PROJECT SPECIAL PROVISIONS

KING COUNTY, WA

SOUTH PARK BRIDGE #3179 REPLACEMENT

VOLUME 2 OF 3

DIVISIONS 8 THROUGH 11

King County CIP 300197

98% SUBMITTAL

(NOT FOR CONSTRUCTION)

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KING COUNTY DEPARTMENT OF TRANSPORTATION

FEBRUARY 16, 2010

SOUTH PARK BRIDGE NO. 3179

(14th/16th Avenue South over Duwamish Waterway)

Contract No. C00497C10
Project No. 300197

SPECIAL PROVISIONS

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King County

SPECIAL PROVISIONS

SOUTH PARK BRIDGE NO. 3179 REPLACEMENT

(16th Avenue south over Duwamish Waterway)

Contract No. C00497C10
Project No. 300197
Fed. Aid No. _____

GENERAL REQUIREMENTS

INTRODUCTION

The following Special Provisions in conjunction with the 2008 *Standard Specifications for Road, Bridge and Municipal Construction*, issued by the Washington State Department of Transportation and the American Public Works Association, Washington State Chapter (Standard Specifications), and the 2007 King County *Road Design and Construction Standards* (KCRDCS), which were adopted by the King County Council, govern this Contract. These Special Provisions supersede the referenced portions of Standard Specifications. Where any provision of Standard Specifications is modified or deleted by these Special Provisions, the unaltered, remaining portions remain in full force and effect.

Copies of the Standard Specifications and KCRDCS are on file in the office of the County Road Engineer, Department of Transportation, Road Services Division, 2nd Floor, 201 South Jackson Street, Seattle, Washington, 98104-3856 where they may be examined

Wherever reference is made in the Standard Specifications to the Secretary of Transportation or Engineer, such reference shall be construed to mean the King County Road Engineer or the County Road Engineer's duly authorized assistants.

Wherever reference is made to the "State Materials Lab" or WSDOT Materials Laboratory in the Standard Specifications such reference shall be revised to read "King County Materials Lab (Renton, WA.)".

DESCRIPTION OF WORK

This project provides for the replacement of South Park Bridge over the Duwamish Waterway in King County by constructing a new drawbridge downriver and parallel to the existing South Park Bridge, intersection improvements, roadway, drainage, and utility construction, approach spans and retaining wall construction, riverbank mitigation, incorporation of historic and art elements, illumination, demolition of existing bridge, and other work, all in accordance with the attached

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Plans, these Special Provisions, the Standard Specifications, the KCRDCS, and the APWA/WSDOT Standard Plans for Road, Bridge, and Municipal Construction.

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MISCELLANEOUS CONSTRUCTION

8-01 EROSION CONTROL AND WATER POLLUTION CONTROL

8-01.1 DESCRIPTION

The following is added at the end of this section:

This section consists of furnishing, installing, maintaining, removing, and disposing of temporary erosion and sediment controls to prevent erosion and scour, to treat sediment laden and contaminated water for acceptable discharge, and to prevent the conveyance of sediment into surface waters, drainage systems, and environmentally critical areas.

8-01.3 CONSTRUCTION REQUIREMENTS

8-01.3(1) GENERAL

The following is added at the end of this section:

In-Water Work:

The turbidity and pH shall be monitored during in-water work activities to ensure that water quality meets prescribed state and federal standards. Turbidity will be monitored at the edge of the mixing zone (assumed as 300 feet downstream based on applicable regulations) during in-water work activities.

In-water shoreline restoration work and outfall construction shall not be performed without prior installation of temporary erosion and sediment control sheeting to prevent sedimentation in the river.

Cofferdam and Temporary Sediment Control Sheeting:

The Contractor shall pump dewater from the cofferdams and from runoff trapped in the temporary sediment control sheeting into holding tanks. The water shall be tested and treated to appropriate levels described in issued wastewater discharge permits.

Noise Control:

Contractor shall turn off motors when not in use. All construction equipment and vehicles shall be equipped with mufflers in good working order. Equipment without properly working mufflers shall not be used and shall be repaired immediately prior to commencing work activities.

All cement concrete shall be poured in the dry, or within confined waters not being dewatered to surface waters, and shall be allowed to cure a minimum of 7 calendar days before contact with water. The waters of the state shall not come in contact with the concrete structure while concrete is curing. Any dewatering required from a contained area with curing concrete shall be discharged to land or tanks with no possible entry to surface waters. The Contractor shall be responsible for contacting the local agency and obtaining sewer discharge permits for discharge into a public or private sewer system.

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The Contractor shall comply with the water quality criteria specified in chapter 173-201A WAC, and RCW90.48 Water Pollution Control. Failure to comply with the State's Water Quality Standards may result in the issuance of civil penalties or other actions, whether administrative or judicial.

Adjacent downstream properties shall be protected from sediment deposition from wind or water action. All sediment control devices including sediment ponds, perimeter silt fencing, and other sediment trapping BMPs shall be installed before ground disturbance and grading commences.

All temporary conveyance channels and pipe outlets shall be stabilized to prevent erosion.

All construction access routes that are subject to water or wind erosion shall be stabilized. Material used to construct road approaches to the site shall be a clean composition and placed in a manner to prevent erosion and tracking out of the material offsite.

All temporary BMPs and accumulated sediments shall be removed or stabilized immediately after final site stabilization and completion of the Contract.

Under no circumstances shall freefall dumping or direct excavation of fill or cut material occur in or next to any water body unless control structures are in place to prevent sediment from directly entering the water body.

All lumber treated with creosote or other protected material shall be completely dry before use in or near the waterway.

In general, Work involving erosion and sedimentation control within The COS limits shall comply with Section 1-07.15. Work involving erosion and sedimentation control within City of Seattle's Rights -of-Way not within The COS limits shall also comply with the requirements of the local jurisdiction. In general, in doing the Work, the Contractor shall address measures that:

1. Prevent and control erosion and sedimentation processes,
2. Prevent and control scour and scour processes in water bearing channels,
3. Prevent transport of sediment,
4. Protect surface waters and drainage systems from entry of sediment and other construction byproduct,
5. Prevent erosion and sedimentation impacts to areas not designated for Work and
6. Coordinate erosion and sedimentation controls with scheduling of the Work. Such measures may include, but not be limited to, one or more of the following:
    a. Installing temporary ditches, berms, culverts, and other measures to control and redirect surface waters;

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b. Installing temporary dams, settling basins, energy dissipaters, and other measures to detain water, prevent scour, and allow for sediment drop and controlled removal;

c. Installing measures controlling surfacing groundwater and dewatering discharges;

d. Installing temporary covers or otherwise protecting slopes, stockpiles, and exposed or disturbed soils from erosion and sediment producing processes;

e. Installing temporary work area perimeter and sediment transport prevention measures, such as silt fence, wattle, filter, and berm;

f. Treating sediment laden waters, and removing and disposing of sediment, Installing sediment and debris removal controls for equipment entering and leaving designated Work areas, and

g. Installing temporary fencing, flagging, and other markings at boundaries of areas identified as not part of the Work.

h. Minimize vegetation and soil disturbance to the extent possible.

8-01.3(1)A SUBMITTALS

The following is added at the end of this section:

Fugitive Dust Control Plan: The Contractor shall be responsible for the preparation and implementation of the FDCP to be used for the duration of the project. Six (6) copies of the plan shall be submitted to the Project Engineer for review and acceptance prior to commencement of any construction activities. The Contractor shall maintain a copy of the accepted plan with any updates, to be made available at the work site upon request.

The FDCP shall outline what measures shall be taken by the Contractor to prevent Fugitive Dust from being released into the air at the work site.

The FDCP shall also address at a minimum, the following project specific information:

1. Introduction
2. Site Information, such as project size, location, topography, and soil type
3. Management Information, such as identification of Contractor personnel responsible for maintaining and implementing the FDCP, and contact person in case of a complaint
4. Identification of all Fugitive Dust sources
5. Fugitive Dust control methods to be used for each Fugitive Dust source

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6. Source and availability of materials to be used for controlling Fugitive Dust

A schedule, rate of application, or calculations identifying how often, how much, and when the control method is to be used

7. Method to cover loads and ensure adequate freeboard to prevent soil particles from blowing away during transport.

8-01.3(1)B TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) SUBMITTAL

The following is added at the end of this section:

At the preconstruction conference, the Contractor shall be present to the Project Engineer proposed temporary erosion and sedimentation controls for consideration and evaluation. Following the outcome of the presentation and associated discussions, the Contractor shall prepare and submit TESC Plans as indicated in the table immediately following.

In the following Table, FNTP = Date of First Notice To Proceed.

Initial TESC Plan Submittal	Final TESC Plan Submittal	Comment
TESC Plan for first 30 Calendar Days of the Project shall be provided 7 Calendar Days of FNTP.	TESC Plan for first 30 Calendar Days of the Project shall be provided within 7 Calendar Days of receipt of comments.	Allow 7 Calendar Days for Project Engineer Review
TESC Plan for first 30 to 100 Calendar Days of the Project shall be provided within 14 Calendar Days of FNTP.	TESC Plan for first 30 to 100 Calendar Days of the Project shall be provided within 14 Calendar Days of receipt of comments.	Allow 14 Calendar Days for Project Engineer Review
TESC Plan for beyond 100 Calendar Days of the Project shall be provided within 28 Calendar Days of FNTP.	TESC Plan for beyond 100 Calendar Days of the Project shall be provided within 14 Calendar Days of receipt of comments.	Allow 21 Calendar Days for Project Engineer Review

The TESC Plans shall show, as it relates to the Contractor's critical path schedule, the scheduling of installation, maintenance, phasing, and removal of erosion and sedimentation controls as it relates to the Work. Unless the Contract specifies otherwise, work areas to be addressed in this plan include as applicable:

The Project Site identifying staging, storage, stockpiling, non-Work boundaries, and other construction related areas;

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1. Areas beyond the Project Site;
2. Transportation facilities including construction traffic routes and access/exit control areas on and off the Project Site;
3. Inlets, catch basins, ditches and channels whether dry or water filled, and other surface drainage facilities;
4. Surface waters such as streams, lakes, and other bodies of water; and
5. Identify areas of erodible soil not being worked that may be exposed that may exceed 4,000 square feet, or may be unprotected or uncovered for more than 2 calendar days.

The TESC Plan submittal shall include, but not be limited to, one or more of the following as the Contract requires, as the Work may require, and as the Work is scheduled:

1. Describe with Shop Drawings of sufficient scale and detail showing the Project Site, and the locations and types of temporary erosion and sediment controls. As necessary, show by a series of time sequence Shop Drawings, how TESC controls are to be installed, maintained, removed and coordinated with the Work and the progress schedule;
2. Describe how non-work areas will be identified and protected;
3. Describe the details and continuing maintenance of entrance and exit equipment wash areas;
4. Show locations with cross-sections as applicable and describe control details of existing and proposed ditch, berm, Culvert, pipe, sediment basin, basin outfall, scour control, inlet, catch basin, drain, bypass, subsurface drain and related feature;
5. Describe treatment processes for, controls of, and the disposal of waters resulting from dewatering, surfacing groundwater, and rainfall;
6. Describe protections and covering practices for stockpile, muck, and related deposits;
7. Describe the controls to prevent sediment, debris, and other pollutants from entering surface waters and drainage features;
8. Provide Manufacturer's Certificate of Compliance, certified laboratory test reports, catalog cuts, samples, and other information providing adequate description of supplies and material proposed for TESC applications;
9. The name of the Certified On-Site Erosion Control Lead (ESC Lead), qualifications, experience, and certifications directly related to temporary erosion

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and sediment control, and other information as the Contract and the Work may require, including how to timely contact. If the Work is of such a magnitude that requires additional help, describe the qualifications of additional help, any on-site training that may be necessary, and frequency and type of reporting to the ESC Lead;

10. A schedule of typical inspections ensuring timely maintenance and repair;

11. Identify and provide timelines for submitting permit required or related documentation;

12. Provide details of seed mix, amendment, mulch, and protections for placing and establishing temporary seeded erosion control areas;

13. In areas where exposed erodible soil exceeds 4000 square feet or that may be unprotected for more than 2 calendar days, describe the controls and the proposed monitoring ensuring erosion and sedimentation shall not become non-compliant; and

14. Provide details of other TESC measures indicated in Section 8-01 as may be used in the Work.

The Contractor shall have at a designated location at the Project Site, and the ESC Lead shall have immediately available, copies of the current TESC Plan.

8-01.3(2)B SEEDING AND FERTILIZING

The following is added at the beginning of this section:

Seed and fertilizer shall be placed at the rate, mix and analysis specified herein or as designated by the Project Engineer.

The following is added at the end of this section:

Seeding: The following seed mix shall be furnished at the rate described below:

Erosion Control Seed Mix

Name	Proportion by Weight	Proportion by % Purity	Proportion by % Germination
Chewing Fescue (Banner) *Festuca rubra*	50%	95%	90%
Perennial Rye (Derby or Pennant) *Lolium perenne*	45%	95%	90%
Redtop Bentgrass	5%	95%	90%

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Agrostis alba

A slurry consisting of seed, fertilizer, mulch, and water shall be uniformly applied over all disturbed areas within easements and rights-of-way unless directed otherwise. Seed shall be applied at the rate of 120 pounds per acre.

When seeded by hand, seed shall be applied at the rate of five pounds per 1,000 square feet. The seed shall be evenly distributed over the disturbed area after application of fertilizer. The seed shall be raked into the surface soil to a depth of 0.25 inches and lightly irrigated by hand.

The hydroseeding method of application shall be used for all bioswale seeding. Seed shall be applied at a rate of 100 pounds per acre. For summer applications, "Stay Moist" moisture retention agent, or an approved substitute, shall be added to the seed mix and applied at a rate of 40 pounds per acre, or as directed by the Project Engineer.

Fertilizing: Fertilizer shall be applied to all areas that are seeded. Fertilizer of the following proportions and formulations shall be used:

Total Available Nitrogen	N	10%	(of which 50% is derived from 38% slow release urea)
Available Phosphorus	P_2O_5	4%	
Available Potassium	K_2O	6%	

All percentages are by weight

Fertilizer shall be applied at the rate of 200 pounds per acre. Fertilizer shall be incorporated into the seed, mulch and water slurry and shall be applied as specified under "seeding". In the event that additional fertilizer is required to establish a uniform, healthy, thick stand of grass, the Project Engineer shall determine the method and rate of application.

Where hydroseeding is not practical and approved hand methods are used, fertilizer shall be applied at the rate of 5 pounds per 1000 square feet. It shall be raked into the surface to a depth of one inch.

8-01.3(2)D MULCHING

The following is added at the end of this section:

Straw mulch shall be used to cover all exposed soil areas not covered with plastic, or erosion control netting, or soil stabilization materials. This Work shall include all tools, materials, labor, and equipment to spread straw mulch over exposed surfaces.

Straw mulch erosion control application shall be with a forced air mulch spreader. In spreading straw mulch, the spreader shall not cut or break the straw stalks into lengths less than 2 inches. Straw mulch coverage shall have a minimum thickness of 2 inches. Where a forced air

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equipment mulch application is indicated as providing unacceptable results, the Contractor shall employ manual or other application methods such as hand spreading and raking.

Should the straw mulch coverage expose at any time bare ground of more than 50% in any 100 square foot area, then the Contractor shall promptly remulch the exposed area to full coverage of the thickness required.

Straw mulch used for covering exposed earth as a temporary erosion control measure shall be derived from harvested wheat or alfalfa plant stalk (no hay from grass source). The straw shall be seasoned (an air dried condition) free from noxious weeds, seeds or other undesirable materials prior to loading and delivery to the site. The straw shall be suitable for spreading by mechanical means or by hand methods as temporary erosion control measure.

The Contractor shall be responsible for providing and placing the straw in areas noted on the Plans and as directed by the Project Engineer. Straw may be spread mechanically or by hand to provide a uniform coverage of three-inch depth. Straw spread by hand from straw bales shall not cover more than 150 square feet of exposed area. The Contractor shall maintain the temporary three-inch mulch covering throughout the time the straw mulch is in place until the areas are stabilized as determined by the Project Engineer. All straw placed prior to seeding shall be removed at time of seeding to ensure a good seed to soil contact.

8-01.3(5) PLACING PLASTIC COVERING

This section is deleted in its entirety and replaced with the following:

Stockpiles, areas with no vegetative growth, areas where vegetative growth is to be inhibited, and areas with disturbed soil may be covered with black plastic covering. Sandbag or similar ballast shall be placed on the cover in a grid with no less than 5 foot spacing in two right angle directions. At all ends without overlap, ballast shall be placed within 12 inches of the edge and spaced no more than 5 feet along the perimeter.

Clear plastic covering shall cover areas where the growth of vegetation is not to be inhibited. With the exception of stockpiles, plastic covering sheets shall be installed with the long axis parallel with slope contours. The upper edge of the fabric shall be placed into a 12-inch wide by 6-inch deep anchor trench and backfilled with native soils tamped into place. Upper slope fabric shall overlap downslope fabric in the anchor trench a minimum of 12 inches. Along the same contour, the ends of new fabric shall overlap in-place fabric a minimum of 24 inches.

In general, ballast shall be placed on the cover using sandbags or similar ballast distributed over the cover in a manner to prevent uplift, slippage, and any other movement of the cover. Spacing of ballast shall be not more than a 10-foot grid in line with and against the long axis of the sheet. All overlaps, edges, and corners shall be ballasted. On steep slopes and where slippage of ballast or ballasted fabric is indicated, the ballast shall be secured in-place by rope tied to upslope anchors firmly set in the earth.

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Within the dripline of trees, excavation of anchor trenches will not be allowed. Rather, ballast shall be placed on the fabric and on the overlaps secured by rope tied to anchor stakes upslope of the dripline area.

Rips and tears shall be timely repaired by placing additional covering over the defect with a minimum 24 inch overlap in all directions from the defect. The repair shall be ballasted with a spacing in any direction of no more than 5 feet and along all edges and at all corners. Ballast shall be anchored to upslope stakes.

Uplifted areas shall receive additional ballast resulting in reduced ballast spacing.

Areas where covering has slipped and the underlying surface becomes exposed shall be timely repaired in the same manner as rips and tears.

Clear plastic covering intended to cover a vegetated surface without long term inhibiting effects shall require frequent monitoring ensuring permanent damage is not occurring. Should vegetative degradation be indicated, the Contractor shall amend the cover practice to a condition not detrimental to the vegetation.

8-01.3(9)A SILT FENCE

The following is added at the end of this section:

Silt fences shall act as a filter to both allow the passage of water through the fence and also to prevent the passage of sediment through, under, or over the fence. Silt fences shall be either in-place before the area is disturbed, or shall be coordinated with beginning soil disturbance activity.

Silt fence(s) shall be constructed at locations downstream or downslope of surface runoff areas, and upstream or upslope of surface bodies of waters. Silt fences shall be spaced to account for grade of slope, runoff flowrate and velocity, sheeting and rilling, type and relative density of soil(s), rate of sediment loading, expected maintenance type and frequency, and other factors as the site and Work require. Silt fences shall not be placed across or in streams, channels and ditches.

Silt fences shall be located along contours with the ends turned uphill to capture runoff and prevent flow around the end of the fence. Where the installation requires crossing of contours in areas other than at the ends, gravel check dams shall be placed perpendicular to the uphill face of the fence to minimize concentrated flow and erosion along the fence. The gravel check dams shall be approximately 1 foot deep at the fence and shall continue perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface. The gravel check dams shall consist of crushed surfacing base course gravel backfill for walls, or shoulder ballast. The gravel check dams shall be spaced at intervals not exceeding 10 feet along the fence where the fence crosses contours. The slope of the fence line where contours are crossed shall not be steeper than 3H:1V.

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The height of the fence fabric/geotextile above ground surface shall be 30 inch minimum and 36 inch maximum.

Posts shall be of a length to be installed to a depth and with a spacing to withstand maximum loading for the durations estimated between sediment removals. Unless the Contractor can justify otherwise to the Project Engineer, posts shall be installed to a minimum 30 inch depth, except as specified below within the dripline of tree, and shall be spaced within a fence line of not greater than six (6) feet. Where required post depth penetration cannot be obtained, the posts shall be adequately secured on the upslope side by bracing or guying to an adequately installed anchor to prevent overturning. Posts shall be either wood or steel. Wood posts shall have minimum dimensions of 1-1/4 inch by 1-1/4 inch and shall be white oak or other hardwood resistant to rot, and with no defects. Steel posts shall consist of U, T, L, or C shape posts with a minimum weight of 1.33 pounds per foot, or other steel posts having equivalent or greater strength and bending resistance than those listed in this paragraph.

The fence fabric and support backing systems shall be attached on the up-slope side of the posts with staples, wire, hog rings, or other connection device as recommended by the manufacturer, in a manner that does not tear or damage the fabric. At the bottom of the fence, the fabric and support backing system shall be buried at least 6 inches below the ground surface, and then backfilled with native soils compacted by tamping or other appropriate compaction methods. Excavation for installation of silt fence within the dripline of trees, and around other vegetation to be retained, shall be without damage to roots. Roots that are exposed shall not be damaged and shall be promptly covered with earth. Where the bottom of fabric and support backing cannot be installed to a 6 inch depth due to interference with roots, the fabric and backing shall be placed flat on the upside of fence for a minimum 12 inch width and then covered with a minimum 6 inch depth of large size aggregate ballast. In non-trench fabric bottom installations, post penetrations into the earth shall be increased and the height of fence above the top of ballast shall not exceed three (3) feet. Fence support backing system, in the form of wire or plastic mesh with maximum mesh spacing of 2 inch by 4 inch and of adequate strength to withstand maximum loading, shall be attached to posts and fabric as recommended by the Supplier. Plastic mesh shall have the same or greater ultraviolet (UV) resistance as the geotextile fabric. All geotextile fabric shall have backing whether exposed or buried. Fence fabric shall be continuous along any single length of filter fence. Continuous fence is defined as follows:

a. The geotextile fabric may be sewn together at the point of manufacture or by the Supplier to form a single length of geotextile for a continuous fence application. All sewn seams shall be located at a support post.

b. Separate geotextile fabric may installed across posts with a minimum 10 foot overlap where the overlap is supported by no less than three (3) posts with spacing between any posts not greater than 4 feet.

c. Overlapped fabric shall always be secured to support backing.

d. The Contractor may place 2 posts, one on each side of the overlapped fabric and backing, and twist the overlapped fabric at least 2 complete revolutions before driving

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the posts into the earth. The overlaps shall extend a minimum one (1) foot beyond the 2 posts before twisting. Lapped or twisted fabric and backing that slip shall be considered defective and shall be replaced with sewn geotextile. For pre-staked silt fence, laps may be performed in accordance with the manufacturer's written recommendations.

8-01.3(9)E TEMPORARY SEDIMENT TRAP (NEW SECTION)

Temporary sediment trap shall be installed in accordance with TESC Plan or manufacturer's recommendations in the areas indicated on the Plans. See Section 7-05.3(5)H. Temporary Sediment Vault/Trap and Sump.

8-01.3(17) CHITOSAN ENHANCED SAND FILTRATION (NEW SECTION)

Chitosan Enhanced Sand Filtration Erosion Control Water Quality Treatment

The water pollution and erosion control items shall include the use of a portable stormwater filtration system. The Stormwater Treatment system shall include a Chitosan-Enhanced Sand Filtration (CESF) system (including pumps and portable tanks) furnished to assure water quality meets minimum requirements. The CESF system shall have a General Use Level Designation authorized by the Washington State Department of Ecology. The system shall be designed, operated, and maintained in accordance with the conditions applicable to its General Use Level Designation.

Submit a treatment system operations plan to the Project Engineer including testing frequencies, cleaning, tank draining, pump maintenance plan, chemical delivery frequencies, types of chemicals that will be delivered, storage plan for chemicals, name and contact information for operators, and safety plan. The Contractor shall obtain Department of Ecology approval and permits for the treatment system.

Each portable plant shall include pressurized sand filter composed of three or four individual filtration chambers. CESF systems shall be designed and operated at a flow rate not to exceed 15 gpm per square foot of sand bed filtration area and should employ a minimum of 3 sand filter pods to ensure adequate backwashing capacity. Each portable plant shall be able to operate at a minimum treatment capacity of 500 gpm.

The filters shall be equipped with a programmable, electronic, automatic backwash control system activated by differential pressure, time interval, or continuous operation. Backwash piping shall include a spigot or sight glass that allows the system operator to verify that no sand filter media is flushed out during backwash cycles. The CESF system treated water output shall be equipped with an automatic integrated turbidity and pH sensors capable of shutting the system down if output turbidity or pH exceed preset values. An audible alarm and warning light will be installed on the treatment system to alert the operator in the event of a system failure. The Contractor is encouraged to include a computerized controller to automatically adjust chitosan dosage based on turbidity, flow, and pH.

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Provide flow and water quality monitoring to ensure discharge thresholds are not violated. Document operations of Stormwater Treatment System. A checklist shall be maintained showing dates, and times of system maintenance, system checks, dates and lot numbers for chemicals added to the system, as well as sediment trap/sump cleaning dates.

The only filtration media approved is pre-washed 0.6 mm (#30) crushed silica sand with a mean effective sand size of 0.34 mm and a filtration quality mesh of 230-400. Minimum sand bed depth shall be 18-inches underlain with a minimum of 6-inches of 1-inch) crushed rock. An intermediate mesh-size garnet may be added to enhance performance.

The liquid chitosan is most effective in treating stormwater runoff with a pH between 6.5 and 8.5. If pH limits are outside the above limit, neutralization is required prior to the use of liquid chitosan. Dosage is dependent upon introduction time, operational flow rate and turbidity. The dosage range chitosan acetate shall not exceed manufacturer's recommendations or the conditions applicable to its General Use Level Designation. Jar tests will be conducted, as needed, to confirm the dosage level of liquid chitosan.

The liquid-chitosan metering pump, liquid chitosan concentrate, and CESF system instrumentation shall be enclosed in a secure, covered structure maintained at a temperature above 40 degrees Fahrenheit with a locking door. The liquid chitosan concentrate, metering pump, and related tubing shall be kept in secondary containment area. The metering pump pressure tubing shall have an anti-siphon valve. Chitosan injection shall be performed with an LMI-brand C77, high Viscosity pump head, electric metering pump, or equivalent. The metering pump discharge tubing shall have an anti-siphon valve. The liquid chitosan-metering pump shall be capable of maintaining a minimum 12 -gallons per hour gph at 80 psi.

The CESF system shall include a flow-regulating valve on the input to and output of the sand filter. These regulating valves will reduce the maximum output of the pump as required and facilitate proper backwash.

All influent and treated effluent piping shall be provided and sized in accordance with the manufacturer's recommendations.

General Use Level Designations have been issued for systems discharging chitosan acetate treated water from holding ponds to surface water by Natural Site Solutions and by HaloSource for CESF technology utilizing StormKlear™ LiquiFloc™ Chitosan Acetate; by Dungeness Development Associates for CESF technology utilizing ChitoVan™ Chitosan Acetate; and by Clear Creek Systems Inc. utilizing FlocClear™ Chitosan Acetate.

The Contractor shall provide one or more generators or other uninterruptible power source as necessary to operate all pumps and other electric components concurrently.

The Contractor shall design and implement the Chitosan Enhanced Sand Filtration to be capable of treating contaminated groundwater as well as water seeping out of stockpiled or other contaminated soils.

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Enhanced Contaminated Groundwater Water Quality Treatment

This Work includes designing, placing, operating, monitoring, maintaining, relocating and removing components used for treating contaminated groundwater and/or water seeping from contaminated soils. The enhanced erosion control water quality treatment must be used to remove sediment, turbidity, and other pollutants from uncontaminated and contaminated groundwater, stormwater, prior to discharge.

Groundwater and surface water quality information for this project is available from: Phase I, and II Environmental Site Assessment Report, Volume I (August 2009, and September 2009). The Information Package includes the following:

1. Groundwater analysis from the project area.
2. Surface water quality analysis for the Duwamish Waterway.

Submittals

At least 70 calendar days before dewatering activities start, the Contractor shall submit a dewatering and discharge plan (DDP) that includes:

1. Title sheet
2. Table of contents
3. Certification and approval sheet (Section 100 of the Preparation Manual)
4. Amendment log and format (Section 200 of the Preparation Manual)
5. Description and schedule of the dewatering and discharge operations
6. Treatment system description and components
7. Anticipated flow rates
8. Operation and system maintenance procedures and example maintenance log
9. Field-recorded data, visual inspection, and calibration procedures and example logs
10. Measuring equipment descriptions
11. Working drawings for dewatering and discharge operations

The Contractor shall also prepare and submit a Coagulant Prevention Plan (CPP) with the DDP. The CPP must include:

1. Description of the best management practices (BMPs) to prevent accidental spillage, overfeeding into the treatment system, or other mishandling of coagulant agents.
2. Monitoring plan for all coagulant or flocculant agents to be used.
3. Description of the agent (chemical and trade name description).

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4. Determination of acute and chronic toxicity for aquatic organisms conforming to EPA methods for the agents.
5. Monitoring proposal to detect residual agent at concentrations at or below established acute toxicity levels for freshwater and marine conditions for that agent.
6. Copy of the documentation showing Washington Department of Ecology (WDOE) approval of the DDP/CPP and approval of the chemical coagulants or in-line flocculants proposed. Contractor shall obtain approval of the DDP/CPP from the WDOE at least 30 calendar days prior to construction activities.

When in use, the Contractor shall provide a daily inspection report. The report form shall include discharge volumes, water quality monitoring records, and discharge point information. The following information shall be included in the report:

1. Date and time
2. Weather conditions including wind direction and velocity
3. Presence or absence of water fowl or aquatic wildlife
4. Color and clarity of the effluent discharge
5. Erosion or ponding downstream of the discharge site
6. Photographs labeled with the time, date, and location

The treatment system must be capable of removing metals, organic chemicals, sediment and turbidity-producing suspended solids. Water discharge must meet WDOE permit, pH, and temperature requirements. Primary and secondary treatment may be required, or the design of the Chitosan Enhanced Sand Filtration may require combined use of the various treatment components in series to achieve effective treatment. The Chitosan Enhanced Sand Filtration shall be able to remove sediment and turbidity producing suspended solids. Methods may include desilting basins, settling tanks, sediment traps, gravity bag filters, sand media filters, pressurized bag filters, cartridge filters, chemical coagulants (including in-line flocculants), temporary holding tanks, and/or any combination of these systems to provide primary and secondary treatment.

The Contractor shall provide WDOE approved materials to Adjust pH or dissolved oxygen by Provide pumps and piping to convey the water from the point of dewatering to the treatment system and to the point of discharge and use a flow meter to measure all discharges from dewatering operations.

Operation

Water quality limits must comply with the receiving water limitations monitoring and discharge effluent limitations monitoring requirements under section titled "Monitoring" of these special provisions. If observations and measurements confirm the water quality limits are exceeded:

1. Stop the discharge immediately.

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2. Notify the Project Engineer.
3. Start corrective measures to modify, repair, or replace the equipment used to discharge treated water.

After the Project Engineer inspects and accepts corrective measures:

1. Resume dewatering and discharge operations
2. Start startup-phase sampling requirements before regular-phase sampling requirements
3. Start regular-phase sampling requirements

Monitoring

Comply with the manufacturer's instructions for all calibrations of the flow meter. While the active treatment system is in operation, perform:

1. Receiving water limitations monitoring. In the receiving storm water drainage system, the discharge must not cause:
   a. Downstream turbidity to increase to more than 50 Nephelometric Turbidity Units (NTU) if the natural background turbidity is less than 50 NTU.
   b. Downstream turbidity to increase more than 10 percent above the natural background turbidity if the natural background turbidity is 50 NTU or greater.
   c. Normal ambient temperature to be altered more than 5 degrees F.
   d. Normal ambient pH to fall below 6.5, exceed 8.5, or change more than 0.5 units.
   e. Dissolved oxygen concentration to fall below 5.0 mg/L.
2. Discharge effluent limitations monitoring. The water to be discharged (effluent) must comply with the following:
   a. Discharged water turbidity must not be greater than 50 Nephelometric Turbidity Units (NTU).
   b. pH of the discharged water must be from 6.5 to 8.5.
   c. Discharged water must not contain chlorine in excess of 0.02 mg/L (instantaneous maximum).
3. Inspect Chitosan Enhanced Sand Filtration
   a. Daily if dewatering work occurs daily
   b. Weekly if dewatering work does not occur daily

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Maintenance

Maintain the various components to prevent leaks and provide proper function. If a component of the dewatering equipment is not functioning properly, discontinue the dewatering operation and repair or replace the component.

Sediments removed from uncontaminated areas during maintenance of the treatment system must be dried, distributed uniformly, and stabilized at a location within the project limits approved by the Project Engineer.

8-01.3(18) CONTAMINATED WATER TREATMENT (NEW SECTION)

Contaminated Water

All water from the cofferdams and upland areas shall be treated for water quality standards for freshwater in Chapter 173-201A WAC: pH 6.5-8.5, fecal colliform of 200 colonies/100 ml, total dissolved gas 110 percent of saturation, 10 NTU over background when the background is 50 NTU or less; or a 20 percent increase in turbidity when the background turbidity is more than 50 NTU; dissolved oxygen 6.5mg/L, 63.5 degrees F or an increase of .54 degrees F if over 63.5 degrees; metals shall not exceed background levels; and total petroleum hydrocarbons < 5mg/l. Toxic substances in excess of WAC 173-201A-040 standards shall not be discharged to surface waters. If these criteria are exceeded the Contractor shall stop discharge to the river and adjust the treatment system, no additional compensation shall be provided. If Contractor elects to discharge contaminated water into the public sanitary sewer system, Contractor shall obtain Stormwater Discharge Permit from the City of Seattle.

Contaminated GroundWater

Contaminated groundwater removed as part of the construction trenching, excavation, or other construction activities shall be pumped to a containment “vessel/tank” and discharged appropriately. Contaminated groundwater may be transported and disposed of at a certified facility capable of treating the hazardous material, and/or treated in the Chitosan Enhanced Sand Filtration and discharged according to permit regulations. Contractor shall obtain City of Seattle approval and permits to discharge into the sewer system.

8-01.3(19) SPILL PROTECTION NETTING (NEW SECTION)

The Contractor shall install spill protection netting with a maximum opening size of 1 inch by 1 inch to enclose all in-water work areas that could generate debris and/or turbidity in the water. The spill protection netting shall be Contractor furnished and is intended to prevent large and small particles from falling into the water during demolition or construction activities. Stormwater may be allowed to drain through the netting, but silts, debris, and other objects shall not be allowed to escape the netting. This Work includes all maintenance, removal, and replacement as necessary to prevent particulate deposition into the river.

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Maintain spill protection net during the duration of Work. Inspect every working day in the morning. Patch or replace damaged sections within 24 hours of discovery. At no time shall work over a torn section be allowed.

Remove Spill protection net upon completion of in-water work.

8-01.3(20) INTERCEPTOR DITCH (NEW SECTION)

Interceptor ditch shall be constructed as indicated on Plans.

Interceptor ditch bottom and sides shall be lined with quarry spalls and the quantity of Quarry spalls used for the lining shall be considered included in the unit bid price for interceptor ditch as in accordance with Section 9-13.6.

Check dams shall be installed along the length of the interceptor ditch as indicated in the plans. Check dams shall be rock in accordance with Section 8-01.3(6)B.

8-01.3(21) DEBRIS CONTAINMENT SYSTEM (NEW SECTION)

A woven geotextile (moderate survivability) for underground drainage on top of a 40 mill construction geotextile for underground drainage shall be constructed under the decking to contain debris on the temporary trestles. The fabric and liner shall be supported, maintained overlapped, and tears shall be patched. The fabric and liner shall and drain back to land and runoff shall be collected for sediment removal. All piping, treatment, hauling, pumping materials, and labor to install and maintain the debris containment system shall be considered part of this bid item. This bid item also includes the fabrication relocation, maintenance of erosion control aprons that shall be used to prevent material from falling into the river while excavation, constructing, backfilling, and draining the cofferdams.

During excavation of material from within the caissons, the Contractor shall use spill prevention aprons to prevent debris, soil, silt or other material from falling into the waterway.

8-01.3(22) TEMPORARY SEDIMENT CONTROL SHEETING (NEW SECTION)

The Contractor shall provide a design and shop drawings that shall be sealed by a Structural Engineer and approved by the Project Engineer for shoring and preventing river water from entering the work area. The Contractor shall provide all materials, labor, and equipment to install and maintain a leak proof barrier to perform work and prevent sediment from entering the river. The sheeting shall be installed at low tide to avoid fish entrapment.

At no time shall the temporary sediment control sheeting block stormwater runoff discharging from existing outfalls. Sheeting may block outfalls if the Contractor installs temporary piping to divert the outfalls downstream.

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8-01.3(23) FLOATING TURBIDITY CURTAIN (NEW SECTION)

This Work consists of the potential need for installation of a Floating Turbidity Curtain to deter silt suspension and movement of silt particles during temporary pile and pier protection removal, pier protection construction, outfall construction, and shoreline construction activities. Any area where it is not feasible to construct Temporary Sediment Control Sheeting and work will potentially cause sediment suspension into the waterway, a floating turbidity curtain shall be installed to contain the sediment. The floating turbidity curtain shall be constructed as required by the approved submittal and according to the Manufacturer's recommendations. The curtain material shall be made of a tightly woven nylon, plastic, or other non-deteriorating material meeting the following specifications:

Grab Tensile Strength for machine direction (md)-370-lbs, cross machine direction (cd)-250 lbs, and Mullen burst strength of 480 psi minimum. The trapezoidal tear strength shall be md-100 lbs and cd-60 lbs minimum. The apparent opening shall be size 70 US standard sieve with a percent open area of 4% and 0.28 sec-1 permittivity.

The curtain material shall be supported by a floatation material having over 29 lbs/ft buoyancy. The floating curtain shall have a minimum 5/16" galvanized chain as ballast and minimum dual 5/16" galvanized wire ropes with a heavy vinyl coating as load lines.

The Contractor shall maintain the Floating Turbidity Curtain in satisfactory condition until its removal is requested by the Project Engineer. The floating system shall maintain bottom contact. Once removed, the Floating Turbidity Curtain shall be relocated and re-used at other locations within the project limits.

8-01.4 MEASUREMENT

The thirteenth paragraph in this section is deleted and replaced with the following:

Seeding, fertilizing, liming, mulching, mowing, and soil binder or tacking agent will be measured in acres by ground slope measurement or through the use of design data. When shown in the proposal as a lump sum item no specific unit of measurement will apply to the item of seeding, fertilizing, and mulching.

The following is added at the end of this section:

Chitosan Enhanced Sand Filtration will be measured per lump sum and Contaminated Groundwater Treatment will be considered included in Chitosan Enhanced Sand Filtration.

Spill Protection Netting will be measured per square yard.

Interceptor ditch will be measured per linear foot along the ground line of the completed ditch.

Debris Containment System shall be measured per square yard.

Temporary Sediment Control Sheeting per linear foot.

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Floating Turbidity Curtain per linear foot.

8-01.5 PAYMENT

The fifth paragraph in this section is deleted and replaced with the following:

Removal of erosion and water pollution control devices including removal and disposal of sediment, stabilization and rehabilitation of soil disturbed by these activities, and any Work deemed necessary by the Project Engineer to control erosion and water pollution will be considered included in the bid items and unit bid prices. Only maintenance will be paid by force account in accordance with Section 1-09.6.

The following is added at the end of this section:

"Seeding, Fertilizing and Mulching", per acre.

"Chitosan Enhanced Sand Filtration", per lump sum.

The lump sum Contract price for "Chitosan Enhanced Sand Filtration" shall be full pay for installing and operating the Chitosan Enhanced Sand Filtration stormwater treatment system during the duration of the Work then removal from the site after it is determined to be no longer needed. This includes configuring the conveyance or transfer system between the plant and storage tank or other BMPs as well as site preparation, connection piping, pre-treatment weir tanks, sand filter backwashing, and operator training, start-up testing, maintenance, equipment rental, and materials necessary to provide a fully functional facility. This includes stormwater treatment system operation and monitoring as well as power, chemicals, chitosan, and waste and backwash removal during operation.

"Spill Protection Netting ", per square yard.

The unit Contract price for "Spill Protection Net" shall include installation, maintenance, repair, removal and disposal of Spill Protection Net.

"Interceptor Ditch", per linear foot.

The unit Contract price for "Interceptor Ditch" shall include all costs associated with constructing, maintaining, and removing the interceptor ditch and check dams within the ditch.

"Debris Containment System", per square yard.

"Temporary Sediment Control Sheeting", per linear foot.

The unit Contract price for Temporary Sediment Control Sheeting shall include all work, labor, materials, and equipment to provide temporary piping, and pumps to divert stormwater from the outfalls, or behind the "Temporary Sediment Control Sheeting".

"Floating Turbidity Curtain", per linear foot.

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The unit Contract price for "Floating Turbidity Curtain" shall be full pay for the actual number of Linear Feet of curtain installed as specified and accepted. Such price and payment will be full compensation for the Work as described in this section including but not limited to furnishing all materials, tools, equipment, and all incidentals necessary to complete the Work.

8-02 ROADSIDE RESTORATION

8-02.1 DESCRIPTION

The following is added at the end of this section:

This Work shall consist of removing and disposing of buried man-made or manufactured debris that may be encountered during soil amendment incorporation included in the Contract. Such debris shall be removed to a maximum depth of two feet. The excavated debris shall be removed from the project site to an approved disposal facility.

8-01.2 MATERIALS

The following is added at the end of this section:

Rock Dust	9-03.3

8-02.3(1) RESPONSIBILITY DURING CONSTRUCTION

The following is added at the end of this section:

For all planting areas, the Contractor shall perform work in a manner that minimizes displacement and compaction of the existing soil. Work will be stopped if, in the opinion of the Project Engineer, construction method, soil moisture content or other condition will result in displacement of the existing soil horizon (such as ruts over 3 inches deep), or compaction of the soil. The Contractor will not be allowed to resume work until conditions improve or an alternate method of construction is approved by the Project Engineer.

8-02.3(2)B WEED CONTROL

The following is added at the end of this section:

Unwanted Vegetation

In addition to noxious weeds, unwanted vegetation within roadside and mitigation areas throughout the project limits includes Reed Canarygrass (Phalaris arundinacea), Purple loosestrife (Lythrum salicaria), Himalayan blackberry (Rubus discolor or R. procerus) and Evergreen blackberry (Rubus laciniatus), Scotch broom (Cytisus scoparius), Hedge bindweed (Calystegia sepium), Giant hogweed (Heracleum Mantegazzianum), Canadian thistle (Cirsium arvense), Butterfly bush (Buddleia spp.), Common reed (Phragmites australis) and Japanese knotweed (Polygonum cuspidatum).

The Contractor shall identify all target weeds, specific to the site, to be controlled in the Weed Control Plan in accordance with Section 8-02.3(2).

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This list of unwanted vegetation is not a complete list of weeds to be controlled within the project limits. The site may also include other invasive and competitive vegetation, as determined by the Project Engineer, which shall be controlled as ordered by the Project Engineer.

8-02.3(3) PLANTING AREA WEED CONTROL

The following is added at the end of this section:

Unwanted vegetation shall be as listed in Section 8-02.3(2)B.

Prior to planting, unwanted vegetation within planting areas shall be chemically treated with an approved non-selective, non-residual herbicide. After a minimum of two weeks, the Contractor shall remove the dead woody vegetation at the ground level.

The Contractor is advised that some planting areas may contain unwanted vegetation that is dense and mature. These areas may require additional efforts to accomplish the required planting area weed control and planting area preparation.

For planting areas to receive soil amendment, grass and unwanted vegetation shall be chemically treated with an approved non-selective, non-residual, herbicide.

After a minimum of two weeks, the Contractor shall remove the dead woody vegetation at the ground level and incorporate the root structure and non-woody top growth into the existing ground surface along with the soil amendment.

No living vegetation shall be incorporated.

The Contracting Agency has estimated the planting areas to be approximately 46,800 square feet.

This quantity is listed only for the convenience of the Contractor in determining the extent of the work involved.

8-02.3(4) TOPSOIL

The following is added at the end of this section:

The Contractor shall notify the Project Engineer a minimum of 14 calendar days prior to topsoil placement.

The Contractor shall place topsoil to a reasonable even grade without localized low areas which will hold water.

Approval and Acceptance

The Contractor shall submit for approval, 14 calendar days prior to beginning placement, a preliminary sample of the topsoil and the proposed method of incorporation. Acceptance samples shall be obtained at the point of delivery.

The Contractor shall submit to the Project Engineer a manufacturer's certification that the topsoil contains all materials and soil amendments of the type and quantities specified. The Project

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Engineer will have 14 calendar days to respond to submittals. Placement shall not begin until approval has been received in writing.

8-02.3(4)A TOPSOIL TYPE A

The following is added at the end of this section:

Topsoil Type A shall be placed in two non-compacted lifts.

The first 4-inch lift of topsoil shall be placed over the existing soil and incorporated to a 10-inch depth.

The second lift of topsoil shall then be placed over the existing incorporated soil to the finished grades shown in the Plans.

8-02.3(5) PLANTING AREA PREPARATION

The following is added at the end of this section:

For planting areas that become compacted due to construction use, such as staging areas and access roads, the Contractor shall loosen and cultivate to a minimum depth of *** 10" *** prior to planting and seeding operations.

No cultivation shall occur in areas within the drip line of existing vegetation scheduled to remain.

For the locations designated in the Plans, the Contractor shall loosen the existing soil by ripping to a depth of 18 inches prior to application and incorporation of the Soil Amendment.

8-02.3(6) SOIL AMENDMENTS

The following is added at the end of this section:

Prior to placement and incorporation of soil amendment, the application and incorporation methods shall be approved by the Project Engineer.

After the initial planting area weed control, soil placement, and grading are completed, and prior to the installation of irrigation lines and planting, all designated planting areas shall be covered with soil amendment. Soil amendment shall not be placed when a condition exists, such as frozen or water saturated soil that may be detrimental to successful application, incorporation, or soil structure.

The Contractor shall notify the Project Engineer a minimum of 7 calendar days prior to the start of soil amendment work.

Soil amendment shall be uniformly and evenly placed in all designated planting areas to a 3 inch, non-compacted depth and incorporated into the existing soil to a 10 inch depth.

After the soil preparation work has been completed and approved by the Project Engineer and prior to plant installation, compost shall be applied to the entire ground surface of designated

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planting areas. Compost shall be applied at a uniform and even 1 inch non-compacted depth. No incorporation of compost into the existing soil is required.

8-02.3(8) PLANTING

Item 1 in the second sentence of the second paragraph of the Section is revised to read:

1. Non-irrigated Plant Material

November 1 to March 1.

The following is added at the end of this section:

Planting shall occur in the planting period immediately following the second herbicide treatment as specified in Section 2-10.

The Contractor shall exercise care when installing plant material in creek or stream bank edges to minimize disturbance of the stream bank and prevent sediment or other pollutant discharges from entering the stream.

Elevations 5', 7', 10.5' and 14' in the shoreline planting zone shall be staked the full length along the shoreline planting slope with minimum 36 inch tall wood lath stakes spaced 40 feet between stakes of each elevation. Each stake shall have its elevation clearly written on both sides of the stake with black marker pen.

The backfill soil area around all emergent plants shall be compacted firmly to ensure plants will not be floated or carried away when submerged.

8-02.3(10) FERTILIZERS

The following is added at the end of this section:

Plant Fertilizer

The Contractor shall provide and apply plant fertilizer for plants between the months of March and June during plant establishment. Fertilizer shall be placed at the rate of 1/4 cup per plant, spread within a 1-foot radius around each plant.

8-02.3(11) BARK OR WOOD CHIP MULCH

The following is added at the end of this :

Bark mulch or wood chip mulch shall be placed to a uniform non-compacted depth of 3" over all planting areas except seeded and emergent areas, and rain garden planting area.

Prior to placement, the bark or wood chip mulch application method shall be approved by the Project Engineer. The Contractor shall notify the Project Engineer 7 calendar days prior to the start of bark or wood chip mulch application. Bark or wood chip mulch shall not be placed in areas of standing water.

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8-02.3(13) PLANT ESTABLISHMENT

This section is deleted in its entirety and replaced with the following:

It shall be the Contractor's responsibility to maintain all the landscaped areas of this Contract from the time of installation until the project is completed and accepted by the Project Engineer as complete. The plant establishment period shall begin when the planting has been completed and on the date of written notice of acceptance by the Project Engineer and shall extend for 365 calendar days.

All plant material shall be watered, pruned, fertilized, sprayed and otherwise maintained and protected throughout the plant establishment period. Rejected plant materials shall be replaced. Plant material for replacement shall be inspected and approved as equal plant material prior to replacement being made. Acquisition of replacements shall be the responsibility of the Contractor with replacements to be made normally during the planting season. The Contractor shall submit a watering schedule indicating how and when all of the landscaped areas will receive water. All plant material shall be watered by thorough sprinkling once every week during the dry season (May 15th through October 1st) or more often as needed to promote healthy and vigorous growth, keep the ground moist, and to prevent wilting, as well as to accommodate weather and seasonal patterns. Groundcover in the plantable paving shall be kept moist for the first six (6) to eight (8) weeks after installation, or until well established as directed by the Project Engineer.

Pruning shall be performed as directed by the Project Engineer so as to maintain a neat, healthy appearance, in accordance with good practice for the type of tree or plant.

The Contractor shall provide the following fertilizer application during the plant establishment period as directed by the Project Engineer. The inspector must be present during this operation.

Fertilizer:

One (1) part Blue Chip Nitriform (Granular) slow release 38-0-0

Two (2) parts Agro Nursery Supplement #3, 7-8-9

Rate of application shall be three cups per tree and 0.25-cup per groundcover plant.

Trees and groundcover shall be sprayed with the proper insecticides, fungicides and chemical mixtures as necessary to control infestation by harmful insects, pests and plant diseases.

All bark covered areas and seeded areas shall be kept weed free. Frequency of weeding shall be sufficient to keep weeds from going to seed, and shall be done at least once each month. Chemical herbicides shall not be used for a period of 60 calendar days after the installation of plant material. When using chemical herbicides, manufacturer's recommended application rates shall be followed. Any plant material damaged by use of herbicides shall be replaced at the Contractor's expense. At least 7 calendar days before the beginning of the landscape establishment period, the Contractor shall submit a weed control plan for approval by the Project Engineer. The weed control plan shall identify the means, manner, methods, and timing intervals

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to assure weed control throughout the plant establishment period. This weed control plan will be subject to revision dependent on results of the implemented plan.

All tree stakes, wrappings, guards and fastenings shall be kept intact and effective in maintaining firm support. Where fastenings have become too tight or too short, new and larger fastenings shall be furnished and installed by the Contractor to prevent strangulation or irregular growth of the tree. Stakes shall be removed during the last month of plant establishment. All deciduous tree stakes shall be kept plumb. All deciduous trees shall be sprayed once during the year with an effective pre-emergent, fungus-inhibiting dormant spray. The inspector must be present during this operation.

Cleanup shall be made immediately after and as part of the work done in the area. The cleanup shall include the entire area under this Contract. The Contract area shall be cleaned of litter and debris at least once each month. Such cleanup shall include the pickup and removal from the Contract area of all clippings, trimmings, leaves, litter, and debris originating from any source whatsoever. Planting areas shall be neatly dressed and finished; walks and paved area shall be hosed off with water as necessary and otherwise kept clean and free from dirt, bark, and litter.

Plantings shall be properly protected against harm from wind, unusual weather, and the public. Special planting techniques, defoliating, wilt proofing, or spray misting may be required for unseasonal planting, prolonged periods of drought, etc., but the need for such use must be approved by the Contracting Agency, and no work shall be performed in, over, or adjacent to planting areas without proper protection and safeguards.

At the end of each month during the plant establishment period, the Contractor shall submit to the Project Engineer a King County Plant Establishment Monthly Statement of Maintenance form itemizing the maintenance work performed during the month for which payment is requested. The list shall include a detailed account of the type of maintenance work performed, on what date, the materials used, and shall call to the attention of the Project Engineer any existing condition that may require special consideration or treatment. Failure to follow this procedure at the end of any month during the plant establishment period shall result in forfeiture of the monthly payment for the month involved.

Inspections of the project site will be performed by the Project Engineer. The Project Engineer will notify the Contractor in writing of any deficiencies in the maintenance work. The Contractor shall perform whatever additional maintenance work is necessary as directed by the Project Engineer. Failure by the Contractor to perform any additional work within the time limits specified may result in forfeiture of the monthly payment or a portion thereof.

8-02.5 PAYMENT

The following paragraph is added immediately after the item “Soil Amendment”:

The unit Contract price per cubic yard for “Soil Amendment” shall include all costs for ripping the existing soil.

The following is added at the end of this section:

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"Plant Establishment", lump sum.

The lump sum Contract price, at the minimum lump sum price stated in the Proposal or more, for "Plant Establishment" shall be full pay for furnishing all labor, materials, tools, equipment, and any other incidental items necessary to perform the maintenance work specified. Payment will be made at the rate of 25 percent per month of the lump sum Contract price for the first three months, and the remainder paid following final acceptance of the plant establishment.

Should the Contractor determine that the cost for this Work is greater than the minimum price stated in the Proposal, the Contractor may bid a higher lump sum price. Should the Contractor write a lump sum Contract price less than the minimum price shown, then the minimum price shown in the Proposal shall govern and become a part of the bid.

8-04 CURBS, GUTTERS AND SPILLWAYS

8-04.3(1) CEMENT CONCRETE CURB ON NEW PAVEMENT

The following is added at the end of this section:

Type 410C Curb shall be constructed on new pavement as shown on COSP numbers 410 and 411. The pavement width shall extend to the back of the curb. The pavement where the curb is to be placed shall be roughened or otherwise treated so that a permanent bond can be secured between the curb and the pavement. Curing compound shall not be used on the pavement where curb is to be constructed.

Dowels, as detailed in COSP numbers 410 and 411 shall be placed at 28 inches on center in the fresh concrete pavement. The dowel bars shall be set while the concrete is still plastic enough to not require hammering them into place.

Premolded joint filler shall be as shown on COSP number 411.

8-04.5 PAYMENT

The following is added at the end of this section:

"Type 410B curb and gutter," per linear foot.

The unit Contract price for "Type 410B curb and gutter" shall include all costs for the Work required to furnish and install the complete curb. Payment does not include the pavement slab upon which curb is placed.

"Type 410C curb", per linear foot.

The unit Contract price for "Type 410C curb" shall include all costs for the Work required to furnish and install the complete curb. Payment does not include the pavement slab upon which curb is placed.

"Extruded Curb, Concrete", per linear foot

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The unit Contract price for "Extruded Curb, Concrete" shall include all costs for the Work required to furnish and install the concrete extruded curb.

8-05 HABITAT STRUCTURES (NEW SECTION)

8-05.1 DESCRIPTION

This Work shall consist of furnishing, installing and constructing various habitat structures as detailed and as shown in the Plans.

8-05.2 MATERIALS

Log with Rootwad

Log with rootwad shall be a 20-foot long trunk of a native coniferous tree species, 18-inch minimum trunk diameter, free of branches, with bark and roots intact. The root spread shall be a minimum of 4 feet. Roots shall be free of rocks and soil.

Source of Material

The Contractor shall submit the source(s) of materials for habitat structures to the Project Engineer for approval at least 14 calendar days prior to use.

8-05.3 CONSTRUCTION REQUIREMENTS

The Contractor shall exercise care when installing habitat structures to ensure that the method of installation minimizes disturbance of waterways and prevents sediment or pollutant discharge into water.

Placement of the habitat structure shall be according to the following:

Log with Rootwad

Place the log with rootwad in a stable position on the ground surface.

8-05.4 MEASUREMENT

Log with rootwad will be measured per each.

8-05.5 PAYMENT

Payment will be made in accordance with Section 1-04.1 for the following:

"Log With Rootwad", per each.

8-06 CEMENT CONCRETE DRIVEWAY ENTRANCES

8-06.1 DESCRIPTION

The following is added at the end of this section:

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This Work shall consist of cement concrete driveway and alley constructed at the locations shown on the Plans and shall be in accordance with COSP number 430. Where COSP number 430 directs the Contractor to use CL 6 concrete the Contractor shall use Class 4000 concrete.

8-06.3(1) EXCAVATION AND SUBGRADE (NEW SECTION)

Subgrade preparation for driveways and the required compaction shall conform to the applicable requirements in Section 2-06 to provide a firm, unyielding subgrade, acceptable to the Project Engineer. Where driveway construction is in an area with exposed tree roots 2 inch or greater in diameter, the Contractor shall comply with the requirements of Section 1-07.16(2). Driveways for accessing alleys and for commercial traffic shall be excavated to accommodate an 8 inch minimum thickness concrete driveway.

Subgrades shall be compacted to 95% relative density per Section 2-03.3(14)D for a 12 inch minimum depth.

8-06.3(2) FORMS AND FINE GRADING (NEW SECTION)

Forms shall have a height of not less than the specified depth of concrete to be placed and shall be of ample strength to resist deformation. All forms shall be securely staked and braced plumb and true to line and grade.

A template shall be set upon the forms, and the subgrade shall be fine graded and compacted to conform to the required section. Prior to the placement of concrete, the subgrade shall be thoroughly dampened.

8-06.3(3) PLACING AND FINISHING CEMENT CONCRETE DRIVEWAY (NEW SECTION)

The concrete shall be spread uniformly and consolidated between the forms (See Section 6-02.3(9)). Through joints and contraction joints shall be located in accordance with COSP numbers 430 and 431. The concrete driveway shall be brush finished with the sidewalk portion scored as specified in Section 8-14.3(3). In the construction of through joints, the premolded joint filler shall be adequately supported until the concrete is placed on both sides of the joint.

Contraction joints (dummy joints) shall be formed with a tee bar by first cutting a groove in the concrete to a depth equal to, but not greater than the joint filler material and then working the premolded joint filler into the groove. Premolded joint filler for both through joints and dummy joints shall be positioned in true alignment and at right angles to the center line of the driveway or alley crossings.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a metal float. Joints shall be edged with 1/4 inch radius edger and the driveway or alley return edges shall be tooled with 1/2 inch radius edger. Curbs shall be tooled with a 1 inch radius edger.

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The surface shall be brushed in a transverse direction in relation to the center line of the driveway or alley return with a fiber hair brush of approved type.

Driveways and alley crossings shall not be constructed at the same time the pavement is placed.

8-06.3(4) CURING AND PROTECTION (NEW SECTION)

Curing materials and procedures shall be as specified in Sections 9-23 and 5-05.3(13).

Before placing any concrete, the Contractor shall have enough protective plastic sheet or other suitable protection at the Project Site to protect the newly placed concrete of an entire day in the event of rain or other unsuitable weather conditions.

8-06.4 MEASUREMENT

This section is deleted in its entirety and replaced with the following:

Measurement for cement concrete driveway and alley return will be by the square yard for the class and thickness of driveway actually placed, measured from the back of the curb to the back of the sidewalk.

8-06.5 PAYMENT

This section is deleted in its entirety and replaced with the following:

Payment will be made in accordance with Section 1-04.1 for the following Bid item:

"Driveway, Cement Concrete, (Thickness)", per square yard.

8-09 RAISED PAVEMENT MARKERS

8-09.1 DESCRIPTION

The following is added at the end of this section:

Raised Pavement Marker Type 2 shall be installed in accordance with Figure 4-001 and Figure 4-004 in the King County 2007 Design and Construction Standards Manual.

8-12 CHAIN LINK FENCE AND WIRE FENCE

8-12.1 DESCRIPTION

The following is added at the end of this section:

Contractor shall install temporary construction fence where shown on Plans or where designated by the Project Engineer

Security chain link fence and gates shall be 8-foot high fence, including barbed-wire overhang as detailed on the Plans.

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8-12.2 MATERIALS

The following is added at the end of this section::

Security Chain Link Fence and Gates 9-16.9

Coated Chain Link Fence

Chain link fence fabric shall be hot-dip galvanized with a minimum of 0.8 ounce per square foot of surface area.

Fencing materials shall be coated with an ultraviolet-insensitive plastic or other inert material at least 2 mils in thickness. Any pretreatment or coating shall be applied in accordance with the manufacturer's written instructions. The Contractor shall provide the Project Engineer with the manufacturer's written specifications detailing the product and method of fabrication. The color shall match Federal Standard 595 color number 37040, or be as approved by the Project Engineer.

Samples of the coated fencing materials shall be approved by the Project Engineer prior to installation on the project.

The Contractor shall supply the Project Engineer with 10 aerosol spray cans containing a minimum of 14 ounces each of paint of the color specified above. The touch-up paint shall be compatible with the coating system used.

8-12.2(1) HIGH VISIBILITY FENCE (NEW SECTION)

The fence shall be brightly colored orange, plastic, open gridded material mounted securely to steel posts. In selected locations, the orange fabric may be hung on temporary construction fencing, or on silt fencing in a manner that will allow the orange to be visible for establishing construction boundaries. This Work shall include maintaining high visibility fencing, and relocating, reconstructing, replacing, and no additional payment will be made.

8-12.2(2) TEMPORARY CONSTRUCTION FENCE (NEW SECTION)

Contractor shall install temporary construction fence where shown on Plans or where designated by the Project Engineer. Relocation of Construction fencing may be required to accommodate Contractor phasing and sequencing. No additional payment will be made for removing, relocating, or replacing, Construction Fence.

8-12.3 CONSTRUCTION REQUIREMENTS

The following is added at the end of this section:

The location and alignment of the fence corners and gates are shown on the Plans and as pre-approved by Boeing Security.

The Contractor shall submit shop drawings of fencing, gates and appurtenances. Shop drawings must be approved by the Project Engineer prior to fabrication or installation.

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Upon completion of the fence, the Contractor shall clean the fence of all soiled places and repair marred or abraded areas.

8-12.3(5) SECURITY CHAIN LINK FENCE (NEW SECTION)

Security chain link fence and gates shall be erected and installed by an organization regularly engaged in the business, employing labor skilled in this type of work to provide a complete security fencing system.

Security double swing gates shall be fabricated to withstand wind and swing loads. They shall have locking bars to seat into keepers that are set in concrete in ground locations which will hold the gate rigidly in position when closed. Hinges shall be provided which will allow the gate to swing the entire arc. Install gates on gate posts only, do not install on buildings.

Fabric shall be fastened to posts, the top rail and the bottom wire with wire ties.

Top rails shall be continuous. The Contractor shall provide for expansion or contraction of the continuous rail. Expansion and contraction sprint couplings shall be installed at intervals of 100 feet maximum.

Posts shall be installed vertically in the concrete with a minimum depth of embedment indicated on the Plans. Spacing of posts shall be as shown on the Plans. In unpaved areas, the concrete shall be struck off two inches above the surrounding grade. In paved areas it shall be struck off flush with the paving. The top of the concrete shall be troweled smooth, with a slight slope away from the posts.

Minor damage to galvanizing of fabric and fence appurtenances shall be repaired by thorough cleaning of the damaged surfaces and the application of touch-up paint compatible with the coating system used., in strict accordance with the manufacturer's recommendations.

Upon completion of the fence, the Contractor shall clean the fence of all soiled places and repair marred or abraded areas.

8-12.4 MEASUREMENT

The following is added at the end of the section:

Security Chain Link Fence will be measured per linear foot measured along the ground line.

Security Double Swing Gate will be measured per each.

Security Single Swing Gate will be measured per each.

High visibility fence shall be measured by the linear foot of construction fence placed. Relocation, removal, and replacement shall be considered included in the bid item high visibility fence.

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8-12.5 PAYMENT

The following is added at the end of this section:

"Coated Chain Link Fence Type 3", per linear foot.

Payment for clearing of fence line for "Coated Chain Link Fence Type 3" shall be in accordance with Section 2-01.5.

"Coated End, Gate, Corner, PullPost for Chain Link Fence", per each.

"Double 20 Ft. Coated Chain Link Gate", per each.

"Single 6 Ft. Coated Chain Link Gate", per each.

"Security Chain Link Fence", per linear foot.

"Security Double Swing Gate" per each.

"Security Single Swing Gate" per each.

High visibility fence shall be measured by the linear foot of construction fence placed. Relocation, removal, and replacement shall be considered included in the bid item for high visibility fence and no additional payment shall be made.

8-13 MONUMENT CASES

8-13.1 DESCRIPTION

The following is added at the end of this section:

Monument, monument cases, and covers shall be installed at the locations shown in the Plans and in accordance with Figure 5-019 in the King County 2007 Design and Construction Standards Manual. The Contractor shall furnish and install the monument. Horizontal and vertical locations will be established by the Project Engineer. The monument case shall match the profile grade of the roadway.

8-13.3 CONSTRUCTION REQUIREMENTS

The last paragraph is this section is deleted.

8-13.3(1) REFERENCE POINTS – GENERAL (NEW SECTION)

The Project Engineer will reference all monuments in advance of construction, and will tie out and reset the points and grades in coordination with Contractor activities.

It shall be the responsibility of the Contractor to furnish and install required castings and materials in accordance with the Contract.

The Contractor shall carefully protect all reference points and witness monuments, to the monuments and shall give the Project Engineer a minimum 6 calendar days advance notice of the

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schedule for monument work removal, and a minimum 6 calendars advance notice of monument casting installation in order to avoid destruction of the survey points.

8-13.3(2) FURNISH AND PLACE MONUMENT CASTINGS (NEW SECTION)

Where indicated on the Plans, the Contractor shall furnish and install COSP Type 020, or WSDOT Standard Plan A-10.30-00 when specified in the Contract, monument frames and covers to the lines and grades established by the Project Engineer.

8-14 CEMENT CONCRETE SIDEWALKS

8-14.1 DESCRIPTION

The following is added at the end of this section:

Cement Conc. Sidewalk and Cement Concrete Sidewalk – SEW shall be constructed as shown on the roadway sections in the Plans and in accordance with the COSP number 420. At driveways, sidewalk depths shall conform to COSP number 430. The driveway areas will be measured separately from sidewalks.

8-14.3 CONSTRUCTION REQUIREMENTS

The first paragraph of this section is deleted and replaced with the following.

The concrete in the sidewalks shall be air entrained concrete Class 4000 in accordance with the requirements of Section 6-02.

8-14.3(3) PLACING AND FINISHING CONCRETE

The second paragraph of this section is deleted and replaced with the following:

Cement Concrete Sidewalk, Cement Concrete Sidewalk – SEW, sidewalk on North and South Approach Span superstructures and sidewalk on Bascule Pier and Span shall all have same finish. The surface shall be brushed with a fiber hair brush of an approved type in a transverse direction except that at driveway and alley crossings it shall be brushed in a longitudinal direction. The placing and finishing of all sidewalks shall be performed in a manner acceptable to the Project Engineer, and the tools used shall be acceptable to the Project Engineer. After brush finish, the edges of the sidewalk and all joints shall be lightly edged again with an edging tool to give it a finished appearance.

Sidewalks 120 feet in length or less, shall be scored to match the pattern of existing sidewalk to which new sidewalk joins unless otherwise specified in Contract. All other sidewalk shall be divided into panels by scoring 1/4 inch deep "V grooves" in the manner indicated on COSP number 420.

8-14.3(6) CURB RAMP (NEW SECTION)

A. General

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All curb ramps constructed under this Contract shall have cast in place detectable warning plates.

Curb Ramps shown on the Plans per COSP number 422a with a ramp length greater than eight (8) feet will be constructed in accordance with the COSP and considered to be a Non-Standard Curb Ramp.

Any curb ramp that is labeled on the Plans as Non-Standard will be referred to as "Non-Standard Curb Ramp".

Curb ramp alignment shall be as indicated on the Plans, or as directed by the Project Engineer in the field. Curb passing through the curb ramp shall be monolithic with the curb ramp. Curb ramps shall be constructed separately from the sidewalk to produce a definite break line between the ramp and the sidewalk. A 3/8 inch through joint premolded filler shall be installed between the curb ramp and the sidewalk with ¼ inch concrete edging as specified in Section 8-14.3(3).

The Contractor shall notify the Project Engineer 5 calendar day in advance of placing concrete for each curb ramp to allow the Project Engineer the opportunity to inspect the curb ramp layout. The Contractor shall not place concrete for a curb ramp until the Project Engineer has either inspected and accepted the layout or waived the layout inspection. The Contractor shall be responsible for the curb ramp installation regardless of the Project Engineer's inspection of the curb ramp layout or not, see Section 1-05.7.

Concrete for curb ramps shall not be overlaid or topped. Triangular shaped sidewing areas shall be brush finished with brushing parallel to the curb face. The adjacent sidewalk "V" groove scoring pattern shall not extend into the curb ramp sidewing areas. The inclined plane of the ramp indicated shall have a coarse textured surface similar to the impression that is obtained through the use of a 3/4 inch x # 9 flattened expanded metal mesh screen pressed into the fresh concrete.

The subgrade for curb ramps shall be graded and formed to provide a minimum concrete depth of 6 inches adjacent to the curb and tapering to a minimum depth of 3 1/2 inches at the back terminus.

Where existing sidewalk or existing curb ramp are to be replaced with new curb ramp and a detectable warning plate, the Contractor shall have supplies and materials in place to complete these constructions within 5 calendar days of beginning this Work. In no case shall this Work extend into or through a non-working day. The only exception to the 5 calendar day requirement is when the manufacturer of detectable warning plate provides written instruction requiring a length of time longer than 5 calendar days for acceptable performance of the plate and is approved by the Project Engineer.

All curb ramp and curb ramp retrofit shall have a detectable warning plate or detectable warning retrofit plate installed in accordance with the manufacturer's written instructions. The Contractor shall ensure the concrete supporting the detectable warning plate is a plane and that the concrete base is completely bonded to and fully supporting of the detectable

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warning. Voids, pockets, and other irregularities in the supporting concrete base are unacceptable. The detectable warning plate shall be oriented as shown on COSP numbers 422a and 422b.

B. Submittal

For COSP numbers 422a and 422b curb ramps, for curb ramp type 1 and curb ramp type 2, and for curb ramp retrofit, the Contractor shall submit to the Project Engineer for approval at least 7 calendar days in advance of this Work, the following detectable warning plate information:

1. A description of the detectable warning plate proposed including the manufacturer's name, address, phone number, and e-mail and web-site addresses as available. (Note – approved materials are specified in Sections 9-37.2 and 9-37.3);

2. For "or equal" products other than approved materials specified in Sections 9-37.2 and 9-37.3, see Section 9-37.4 for additional submittal requirements;

3. Shop Drawings showing fabrication details, dimension details, composite structural system, joint and edge detail; preparation of the concrete surface to receive the plate; Supplies used for installation, support, and bonding; and installation instructions for placement with new curb ramp concrete and for curb ramp retrofit as the Work requires. Where a curb ramp construction or curb ramp retrofit requires more than 5 calendar days to complete, provide written instruction from the manufacturer stating in detail the reason(s) for more than 5 calendar days;

4. Manufacturer's Certificate of Compliance indicating the plate meets all requirements of these Specifications including material test reports from a testing laboratory accredited by a recognized designated standards organization such as ASTM; and

5. Manufacturer's 1 year warranty against breakage, fading, and deformation.

C. Standard Curb Ramp

COSP Curb Ramps, No 422a and 422b shall be installed at locations indicated on the Plans.

The coarse textured surface similar to the impression that is obtained through the use of a 3/4 inch x # 9 flattened expanded metal mesh screen shall have the long axis of the diamond shaped impression perpendicular to the curb line for

COSP number 422a ramps, and shall be parallel to the curb line for COSP number 422b ramps.

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Curb ramps shall be considered as beginning at a point flush with the pavement and terminating at a point flush with the sidewalk or sidewalk landing. For COSP Curb Ramp No. 422a, the ramp area, the detectable warning plate area, and sloping triangular shaped wings indicated on COSP number 422a will be considered as part of the curb ramp. For COSP Curb Ramp No.422b, the landing area, ramp areas, and detectable warning plate area, indicated on COSP number 422b, will be considered part of the curb ramp.

8-14.3(7) BUS SHELTER B22 FOOTING (NEW SECTION)

A. General

The Contractor shall construct a bus shelter B22 footing according to the details shown in Appendix A unless indicated otherwise on the Plans. Prior to construction, the Contractor shall notify METRO at least 14 calendar days in advance of starting work so that coordinating the installation of the bus shelter by METRO forces is accommodated.

The bus shelter footing shall be constructed in accordance with section 8-14.

B. Internal Solar Bus Shelter Lighting

The Contractor shall construct internal solar bus shelter lighting according to the details shown in Appendix A. The Contractor shall ground the 12-volt solar lighting system by the following:

1. All new conduit underground shall have a minimum of 24 inches from finished grade or 30 inches from the top of the shelter pad.
2. Using tie-wire the Contractor shall tie 23 feet of the #4 solid copper grounding electrode to the shelter bus pad rebar, leaving 2 feet from grade level to attach to the grounding lug in the shelter leg.
3. The #4 solid copper grounding electrode shall be enclosed by at least 2” of concrete in accordance with NEC 250.52(A)(3).
4. At the back shelter leg of highest elevation the Contractor shall install the 1 inch GRS conduit and the #4 solid copper electrode.
5. The Contractor shall leave the #4 solid copper electrode and the conduit capped and buried approximately ¼” beneath the concrete surface. Place two feet of the #4 solid copper electrode inside conduit leaving a small arc at the top of the entrance into the conduit. (See Detail “1” in Appendix A)
6. To keep concrete from entering the conduit and cap space, the Contractor, after placing 2 feet of #4 solid copper electrode in the conduit, shall use a foam fill or material inside the 3 inch PVC cap, allowing the instructed time to dry before pouring the concrete.

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7. King Country Metro shall remove 3 inch PVC cap, pull out the #4 solid copper electrode, install a 1 inch thread GRS nipple and connect the #4 solid copper electrode (and fixed ground if applicable) to the grounding lug in the shelter leg.

8. If there is no specified connection to a power source, 1" GRS conduit shall be extended 6 inches beyond the edge of shelter footing and capped. Otherwise, the Contractor shall run the conduit to the specified location.

9. The Contractor shall prepare an as-built drawing for each shelter location. A copy of the as-built drawing shall be delivered to the King County Metro Transit project representative for each shelter pad location.

8-14.3(8) STRIPPING FORMS AND FINISHING – MONOLITHIC CURB AND SIDEWALK (NEW SECTION)

Stripping forms and finishing for the curb section of the monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)D.

The concrete shall be cured for at least 72 hours by one of the methods specified in Section 5-05.3(13).

8-14.4 MEASUREMENT

The following is added to the end of this section

Measurement for "Curb Ramp, (No)" will be per each and shall not include the curb.

Measurement for "Bus Shelter B22 Footing" per square yard.

Measurement for "Cement Concrete Sidewalk – SEW" will be measured per square yard of finished surface and include the surface area of the sidewalk ramps.

8-14.5 PAYMENT

The following is added at the end of this section:

"Curb Ramp, (No.)", per each.

The unit Contract price for "Curb Ramp, (No.)" shall include all costs for the Work required to construct the curb ramp and wing(s) complete and in place, including detectable warning plate, sawcut, common excavation, sidewalk thickened edge and brushed or coursed textural surface finish as detailed on COSP number 422a.

Payment for the removal of existing concrete walk, curb, or curb and gutter shall be made separately in accordance with Section 2-02. Payment for new curb or new curb and gutter shall be made separately in accordance with Section 8-04.

Curb ramp landing for COSP number 422a curb ramp shall be paid as "Cement Conc. Sidewalk" per this Section.

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"Bus Shelter Footing", per square yard.

The unit Contract price for "Bus Shelter B22 Footing" Shall include all the cost for the Work required to construct the bus shelter B22 footing and install the internal solar bus shelter lighting.

"Cement Concrete Sidewalk - SEW", per square yard.

Payment for excavation of material not related to the construction of the sidewalk but necessary before the sidewalk can be placed, when and if shown in the Plans, will be made in accordance with the provisions of Section 2-03. Otherwise, the Contractor shall make all excavations including haul and disposal, regardless of the depth required for constructing the sidewalk to the lines and grades shown, and shall include all costs thereof in the unit Contract price per square yard for "Cement Conc. Sidewalk - SEW".

8-15 RIPRAP

8-15.1 DESCRIPTION

The following is added at the end of this section:

This Work shall also consist of furnishing and installing streambed boulders, streambed cobbles, and rockery of the types specified at the locations shown in the Plans or as directed by the Project Engineer.

8-15.2 MATERIALS

The following is added at the end of this section:

Streambed Cobbles	9-03.11(2)
Streambed Boulders	9-03.11(3)
Rockery	9-03.11(5)

8-15.3(1) EXCAVATION FOR RIPRAP

The second paragraph of this section is deleted and replaced with the following:

All costs for the excavation, including ditch excavation, required for the placement of riprap shall be included in the Contract price for the class of riprap to be placed.

8-15.3(8) STREAMBED BOULDERS AND COBBLES (NEW SECTION)

Streambed cobbles shall be in accordance with Section 9-03.11(2) and in the location shown in the Plans. Streambed boulders shall be in accordance with Section 9-03.11(3) and in the locations shown in the Plans or at the direction of the Project Engineer.

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8-15.3(9) ROCKERY (NEW SECTION)

Construct rockery at the locations and as shown on the Plans. The rockery shall be started by excavating a trench and preparing a compacted, level base as shown on the Plans. Larger rocks shall be placed at the base of the rockery for stability. The rocks shall all have inclining faces sloping to the back of the rockery and each row of rock shall be seated as tightly and evenly as possible on the rock below in such a manner that there will be no movement between the two. Rocks shall be placed and keyed together such that there are no open voids in the exposed face of the rockery over three inches across in any direction. The final course shall have a continuous appearance and be placed to minimize erosion of the backfill material. Rock for rockery shall be in accordance with Section 9-03.11 (3). Rockery backfill shall be in accordance with Section 9-13.7 (2) and shall be placed in lifts after each course of rocks is placed.

8-15.4 MEASUREMENT

The following is added at the end of this section:

Streambed cobbles will be measured by the cubic yard of streambed cobbles actually installed in placed.

Streambed boulders for the planting and mitigation areas will be measured by each boulder actually installed in placed.

Rockery will be measured by the ton of rock installed in place with gravel backfill and geotextile fabric included in the cost of rockery. Measurement will be to the nearest one-tenth (0.10) ton. Excavation for the rockery will be included in a separate item and no additional compensation will be made.

Rock Dust will be measured by the cubic yard of rock dust installed in place.

8-15.5 PAYMENT

The following is added at the end of this section:

"Streambed Boulder Two-Man", per each.

“Streambed Boulder Three-Man”, per each.

"Streambed Boulder Four-Man", per each.

"Streambed Boulder Six-Man", per each.

“Streambed Cobbles”, per cubic yard.

“Rockery”, per ton.

“Rock Dust”, per cubic yard.

98% Submittal - Not for Construction

8-17 IMPACT ATTENUATOR SYSTEMS

8-17.1 DESCRIPTION

This section is deleted in its entirety and replaced with the following:

This Work consists of furnishing, constructing, repairing, and removing permanent and temporary impact attenuator systems proposed by the Contractor and approved by the Engineer.

8-17.2 MATERIALS

The following is added at the end of this section:

The permanent impact attenuator system shall meet or exceed FHWA TL-2 (Test Level 2) criteria and shall fit within the available site as shown on the Plans. System width shall be minimum 18 inches to maximum 24 inches wide and shall not exceed 12 feet in length. The permanent impact attenuator system shall have features to protect cross over traffic from striking attenuator from opposing directions and shall have features to protect pedestrians and bicycles on the sidewalk side.

8-18 MAILBOX SUPPORT

8-18.3 CONSTRUCTION REQUIREMENTS

This section is deleted in its entirety and replaced with the following:

Existing mailboxes shall be remounted where designated as shown on the mailbox mounting details in the Plans in accordance with the KCRDCS (Fig. No. 5-014 and/or 5-015). Mailbox installations shall be furnished and installed with two- by ten-inch treated timber planks mounted on 1.5-inch diameter galvanized iron pipe or four- by four-inch treated timber posts set in concrete. Timber planks and posts shall be pressure treated with a waterborne wood preservative (ACA, CCA, ACZA) in accordance with the requirements of Section 9-09.3(4) of the Standard Specifications. The pipe shall be galvanized in accordance with Section 9-00.7. Concrete shall be Class 3000 in accordance with Section 6-02.

8-19 BRIDGE ELECTRICAL SYSTEM (NEW SECTION)

8-19.1 DESCRIPTION

8-19.1(1) GENERAL

Under this item, furnish, install, test, and place in satisfactory operating condition the complete electrical system for control and operation of the double leaf bascule bridge, including a control desk, Programmable Logic Controller (PLC) equipment, Motor Control Centers, DC Drive Controllers, distribution equipment, closed circuit television system, intercom communication system, lighting, traffic signals, traffic signal poles, traffic signal mast arms, traffic gates, resistance gates, field start up service, spare parts and all required provisions for interlocking complete with all accessories as specified herein and as shown on the plans.

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The control system specified herein shall be coordinated as required, with the Work of all other sections of the specifications and the plans, so that all installations shall operate as designed. Specific coordination is directed toward mechanical work.

Any apparatus, device, circuit, appliance, material, or labor not herein specifically mentioned or included, but that may be found necessary to complete or perfect the installation and equipment in a manner acceptable to the Project Engineer, shall be furnished by the Contractor as if specifically included in these specifications, and without extra cost to the County.

8-19.1(2) REFERENCE STANDARDS

Portions or all of certain recognized industry or association standards referred to herein as being a requirement of these specifications shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements in this specification. Unless otherwise stated, the reference standard shall be the standard which is current as of the date of issuance of these specifications. Reference may be made to standards either by full name or, for the sake of brevity, by letter designation as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute, Inc.
ASME	American Society of Mechanical Engineers
AWG	American Wire Gauge
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
IES	Illuminating Engineering Society
ICEA	Insulated Cable Engineer's Association
JIC	Joint Industrial Council
NEC	National Electrical Code of NFPA
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
UL	Underwriters' Laboratories, Inc.

8-19.1(3) PERMITS AND CODES

The electrical installation shall comply with the National Electrical Code and all applicable laws and ordinances in effect at the construction site and with regulations of the utility companies furnishing power and telephone services to the site.

98% Submittal - Not for Construction

Obtain approval from the Coast Guard for any temporary construction navigation lighting required.

File with the Project Engineer a certificate of final electrical inspection and acceptance by the Board of Fire Underwriters or an approved inspection agency.

8-19.1(4) PLANS AND SPECIFICATIONS

Omissions from the Contract Plans and specifications, or the mis-description of details of work which are evidently necessary to carry out the intent of the Plans and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omissions and details or work, but they shall be performed as if fully and correctly set forth and described in the Plans and specifications. In any case of discrepancy in figures, catalog numbers, or descriptions in the Plans or in the specifications, the matter shall be properly submitted to the Project Engineer who shall promptly make determination in writing. Any adjustment in the plans by the Contractor without written approval shall be at the Contractor's own risk and expense.

A. Equipment Locations

The Contract Plans show, in general, the arrangements and location of all equipment. This shall be considered as illustrative and subject to the approval of the Project Engineer; the Contractor shall modify it as necessary, for complete and proper construction and operation. The location of the conduits, boxes, and equipment shown on the plan is diagrammatic only, and may be subject to shifting as required or as the Project Engineer may direct in order to conform to local conditions. The Plans may be utilized in the preparation of as-built drawings showing the permanent construction as actually made.

B. Circuit-and-Raceway Schedules

Specification and data sheets for most of the circuits and raceways are included in the Plans. These data sheets fully describe the raceways shown on the plan sheets, and fully describe the circuits enclosed in the scheduled raceways. Raceways and circuits used solely for lighting and general purpose receptacles are shown only on the plans, and are not included in the schedules.

The Raceway Schedule is keyed to the raceway numbers as they appear on the plan sheets. The schedule gives the raceway type (galvanized steel - GRS, PVC coated rigid steel - PVGRS, etc.), fill (total area of enclosed circuits) trade size (nominal inside dimension), and a list of the enclosed circuits.

The Circuit Schedules are keyed to the circuit numbers as they appear in the wiring diagrams. The schedules give the origin and destination of each circuit, the number of cables in the circuit, the description of each cable in the circuit (size in AWG, type per data sheets in this specification, and number of conductors in each cable), area of each cable, and a listing of all the raceways that the circuit is routed through.

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8-19.2 MATERIALS

The Electrical Equipment and its installation shall be in accordance with regulations of the NEC and shall conform to Section 8 of AASHTO's LRFD Movable Bridge Design Specifications and current interim specifications except as otherwise provided herein.

All materials and equipment furnished under these specifications shall be new and, to the extent possible, standard products of the various manufacturers. Where more than one of any specific item is required, all shall be of the same type and manufacturer. Items of equipment or material which are not specifically defined herein shall conform to the general standard of quality established herein.

Each piece of electrical equipment and apparatus shall have a permanent type corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, the catalog or model number, and the rating or capacity of the equipment or apparatus.

All electrical devices, printed circuit boards, including their components, and any other electrical or electronic parts, shall be completely identified in such a way as to be easily procured from a supplier of that device. All prints and drawings of same shall show complete circuitry and identify all components as to their specific use and function in the circuit.

The Contractor shall retain the services of a qualified control system integrator who shall have complete system responsibility for the detailed integration of all system components, in order to ensure a complete operating system is furnished and installed in accordance with specified requirements of this project. The Contractor shall be responsible for ensuring total compatibility of all equipment and devices furnished and installed and shall provide supervisory assistance in the selection, installation and integration of all bridge control system and associated equipment. Components associated with bridge control system include but shall not be limited to control console, switchboard cabinet, relay cabinet, remote control console, programmable controllers, modems, computer and interfacing equipment and other facilities as may be required.

The control system integrator shall review and approve shop drawings, prior to submission to the Project Engineer, to ensure that all components of the bridge operating system submitted for use are compatible in every respect and that all components meet or exceed the specific requirements and intent of the project. The total bridge operating system shall be subject to the approval of the Project Engineer, based on the Contract Documents.

The control system integrator shall ensure maximum reliability and ease of maintenance for all components of the operating system and shall be responsible for all training of the bridge operator staff and for the supervision of all trial operations. The system integrator must have demonstrable competence in providing electrical control systems for movable bridges of various types, particularly bascule bridge types, but including vertical lift and swing type bridges utilizing programmable controllers and fiber optic communications. Such competence shall be demonstrated by identifying a minimum of (3) three movable bridges for which he has provided complete systems within the past five years.

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The control system vendor shall be of a caliber and background similar to that of Link Controls, Inc. of Ronkonkoma, NY, (631) 471-3950, Panatrol Corp, Bedford Park, IL, (708) 496-3080, Anderson Electric Control, Kent, WA, (253) 395-3003 or approved equal.

System integrator shall make available a field service staff with the capability of providing services for field coordination of construction and final adjustments to the control system to the satisfaction of the Project Engineer. Field staff shall be capable of responding, at the site, to an emergency within 24 hours.

Name and written qualifications of the proposed system vendor shall be provided within 21 calendar days of First Notice to Proceed and shall be subject to approval by the Project Engineer.

All ferrous metal work shall be hot-dip galvanized in accordance with ASTM A123 or ASTM A153, whichever is applicable. If any galvanizing is damaged, the metal work shall be refinished by cleaning and painting, with two coats of approved galvanizing repair paint, or approved zinc chromium paint.

Lock washers shall be provided on all mechanical fastenings.

In order to prevent deterioration due to corrosion, all bolts, nuts, studs, washers, pins, terminals, springs, hangers, cap screws, set screws, tap bolts, brackets, and other hardware fastenings and fittings shall be of an approved corrosion-resisting material such as silicon bronze, or stainless steel. Hot-dip galvanizing, per ASTM Specification A-153, will be considered approved treatment for all non-moving ferrous hardware.

The manufacturer of the resistance gates shall submit calculations, signed by a Licensed Professional Engineer in the State of Washington, showing that the resistance gate arm and its end connections, end lock, side arm lock, housing and anchor bolts are capable of withstanding the design loads. The calculations shall be submitted to the Project Engineer for review and approval.

8-19.2(1) SHOP DRAWINGS

Within 120 calendar days after receipt of the First Notice to Proceed, submit shop drawings to the Project Engineer in accordance with Section 1-05.3. Submit full size drawings for those items requiring construction from such drawings. Provide descriptive leaflets for standard catalog items which are mass produced.

Submit shop drawings for all cabinet enclosures, motors, panel boards, span brakes, transformers, switches, raceways, conductors, wiring devices, lighting fixtures, lamps, service equipment, boxes, control equipment, fasteners and other such equipment, and methods of fastening to structures. The control system vendor shall review, coordinate and prepare as necessary all shop drawings pertaining to the bridge operating control system before submitting these drawings to the Project Engineer for his review. The Control system integrator shall review and approve the shop drawing prior to submittal to the Project Engineer. No equipment shall be purchased without the Project Engineer's approval of shop drawings.

Shop drawings shall include manufacturer's test data, shall be certified by the manufacturer, and shall identify the application for which they are proposed.

Design Submittal - Not for Construction

Equipment identification shall be the same as shown on the Contract Plans. Standard drawings showing more than one model or size shall be marked to indicate the model or size proposed.

Shop drawings of cabinets containing electrical equipment shall include outside dimensions, shipping splits, cabinet door hinge and opening hardware locations, areas for conduit penetrations, one-line and three-line diagrams, wiring diagrams, schematic and interconnection diagrams, terminal block arrangements and numbers if such terminal blocks are intended for connection of field wiring, and operating instructions.

The shop drawing shall indicate how the equipment/cabinets will be placed with the constructed control tower / bascule pier to ensure that the physical dimensions of individual units will pass through doorways or other passage ways. Indicate shipping splits equipment/cabinets required to meeting installation requirements.

Provide layout drawings and geographic wiring diagrams for the control desk and for the programmable controller cabinets.

Submit shop drawings when installation and mounting details of switches, fixtures, and devices are different from or not specifically detailed on the Contract Plans.

If requested by the Project Engineer, submit for inspection samples of the proposed substitute items at no additional cost to the County. Submit all support data in quintuplicate for review. Neither the County nor the Project Engineer will be liable for any materials purchased or work done or any delay incurred prior to their review. Failure of the Project Engineer to note unsatisfactory materials as received will not relieve the Contractor from responsibility. Deliver manufacturers' guarantees or warranties on materials to the Project Engineer upon receipt of the materials.

Catalog cuts and manufacturers' standard drawings may be submitted on their respective standard sizes. Submit them to the Project Engineer for review and distribution.

The Project Engineer will not be responsible for errors of working drawings, even though approval has been indicated, or for quantities or bills of material which may be included. Any failure of the Project Engineer to correct errors on working drawings, or implied approval thereof, shall not relieve the Contractor of the full responsibility for the safe and adequate execution of the Work in accordance with the plans and specifications.

After review of the working drawings by the Project Engineer, no changes shall be made without resubmission for approval by the Project Engineer, and all changes or revisions later made shall be clearly marked and dated.

Before final payment is made, the Contractor shall deliver to the County two sets of as-built drawings reflecting all changed or modifications made from the Contract Plans having to do with the finished structure. As-built drawings shall be suitable for permanent storage, and any reproducible material which is subject to fading when exposed to light will not be acceptable.

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8-19.2(2) REFERENCES

Reference to a particular product by manufacturer, trade name, or catalog number establishes the functional requirements and quality standards of material and equipment required for this installation and is not intended to exclude products equal in function and quality and similar in design. Whenever any section, materials, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or approved equal", if not inserted, shall be implied, except as otherwise noted.

8-19.2(3) SUBSTITUTIONS

Reference to a particular product by manufacturer, trade name, or catalog number establishes the functional requirements, quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design.

Equipment for which an acceptable manufacturer is not specifically named, or named equipment for which substitution is proposed, shall be manufactured by a company which has had a minimum of ten years of experience in the manufacture of similar equipment and which, in the Project Engineer's opinion, has demonstrated its proficiency in the manufacture of such equipment. All equipment will be subject to the Project Engineer's approval.

8-19.2(4) STRUCTURAL STEEL

Material for support of limit switches shall conform to the requirements of ASTM A36 structural carbon steel. Bolts used shall conform to the requirements of ASTM A325 Type 1 bolts and hardened steel washers shall be provided as shown in the Contract Plans.

8-19.3 CONSTRUCTION REQUIREMENTS

All construction and installation shall be made by workmen skilled in this type of work and under the supervision of an experienced and qualified electrical supervisor. In addition, the approved control system vendor shall provide supervisory assistance to the electrical Contractor as specified herein. All work shall be executed in a neat and workmanlike manner and shall present a neat and mechanical appearance when completed. Upon completion of the Contract, deliver to the Project Engineer a corrected plan showing in detail all changes on construction from the original plans, especially location and sizes of conduits, complete schematic circuit diagrams and the like.

Provide all terminal strips with approved permanent terminal markings for each connected conductor in service. Place the marking on a material which will not be affected by age or moisture and apply two coats of clear lacquer after placing the markings.

8-19.3(1) RACEWAYS

A. General

All conduit shall be of the material called for in the plans. All conduits shall be free from blisters, cracks, or injurious defects. Wiring troughs shall be hot dip galvanized after fabrication.

Raceway sizes shall be as shown on the plans, and shall be 3/4" minimum trade size.

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B. Galvanized Rigid Steel Conduit

The conduit shall be UL listed and shall comply with the requirements of ANSI Standard C80.1 "Specifications for Rigid Steel Conduit (Zinc-Coated)". Manufacturers shall be Allied, Steel duct, Triangle, Youngstown, or approved equal.

All rigid steel conduit fittings shall be hot-dip galvanized after fabrication in accordance with ASTM-A153. Manufacturer shall be Appleton Electric, Crouse-Hinds, O.Z./Gedney, Pyle-National, Russell & Stroll, Thomas & Betts, or approved equal.

After field threading, re-galvanize all steel conduit with "Zinc Rich", "Zincilate 810", or "Galvanizing Powder M-321". Apply this material in the field, immediately after the conduit is threaded and cleaned.

C. PVC Coated Galvanized Rigid Steel Conduit

The PVC coated galvanized rigid conduit shall be UL listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit and be UL Listed. The PVC coated rigid galvanized steel conduit must be certified and authorized to apply the ETL Verification Mark “ETL Verified to PVC-001”. ETL Verified to Intertek ETL SEMKO High Temperature H2O PVC Coating Adhesion Test Procedure. Continued compliance to this specification is monitored through production testing, quarterly inspections by Intertek ETL SEMKO at production facility and random sample testing. Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. All conduit and fittings must be new, unused material. The PVC coating shall be gray, 40 mils in thickness, and be free of blisters, bubble, or pin holes. Applicable UL standards may include: UL 514B Standard for Safety, Fittings for Conduit and Outlet Boxes. Conduit and fittings shall be evaluated for reliability and performance. Certified test results are the respective test data that have been witnessed and certified to be accurate by an independent, recognized third party. Acceptable conduit and fitting PVC bonds shall be confirmed with a minimum average of 30 calendar days in a heat and humidity test (ASTM D1151 and D2247) with the temperature at 150 degrees F and 95% humidity. Acceptable seal performance shall be confirmed at 15psig (positive) and 25 inches of mercury (vacuum) for 72 hours. Manufacturer shall be Perma-Cote Industries or approved equal by Plasti-Bond or Rob-Roy.

All conduit and fittings shall be hot-dip galvanized inside and out with hot galvanized threads prior to applying plastic coatings. All exterior surfaces shall be coated with a heat polymerizing adhesive not to exceed .0005" thick prior to plastic coating. The exterior plastic coating shall be bonded to the metal with a thickness of .040" nominal the full length of the pipe except the threads. Interior coating shall be 2 mil minimum urethane.

Repair any nicks or gouges in the PVC coating after installation with manufacturer’s approved touch-up compound to restore corrosion protection.

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All fittings, support struts, pipe clamps, etc, shall be PVC coated to meet all requirements of the conduit manufacturer.

D. Liquid-tight Flexible Metal Conduit

Liquid-tight flexible steel conduit shall be constructed of a flexible galvanized steel core made from continuous steel metal and an extruded PVC cover. Conduit shall be Anaconda Type UA, Electri-Flex Type LA, Rob-Roy Flex, or approved equal.

Fittings shall have insulated throat and be UL labeled. An "O" ring assembly shall be used on each fitting. Manufacturers shall be Appleton Electric, Ideal Industries, Thomas & Betts, or approved equal.

E. Rigid Nonmetallic Conduit

The conduit shall be rigid polyvinyl chloride, schedule 80, 90 degree C, of the sizes indicated on the plans and shall conform to the NEMA standards. Conduit shall be UL listed in conformity with Article 347 of the National Electric Code. Conduit, fittings, and cement shall be produced by the same manufacturer who shall have had at least five years experience in manufacturing these products. All joints shall be solvent welded in accordance with the recommendation of the manufacturer.

F. Cable Trays

Cable trays shall conform to NEMA Standards for cable trays constructed of galvanized steel or stainless steel with gasketed covers. Cable trays outside of the conditioned spaces of the control towers shall be oil and water tight. Tray of the ladder type shall be of the size outlined on the plans, 9 inch rung spacing, and shall sustain a minimum of 276 pounds per linear foot load on a 10 foot span with a safety factor of 1.5 and a minimum deflection of 0.41 inches. Tray of the solid bottom type shall be provided with a flat bolt-on cover and installed in the bascule pier areas. Ratings shall be similar to the ladder type tray. Cable trays shall be B-Line Systems, Inc., series 3, Square D, PW Industries or approved equal.

Provide trays at the elevation and locations shown on the plans. The interconnections of the sections, fittings and other components shall provide a rigid mechanical assembly with splice plates properly installed to avoid structural weakness. Locate tray splices at the 1\4 points of the span between supports.

Tray shall run parallel or perpendicular to the main structural lines of the building or bridge structure. Drilling or welding of the building steel members will not be permitted. Trays shall be mechanically connected at joints, fittings, and terminations, and shall provide a continuous ground path.

Support cable trays as shown on the Contract Plans, at the midpoint of each horizontal bend and in accordance with manufacturer's recommendations.

G. Installing Raceways

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Connect conduit sections to each other with screw couplings, made up so that the end of both conduits will butt squarely against each other inside of coupling and non-metallic conduit shall be solvent welded in accordance with the manufacturer's recommendations. Install conduits so as to be continuous and watertight between boxes or equipment. Protect conduits at all times from the entrance of water and other foreign matter by capping or well plugging overnight and when the work is temporarily suspended.

Install all conduits so that they will drain properly. Provide drainage tees at low points where required.

All field bends shall be long sweep, free from kinks, and of such easy curvatures as to facilitate the drawing in of conductors without injury. Conduit runs shall be made with as few couplings as standard lengths will permit, and the total angle of all bends between any two boxes shall not exceed 360 degrees. Long running threads will not be permitted.

Use pull boxes wherever necessary to facilitate the installation of the conductors. Condulets shall not be used for pulling more than ten conductors or for making such turns in conduit runs or for branching conductors, except for indoor wiring to lighting fixtures and receptacles.

Galvanized rigid steel (GRS) conduit shall be installed only within the control towers and where the areas remain dry. PVC coated rigid steel (PVGRS) shall be installed within the pier areas and in areas where the conduit will be exposed to wet environments. Rigid non metallic (PVC) conduit shall be installed where ever the raceway is to be buried below grade or within concrete.

All conduit fittings shall be of the same type material as the conduit installed.

Where conduits pass through the floors or walls of the control room, galvanized rigid conduit sleeves shall be provided for free passage of the conduits. After the conduits are installed, caulk the opening with an elastic fireproof compound and escutcheon plates provided on the interior walls, ceilings, and floors for airtight fits.

Where cable trays pass through floors or where conductors are required through floors for access to electrical equipment as shown on the plans, fill the openings and caulk with a fire proofing sealant after all conductors are installed. Where conductors pass through floors without the use of a cable tray, provide escutcheon plates. Sealants shall be manufactured by Carborundum, Dow Corning, Nelson Fire Stop Products, or approved equal.

Exposed raceway runs shall be straight and shall be parallel or at right angles to the general structure lines. Attachment to steel or concrete in the pier areas shall be by PVC coated fittings, straps, or hangers held at not less than two points by stainless steel bolts or lag screws. Concrete inserts shall be Unistrut, B-line, Midland Ross, or approved equal, fabricated from stainless steel. Conduits mounted exteriorly on parts of the steel work shall be set not less than 2 inches clear from the supporting structure to prevent accumulation of dirt, and they shall be securely clamped to the steel work to prevent rattling and wear. The

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clamps, in general, shall consist of U-bolts attached to angle or channel iron supports bolted to the members. The spacing of the clamps shall not exceed 6 feet.

Supports for electrical work which are fabricated from structural plates or shapes bolted to structural members and which are shown or requested to be included on the steel Contract Plans, will be paid for under the items shown on the plans. Additional alterations and supports not shown or requested, but that are found necessary after completion of steel fabrication plans, shall be included for payment and additional compensation will not be considered.

See Division 10 "Operating Machinery" of these Special Provisions for coordination with bridge mechanical system.

At any point where a conduit crosses an expansion joint, or where movement between adjacent sections of conduit can be expected, install bronze or alloy expansion fittings equal to Type AX from the WSDOT QPL or approved equal.

Use of flexible conduit is allowed only for the connection of motors, limit switches, and other devices that must be periodically adjusted in position. Connections between the rigid conduit system and all movable motors, and movable limit switches shall be made with flexible conduit with couplings and threaded terminal fittings. The flexible conduit shall be fully interlocked and shall be Type RT-6 as made by the Flexonics Corporation, Type UA-OR as Anaconda's Sealtite, Carflex by Carlon, or approved equal. Flexible conduit extensions shall not exceed 24 inches in length and shall be equipped with bonding jumpers.

All conduits shall be carefully cleaned, both before and after installation. Upon completion of the conduit installation, clear each conduit with a tube cleaner equipped with a mandrel of a diameter not less than 80 percent (80%) of the nominal inside diameter of the conduit, and shall then draw in the conductors.

Provide both ends of each conduit run with a brass tag having a number stamped thereon in accordance with the conduit diagrams. Securely and permanently fasten these tags to the conduit ends with bare copper wire.

8-19.3(2) CONDUCTORS

Furnish insulated conductors and conductor accessories in sufficient quantities for a complete installation. Installation shall be in accordance with the National Electrical Code, and shall include placement, splicing, terminating, identification, testing, and verification of each circuit and conductor.

Conductors at 480 volts (power conductors) potential shall not be routed in the same raceway as conductors at 120 volts potential or less (control conductors).

Cable types, as shown on the plans, shall be as shown on the cable data sheets. The "type" as shown on the circuit schedules in the plans is the "type" referenced to at the top of each cable specification sheet. Unscheduled conductors for lighting circuits shall be Type B.

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The "Outside Diameter" is the nominal diameter used to calculate the required conduit size. If actual cables used are of larger diameter, the Contractor shall increase the size of the affected conduits, as required by the NEC, at no additional cost to the County.

A. Acceptable Manufacturers

Acceptable manufacturers for types B, D, G, and H are American Insulated Wire, Okonite, Southwire or approved equal. Acceptable manufacturers for type E are Okonite, American Insulated Wire, Belden or approved equal. Acceptable manufacturers for type FO are Belden, Alpha, Anixter or approved equal.

Provide a durable marking on the outer surface of all cables or conductors at intervals not exceeding 24 inches. Marking shall include manufacturer's name, insulating material, conductor size, and voltage class.

Each conductor, of power, control and signal wiring, shall be color coded with colored insulation. Color coding of power wiring shall be black for Phase A or 1, red for Phase B or 2, blue for Phase C or 3, white for neutral, and green for equipment ground. Switch legs for local wall switches shall conform to local Code requirements.

B. Circuit Identification

All conductors and each circuit, as shown in the Circuit Schedule on the Plans, shall be identified at tap, termination and in all junction boxes, pull boxes and equipment enclosures with an identification tag. Conductors supplied by multiple vendors, or supplied by multiple subcontractors shall be consistently and uniquely identified such that any given conductor will be assigned only a single identification. Tags shall be of an opaque nylon material arranged to include a marker board, non-releasing holding device, and cable fastening tail. The marking board shall be not less than 3/8 inch wide x 3/4 inch long, and 25 mils thick, roughened on one side to hold black nylon marking ink from a permanent marking pen. Identification shall be permanent and waterproof. Once installed, the tie shall not be removable except by cutting it loose from the cable.

C. Installation or Placement

Draw the wire and cables into conduits without causing injury to the wires or their insulation or covering.

Install all cables as recommended by the manufacturer. Adhere to the manufacturer's recommended maximum pulling tension and minimum bending radius during installation. Use the necessary guides, pulleys, sleeves, and pulling aids to prevent abrasion and damage to the cables during installation. Use lubricants recommended by the cable manufacturer and acceptable to the Project Engineer for the pulling of conductors or cables. Permanently and clearly tag both ends of every single length of conductor with approved tags marked in accordance with the same number and designation shown on the wiring diagrams. Connect

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all outgoing wires No. 8 AWG or smaller in the control desk, on the switchboards and panels and in terminal cabinets to terminal blocks.

Spare conductors of a multi conductor cable shall be left at their maximum lengths for possible replacement of any other conductors in the cable. Coil each spare conductor and then tape it to the conductors being used.

Twisted shielded pair conductors or instrument conductors shall not be terminated at any point except at point of origin or point of finish. When instrumentation cable are required to cross the channel, a corrugated PVC duct provided within the submarine cables shall be utilized to prevent cutting or splicing of the cables. Where instrument conductors are required be cut and spliced in order to connect to other instrument conductors, the individual conductors and shielding shall be spliced in accordance with the manufacturer's instructions. The splice connections shall then be taped and wrapped to ensure adequate seal from noise and environment in accordance with the manufacturer's instructions.

Conductors inside terminal boxes and at the control panels and control desk shall be installed in plastic wire ways or shall be neatly formed into cables and laced with two strands of an approved wax-treated linen cord or plastic tie-wraps, with the individual conductors leaving the cable at their respective terminal points. These conductors shall be looped to allow not less than 3 inches of free conductor when disconnected. These formed cables shall be held securely away from the terminals and from contact with the cabinet by means of approved insulating supports. Wiring duct meeting JIC standards will be acceptable.

All terminal strips shall be provided with approved permanent terminal markings for each connected conductor in service. The marking shall be placed on a material which will not be affected by age or moisture and shall be given two coats of clear lacquer after the markings are placed thereon or as stated elsewhere in these Specifications.

Splicing of conductors will not be permitted except for wiring to service lighting fixtures and receptacles.

All splices, T-taps, and free ends of 600 volt cables shall be insulated. General use cables shall be insulated with type 33 tape. High ambient cable shall be insulated with type 70 tape.

Wherever it becomes necessary to terminate, joint, or branch conductors, terminal blocks in boxes shall be used.

Cable connections for No. 8 and smaller, for making terminations and splices shall be with high pressure indent type pressure connectors. Connectors shall be copper and as manufactured by Buchanan Products, Burndy, Thomas & Betts, or approved equal.

Cable connections for No. 6 and larger for making terminations, T-taps, and splices shall be with a high compression or bolted type pressure connector. Compression connectors shall be installed as recommended by the manufacturer using the recommended tooling for installation. Bolted connectors shall have a non-rotating pressure cap and as manufactured by Burndy, O.Z. Electric, Buchanan, or approved equal.

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D. Tests after Placement

The Contractor shall develop and submit to the Project Engineer a testing and certification plan for all aspects of the electrical system(s). The testing and certification plan shall systematically check the requirements of the electrical system to verify conformance with the Contract requirements. The Contractor shall submit the testing and certification plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing the electrical system(s). The Contractor shall successfully complete all testing of the electrical system independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer.

Once the Contractor has successfully tested the completed electrical system and submitted the corresponding certification forms, the Contractor shall again test the electrical system in the presence of the Project Engineer and the County's agents consisting of not more than two representatives of the bridge designer for purposes of validation to demonstrate it meet the Contract requirements. If the initial validation testing in the presence of the Project Engineer and the designer's representatives is unsuccessful and cannot be remedied and successfully re-tested within 24 hours of the initial test, the Contractor shall reschedule subsequent testing and shall reimburse the County for the direct cost associated with re-mobilizing and participation in all subsequent electrical system validation testing by the designer's representatives at a costs of up to $12,500 each subsequent electrical system validation testing event.

All insulated conductors shall be electrically tested after placement. All circuits, including lighting circuits, shall be tested with the circuit complete except for connections to equipment. All splices shall be complete prior to testing. Any circuit failing to test satisfactorily shall be replaced, or repaired and retested as directed by the Project Engineer. All equipment and labor required for testing shall be provided by the Contractor.

All insulated conductors shall be tested for continuity and conductor identification. In addition, all insulated conductors of multi-conductor cable shall be tested for short circuits. Furnish portable, battery powered, ring testers, and other test equipment as required for these tests.

1. Continuity tests shall include all tests necessary to confirm that each conductor is continuous throughout its entire length.

2. Identification tests shall include all tests necessary to confirm that the conductor being investigated originated and terminates at the locations designed in the Circuit List or indicated on the Contract Plans.

3. Short circuit tests shall include all tests necessary to confirm that no conductor of a multi-conductor cable is short circuited to another conductor in that cable.

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4. Power and control cable rated below 2,000 V. - All insulated conductors, except instrumentation cable, rated less than 2,000 v. shall be tested with a 1,000 v. megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and ground and between each conductor and all other conductors of the same circuit. Minimum acceptable resistance values shall be in excess of 100 Megohms.

5. Instrumentation cable - All insulated conductors of supervisory and communication cable shall be tested with a 500 v. megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and the cable shielding tape and between the two conductors in each pair. Minimum acceptable resistance values shall be 50 Megohms divided by the actual cable length in miles.

TYPE B
600 Volt Single Conductor Flame Resistant Power Cable

Description:

Reference:	ICEA S-66-524
Conductor:	Class B Stranding, 90 DEG C, Standard Round Uncoated Copper
Insulation:	Flame Resistant Cross Linked Polyethylene
Jacket:	None
UL Listing:	THWN
Tests:	Flame Test Requirements per IEEE 383, using a gas burner flame source.

Details:

Size (AWG)	Number of Strands	Insulation Thickness-Inches	Outside Diameter-Inches
12	7	.030	0.16
10	7	.030	0.18
8	7	.045	0.24
6	7	.045	0.28
4	7	.045	0.35
2	7	.045	0.40
1	19	.055	0.46
1/0	19	.055	0.51
2/0	19	.055	0.57
3/0	19	.055	0.60
4/0	19	.055	0.66
250	37	.065	0.73
350	37	.065	0.84
500	37	.065	0.97

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TYPE D
600 Volt Multi-conductor No. 12 AWG
Flame Resistant Control and Power Cable

Description:

Reference:	ICEA S-66-524
Conductor:	12 AWG, 7 Strand, Class B Stranding, 90 DEG C, Standard Round Uncoated Copper
Insulation:	Flame Resistant Ethylene Propylene (FR-EP), .030 inches thickness
Shield:	None
Jacket Cable Assembly:	Chlorinated Polyethylene over Polyester-film Tape
UL Listing:	Each conductor, XHHW; Assembly shall meet NEC art 340 requirements for tray cable type TC, and shall be sunlight resistant.
Tests:	Each conductor and the finished cables shall meet the flame test requirements per IEEE Standard No. 383.
Conductor Identification:	ICEA Method 1, Table K2, Colored Compounds with Tracers

Details:

Number of Conductors	Jacket Thickness-Inches	Outside Diameter-Inches	Nominal Area Square Inches
2	.045	0.365	0.105
4	.045	0.422	0.140
7	.060	0.501	0.197
9	.060	0.614	0.296
12	.060	0.689	0.373
60	.080	1.585	1.970

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TYPE E
600 Volt Single Pair Flame Resistant
Shielded Control Cable

Description:

Reference:	ICEA S-19-81, ICEA S-68-516 (Interim Standard No. 1)
Conductor:	16AWG, 7 Strand, Class B Stranding, 105 DEG C, Standard Round oated Copper
Insulation:	Ethylene Propylene, 25 mil Thickness
Twisting:	Approximately 4 Turns/Foot Staggered
Shield:	Each pair, and the composite cable assembly-coated copper 20 AWG drain wire and aluminum/mylar tape over insulated conductors.
Jacket:	Conductor and cable assembly - flame resistant chlorosulfonated polyethylene, IPCEA S-19-81, fifth edition, part 4.
Conductor Identification:	One black and one white conductor per pair.
Tests:	Each conductor and each finished cable shall meet the flame test requirements per IEEE Standard No. 383.
UL Listing:	Each cable assembly shall meet NEC art 340 requirements for Type TC, and shall be sunlight resistant.

Details:

Number of Pairs	Jacket Conductor	Cable	Outside Diameter-Inches
1	15 mils	45 mils	0.42
4	19 mils	60 mils	0.81

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TYPE G
Bare Grounding Wire

Description:

Conductor:	Standard Round Uncoated Soft-drawn Copper
Stranding:	Sizes 8 AWG and smaller, solid; Sizes 6 AWG and larger, 7 strand, class B stranding
Insulation:	None

Details:

Size (AWG)	Diameter (inches)
8	0.13
2	0.29
1/0	0.74

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TYPE H
600 Volt Three Conductor With Ground Power Cable

Description:

Reference: ICEA S-66-524, ICEA 5-19-81
Conductor: Standard round, Class B stranding, uncoated copper, 90 degrees C
Insulation: Flame resistant Chlorosulfonated polyethylene
Jacket: Conductor; none. Cable assembly: chlorosulfonated polyethylene
Conductor Identification: Colored compound or colored coating
Ground: Single or three insulated copper ground conductors.

Details:

Phase Conductor Size (AWG or MCM)	Ground Conductor Size (AWG)	Thickness – Inches Conductor Insulation	Assembly Jacket	Overall Diameter - Inches
12	12	0.045	0.060	0.49
10	10	0.045	0.060	0.58
8	10	0.060	0.060	0.75
6	8	0.075	0.080	0.94
4	3x10	0.075	0.080	1.05
2	6	0.075	0.080	1.19
1/0	6	0.100	0.080	1.43
2/0	4	0.100	0.080	1.56
4/0	4	0.100	0.110	1.86
250	3	0.130	0.110	2.07
350	3	0.130	0.110	2.34
500	2	0.130	0.110	2.65

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TYPE F
Multi Mode Fiber Optic

Description:

Fiber type:	62.5/125 microns multimode, outer coating 250 microns
Fiber/Tube count:	6 individual color coded tubes with up to 12 fibers each
Buffer:	Thermoplastic buffer tube
Cable Assembly:	6 tubes and up to 12 fillers per tube cabled around a central E-Glass and Aramid Yarn strength element
Attenuation:	3.50 dB/KM maximum @850 nm, 1.2 dB/KM maximum @1300 nm
Bandwidth:	200 MHz-KM @ 850 nm, 600 MHz @1300 nm
Jacket:	Polyvinyl Chloride (PVC)
	Nominal wall - 0.060 inches
	Nominal diameter – 0.265 inches
	Color - Black
Suitable manufacturer:	Belden No. B9B202
Usage:	CCTV Video and Data Communication

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TYPE S
Multi-Conductor Special Purpose
Communication and Data Cable

Description:

Reference:	ICEA S-19-81, UL 2250
Type 22S8	
Conductor:	22AWG, 7 Strand, 4 pair with Individual Shielding, XLP Insulation, PVC Jacket, 300 Volt, 90 degree C
Twisting:	Each pair twisted, approximately 4 turns/foot
Use:	Process Control, Span Position Data
Conductor Identification:	Red/Black, White/Black, Green/Black, Blue/Black

Suitable manufacturer: Belden No. 9330, Alpha Wire No. 6054

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8-19.3(3) BOXES

All exterior surface mounted pull, junction, splice, and terminal boxes shall be 14 gauge stainless steel, NEMA 4X, and shall be provided with hinged, overlapping covers of the same material, with pad-lock provisions and shall be by Hoffman Engineering Company, Hammond Manufacturing, Wiegmann or approved equal. Exterior boxes mounted on the bridge steel work shall be primed and painted the same color as the bridge. Wall-mounted boxes installed in the new control house shall be NEMA 12. Junction boxes and terminal cabinets mounted in the machinery rooms shall be NEMA 4X, 14 gauge stainless steel as described above.

Furnish and install junction and pull boxes, reducers, and other fittings as required by these specifications or where required by the NEC or where required to facilitate pulling, whether shown on plans or not.

Provide drain holes in the boxes. Provide all boxes with mounting lugs and securely fasten to the structure with not less than four bronze or metal through-bolts. All cast-iron boxes shall be bossed, drilled, and tapped for threaded conduit ends, which shall enter squarely. Sheet metal enclosures shall be drilled to receive the conduit ends, which shall be secured with insulated hub connectors. The conduit ends projecting into all boxes and enclosures shall be equipped with insulated bushings or hubs. No box or enclosure shall be drilled for more conduits than actually enter it.

Boxes for surface or exterior mounted wiring devices shall be weatherproof rated, cast-iron, hot-dipped galvanized, Type FS, FD, or approved equal.

Boxes for flush-mounted devices in finished areas shall be stamped galvanized steel.

Fasten device boxes to the mounting surface with not less than two bolts.

Fabricate framework for supporting boxes, switches, and other externally mounted electrical devices from 3/8 inch thick A36 structural steel galvanized in accordance with ASTM A123.

All mounting bolts, nuts, washers, and other hardware used for fastening boxes, disconnect switches, devices, lighting outlet boxes, conduit clamps, and similar devices shall be brass, monel metal, or stainless steel. Bolt heads and nuts shall be hexagonal, and bolts smaller than 3/8 inch diameter shall not be used except as may be necessary to fit the mounting holes in small devices, outlet boxes, and similar standard equipment.

8-19.3(4) WIRING DEVICES

General use, single pole, or 3-way switches shall be Arrow-Hart 1991 or 1993, Bryant 4901 or 4903, General Electric 5951-1 or 5953-1, Hubbell 1221 or 1223, or approved equal.

General use, duplex receptacles shall be Arrow-Hart 5262, Bryant 5262, General Electric 4065-1, or Hubbell 5262. GFI protection shall be provided by GFI circuit breakers or GFI receptacles where required by the CEC or NEC and as shown on the plans. Devices installed indoors shall be brown color.

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Devices installed outdoors shall meet NEC Art. 410-57 and shall be corrosion-resistant, with gray fiberglass weatherproof covers, suitable for wet locations and U.L. listed.

Cover plate for flush installations shall be 0.040 inch thick satin finished Type 302 stainless steel. Cover plates for indoor surface installation shall be cast aluminum or cadmium-plated cast-iron. Covers shall fit Type FS or FD boxes without overlapping edges or corners.

8-19.3(5) SMOKE DETECTORS

Smoke detectors shall have ionization chambers capable of detecting products of combustion. Power requirements shall be 120VAC with battery backup. Unit shall be capable to function as an individual unit or in an interconnected system. Internal alarms shall be provided. Auxiliary contacts shall be provided for remote annunciation to the Security/Intruder Monitoring system specified elsewhere in these Special Provisions. Units shall be installed where shown on the Contract Plans, and they shall be interconnected to sound all units in each control tower if any one unit is activated. The smoke detector units shall have all of the operational, maintenance and physical features of Kidde model i12040 with Kidde SM120X relay module and shall be approved by the Project Engineer.

8-19.3(6) NAMEPLATES

Provide nameplates for all major pieces of equipment named on the Contract Plans, for all devices on the control desk and in panels, and shall be made of laminated micarta or textolite with chamfered edges, and shall be engraved to show BLACK letters on a WHITE background. They shall be mounted with monel or stainless steel screws. Nameplates for devices shall show the device designation used on the schematic wiring diagram. Fuse nameplates shall show the type, ampere, and voltage rating of the fuses.

8-19.3(7) MOTORS

Motors shall be built in accordance with NEMA standards. All exposed metal surfaces shall be protected with a moisture-proof corrosion-resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a heavy-duty corrosion-resistant material. The rotors shall be balanced mechanically and electrically. All windings shall be provided with special insulation to retard decrease in insulation resistance due to excessive moisture. Each motor shall have Class B insulation.

Install the motors with approved sizes and types of wire terminals and splice fittings for the connection of the motors to the circuit wiring. Furnish each motor with a cast-iron frame, bearing brackets with re-lubrication fittings and conduit connection box.

Each motor, unless otherwise specified or indicated on the plans, having a horsepower of 1/3 HP or larger shall be 480 volt, 3-phase, 60-Hertz, totally enclosed, non-ventilated, 30-minute rated, squirrel cage induction motor. Hydraulic brake release motors, main pump and auxiliary pump motors shall be rated for continuous operation.

Motor horsepower shall be as shown on the Contract Plans. Where motors are supplied as an integral part of another item, the motors shall be of a NEMA design and speed compatible with that item.

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Where alternate equipment is provided, actual motor horsepower shall be at least 115 percent of the driven load.

Motor mounted solenoid brakes supplied with the traffic gate, resistance gate and span lock assemblies shall be motor-mounted, totally enclosed spring-set, solenoid-release, with hand release lever.

8-19.3(8) PANELBOARDS

Provide and install all wall mounted panelboards where shown on the Contract Plans. Mounting height shall be 6'-6" at the top. Construction shall be as follows:

1. Cabinets. Panel shall be dead front type and enclosed in a code gauge galvanized sheet steel cabinet complete with hinged door, lock and two keys, finished in ANSI 61 Light Gray enamel paint, with circuit directory filled out in type and with all exposed metal surfaces prime coated and factory painted. All locks shall be keyed alike.

   Cabinets shall be of sufficient size to provide gutter space no less than that required by the Underwriter's Laboratories and in no case less than 4 inches.

2. Mains. Branch circuits shall be changeable without additional machining, drilling or tapping. Branch circuit connections shall provide sequence phasing, with connections permanently identified on the face of the front of the panel interior. Mains shall be equipped with automatic circuit breakers for branch circuit protection and shall have ratings as indicated. All single pole branches shall be rated 20 ampere, unless indicated otherwise.

   Buses shall be rigid copper or copper alloy, installed to provide consecutive phasing. Solid neutral bus shall have solderless connectors, shall be insulated from the cabinet and shall have an ampacity equal to the ampacity of the phase buses. Equipment grounding bus shall be bonded to the cabinet, shall have solderless connectors and a main lug. All copper parts shall be plated to prevent corrosion.

3. Branches. Circuit breakers shall be of the indicating type, providing distinctive "on", "off", and "tripped" positions of the operating handle. All multi-pole breakers shall be so designed that an overload in any one pole automatically causes all poles to open. Multi-pole breakers shall have a single operating handle. Single pole 15 and 20 ampere branch breakers shall be UL listed for switching duty.

   Breakers shall be thermal magnetic type having inverse time delay thermal trip on overloads and instantaneous magnetic trip on short circuit. Circuit breakers shall be quick-break, quick-make on manual, as well as automatic operation. Each circuit breaker shall be independently removable without disturbing adjacent units

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or other bus connections and shall be fastened to the main bus bars with a bolt-on connection. All copper parts shall be plated to prevent corrosion.

All 100 ampere frame breakers shall have an interrupting rating of 10,000 amperes A.C. All larger frame size breakers shall have an interrupting rating of 22,000 amperes.

All panelboards shall be factory assembled, UL listed, Type NQOB as manufactured by Cutler-Hammer, Square D, Westinghouse, General Electric, or approved equal.

8-19.3(9) DRY TYPE TRANSFORMERS

A. General

Furnish dry type transformers suitable for indoor mounting in the quantity, voltage, phase, KVA rating, and method of mounting as shown on the Contract Plans. Transformers shall be UL 1561 listed and labeled "Suitable for non-sinusoidal current loads" with a K factor not to exceed a rating of K-30.

Transformers shall be Class AA. The temperature rating shall rise above ambient, as listed below. Primary taps shall be as listed below.

	Below Normal	Above Normal	Temp. Below Rise
Single phase less than 25 kva	Two 5 percent	---	115ºC
Single phase 25 kva and larger	Four 2-1/2 percent	Two 2-1/2 percent	80ºC

Provide transformers with electrostatic shields between the primary and secondary windings as shown on the plans.

Transformers shall have a rated sound level of 45 decibels or below when measured in accordance with NEMA Standards.

Furnish wall hanger brackets especially designed to accommodate the transformers with all wall mounted transformers.

Thoroughly clean transformers, then give them a rust resisting primer coat and two or more finish coats of paint or enamel. Finish transformers with ANSI 61 Light Gray indoor paint.

Submit manufacturer's data on power/distribution transformers, including certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, % impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.

The transformers shall be as manufactured by General Signal Corporation, International Transformer Corporation, Sorgel Electric Corporation, or approved equal.

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B. Mini-Power Zone

The mini-power zone shall be as rated on the plans, consisting of a complete package that houses the transformer, main circuit breaker, secondary circuit breakers and all branch circuit breakers. The transformer shall have a temperature rise of 115 degrees C. The branch breaker section shall have a capacity of 10 single pole breakers minimum. Primary voltage shall be 480 volts AC single phase, secondary voltage shall be 120/240 volts AC single phase. Enclosure shall be painted 316 stainless steel, NEMA 3R rated. Unit shall have all of the operation, maintenance, physical and performance features of Square D catalog number MPZ5S40FSS as determined by the Project Engineer.

8-19.3(10) MOTOR CONTROL CENTERS

The Motor Control Centers (MCC's) shall conform to NEMA Standard "A-C General Purpose Motor Control Centers" Part ICS 2-322, U.L. Standard No. 845, and to the NEC. Exposed metal parts shall be primed and painted with ASA61 light gray.

The vertical sections shall be nominally 90 inches high, 20 inches wide, and 15 inches deep. Each section shall have a horizontal wire trough located at both top and bottom, and shall be connected by a vertical wire trough. Each unit shall have an individual front door for access. Construction details shall be as indicated in the MCC Construction Data.

The new starters shall be 3-pole, 480-volt, full voltage, magnetic combination type, with trip indicating motor circuit protectors. Connection to the bus shall be by stab-type contacts. Quantities shall be as shown on the Contract Plans. Internal connections and accessories shall be as shown on the motor starter wiring diagrams.

Circuit breakers shall be 3-pole, heavy duty, 600 V, quick-make, quick-break, with an AIC of 22,000 amperes symmetrical. Quantities shall be as shown on the Contract Plans.

An incoming line transient voltage surge protector (TVSS) shall be provided and installed in an MCC module within the MCC-. The TVSS shall be a rated for industrial distribution systems, less than 1 nanosecond response time, maximum surge current of 160ka per phase, rated at 277/480 volt grounded wye, LED failure indicators, one per phase, high energy parallel design for high energy category C3 applications, EMI/RFI noise filtering and in-line fuses. Unit shall be UL 1449 and 1283 listed and be provided with a 5 year warranty. Unit shall be provided with a disconnecting device to allow servicing without main power shutdown. Unit shall be National Lightning Protection Corp., 1-800-628-2816, TPI 4000 Plus. TVSS unit shall be fully compatible and approved by the supplier of the lightning protection system specified elsewhere in these special provisions.

Incoming line metering accessories shall be added to the metering section in MCC-1, as follows:

1. Watt Transducer - 1% accuracy, with an output of + or - 1.0 MA DC, and a range of + or - 400 KW, and 3-150/5 ampere CT's shall be provided and connected as shown in the plans. .

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2. Phase Reversal Relay - Relay shall be similar to Time-Mark Type C269, and shall have a normally closed contact wired to terminal blocks. This contact shall open upon phase under voltage, loss of phase or reversed incoming phases.

MCC CONSTRUCTION DATA:

Wiring	**System**	**Enclosure**
Class 1	480 Volt	X NEMA 1 Gasketed
Type B	3 Phase	___NEMA 3 Weather Resistant
	4 Wire	___Junction Box Required

BUS BRACING BUS MATERIAL BUS RATING

22,000 Amps (SYM) X	Copper __	Mains, Amps	600
42,000 Amps (SYM) __	Aluminum __	Vertical, Amps	300
	Either X	Neutral, Amps	None
		Bare Ground, Amps	300

CONTROL VOLTAGE:

Voltage Level 120	**Source:**	
Secondary Fuses:	Starter Control Transformer	X
One X	MCC Control Transformer	
Two___	External Control Source	

EXTERNAL CONNECTIONS:

Incoming Line Feeders:	**Entrance:**		
Cable X	Incoming Line:	Top X	Bottom __
Bus Duct__	Load Feeders:	Top X	Bottom __
	Control Cables:	Top X	Bottom __

All internal wire and cable to be rated for 600 volts.
Wiring and connections shall be as shown on the plans.
The motor control centers shall be Square D, Cutler Hammer, Allen Bradley or approved equal.

8-19.3(11) SERVICE AND DISTRIBUTION

A. General

Commercial electric power for operation of the bridge and its auxiliaries will be supplied by the Seattle Public Utility Co. at 480 volts nominal, 3-phase, 4-wire, grounded wye, 60-Hertz. Point of contact is Mr. Liman Zhuang, 206-615-1001.

B. Service Disconnect

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Install one 600A fusible disconnect switch at the north abutment generator area where shown on the Contract Plans. Disconnect enclosure shall be NEMA 4X rated stainless steel. Fuses shall be Class K-5 dual element type and sized as shown on the plans. One 600A fusible disconnect switch shall be installed within the north control tower where shown on the plans. Disconnect enclosure shall be NEMA 12 rated.

The utility meter will be provided and installed by the power company. The meter pack shall be provided by the Contractor.

C. Service Grounding

The 480-volt wye power system shall be solidly grounded to the grounding grid assembly at the generator pad located at the north abutment or utility service metering equipment and to the grounding grid assembly within each pier.

Terminal lugs and the metal framing and enclosures of all electrical equipment such as control panels, control desk, panelboards, motors, and other apparatus shall be bonded to the grounding grid assembly as shown on the plans and required by the NEC.

Terminals of grounding system shall be solderless type, secured by means of hexagonal head, copper plated steel machine bolts with lock washers.

D. Structure Grounding

Ground cable shall be stranded, soft drawn, insulated copper, conforming to ASTM B3 Class B. Ground cables shall be interconnected or bonded to structural steel or connected ground rods by exothermic welds. Two coats of insulating varnish shall be applied over all exothermic welds and exposed cables.

Thermite welds shall be made with molds, cartridges, and accessories as recommended by the manufacturer of the molds for the items to be welded. Molds and powder shall be furnished by the same manufacturer, and shall be by Cadweld, National Lightning Protection, Approved Lightning Products Co., or approved equal.

Grounding system cable shall be a minimum of 380 pounds/1,000 foot copper unless otherwise indicated. Each strand shall be No. 14 AWG. Stands shall be basket or rope lay, cross sectional area shall be #1/0 AWG minimum. Cable interconnections shall be bolted. Cable terminations shall be on bonding plates, sized as shown on the plans.

E. Ground Resistance

Ground resistance shall have a value of 5 ohms or less after connection to the service equipment and shall be measured with an approved ground tester.

Ground resistance measurements shall be taken as follows:

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1. The resistance of each individual ground rod shall be measured at the time of installation and before connection to the ground bus. If the resistance is greater than 25 ohms, a second rod shall be driven near the rod being tested.

2. The resistance of the ground bus shall be measured, with all rods connected to the bus prior to connection to the service equipment.

3. The resistance of the ground bus shall be measured with all rods connected to the bus after connection to the service equipment.

Forward a report of the test to the Project Engineer.

It is preferable that all ground rods have approximately like resistances so that when paralleled all rods will carry very nearly the same current. In those instances where a wide variance of resistance is encountered, add additional sectional rods to those already installed that have the high resistance.

F. Lightning Protection

Provide and install a complete lightning protection and ground system as shown on the Contract Plans. The system shall consist of two stainless steel Electronically Actrivated Streamer Emmission (E.A.S.E) lightning protection air terminal conductors. The air terminal shall release stored energy based upon rapid variation of ambient field strength. Air terminals thay utilize a pulsed release are not acceptable. The air terminal shall be tested per appendix C of NFC 17-102 or similar international standard and/or test procedure. The air terminal shall utilize a central rod that is continuous to ground. Air terminals that utilize a central rod that is isolated from ground are not acceptable. The air terminal's internal circuitry shall be parallel. Series connectioned circuitry is not acceptable. Air terminals that utilize radioactive ionization sources are not acceptable. The E.A.S.E air terminal shall be manufactured by National Lightning Protection Corp. (NLP). Each E.A.S.E. unit shall be NLP's type US-1213-P4 Prevectron Topset 3.4 mounted on the top of the lighting poles #12 and #13 as shown on the Contract Plans. Pole top extensions shall be provided by NLP for mounting of the Topset Unit. Coordinate with lighting pole supplier as required. The air terminal manufacturer shall have a minimum $10,000,000 catastrophic umbrella insurance policy for their product. The completed project shall be listed on a certificate of accord furnished to the County upon completion of the project. Attention shall be given to the main service Transient Voltage Surge Suppressor specified elsewhere in the specification. In addition to the main service TVSS, surge suppression shall also be provided for the incoming telephone line and CCTV system. The lightning protection system and grounding system shall be installed in accordance with NLP requirements and shall obtain an inspection from an NLP representative or from a nationally recognized testing laboratory such as U.L., Willey Testing Lab or Edison Testing Laboratories (ETL) and provide certification of compliance to the Project Engineer. The Contractor shall provide to the Project Engineer at the completion of the installation a Prevectron tester available from NLP.

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Lightning protection cable shall be a minimum of 375 pounds/1,000 foot copper unless otherwise indicated. Each strand shall be No. 16 AWG or No. 14 AWG. Stands shall be basket or rope lay, cross sectional area shall be 115 MCM minimum. Cable interconnections shall be bolted. Cable terminations shall be on bonding plates having a minimum of 2 square inches of surface. Bonding plates shall be provided for circumferential welds or bolted connections.

8-19.3(12) EMERGENCY GENERATOR

The engine-generator shall be the product of a manufacturer regularly engaged in the manufacture of generator plants. The engine generator shall provide standby emergency power to support the operation of the bridge and all support components. The generator shall be shown to be capable of operating the bridge with either a single main drive motor on each bascule span or with the auxiliary drive motor on each bascule span. Operation using dual motor operation is not permitted. The standby generator alternator shall be capable of withstanding the harmonic distortion as a result of operating the bridge with the DC drive motor and drive controller per bascule span as specified elsewhere in these special provisions. The set and all controls shall be built and tested by the manufacturer precluding divided responsibility. The generator shall be tested at the manufacturer's facilities. Certified test reports of the complete assembly shall be available from the manufacturer showing the plant's power rating, voltage, and frequency regulation, and other pertinent data. Detailed operation and maintenance manuals with parts lists shall be provided. The engine-generator sets shall be sized as indicated elsewhere in these Special Provisions.

The Contractor will not be permitted to use the standby generator set for construction power during construction of the bridge. Construction power shall be provided by a Contractor supplied generator set or by using utility power once connected to the bridge.

The Contractor shall select, provide and configure the emergency generator such that a minimum of 3 feet vertical clearance between the top of the generator enclosure and the bottom of the prestressed concrete beams above the emergency generator is provided.

A. Rating

The rated output shall mean the set full continuous derated output under the climatic conditions shown below. The set shall also be capable of carrying the full rated load at rated speed, without undue heating of the engine or alternator.

B. Assembly Details

Engine Features

The engine shall be heavy duty, diesel fueled, water cooled unit mounted radiator, multi-cylinder, 4 stroke, designed for cold quick start, capable of delivering full load output at all ambient temperature conditions. Speed shall be 1,800 RPM with a brake horsepower rating of not less than 1.5 brake horsepower per KW of the generator requirements. Provide

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generator set with a block heater to maintain jacket water temperature at a minimum of 50 degrees F. Provide flexible piping connections at both the engine and radiator.

The engine shall be equipped with the following:

1. Fuel filters.
2. Isochronous Governor capable of 0.25% steady strip frequency regulation.
3. Automatic battery charging alternator with solid state voltage regulation.
4. Replaceable cylinder liners of the wet sleeve type.
5. Replaceable valve seat inserts.

Starting System

The remote-controlled engine starting shall be by means of 24 volt starting motors. Batteries of sufficient capacity for five, 15-second consecutive crank periods shall be furnished. The battery voltage shall be 24 volt DC. Provide two series-connected 12-volt batteries. Provide battery rack with corrosion-resistant battery trays.

Battery Charger

A standby, adjustable, fully automatic, constant voltage, current limited, charging device with rheostat and ammeter shall be furnished by the supplier to maintain the battery in full operation condition at all times.

Cooling System

The cooling system shall insure that the maximum cooling water temperature is safely within the normal working temperature range when the set is operating continuously at full load at maximum ambient air temperature up to 110 degrees F. The engine outlet water temperature under such conditions shall not exceed 225 degrees F. Provide a 50:50 ratio of water and ethylene glycol solution.

The generator set shall be provided with self-contained cooling system of ample capacity comprising unit mounted heavy duty design radiator, multiply V-belt driven radiator fan and gear driven centrifugal pump for water circulation. Radiator fan blades should be of heavy gauge sheet metal well protected against corrosion or of cast anti-corrosion metal. The radiator assembly shall include a core guard and an air duct flange and exhaust air out.

Lubrication System

A pressure type lubricating system with gear type oil pump and a full flow filter shall be fitted to the engine. The lube oil system shall have full flow filters of sufficient capacity. The lube oil filter elements shall be of the replaceable element type.

Intake and Exhaust System

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Air is to be induced to the engine manifold through an air cleaner with reusable elements.

The exhaust system shall include a residential type silencer, a condensation trap and drain cock, a flexible connection near the engine and a rain hood over exhaust pipe end. The exhaust line shall be the size recommended by the engine manufacturer. The exhaust line shall be suspended from the underside of the approach span and extended to the outer edge of the approach span.

The exhaust system shall be provided with all necessary piping, clamps, silencer, wall flashings and other item required for proper installation by the Contractor.

Governing System

The engine shall run steadily at any load within its rating at its rated speed, and the changes in speed at a steady load shall not exceed 0.5 percent when all transients have decayed.

The maximum speed variation upon applying a 50 percent 0.8 power factor load change shall not exceed 5 percent.

The governor shall be electronic, and shall have provisions for remote adjustment of speed. The governor shall be of the electronic type and shall be capable of close speed regulation within $\pm$ 0.25 percent.

Safety Switches

The engine shall be equipped with automatic safety switches to stop the engine in the following cases:

1. Water Temperature exceeds a preset safe working limit.
2. Lubricating oil pressure lower than a preset safe working limit.
3. Speeds exceeding 110 percent of rated speed.

Control System

Engine controls shall include complete engine start controls which operate on closing contact, and stop control which operates opening contact. A cranking time delay relay shall be provided to open the starting circuit in approximately 45 to 90 seconds if the plant is not started within that time. The electric plant controls shall include a weekly exerciser timer to permit exercising under load, running time meter, and run-stop-remote selector-switch. High water temperature, overspeed shutdown, and low oil pressure shutdown with signal light and alarm terminals shall be provided. Visual indications only shall be provided for low battery voltage, high battery voltage and generator power on.

The controls shall provide digital readouts for the engine and generator in English and metric units for engine oil pressure, engine oil temperature, engine coolant temperature, engine RPM, battery volts, generator AC volts L-L, L-N and average, generator AC current average

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and per phase, generator AC frequency, generator kW, generator kVA, generator kVAR, power factor, total kW-hr, %kW, %kVA and %kVAR.

The complete control shall be designed, built, and tested by the manufacturer of the engine. It shall include the necessary relays and component parts together with UL listed and tested electrically and mechanically interlocked contactor, and shall provide the transfer functions indicated for the specific units.

Remote annunciator shall be provided to meet NFPA 110, Level 1. The annunciator shall provide remote annunciation of all points listed above and shall communicate via Modbus RTU communications via RS-485 half duplex with a baud rate from 2.4k to 57.6k and shall be capable of being located up to 800 feet from the generator set.

Engine Instrument Panel

An engine mounted instrument panel shall be equipped with gauges for water temperature, oil pressure, oil temperature, battery charge rate ammeter, and intake manifold vacuum.

Sub-Base

The engine generator unit shall be mounted on a full sub-base fabricated of structural steel. Vibration isolators of the type and quality recommended by the manufacturer shall be supplied. Mounting holes for the isolators shall be located in the sub-base by the engine manufacturer to insure equal distribution of weight on the isolators. Maximum vibration transmission shall not exceed 6 percent.

Weather Protective Enclosure

The engine generator unit shall be enclosed in a weatherproof enclosure. Enclosure shall be fabricated from 14 gauge cold rolled steel with lockable gasketed doors. Doors shall be easily removed for service. Enclosure shall provide unrestricted airflow design. Radiator shall be guarded and service access panels shall be lockable. Enclosure dimensions shall not exceed 140”L x 56”W x 76”H.

Alternator

The alternator shall be salient-pole, reconnectable 12-lead, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed for smooth voltage wave form. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092. Temperature rise of the rotor and stator shall be limited to NEMA class F. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable Volts-per-Hertz operation capable of maintaining voltage within + or - 2% at any constant load from 0 to 100% of rating. The regulator must be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads.

On application of any load up to the rated load, the instantaneous voltage dip shall not exceed 20% and shall recover to + or - 2% of rated voltage within one second.

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The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a 3 phase symmetrical short by inherent design or by the addition of an optional current boost system.

A re-settable line current sensing circuit breaker with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage due to its own high current capability and shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition.

The alternator instrument panel shall be wired, tested, and shock-mounted on the electric plant by the manufacturer of the alternator. It shall contain manual reset overload protection, running time meter, AC voltmeter with phase selector switch, AC ammeter with phase transfer switch, voltage adjusting rheostat, and panel lights.

Fuel System

The unit shall operate on diesel fuel. The fuel system shall include a storage tank, float switch, fuel transfer pump for a lift of 10 feet, automatic shut-off and fuel filters. The fuel storage tank shall be installed above ground where shown on the Contract Plans. A fuel line standard with the manufacture of the engine-generator set shall be furnished and installed to meet current codes and requirements and to the satisfaction of the Project Engineer. The storage tank shall be double walled and have a capacity of not less than 500 gallons.

C. Shop and Field Tests

Shop Test

The units of the engine-generator set, with all accessories connected and in place, shall be subjected to full-load test runs at the manufacturer's plant, as hereinafter specified.

The engine shall be run continuously for not less than one hour without stoppage, and shall include at least 30 minutes of operation at 50 to 75 percent, and 15 minutes of operation at 100 percent of rated load. A record shall be kept of the water temperature in the engine head until a stabilized temperature is reached. When the engine is stopped, the temperature of the water shall rise to not more than 225 degrees F.

The tests shall include complete performance tests of the entire generator set to show that the generator voltage regulator and the engine governor perform properly to meet all specified requirements.

The generator and exciter shall be subjected to a full load heat run, and the test results shall be reported on the standard performance specification forms of the National Electrical Manufacturers Association.

Six (6) certified copies of the results of the above tests shall be submitted to the Project Engineer. Copies of the test reports shall be included with the manuals placed in the O&M

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Manuals specified in these special provisions. The units of the engine generator set shall not be shipped from the plant of the manufacturer until certified tests therefore have been submitted to the Project Engineer.

Field Test

The Contractor shall arrange for and provide all necessary field tests, as directed by the Project Engineer, to demonstrate that the entire engine-generator installation is in proper working order and in accordance with the Contract Documents.

The Contractor shall develop and submit to the Project Engineer a testing plan for the engine-generator set and all associated components in place, fueled and fully serviceable. The testing plan shall systematically check the requirements of the engine-generator set to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the engine-generator set independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer. Once the Contractor has successfully tested the installed engine-generator set and submitted the corresponding certification forms, the Contractor shall again test the engine-generator set and all associated components in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract.

Field testing shall also include complete operating tests to show that the entire engine-generator and all components operate satisfactorily to sustain the loads imposed during operation of the bascule spans.

During the testing period, the Contractor shall arrange to have at the site a representative of the manufacturer of the engine-generator. This representative shall be capable of making adjustments to the equipment, of locating faults or defects and correcting them if possible, and of obtaining from the manufacturer without delay new parts or replacements for apparatus which, in the opinion of the Project Engineer, does not perform satisfactorily.

Should the tests show that any piece of equipment apparatus, in the judgment of the Project Engineer, is defective or functions improperly, adjustments or replacements shall be made by the Contractor to make the installation satisfactory to the Project Engineer at no extra cost to the County.

D. Supplier

The engine generator set shall be supplied by the manufacturer as a complete factory assembled generator set to include the engine, generator, remote radiator, control panel, and all accessories specified mounted on a single steel grid base. The supplier shall have been regularly engaged in the manufacture of such equipment for the past ten years and who has parts and service facilities locally available so there is one source of supply and responsibility.

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All accessories needed for the proper operation of the plant shall be furnished. These shall include a muffler, cooling system piping, exhaust pipe, radio shielding, safety alarms, plant weekly exerciser timer, running time meter, flexible exhaust connection, starting batteries, battery cables, battery rack, fuel filter, solenoid, crankcase heater, thermostat, primary regulator, flexible fuel connections, shut-off valve, and detailed operation and maintenance manuals with parts list.

Each piece of equipment and apparatus shall have a stainless steel, brass or bronze nameplate on which is stamped the name of the manufacturer and the rating or capacity of the equipment or apparatus.

Manufacturers shall meet the requirements of the Contract Documents as determined by the Project Engineer. Manufacturers may include Caterpillar, Generac.

E. Warranty

The Emergency Generator System shall be warranted by the manufacturer for two years or 1000 hours, whichever occurs first, from the date of site start-up and acceptance.

Instruction Booklets

The supplier shall furnish to the Project Engineer seven (7) copies of booklet containing instructions covering the operation of the engine-generator unit and its associated equipment, together with an engine parts catalog and maintenance instructions for the unit. The booklet shall contain copies of wiring diagrams showing the connections of all major components, including the engine, generator, control panel, starting panel and starting batteries. One (1) copy of the instruction book shall be furnished for the Project Engineer's records.

F. Emergency Engine Generator Set

General features shall be as described in 8-19.3(13) above.

This Work consists of furnishing, installing, testing and placing in permanent operating conditions a diesel fueled engine-generator set complete with automatic regulators, automatic start/automatic load transfer switch unit mounted radiator, radiator fan and fan motor, environmental enclosure, exhaust system, water circulating system, engine block heater and an electric starter with battery and battery charger.

The installation of the engine and electric generating system shall include an electric plant rated for standby service at not less than 250 KW, 480/277 volts, three-phase, four-wire, center-tapped, 312.5 KVA, 0.8 pf, 60-Hertz. The system shall be a package of new and current equipment consisting of:

1. A diesel fueled engine-driven electric plant to provide emergency electrical power.

2. Engine-mounted start-stop control system.

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3. Generator set shall provide a minimum Starting KVA (SKVA) of not less than 476 KVA at not more than a 20% voltage dip.

4. Main Circuit Breaker

5. Mounted accessories as specified.

6. A three (3) pole, Automatic Start/Automatic Transfer Switch with solid neutral rated at 600 AMPS. Each contact pole of the main transfer device shall be double-break design, with solid silver cadmium contacts, capable of handling both non-inductive and inductive loads and allow for inrush currents of 20 times the continuous rating. Contact pressure shall be maintained by a coil spring, not a part of the current-carrying path. The ampere rating of the transfer switch shall be sufficient to handle the capacity of the plant and loads being transferred. The transfer switch enclosure shall be NEMA 4 rated.

The transfer switch shall provide sequential automatic starting and stopping of the generator set and switching of the electric load upon power failure as follows:

Upon commercial supply feeder outage automatically start the generator set, and when the generator set comes up to voltage, automatically disconnect the power circuit from the main line and transfer it to the generator set output. Upon commercial supply feeder power return and not performing a bridge opening, automatically transfer the load back to the commercial supply feeders. After a 5 minute cool down period, shut down the engine generator set.

The transfer switch shall provide the following functions using solid state logic control:

Time delay on transfer from normal to emergency: Adjustable

Time delay on transfer from emergency to normal: Adjustable

Time delay on engine cool down: Adjustable

Frequency/voltage monitor of emergency source

Four position selector switch (test, auto start, off, and local start)

Relay contacts for normal and emergency power

Frequency meter mounted in enclosure door

Voltmeter, ammeter and selector switch mounted in enclosure door

Plant exerciser with two position selector switch for load/no load

Generator set shall be Caterpillar Model C9 with an LC5034J frame alternator, or equal by Generac.

G. Generator Set Pad

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This Work shall include furnishing and installing a generator set pad as shown in the Contract Plans. Generator pad shall provide a firm surface and adequate spill protection in-case of emergency overflow of the above ground fuel storage tank, Section 8-19.3(13)B. Pad shall be dimensions 32' x 16' x 14" with perimeter curb heights of 4" and slope ¼" per foot away from the abutment wall. Perimeter curb shall be cement concrete extruded curb type 5 per WSDOT Standard Plan F-10.42-00. The generator pad shall be reinforced with #8 reinforcing bars at 12" on-center within a 14 inch thick concrete Class 4000 slab. The pad shall be placed on 8 inches of compacted Should Ballast (9-03.9(2). Cracking in the concrete pad shall be minimized. In the event of minor cracking, the Contractor shall provide a waterproof sealant to fill the gap, with approval from the Project Engineer. The generator and fuel tank shall not be installed on the pad until curing and hardening of the concrete is complete. The generator set shall be installed with leveling pads as recommended by the Manufacturer.

Contractor to make provisions in the concrete pad to allow for anchoring systems for the generator and fuel tank and conduits that penetrate the pad and curbs. The Manufacturer's drawings may provide details and locations for anchoring systems and conduit locations. A detailed drawing shall be submitted to the Project Engineer showing the final placement of the generator and fuel tank and conduit routing near the generator pad. The utility pull box shall have a watertight seal to prevent leakage into the box.

8-19.3(13) LIGHTING

A. Lighting Fixtures

Furnish all fixtures, lighting equipment, and components shown on the Contract Plans, listed on the "Fixture Schedule" and all labor and materials to install the specified equipment in the manner indicated. Deliver all fixtures and lighting equipment with accessories, hangers, canopies, hickeys, casings, end plates, sockets, fixture wires, holders, reflectors, globes, glass, guards, ballasts, diffusing louvers, recessing boxes, etc., all wired and assembled as indicated.

Furnish and install all lamps and accessory wiring. Entire fixtures and all component electrical parts shall be listed by UL. The Project Engineer reserves the right to require colors and finish to meet special requirement on the building. Furnish and install the lighting fixtures as required by the following schedule:

Designation	Application	Description
A	Operator's Level	24" x 24", 3 lamp, parabolic fixture with 9-3 inch deep parabolic louvers in a steel housing with mitered corners and finished with an iron phosphate pretreatment ensuring good paint adhesion and rust resistance before painting with a polyester enamel. The louver shall be constructed of a pre-anodized aluminum, steel parts die-formed from code-gauge,

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		cold rolled steel. The louver shall be secured by rugged t-hinges and spring loaded cam latches. Thermally protected, resetting, class P, HPF, ballasts, CBM approved and UL listed for three 17W T8 CW/RS fluorescent lamps. Lithonia Mfg. catalog no. 2PM3N GB 317 9LD 120 GEB PAF, Prescolite, Williams Inc., or approved equal.
B	Roadway Level	Stem mounted, 2-32 watt T8 fluorescent lamp fixture, low profile, wraparound, die formed housing, 20 gauge, from cold rolled steel. The housing shall be finished with a five stage iron phosphate pretreatment process ensuring superior paint adhesion and rust resistance. Painted parts shall be finished with a high gloss, electrostatically applied, baked white enamel finish. The ballast shall be class P, HPF, sound rated of A, U.L. listed, thermally protected. Stem shall be 12 inches in length. Ballast shall be DBM approved. High impact acrylic lower diffuser, optically engineered for superior light distribution and tinted to mask lamp image with easy snap-in installation. Fixture to be 120 volt AC rated. Fixture shall be by Lithonia Lighting Co. catalog no. LB232 120 GEB SQ12, Day-Brite Lighting, American Fluorescent Corp., or approved equal.
C	Equipment Level	Stem mounted industrial fluorescent fixture with 2 – 32 watt T8 lamps, housing formed from cold-rolled steel. The housing shall be finished with a five stage iron phosphate pretreatment process ensuring superior paint adhesion and rust resistance. Painted parts shall be finished with a high gloss, electrostatically applied, baked white enamel finish. Ballast shall be thermally protected, resetting, Class P, HPF, UL listed, rapid start and sound rated. Fixture shall be Lithonia Lighting Co. catalog number EJ 232 120 GEB SQ12, Williams Lighting, Day-Brite or approved equal.
D	Stairway Lighting	Surface mounted, 10 inch square fluorescent fixture with seamless die-cast aluminum housing, epoxy primer and white durable powder top-coat. Polycarbonate translucent lens shall provide uniform illumination. Ballast shall be UL Listed,

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		energy efficient, 120 volt, high power factor sized for a single 38 watt, 2D fluorescent lamp. Fixture shall be Rudd Lighting catalog no. SS0238-ULW, Gotham Lighting, Lithonia Lighting or approved equal.
E	Over Control Console	Low voltage, track type lighting fixture for 50 watt size MR-16 lamps. Fixture to come with an integral 12-volt transformer and be surface mounted using a canopy adaptor, fixture shall be dimmable and shall be round in shape. Rudd Lighting Co. catalog no. TRB2R, Lithonia Lighting Co., or approved equal. Provide all track and fittings as required.
F	Exterior Soffit	Recessed soffit mounted downlight, galvanized steel frame-in with adjustable integral yoke to retain optical system, galvanized bar hangers up to 24 on center inches, galvanized steel junction box with removable access door,, white splay diffuser with tempered lens, 1-32 watt TRT fluorescent lamp, 120 volt, Class P, thermally protected ballast. Lithonia Lighting Co. catalog no. LF6 1/32TRT F6LS73 120, Ruud Lighting, Williams Lighting or approved equal.
G	Bathrooms	Similar to Type B but 24 inches long with 2-17W T8 lamps and 6 inch stem. Lithonia Lighting Co. catalog no. LB217 GEB SQ6 or approved equal.
H	Over Entrance Doors	Surface mounted wall pack fixture, 1-50watt metal halide lamp, 12 inch die cast aluminum housing, weather resistant with gasketed ballast compartment and optical chamber, hinged die-cast lens frame, finished with e-coat epoxy primer and bronze powder coat. UL Listed for wet locations. Ruud Lighting Co. catalog no. MGWP0405-M, Lithonia Lighting, Hydrel or approved equal.
I	Emergency Lighting	Emergency, battery powered, surface mounted lighting fixture. Units to be provided with two, high output, 25 watt sealed beam lamps, and be equipped with self contained battery inverter power packs. Unit electronics shall be fully automatic in design. The charger shall be of the three stage type with constant current equalizer and float voltage

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		modes. Circuitry will include a 15 minute time delay relay, low voltage battery disconnect and with burnout protection circuits. Custom designed, integrated circuitry shall be self diagnostic in design and constantly monitor charger performance and battery voltage. The unit shall be programmed to exercise the battery and check the emergency operation by automatically perform a five minute discharge/diagnostic check every six months. The unit shall have visual indicators to precisely indicate the area and type of malfunction. A manual test switch shall be provided to allow a 5 minute test at any time. The unit shall be Dual-Lite Spectrum Series I Model No. ML-7E-I, Lithonia Lighting, EmergiLite or approved equal.
J	Bascule Pier Lighting	Industrial type fluorescent fixture for high Dust/Moisture locations. Provide two 32 watt T8 lamps. Fixture shall be formed from reinforced polyester fiberglass with cold rolled steel enclosed wireway. Diffuser shall be shatter resistant 15% DR acrylic and secured to the housing with captive, corrosion-resistant, cam-action latches, 6 per 4'-0" unit. Fixture to have thermally protected, resetting, class P, HPF, Type 1 ballast with a sound rating of A. CBM approved and UL listed. Ballast shall be cold weather rated for 0 degree starting. Fixture shall be Lithonia Lighting Co. catalog no. DM232 AR 120 CW STSL, Kenal, Crouse Hinds or approved equal.
K	Maint. Walkways	Stanchion mounted, enclosed and gasketed fixture suitable for wet locations, 30 degree angle base with globe and guard, 1 1'4" hub size with 30 watt compact fluorescent lamp, Crouse-Hinds catalog number VXHA45GP, Appleton Electric, Hubbell or approved equal.
L	Clearance Gauge	High performance, HID, compact fixture, die cast aluminum housing and doors, anodized specular reflector, stainless steel locking hardware, electronic ballast, textured powder coat finish, black in color, tempered glass lens with half glare shield, 70 watt metal halide lamp, yoke mount, narrow spot distribution. Hydrel Lighting catalog no. 8100

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70CMT6 120 NSP YM HGS SF GEB LPI BL, Ruud Lighting, Lithonia Lighting or approved equal.

Install lighting fixtures on movable spans or where vibration may be a hazard to lamp life with shock-absorbing lamp receptacles.

Submit catalog cuts of fixtures with complete photometric data, where different from those indicated, to the Project Engineer for approval.

Fluorescent fixtures shall be internally wired with No. 16, Type AF, insulated fixture wire in accordance with the latest requirements in the current edition of the NEC.

Fixtures with incandescent medium-base sockets shall be internally wired with no smaller than No. 16 and mogul sockets no smaller than No. 14 Type AF.

B. Ballasts

Furnish and install ballasts as required for all lighting fixtures. Ballasts shall meet the requirements specified herein and shall be designed to meet applicable Certified Ballast Manufacturer's and/or American Standard Association and Underwriter's Laboratories specification. Ballasts furnished must provide lamp watts within 90 percent minimum of lamp manufacturer's published ratings. All ballasts shall be sound rated "A". Replace any ballasts which do not operate quietly. Apply ballasts such that the ballast case temperature will remain below 90 degrees C, for full ballast life. The ballast shall supply an open circuit voltage which, at the minimum supply voltage limit, will meet requirements of the lamp manufacturer, and shall be guaranteed to start at least 90 percent of seasoned HID lamps at the minimum supply voltage limit in -20 degree F. ambient. All ballasts shall be equipped with either internal, non-resetting thermal protection devices adjacent to the coils and in the power capacitor or each ballast shall be provided with dual-element, inline, slow blowing external fuse.

All ballasts shall be of the high power factor type, with 120 V primaries.

Provide radio-frequency interference suppressor.

C. Navigation Lights

Provide navigation lights, reflective markers, and signals during and after construction in accordance with the rules and regulations outlined in DG-208 of the United States Coast Guard, Part II, Number 208 of Volume 33 of the Federal Register. All phases of such work must be completed to the Coast Guard's satisfaction and approval.

All pier and center channel navigation lights, doors and lenses shall be gasketed, and the entire units shall be completely weatherproof. Fittings shall be noncorroding and the sockets shall be of porcelain, mounted on shock absorbers. All lenses shall be of permanent, rigid, heat-resistant glass, 187mm, standard regular marine Fresnel type.

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Pier marker lights shall be cast aluminum, gasketed and a 180 degree red Fresnel lens. Locate and mount light fixtures as shown on the Contract Plans. Pier marker lights shall be B&B Roadway Manufacturing type PL, Federal Signal, Fed Transit or approved equal.

Center channel navigation lights shall have an automatic latch mechanism to hold the light securely in the normal and service positions. The fixture shall be cast aluminum, have two lamp sections with upper section to have a 180 degree red Fresnel lens and the lower section to have a 180 degree green Fresnel lens. The center channel navigation lights shall display green at the fully-open position and red for all other positions as shown in the Contract Plans. Center channel navigation lights shall be B&B Roadway Manufacturing type BS, Federal Signal, Fed Transit or approved equal.

Lamps for all navigation lights shall be of the four (4) tier LED style, 120 volt, with standard medium base. Lamps shall be rated for 100,000 hour life, color shall match lens color of the fixture.

The Contractor shall provide retrieving chains for each center channel navigation light. Attach the retrieving chain to eyebolts attached to the top rail of the pedestrian railing. Secure retrieving chains with pad locks at bottom rail of pedestrian railing. The Contractor shall provide a total of eight (8) stainless steel commercial grade padlocks and keys. Key all padlocks to a single key.

D. Photoelectric Controller

The navigation light photoelectric controller shall be furnished and installed as shown on the Contract Plans. The photocell shall operate at 120 volts AC with a load rating of 1000 watts and capable of sustaining 130 amps inrush current at 120 volts AC. The photocell shall mount in a 3-pole twist lock 3 inch receptacle made from molded thermoplastic. Housing of photocell shall be of grey polycarbonate with an acrylic window and UVA7 ultraviolet inhibitor, Fisher Pierce model 7760-ES10, or approved equal by Crouse-Hinds, and shall be factory set at 20 foot candles.

8-19.3(14) HORN SIGNAL SYSTEM

Furnish and install a complete self contained air horn signaling system complete with air compressor, dual stainless steel projectors, piping and all hardware required as shown on the Contract Plans.

The projectors shall be capable of producing a tone between 260 and 300 Hz with a decibel rating of 120db intensity at 10 feet. Tone and volume shall be field adjustable. The air horn assembly shall be a single unit comprised of compressor, horns and all piping and shall be of weatherproof construction suitable for outdoor mounting.

The compressor shall be a weatherproof, rapid response, direct drive piston type compressor. Piston and cylinder shall be on oil-less, non-lubricated type, with a Teflon compound piston ring. Compressor valve shall be stainless steel. Bearings shall be permanently sealed, pre-lubricated ball type, requiring no maintenance. All components and fasteners shall be corrosion resistant.

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The compressor motor shall be standard speed, 1 hp motor, 120 volts AC, 60 Hertz.

Air horn assembly system shall be B&B Roadway Corp. model AHR-2 or approved equal that meets the requirements of the Contract Documents including the following minimums:

1. Application: The air horn shall be used as an aural signal to draw attention to operation of the bridge.

2. Projectors: The projectors shall be of stainless steel, approximately 16" in overall length each, and shall feature a diaphragm designed for high pressure operation and low air consumption. The projectors shall be capable of producing a tone between 260 and 300 Hz with a decibel rating of 120db at 10 feet. Tone and volume shall be field adjustable.

3. Compressor Unit: Compressor motor shall be 1.5 hp, 120V, 60Hz, equipped with pre-lubricated and sealed ball bearings. Motor shall operate efficiently over a wide temperature range. Compressor shall be piston type, direct-drive and oil-less. Unit shall use a pressurized reservoir to ensure rapid and consistent response.

4. Mounting: The standard air horn assembly shall be designed for horizontal mounting, remote from the compressor unit. Air horn assembly shall be suitable for outdoor mounting. The compressor unit shall be mounted inside the control house or other weatherproof shelter.

5. Field Connections: The electrical contractor shall provide an on-off switch at the control station to provide power to the compressor unit. The electrical contractor shall also provide a pushbutton or similar control device at the control station to control the solenoid valve on the remote projector assembly to regulate sounding of the horns. The contractor shall provide clamps and one length of ¼" tubing, minimum 200 pound rating, to connect from the port at the compressor unit to the port at the solenoid valve on the remote projector assembly. Tubing shall be trimmed to fit on site with no excess length or loops.

6. Approximate Weight: 70 pounds

, Federal Signal, Fed Transit or approved equal.

8-19.3(15) COMMUNICATIONS

A. Inter-Communications

In order to provide means of intercommunication throughout the bridge structure for the South Park Bridge, furnish and install a multi-circuit industrial rated communication, page/party system. The system shall provide facilities for both page and common-talk party line operation at various locations throughout the system. Two-way conversations shall take place between stations using telephone type handsets. Handsets shall perform in areas as high as 115 dB (Sound Pressure Level) ambient noise without the use of acoustical

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enclosures or booths (not to exceed 115 dB SPL). One way communication shall be possible between the operator's station and the speaker stations located at the traffic gate/traffic signal areas to communicate with pedestrians when required. Conversations within the bridge Page/Party communication system will not be heard over the one-way communication line. The equipment shall be as manufactured by Gai-Tronics, Reading, PA or others that meet the following requirements.

The operator's station shall be installed on the operator's level of the north control tower and mounted on control console as shown on the Contract Plans. Intercom stations shall be located at locations throughout the bridge structure where shown on the Contract Plans. Stations located within the bridge piers shall be provided in NEMA 4 enclosures and be suitable for wet locations. Speakers for all units shall have integral drivers, 30 watt rated and be corrosion resistant. Speakers shall be located within 5 feet of the station hand set. Wall mounted intercom stations shall be located 4'-6" above finished floor as shown on the Plans unless otherwise indicated.

Furnish and install all handset, speakers microphones, environmental enclosures, mounting hardware and brackets as required to provide a complete and operational intercommunications system as described herein and shown on the plans. The inter-communications system shall enable the operator to communicate with individuals in and around the bridge interior spaces and the pedestrian areas near the traffic gates. The operator will need to alert all areas of the bridge when an operation is about to occur. All internal locations of the bridge will be zoned together to enable an "all call" feature. All intercom stations located outdoors or in unheated spaces will need to be able to withstand outdoor environmental conditions. These conditions will include rain, snow, dust, humidity, chemical pollutants, extreme temperatures (-40 F to 140 F), and other environmental hazards.

In order to provide a means of one-way communication with the vehicles, pedestrians and marine vessels, furnish and install a single circuit communication system as a part of the intercommunications system. The system shall consist of an amplifier and weatherproof speaker for each station (2 stations required) and mounted on the bridge traffic signal poles as shown on the Contract Plans.

Furnish all material and coordination to install cable from each extension in the system.. Install the cable from point to point in accordance with the manufacturer's recommendations as per the plans with no intermediate splices.

The operator's station shall be a desk top style, single party line with handset and built-in speaker, Gai-Tronics Model 726 102. A zone selector switch shall be provided to select between the internal Page/Party communications and the One-Way communications with the pedestrian areas. Desk set shall operate at 115 VAC, 60 Hz with an amplifier sensitivity of 0.5 VAC for the rated output, have a frequency response of 250-4,000 Hz, +0, -3dB and a distortion of 1% maximum THD at 1,000 Hz, 12 watts and an operating temperature range of -22 deg F to +158 deg F. Speaker shall be internal to the enclosure and the handset shall be mounted on the desk station with a 6 foot extended retractile cord. Intercom stations located on the Roadway Level and Equipment Level of both control towers shall be Gai-Tronics

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Model 700-102. Station shall operate at 115 VAC, 60 Hz with an output level of 1.5 Vrms nominal into a 33 ohm load and a gain of 55 dB nominal, adjustable from 40 to 63 dB and a frequence response of 250-4,000 Hz, =/-1.5 dB and a distortion of 1% maximum THD at 1,000 Hz. Enclosures shall be 16 gauge cold-roled steel/gray polyurethane suitable for wall mounting. Handset shall be dynamic, noise cancelling type with a 6 foot retractile cord and a Push-to Page pressbar and handset hook switch. Intercom stations located in the bascule pier areas and machinery areas shall have similar output levels and requirements as the Model 700-102 and be housed in non-metallic NEMA 4 weatherproof enclosures made of glass-reinforced polyester resin and be tropicalized for moist environments, Gai-Tronics Model 730-103. Speakers for all units, except for the desk top unit, shall have integral drivers, 30 watt rated, corrosion resistant, Gai-Tronics Model 13320, weatherproof direct-radiating horn with an asymmetrical shape for efficient sound dispersion. Frequency response shall be 450 – 4500 Hz +\- 5dB. Horn shall be constructed of high-impact, glass-reinforced polyester. Speakers shall be located within 5 feet of the station. Wiring shall be by Gai-Tronics or approved equal. Cross channel wiring to the south bascule pier shall be continuous without splicing and utilize the cross channel duct system shown on the plans.

In order to provide a means of one-way communication with vehicles and pedestrians, a single circuit communication system shall be furnished and installed as shown on the plans. The speakers shall be mounted on the traffic signal poles and located such to direct the audio signal to the traffic gate areas on the north and south approaches.

B. Closed Circuit Television

Provide and install a complete Internet Protocol (hereafter, "IP") CCTV system including but not limited to six color cameras, four (4) 5 GHz wireless transceiver units, antennas, CAT5E cable, fiber optic cable, conduit, software, Ethernet switches, computer workstation, display monitors, display ceiling mounts, network video recorder, CCTV equipment cabinet, all mounting hardware, fiber optic accessories, all necessary cable terminations, and all necessary hardware to install a complete an operational Pan-Tilt-Zoom (PTZ) IP CCTV network system as shown on the plans and described herein. The new IP CCTV system shall be networked and controlled from a computer workstation that interfaces with dual-display monitors located within the North Control Tower, Operator's Level. A computer workstation, specified later below, shall be installed with Pelco DS Control Point 1.7 (6.8.2.22) or latest version and any additional supported software, which is free downloadable software from Pelco's Internet website http://www.pelco.com/software/downloads/.

A network video recorder (hereafter, "NVR") shall be provided, installed, and configured to allow for multi-camera (up to 16 IP Video channels) of recording capabilities using MPEG4 compressed video for a minimum of at least 30 calendar days. The recorder shall be capable of recording at a specified frame rate of at least 5 frames per seconds with a frame size value of 8000 to 25,000 bytes, an activity level of 50%, and a video resolution of 4CIF. Network video recorder shall be supplied with an internal storage drive of 1.5 Terabytes and programmed to provide recording feedback for each of the six video cameras being monitored. NVR shall be supplied with dual Gibabit network interface cards, Windows XP

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Professional with Service Pack 2 installed, and DS ControlPoint User Interface software. NVR shall be configured to perform as a video recorder of all camera units, but provide computer functionality in the event the main control workstation were to fail. Network video recorder shall be Pelco Model: DSNVR161500.

A fully functional, fixed/variable speed, Pan-tilt-zoom (PTZ) keyboard shall be provided and installed for direct interaction with the Pelco cameras using the aforementioned DS Control Point software. Keyboard dip switches #7 and #8 shall be set to "ON" for ASCII mode capabilities. A RS-232/RS-422 converter kit shall be provided to interface the PTZ keyboard with the below supplied computer workstation. Converter kit shall be Pelco Cat. No: PV140. Keyboard shall be configured and setup to provide full pan-tilt-zoom capabilities of each of the cameras. Keyboard shall be manufactured by Pelco, Cat. No: KBD300A with optional KBDKIT provided.

A CCTV equipment cabinet shall be provided that allows for CCTV equipment to be housed and connected. CCTV PC Workstation, Network Video Recorder, Ethernet switches, and all related CCTV video equipment shall be placed within the cabinet. Contractor shall mount the PC workstation at the bottom of the rack, and shelf mount the NVR and Ethernet switches on separately spaced "quick position shelves". Caster wheels, rear access back panel and smoked glass front door. CCTV equipment cabinet manufacturer shall be, or approved equal: Middle Atlantic Products, Inc. Part No: BRK20-22, with options Part No: RKW-HD, RK-GD20 for (B)RK rack, Rear Access Panel with an overall height of 27.78 inches, and quick position shelves Part No: SH-BRK.

Video and data transmission of all cameras shall communicate over an IP Ethernet based network using various communication methods, such as, for example, CAT5e cable, wireless transmission, and dual-redundant fiber optic cables that extend across the underground duct between the North and South control towers. Refer to plan sheet BE24 for a full detailed description of the complete network layout.

Furnish and install six (6) color cameras at the South Park Bridge. Cameras shall be provided as follows:

Camera #1 shall be located on the West end of the North side pier. This camera shall face a Southeast direction with a field of view including the Southwest corner of the South side pier. The camera will used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the dual-display monitors located within the North control tower, operator's level. An external mounted power supply shall be secured to the inner wall of the Control Tower wall that allows both 120V conduit and CAT5e conduit to terminate. Power supply shall provide 24VAC output conductors that will route directly with the CAT5e cable through a sleeve in the concrete wall of the control tower for direct connection into the camera mounting stem of the camera unit. See CCTV camera detail plan sheet BE25 for further detail of the installation.

Camera #2 shall be located on the East end of the South side pier. This camera shall face a Northwest direction with a field of view including the Northeast corner of the North side pier.

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The camera will be used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the dual-display monitors within the North control tower, operator's level. An external mounted power supply shall be secured to the inner wall of the control tower wall that allows both 120V conduit and CAT5e conduit to terminate. Power supply shall provide 24VAC output conductors that will route directly with the CAT5e cable through a sleeve in the concrete wall of the control tower for direct connection into the camera mounting stem of the camera unit. See CCTV camera detail plan sheet BE25 for further detail of the installation.

Camera #3 shall be mounted on a roadway lighting pole (Pole No. 14) located on the Southeast side of the North control tower as shown on the plans. This camera shall face North with a field of view including both the traffic gate and resistance gates on the North side approach spans with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gate or resistance gate before lowering the traffic gate or resistance gate. It will also be used to verify that the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on dual-display monitors located inside the North control tower, operator's level..

Camera #4 shall be mounted on a roadway lighting pole (Pole No. 11) located on the Northwest side of the South Control Tower as shown on the plans. This camera shall face South with a field of view including both the traffic gate and resistance gate on the South side approach spans with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gate or resistance gate before lowering the traffic gate or resistance gate. It will also be used to verify the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on the dual-display monitors located inside the North control tower, operator's level.

Camera #5 shall be mounted on a roadway lighting pole (Pole No. 23) located on the North end and West side of 16th Ave. S. This camera shall face North for observance of the Intersection of 16th Ave. S. and E. Marginal Way. Camera #5 shall be used to view potential traffic congestion at the intersection during a bridge opening. Camera shall be fed 120V power under the Illumination Roadway Lighting section of the project (see Illumination plans IL05, IL09 and IL10). Power shall be fed from Panel board "N1" circuit #6. Contractor shall be responsible for routing and connecting the 120V Illumination circuit found either within the illumination pull box (at or near the pole), or from pre-pulled conductors within the pole. Contractor shall be properly connect and route the conductors inside the pole to the camera. Camera #5 shall be connected to and supplied with a 5 GHz unlicensed wireless radio unit for communication with the North control tower. Contractor shall be responsible for all installation, including proper alignment and signal strength testing per manufacturer's recommendation.

Camera #6 shall be mounted on a roadway lighting pole (Pole No. 7) located on the South end and West side of 16th Ave. S. This camera shall face South for observance of the Intersection of 14th Ave. and Dallas Ave. Camera #5 shall be used to view potential traffic congestion at the intersection during a bridge opening. Camera shall be fed 120V power

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under the Illumination Roadway Lighting section of the project (see Illumination plans IL02, IL09 and IL10). Power shall be fed from Panel board "S1" circuit #6. Contractor shall be responsible for routing and connecting the 120V Illumination circuit found either within the illumination pull box (at or near the pole), or from pre-pulled conductors within the pole. Contractor shall be properly connect and route the conductors inside the pole to the camera. Camera #6 shall be connected to and supplied with a 5 GHz unlicensed wireless radio unit for communication with the South control tower. Contractor shall be responsible for all installation, including proper alignment and signal strength testing per manufacturer's recommendation.

All video cameras shall be an IP based, High-Resolution Day/Night color-capable unit with NTSC signal format having a 2:1 interlaced scanning system. Image sensor shall be ¼-in EXview "HAD" with a 768 horizontal x 494 vertical pixel format. Camera lens shall be an integrated zoom lens with f/1.4 (focal length, 3.4mm-119mm capabilities. Camera zoom shall be 35X optical and 12X digital with a zoom speed of 3.2/4.6/5.5 seconds. 24VAC/operating power, auto/manual focus, auto/manual integration, low temperature heater, outdoor pressurized environmental housing. Each camera unit be integrally supplied with the internal IP circuitry for direct connection to an Ethernet network. See sheet plan BE24 for full details on the model and camera type/style being used.

Each enclosure shall be provided with camera mounting hardware. The cameras located on the traffic signal poles shall be furnished with all required mounting hardware needed to mount the camera on the roadway lighting pole. The cameras located on the bascule pier shall be mounted to the concrete pier. All required material and hardware shall be furnished as needed to mount the camera.

Each control house shall be provided with a wireless radio transceiver unit for communicating to remote cameras (Cameras 5 & 6). Each wireless unit shall provide a self-contained panel that houses a 5.3/5.8 GHz unlicensed IP-based radio transceiver unit with built-in internal directional antenna. The unit shall mount directly on a 3" galvanized steel pole or conduit that extends above the rooftop of each control tower. A fabricated support member pole cup and weatherproof roof flashing shall be provided and installed under a separate Control Tower specification within the project. Contractor shall be responsible for mounting the pole, radio units, power conductors and CAT5e cable, conduits, and appropriate mounting hardware to the galvanized steel pole. Contractor shall be responsible for securing the pole within the fabricated support member pole cup using steel bolts, washers, and/or lock nuts. Contractor shall provide a direct ground strap connection between the galvanized steel pole/conduit and the bridge grounding system using a #2/0 bare stranded copper conductor. Contractor shall make provisions for properly routing the ground conductor to the nearest bridge grounding system location. A welded loop style terminal connector shall be used to properly bolt the ground conductor to the bridge grounding system.

An unmanaged fiber and copper Ethernet switch and wall mount kit shall be installed and mounted within the South Tower cross-channel termination panel. Refer to S. Channel Termination Panel plan detail sheet for further detail on mounting within the panel.

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Contractor shall be responsible for the installation of the Ethernet switch and power circuit (supplied from Lighting Panel LP-2) within the cross-channel panel. Redundant multi-mode fibers shall be terminated at the Ethernet switch using type SC connectors. Two additional fibers (spares) shall be coiled up within a 12-inch diameter coil and secured with tie-straps inside of the cross-channel termination panel. Unmanaged 10Base-T/100Base-FX Ethernet switch shall be manufactured by Pelco, Cat. No: FX82052MSCR-4, Ethernet switch wall mount kit shall be: Pelco Cat. No: WM5002-3U, Separate "ruggedized" power supply shall be Pelco Cat. No: WCS1-4.

A workstation class computer shall be provided and provide at a minimum the following requirements:

1. Mini Tower shall provide (1) 3.5" Bay, (2) 5.25" Bays, and capable of mounting (2) Internal Hard drives. Internal connections shall include: A total of (4) SATA connectors, of which, (2) shall be designated for hard drives and (2) designated for optical drives.

2. Intel® Q965 (ICH8) Express Chipset

3. Intel® Core™ 2 Duo 1066MHz FSB Socket T with Dual Core technology XD, EM64T, 2MB and up to 4MB L2 cache, EIST and VT (E6000 series)

4. Microsoft® Windows® XP Professional with Service Pack 3 (installed)

5. Hard drive shall be either Serial ATA or Serial ATA 3.0 with SMART III technology. Hard drive shall have a burst transfer rate of 300 Mbit/s, and support FAT16 AND FAT32 partitioning in a Windows XP environment. Hard drive shall have an available access speed of either 7200RPM SATA 3.0Gb/s: with a minimum of 80GB (or) 10K RPM SATA 1.5Gb/s: 80GB (min.).

6. System board shall provide a (4) 7-pin Serial ATA connectors, (1) 34 pin floppy drive connector, 5 pin connector for internal fan, PCI 2.3 120-pin connector, Front Panel 40-pin connector.

7. Minimum of 2 GB of DDR2 SDRAM system memory. Unbuffered, non-ECC DIMMs only.

8. Network Interface Card that supports 10/100/1000 Ethernet

9. Expansion bus shall be PCI 2.3 (PCI: 33 MHz), PCI Express 1.0a (x1 @ 5 Gbps, x16 @ 80 Gbps), SATA 1.0a and 2.0, and USB 2.0 Ports (supporting 480 Mbps) – two in front, 6 in rear.

10. DC Power Supply: Shall be provided per mfg. recommendation. Minimum requirements shall be 305 W, 76% power efficiency, with a heat dissipation of 1041 BTU/hr. Manual Voltage selection of power shall be capable of 90 to 135 volts at 50/60 Hz, 180 to 265 volts at 50/60 Hz.

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11. Internal USB 10 pin connector for optional media bay device.
12. Serial Port (1) rear
13. Parallel Port (25 pin – bidirectional)
14. PCI-Ex1, (1) full height available slot, 36 pin connector size, one bi-directional differential lane pair (2.5 Gbs per lane) 5 Gbs total.
15. PCI, (2) full height available slots, 120 pins connector size, 32 Bit/33 MHz data bus, 3.3V External Operation (1.8 V internal regulation).
16. PCI-Express x16, one full height, 164 pin connector size, 16 bi-directional differential lane pair (2.5 Gbs per lane) 80 Gbs total.
17. High Definition Sound Card, 20-bit analog-to-digital; 20-bit digital-to-analog, with stereo line in, speakers line out, microphone-in, and headphone out
18. Graphics Cards shall be a 256MB ATI Radeon® X1300 PCI-Express X16 with a Max. resolution of 1920x1200 @ 75 Hz & 16.7 million colors. RAMDAC of dual 400MHz, dual VGA (DB15) or DVI optional DMS-59 cables, dual monitor support, dual rotation support.
19. Multimedia USB Keyboard
20. USB 2-button optical premium mouse with scroll, black color.
21. Audio Sound Speakers
22. 16x DVD+/-RW SATA Optical Drive

Workstation Class Computer shall provide all of the performance, operational, maintenance and physical features of a Dell Optiplex 745 Minitower as determined by the Project Engineer.

Furnish all material and coordination to install the cable from each camera in the system to the appropriate unmanaged Ethernet switch as shown on the plans. Install the cable from point to point as shown on the plans with no intermediate splices.

Prior to and after installation of fiber optic cable within the submarine duct system, Contractor shall perform a pre and post test of each fiber strand to verify that all multi-mode fiber optic cable strands meet the manufacturer's recommended signal attenuation requirements for proper signal communication. In the event the fiber optic cable strands becomes damaged during installation, or attenuation limits fall outside the limits of the manufacturer's attenuation requirements, Contractor shall be fully responsible for all costs associated with replacing and reinstalling the fiber optic cable strands within the submarine duct system, which includes all time and labor involved.

C. Telephone

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Furnish and install a raceway system throughout the north and south control towers for the bridge telephone system. Conduits shall be ¾" minimum and shall be routed to the Telephone System Service Panel where shown on the Contract Plans. Route within the conduit a standard 4 conductor cable from each telephone outlet box to the Telephone System Service Panel. Route the incoming 2" conduit to the Service Panel. Connect conduits to recessed boxes where shown on the plans for the operator's level and roadway level telephone extensions and service mounted boxes on the equipment levels of each control tower. Provide standard modular outlet telephone jack cover plates for recessed wall outlets on the operator's level and wall phone outlet plates on the roadway level and equipment level outlets.

D. Marine Band Radio

Provide and install on the top of the CCTV electronic rack a marine band radio which consist of but not limited to a master receiver/transmitter station, 120 volt AC/13.2 volt DC power supply, stainless steel 3 dB gain marine antenna, coax cable type RG-8U, length and fittings as required and microphone. Receiver/Transmitter unit shall be capable of monitoring U.S., Canadian and International channels, with 25 watt transmit power, with a transmit frequency range of 156.025 to 157.425 MHz and a receiver frequency range of 156.325 to 163.275 MHz, signal to noise ratio greater that 37 dB at 3 kHz. Mount the marine radio antenna on the roof of the north control tower where shown on the Control Tower (CT) Contract Plans. Unit shall provide all of the performance, operational, maintenance and physical features of the Hummingbird model VHF255s as determined by the Project Engineer.

E. Security Monitor System

Provide and install an security/intruder monitoring system in both control towers and bascule piers to monitor the status of all entrance doors to the bridge. The monitoring system in the south tower shall be interconnected to the north tower to alert the bridge operator of the conditions in the south tower and bascule pier. Detection switches shall be placed on the entrance doors at the roadway level and the fender pier access door in the bascule pier. A master monitor panel shall be located on the operator's level of the north control tower to provide status of both the north tower and south tower. As part of the monitoring system, provide and install an intercom system to permit a dedicated communication line between the operator's level and the roadway level entrance door on the north tower. The entrance door station shall be capable of both calling the operator's station to request entrance to the tower and to communicate with the operator. Monitor system shall be capable of dialing out on the bridge telephone line to a remote location when trouble is detected. Telephone number to be provided by the City of Seattle.

Monitor system shall be capable of receiving a status alarm contact from the tower smoke detector system specified elsewhere in these Special Provisions in the event smoke or fire is detected. If detected, the monitor system shall dial out to the remote location above with a dedicated message to differentiate between an intruder alarm or a fire alarm.

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8-19.3(16) PROGRAMMABLE CONTROLLER

All analog and digital logic functions required to control, interlock, and coordinate the bridge remote control system and associated components shall be performed by the programmable controller (PLC) as shown in the schematic diagrams.

The PLC equipment shall be installed in two cabinets. The Main PLC cabinet shall be installed in the north control tower. This Main PLC cabinet shall house the main central processor units (CPU), input-output units (I/O's), and all other associated equipment. The Remote PLC Cabinet shall be installed in the south control tower. This Remote PLC Cabinet shall house the remote I/O units and associated equipment.

The power supply module shall be isolated from the commercial power supply source by a constant voltage transformer/power conditioner to prevent electrical system noise and voltage fluctuations from interfering with the operation of the CPU. Unit shall be rated for 1,000 VA, 120 volts, with a nominal voltage of 115 volts. Unit shall be MGE catalog number T800P-01000 or approved equal. To supplement and protect the power supply for each PLC system, provide a UPS power supply for each cabinet to maintain power to the PLC's during interim loss of power. UPS shall be capable of providing uninterrupted power for a minimum of 20 minutes.

A. Quality Control

All PLC equipment (CPU, I/O frames, input cards, output cards, multiplexer, cables, etc.) shall undergo a minimum of 100 hours continuous burn-in prior to shipment. Burn-in shall be done while carrying temperature between rated limits of the device and cycling the equipment through a program.

PC equipment, including programming devices, shall be tested so as to ensure their proper operation in the presence of both radio frequency and electrical noise.

B. Redundant Control Processor

The programmable logic controller system shall be arranged such that both the main and redundant processors shall be programmed with identical information, operate on the same time base and run in complete synchronization, except that the redundant processor outputs shall be electrically isolated from the main system. In the event that trouble or failure of the main CPU occurs, transfer to the redundant CPU for bridge operations shall be made by manual means and of such ease that non-technically oriented personnel may make the transfer without difficulty. Location of the manual transfer switch shall be on the door of the main PLC cabinet and shall utilize a key switch with indicating lights to indicate the CPU in service.

C. CPU Memory

Each central processor shall have a metal oxide semi-conductor memory with a battery backup power system. Batteries shall be able to support the memory for not less than three months without external power.

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A key operated selector switch shall disallow changes in the stored program while in the "Operate" position.

The status of the inputs and outputs shall be checked at the time they are called for in the program rung the CPU is operating on.

The outputs shall be available to be turned "ON" or "OFF" as soon as its rung has been scanned.

The CPU shall check the parity of each word at the time it is scanning that word. The CPU shall contain "trouble" lights to indicate memory parity errors or processor malfunctions.

All CPU operating logic shall be contained on plug-in cards for ease of replacement. Chassis wired logic is not acceptable.

The memory unit shall have spare program capacity equal to 20 percent of the memory used.

D. Systems Input and Output (I/O's)

I/O frames shall be completely pre-wired for a full complement of I/O boards.

Additional I/O frames (up to the maximum PLC capacity) can be added at any time in the field.

I/O modules shall have key slots, which are unique for each card type, so that the wrong card type cannot be inadvertently installed in a slot that was programmed for a different card type.

I/O cards shall be replaceable without removing panel wiring.

I/O cards shall provide at least one common terminal for every two inputs or outputs.

Inputs and outputs shall be provided with reed relay or optical isolation between field circuits and internal circuitry.

Status lights shall be provided for each input or output amplifier indicating a signal is present to turn the input or output "ON".

Outputs shall be fused, and the fuses shall be easily removable without the use of special tools.

Output cards used only for pilot light service shall have a minimum continuous load capacity of 0.25 amperes at 120 VAC.

Output cards used for other loads shall have a minimum continuous load capacity of 1.5 amperes, and shall be capable of operating and withstanding the operating and surge characteristics of a NEMA size 4 starter.

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Analog inputs and outputs shall have a range of 4 to 20 milliamperes. Conversions between external analog signals and internal numeric values shall have a resolution of no less than one part in 999.

Timers shall be available through programming of counters utilizing time base inputs to counters. Time bases shall be available in seconds and tenths of seconds.

Arithmetic capability shall include add, subtract, multiply and divide, in integer mode using numbers up to 999. See schematic legend sheet in the Plans for function descriptions.

E. Data Logging System

Provide a subsystem capable of report generation. System shall output to a multifunction printer/scanner/copier/fax machine. Printer shall be capable of printing up to 32 pages per minute and 1200 dpi print resolution. Printer shall be located on a printer stand next to the main control console in the north control tower operator's level. The fax shall be connected to the phone line provided elsewhere in the special provisions. Connectivity shall be by USB or wireless. Printer shall be Hewlett Packard model 6500, Cannon, Epson or approved equal. All necessary hardware and programming is to be included.

This subsystem shall store operational and alarm data and will print a report summary on command. Each printout shall include day-of-year, time-of-day, and the message as they appear in these special provisions and on the plans. Printer output messages shall be as shown on the plans.

A Bridge Activity Movement Report shall be included as part of the data logging system. The report shall contain the following information:

Date, time of opening initiated, time of span off seat position, time span motors stopped and position of the span when stopped, time span motors began to lower, time span motors stopped and span position, and the time the bridge was opened to vehicular traffic.

Each time the span motors are stopped, whether raising or lowering, the Data Logging System shall store the activity report with the time and position of the span regardless of whether the span is fully open or fully closed.

The Activity Report shall be formatted similar to below:

South Park Bridge Activity Report
(Example)

Date:	April 18, 2011	Time Opening Initiated:	10:30:05
North Leaf off Seat:	10:32:28	South Leaf off Seat:	10:32:28
North Leaf Open at:	10:35:13	South Leaf Open at:	10:35:19
North Leaf Position:	74.2 Deg	South Leaf Position:	74.4 Deg
North Leaf Lowered:	10:51:38	South Leaf Position:	10:51:48
North Leaf Seated:	10:54:48	South Leaf Seated:	10:54:48

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North Leaf Position: 00.00 Deg South Leaf Position: 00.00 Deg
Time Opening Completed: 10:58:26
Total Time of Opening: 00:25:58

F. Programming

The program shall be entered using an IBM format Compatible Lap Top Personal Computer. Software shall be fully compatible with the PLC equipment. Provide two (2) fully compatible computer systems complete with modem hardware and software with a baud rate suitable for the modem equipment provided. Each computer shall be provided with a Pentium 4 processor, 40 Gigabyte hard drive, 512 Megabyte memory, DVD/CDRW combo CD drive with a minimum 14 inch screen. In addition to the software above, each lap top shall have Windows 2007 and Microsoft Office 2007. The lap top computers and all software shall be turned over to the owner at the completion of the project. Storage of one computer shall be within the PLC cabinet on a fold down work table mounted to the PLC cabinet door.

Each of the following logic symbols shall take no more than one word of CPU memory:

1. coil with address
2. normally closed contact with address
3. normally open contact with address
4. branch open
5. branch close

The CPU shall automatically close gaps in memory when logic statements are removed, thus eliminating NOP's in memory.

It shall be possible, at any time by means of a permissive key interlock, to modify an existing program in memory by inserting one or more ladder diagram rungs between any two existing (previously programmed) rungs. This ability to insert rungs of unspecified word length shall be accomplished by the technique of automatic "gap open", not by the imprecise method of reserving "contingency" blocks of memory for future changes.

It shall be possible to connect programming equipment to the CPU while the CPU is running without interfering with the operation of the CPU.

It shall be possible to record programs stored in the CPU memory on magnetic disk. Disk drive hardware shall be provided with the lap top computer.

It shall be possible to copy programs stored on magnetic disk into the CPU memory.

It shall be possible to verify programs stored on magnetic disk against programs stored in the CPU memory.

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It shall be possible to monitor the contents of the various timer and analog registers shown in the Contract Plans. Numerical access pad and display unit shall be provided on the control desk.

It shall be possible to communicate with the CPU at the bridge site and the lap top computer located at a remote location via an internet connection. Communication shall be secure and password protected. Connection equipment and necessary software shall be provided with the PLC equipment and the lap top computer.

G. Cabinet

Furnish cabinets as described later in this Special Provision.

H. System Hardware

The system shall be complete with all power supplies, racks, interface modules, fault monitors, and any other internal devices required.

I. Documentation

The Contractor shall furnish Instruction Manuals described under "Instruction Books" in this special provision. In addition, these manuals shall include operation of the equipment, programming of the equipment, theory of operation, maintenance information, schematics of all cards or units within the system, and point-to-point wiring diagrams.

Provide documentation of the PLC program, which shall include:

1. Ladder diagram printout.
2. Rung address.
3. Contact addresses and English contact description.
4. Cross reference of rungs which control contacts.
5. Cross reference of contact controlled by each rung.
6. English comments before each series of rungs.
7. Cross reference to relay numbers in plans.

J. Factory Tests

The Contractor shall pre-test the PC at the factory to ensure that the ramp functions operate in accordance with the plans.

The Contractor shall develop and submit to the Project Engineer a pre-testing plan for the programmable controller. The testing plan shall systematically check the requirements of the programmable controller to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop

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and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the programmable controller independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer. Once the Contractor has successfully pre-tested the programmable controller and submitted the corresponding certification forms, the Contractor shall again pre-test the programmable controller in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract.

The control console described in these specifications, or a test panel shall be provided to derive the control signals and indicators required to simulate span position.

Notify the Project Engineer 30 calendar days prior to scheduled completion of the Contractor's pre-tests so that the Project Engineer can arrange for a witness to the confirmation tests.

The costs (if any) of debugging the schematics or adapting the program to the hardware, both at the shop and on the project site after installation, shall be included in the pay item(s) to which it pertains. The Contractor shall debug the programmable controller at no additional cost to the County.

K. Manufacturers

The PLC shall be as manufactured by Allen Bradley Contrologix series or approved equal.

8-19.3(17) CONTROL PANELS

The following general requirements apply to all panels and enclosures. Specific requirements are included later in this special provision with the description of each panel.

Furnish the following panels and enclosures:

Control Console

Main PLC Cabinet

Remote PLC Cabinet

Electrical indicating instruments, unless otherwise specified, shall be of the digital type, with 4 digit, 0.56 inch high LED display, shall be designed for semi-flush mounting, and shall be 1.89 inches and 3.89 inches wide. Instrument ranges and scales shall be as shown on the plans. Instruments shall be as manufactured by Simpson, Red Lions, Datel or approved equal.

Push buttons, indicating lights, and non-illuminated selector switches shall be 30.5mm, heavy duty oil tight by Allen Bradley 800T, Square D type K or Cutler Hammer 10250T or approved equal.

Multi-light controls shall be a one to four light display with individually controlled lamp and color chip lenses. Lens colors shall be as shown on the plans. Control switches shall measure

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2.25 inches square, be of oil tight construction for protection against oil, water, and coolant penetration behind the panel or into the device. Assemblies shall have four swing-out mounting lugs for simple panel mounting, and have heavy duty contact blocks capable of tandem mounting. Units shall have internal 120 VAC transformers and each lamp individually controlled. Lamps shall be LED type. Nameplate engraving shall be as shown on the plans.

Key switches shall be double pole, double throw spring return or maintained contact type, heavy duty oil tight, as shown on the plans, Cutler Hammer type 10250T, Allen Bradley type 800T, Square D type K or approved equal. All key switches shall be keyed alike. Access key for the bypass switch panel cover shall be keyed separately.

Toggle switches shall be 3 pole, double throw spring return or maintained contact type as indicated on the plans, 10A minimum at 115 VAC, with a red switch guard. Switch guard shall be red high strength plastic configured such that when closed it returns the toggle switch to the normal position.

All load relays (R166, R170, etc.) shall be 10 ampere, 600 volt rated, Allen Bradley Type P, Square D Type X or Cutler Hammer type M-600 with normally open and normally closed power poles as shown in the plans.

All panels and enclosures shall be of the freestanding type. The construction shall be of steel plate of thickness described in the individual panel specifications and shall consist of a frame of suitably sized, formed structural steel members joined by electrical welding to ensure true surfaces and adequate support for the instruments mounted thereon.

All welds on the exposed surfaces shall be ground smooth. Finished surfaces shall be free from waves, bellies or other imperfections. Exterior surfaces shall be sandblasted, ground smooth, filled, primed, sanded and finished.

All instrument cutouts, mounting studs, and support brackets shall be located accurately. Unless specified otherwise, doors shall be hinged and shall have turned-back edges and additional bracing where required to assure rigidity. Hinges shall be of the piano or concealed type. Door latches shall be of the three-point type to assure tight closing.

Before application of paint, all surfaces shall be carefully cleaned of all dirt, moisture, rust, scale, lubricants and other substances. Lubricants shall be removed by suitable solvents. Rust and scale shall be removed by sandblasting, power sanding, power grinding or power wire brushing.

Exterior finish shall consist of application of suitable primers and two or more finish coats of enamel, as required to provide a smooth, hard and durable finish. The finish color for control panels shall be ANSI 61 Light Gray.

Interior surfaces shall be finished with gloss white lacquer applied over suitable primers.

The supplier shall include six 16-ounce containers of touch-up paint in aerosol cans for each color specified above. Touch-up paint shall be of the same type and color as the finish paint used

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in the factory applied painting. Complete painting instructions shall accompany the touch-up paint.

Paint films shall be free of sags, checks, blisters, teardrops or fat edges. If any such defects appear, they shall be repaired by and at the expense of the supplier.

Provide interconnecting wiring between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, they shall be connected to terminal blocks except for specific instrumentation cables as shown on the plans. Conductors for connection of machine tool relays, panelboard circuits and other miscellaneous equipment shall be UL listed type THWN-MTW. Minimum size shall be No. 14 AWG. For internal conductors between the PLC I/O cards and the field wiring terminals shall be of similar type with a minimum size of No. 16 AWG.

Install all interior wiring neatly and carefully. Terminate at suitable terminal blocks. Make all wire terminations with ring tongue nylon self-insulating wire terminals. Install wire terminals using a high compression indenting crimping tool that assures a full crimp by releasing the terminal only when the crimp is complete. All control and instrument wiring used within the panels shall conform to NEC and NEMA standards and shall be installed and tested at the factory.

Wiring to each control switch shall be individually bundled. Install with a "drop loop" of sufficient length to allow its removal from the panel for maintenance without disconnecting the wiring.

Internal wiring in factory pre-wired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.

Provide terminal blocks for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Provide terminal blocks with white marking strips. All terminal blocks shall be rated 600 volts and have pressure plate screw terminals. Standard terminal blocks for 8 AWG and smaller conductors shall be channel mounted in groups of 12, 16 or 20 terminal points as shown on the plans and shall be Square D 9080 GP6, Allen Bradley 1492-CA1, or approved equal. Variations in number of terminal blocks per group shall be as shown in the Contract Plans. Identify individual terminal blocks using the numbering system shown in the plans, using ABB/Enterlec marker-holder catalog number PEBM 0113 084.01 or approved equal.

Provide terminal blocks with corrosion resistant platings on non-ferrous hardware.

Group terminal blocks for easy accessibility unrestricted by interference from structural members and instruments. Provide sufficient space on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

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Permanently label each terminal block, device, fuse block, terminal, and both ends of each conductor, to coincide with the identification indicated on the manufacturer's wiring diagrams. Terminal blocks and devices already numbered on the plans shall be so numbered on the equipment supplied. Identify mounted electronic components by marking with contrasting colored ink beside the component.

Identify individual conductors by permanent marking sleeves using handheld marking tapes or other computer generated software. The marking shall be done on a sleeve not less than 1/2 inch long. The inside diameter of the sleeve shall be such that it will slip snugly over the insulated wire. Mark each sleeve so that the identification shall be permanent and waterproof. Adhesive type labels are not acceptable.

Provide internal illumination in all panels and enclosures using 18" fluorescent strip fixtures. Install a lighting switch activated by the access door of the panels and enclosures. The control desk will not require internal lighting.

Provide a convenience outlet in each panel and enclosure for use with power tools, portable lamps, and other similar equipment. Furnish in each enclosure and the control desk a 120 volt AC circuit to feed the interior lighting, the convenience outlets and the illuminated indicators.

Prepare wiring diagrams on sheets approximately 22 inches by 34 inches. Where interconnecting wiring from different items of equipment or sectional wiring diagrams of the same item of equipment appear on different wiring diagram sheets, all interconnections shall be clearly identified.

Information indicated on the Contractor's drawings shall include wiring of the individual panel items as they actually will appear in the panel, contact arrangements of switches, and internal wiring of relays and instruments.

Elementary diagrams shall be cross-referenced to terminal markings on the connection and interconnection diagrams, but need not show complete details of circuits external to the panels. Identify each item of panel mounted equipment indicated on the diagrams by item number and name.

Factory test all control panels for circuit continuity and operation.

Provide laminated phenolic nameplates on the panel faces for all instruments and devices mounted on the panel faces, except where the instruments or devices are themselves provided with a service engraving. Attach phenolic nameplates to the panels with double-sided adhesive tape.

All nameplates shall be WHITE with BLACK engraved lettering unless specified otherwise.

A. Control Console

Furnish and install the Control Console in the operator's tower where indicated on the Contract Plans, for operation of the span and its auxiliaries. All devices necessary for the local electrical control of the bridge shall be mounted on this console.

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The control console shall be of neat, substantial construction, arranged as shown on the plans. It shall be fabricated from not less than No. 11 gauge sheet metal properly formed, and suitably reinforced by steel angles to provide adequate strength. The flat top and inclined portions of the console top shall be 10 gauge brushed stainless sheet steel. The top and front slope shall be of non-reflecting finish.

Provide removable gasketed doors in the front of each console, secured with 3-way latches. Provide interior lighting within control console operated by door switches suitable to illuminate the interior of the control console without supplemental lighting. The console shall be neatly fitted up with close joints, and all rough edges or corners shall be ground off smooth and all projecting edges rounded off. All metal hardware shall be of substantial construction, and shall have a satin-chrome plate finish.

The bottom shall be of open type construction. The opening shall be framed with standard size strut, arranged to facilitate the clamping of cables or conduits.

Mount the span control switches and other control devices within the body of each console. Mount the indicating lights for each operation inside or adjacent to the control device governing that operation as indicated.

1. Indicating Lights - Functions to be indicated, and the color of the caps for such indication shall be as shown on the plans. Each indicating light shall be as shown on layout. Each lens shall be provided with an engraved legend, as indicated on the plans, which shall be readily visible when the lamp is energized. Each indicating light shall be similar to type shown and it shall be suitable for mounting on the desk top provided.

2. Span Operated Counter shall be 120VAC, 6-digit, panel mount, key-reset. Unit shall count 1/2 digit on a closed contact and 1/2 digit on an open contact. Counter shall be Veeder-Root catalog number 744386-241 or equal.

3. Provide the control console with a touch-screen display that will provide alarm displays, data logging records, key data registers as shown on the plans and specified in these specifications. Touch Screen display shall be fully compatible with the PLC equipment specified elsewhere in these special provisions. Display shall be fully compatible with the PLC equipment, Allen Bradley Panelview Plus CE or approved equal.

The touch screen display shall be programmed to display the operational conditions of the South Park Bridge both before the operation begins and during the operation of the bridge.

The display screens shall include but not be limited to the following:

Limit switch trip points for the north span and the south span

Status of communication between local and remote PLC Cabinets

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Status of alarm conditions at the South Park Bridge

Summary of past alarms for the past 21 calendar days

Speed of the lift span

Position of the lift span

Voltage, Current and Power status from MCC Power Monitor

Display screens shall be easy to read and understand. Submit a concept of each display screen for review and approval by the county and the Project Engineer.

B. Main and Remote PLC Cabinets

Each of the PLC cabinets shall be of neat, substantial construction, arranged similar to the layouts shown on the plans. It shall be fabricated from not less than No. 12 gauge sheet steel metal properly formed, and suitable reinforced by steel angles to provide adequate strength. The door shall be 12 gauge sheet steel. The Main PLC cabinet shall be Hoffman Engineering Co. catalog number A-907220FSD with back panel, Hammond Industries catalog number 1418BY20 with back panel, Wiegmann or approved equal. The Remote PLC cabinet shall be Hoffman Engineering C. catalog number A-726018FSD with back panel, Hammond Industries catalog number 1418ZX18 with back panel, Wiegmann or approved equal. The general arrangement may be varied to fit specific equipment used. The cabinet dimensions shall not be exceeded. The cabinet shall have a nameplate attached to the left hand door. Nameplates shall be not less than one inch high and shall be attached with screws. Provide a cooling fan with filtered intake and exhaust vents with each cabinet.

Factory test the PLC cabinet for circuit continuity and operation with associated equipment prior to shipment to the job site.

The control panels shall be manufactured by Anderson Electric Controls, Kent WA, (395) 268-3003, Link Controls Inc., Ronkonkoma, NY, (631) 471 3950, Panatrol Corp., Bedford Park, IL, (708) 496-3080 or approved equal.

C. Testing

The Contractor shall pre-test the complete electrical control system at the system integrators location. Testing shall include the control console, PLC cabinet and Motor Control Centers.

The Contractor shall develop and submit to the Project Engineer a pre-testing plan for the electrical control system. The testing plan shall systematically check the requirements of the electrical control system to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the electrical control system independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer. Once the Contractor has successfully pre-tested the electrical control

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system and submitted the corresponding certification forms, the Contractor shall again pre-test the electrical control system in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract.

External field devices such as limit switches, traffic gates etc., shall be simulated using a test panel capable of being switched to indicate different switch positions. Outputs to field devices shall be simulated using light panels.

Notify the Project Engineer 30 calendar days prior to scheduled completion of the Contractor's pre-tests so that the Project Engineer can arrange for a witness to the confirmation tests.

The System Integrator's cost (if any) of debugging the control system shall be included in the pay item(s) to which it pertains. The Contractor shall debug the control system at no additional cost to the County.

8-19.3(18) SPAN DRIVE MOTORS AND MOTOR CONTROLLERS

Each span drive shall consist of a motor and a drive controller, as follows:

1. Motors - The span drive motor construction shall be as prescribed in the "Motor Construction" specification contained herein, and shall have the following features:

   Motors shall be 75 horsepower, 850 rpm, DC, 500-volt armature, 300 volt field, 60 minute rated, totally enclosed, fan cooled, frame 409AT frame, with high level thermostat, class F insulation, weatherproof conduit box, 250w/115v space heater, weatherproof enclosure, grease fittings, 40 degree C ambient, 1.0 service factor. Motor shall be capable of operating in overspeed conditions up to 1150 rpm. Provide capability for field conversion of conduit box for mounting on either side of motor. Each motor will operate only when required to lift the bascule span for a duration of 1 minute 30 seconds for dual motor operation and 2 minutes for single motor operation. Normal operational loads are estimated to be around 40% of the full load capability for the majority of operation. External cooling fans are not required.

   Double-ended rotor shaft for connection to thruster brakes mounted on the drive end and tachometer/overspeed switch assembly mounted on the tail end of the motor.

2. Drive Controllers - The span drive controllers shall have NEMA 1 gasketed dust-resistant enclosures mounted on shock and vibration resistant bases, and shall contain the following major components:

   Solid State, 3-Phase, SCR Controller

   Incoming Line Circuit Disconnect Switch with External Operating Handle

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Forward/Reverse Control

Armature Feedback Speed Control

Field Loss Protection

Circuit Checker

Armature Shunt, 50mv, with 4 ½" meter with a transducer, +/- output for a remote meter

Emergency Stop Control by Current Limit

Motor/Controller Failure Light and Relay for Remote

Annunciation

"Ready" Light

Motor Run Contact

Field Reduction during periods of non-use

Nameplates: "North Span Drive 1", "North Span Drive 2", "South Span Drive 1" and "South Span Drive 2"

Speed Indicator in RPM

Current Indicator in Amps

Torque Indicator in % of full load

Regenerative Capability in Both Forward and Reverse

Cooling Fans

Current (torque) limit adjustment, set at 150% rated motor current.

Line Reactors

Isolation Transformer

A. Operation

The span drive shall rotate the counter balanced spans of the bridge whenever the operator deems it necessary to allow marine traffic to pass. See "Sequence of Normal and Emergency Operation", for operation details. When operating 2 with both main drive motors in the 2-motor mode of operation, both motor shall be adjusted to share the load equally, in the accelerating mode, full speed mode and in the decelerating mode.

Provide necessary circuitry as required to insure that the "B" drive is loaded equally to the "A" drive when both "A" and "B" motors are selected to operated in tandem.

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B. Interlocks

See the schematics in the plans for operation of the motors.

C. Testing

Supply the above equipment as a completely integrated pre-engineered system. The Contractor shall test each motor and drive controller as an interconnected system at the factory, and shall provide certified test results, including certified torque-speed curves to the Project Engineer. Speed-torque-current relationships from an overhauling torque or 150 percent of full load to a driving torque of 200 percent of full load shall be shown. See "Instruction Books" for systems tests including this equipment.

The Contractor shall develop and submit to the Project Engineer a testing plan for the span drive motors and motor controllers. The testing plan shall systematically check the requirements of the span drive motors and motor controllers to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the span drive motors and motor controllers independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer. Once the Contractor has successfully pre-tested the span drive motors and motor controllers and submitted the corresponding certification forms, the Contractor shall again test the span drive motors and motor controllers once installed on the bridge in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract.

The span drive controller equipment shall be Emerson Industrial/Fincor Mentor II series, Allen Bradley Power Flex 700 Series, ABB or approved equal.

D. Drive Controller Enclosure

The drive controller enclosure shall be no larger than 36”w X 24”d X 90”h, NEMA 1 rated, vented and filtered, made from 12 gauge steel and be prime coated on all interior and exterior surfaces. Exterior surfaces shall be given 2 coats of lead-free baked enamel paint. Interior surfaces shall be painted with 2 coats of lead free gloss white enamel. Access door for both the North and South Drive Controller 1 shall be hinged on the left side of the cabinet and access doors for both the North and South Drive Controller 2 shall be hinged on the right side of the cabinet as shown on the plans.

8-19.3(19) AUXILIARY DRIVE MOTOR

The Auxiliary Drive Motor shall be built in accordance with NEMA standards. Protect all exposed metal surfaces with a moisture-proof corrosion resistant polyester paint. The rotors shall be balanced mechanically and electrically. Provide all windings with special insulation to retard a decrease in insulation resistance due to excessive moisture. The motor shall have Class B insulation.

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The motor shall be a 50/25hp, 1800/900 RPM, 2 speed, 2 winding, constant torque, continuous duty rated, 405TFrame, 1.0 service factor, class F insulation, 480 volt, 3 phase, 60-hertz, NEMA Design B, totally enclosed fan cooled, squirrel cage induction motor. Motor frame shall be severe duty rated with cast iron enclosure and conduit box, equipped with standard length shaft. The auxiliary drive motor shall be shipped to the machinery manufacturer for installation on the machinery platform and installation in the bascule span machinery rooms. Motor shall be manufactured by Reuland Electric or equal by Reliance Electric or General Electric.

Provide a motor space heater of 100 watt minimum, 120 volt A.C.

8-19.3(20) SPAN MOTOR AND MACHINERY BRAKES

Furnish and install electrically operated thruster brakes in the machinery rooms as shown on the plans. Brakes shall be spring-set, thruster-reversed, shoe-type brakes of open type construction with corrosion-resisting fittings. Each of the machinery brakes shall be factory set at 4500 foot pounds intermittent and shall be Mondel Engineering model number 23MBT/E-ED301/6 or approved equal by Link Controls. Delay settings shall be as shown on the Contract Plans. The motor brakes shall be factory set at 600 foot pounds intermittent and shall be Mondel Engineering model number 13MBT/E-ED80/6 or approved equal by Link Controls Catalog or Ametek Technoligies.

Brake wheel couplings for the machinery brakes and motor brakes are to be provided with the brakes machinery. Brake wheel couplings shall be as shown on the machinery Plans. Coordinate final borings with machinery supplier. Refer to machinery Contract Plans for further information.

Provide NEMA 3 type rain tight enclosure with strip heater for all brakes. The enclosure shall have a split cover with plexiglass windows positioned to view the thrustor, limit switches and brake shoes for ease of maintenance and inspection.

Equip each brake with a hand release, which will not change the torque setting, require removal of the brake enclosure or require removable levers or wrenches. Install hand release handles for the machinery brakes on the side of the brake closest to the respective entrance door of the machinery room. Provide each hand release with a lever type limit switch for interlocking purposes. It shall not be possible to release the hand release of the brake without tripping this switch. Furnish two additional lever type limit switches with each brake. One switch shall be activated when the brake is fully set and the other switch shall be activated when the brake is fully released.

The oil used in the thruster operating chambers of the brakes shall be of a grade capable of operating in extreme ambient temperatures ranging from -40 degrees F to 150 degrees F.

The thruster motor shall be totally enclosed with built in adjustable time delays for setting, 460 volt, 3-phase, 60 Hertz, squirrel cage motor.

8-19.3(21) LIMIT SWITCHES

Limit switches shall be rated for not less than 250 volts AC or DC, and 10 amperes continuous AC or 0.4 amperes DC, and shall be of the following type:

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Type 1 - Rotary cam, 12 circuit, NEMA 4X stainless steel enclosure, single pole/double throw contacts with straight drive gear multiplier with a ratio 1:4, timing dial and position resolver as specified elsewhere in these special provisions, Gemco type 1980R-412-X-SP-TD1-S-4-L, Link Controls type 72-610-4X-12-SD28 will be considered acceptable. Allen Bradley products with similar or quality, function, size, maintenance and performance features or approved equals will be allowed.

Type 2 – Heavy duty lever arm 2-circuit operator, with snap action contact blocks, NEMA 4 enclosure, Namco Type EA780-20000 will be considered acceptable. General Electric, Cutler Hammer products with similar or quality, function, size, maintenance and performance features or approved equals will be allowed.

Type 4 – Heavy duty, plunger operator, 2-circuit, NEMA 4, cast aluminum, epoxy coated enclosure with roller bearing tip plunger, B&B Roadway Model LPS will be considered acceptable. Namco, Cutler Hammer products with similar or quality, function, size, maintenance and performance features or approved equal.

Provide the limit switches with brass tags as they appear in the plans:

Switch

Number	Type	Description
LS-EL 1	12-circuit rotary limit switch monitoring span height above seat position	
LS-EL1N/S	*	Closed Below 2.5 degrees
LS-EL2N/S	*	Closed Above 63.0 degrees
LS-EL3N/S	*	Closed Below 13.0 degrees
LS-EL4N/S	*	Closed Above 74.5 degrees
LS-EL6N/S	*	Closed Above 68.0 degrees
LS-EL7N/S	*	Closed Below 5.0 degrees
LS-EL8N/S	*	Closed Above 7.0 degrees
LS-HL1N/S	2	Closed Below 11.0 degrees
LS-HL2N/S	2	Closed Above 64.0 degrees
LS-SW/SE10	4	Opens when the south span is fully seated
LS-NW/NE10	4	Opens when the north span is fully seated

*Indicates switch is a portion of rotary limit switch LS-EL

8-19.3(22) POSITION MONITOR SYSTEM

The Position Monitor System shall consist of a span position resolver, a digital decoder/display unit and remote digital display unit. Two systems are required.

Mount the position resolver within the stainless steel rotary limit switch enclosure specified elsewhere in these special provisions. Mount the rotary limit switch where shown on the

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Contract Plans. Output shall be 3 digit decimal, programmable to correspond to 1,000 counts (0 through 999) for 359 degrees of shaft rotation.

The resolver unit shall be a size 11 transducer as manufactured by Gemco or approved equal. The unit shall be compatible with the programmable logic controller PLC equipment used. The cable between the resolver and the decoder/display unit shall be as recommended by the manufacturer and UL listed as tray cable.

The Digital Decoder/Display unit shall interface with the programmable logic controller to provide span position. Provide PC handshake interface equipment as required. The digital decoder/display unit as manufactured by Gemco shall be Series 2120 or approved equal. Decoder units shall mount on the Main PLC Cabinet and Remote PLC Cabinet doors as shown on the plans.

The Digital Display modules mounted on the main control console shall be 3-digit decimal display and calibrated to function from a 4-20 ma input signal provided from an output from the decoder/display unit above. The display unit shall have a separate power source.

8-19.3(23) TRAFFIC GATES AND RESISTANCE GATES

A. Traffic Gates

Traffic gates shall be as detailed on the Contract Plans. Each gate arm shall be of the length indicated on the Contract Plans, which shall open through an angle of 90 degrees from the horizontal to the vertical. Each gate shall have a welded steel housing, hot dipped galvanized after fabrication, arranged to provide a weather-tight housing for the motor, disconnect switch, gear train, limit switch and fuses for the warning lights. The transmission gearing for each gate shall be enclosed. Provide weather-tight, gasketed doors for access to the operating equipment.

The gate arms shall be a three-section combination aluminum and fiberglass unit. The first section closest to the gate housing shall be aluminum with the remaining sections made of fiberglass. Each assembled gate arm shall be designed for a 75 mph wind load. If recommended by the manufacturer, provide a bumper rod with compression spring near the end of each gate arm to stop the travel at the closed position without undue shock.

All bolts, screws or other fastenings used in the gate arm assembly and for connection to the gate stand shall be of corrosion-resisting metal or shall be hot-dip galvanized.

The number of warning lights on the gate arms shall be as indicated on the Contract Plans. Each warning light shall be a weatherproof, two-way, cast aluminum unit with red Fresnel lenses front and back. The lights shall be interconnected with three-conductor portable cord using watertight connectors at the fixtures. The lights shall be connected so that adjacent units will flash alternately. The flasher unit shall be mounted within the gate housing. Lamps shall be LED type. Fuses for the warning lights shall be midget cartridge fuses installed in molded rubber connection kits. Provide cannon plug connectors from the gate housing to the gate arm for the warning lights.

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Provide an 8-circuit heavy-duty limit switch in each gate, operated by the gate mechanism. Each limit switch shall be a rotary, cam-type, switch and it shall be gear-driven from the transmission. The contacts shall be quick-break with silver alloy buttons. The limit switch shaft shall be stainless steel, and cams shall be secured thereto with setscrews.

The motor for each warning gate shall be furnished as part of the gate by the gate manufacturer. Each motor shall be a totally enclosed, 480 volt, three-phase, 60-cycle ball-bearing induction motor complete with solenoid released brake and shall be capable of withstanding instant reversal when running at full speed. Each motor and gear train shall be capable of raising and lowering the gate in about 11 seconds. A motor-mounted, spring-set, magnetically released disc brake shall be provided for stopping and holding the mechanism. Provide a watertight disconnect switch to permit disconnecting the motor and brake from the incoming power.

All internal wiring for each gate shall be brought to numbered terminal blocks inside the housing for the connection of external circuits.

Each gate arm shall be striped on both faces with alternate red and white reflectorized stripes 16 inches wide measured parallel to the edge of the gate arm. The stripes shall slope downward at an angle of 45 degrees toward the centerline of the roadway. The galvanized gate stands, gate arm channels and supports shall be painted in accordance with the requirements specified herein for painting structural steel.

Each warning gate shall be bolted to its concrete foundation as indicated on the plans. In erecting the gates, carefully attach the aluminum and fiberglass arms to the supporting members so as to make a rigid connection. The arms shall be counterbalanced and the limit switches factory adjusted so that the arms are stopped in a truly vertical or horizontal position.

The Contractor shall provide provisions for hand operation, and furnish a hand crank for each gate. Furnish each gate with an adaptor that will enable a hand-held drill to be used for operation.

Traffic gate assemblies shall be Roadway Manufacturing model VW-4, B & B Roadway Corp., Russellville, AL or approved equal that meets the requirements of the Contract Documents including the following minimums, unless noted otherwise:

1. Application: The gate shall be designed for use as a warning, traffic control and access control gate. The gate shall be explicitly designed for traffic control on movable bridges, HOV and reversible lanes and similar applications.

2. Housing: The operating mechanism and main control components shall be contained in a weatherproof housing. The housing shall be constructed of .188” carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All fasteners shall be corrosion resistant. Housing design shall allow for easy removal of the arm shaft assembly as a unit, including bearings and

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main arm crank, for ease of service. Arm assembly mounting design shall be fully gasketed and shaft openings shall incorporate O-ring seals. Front and rear access doors shall be mounted on full cross bronze straps. Hinges shall be of the slip-off type and shall have stainless steel pins. Door handles, two per door, shall use a vise action to compress a neoprene bulb-type gasket to seal the door openings.

3. Mounting: The gate shall be fixed to a suitable foundation as shown in the Contract Plans, using four 3/4" diameter minimum anchor bolts. The gate housing base shall provide four 1.00" holes on a 20 1/4" square pattern.

4. Arm: The gate arm shall be 4" square, 6005-T5 aluminum extruded tubing. Stainless steel truss cables and a damping type bumper rod shall be furnished with longer arms at the discretion of the manufacturer. Front and rear arm surfaces shall be covered with alternating red and white pre-striped diamond grade reflective sheeting. Stripes shall be 6" wide, and shall slope at 45 degrees down toward the arm tip. Remaining exposed surfaces shall be painted white.

5. Arm Base: The arm base shall be designed with a shear pin mechanism to minimize damage to the gate and vehicle in the event of a collision. In the event of an impact, the shear pin shall break, allowing the arm to swing approximately 75 to 80 degrees. At the full open position, a spring-loaded latch shall engage, preventing the arm from swinging back into traffic. Arm shall be easily reset by manually releasing the latch, rotating the arm back into position and replacing the shear pin.

6. Arm Mounting Channels: A pair of carbon steel channels, hot dip galvanized, painted aluminum, shall be rigidly affixed to the ends of the main arm shaft. The channels and a steel crossmember shall provide a sturdy mount for the arm, arm base assembly and counterweights.

7. Counterweights: At the rear end of the side arm channels, hot dip galvanized counterweights shall be mounted to balance the arm. Counterweights shall be sectional and shall permit at least 10% adjustment.

8. Arm Shaft: The main arm shaft shall be of 2" diameter AISI 4150 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty relubricable ball bearings.

9. Operating Mechanism: The warning arm shall pivot in the vertical plane via a mechanical 4-bar linkage. The linkage shall utilize cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends. The connecting rod shall be of 1" diameter AISI 4150. The linkage shall be driven by a fully enclosed, double reduction, worm gear speed reducer. Gear ratio used shall produce an operation time of 11 seconds unless noted otherwise.

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10. The velocity of the arm shall follow a sinusoidal pattern to provide smooth operation. The arm shall begin and end its full motion path with zero velocity and accelerate smoothly to maximum velocity at mid-travel.

11. Motor: The motor voltage and phase shall be as required by the Contract Documents. The motor shall be 1/2 hp minimum, except when a greater rating is recommended by the gate manufacturer to handle exceptionally heavy applications or unless noted otherwise. The motor shall be a C-face design and shall be mounted directly to the transmission. The motor shall be instantly reversing and overload protected.

12. Braking Mechanism: The motor shall be equipped with a solenoid-release, automatic brake. The brake shall have a manual release lever to permit manual operation of the gate during emergencies or setup.

13. Hand Crank: A hand crank shall be provided with each gate to facilitate manual operation of the gate.

14. Limit Switch: The gate limit switch assembly shall be a self-contained unit. The assembly shall provide 8 independent SPDT control switches. Switches shall be rated for 15 amps at 480 VAC unless noted otherwise. Switches shall be controlled by individually adjustable cams. The limit switch assembly design shall permit adjustment of all cams with the gate in any position. The limit switch assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

15. Safety Switches, Terminal Blocks and Wiring: A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A hand crank safety switch shall be provided to prevent powered actuation of the gate during manual operation. Safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a pull-to-override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure mounted facing the roadway side access opening. Pressure-type, modular terminal blocks shall be fully labeled and clearly coded to wiring diagrams. All control wiring shall be clearly coded to wiring diagrams and shall terminate at the terminal block. Connections to screw-type terminals shall have lugs. Conductors shall be #16 AWG stranded, minimum. Wiring shall be run in conduit where practical unless noted otherwise.

16. Warranty: A 2 year warranty shall cover the gate and related equipment against defective material and components. Manufacturer shall furnish replacement parts for a minimum of 10 years. Replacement parts for standard components shall

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normally be available within 1 working day. Lamps, fuses and other components designed for a life less than 2 years shall be covered for the rated life of the component or the warranty period of the component manufacturer.

Each gate housing shall come equipped with a 175 watt heater and thermostat as well as a switched service light and duplex, 15 ampere, 120 volt, GFI specification grade receptacle.

The tops of the two oncoming warning gates, as shown on the Contract Plans, shall be modified to accommodate the warning bells specified elsewhere in these special provisions.

B. Resistance Gates

Resistance gates shall be as detailed on the Contract Plans. Each resistance gate shall be designed for use as a penetration resistance barrier and shall be explicitly designed for traffic control on movable bridges. Each resistance gate shall have an arm of the length indicated on the Plans, which shall open through an angle of 90 degrees from the horizontal to the vertical. The gate housing shall be constructed from 3/8" carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All fasteners shall be corrosion resistant. Housing shall be designed to allow ease of maintenance and removal of shaft components. Arm assembly mounted shall be fully gasketed and shaft openings shall incorporate O-ring seals. Housing shall have front and rear access doors mounted on full cross straps. Hinges shall be of the slip-off type and shall have stainless steel pins. Doors shall be secured with two handles using a vise action to compress a neoprene gasket to provide a weatherproof seal and shall be lockable. Traffic Gate handles and Resistance Gate handles shall be keyed alike.

The resistance gate assemblies shall be model VR-6 as manufactured by B & B Roadway Corp., Russellville, AL or approved equal that meets the requirements of Contract Documents including the following minimums, unless noted otherwise:

1. General: The resistance barrier shall be designed for use as a penetration resistance barrier and shall be suitable for use as a warning barrier for wide spans. The barrier shall be explicitly designed for traffic control on movable bridges, as required by AASHTO's current Standard Specifications for Movable Highway Bridges, and shall be suitable for similar applications as well.

2. Housing: The operating mechanism and main control components shall be contained in a weatherproof housing. The housing shall be constructed of .375" (9.5mm) carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All external fasteners ½" and under shall be stainless steel. Fasteners over ½" shall be stainless steel, hot dip galvanized or mechanically galvanized. Arm shaft openings shall incorporate O-ring seals.

3. Operating Mechanism: The warning arm shall pivot in the vertical plane via a mechanical 4-bar linkage. The linkage shall utilize cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends. The connecting rod shall be of AISI 4150. The

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linkage shall be driven by a fully enclosed, double reduction, worm gear speed reducer. Gear ratio used shall produce an operation time of 16 seconds. An auxiliary crank shall be used, paired with the transmission crank, to reduce the load on the transmission and to better balance and stabilize the load on the housing and mounting structure. The auxiliary crank shall be mounted in a permanently lubricated bronze bearing. The velocity of the arm shall follow a sinusoidal pattern to provide smooth operation. The arm shall begin and end its full motion path with zero velocity and accelerate smoothly to maximum velocity at mid-travel.

4. Transmission: The mechanism linkage shall be driven by a fully enclosed, heavy duty worm gear, double reduction speed reducer. The transmission shall have an occasional momentary peak load rating of not less than 30,000 inch-pounds. The output shaft shall be 2" in diameter. Gear ratio used shall produce an operation time of approximately 16 seconds unless specified otherwise.

5. Torque Limiter: A heavy duty torque limiter shall be provided to limit the torque transmitted to the operating mechanism due to excessive wind loads, physical obstruction to the arm or instant reversing of heavy arm assemblies. The torque limiter shall be capable of being set anywhere within a range of 10,000 to 75,000 in-lbs torque. Each torque limiter shall be factory set for the load recommended by the manufacturer, based on installation requirements. Each torque limiter shall be adjusted and tested at the factory, under over-load conditions, for a minimum of 5 minutes to verify the setting. The gate limit switch assembly shall be driven from the output side of the torque limiter so that slippage of the torque limiter will have no effect on the limit settings.

6. Motor: The motor voltage and phase shall be as required by the Contract Documents. The motor horsepower shall be as recommended by the barrier manufacturer to suit the installation, not less than 1hp unless otherwise noted. The motor shall be a C-face design and shall be mounted directly to the transmission. The motor shall be instantly reversing and overload protected.

7. Limit Switch: The barrier limit switch assembly shall be a self-contained unit. The assembly shall provide 8 independent SPDT control switches unless otherwise noted. Switches shall be rated for 15 amps, 480 VAC unless otherwise noted. Switches shall be controlled by individually adjustable cams. The limit switch assembly design shall permit adjustment of all cams with the barrier in any position. The limit switch assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

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8. Brake Mechanism: The motor shall be equipped with a solenoid-release, automatic brake. The brake shall have a manual release lever to permit manual operation of the barrier during emergencies or setup.

9. Arm Shaft: The main arm shaft shall be of 2.25" diameter AISI 4150 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty sealed ball bearings with lubrication fittings.

10. Doors: Front and rear access doors shall be mounted on full cross straps. Hinges shall be of the slip-off type and shall have stainless steel pins. A stop shall be mounted inside the door to secure the door from being raised off the hinges in the closed position. Door latches, two per door, shall use a vise action to compress a neoprene bulb-type gasket to seal the door openings unless noted otherwise.

11. Arm Mounting Tubes: A pair of carbon steel rectangular tubes, hot dip galvanized, painted aluminum, shall be rigidly affixed to the ends of the main arm shaft. The tubes shall be offset to locate the arm centerline at the height specified above the housing base. The tubes and a steel crossmember shall provide a sturdy mount for the arm and counterweights. The tubes shall have provision for easily adjusting the counterweight offset so the arm can be properly balanced in all positions.

12. Counterweights: At the rear end of the side arm tubes, hot dip galvanized counterweights shall be mounted to balance the arm. Counterweights shall be sectional and shall be balanced at the factory.

13. Arm: The barrier arm design shall be as depicted on the Contract Plans. Stainless steel truss cables and a damping type bumper rod shall be furnished. Front and rear arm surfaces shall be covered with pre-striped alternating red and white diamond grade reflective sheeting. Stripes shall be 6" wide and shall slope at 45 degrees down toward the arm tip. Remaining exposed surfaces shall be painted white.

14. Energy Absorption Cables: The barrier shall utilize 6x25 construction, 300-series stainless steel, annealed energy absorption cables to assist in diffusing the kinetic energy of an impacting vehicle. Cables shall be annealed in a coil not less than 42" diameter. The barrier shall be capable of absorbing the energy of a 5,000 pound vehicle traveling up to 50 mph.

15. Side Arm Latches: The energy absorption cables shall be anchored at both ends of the span in the closed to traffic position. At the housing, heavy duty side arm latches shall be mechanically linked to the operating mechanism to automatically engage a shaft through the side arm tubes when the arm is lowered, to assist in transferring the impact load into the housing in the event of an impact.

16. Arm End Latch: The energy absorption cables shall be anchored at the tip end of the arm in the closed to traffic position. A passive end latch mounted on the arm tip shall engage a rigidly mounted and anchored socket on or in a wall or post for

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independent barriers. For paired barriers, on-coming barrier shall be fitted with a bar and anchor nut while off-going barrier shall be fitted with a yoke. On-coming barriers shall be sequenced to close first and open last. Yoke on the off-going traffic barrier shall fit over the anchor nut in the closed to traffic position. End latch system shall be designed by the manufacturer so that the yoke will engage the anchor nut in a collision to connect the two barriers into a continuous unit. End latches shall not require powered actuation for proper engagement.

17. Mounting: The barrier shall be fixed to a suitable foundation, as shown in the Contract Plans, using eight 1" diameter anchor bolts. The barrier housing base shall provide 1.25" mounting holes.

18. Hand Crank: Both a hand crank and a drill crank shall be provided with each barrier to facilitate manual operation of the barrier.

19. Safety Switches, Terminal Blocks and Wiring: A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A hand crank safety switch shall be provided to prevent automatic actuation of the barrier during manual operation. Safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a pull-to-override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure mounted facing the roadway side access opening, except where custom components required by the customer prevent this arrangement. Pressure-type, modular terminal blocks shall be fully labeled and clearly coded to wiring diagrams. All control wiring shall be clearly coded to wiring diagrams and shall terminate at the terminal block. Connections to screw-type terminals shall have lugs. Conductors shall be #16 AWG stranded, minimum. Wiring shall be run in conduit where practical.

20. Warranty: A 2 year warranty shall cover the barrier and related equipment against defective material and components. Manufacturer shall furnish replacement parts for a minimum of 10 years. Replacement parts for standard components shall normally be available within 1 working day. Lamps, fuses and other components designed for a life less than 2 years shall be covered for the rated life of the component or the warranty period of the component manufacturer.

The gate arm design shall be of a double rail aluminum tube. Stainless steel truss cables and a damping type bumper rod shall be furnished if recommended by the manufacturer. Front and rear arm surfaces shall be covered with pre-striped alternating red and white diamond grade reflective sheeting. Stripes shall be 6" wide and shall slope at 45 degrees down toward the arm tip. Remaining exposed surfaces shall be painted white.

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Energy absorption cables shall be utilized to assist in diffusing the kinetic energy of an impacting vehicle. The resistance gate shall be capable of absorbing the energy of a 5000 pound vehicle traveling up to 50 mph. The double rail aluminum tube resistance arm shall two ½" cables, one in each tube. The energy absorption cables shall be anchored at both ends of the gate arm span while in the closed or lowered position.

All bolts, screws or other fastenings used in the gate arm assembly and for connection to the gate stand shall be of corrosion-resistant metal or shall be hot-dip galvanized.

The number of warning lights on the gate arms shall be as indicated on the Plans. Each warning light shall be a weatherproof, two-way, cast aluminum unit with red Fresnel lenses front and back. The lights shall be interconnected with three-conductor portable cord using watertight connectors at the fixtures. The lights shall be connected so that adjacent units will flash alternately. Lamps shall be LED type. Fuses for the warning lights shall be midget cartridge fuses installed in molded rubber connection kits. Provide cannon plug connectors from the gate housing to the resistance gate arm for the warning lights.

An 8-circuit heavy-duty limit switch shall be provided in each gate, operated by the gate mechanism. Each limit switch shall be a rotary, cam-type switch and it shall be gear-driven from the transmission. The contacts shall be quick-break with silver alloy buttons. The limit switch shaft shall be stainless steel, and cams shall be secured with set screws.

The motor for each resistance gate shall be furnished as part of the gate assembly by the resistance gate manufacturer. Each motor shall be a totally enclosed, 480 volt, three-phase, 60-cycle ball-bearing induction motor complete with solenoid released brake and shall be capable of withstanding instant reversal when running at full speed. Each motor and gear train shall be capable of raising or lowering the gate arm in about 16 seconds. A motor-mounted, spring-set, magnetically released disc brake shall be provided for stopping and holding the mechanism. The brake shall have a manual release lever to permit manual operation of the gate. A watertight disconnect switch shall be provided to permit disconnecting the motor and brake from the incoming power. A hand crank shall be provided with each gate operator to facilitate manual operation of the resistance gate.

Each gate housing shall come equipped with a 175 watt heater and thermostat as well as a switched service light and duplex, 15 ampere, 120 volt, GFI specification grade receptacle. All internal wiring for each gate shall be brought to numbered terminal blocks inside the housing for the connection of external circuits.

Each resistance gate housing shall be bolted to its concrete foundation as indicated on the Plans. Anchor bolts shall be furnished with the resistance gate by the manufacturer. In erecting the resistance gate, the arms shall be carefully attached to the supporting members so as to make a rigid connection. The arms shall be counterbalanced and the limit switches adjusted so that the arms are stopped in a truly vertical or horizontal position.

C. Testing

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The Contractor shall arrange for and provide all necessary field tests, to demonstrate that all traffic signals, traffic gates, resistance gates, and warning bells are in proper working order. Should the tests show that any piece of equipment or apparatus, in the judgment of the Project Engineer, is defective or functions improperly, such adjustments or replacement shall be made by the Contractor as to make the installation satisfactory to the Project Engineer, and at no extra cost to the County.

The Contractor shall develop and submit to the Project Engineer a testing plan for the traffic gates and resistance gates. The testing plan shall systematically check the requirements of the traffic gates and resistance gates to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the traffic gates and resistance gates independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer. Once the Contractor has successfully tested the traffic gates and resistance gates and submitted the corresponding certification forms, the Contractor shall again test the traffic gates and resistance gates once installed on the bridge in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract.

8-19.3(24) TRAFFIC SIGNALS AND WARNING BELLS

A. Traffic Signals

Each traffic signal assembly shall consist of a single-face, three-section, red, amber, green signal head assemblies for vertical mounting as indicated on the plans. Light assemblies shall be of a 12” lens made of ultraviolet stabilized polycarbonate, LED circuit board inclusive of all LED’s, and required LED circuit components. Each traffic light section shall be a weatherproof unit consisting of a separate polycarbonate housing with hinged lens holder and polycarbonate hood. The lens shall conform to the specifications of the Institute of Transportation Engineers. The housing shall be marked “TOP” to designate the proper orientation of the LED unit in the traffic signal housing. Manufacturer’s part numbers and date codes shall be visible from the rear of the assembly. The lens shall be keyed to the housing to insure the proper orientation and to avoid possible rotation during any handling.

The light intensity and distribution of light shall, as a minimum, meet the current ITE standards and measures criteria for vehicular traffic control. To verify the performance of the LED traffic signals in elevated temperature operation, as measured at the 2 ½ degree down and 2 ½ degree left or right position, the light shall maintain a uniform appearance across the lens and shall not exhibit areas of intensity such that it appears to have very bright, shadowed, or less intense points to the motorists.

The LED’s shall be connected in series parallel strings. The failure of any one LED, and its associated string of LED’s shall not cause the loss of more than 2 percent of the light output of the complete LED signal.

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The red traffic signal shall be provided with a strobe light. The strobe shall flash at a rate of approximately once per second. The strobe shall be visible at a distance of at least 1000 feet at normal conditions and conform to the applicable ITE standards.

The intensity of the light shall not vary by more than 30% from the nominal over the allowable voltage range as specified by the manufacture. Transient voltage suppression and fusing shall be provided to minimize the effects and repair cost of an extreme over-voltage situation or other failure mode.

Each traffic light section shall be provided with a tunnel-type, detachable visor. Lenses shall be furnished with a continuous soft rubber gasket completely surrounding the edge of the lens. The traffic signal poles shall consist of a tapered steel 16 flat flute shaft complete with anchor base, anchor bolts, handhole, cast pole top, and a flange plate near the top of the pole for mounting the mast arm. Round tapered support beams shall be complete with a mounting flange plate, hanger clamp and outlet having a 1-inch ID rubber grommet for wiring each signal and a removable cap.

The shaft shall be made of 1 length steel fabricated from a minimum 7 Ga. high strength cold rolled steel and shall conform to the requirements of ASTM A595 Grade A. A 4"x8" handhole complete with cover shall be welded into the shaft 15" above the base. A J-hook wire support shall be welded near the top of the shaft. Furnish an opening near the top of the shaft to provide a cable entrance from the shaft into the bracket mast arm.

A one-piece cast steel anchor base of adequate strength, shape and size, shall conform to ASTM A27 Grade 65-35 and shall be secured to the lower end of the shaft by two continuous electric arc welds, approximately 2" apart. Provide four holes in the base to receive the anchor bolts, four holes for ventilation in the body of the base and four tapped holes for attaching the covers.

The tapered round support beams shall be made of 7 Ga. steel and conform to ASTM A 595 Grade A. A flange plate shall telescope the large end of the beam and be welded by two continuous electric arc welds. The flange plate shall have four holes for the flange bolts conforming to ASTM A325. Each support beam shall have wire outlet holes on the bottom surface, with rubber grommet, located at each signal position. The vertical traffic signal pole shall be 16 flat flute, painted the same in Silver Bullet finish in accordance with Special Provisions Section 6-07.3(4) Valmont FL series or approved equal.

B. Traffic Gate Mounted Warning Bell

Provide and mount warning gongs on the on-coming traffic gates as shown on the plans. The warning gong shall be a twelve-inch motor driven gong type, and operate at 120 VAC. Each warning gong shall be B&B Roadway Manufacturing model G-12 or approved equal that meets the Contract Document requirements including the following minimums:

1. Application: The warning gong shall be provided an audible traffic signaling device to draw attention to the warning gate or traffic barrier and, thereby, to the bridge status.

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2. Housing: The housing shall be of heavy duty, cast aluminum construction. Gong assembly shall be equipped with an aluminum mounting adapter for mounting to the top of warning gate housing. Mounting shall be designed to enclose all wiring. A hinged and gasketed rear door shall provide service access. A cast aluminum guard above the shell shall provide weather protection.

3. Operating Voltage: Gong shall operate on 120V power. Current draw is .45 FLA.

4. Gong Shell: Gong shell shall be pressed steel

8-19.3(25) INSTRUCTION BOOKS

The Contractor shall furnish 8 bound copies each of two loose-leaf booklets. The materials shall be bound into each booklet between rigid plastic or cloth binding covers. The instruction booklets shall be approximately 9 inches by 12 inches, and the diagram booklet large enough to contain the drawings without excessive folding so that they may be easily opened. The booklets shall be neatly entitled with a descriptive title, the name of the project, the location, year of installation, owner, supplier and Project Engineer. Copies of drawings shall be in black on white background and shall be easily legible. The arrangements of the booklets, the method of binding, materials to be included, and the composite text shall all be reviewed and approved by the Project Engineer.

Booklets shall include but not limited to operation and maintenance details and manuals for the traffic signals, traffic gates, resistance gates, warning gongs, intercom system, CCTV system and generator set.

A. First Booklet

The first booklet shall contain the following:

1. Table of Contents.

2. Operator's Instructions, which shall cover in full the step-by-step sequence of operation of the bridge and its auxiliaries, and shall note all precautions required for correct operation. Complete instructions for the following shall be included.

   a. Selection of the power supply.

   b. Normal operation of the span on commercial power source.

3. Detailed maintenance instructions for adjusting, lubricating, and operating all of the electrical equipment, including manufacturer's recommended preventative maintenance lubrication schedule.

4. A set of descriptive leaflets, bulletins, and drawings covering all items of equipment and apparatus made a part of the completed bridge operation and control. The catalog number of each piece, to be used in case it becomes necessary to order replacement parts from the manufacturer. This information

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shall be furnished for all electrical equipment such as motors, switches, circuit breakers, relays, cables, etc.

5. Copies of all warranties on equipment supplied to the project.

B. Second Booklet

The second booklet shall contain legible reduced size photostatic copies of the following drawings, corrected to show the Work as constructed:

1. The complete spare parts list.
2. All schematics and wiring diagrams.
3. The control desk and control panel layouts and wiring diagrams for all equipment.
4. The schedule of electrical apparatus.
5. All submitted shop drawings.
6. All conduit layout and installation drawings.

8-19.3(26) TRAINING

Bridge operators shall be fully trained on operation of the bridge both for local control and for remote control by the Contractor. Up to 9 operators shall be trained on the operation of the bridge. The training period shall be up to 4 hours each training session exclusive of a one hour lunch period. The Contractor shall conduct 3 training sessions, approximately 3 operators each session, over three consecutive days between the hours of 10:00 am to Noon and 1:00 pm to 3:00 pm. One of the training sessions shall be video recorded and provided to the County for future the training of other operators by the Contractor.

Maintenance personnel shall be fully trained on the maintenance and fundamentals of the bridge electrical control system, PLC system and the DC drive controller systems, span locks, engine-generator set, traffic gates, resistance gates, CCTV's and operation of the bridge by the Contractor. Up to 8 maintenance personnel shall be trained. The training period shall be up to 6 hours each training session exclusive of a one hour lunch period. The Contractor shall conduct 2 training sessions, approximately 4 maintenance personnel each session, over two consecutive days between the hours of 9:00 am to Noon and 1:00 pm to 4:00 pm.

8-19.3(27) FIELD TESTS

A. Preliminary Checkout Period

The Contractor shall arrange for and provide all the necessary field tests, as indicated herein and as directed by the Project Engineer, to demonstrate that the entire integrated electrical system is in proper working order and is in accordance with the Contract Documents. Should the tests show that any piece of equipment or component of the system, is defective or functions improperly, adjustments or replacement shall be made by the Contractor as to make

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the system fully functional and serviceable as determined by the Project Engineer, and at no additional cost to the County.

The Contractor shall develop and submit to the Project Engineer a testing plan for the entire electrical system as a whole, in place, integrated, operational, reliable and serviceable. The testing plan shall systematically check the requirements of the electrical system as a whole to verify conformance with the Contract requirements. Submit the testing plan to the Project Engineer for review and approval. The Contractor shall develop and utilize testing certification forms to provide objective evidence of successfully testing. The Contractor shall complete all testing of the entire electrical system as a whole independent of the Project Engineer and submitted signed certification forms attesting to the successful testing to the Project Engineer.

The Contractor shall be solely responsible for operation and maintenance, including all costs thereof, for systems or equipment temporarily placed in operation for testing and adjusting purposes or for the convenience or necessity of the Contractor, prior to final acceptance by the Project Engineer.

B. Manufacturer Representatives

The Contractor shall provide appropriate representatives of the bridge electrical control equipment and components to be on-site during the testing period to resolve issues in a timely manner.

These representatives shall be capable of making adjustments to the equipment, of locating faults or defects and correcting them if possible, and of obtaining from the manufacturers without delay, new parts for replacement of apparatus which do not perform satisfactorily.

C. Operational Testing Period

Once the Contractor has successfully tested the entire electrical system as a whole, in place, integrated, operational, reliable and serviceable and submitted the corresponding certification forms, the Contractor shall again test the electrical system in the presence of the Project Engineer to demonstrate it meets the requirements of the Contract. The Contractor and its manufacturers' representatives, shall conduct an operational test period of not less than one week, during which time all aspects of the bascule span control system and remote control system will be tested and observed by the Project Engineer. During this period, the Contractor shall make any repairs necessary as a result of equipment failure due to faulty equipment or workmanship. Should operational tests show that any piece of equipment furnished by the Contractor, in the judgment of the Project Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the Contractor as to make the installation completely acceptable to the Project Engineer, and at no extra cost to the County.

Once the Contractor has successfully tested the electrical system as a whole and submitted the corresponding certification forms, the Contractor shall again test the electrical system as a

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whole in the presence of the Project Engineer and representatives of the bridge designer for purposes of validation to demonstrate it meet the Contract requirements. If the initial validation testing in the presence of the Project Engineer and the designer's representatives is unsuccessful and cannot be remedied and successfully re-tested within 24 hours of the initial test, the Contractor shall reschedule subsequent validation testing and shall reimburse the County for the direct cost associated with re-mobilizing and participation in all subsequent electrical system as a whole validation testing by the designer's representatives at a costs of up to $12,500 each subsequent electrical system validation testing event.

8-19.3(28) SEQUENCE OF NORMAL OPERATION

The span shall normally be operated using the commercial electric power source. The span normally will be retained in the seated, closed position. The sequence of normal operation shall be as follows:

Operating Procedure (Local)

A. Preliminary Switch Settings

1. Check supply voltage. Voltage should always be within 5% of 480V line-to-line.

2. Verify the "Speed Select" control switch in the "Auto" position. Placing the control switch in the "Maintenance" position will operate the span at the maintenance speed of 460 RPM and will not automatically withdraw the span locks upon starting the opening process. Placing the control switch in the "Adverse Weather" position is to be used at times when weather conditions consist of high winds and/or heavy snow or ice loads. Operating the bridge in this position will use both main drive motors but restrict the operating speed to 850 rpm. Automatic operation of the span locks will be functional with the control switch in the "Adverse Weather" position.

3. Normal position of the "Span Motor Select" control switch is in the "Motor 1-2" position. This will operate the bridge using both main drive motors at a motor speed of 1150 rpm. Selecting either "Motor 1" or "Motor 2" will use only one main drive motor and operate the bridge at a speed of 850 rpm.

B. To Open Span

1. Three distinct blasts from vessel signifies that a bridge opening is required.

2. Turn "Bridge Control" key switch to the "On" position.

3. Activate the traffic signals by turning "Traffic Signals" control switch to "ON". This will turn on the warning bells and begin flashing the traffic signals.

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4. Signal vessel with the "Horn" pushbutton if the span is to be opened immediately, or with four distinct blasts if a delay is necessary due to a traffic jam, accident, or other causes.

5. When on-coming traffic has stopped, lower both on-coming gates by turning and holding the NW and SE "Traffic Gate" control switches to the "Lower" position.

6. When on-coming traffic gates are lowered and it is observed that the Span is clear of Off-Going traffic and pedestrians, then lower both off-going gates by turning and holding the NE and SW "Traffic Gate" control switches to the "Lower" position.

Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Traffic Gates Lowered
Resistance Gates	Green	Resistance Gates Raised
Span Locks	Green	Span Locks driven
Span	Green	Spans full seated
Brakes	Green	Brakes applied
Span	Green	Bascule leafs are fully seated

7. When all traffic gates are fully lowered and it is observed that the span is clear of all vehicles and pedestrians, turn both the SE and NW Resistance Gate control switches to the “Lower” position.

Observed the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Traffic Gates Lowered
Resistance Gates	Red	Resistance Gates Lowered
Span Locks	Green	Span Locks driven
Span	Green	Spans full seated
Brakes	Green	Brakes applied

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Span	Green	Bascule leafs are fully seated

8. Observe that no vehicles or pedestrians are near the movable span, then turn the "Auto Raise" switch to begin raising the spans.

The "Auto Raise" light will go on, indicating that the "Auto Raise" circuit is active.

Each of the span lock "Push To Stop" lights will go on, as their motors are started automatically and the "Driven" lights will go off. When each span lock has reached the fully "Drawn" position, their motors will stop, their "Push To Stop" lights will go off and their "Drawn" lights will go on.

The brakes will be released as soon as "Raise" signal to the drive motors is initiated. The brake lights will go from Green to Red as the brakes are released.

Power will be applied to the span drive motors. The "Motor Run" lights for each drive motor will go on and the motor ammeters will show a surge in current as torque is applied to move the span. The speed indicators will show a gradually rising speed as all motors speed up to 1150 rpm in 10 seconds. The span position indicator will show span height above the seat.

As the spans leave the seated position, the "Seated" lights will go out, and the "Near Closed" lights will go on, until the span has risen to about 14 degrees. The warning gongs and warning bells will go off as soon as the spans are above the seated position.

Any abnormal event that would interfere with the proper operation of the span will cause the span drives to stop, and will log the event and display it on the Panelview screen located on the control console.

Observe the indicating lights:

Observe the indicating lights after bridge is moving, as follows as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Traffic Gates lowered
Resistance Gates	Red	Resistance Gates lowered
Span Locks	Red	Span locks fully drawn
Full Auto	Red	Auto Raise and Push To Stop
Brakes	Red	Brakes are released

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Span	None .	Span between "Near Closed" and "Near Open" positions

9. As the span approaches about 63 degrees, as observed on the "Position Indicator" and the amber colored "Near-Open" indicating light, the drive motor control will automatically slow the span speed down from the normal high speed mode to a speed of 460 RPM and will automatically stop the span when the span reaches full open position. Power will be cut from the motor, and the motor and machinery brakes will be applied, holding the span in the full-open position.

Observe the indicating lights, after bridge is stopped, as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Traffic Gates lowered
Resistance Gates	Red	Resistance Gates lowered
Span Locks	Red	Span locks fully drawn
Full Auto	None	Span Not Moving
Brakes	Green	Brakes are set
Span	Red	Span fully open

C. To Close Span:

1. After confirming that the vessel has cleared the span and no vessels are approaching the span for passage through the opening, sound four short warning blasts, denoting the closing of the spans.

2. Turn the "Auto Lower" control switch to "Lower" which will release the brakes and apply power to the drive motor control. The Motor Run lights will come on and the motor RPM will increase to 1150 rpm in 10 seconds as the spans begin to lower. Observe the indicating lights showing the approximate position of the span and observe each span automatically begins slowing down to 460 RPM at about 13 degrees above the seat position.

When the each span reaches about 1.5 degrees above seat position the spans will slow to 85 RPM, and continue to lower until the each span has reached the fully seated position. The warning bells will come on when all spans are fully seated. Power will automatically cut off and the span locks will automatically be driven. When the span locks are fully driven, the automatic lowering sequence will be complete and the "Auto Lower" light will go off.

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Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Traffic Gates lowered
Resistance Gates	Red	Resistance Gates lowered
Span Locks	Green	Span locks driven
Full Auto	None	Spans Not Moving
Brakes	Green	Brakes are set
Span	Green	Spans seated

3. Visually observe that the bridge spans are down and that no pedestrians are near the traffic gates or resistance gates. Raise the resistance gates by turning the SE and NW Resistance Gate control switches to the "Raise" position. Limit switches will automatically stop the resistance gates at the raised position.

4. Raise the traffic gates by turning the NE and SW traffic gate control switches to the "Raise" position, then turn the NW and SE traffic gate control switches to the "Raise" position. Limit switches will automatically stop the gates at the open positions. As an option, the "All Gates Raise" push button can be pushed and all four traffic gates will raise at the same time.

5. When all traffic gates are at the open limits, set the Traffic Signal switch to the "Green" position. The warning bells will go off.

Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Green	Signals set to allow traffic
Traffic Gates	Green	Traffic Gates raised
Resistance Gates	Green	Resistance Gates raised
Span Locks	Green	Span locks driven
Brakes	Green	Brakes are set
Span	Green	Span are seated

6. The "Bridge Control" key switch should now be turned "Off". This key operated switch will prevent unauthorized tampering with the operation of the bridge and its auxiliaries.

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8-19.3(29) SPARE PARTS

The Contractor shall furnish the following spare parts:

1. One circuit breaker of each kind and size of branch circuit breaker installed in the panelboards.
2. Three control relays with a minimum of one contact block with 4 contacts installed on the relay.
3. A quantity of 30% (3 minimum) of the total for each size and type of thermal overload relay installed in the motor starters of the Motor Control Center.
4. For the control desk lights:

   12 LED indicating lamps for each type installed

   1 color cap of each color and legend
5. For the programmable controller:

   One each of each type circuit card or module containing solid state devices. If more than ten cards or units of a type are provided, two spares shall be supplied.
6. For the drive controller;

   One complete drive controller assembly

   One each of every type of fuse, relay, transformer or contactor installed.
7. Spare Lamps as Follows:

   1 case of 17 watt, T8 fluorescent lamps

   2 case of 32 watt, T8 fluorescent lamps

   1 case of Compact Fluorescent Lamps (CFL)

   2 70 watt metal halide lamps
8. For the traffic gates

   One complete traffic gate arm complete with warning lights and supporting hardware

   1 case of LED lamps for the warning light assemblies

   3 complete warning light assemblies
9. For the resistance gates

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One complete resistance gate arm complete with warning lights and supporting hardware

One end lock device and mating plate

Provide spare parts in sealed, uniform-sized cartons, with typed and clearly varnished labels to indicate their contents. Provide a directory of permanent type describing the parts. The directory shall state the name of each part, the manufacturer's number therefore, and the rating of the device for which the part is a spare. The spare parts shall also be marked to correspond with their respective item numbers as indicated on the elementary wiring diagram. Each circuit card requiring adjustments shall be adjusted at the bridge prior to final delivery to the County. A lockable steel cabinet shall be provided by the Contractor for storage of the spare parts and instruction manual, as shown on the plans. Minimum size shall be 48" W x 16" d x 72" h. Cabinet shall be located on the Equipment Level of the north control tower.

8-19.3(30) PAINTING

Exposed metal parts of the electrical equipment installation attached to the steel work of the bridge, such as raceways, boxes, and their accessories, shall be hot-dipped galvanized and shall be painted the same color as the steel work. Interior metal parts shall be primed and painted to match surrounding surfaces.

8-19.3(31) GUARANTEE

The Contractor shall be responsible for the proper performance in part and as a whole of the electrical equipment provided for the operation of the lift spans and related parts for a period of one year after the successful completion of the operational testing period as determined by the Project Engineer. During the first year of operation, the Contractor shall correct, at no additional cost to the County, any difficulties in the operation which may arise as the result of defects of material, equipment and manufacture. Responsibility for such correction shall include the repair, readjustment and replacement not only of such defective parts, but other parts which may have been damaged thereby. The County reserves the right to correct any such defects, and require the Contractor shall pay the cost thereof if the Contractor does not address performance issues within 7 calendar days of notification of performance issues. The Contractor shall provide give a written guarantee satisfactory to the County to insure the conformance of this obligation.

8-19.4 MEASUREMENT

The lump sum Contract price for “Bridge Electrical System” contains the following approximate quantities of materials and completed work:

Motor Control Center 1 - Vert - 20 Inch	5	Each
Surge Protector	1	Each
Metering Compt	1	Each
600 A Main CB	1	Each
100 A Branch CB	5	Each

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1	225 A Branch CB	2	Each
2	400 A Branch CB	1	Each
3	Size 1 Non Rev. Starter	5	Each
4	Size 1 Revering Starter	6	Each
5	Size 3 2Spd Rev Starter	1	Each
6	MCC Vert Section (20")	4	Each
7	400 A Main CB	1	Each
8	100 A Branch CB	4	Each
9	225 A Branch CB	2	Each
10	Size 1 Non Rev Starter	4	Each
11	Size 1 Reversing Starter	5	Each
12	Size 3 2spd Rev Starter	1	Each
13	250kw Dsl W/ Tx Sw	1	Each
14	600 A Fused Disc NEMA 12	1	Each
15	600 A Fused Disc NEMA 4	1	Each
16	30 A Non-Fused Disc NEMA 4 3-Pole	2	Each
17	200 A Non-Fused Disc NEMA 4 4-Pole	4	Each
18	100 A Non-Fused Disc NEMA 4 6-Pole	2	Each
19	Ground System	2	Each
20	25kva Tx 1ph 480/120, Shielded	1	Each
21	30kva Tx 1ph 480/120, Shielded	1	Each
22	PLC Pnl Bd PP-1	1	Each
23	PLC Pnl Bd PP-2	1	Each
24	Utility Pnl Bd LP-1	1	Each
25	Utility Pnl Bd LP-2	1	Each
26	Control Console	1	Each

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1	Main PLC Cabinet	1	Each
2	Remote PLC	1	Each
3	Span Drives 75hp DC 850rpm	4	Each
4	Aux Drive,2spd 50/25hp	2	Each
5	Motor Brake 1/2hp (13")	4	Each
6	Machinery Brake (23")	4	Each
7	Rotary Limit Switch W/ Resolver	2	Each
8	Position Decoder	2	Each
9	Air Horn W/ Comp (Type AHR By B&B Roadway)	1	Each
10	Tach Gen/Overspeed Sw	4	Each
11	Limit Switches - Lever Arm	6	Each
12	Limit Switches - Plunger	4	Each
13	Lighting (Lot)	2	Each
14	Pier Lights	6	Each
15	J-Box	6	Each
16	Midspan Lights	4	Each
17	Retrieving Chain	4	Each
18	J-Box	4	Each
19	Wall Outlets And Switches (Lot)	2	Each
20	Intercom System	1	Each
21	Warning Signs	2	Each
22	Traffic Signal/Lights W/Pole & Mast Arm	2	Each
23	Traffic Gates	4	Each
24	Resistance Gates	4	Each
25	Cable Term Boxes - NEMA 4X	4	Each
26	Misc J-Boxes - NEMA 4X	8	Each
27	Cable Tray	450	L.F.

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Lightning Prototection & Grounding System	2	Each
Wiring	44000	L.F.
Conduit-GRS (Installed)	1000	L.F.
Conduit-PVCRS (Installed)	4500	L.F.
Start-Up Services	1	Each
Testing Services	1	Each
Spare Parts	1	Each
Smoke/Heat Detectors	6	Each
Marine Radio	1	Each
Bridge Tender's Training	1	Each
Operation of New Bridge During Construction	1	Each
Control Tower Telephone System (Lot)	1	Each
Commissioning & Testing	1	Each
Emergency Generator Set	1	Each.
Automatic Transfer Switch	1	Each.
Fuel Storage Tank with piping	1	Each.
Generator Set Pad	1	Each.
CCTV Cameras	6	Each.
CCTV Control Components (Lot)	1	Each.
CCTV Monitor	2	Each
CCTV Wireless Components (Lot)	2	Each

The quantities listed are only for the convenience of the Contractor in determining the scope of work involved and are not guaranteed to be accurate. The prospective bidders shall verify these quantities before submitting a bid. No adjustments other than for approved changes will be made in the lump sum Contract price for "Bridge Electrical System" even though the actual quantities required may deviate from those listed.

8-19.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following bid item when it is included in the Proposal:

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"Bridge Electrical System", lump sum.

The lump sum Contract price for "Bridge Electrical System" shall be full pay for; furnishing and installing the complete system as specified, in place, fully operational and reliable; operation and maintenance manuals; testing, shop drawings, materials, labor, tools, equipment, incidentals and services (including control system vendor services) necessary to achieve a complete and acceptable installation.

8-20 ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

8-20.1 DESCRIPTION

This section is deleted in its entirety and replaced with the following:

This Work shall consist of furnishing, installing and field testing all materials and equipment necessary to complete in place, fully functional system(s) of any or all of the following, types including modifications to an existing system all in accordance with approved methods, the Plans, the Special Provisions and these Specifications:

Illumination System

Conduit Duct Bank

Temporary Traffic Signal Revision

Unless otherwise noted, the location of signals, controllers, standards, and appurtenances shown in the Plans are approximate; and the exact location will be established by the Project Engineer in the field.

8-20.1(1) REGULATIONS AND CODE

The following is added at the end of this section:

All Contractor designed temporary works, work methods and operations shall conform to the Contract and the following standards: the American Association of State Highway and Transportation Officials, the Occupational Safety and Health Administration (OSHA).

8-20.2 MATERIALS

The following is added at the end of this section:

Materials for duct banks shall meet the requirements of the following sections:

Utilities on Bridge	6-01.10(A)
Concrete Structures	6-02
Gravel Backfill	9-03.12
Illumination, Signal, Electrical	9-29

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8-20.3 CONSTRUCTION REQUIREMENTS

8-20.3(1) GENERAL

The following is added at the end of this section:

Prior to performing any work related to the temporary traffic signal revisions at South Cloverdale Street and 14th Avenue South, the Contractor shall coordinate through the Engineer with the City of Seattle Traffic Signal Maintenance and Operations for implementation of signal timing revisions. The signal and timing for the final stage shall be restored to the same condition as at the beginning of the project unless otherwise allowed by the Project Engineer.

8-20.3(5) CONDUIT

This section is deleted in its entirety and replaced with the following:

Installation of conduit shall conform to appropriate articles of the Code and these Specifications.

The size of conduit used shall be as shown in the Plans. Conduits smaller than 1-inch electrical trade size shall not be used unless otherwise specified, except that grounding conductors at service points may be enclosed in 1/2 -inch diameter conduit.

It shall be the option of the Contractor, at no expense to the Contracting Agency, to use larger size conduit if desired, and where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet. Reducing couplings will not be permitted.

The ends of all conduits shall be well reamed to remove burrs and rough edges. Field cuts shall be made square and true. Slip joints or running threads will not be permitted for coupling metallic conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. The threads on all metallic conduits shall be rust-free, clean and well painted with a good quality colloidal copper suspended in a petroleum vehicle before couplings are made up. All couplings shall be tightened so that a good electrical connection will be made throughout the entire length of the conduit run. If the conduit has been moved after assembly, it shall be given a final tightening from the ends prior to backfilling. Non-metallic conduit shall be assembled using the solvent cement specified in Section 9-29.1. Where coating on galvanized conduit has been injured in handling or installing, such injured places shall be thoroughly painted with galvanizing repair paint, Formula A-9-73.

Conduit ends shall be capped (do not glue non-metallic caps). Metallic conduit ends shall be threaded and capped with standard threaded conduit caps until wiring is started. When conduit caps are removed, the threaded ends shall be provided with approved conduit bushings or end bells (do not glue in place) for nonmetallic conduit.

Conduit stubs from controller cabinet foundations shall extend to the nearest junction box in that system.

Metallic conduit stubs, caps, and exposed threads shall be painted with galvanizing repair paint Formula A-9-73.

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Metallic conduit bends, shall have a radius consistent with the requirements of Article 344.24 and other articles of the Code. Where factory bends are not used, conduit shall be bent, using an approved conduit bending tool employing correctly sized dies, without crimping or flattening, using the longest radius practicable.

Nonmetallic conduit bends, where allowed, shall conform to Article 352.24 of the Code.

Conduit shall be laid so that the top of the conduit is a minimum depth of:

1. 24 inches below the subgrade including asphalt or concrete shoulder areas and asphalt or concrete sidewalk areas.
2. 48 inches below the bottom of ties under railroad tracks unless otherwise specified by the Rail Road Company.
3. 18 inches below the finish grade in all other areas.

Galvanized steel conduit shall be installed at the following locations:

1. All railroad crossings.
2. All pole risers, except as otherwise required by owning utilities.
3. All bends with radius less than 3 feet on runs over 180 feet in length. Runs embedded within reinforced concrete structures are exempted.
4. All other locations noted in the Contract.
5. All runs externally attached to structures.
6. All runs installed in barrier that is constructed by slip forming

Galvanized steel conduit or Schedule 80 polyvinyl chloride (PVC) conduit shall be installed at the following locations:

1. All roadbed crossings.
2. All conduit entering foundations.
3. All other locations noted in the Contract.

Schedule 40 or Schedule 80 PVC conduit shall be installed at the following locations:

1. All runs installed at traffic signal installations, except road crossings or where externally attached.
2. All other locations noted in the Contract.

Non-metallic conduit may be employed as an alternate to metallic conduit at other locations unless specified otherwise in the Contract. Nonmetallic conduit installation shall include

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equipment grounding conductor and shall conform to requirements noted in the WSDOT Standard Plans.

Liquidtight flexible metal conduit is allowed only at locations called for in the Plans.

1. The use of aluminum conduit shall be restricted to above ground locations.
2. Aluminum conduit shall not be placed in concrete.

Metallic conduit shall be placed under existing pavement by approved directional boring, jacking or drilling methods, at locations approved by the Project Engineer. The pavement shall not be disturbed unless allowed in the Plans, or with the approval of the Project Engineer in the event that obstructions or impenetrable soils are encountered.

Boring operations shall be conducted to prevent caving ahead of the pipe, which will cause voids outside the pipe. The auger head shall precede no more than 4 inches ahead of the pipe being jacked.

The Contractor shall install steel casings as specified and shown in the Plans. The Contractor must be prepared to use a method approved by the Project Engineer to clear any obstructions to boring operations, which may be encountered.

After the casing pipe is in place, the inside shall be cleaned free of rock, dirt and water.

The space between the conduit and the casing shall be plugged with sand bags and a grout seal 12 inch thick at each end of the casing. Casings abandoned due to an encountered obstruction shall be grout sealed in the same manner. Grout shall obtain a minimum of 4000 psi compressive strength at 7 days.

In lieu of sandbags and grout, unopened sacks of prepackaged concrete may be used to seal the casing.

Material shall not be removed from the boring pit by washing or sluicing.

Bore pits shall be backfilled and compacted in accordance with Section 2-09.3(1) E. Directional boring, and jacking or drilling pits shall be kept 2 feet from the edge of any type of pavement wherever possible. Excessive use of water that might undermine the pavement or soften the subgrade will not be permitted.

When approved by the Project Engineer, small test holes may be cut in the pavement to locate obstructions. When the Contractor encounters obstructions or is unable to install conduit because of soil conditions, as determined by the Project Engineer, additional work to place the conduit will be paid in accordance with Section 1-04.4.

When open trenching is allowed, trench construction shall conform to the following:

1. The pavement shall be sawcut a minimum of 3 inches deep. The cuts shall be parallel to each other and extend 2 feet beyond the edge of the trench.

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2. Pavement shall be removed in an approved manner.

3. Trench depth shall provide 2 feet minimum cover over conduits.

4. Trench width shall be 4 inches or the conduit diameter plus 2 inches, whichever is larger.

5. Trenches located within paved roadway areas shall be backfilled with controlled density fill (CDF) meeting the requirements of Section 2-09.3(1)E. The controlled density fill shall be placed level to, and at the bottom of the existing pavement. The pavement shall be replaced with paving material that matches the existing pavement.

On new construction, conduit shall be placed prior to placement of base course pavement.

Conduit terminating in foundations shall extend a maximum of 2 inches above the foundation vertically including grounded end bushing or end bell.

Conduit entering through the bottom of a junction box shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduit shall enter from the direction of the run, terminating 6 to 8 inches below the junction box lid and within 3 inches of the box wall nearest its entry location.

Galvanized rigid steel conduit entering cable vaults shall extend 2 inches for the installation of grounded end bushing and bonding. PVC conduit entering cable vaults and pull boxes shall terminate flush with the inside walls of the structure. All conduit ends shall be terminated with termination kits.

When conduit or casing is to be placed under pavement it shall be placed prior to the placement of a subbase, base, surfacing, and pavement.

Conduit entering through the bottom of a junction box shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduit shall enter from the direction of the run, terminating 6 to 8 inches below the junction box lid and within 3 inches of the box wall nearest its entry location.

Suitable marker stakes shall be set at the ends of conduits, which are buried so that they can be easily located.

Fittings shall be installed at locations as designated by the Project Engineer so as to provide a conduit channel that will permit freedom for installing the electrical control wires. When conduit fittings are called for in the Plans, or where their installation is required by the Project Engineer, the Contractor shall also furnish all necessary covers and gaskets.

All covered underground conduit shall be cleaned with an approved sized mandrel and blown out with compressed air prior to pulling wire.

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Conduits installed for future use shall be prepared as follows: After final assembly in place, the conduit shall be blown clean with compressed air. Then, in the presence of the Project Engineer, a cleaning mandrel correctly sized for each size of conduit shall be pulled through to ensure that the conduit has not been deformed. As soon as the mandrel has been pulled through, a pull tape shall be installed and both ends of the conduit shall be sealed with conduit caps. All conduits scheduled for future use shall originate in a foundation or junction box as detailed in the Plans and terminate in a junction box. All equipment grounding conductors, and the bonding conductor for metallic conduits shall be bonded in all junction boxes in accordance with Section 8-20.3(9).

Where surface mounting of conduit is required, supports shall consist of "unistrut" type or equal mounting complete with clamps sized for the conduit. Support spacing shall comply with the Code or shall be as noted in the Contract. Approved expansion fittings shall be installed at all expansion joints. Approved deflection fittings shall be installed at the joint between the bridge end and the retaining wall end and the transition point from the bridge attachment to the underground section. In addition to the expansion fittings installed at all expansion joints, when PVC conduit is installed, an additional expansion fitting shall be installed for each 100 feet of conduit. Fasteners shall be as approved by the Project Engineer.

Existing conduit in place scheduled to receive new conductors shall have any existing conductors removed and a cleaning mandrel sized for the conduit shall be pulled through.

Conduit runs shown in the Plans are for bidding purposes only and may be changed, with approval of the Project Engineer, to avoid underground obstructions.

A maximum of 1000 feet of continuous open trench will be allowed, unless otherwise approved by the Project Engineer. All conduit exposed above grade level, or on any elevated structures, or as noted in the Plans shall be galvanized rigid steel innerduct conduit.

8-20.3(6) JUNCTION BOXES, CABLE VAULTS, AND PULL BOXES

This section is deleted in its entirety and replaced with the following:

Standard junction boxes, pull boxes and cable vaults shall be installed at the locations shown in the Plans. The Contractor may install, at no expense to the Contracting Agency, such additional boxes as may be desired to facilitate the Work. Junction box installation shall conform to details in the WSDOT Standard Plans.

All junction box lids and frames shall be grounded by means of a minimum No. 8 AWG braided tinned copper bonding jumper bolted to the lid with countersunk stainless steel bolts that will allow the removal of the junction box lid without breaking the ground.

Cable vaults and pull boxes shall be installed in accordance with the following:

1. Excavation shall be performed in accordance with Section 2-09.

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2. Cable vaults and pull boxes shall be installed on 6 inches of crushed surfacing top course, per section 9-03.9(3), placed on a compacted or undisturbed level foundation. If a cable vault or pull box is installed outside a paved area, an asphalt pad shall be constructed surrounding the junction box.

3. All openings around conduits shall be sealed and filled with grout to prevent water and debris from entering the vaults or pull boxes. The grout shall meet the specifications of the cable vault and pull box manufacturers.

4. Backfilling around the Work shall not be allowed until the concrete or mortar has set.

5. Pull boxes shall be installed in accordance with Plans and details.

6. Pull boxes shall be configured such that the tensile and bending limitations of the cable are not compromised. Pull boxes shall be configured to mechanically protect the cable against installation force as well as inert forces after cable pulling operations.

7. Upon acceptance of work, cable vaults, and pull boxes shall be free of debris and ready for cable installation. All grounding requirements shall be met prior to cable installation.

8. Where installed near steel casings, the pull boxes and cable vaults shall be offset 3 feet, minimum from the centerline of the casing. Factory bends shall be used to route the conduits to the cable vault or pull box.

Adjustments involving raising or lowering the junction boxes shall require conduit modification if the resultant clearance between the top of the conduit and the junction box lid becomes less than 6 inches or more than 8 inches in accordance with WSDOT Standard Plan J-11a.

Cable vaults and pull boxes shall be adjusted to final grade using risers or rings manufactured by the cable vault and pull box manufacturer. Cable vaults and pull boxes with traffic bearing lids shall be raised to final grade using ring risers to raise the cover only.

All voids resulting from the adjustment shall be backfilled with materials matching adjacent surfacing material and compacted in accordance with Section 2-09.3(1)E.

Damage to the junction boxes, pull boxes, cable vaults and the associated conduit system, or wiring resulting from the Contractor's operations, shall be repaired to the Project Engineer's satisfaction at no additional cost to the Contracting Agency.

Both existing and new junction boxes, pull boxes, and cable vaults shall be adjusted to be flush with the finished grade as well as with the grade during the various construction stages proposed in the Contract.

Where conduit and junction boxes are placed in barrier, the Contractor shall coordinate the work of the sub contractor constructing the barrier and the electrical sub contractor so that each

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junction box placed in the barrier is placed in correct alignment with respect to the barrier, with the face of the box flush or uniformly chamfered within ½ inch of the barrier surface. If any point on the surface of the junction box placed in barrier is recessed more than 1/2 inch from the surface of the barrier, the Contractor shall install a box extension meeting the Project Engineer's approval and grout around the extension or remove and replace the entire section of barrier.

8-20.3(8) WIRING

The third paragraph of this section is deleted and replaced with the following

All splices in underground illumination circuits, induction loop circuits, and magnetometer circuits shall be installed in junction boxes. The only splice allowed in induction loop circuits and magnetometer circuits shall be the splice connecting the induction loop lead-in conductors or magnetometer lead-in conductors to the existing shielded home run cable. Loop wires shall be spliced to lead-in cable at the loop junction box with an approved mastic tape, 3-M 06147 or equal. The mastic pad shall be a minimum of 5 inches long. The mastic splice shall be centered on the wire at the splice point, folded up around the sides, and jointed at the top. The mastic pad ends shall be visible and fully sealed to the conductor insulation. The ends of the lead-in cable shall have the sheathing removed 8 inches and shall be dressed external to the splice. All connections with #10 and smaller wire shall use copper crimped connectors installed with a positive action (ratchet) tool. The non-insulated die shall be an indent type and insulated die shall be of a smooth shape capable of crimping pre-insulated terminals and connectors. The tool shall be compound lever type with a ratchet mechanism to ensure positive closure for full crimping cycle. The tool shall be field adjustable to proper calibration with common tools and materials. All connectors shall be wrapped with two layers of electrical tape. All epoxy splice kits shall be physically separated from other splices and wiring within the junction box to avoid damage from heat during the casting process.

8-20.3(8)B SIGNAL SPLICES (NEW SECTION)

Signal cable shall be spliced only in poles, pedestal bases, or overhead within 2 feet of the poles. Aerial splices shall be covered by reverse wrapping of the first layer with electrician insulating tape, then a built-up rounded end of electrical tape, then a minimum of 2 layers forward with electrician tape. At locations where existing signal cables are being utilized, the traffic signal cables shall be spliced in pole or pedestal bases and each individual conductor shall be insulated and the entire splice shall be waterproofed. Each individual splice or termination of extra leads shall be insulated, taped and made waterproof. Service cable or master cable shall not be spliced except as indicated on the Plans.

8-20.3(9) BONDING, GROUNDING

The first paragraph of this section is deleted and replaced with the following**:**

All metallic appurtenances containing electrical conductors (luminaires, light standards, cabinets, metallic conduit, non-metallic conduit, etc.) shall be made mechanically and electrically secure to form a continuous systems that shall be effectively grounded. Where metallic conduit systems

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are employed, the conduit system constitutes the equipment grounding conductor. Where non-metallic conduit is installed, the installation shall include an equipment ground conductor, in addition to the conductors noted in the Contract. Bonding jumpers and equipment grounding conductors shall be installed in accordance with Section 9-29.3. and sized per NEC 250-122. Where parallel circuits are enclosed in a common conduit, the equipment grounding conductor shall be sized by the largest overcurrent device serving any circuit contained within the conduit.

The following is added at the end of this section:

Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors shall be adjusted proportionately according to circular mil area in compliance with NEC 250-122(b).

The grounding electrode system shall consist of a ground ring and shall be 25 ohms or less impedance. The ground ring shall be placed in contact with the earth at a depth of 2.5 feet or more and consist of bare copper conductor not smaller than No. 2. The grounding electrode system shall be tested with a ground rod tester in the presence of the Electrical Inspector prior to activating the service.

8-20.3(10) SERVICES TRANSFORMER, INTELLIGENT TRANSPORTATION SYSTEM CABINET

The following is added at the end of this section:

The Contractor shall request the State Department of Labor and Industries (L&I) to perform required inspections for service approval. The request by the Contractor to L&I shall be sent by certified mail with a copy forwarded to the County. The Contractor shall notify the Project Engineer when the service is approved by L&I and ready for connection.

8-20.3(11) TESTING

The fourth paragraph of this section is deleted and replaced with the following:

The Contractor shall conduct functional tests to demonstrate that each part of the illumination system or other electrical system functions as specified. These demonstrations shall be conducted in the presence of aN Electrical Technician or Supervisor, and the Electrical Inspector.

8-20.3(13)A LIGHT STANDARDS

The following is added at the end of this section:

Light standards shall be handled when loading, unloading, and erecting in such a manner that they will not be damaged. Any parts that are damaged due to the Contractor's operations shall be repaired or replaced at the Contractor's expense.

Light standards shall not be erected on concrete foundations until foundations have set at least 72-hours or attained a compressive strength of 2,400-PSI, and shall be raked sufficiently to be plumb after all load has been placed.

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"Pole In Ground" installations shall conform to COSP number 536a using Seattle City Light (SCL) Stock Pole #573986, Mast Arm #570527 and Foundation #568028. For pole base and bracket arm installation the Contractor shall conform to COSP number572.

All other installations: "Pole on SE Wall Moment Slab," "Pole on Bridge Deck" and "Pole on Bascule Pier" shall conform to the requirements as specified in the Plans, Valmont Industries Inc. Manufacturer Specifications and these Special Provisions. The Contractor shall procure the following from Valmont Industries Inc.:

1. Valmont FL50-900A370-8S-HH-FP/GV-AB light standard including mast arm, bracket arm flange plate, removable cap and base plate. The bracket arm flange plate shall conform to COSP number 572. The base plate shall conform to the Plans and these Special Provisions.

2. Valmont 1'-0" Pole top Tenon.

Where the pole top tenon is required by the Plans, the Contractor shall provide a design to properly connect the pole extension, required for the lightning protection air terminal, to the pole top tenon. The Contractor design shall be submitted to the Project Engineer for approval.

Fixed pole base installation, for all installations other than "Pole In Ground" installations, shall conform to the following:

1. At all "Pole on SE Wall Moment Slab" installations the Contractor shall construct a concrete moment slab as detailed in the Plans. At all "Pole on Bridge Deck" and "Pole on Bascule Pier" installations the Contractor shall include the additional reinforcing steel in the base structure as detailed in the Plans.

2. For each Valmont FL50-900A370-8S-HH-FP/GV-AB light standard, the Contractor shall install one (1) modified 10" dia. bridge elbow with four (4) 1" dia. All Thread Rod (ATR) tapped into the top flange as detailed in the Plans, one (1) bottom flange conforming to sheet 3 of 4 of WSDOT Pre-approved Plan #DB00653, four (4) high strength full thread anchor bolts and one (1) anchor plate conforming to WSDOT Bridge Standard Drawing 10.2-A7-2. The Contractor shall install all heavy-hex nuts, lock washers, plate washers, standard washers, machine screws and decorative cover plates as required by the Plans.

3. ATR tapped into the top flange of bridge elbow shall be peened in prior to welding the top flange to the elbow and extend through the top heavy-hex nut a minimum of 2 full threads. ATR shall be tightened in accordance with Section 6-03.3(33) and 8-20.3(4). The ATR shall be tightened to the specified torque, plus or minus 2-percent, in 2 stages using an accurately calibrated torque wrench upon erection of the light standard. Except as otherwise specified, the Contractor shall tighten the ATR to a torque of 95-foot-pounds.

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4. Anchor bolts shall extend through the top heavy-hex nut a minimum of 2 full threads. Anchor bolts shall be tightened by the Turn-Of-Nut Tightening Method in accordance with Sections 6-03.3(33) and 8-20.3(4).

5. The galvanized surfaces of all plates shall be smooth, without irregularities, to reduce friction and to prevent slackening of bolt tension due to flattening of the irregularities.

6. Anchor bolts damaged after the foundation concrete is placed shall not be repaired by bending or welding. The Contractor's repair procedure is to be submitted to the Project Engineer for approval prior to making any repairs. The procedure is to include removing the damaged portion of the anchor bolts, cutting threads on the undamaged portion to remain, the installation of an approved threaded sleeve nut and stud, and repairing the foundation with epoxy concrete. Epoxy concrete shall meet the requirements of Section 9-26.3(1)B.

7. Grout pads where applicable shall not extend above the elevation of the bottom of the anchor plate.

All new light standards shall have an approved metal tag riveted to the pole above the handhole. The information provided on the tag and the location of the tag shall be as noted on the pre-approved drawings.

For "Pole In Ground" installations handholes shall be located and installed as per Page 1 of 4 of WSDOT Standard Drawing #DB00653. For all other installations handholes shall be located as per Page 3 of 4 and installed as per Page 1 of 4 of WSDOT Pre-approved Plan #DB00653.

All new and relocated metal light standards shall be numbered for identification using painted series C numbers installed 3-feet above the base facing the Traveled Way. Paint shall be black enamel alkyd gloss conforming to Federal Specification TT-E489. The following information shall be provided.

1. Luminaire Number
2. Luminaire Wattage
3. Luminaire Voltage
4. Service Number

8-20.3(13)C LUMINAIRES

The following is added at the end of this section:

The Contractor shall install Universe Collection Architectural Area Lighting Luminaire UCL-SR-FLR-H2-400HPS-MAS as per Manufacturer Specifications. If conflicting information occurs between Standard Specifications and Manufacturer Specifications the more stringent shall control.

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8-20.3(14)C INDUCTION LOOP VEHICLE DETECTORS

The second sentence of item 2 in this section is deleted.

The following is added at the end of item 4:

Disconnect existing loops from loop lead in cables at the splice point. Replace loops in the roadway and splice to the existing lead in cables. All loops shall be tested in accordance with Section 8-20.3(14)D and approved by the Project Engineer prior to placement of the final lift of asphalt. Vehicle loop detectors indicated on the Plans are located schematically and actual loop detector locations will be verified by the Project Engineer prior to sawcut or installation. The Contractor shall mark out proposed detector loops on the roadway at least 5 calendar days before any sawcut or installation occurs. The location of stop bar pavement marking shall be obtained by the Contractor prior to sawcut or loop detector installation. In general, loop locations shall be located behind existing or proposed stop bar pavement marking, and shall not be located where pavement dowel or tie bars or metal supports within the pavement are located. Loops located within or beyond the stop bar pavement marking will not be allowed. The Contractor shall not begin sawcutting pavement until loop locations have been approved by the Project Engineer. When parallel to a pavement joint or edge, the sawcut shall be at least 1 foot away from the edge or joint. All saw cuts shall be cleaned of all debris.

The Contractor shall sawcut pavement to a depth that provides a minimum 1 inch cover between the top of loop wire and pavement surface.

One single continuous length of loop wire shall be used to form a loop with four turns in the loop saw cut. The wire shall be placed by tamping it into the saw cut with a blunt wooden stick, taking care not to damage the insulation. To reduce abrasion of the insulation, the Contractor shall sawcut all corners at least once to reduce the corner angle. This corner angle shall then be filed or smoothed acceptably free of sharp edges.

The sawcut in concrete shall be filled with a quick-drying high strength highway concrete patching material. The Contractor shall submit to the Project Engineer at least 5 calendar days in advance of starting work, a catalog cut describing the patch material properties including strength and time to develop strength characteristics.

In asphalt installations, the loop wire shall be sealed with an asphaltic sealant approved by the Project Engineer. Sealing shall not be performed when the pavement is damp.

When placing loops across joints or cracks in pavement, the portion of wires across the joint or crack shall be protected by placing it in tubing as indicated on COSP. The tubing shall be sliced open to insert the wire in the tubing and then placed across the joint or crack extending a minimum six inches each side of the joint or crack.

Loop wire, from the loop to the lead-in splice, shall be twisted a minimum of 3 turns per foot. Care shall be taken so that the twists are uniform.

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A minimum of 60 inches of loop wire shall be brought into the handhole and spliced to the lead-in cable with a crimped soldered, waterproof splice.

8-20.3(14)D TEST FOR INDUCTION LOOPS AND LEAD-IN CABLE

This section is deleted in its entirety and replaced with the following:

All tests shall be performed by the Contractor in the presence of the Electrical Inspector or Traffic Signal Technician for each loop or the tests will be conducted by County personnel at the request of the Contractor. The tests shall be performed at the amplifier location after complete installation of the loop. All costs associated with testing shall be included in the unit Contract prices of the respective bid items.

Test A — The DC resistance between the two lead-in cable wires will be measured by a volt ohm meter. The resistance shall not exceed 5 ohms measured at the loop ends in the junction box.

Test B — A megohm meter test at 500 volts DC shall be made between the lead-in cable shield and grounding, prior to connection to grounding. The resistance shall equal or exceed 200 megohms.

Test C — A megger test shall be made between the loop circuit and grounding. The resistance shall equal or exceed 200 megohms.

Test D — An inductance test to determine the inductance level of each inductance loop. The Contractor shall record the inductance level of each inductance loop installed on the project and shall furnish the findings to the Project Engineer. An inductance level 90 micro-henries.

If any of the installations fails to pass all tests, the loop installation or lead-in cable shall be repaired and replaced and then retested.

8-20.3(16) REINSTALLING SALVAGED MATERIAL

The last paragraph in this section is deleted and replaced with the following:

Metal poles relocated to new permanent locations shall be inspected by the Contractor in the presence of the Electrical Inspector for structural integrity prior to reinstalling. The Contractor shall arrange for a magnetic particle test, at the Contractor's expense, on all metal poles to be relocated

8-20.3(18) 3-CONDUIT DUCT BANK AND 6-CONDUIT DUCT BANK (NEW SECTION)

This Work shall include the installation of 3-Conduit Duct Bank and 6-Conduit Duct Bank as shown in the Plans. This Work consists of excavation, foundation preparation, bedding, 3-conduit and 6-conduit duct banks, backfilling, compaction and restoration pavement.

Examine site and identify existing utilities and structures in the area prior to performing any excavation. The location of the duct banks and utility vaults shall be verified in the field prior to construction. Notify the Project Engineer of any discrepancies not shown in the Plans.

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Construction activities shall avoid impeding traffic and access to abutting properties. Adequate traffic control shall be provided when needed.

Utility vaults shown shall be precast vault measuring at least 13'(L) by 8'(W) by 8'-7"(H) with 4 3/4" diameter knockouts to accept conduits. Pull boxes shown shall be WSDOT Standard Detail J-90.10.00. Utility vaults and pull boxes shall be installed per Section 8-20.3(6).

Where shown, 3-Conduit Duct Bank and 6-Conduit Duct Bank shall be installed below grade using the appropriate trench detail. Slope trenches a minimum of 4% so that conduit and ducts drain towards vaults. Make joints in ducts and fittings watertight according to manufacturer's instructions and accordance with the current electrical codes. Stagger couplings so those of adjacent ducts do not lie in the same plane. Conduit ends shall be terminated with termination kits. Conduits on the bridge structure shall be installed using utility hangers as detailed in Plans and Section 6-01.10(A).

Duct banks shall be formed, full length to the line and grade required. Conduits shall meet the requirements in accordance with Section 8-20.3(5). Rigid conduit spacers shall be installed at 5 feet minimum spacing in all duct banks to separate conduit and maintain separation from reinforcing. Do not pour concrete until conduit installation has been inspected and approved. Remove all debris, rocks, broken concrete, and formwork before backfilling trenches. Duct banks shall be reinforced and backfilled with orange tinted CDF as detailed in the Plans. Spade concrete carefully during pours to prevent voids under and between conduits and at the exterior surface of the envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each duct bank between structures in one continuous operation. When more than one pour is necessary, terminate each pour in a vertical plane. Conduit end bell fittings shall be provided for each conduit to be terminated at vaults. Warning tape and orange #14 THWN or XHHW location wire shall be provided as detailed in the Plans and Section 8-20.3(5). Warning tape and wire shall extend the full length of the duct bank. Final pavement or pavement restoration shall be completed.

After final assembly in place, each duct bank shall be tested and cleaned. Then, in the presence of the Project Engineer, pull brush through full length of ducts using round bristle with a diameter ½" greater than internal diameter of duct. A cleaning mandrel, correctly sized for each conduit, shall be pulled through to ensure the conduit has not been deformed. Install 200-pound minimum tensile strength pull string in each conduit duct, including spares. Clean internal surfaces of vaults.

8-20.4 MEASUREMENT

The first paragraph in this section is deleted and replaced with the following:

When shown as lump sum in the Plans or in the proposal as illumination or temporary signal revision, no specific unit of measurement will apply, but measurement will be for the sum total of all items for a complete system to be furnished and installed.

The following is added at the end of this section:

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When shown as lump sum in the Plans or in the proposal as 3-Conduit Duct Bank and 6-Conduit Duct Bank no specific unit of measurement will apply, but measurement will be for the sum total of all items for a complete system to be furnished and installed.

The lump sum Contract price for "Illumination System" contains the following approximate quantities of materials and completed Work:

Seattle City Light Stock Pole #573986	3	Each
Seattle City Light Stock Mast Arm #570527	3	Each
Seattle City Light Stock Foundation #568028 (complete)	3	Each
Universe Luminaire UCL-SR-FLR-H2-400HPS-MAL	18	Each
Valmont FL50-900A370-8S-HH-FP/GV-AB	18	Each
Valmont 1'-0" Pole Top Tenon (See Sheet BE22)	2	Each
Underpass Light	1	Each
Elbow w/ Modified Top Flange & WSDOT Bot. Flange	18	Each
All Thread Rod (ATR)	72	Each
High Strength Full Thread Anchor Bolt	72	Each
Anchor Plate	863	LB.
Heavy Hex Nuts	288	Each
Plate Washer	144	Each
Standard Round Washer	72	Each
Hardened Lock Washer	144	Each
Stainless Steel Machine Screw	144	Each
Screw Lock Washer	144	Each
Decorative Cover Plate	18	Each
Concrete Class 4000P	18	C.Y.
Epoxy Coated Stl. Reinf. Bar	5000	LB.

The lump sum Contract price for "3-Conduit Duct Bank" contains the following approximate quantities of materials and completed Work:

Conduit Pipe 2 In. Diam., Sch 40	70	L.F.

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Conduit Pipe 4 In. Diam., Sch 40	140	L.F.
Controlled Density Fill	72	CF
Backfill	247	CF
Pipe Bedding Material	2	CF
Structure Excavation Cl. B	12	C.Y.
Warning Tape	70	L.F.
Utility Pull Box	2	Each
Conduit Riser	3	Each
Pull String	210	L.F.
Location Wire	70	L.F.

The lump sum Contract price for "6-Conduit Duct Bank" contains the following approximate quantities of materials and completed Work:

Conduit Pipe 2 In. Diam., Sch 40	256	L.F.
Conduit Pipe 3 In. Diam., Sch 40	768	L.F.
Conduit Pipe 4 In. Diam., Sch 40	512	L.F.
Controlled Density Fill	1124	CF
Backfill	3503	CF
Pipe Bedding Material	25	CF
HMA	15	C.Y.
Structure Excavation Cl. B	176	C.Y.
Warning Tape	512	L.F.
Utility Vault Box 712-LA	1	Each
Utility Pull Box	2	Each
Conduit Riser	1	Each
Pull String	1536	L.F.
Location Wire	512	L.F.

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The quantities listed for items included "3-Conduit Duct Bank" and "6-Conduit Duct Bank" are only for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. The prospective bidders shall verify these quantities before submitting a bid. No adjustments other than for approved changes will be made in the lump sum Contract prices for 3-Conduit Duct Bank and 6-Conduit Duct Bank even though the actual quantities required may deviate from those listed

8-20.5 PAYMENT

This section is deleted in its entirety and replaced with the following:

Payment will be made in accordance with Section 1-04.1, for each of the following bid items that are included in the proposal:

"Illumination System", lump sum.

The lump sum Contract price for "Illumination System" shall be full pay for the construction of the complete electrical system, modifying existing systems, or both, as shown in the Plans and herein specified including excavation, backfilling, concrete foundations, conduit, wiring, restoring facilities destroyed or damaged during construction, salvaging existing materials, and for making all required tests. All additional materials and labor, not shown in the Plans or called for herein and which are required to complete the electrical system, shall be included in the lump sum Contract price.

"Temporary Signal Revision", lump sum.

The lump sum Contract price for "Temporary Signal Revision" shall be full pay for modifying existing systems for all stages of construction, as shown in the Plans and herein specified including excavation, backfilling, concrete foundations, conduit, wiring, restoring facilities destroyed or damaged during construction, salvaging existing materials, and for making all required tests. All additional materials and labor, not shown in the Plans or called for herein and which are required to complete the electrical system, shall be included in the lump sum Contract price.

"Conduit Pipe ____ In. Diam.", per linear foot.

The unit Contract price per linear foot for "Conduit ____ In. Diam." shall be full pay for furnishing all pipe, pipe connections, elbows, bends, caps, reducers, conduits, and unions; for placing the pipe in accordance with the above provisions, including all excavation, directional boring, jacking or drilling required, backfilling of any voids around casing, conduits, pits or the trenches, restoration of native vegetation disturbed by the operation, chipping of pavement, and bedding of the pipe; and all other work necessary for the construction of the conduit, except that when conduit is included on any project as an integral part of an illumination system or the conduit duct bank is not shown as a pay item, it shall be included in the lump sum price for the system shown.

All costs for installing conduit containing illumination wiring shall be included in the Contract prices for the illumination system.

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All costs for installing junction boxes containing illumination wiring shall be included in the Contract prices for the illumination system.

"Casing", per linear foot.

The unit Contract price per linear feet for "Casing" shall be full payment for boring, jacking or drilling for installing casing, and backfilling any voids around the casing and pits or back filling of the trenches required to install the casing. This cost will also include any restoration of native vegetation disturbed by the operation.

"3-Conduit Duct Bank", lump sum.

The lump sum Contract price for "3-Conduit Duct Bank" shall be full pay to provide a complete 3-conduit duct bank system, including, but not limited to furnishing and installing the conduit, joints and fittings, spacers, hangers, straps, warning tape, wire, pull string, pullbox, utility vaults, including all excavation, bedding, backfilling, final pavement and testing and cleaning of the conduits.

"6-Conduit Duct Bank", lump sum.

The lump sum Contract price for "6-Conduit Duct Bank" shall be full pay to provide a complete 6-conduit duct bank system, including, but not limited to furnishing and installing the conduit, joints and fittings, spacers, hangers, straps, warning tape, wire, pull String, pullbox, utility vaults, including all excavation, bedding, backfilling, final pavement and testing and cleaning of the conduits.

8-21 PERMANENT SIGNING

Section 8-21.1 is deleted in its entirety and replaced with the following:

King County shall furnish and erect new signs within the limits of the Work. The Contractor shall coordinate with King County on installations, site access and schedule. The Contractor shall notify King County a minimum of two weeks in advance of opening new bridge for installation of required signage necessary of opening bridge to public.

The Contractor shall notify Richard Garcia (206-684-2732), King County Metro Construction Coordinator, for coordinating removals and relocations of bus stop signs and other Metro items during construction.

The Contractor shall notify Drew Robinson (206-684-2105) of King County Metro for coordinating removals and relocations of bus shelters during construction.

The Contractor shall notify King County Metro 20 calendar days in advance of removal date of bus shelters and bus stop signs. King County Metro shall remove bus shelters and bus stop signs.

The Contractor shall notify King County Metro 7 calendar days in advance of work resulting in a road closure on which buses operate that will require buses to reroute.

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The Contractor shall notify King County Metro 5 calendar days in advance of work resulting in a temporary closure and/or relocation of a bus stop or for work within an area of a bus stop that will limit full access to it by coaches and pedestrians/passengers. (Relocated stop is to remain ADA accessible if the affected stop is designated as such).

8-22 PAVEMENT MARKING

8-22.1 DESCRIPTION

The following is added at the end of this section:

The Plastic Stop Bar, Plastic Bicycle Lane Symbol and Plastic Traffic Letter shall be installed in accordance with Figure 4-003 in the King County 2007 Design and Construction Standards Manual. The Lane Extension Line shall be installed in accordance with Figure 4-004 in the King County 2007 Design and Construction Standards Manual.

8-22.3(6) REMOVAL OF PAVEMENT MARKINGS

The following is added at the end of this section:

Removal of Raised Pavement Markers

No portion of the raised pavement markers is to remain. The Contractor shall remove raised pavement markers including epoxy or other adhesive in a manner that will not damage the underlying pavement. Any damage to the underlying pavement caused by the Contractor's operations shall be repaired to the satisfaction of the Project Engineer at no additional cost to the Contracting Agency.

Debris resulting from the removal operation shall become the property of the Contractor and shall be disposed of outside the project limits.

Removal of Paint Line

Existing traffic paint lines shall be removed along the roadway where indicated on the Plans. Paint Line shall be removed by one of the following methods:

Turbo Blast Removal: The removal of existing striping accomplished using dry abrasive blasting of steel shot, and automated recovery system with a self contained collection system by vacuum. Damaged pavement shall be repaired by the Contractor to the satisfaction of the Project Engineer at no cost to the County.

Hydro Removal: The removal of existing lines shall be accomplished using high-pressure water/sand jets to prevent damage to the pavement. The use of chemicals or grinding will not be allowed. Damaged pavement shall be repaired by the Contractor to the satisfaction of the Project Engineer at no cost to the County.

Existing plastic stop bars, crosswalk lines and traffic arrows shall be removed, if conflicting, prior to paving. The Contractor shall use a method approved by the Project Engineer.

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Care shall be taken in removing existing paint line, plastic stop bars, crosswalk lines and traffic arrows not to damage the existing pavement. Any pavement damaged due to the Contractor's operations shall be repaired or replaced by the Contractor, to the satisfaction of the Project Engineer, at Contractor expense.

8-22.3(7) TEMPORARY PAVEMENT MARKINGS (NEW SECTION)

See Sections 1-07.23(1) and 1-10.3(4)C.

8-22.4 MEASUREMENT

The following is added at the end of the first paragraph::

Lane Extension Line will be measured by the completed linear foot as "Painted Wide Line."

The following: is added at the end of the fourth paragraph

No deduction will be made for the unmarked area when the marking includes a broken line such as Lane Extension Line.

The eighth and ninth paragraphs in this section are deleted and replaced with the following:

Removal of Pavement Markings shall include removal of paint and plastic lines, regardless of width, and raised pavement markers will be measured by linear foot, with no deduction being made for the unmarked area when the markings include a gap.

Removal of crosswalk lines will be measured by the linear foot of each line removed as measured parallel to the curb line or centerline.

Removal of stop bars will be measured by the linear foot of each line removed as measured perpendicular to the curb line or centerline.

8-22.5 PAYMENT

The following is added at the end of this section:

"Removing Pavement Markings", per linear foot.

8-26 CONTROL HOUSE HEATING, VENTILATION, AND AIR CONDITIONING (NEW SECTION)

8-26.1 DESCRIPTION

8-26.1(1) GENERAL

The Work under this Section shall consist of furnishing all labor, equipment, and materials required for the installation, testing, and balancing of the Control House HVAC system as shown on the Plans and specified herein. HVAC systems shall be installed in two control houses as shown on the plans.

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All components of the control house heating, venting and air conditioning system shall be properly sized and selected for service as shown on the Plans and specified herein.

8-26.1(2) CODES

The Contractor shall comply with the requirements of the following codes and standards:

1. International Building Code – Mechanical Section
2. Washington State Energy Code – 2006 Edition
3. Refrigeration system of condensing units shall be constructed in accordance with ASHRAE Standard ASHRAE 15-94 "Safety Code for Mechanical Refrigeration".
4. SMACNA Compliance: Comply with applicable portions of SMACNA-95 "HVAC Duct Construction Standards, Metal and Flexible".
5. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories.
6. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
7. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
8. AABC: "National Standards for Total System Balance."
9. ASHRAE: ASHRAE Handbook, HVAC APPLICATIONS, Chapter 34, Testing, Adjusting, and Balancing.
10. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

Required Drawings and Product Data

1. Product data, including electrical requirements and catalog cuts of all equipment specified and as shown on the Plans.
2. Product data for each specialty and/or special duty equipment. Include rated capacities of selected models, furnished specialties and accessories, and installation instructions.
3. Shop drawings detailing dimensions, required clearances, for installation.
4. Maintenance data for furnace, condensing unit, and any other gas specialties and special duty valves, for inclusion in operating and maintenance manual.
5. Working Drawings: Working drawings as necessary for the fabrication and installation of control house heating, venting and air conditioning system shall be

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prepared by the Contractor and shall be submitted to the Project Engineer for approval. The drawings shall include equipment details, catalog and data sheets of standard components, and a tabulation giving the name of the part, description, function, manufacturer, rating, type, model, and catalog and serial number of each component. Each component shall be identified by an item number and complete assembly layout drawings shall be furnished identifying each component by the item number.

8-26.1(3) REFERENCES

Reference to a particular product by manufacturer, trade name, or catalog number establishes the functional requirements and quality standards of material and equipment required for this installation and is not intended to exclude products equal in function and quality and similar in design. Whenever any section, materials, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or approved equal", if not inserted, shall be implied, except as otherwise noted.

8-26.1(4) SUBSTITUTIONS

Reference to a particular product by manufacturer, trade name, or catalog number establishes the functional requirements, quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design.

Equipment for which an acceptable manufacturer is not specifically named, or named equipment for which substitution is proposed, shall be manufactured by a company which has had a minimum of ten years of experience in the manufacture of similar equipment and which, in the Project Engineer's opinion, has demonstrated its proficiency in the manufacture of such equipment. All equipment will be subject to the Project Engineer's approval.

8-26.2 MATERIALS

8-26.2(1) AIR HANDLER

The Contractor shall furnish air handlers with operational, maintenance, performance, efficiency and physical features of the manufacturer and Model number as listed below as determined by the Project Engineer and other requirements of the Contract Documents, including all accessories for a complete installation.

Trane Company Model 4TEH3F36B (2 assemblies required) or approved equal.

Unit shall operate on 240 VAC single phase power.

Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Casing shall be completely insulated with cleanable, foil faced, fire-retardant, permanent, odorless glass fiber material. All insulation edges shall be either captured or sealed. Knockouts shall be provided for unit electrical power and refrigerant piping connections. Captive screws shall be provided on all access panels.

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Double inlet, double width, forward curved, centrifugal-type evaporator fan with adjustable belt drive shall be provided. Thermal overload protection shall be provided on motor. Fan and motor bearings shall be permanently lubricated.

Evaporator coil shall be aluminum fin surface mechanically bonded to 3/8" internally enhanced copper tubing and factory pressure and leak tested at 375 psig. Coil shall be provided with a double sloped condensate drain pan. The drain pan shall be removable for cleaning and shall be provided with an external connection on the side of the unit and a drain hose.

An approved 1" throwaway air filter accessible from side access panel shall be provided and installed in the return air system.

An auxiliary electric resistance heating unit specified below shall be supplied with the air handler. Unit shall have a capacity of 5 KW and operate on 240 VAC single phase power.

The Contractor shall furnish auxiliary electric resistance heating units with operational, maintenance, performance, efficiency and physical features of the Trane Company Model BAYHTR1305 (2 assemblies required) as determined by the Project Engineer and other requirements of the Contract Documents.

Manufacturer: Manufacturer and Model number are shown above for reference. Subject to compliance with Contract Document requirements, manufacturers shall be, but are not limited to, one of the following:

1. The Trane Company
2. Lennox Corporation
3. Carrier A/C Group, Carrier Corporation.

8-26.2(2) HEAT PUMP

Heat Pump units shall meet or exceed the minimum EER efficiency levels as prescribed in Washington State Energy Code.

The Contractor shall furnish heat pumps with operational, maintenance, performance, efficiency and physical features of the manufacturer and Model number as listed herein as well as other requirements of the Contract Documents, including all accessories for a complete installation. Factory assembled and tested air-cooled heat pump units, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and operating controls mounted at the operator's level shall be provided. Unit shall provide 36,000 BTUH of total cooling at 2800 cfm. Unit shall be capable of 36,000 BTUH heating. Unit shall operate on 480 VAC 3 phase power. Trane Company Model 4TWA3036A4 (2 assemblies required).

Unit casing shall be constructed of 18 gauge zinc coated heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Units shall have removable end panels which allow access to all major components and controls, weep holes for water drainage.

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The compressor shall be a single hermetically sealed direct drive scroll compressor with centrifugal oil pump providing positive lubrication to all moving parts. The heat pump shall have both a liquid line and suction gas line service valve with gauge port., a refrigeration filter drier, expansion valve and check valves. A crankcase heater, discharge line thermostat, internal temperature and current-sensitive motor overloads shall be included for protection. External high and low pressure cutout devices shall be provided.

The condenser coil shall have copper tubes and aluminum fins, complete with liquid accumulator and liquid subcooler. Aluminum propeller fan shall be direct driven, with permanently lubricated fan motor having current and thermal overload protection. Coils shall come furnished with corrosion resistant coating. Metal grilles with PVC coating for coil protection shall be provided.

8-26.2(3) ACCESSORIES

Low Ambient Head Pressure Control.

Anti-Short-cycle Timer with 5 minute off timing period.

Low-voltage thermostat and sub-base to control condensing unit and evaporator fan.

Timed-off Control.

Precharged and insulated suction and liquid tubing of proper length.

Mounting Base for heat pump.

Manufacturer: Manufacturer and Model number are shown above. Subject to compliance with requirements, manufacturers shall be, but are not limited to, one of the following:

1. The Trane Company
2. Lennox Corporation
3. Carrier A/C Group, Carrier Corporation.
4. Or approved equal.

8-26.2(4) VENTILATION FAN

Furnish rest room ventilation fan of Manufacturer and Model number as shown below, including all accessories for a complete installation of ventilation fan. Work shall include providing ventilation fan, duct work, and hole boring through concrete wall to pit. After installation of duct, hole shall be insulated and fire stopped as outlined below. Broan Model L100MG (1 assembly required) or approved equal.

Ventilation fan shall provide 115 CFM at 0.125 inches of water, a noise level of 1.0 sones, and shall have a galvanized steel housing insulated with ½" of acoustic insulation. Housing shall have adjustable mounting brackets to attach housing to ceiling. A backdraft damper shall be located in the duct connector. Vertical fan installation, horizontal duct connector shall be supplied. Blower unit shall be removable from housing and will have a dynamically balanced

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centrifugal blower. Motor to be permanently lubricated and mounted on resilient anti-vibration mounts. A galvanized bird screen, motor side fan guard, thermostat and all other accessories necessary for installation such as bolts, caulking, firestop material, etc.

Exhaust fan shall come on with the separate bathroom light and shall have a metal grill.

Manufacturer: Manufacturer and Model number are shown above. Subject to compliance with requirements, manufacturers shall be, but are not limited to, one of the following:

1. Broan
2. Dayton
3. Panasonic, Matsushita Electric Corporation of America
4. Or approved equal

8-26.2(5) LOUVERS

Furnish and install louvers from Manufacturer and Model number as shown in the plans, including all accessories for a complete installation of louvers.

Manufacturer: Manufacturer and Model number are shown above. Subject to compliance with requirements, manufacturers shall be, but are not limited to, one of the following:

1. Ruskin Dampers and Louvers.
2. C/S Group.
3. Industrial Louvers Incorporated.
4. Or approved equal.

8-26.2(6) DUCT WORK – SHEET METAL MATERIALS

Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discoloration and other imperfections including those which impair painting.

Sheet Metal, General: Provide sheet metal in thickness indicated, packaged and marked as specified in ASTM A700, Standard Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment.

Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, Coating Designation G 90. Provide mill-phosphatized finish for exposed surfaces of ducts exposed to view.

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Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing, installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.

Tie Rods: Galvanized steel, ¼-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

8-26.2(7) SEALING MATERIALS

Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.

Joint and Seam Tape: 2 inches wide, glass-fiber-fabric reinforced.

Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Standard Specification for Elastomeric Joint Sealants, Type S, Grade NS, Class 25, Use O.

8-26.2(8) FIRE-STOPPING

Fire Damper – Install fire damper at location shown on the plans. Fire damper frames and interlocking blades shall be constructed of heavy duty 20 gauge steel. The fire dampers shall have a 1 ½ hour UL rating and shall meet the requirements of NFPA 90A. The fire damper shall be Ruskin model FDR 25 or equal.

Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops, Underwriters Laboratory Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.

Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
2. "Pensil 851"; General Electric Co.
3. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
4. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
5. "RTV 7403"; General Electric Co.
6. "Fyre Putty"; Standard Oil Engineered Materials Co.

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7. Or approved equal.

8-26.2(9) DUCT INSULATION

Insulation of ductwork at locations shown on the plans is to be in accordance with Washington State Energy Code. Heating and cooling supply duct insulation shall have an R value of 3.5. Return air duct insulation shall have an R value of 1.9.

8-26.2(10) HANGERS AND SUPPORTS

Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials shall be provided. Do not use powder actuated concrete fasteners for lightweight aggregate concrete or for slabs less than 4 inches thick.

Hangers: Galvanized sheet steel, or round, galvanized steel, threaded rod.

Straps and Rod Sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.

Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

For stainless steel ducts, provide stainless steel support materials.

For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

8-26.2(11) RECTANGULAR DUCT FABRICATION

Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," Tables 1-3 through 1-19, including the associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discoloration.

Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:

1. Supply Ducts: 3 inches water gage.

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2. Return Ducts: 2 inches water gage, negative pressure.

3. Exhaust Ducts: 2 inches water gage, negative pressure.

8-26.2(12) SPECIAL CONSTRUCTION

All ductwork and fittings are to be constructed of material one gauge lower in number (thicker material) than required by the standards for each duct in this Section. Increased hanger requirements will apply, corresponding to the thicker material as conforming to the required standards.

8-26.2(13) ROUND AND RECTANGULAR DUCT FITTINGS

Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard."

8-26.2(14) REGISTERS AND GRILLES

Furnish manufacturer's floor registers and grilles as shown in the plans; of size, shape, capacity and type indicated herein and on the Plans; constructed of materials and components as indicated, and as required for complete installation.

Heavy duty double deflection supply registers constructed of 20 gauge steel with opposed blade damper shall be provided. Return grilles shall be of similar construction without damper. The finish for all grilles and registers shall be a factory applied white baked enamel.

Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:

1. Titus Products Div.; Philips Industries, Inc.
2. Anemostat Products Div.; Dynamics Corp. of America.
3. Carnes Co.; Div. of Wehr Corp.
4. Or approved equal.

8-26.2(15) INSTRUMENTATION

Contractor to provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

Provide only those instruments, which have the maximum field measuring accuracy and are best suited to the function being measured.

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8-26.3 CONSTRUCTION REQUIREMENTS

8-26.3(1) AIR HANDLERS

Install air handlers where shown, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

Coordinate with other work, including ductwork, floor construction and piping, as necessary to interface installation of air handler with other work.

Install unit on vibration mounts; comply with manufacturer's indicated installation method, if any.

Provide access space around unit for service as indicated, but in no case less than that recommended by manufacturer.

Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

Verify that electrical wiring installation is in accordance with manufacturer's submittal. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

8-26.3(2) GROUNDING

Provide positive equipment ground for unit components.

8-26.3(3) HEAT PUMPS

Install Heat Pump units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

Connect pre-charged refrigerant tubing to unit's quick-connect fittings. Run tubing so as not to interfere with access to unit.

Install furnished accessories.

8-26.3(4) DUCTWORK

Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.

Install ducts with the fewest possible joints.

Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

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Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Coordinate layout with lighting layouts and similar finished work.

Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

Seam and Joint Sealing:

1. Seal duct seams and joints as follows:

    a. Supply in Unconditioned Space (more than 2 Inches Water Gauge): All transverse joints, longitudinal seams, and duct penetrations.

    b. Return in Unconditioned Space: All transverse joints and longitudinal seams.

2. Seal externally insulated ducts prior to insulation installation.

Hanging and Supporting:

1. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.

2. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

3. Support vertical ducts at a maximum interval of 16 feet and at each floor.

4. Upper attachments to structures shall have an allowable load not exceeding ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

5. Install concrete insert prior to placing concrete.

6. Install powder actuated concrete fasteners after concrete is placed and completely cured.

Connections

1. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards".

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2. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards".

3. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards".

Ductwork Accessories:

1. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

2. Install turning vanes in square or rectangular 90 degree elbows in supply and exhaust air systems, and elsewhere as indicated.

3. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

Air Outlet and Inlets:

1. Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

2. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

Locate registers, and grilles as indicated on Plans.

8-26.3(5) PROCEDURES FOR AIR SYSTEM BALANCING

The Contractor shall balance the HVAC system. Prior to operating the system, the Contractor shall submit an Air System Balance Test Procedure including measurements to be recorded, instruments to be used, etc. to the Project Engineer for approval.

Record and Report Data

1. Record all data obtained during testing, adjusting, and balancing in accordance with the approved test procedure.

2. The Contractor shall prepare a report detailing the data measured during the Air System Balance Test and submit to the Project Engineer for approval.

8-26.4 MEASUREMENT

Control house heating, ventilation, and air conditioning will not be measured but will be paid for on a lump sum basis in accordance with Section 1-04.1.

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8-26.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Control House Heating, Ventilation, and Air Conditioning", lump sum.

The lump sum Contract price for "Control House Heating, Ventilation, and Air Conditioning" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the manufacture, fabrication, transportation, erection, testing, and adjusting all aspects of the HVAC system.

8-27 PEDESTRIAN GUARDRAIL (NEW SECTION)

8-27.1 DESCRIPTION

This Work consists of removing, salvaging and cleaning existing bridge trusses; fabricating and installing the pedestrian guardrail consisting of posts, the top rail, steel pickets, concrete footings, grout and salvaged trusses; and installing the pedestrian guardrail along the edge of cement concrete sidewalk where shown in the Plans.

8-27.2 MATERIALS

Materials shall meet the requirements of the following sections:

Structural Steel and Related Materials	9-06
Paint:	9-08

Paint color shall be: black

8-27.3 CONSTRUCTION REQUIREMENTS

The Contractor shall salvage material as required to fabricate and install Pedestrian Guardrail as required. The Contractor shall ensure that all materials are protected from damage during removal, handling, storage, and installation.

The Contractor shall inform the Project Engineer in writing 14 calendar days prior to the intended installation of Pedestrian Guardrail.

Work items include the following:

1. Field measuring and determining the locations and amount of existing bridge trusses needed to be salvaged for constructing the pedestrian guardrail and for purposes of developing shop drawings. The Contractor shall locate and conduct field measurements in the presence of the Project Engineer;
2. Salvaging bridge trusses as shown in the Plans;
3. Provide shop plans for fabricating pedestrian guardrail;

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4. Clean and paint the salvaged trusses in accordance with Section 6-07.

5. Fabricate the Pedestrian Guardrail using the steel components and salvaged trusses as shown in the Plans;

6. Install concrete footings and Pedestrian Guardrail.

Fabrication of the pedestrian guardrail shall be in accordance with approved shop plans subject to the following:

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

2. Welded Connections: Comply with 6-03.3(25). Continuously weld joints and seams; grind, fill and dress welds to produce smooth, flush surfaces without distortion.

8-27.4 MEASUREMENT

"Pedestrian Guardrail" will be measured by the linear foot installed and accepted from end to end of Pedestrian Guardrail measured along the length.

8-27.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following item:

"Pedestrian Guardrail", per linear foot.

The unit Contract price per linear foot for "Pedestrian Guardrail" shall be full pay for all costs in connection with salvaging truss existing trusses, fabrication of the Pedestrian Guardrail, furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, transportation, storage, fabrication, and installation including all other items necessary for the Work whether or not such work is shown or specified.

8-28 ART FEATURES (NEW SECTION)

8-28.1 DESCRIPTION

This Work consists of removing, salvaging, cleaning and painting four (4) complete bascule rolling girder segments (rockers); fabricating and attaching structural steel for supporting the salvaged rockers; and construction of concrete footings and drilled shafts for displaying the salvaged rockers as "Art Features" in the locations shown in the Plans.

8-28.2 MATERIALS

Materials shall meet the requirements of the following sections:

Structural Steel and Related Materials 9-06

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Paint: 9-08

8-28.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide forms, reinforcement and concrete for walls and footings; steel tubing, plates and hardware for the support system; paint as specified; and all other materials as required to install four (4) complete Art Features as described and specified. The Contractor shall ensure that all materials are protected against damage during offloading, handling, storing, and installation of the Art Features.

The Contractor shall inform the Project Engineer in writing 14 calendar days prior to the intended installation of the rockers. Concrete work shall be complete and approved prior to the delivery of the rockers; delivery shall be coordinated with the Project Engineer such that the rockers set can be unloaded and installed without need for extraneous on-site handling and storage.

Work items include the following:

1. Field measure one (1) existing rockers set to be salvaged and re-used for purposes of developing shop plans. The Contractor shall conduct field measurements in the presence of the Project Engineer;
2. Salvage four (4) complete, rocker sets as shown in the Plans;
3. Provide shop plans;
4. Clean the complete, historic bascule girder rockers set in accordance with Section 6-07;
5. Construct drilled shafts associated with the Art Features as shown in the Plans;
6. Procure supplies for and fabricate the steel tube supports, including steel plates and hardware as shown in the Plans;
7. Prepare salvaged and fabricated steel for painting in accordance with Section 6-07;
8. Paint components in accordance with Section 6-07, as appropriate;
9. Construct concrete walls and footings with steel tube posts for supporting and displaying the rockers as shown in the Plans;
10. Install four (4) completed rockers.

Fabrication of the Art Features shall be in accordance with approved shop drawings subject to the following:

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

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2. Welded Connections: Comply with 6-03.3(25). Continuously weld joints and seams; grind, fill and dress welds to produce smooth, flush surfaces without distortion after final finishing.

Provide shop drawings in accordance with 1-05.3 and 6-01.9.

Include the Art Features installation in the Baseline Project Schedule and update those activities as the project progresses.

8-28.4 MEASUREMENT

"Art Features" will not be measured but will be paid for on a lump sum basis to include all Work as described in 8-28.5. "Art Features" contains the following approximate quantities of materials and completed Work:

Salvage and modify existing rolling girder segments	4	Each
Salvage and modify existing rocker tracks	4	Each
Cleaning and Painting – Art Features	1	L.S.
Structure Excavation Class A Incl. Haul	136	C.Y.
Soil Excavation for 3'-0" Dia. Shaft	32	C.Y.
Furnishing & Placing Temp. Casing for 3'-0" Dia. Shaft	80	L.F.
St. Reinf. Bar for Art Feature	12,070	LB.
Concrete Class 4000P for 3'-0" Dia. Shaft	32	C.Y.
Concrete Class 4000	58	C.Y.
Gravel Backfill Class B	48	C.Y.
1" Dia. A490 Bolts	32	Each
1" Dia. A307 Bolts	56	Each
Structural Steel (HSS 4x4x1/4)	280	LB.
Structural Steel Plate	1,168	LB.

The quantities are listed only for the convenience of the Contractor in determining the volume of Work involved and are not guaranteed to be accurate. The Contractor shall verify these quantities before submitting a bid. No adjustment other than for approved changes will be made in the lump sum price for "Art Features" even through the actual quantities may deviate from those listed.

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8-28.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Art Features", per lump sum.

The lump sum Contract price for "Art Features" shall be full pay for all costs in connection with salvaging existing rockers and rocker tracks, furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, transportation, storage, fabrication, installation, shafts and painting, including all other items necessary for the Work whether or not such work is shown or specified.

8-30 PEDESTRIAN RAILING (NEW SECTION)

8-30.1 DESCRIPTION

This Work consists of fabricating temporary railing replacement panels, salvaging ornamental iron rail panels from existing South Park Bridge, installing temporary railing replacement panels on the existing South Park Bridge, add ballast to the replacement panels, transporting salvaged ornamental iron rail panels to the fabricator, installing embedded pedestrian railing and gear support anchorages, installing a County-provided pedestrian railing system, salvaging gears from existing South Park Bridge, transporting salvaged gears to the fabricator, removing temporary gear opening covers from the pedestrian railing system, and installing modified gears.

The pedestrian railing system will be provided by the County and will include the pedestrian railing on the outboard edges of the sidewalks and its associated temporary gear opening covers, gears and gear support posts. The pedestrian railing system will also include the handrail surrounding the cantilevered observation decks of the control towers. The Contractor shall coordinate delivery of material to and from the County-provided fabricator with the Project Engineer.

8-30.2 MATERIALS

The pedestrian railing system and all connection hardware except the anchor bolt assemblies and associated hardware will be provided by others and delivered to the construction site. The pedestrian railing system fabricator will be a third party referred to as the Pedestrian Railing Artist (PRA). The PRA will be located within King County.

Materials shall meet the requirements of the following sections:

Structural Steel and Related Materials 9-06

Galvanizing of non-stainless steel fasteners shall be in conformance with AASHTO M 232 (ASTM A153). Zinc coating mechanically deposited in accordance with AASHTO M 298 will not be allowed as an alternate.

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8-30.3 CONSTRUCTION REQUIREMENTS

Work item includes the following general aspects of construction:

1. Fabricating temporary pedestrian railing replacement panels,
2. Salvaging ornamental iron rail panels, and installing temporary pedestrian railing panels,
3. Transporting salvaged ornamental iron rail panels to the PRA,
4. Installing pedestrian and gear support anchorages on the control tower, bridge and approaches,
5. Installing the pedestrian railing system delivered by the PRA,
6. Salvaging existing gears,
7. Transporting salvaged existing gears to the PRA,
8. Removing temporary gear opening covers and installing modified gears delivered by the PRA

Include the pedestrian railing system delivery and pedestrian railing system installation in the Baseline Project Schedule and update those activities as the project progresses.

8-30.3(1) ORNAMENTAL IRON RAIL PANELS

The Contractor shall salvage all ninety-six (96) ornamental iron rail panels within 90 calendar days of receipt of the Second Notice to Proceed. The Contractor shall transport salvaged ornamental iron rail panels to the PRA. The PRA will be responsible for unloading the salvaged ornamental iron rail panels at the PRA's shop located within King County.

The Contractor shall fabricate ninety-six (96) temporary pedestrian railing replacement panels consisting of a galvanized steel plate adhered between two plywood face panels and associated connection hardware including pipe clamps as described in the Contract Plans. The Contractor shall establish the weight of each replacement panel after fabrication, record the weight and provide the recorded weight to the Project Engineer.

The Contractor shall maintain the balance of the bascule span of the existing bridge during and after replacement of the ornamental rail panels. The Contractor shall remove ninety-six (96) existing ornamental iron rail panels from the bascule span of the existing bridge and replace them with temporary pedestrian railing replacement panels one panel at a time such the balance of the existing span is not significantly out of balance at any given point in time.

The Contractor shall weigh each ornamental iron rail panels as it is removed from the bridge and record the location and weight. The Contractor shall record weight and location of each replacement panel installed. The Contractor balance the bascule span by thru-bolting up to 67 pieces (212 linear feet / 1,043 pounds) of painted 3" x 3" x 1/4" angle iron (ballast angle) to the

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exterior face of the replacement railing panels as directed by the Project Engineer. Fasten with three galvanized 1/2 inch bolts at each piece of ballast angle.

The Contractor shall salvage those aspects of the navigation lights near the center to the bridge that are mounted to the existing pedestrian railing panels. Re-install those salvaged aspects of the navigation lights on the replacement panels. Provide requisite closure of the sidewalk to the public and traffic control during removal and installation of the railing panels.

8-30.3(2) INSTALL ANCHORAGES

The Contractor shall provide the anchor bolt assemblies defined as the anchor bolts, nuts, washers, beveled washers, couplers, all-thread rods, and anchor plates that are for the purpose of anchoring the railing to the structure. The Contractor shall install the concrete embedded anchorages, each consisting of multiple anchor bolts or anchor rods, for the pedestrian railing and gear supports as well as the anchorages on the steel bascule span. The PRA will provide shop drawings identifying the location of each anchorage by three dimensional coordinate system and station, offset and elevation. Place the anchorages at the required locations within 1/16 inch accuracy such that the pedestrian railing, gear supports and gear can be installed without interference modifications. Anchor bolts shall be positioned with a metal template provided by the PRA to ensure that bolts match the hole spacing of the pedestrian railings and gear support base plates. Accurately position and restrain the anchor bolts during placement and curing of the concrete. Bolts will be perpendicular to the profile grade. The PRA will retain a second set of metal templates for field verification of the anchor bolts.

8-30.3(5) INSTALL PEDESTRIAN RAILING AND GEAR SUPPORTS

The Contractor shall inform the Project Engineer in writing 28 calendar days prior to intended start of the pedestrian railing system installation. Coordinate the delivery of the pedestrian railing system with the Project Engineer such that the railing sections can be unloaded and installed without need for extraneous on-site handling and storage. The Contractor shall organize the delivery of the pedestrian railing system such that the no more than 40 individual trips using an 18 foot stake truck or similar vehicle are required for delivery of all components of the pedestrian railing system. The PRA will deliver the pedestrian railings system to the site in sections as prescribed by the Contractor to allow unloading the railing sections on the bridge at the approximate location of installation points. The Contractor shall be responsible for offloading, handling, storing, protecting, and installing the pedestrian railing.

Upon delivery of the pedestrian railing to the site, the Contractor shall inspect the pedestrian railing system in the presence of the Project Engineer. Verbally inform the Project Engineer of any apparent defects in the finish and/or fit up of railing system during the inspection. Photographically document apparent defects and report them to the Project Engineer in writing within 24 hours of delivery. Once the Contractor is in possession of the pedestrian railing, the Contractor shall assume responsibility for condition of the pedestrian railing until it is installed and accepted by the Project Engineer. Damage to the pedestrian railing shall be repaired or replaced at the Contractor's expense at the sole discretion of the Project Engineer.

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Provide erection plan and procedures to the Project Engineer in accordance with 6-03.3(7). Install the pedestrian railing system in accordance with the approved erection plan and Contract Documents. The Contractor shall not modify the pedestrian railing system without written approval from the Project Engineer.

The pedestrian railing system shall be installed true to line and grade (or camber). After first setting the railing, the Contractor shall readjust all or part of it, if necessary, to create an overall line and grade pleasing to the eye at the sole discretion of the Project Engineer.

8-30.3(6) SALVAGE GEARS

The Contractor shall salvage forty-one (41) Plans-specified gears from the existing bridge, remove the shafts from the hubs of all gearts, and transport them to the PRA shop for modification and incorporation into the pedestrian railing system within 45 calendar days of commencement of demolition of the existing bridge bascule span. The PRA will be responsible for unloading the gears at the PRA's shop.

8-30.3(7) INSTALL MODIFIED GEARS

Once the PRA has modified the salvaged gears and attached supports as applicable, the Contractor shall install them.

The Project Engineer will inform the Contractor no later than 28 calendar days prior to the intended availability of the modified gears for installation. The Contractor shall install the modified gears within 28 calendar days of the availability of the gears. Coordinate the delivery of the modified gears with the Project Engineer such that the gears can be unloaded and installed without need for extraneous on-site handling and storage. The Contractor shall organize the delivery of the modified gears and gear supports such that the no more than 10 individual trips using an 18 foot stake truck or similar vehicle are required for delivery of all components of the modified gears. The PRA will deliver the gears to the site as prescribed by the Contractor to allow unloading the gears on the bridge at the approximate location of installation points. The Contractor shall be responsible for offloading, handling, storing, protecting, and installing the gears.

Upon delivery of the gears to the site, the Contractor shall inspect the gears in the presence of the Project Engineer. Verbally inform the Project Engineer of any apparent defects in the finish during the inspection. Photographically document apparent defects and report them to the Project Engineer in writing within 24 hours of delivery. Once the Contractor is in possession of the gears, the Contractor shall assume responsibility for condition of the gears until they are installed and accepted by the Project Engineer. Damage to the gears shall be repaired or replaced at the Contractor's expense at the sole discretion of the Project Engineer.

Provide erection plan and procedures to the Project Engineer in accordance with 6-03.3(7). Install the gears in accordance with the approved erection plan and Contract Documents. The Contractor shall not modify the gears without written approval from the Project Engineer.

Simultaneously remove the temporary gear opening covers from the bridge and install the modified gears one gear at a time. Provide requisite closure of the sidewalk to the public and

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traffic control during removal of the temporary gear opening covers and installation of the modified gears.

The gears shall be installed true to line and grade (or camber). After first setting the gears, the Contractor shall readjust all or part of the pedestrian railing system, the gear supports or the gears, if necessary, to create an overall line and grade pleasing to the eye at the sole discretion of the Project Engineer. The Contractor is responsible for the disposal of the temporary gear opening covers.

8-30.4 MEASUREMENT

Pedestrian railing will not be measured but will be paid for on a lump sum basis as described in 8-30.5. "Pedestrian Railing" contains the following approximate quantities of materials and Work:

Item	Quantity	Unit
Fabricate/ Install Temporary Replacement Panels	96	Each
Salvage Ornamental Iron Rail Panels	96	Each
Furnish and Install Railing Anchorages (Bridge)	338	Each
Furnish and Install Gear Support Anchorages	23	Each
Furnish and Install Railing Anchorages (Control Tower)	24	Each
Structural Steel – Anchor Plates	1,500	Lbs
Install Pedestrian Railing (Bridge)	2,990	L.F.
Install Pedestrian Railing (Control Tower)	205	L.F.
Salvage Existing Gears	41	Each
Install Modified Gears (with and without Supports)	41	Each
Ballast Angle (painted 3" x 3" x 1/4" with bolts)	67	Each

The quantities are listed only for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. No adjustments other than for approved changes will be made in the lump sum Contract price for Installation of Art Elements.

8-30.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Pedestrian Railing", lump sum.

The lump sum Contract price for "Pedestrian Railing" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for salvage, manufacture,

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fabrication, transportation, coordination, storage, erection, installation, traffic control, and including the providing of items shown on the plans and described herein.

8-31 PLANTABLE PAVING (NEW SECTION)

8-31.1 DESCRIPTION

This Work consists of installing plantable paving, including base course, according to the manufacturers written recommendations and these specifications, in the locations shown in the Plans. Topsoil and plants shall be paid for as separate items.

8-31.2 MATERIALS

Materials shall meet the requirements of the following sections:

Gravel Base: 4-2

Plantable Paving Product per the following:

1. Invisible Structures Grass Paving 2; Contact: Invisible Structures, Inc., Golden, CO; 1-800-233-1510; www.invisiblestructures.com.
2. BodPave85 Porous Paving Grid; Contact: Boddingtons Inc., Roseville, MN; 1-651-330-2920; www.boddingtons.us.
3. Porous Paving Garden Grid; Contact: Green Innovations, Ltd., Pickering, Canada; 1-888-725-7524; www.greeninovations.ca
4. Approved equal.

The Contractor shall be responsible for providing the plantable paving product and base material, and all other materials necessary for the complete installation of the product. The Contractor shall be responsible for ensuring that all materials are protected from damage during offloading, handling, storing, protecting, and installation of the plantable paving product.

8-31.3 CONSTRUCTION REQUIREMENTS

The Contractor shall inform the Project Engineer in writing 10 calendar days prior to the intended installation of Plantable Paving. Installation of the base course shall be complete and approved prior to the installation of the paving product.

Work items include the following:

1. Install gravel base course ensuring that sub-base is adequate with proper compaction, and soil porosity and gradient will provide adequate subsurface drainage; leave one (1) inch depth below final grade for plantable paving unit and topsoil;
2. Clean surfaces of paving product thoroughly prior to installation;

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3. Install paving product by placing rings facing up, using the snap fit system provided along each edge to maintain proper spacing and interlock the units, place tops of rings flush or slightly below the surface of adjacent hard-surfaced pavements;

4. Anchor units to the base course, using anchors specified by manufacturer in locations necessary to prevent movement by traffic.

8-31.4 MEASUREMENT

Plantable paving will be measured per square foot to include all Work items as described in 8-31.3 and 8-31.5.

8-31.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Plantable Paving", per square foot.

The unit Contract price for "Plantable Paving" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the base course preparation and installation of paving product, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

8-32 GEAR BOX ASSEMBLY (NEW SECTION)

8-32.1 DESCRIPTION

This Work consists of removing, salvaging, cleaning and painting one (1) complete gear/shaft/frame set; fabricating and attaching steel tubes for supporting the salvaged gear/shaft/frame set; and construction of concrete walls and footings for displaying the salvaged gear/shaft/frame set in the location shown in the Plans.

8-32.2 MATERIALS

Materials shall meet the requirements of the following sections:

Structural Steel and Related Materials	9-06
St. Reinf. Bar for Gear Box Assembly	9-06
Salvaged gear/shaft/frame	9-06
Paint:	9-08

8-32.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide forms, reinforcement and concrete for walls and footings; structural steel and hardware for the support system; paint; and all other materials as required to install one (1) complete Gear Box Assembly as required. The Contractor shall ensure that all materials are

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protected against damage during offloading, handling, storing, and installation of the Gear Box Assembly.

The Contractor shall inspect all existing gears, shafts and frame sets in the presence of the Project Engineer and identify those items which are in the best condition. The Contractor shall salvage those items deemed to be in the best condition by the Project Engineer.

The Contractor shall inform the Project Engineer in writing 14 calendar days prior to the intended installation of the gear/shaft/frame set in place. Concrete work shall be complete and approved prior to the delivery of the prepared gear/shaft/frame set ready for installation; delivery shall be coordinated with the Project Engineer such that the gear/shaft/frame set can be unloaded and installed without need for extraneous on-site handling and storage.

The Gear Box Assembly includes but is not limited to: a concrete foundation, steel reinforcement for concrete foundation, structural steel, salvaged steel frame set and salvaged steel gears and shafts.

Provide shop drawings in accordance with 1-05.3 and 6-01.9.

Work items include the following:

1. Field measure one (1) existing gear/shaft/frame set to be salvaged and re-used for purposes of developing shop plans. The Contractor shall conduct field measurements in the presence of the Project Engineer;
2. Salvage one (1) complete, gear/shaft/frame set intact as shown in the Plans;
3. Provide shop plans for installing the gear/shaft/frame set in concrete;
4. Clean and paint gear/shaft/frame set in accordance with Section 6-07.
5. Prepare salvaged and fabricated steel for painting in accordance with Section 6-07.
6. Construct concrete walls and footings with steel tube posts for supporting and displaying the historic gear/shaft/frame set intact as shown in the Plans;
7. Install one (1) completed Gear Box Assembly in place.

Fabrication of the Gear Box Assembly shall be in accordance with approved shop drawings, subject to the Plans and the following:

a. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

b. Welded Connections: Comply with 6-03.3(25). Continuously weld joints and seams; grind, fill and dress welds to produce smooth, flush surfaces without distortion after final finishing.

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Include the Gear Box Assembly installation in the Baseline Project Schedule and update those activities as the project progresses.

8-32.4 MEASUREMENT

"Gear Box Assembly" will not be measured but will be paid for on a lump sum basis to include all Work items as described in 8-32.5. "Gear Box Assembly" contains the following approximate quantities of materials and completed Work:

Salvage Gear / Shaft / Frame Set1	1	Each
Cleaning and Painting – Gear Box Assembly	1	L.S.
Gravel Backfill for Wall	2	C.Y.
Concrete Class 4000	28	C.Y.
St. Reinforcement Bar for Gear Box Assembly	997	LB.
Steel HSS4x4x1/2	215	LB.
Steel 1" Thick Plate	80	LB.

The quantities are listed only for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. No adjustments other than for approved changes will be made in the lump sum Contract price for "Gear Box Assembly".

8-32.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Gear Box Assembly", per lump sum.

The lump sum Contract price for "Gear Box Assembly" shall be full pay for all costs in connection with salvaging one complete gear box assembly, furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, transportation, storage, fabrication, installation, and painting, including all other items necessary for the Work whether or not such work is shown or specified.

8-33 PEDESTRIAN LANDINGS (NEW SECTION)

8-33.1 DESCRIPTION

This Work consists of removing, salvaging, and cleaning and painting existing bascule roadway steel grating; fabricating the grating to the sizes required for constructing four (4) pedestrian landings in the sizes and locations shown in the Plans; installing concrete footings with steel components for support; preparing the base for each landing; and installing concrete fill within the grate material in the locations shown in the Plans.

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8-33.2 MATERIALS

Materials shall meet the following requirements:

Structural Steel	Section 9-06
Steel tubes and plates	Section 9-06
Epoxy coated steel reinforcement bar	Section 9-06
Paint:	Section 9-08

8-33.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide base material under the landings; concrete for footings and all steel components for support; salvaged quantities; and all other materials as required to install four (4) Pedestrian Landings as described and specified. The Contractor shall ensure that all materials are protected during removal, handling, storing, protecting, and installing the completed Pedestrian Landings.

The Contractor shall inspect all existing steel bridge grating in the presence of the Project Engineer and identify those items which are in the best condition. The Contractor shall salvage those items deemed to be in the best condition by the Project Engineer.

The Contractor shall inform the Project Engineer in writing 14 calendar days prior to the intended installation of each Pedestrian Landing. Subgrade and footings with support systems shall be complete and approved prior to the delivery of the prepared grating for installation; delivery shall be coordinated with the Project Engineer such that the grating can be unloaded and installed without need for extraneous on-site handling and storage.

The pedestrian landing includes but is not limited to: a concrete walkway, concrete foundation piers, steel reinforcement for concrete foundation piers, steel tubes embedded in concrete foundation piers, steel support beams, separator plates, foundation plates, connector plates, stiffener plates, walkway plate, salvaged bridge grating, salvaged bridge truss and various sizes of steel tube for pedestrian railing.

Provide shop drawings in accordance with 1-05.3 and 6-01.9.

Work items include the following:

1. Field measuring and determining the locations and amount of existing grating needed to be salvaged for constructing the pedestrian landings and for purposes of developing shop drawings. The Contractor shall locate and conduct field measurements in the presence of the Project Engineer;
2. Salvaging roadway steel grating as shown in the Plans;
3. Providing shop plans for constructing the four (4) pedestrian landings;
4. Cleaning and painting grating in accordance with Section 6-07;

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5. Sizing and cutting the grating to sizes necessary to construct the Landings;

6. Procuring supplies for and fabricating all steel components shown in the Pedestrian Landing Details;

7. Constructing concrete footings with steel tube posts for supporting the Pedestrian Landings;

8. Installing four (4) completed Pedestrian Landings in place.

Fabrication of the steel grating to the sizes as shown on the Plans shall be in accordance with approved Shop Plans and the following:

1. Construct square-cornered grates with closely fitted joints, and that will remain flat under installed conditions.

2. Welded Connections: Comply with 6-03.3(25).

3. Grind all welds and cuts smooth.

8-33.4 MEASUREMENT

Pedestrian landings will not be measured but will be paid for on a lump sum per each basis to include all Work items as described in 8-32.5.

The lump sum Contract price for "Pedestrian Landing __" contains the following approximate quantities of materials and completed Work:

Pedestrian Landing 1

W8x13 Steel Beam	2431	LB.
MC6x15.1 Steel Beam	1269	LB.
Separator Plate	62	LB.
Foundation Plate	43	LB.
Connector Plate W-W	46	LB.
Connector Plate MC-W	94	LB.
Foundation Rod	516	LB.
½" Stiffener Plate	46	LB.
¼" Walkway Plate	3322	LB.
Foundation Rebar	749	LB.
Bridge Grating Reclamation	326	S.F.

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1	Bridge Truss Reclamation	82	L.F.
2	Pedestrian Railing Top Rail	720	LB.
3	Pedestrian Railing Post	312	LB.
4	Pedestrian Railing Pickets	1086	LB.
5	Walkway Concrete	3	C.Y.
6	Foundation Concrete	4	C.Y.
7	Cleaning and Painting – Ped. Landing 1	1	L.S.
8	Pedestrian Landing 2		
9	W8x13 Steel Beam	2535	LB.
10	MC6x15.1 Steel Beam	1284	LB.
11	Separator Plate	67	LB.
12	Foundation Plate	46	LB.
13	Connector Plate W-W	114	LB.
14	Connector Plate MC-W	103	LB.
15	Foundation Rod	560	LB.
16	½” Stiffener Plate	50	LB.
17	¼” Walkway Plate	2986	LB.
18	Foundation Rebar	744	LB.
19	Bridge Grating Reclamation	293	S.F.
20	Bridge Truss Reclamation	90	L.F.
21	Pedestrian Railing Top Rail	791	LB.
22	Pedestrian Railing Post	342	LB.
23	Pedestrian Railing Pickets	1192	LB.
24	Walkway Concrete	3	C.Y.
25	Foundation Concrete	5	C.Y.
26	Cleaning and Painting – Ped. Landing 2	1	L.S.
27	Pedestrian Landing 3		

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1	W8x13 Steel Beam	845	LB.
2	MC6x15.1 Steel Beam	265	LB.
3	Separator Plate	21	LB.
4	Foundation Plate	14	LB.
5	Connector Plate W-W	31	LB.
6	Connector Plate MC-W	31	LB.
7	Foundation Rod	172	LB.
8	½” Stiffener Plate	15	LB.
9	¼” Walkway Plate	664	LB.
10	Foundation Rebar	148	LB.
11	Bridge Grating Reclamation	65	S.F.
12	Bridge Truss Reclamation	30	L.F.
13	Pedestrian Railing Top Rail	264	LB.
14	Pedestrian Railing Post	114	LB.
15	Pedestrian Railing Pickets	397	LB.
16	Walkway Concrete	1	C.Y.
17	Foundation Concrete	1	C.Y.
18	Cleaning and Painting	1	L.S.
19	Pedestrian Landing 4		
20	W8x13 Steel Beam	1235	LB.
21	MC6x15.1 Steel Beam	529	LB.
22	Separator Plate	26	LB.
23	Foundation Plate	18	LB.
24	Connector Plate W-W	34	LB.
25	Connector Plate MC-W	45	LB.
26	Foundation Rod	215	LB.

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½" Stiffener Plate	19	LB.
¼" Walkway Plate	1277	LB.
Foundation Rebar	185	LB.
Bridge Grating Reclamation	125	S.F.
Bridge Truss Reclamation	45	L.F.
Pedestrian Railing Top Rail	395	LB.
Pedestrian Railing Post	171	LB.
Pedestrian Railing Pickets	596	LB.
Walkway Concrete	1	C.Y.
Foundation Concrete	1	C.Y.
Cleaning and Painting – Ped. Landing 4	1	L.S.

The quantities are listed only for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. No adjustments other than for approved changes will be made in the lump sum Contract price for "Pedestrian Landing __".

8-33.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid items:

"Pedestrian Landing 1", per lump sum.

"Pedestrian Landing 2", per lump sum.

"Pedestrian Landing 3", per lump sum.

"Pedestrian Landing 4", per lump sum.

The lump sum Contract price for "Pedestrian Landing 1", Pedestrian Landing 2", Pedestrian Landing 3", and Pedestrian Landing 4" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, painting, transportation, storage, fabrication, installation, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

8-34 PEDESTRIAN LANDING RAILING (NEW SECTION)

8-34.1 DESCRIPTION

This Work consists of removing, salvaging and cleaning existing bridge trusses; fabricating pedestrian railing using the salvaged trusses; and installing the railing at the four (4) pedestrian landings where shown in the Plans.

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8-34.2 MATERIALS

Materials shall meet the requirements of the following sections:

Paint: 9-08

Paint color shall be: black

8-34.3 CONSTRUCTION REQUIREMENTS

The Contractor shall salvaged material quantities and other materials as required to fabricate and install Pedestrian Landing Railing as described and specified. The Contractor shall ensure that all materials are protected from damage during removal, handling, storage, and installation.

The Contractor shall inform the Project Engineer in writing 10 calendar days prior to the intended installation of each Pedestrian Landing Railing.

Work items include the following:

1. Field measuring and determining the locations and amount of existing bridge trusses needed to be salvaged for constructing the pedestrian landing railings and for purposes of developing shop drawings. The Contractor shall locate and conduct field measurements in the presence of the Project Engineer;
2. Salvaging bridge trusses as shown in the Plans;
3. Provide shop plans for fabricating pedestrian landing railing;
4. Clean and painting the salvaged trusses in accordance with Section 6-07;
5. Fabricating the railing using the steel components and salvaged trusses;
6. Installing Pedestrian Landing Railing in place.

Fabrication of the pedestrian landing railing shall be in accordance with approved Shop Plans, subject to the Plans and the following:

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
2. Welded Connections: Comply with 6-03.3(25). Continuously weld joints and seams; grind, fill and dress welds to produce smooth, flush surfaces without distortion or discoloration, and welds invisible after final finishing. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
3. Conceal fasteners if possible otherwise, locate where they will be the most inconspicuous.

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4. Fabricate post to length required to allow for embedded depth in concrete footing and in location where extended post is required for Interpretive Sign Panel installation.

8-34.4 MEASUREMENT

Pedestrian landing railing will be measured per linear foot to include all Work items as described in 8-34.5.

8-34.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Pedestrian Landing Railing", per linear foot.

The linear foot Contract price for "Pedestrian Landing Railing" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, painting, transportation, storage, fabrication, installation, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

8-35 LIGHT POLE AND BALUSTRADE (NEW SECTION)

8-35.1 DESCRIPTION

This Work consists of saw-cutting, removing, salvaging and cleaning, restoring, sealing sections of four (4) existing balustrade with light pole; installing concrete foundation; transporting and installing sections of light pole and balustrade; and installing new light fixture and electrical wiring in the location shown on plans.

8-35.2 MATERIALS

Materials shall meet the requirements of the following sections:

Epoxy coated steel reinforcement bar	9-06
Gravel Backfill	9-03
Conduit	9-29
Concrete crack repair	9-20

Clear sealer: Permissible penetrating sealers including silanes, siloxanes, and silicates

8-35.3 CONSTRUCTION REQUIREMENTS

The Contractor shall salvage the light fixtures and provide wiring, conduit and reinforced concrete for the foundation; and all other materials as required to install the Light Pole and Balustrade as described and specified. The Contractor shall ensure that all materials are protected against damage during removal, handling, storing, and installation.

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The Contractor shall inspect all existing concrete Light Poles and Balustrades in the presences of the Project Engineer and identify those items which are in the best condition. The Contractor shall salvage those items deemed to be in the best condition by the Project Engineer.

The Contractor shall inform the Project Engineer in writing 14 calendar days prior to the intended installation of Light Pole and Balustrade for each of the Light Pole and Balustrade sections. Installation shall be coordinated with the Project Engineer such that the sections can be unloaded and installed without need for extraneous on-site handling and storage.

The light pole and balustrade includes but is not limited to: gravel backfill for footings, concrete footings, epoxy coated steel reinforcement, and salvaged light pole and balustrade.

Provide shop drawings in accordance with 1-05.3 and 6-01.9.

Work items include the following:

1. Survey all existing light pole and balustrade sections and select those in best condition with approval of the Project Engineer.
2. Field measure the selected light pole and balustrades to be salvaged for purposes of developing shop drawings. The Contractor shall locate and conduct field measurements in the presence of the Project Engineer;
3. Salvage light pole and balustrade sections as shown in the Plans;
4. Provide shop plans for installing new light fixtures and wiring as shown in the Balustrade Light Details;
5. Clean the salvaged light pole and balustrade sections in accordance with Section 6-07;
6. Repair all cracks and spalls.
7. Apply clear sealer.
8. Fabricating concrete base for new light fixture;
9. Installing Light Pole and Balustrade sections in place.

Fabrication and installation of the concrete base for the new light fixture shall be in accordance with approved Shop Plans.

8-35.4 MEASUREMENT

Light pole and balustrade will not be measured but will be paid for on a lump sum for all four (4) 9’-6” sections and shall include all Work items as described in 8-35.5.

The lump sum Contract price for “Light Pole and Balustrade” contains the following approximate quantities of materials and completed Work:

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Light Pole and Balustrade Reclamation	4	Each
Gravel Backfill for footings	2.5	C.Y.
Concrete Class 4000	8.0	C.Y.
Epoxy coated steel reinforcement bar	1260	LB.
King Post Luminaire	4	Each
Conduit	50	L.F.

The quantities are listed only for the convenience of the Contractor in determining the volume of work involved and are not guaranteed to be accurate. No adjustments other than for approved changes will be made in the lump sum Contract price for "Light Pole and Balustrade".

8-35.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Light Pole and Balustrade", per lump sum.

The lump sum Contract price for "Light Pole and Balustrade" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal, salvaging, cleaning, sealing, transportation, storage, fabrication, installation, including all other items necessary for the Work whether or not such work is shown or specified.

8-36 RAIL POST BOLLARDS (NEW SECTION)

8-36.1 DESCRIPTION

This Work consists of removal, salvage, restoring and cleaning of existing bridge rail posts; and fabrication and installation of Removable and Fixed Rail Post Bollards using the salvaged bridge rail posts.

8-36.2 MATERIALS

Materials shall meet the following requirements:

Steel panels, sleeves and other components	9-06
Paint:	9-08

Paint Color shall be black.

8-36.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide concrete for footing with tubular steel sleeving, salvage efforts and all other materials necessary for the fabrication and installation of the Rail Post Bollards. The Contractor shall be responsible for ensuring that all materials are protected from damage during offloading, handling, storing, protecting, and installation of the bollards.

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The Contractor shall inform the Project Engineer 14 calendar days prior to the intended installation of Rail Post Bollards. Footings with sleeving and fabrication of the Rail Posts shall be complete and approved prior to the delivery for bollard installation.

Work items include the following:

1. Survey all existing rail posts and select those in best condition with approval of the Project Engineer.
2. Field measure the selected rail posts to be salvaged for purposes of developing shop drawings. The Contractor shall locate and conduct field measurements in the presence of the Project Engineer;
3. Salvaging rail posts as shown in the Plans;
4. Provide shop plans for fabricating and installing Rail Post Bollards as shown in the Architectural Site Detail Plans;
5. Clean and painting the salvaged rail posts in accordance with Section 6-07 as appropriate;
6. Installing concrete footings and Rail Post Bollards in place.

Fabrication of the bollard is based on Shop Plans, subject to the Architectural Site Detail Plans and the following:

1. Welded Connections: Comply with 6-03.3(25).
2. Fabricate bollard from salvaged bridge rail post to length required to allow for embedded depth in footing.

8-36.4 MEASUREMENT

Rail post bollard will be measured per each and shall include all Work items as described in 8-35.5.

8-36.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid items:

"Rail Post Bollard Fixed", per each.

"Rail Post Bollard Removable", per each.

The unit Contract price for "Rail Post Bollard Fixed" and "Rail Post Bollard Removable" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, painting, transportation, storage, fabrication, installation, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

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8-37 BRICK PAVING (NEW SECTION)

8-37.1 DESCRIPTION

This Work consists of installing new brick paving and removing, salvaging, cleaning, storing and reinstalling existing historic brick sections within the Project Site.

8-37.2 MATERIALS

Materials shall meet the requirements of the following:

Crushed Rock shall be Base Course Section 9-03.9(3)

Concrete Base Material shall be Concrete Class 3000 Section 6-02.

Sand Cement Cushion shall be one (1) part Portland cement (as specified in Section 9-01) and five (5) parts clean, dry, course screened sand.

Grout Filler color shall match the grout of the salvaged brick sections.

Brick Paving for Walkway and Roadway: 'Holland Rustic Blend' pavers with standard finish, 3-15/16" by 7-7/8" by 2-3/8" thick, ASTM C936. Contractor shall submit samples to the Project Engineer for approval.

8-37.3 CONSTRUCTION REQUIREMENTS

The Contractor shall provide all base material, new brick paving, salvaged brick paving sections, mortar and grout filler for installing the brick paving and salvaged brick paving sections as shown in the Architectural Site Detail Plans. The Contractor shall be responsible for ensuring that all materials are protected from damage during handling, storage and installation of the brick paving.

The Contractor shall inform the Project Engineer 14 calendar days prior to the intended removal of existing brick sections and prior to installation of brick paving and salvaged brick paving sections.

Work items include the following:

1. Surveying existing brick paving and select those locations where brick paving sections are in the best condition for salvaging with approval of the Project Engineer;

2. Field measuring the existing brick paving sections to be salvaged. The Contractor shall conduct field measurements in the presence of the Project Engineer;

3. Salvaging sections of existing brick paving without damage to the existing mortar joints between the brick pavers by means of saw cutting and removal of sections of the existing brick paving and its associated concrete base and sand/mortar bedding. Securing salvaged sections of brick paving with banding to mitigate the

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potential for damage of the existing mortar joints between the salvaged brick pavers;

4. Separating the existing salvaged brick paving from the existing concrete base without damage to the mortar joints between the salvaged brick paving and dispose of the concrete base;

5. Separating the existing sand/mortar bedding from the salvaged brick paving without damaging the mortar joints between the salvaged brick paving and dispose of the bedding material;

6. Saw cutting the salvaged brick paving to final dimensions (if necessary);

7. Cleaning salvaged brick paving, prior to installation, by pressure washing or other methods to remove all soil and unwanted debris without damaging the mortar joints between the salvaged brick pavers;

8. Installing cleaned salvaged brick paving, including crushed rock, concrete base, sand cement base material. Sand cement shall be mixed and placed dry, then spread evenly upon the concrete base to a uniform depth of one (1) inch. Salvaged brick paver sections shall be placed over the sand cement base material. Expansion joints shall be constructed around the salvaged brick paver sections.

9. Installing new brick paving for walkway, new brick paving for roadway including crushed rock, concrete base, sand cement, all base material, and grout filler. Grout color shall be approved by the Project Engineer and shall closely match the color of the grout in the salvaged brick paver sections. Sand cement shall be mixed and placed dry, then spread evenly upon the concrete base to a uniform depth of one (1) inch. Bricks shall be placed and watered, and joints filled with grout filler. Expansion joints shall be constructed around or along all concrete castings within brick paved areas.

All mortar joints between the salvaged brick pavers shall remain intact without cracks or loss of adhesion to the salvaged brick pavers with all sections of salvaged brick paving. The Contractor shall salvage 150% of the required sections of salvaged brick paving for use as replacement section if the mortar joints between the salvaged brick pavers are damaged. The Contractor shall replace any section, as a whole, of salvaged brick paving in which the mortar jointing between the salvaged brick pavers has been damaged, as determined by the Project Engineer, during the salvage, cleaning or placement operations.

8-37.4 MEASUREMENT

Brick paving for walkway, brick paving for roadway, and salvaged brick paving will be measured per square foot of installed and accepted material to include all Work items as described in 8-37.5.

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8-37.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid items:

"Brick Paving for Walkway", per square foot.

"Brick Paving for Roadway", per square foot.

"Salvaged Brick Paving", per square foot.

The unit Contract price for "Brick Paving for Walkway", "Brick Paving for Roadway", and "Salvaged Brick Paving" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal, cleaning, transportation, storage, installation including base material, sand cement material and grout, and traffic control, and all other items necessary for the Work whether or not such work is shown or specified.

8-38 INTERPRETIVE SIGNS (NEW SECTION)

8-38.1 DESCRIPTION

8-38.1(1) INTERPRETIVE SIGN PANEL ON POST

This Work consists of fabricating non-illuminated, hollow box-type post structures and interpretive sign panel supports, and installing in pavement.

8-38.1(2) INTERPRETIVE SIGN PANEL ON RAILING

This Work consists of fabricating non-illuminated interpretive sign panels supports, and installing on the pedestrian landing railing and as indicated on the Plans. Pedestrian landing railing and railing extension for panel is paid for as a separate item.

8-38.2 MATERIALS

Materials shall meet the requirements of the following:

Steel components:	9-06
Paint:	9-08

Steel tubing for post shall be cold-formed steel tubing complying with ASTM A 500, Grade B, size as shown in Plans.

Aluminum Extrusions for Panel Frames shall be ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish specified, and with at least the minimum strength and durability properties of alloy 6063-T5.

Fasteners shall be concealed fasteners fabricated from metals that are non-corrosive to sign material and mounting surface.

Pipe Sleeve shall be Schedule 40 Polyvinylchloride, sized as shown in Plans.

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8-38.3 CONSTRUCTION REQUIREMENTS

The Contractor shall inform the Project Engineer 14 calendar days prior to the intended installation of Interpretive Sign Panels.

Work items include the following:

1. Provide shop plans for approval for fabricating and installing interpretive sign panel supports on post and interpretive sign panels supports on Railing.
2. Fabricate post and sign panels as specified and approved.
3. Painting posts and sign panels in accordance with Section 6-07.
4. Prepare hole for concrete footing in firm, compacted soil;
5. Install Concrete Class 3000 footing with sleeve while centering, aligning and grouting the post inside the sleeve.
6. Submit sign panel supports with surfaces free from distortion or other defects in appearance.
7. Mount approved sign panel supports at the angle and height specified in the Plans.

8-38.3(1) PERFORMANCE REQUIREMENTS

8-38.3(2) FABRICATION

Welded Connections: Comply with 6-03.3(25). Continuously weld joints and seams; grind, fill and dress welds to produce smooth, flush surfaces without distortion or discoloration, and welds invisible after final finishing. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

Construct square-cornered sign panels and frames with closely fitted joints, and that will remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner; increase metal thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations. Panel frame shall have integral, removable top edge to receive sign graphics. Preassemble sign panels in the shop to greatest extent possible.

Conceal fasteners if possible otherwise, locate where they will be the most inconspicuous.

Fabricate post to length required to allow for embedded depth in concrete footing.

8-38.4 MEASUREMENT

Interpretive sign panel on post will be measured per each to include all Work items as described in 8-38.5.

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Interpretive sign panel on railing will be measured per each to include all Work items as described for Panels only in 8-38.5.

8-38.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid items:

"Interpretive Sign Panel on Post", per each.

"Interpretive Sign Panel on Railing", per each.

The unit Contract price for "Interpretive Sign Panel on Post" and "Interpretive Sign Panel on Railing" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the fabrication, painting, transportation, and installation, including all other items necessary for the Work whether or not such work is shown or specified.

8-39 SUBMARINE CONDUIT SYSTEM (NEW SECTION)

8-39.1 DESCRIPTION

This Work consists of designing, manufacturing and installing a Contractor designed submarine conduit system to convey a minimum of 6 (six) fiberglass reinforced epoxy (FRE) ducts between Piers 3 and 4. The submarine conduit system shall run from the counterweight pits of Piers 3 and 4 and traverse the Duwamish Waterway at an elevation of below the floor of the waterway as depicted in the Contract Plans. All Work shall be completed without disturbance of the floor of the Duwamish Waterway.

8-39.2 MATERIALS

8-39.2(1) PIPE CASING AND PIPE SLEEVES

Steel Pipe Casing and Pipe Sleeves shall conform to ASTM A 106, Grade B, minimum.

Pipe sleeves shall have 3/4 inch by 6 inch shear studs at nominal 12 inch square grid pattern where embedded in concrete.

Pipe sleeves shall be galvanized in accordance with ASTM 123 after fabrication.

Standard pipe sleeve field joint: AWWA C 206 shall be a single weld, butt joint as a minimum.

Steel Pipe Casing and Pipe Sleeves shall of the same diameter and minimum wall thickness, selected from the alternates below, at the Contractor's option.

Nominal Outside Diameter	Minimum Wall Thickness
16 inch	0.281 inch
18 inch	0.312 inch
20 inch	0.406 inch

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24 inch	0.375 inch
26 inch	0.375 inch
30 inch	0.469 inch

8-39.2(2) FRE DUCTS

The ducts, elbows and fittings shall be filament wound reinforced epoxy as manufactured in accordance with the current versions of NEMA TC-14 and UL 1674, minimum nominal glass content of 68% and a minimum tensile strength of 1,000 psi. Ducts shall be non-tapered. Ducts, elbows and fitting shall be manufactured from the same resins, hardener, glass system manufactured by the same filament wound system. The ducts shall have bell and spigot ends. The ducts shall be joined together using a two-part epoxy adhesive creating a watertight joint. The duct wall thickness shall be a minimum thickness of a 0.085 inch. The inside diameter of the ducts shall be a minimum of 4.0 inches.

8-39.2(3) GROUT

Commercial pre-packaged grout material shall be used which meets all properties specified herein. The dry grout material shall be a proportioned commercial product pre-packaged in plastic lined or coated bags. Grout bags shall be stamped with the date of manufacture, Lot number and mixing instructions. Materials with a total time from manufacture in excess of six months shall be re-tested and certified by the supplier before use, or it shall be removed and replaced. Water shall be potable, clean and free of injurious quantities or substances (chlorides, sulfates and nitrates) known to be harmful to Portland cement.

Pre-hardening expansive grout admixtures based on gas formation shall not be used. Specifically excluded materials are aluminum powder, fluidized coke (coke breeze) and any gas-forming agent that produces hydrogen, carbon dioxide, oxygen and air. Inert gas-forming materials may be used. Products shall be certified accordingly by the manufacturer. Grout shall achieve non-bleeding characteristics.

Grout shall meet or exceed the specified physical properties stated below.

Grout Properties

PROPERTY	TEST VALUE	TEST METHOD
Fine aggregate (if used)	Max. size < No. 50 sieve (300 micron)	ASTM C 33
Volume change at 24 hours	0.0% at 24 hours.	ASTM C 1090*
Expansion	< 2.0% for up to 3 hours	ASTM C940

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Compressive strength 28 day (Average of 3 cubes)	> 3500 psi	ASTM C 942
Initial set of grout	Min. 2.5 hours Max. 12 hours	ASTM C 953
Fluidity test**		ASTM C 939
Efflux time from flow cone immediately after mixing	Min. 11 seconds Max. 30 seconds Or Min. 9 seconds Max. 20 seconds	ASTM C 939*** ASTM C 939
Efflux time from flow cone 30 minutes after mixing with remixing for 30 seconds.	Max. 30 seconds Or Max. 30 seconds	ASTM C 939***

** Adjustments to flow rates will be achieved by compliance with the manufacturer's recommendations.

*** Grout fluidity shall meet either the standard ASTM C 939 flow cone test or the modified test described herein. Modify the ASTM C 939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a cone-liter container placed directly under the flow cone.

8-39.2(4) FRE DUCT SUPPORT SYSTEM

Members in direct contact with FRE ducts shall be fiberglass or other Project Engineer approved non-metallic materials.

Threaded rods and hardware shall be stainless steel that meets the requirements of ASTM A 493, Type 302.

Bolts: ASTM F 593 Group 1, Condition A Stainless Steel, or ASTM A 193, Grade B8, Class 1Stainless Steel

U-bolts: ASTM A 276 Type 304 Stainless Steel

Washers: ANSI B.18.22.1 Stainless Steel Alloy 304

Nuts: ASTM F 594 Group 1 Stainless Steel, or ASTM A 194 Grade 8 or 8A Stainless Steel

8-39.3 CONSTRUCTION REQUIREMENTS

This submarine conduit system includes but is not limited to: a minimum of 6 runs of FRE ducts, steel pipe sleeves embedded within the caisson caps, Contractor designed duct spacers/supports diagrams, Contractor designed pipe seals placed in the exterior walls of the caissons, a steel pipe casing between Piers 3 and 4, grout backfill with the steel pipe casing and pipe sleeves,

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Contractor designed temporary construction platforms, Contractor designed FRE duct supports and all appurtenances necessary to make the system complete and watertight.

All FRE ducts shall be continuous, clean and free from obstructions including grout and free of kinks. The Contractor shall replace any FRE ducts that are not clean and free from obstructions as determined by the Project Engineer at no additional cost to the County.

Provide shop drawings in accordance with 1-05.3 and 6-01.9.

8.39.3(1) CONTRACTOR QUALIFICATIONS

The Contractor shall as a minimum meet one of the following criteria:

A. Employ a tunneling sub-contractor having successfully completed 3000 feet or 10 drives of microtunneling using the type of equipment to be used or

B. Meet both of the following criteria:

1. Provide a representative of the manufacturer of the microtunnel boring machine (MTBM) being used by the Contractor whose level of experience in microtunneling is acceptable to the Project Engineer and,

2. Provide a MTBM operator with a minimum of 3000 feet or 10 drives of successful pilot tube microtunneling installation using the equipment to be used who will be in direct supervision of the pilot tube microtunneling operation at all times.

8-39.3(2) TUNNELING

The steel pipe casing will be considered temporary support of excavation used for placement of the FRE ducts. The Contractor shall use micro-tunneling methods to place the steel pipe casing control line and grade, control flow of groundwater to allow placement of grout backfill and placement of the FRE ducts, prevent loss of soil into the tunnel and dredge wells, and prevent disturbance of the floor of the Duwamish Waterway. The Contractor shall design the pipe casing and tunneling system within the limits described in the Contract. The Contractor shall remain solely responsible for the design of the tunneling system and associated work tasks.

The Contractor shall use a fully directionally guided microtunnel boring machine (MTBM) for placement of the steel pipe casing. The MTBM shall be mechanically articulated to enable steering of the shield and which includes remote control system with following features:

1. Allows for operation of system without need for personnel to enter tunnel. Has display available to operator, at remote operation console, showing position of shield in relation to design reference together with other information such as face pressure, roll, pitch, steering attitude, valve positions, thrust force, and cutter head torque; rate of advance and installed length.

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2. Integrates system of excavation and removal of spoil and its simultaneous replacement by pipe. As each pipe section is jacked forward, control system shall synchronize all of operational functions of system.

Provide a MTBM, which includes active direction control system with following features:

1. Controls line and grade by guidance system that relates actual position of MTBM to design reference (e.g., by laser beam transmitted from jacking shaft along pipe to target mounted in shield).

2. Provides active steering information, which shall be monitored and transmitted to operating console.

3. Provides positioning and operation information to operator on control console.

The spoil transportation system shall, at a minimum balances soil and groundwater pressures by use of slurry system; system shall be capable of adjustments required to maintain face stability for particular soil condition and shall monitor and continuously balance soil and groundwater pressure to prevent loss of slurry or uncontrolled soil and groundwater inflow, and:

1. Provides pressure at excavation face by use of slurry pumps, pressure control valves, and flow meter.

2. Includes slurry bypass unit in system to allow direction of flow to be changed and isolated, as necessary.

3. Includes separation process. Design it to provide adequate separation of spoil from slurry so that slurry with sediment content within limits required for successful tunneling can be returned to cutting face for reuse. Appropriately contain spoil at site prior to disposal.

4. Uses type of separation process suited to size of tunnel being constructed, soil type being excavated, and work space available at each work area for operating plant.

5. Allows composition of slurry to be monitored to maintain slurry weight and viscosity limits required.

The MTBM cutter face shall at all times be capable of supporting the full excavated area without the use of ground stabilization and have the capability of measuring the earth pressure at the face and setting a calculated earth balancing pressure. The MTBM shall be advanced by jacks mounted in a jacking frame and located in the launching dredge well. The MTBM shall be moved forward by the jacks advancing a successive string of connected pipes toward a receiving dredge well.

The interior wall of the caisson dredge well may be used as to resist the jacking forces within the limits specified within. The Contractor shall limit the jacking reaction load applied to the interior wall of the caisson to 200,000 pounds spread uniformly over a minimum area of 5 feet

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wide by 5 feet high. The Contractor shall design thrust blocks to distribute the jacking loads uniformly and shall not impart excessive loads on the caisson walls or cause the tunneling system to become misaligned. The thrust blocks shall be properly designed and constructed. The thrust blocks shall be normal to the proposed pipe alignment. The thrust blocks shall be designed to support the maximum jacking reaction load and shall include a minimum safety factor of 2.0. Failure of the thrust block system and any corrective action required shall be the responsibility of the Contractor.

The control equipment shall integrate the method of excavation and removal of soil and its simultaneous replacement by the steel pipe casing. Line and grade shall be controlled by a guidance system that relates the actual position of the MTBM to a design reference (e.g. by a laser beam transmitted from the drive shaft along the center line of the steel pipe casing to a target mounted in the shield). As each steel pipe casing section is jacked forward, the control system shall synchronize spoils removal, excavation, and jacking speeds. The MTBM display equipment shall continuously show and automatically record the position of the shield with respect to the project design line and grade.

The line and grade of the steel pipe casing shall be determined by the Contractor once the caissons have been sunk to the final position and tremie seals placed and cured. The Contractor shall locate the positions of the pipe seals within the walls of the caissons, in a three dimensional coordinate system consistent with the Project coordinate system, to within an accuracy of plus or minus 1/2 inch. Record the exact position of the shield after each shove to ensure alignment is within specified tolerances. Make immediate corrections to alignment before allowable tolerances are exceeded. The tolerance in the grade and alignment of the final tunnel lining shall comply with the following such that a continuous slope is maintained:

a. Maximum Departure from established Grade: Not to exceed a total of 1.5 inch.

b. Maximum Departure from established Line: Not to exceed 1.5 inch.

c. The return to line and grade shall not exceed 1 inch in 30 feet.

The overcut diameter shall not exceed the outside pipe diameter by more than two (2) percent, unless approved by the Project Engineer. Excavated soils shall be removed from the site and disposed of in accordance with federal, state and local regulations. Repair of voids created by the tunneling process shall be repaired by the Contractor at no additional cost to the project and by means approved by the Project Engineer.

Selection of an excavation technique, excavation support system, and dewatering system is the Contractor's responsibility. The Contractor is responsible to ensure all excavations are in compliance with all Federal State and Local regulations. All excavations shall be adequately ventilated. Air monitoring of the shafts or pits shall be conducted on a continuous basis.

Design of any pipe casing indicated on the Plans considers minimum requirements only and does not take into account any construction loads. Criteria for longitudinal loading (jacking forces) on the pipe casing shall be determined by the Contractor based on the selected method of

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construction. The Contractor shall design the pipe casing to withstand the thrust from the MTBM without damage or distortion. Propulsion jacks shall be configured to that the thrust is uniformly distributed and will damage or distort the pipe casing.

The Contractor shall design the pipe casing lengths and pipe joints to safely carry loads imposed during construction, including jacking forces. The minimum requirements for pipe casing joint shall be fully welded around the circumference that are flush with the outside diameter of the pipe when pipe casing is assembled.

The repair of or compensation for damage to the caissons and Duwamish Waterway due to negligence for lack of adequate protection on the part of the Contractor will be at no cost to the County.

The tunnel machine operator shall be fully trained on other tunneling projects on the use of the machinery on this project or at all times be under the direct supervision of a fully trained and designated operator.

The MTBM shall be operated so as to prevent either surface heave or loss of ground during tunneling and shall be steerable to maintain line and grade within the tolerances specified.

The pipe casing shall be jacked in place without damaging the pipe joints or completed pipe section. Any pipe, which has been damaged during installation, shall be replaced by the Contractor at no additional cost to the County.

All excavated material from the tunnel and shaft construction shall be disposed of away from the construction site in accordance with federal, state and local regulations.

Use a generator which is suitably insulated for noise ("hospital" type) in residential or commercial areas.

8-39.3(3) SUBMITTALS

The Project Engineer will base the review of submitted design, details and data with consideration of requirements necessary for the completed Work, and the possibility of unnecessary delays in the execution of the Work to be constructed under this Contract. The review of the submittals will not be to check the adequacy of design of the tunneling system, which is the responsibility of the Contractor, but to confirm that the items requested have been considered in developing the design. Review and acceptance of the Contractor submittals by the Project Engineer shall not be construed in any way as relieving the Contractor of its responsibilities under this Contract. Such review by the Project Engineer shall not be construed by the Contractor as an endorsement by the Project Engineer that such methods are constructible or will work for the specific subsurface soils encountered.

Submit for review a complete work plan including drawings showing details of the proposed method of construction. Include written descriptions as necessary to clearly indicate the manner in which the pipe casing installation will be performed including the sequence of Work. Show the location of working launching and receiving dredge wells, including method of excavation, shoring, falsework and bracing, and dewatering techniques that are proposed to be used. The

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following is not intended to limit, but to provide the minimum of details, which must be included:

1. A quality control plan that includes at a minimum how supervision of installation shall be accomplished and procedures for assuring line and grade requirements are meet. Include forms to be used to determine Work progress.
2. Manufacturer's literature describing in detail the tunneling system to be used. Include the method of controlling line and grade of the tunneling machine and details of the pipe casing installation. Provide detailed description of projects on which this tunneling system has been successful used, including the names, addresses and telephone numbers of owner's representative for these projects.
3. Method of spoils removal including surface storage and disposal
4. Method of controlling groundwater at the dredge wells and by the tunneling machine.
5. Launching and receiving locations/layout/dimensions, surface support operations and equipment, profile/alignment/depth of pipe casing, method of excavation, and shoring and bracing.
6. Health and Safety plan in accordance with Washington State Labor and Industry requirements for launching and receiving pits. Include details for security fences, pits covers, emergency rescue provisions.
7. Pipe design, details and installation.
8. Thrust block design. Include materials to be used.
9. Sequence of operations.
10. Number and duration of shifts planned to work each working day.
11. Methods of spoil transportation from face, surface storage and disposal locations.
12. Schedule of work.
13. Duct placement methods and procedures
14. Grouting methods and procedures.
15. Casing joint details.
16. Provide the MTBM manufacturer's literature describing the casing pipe, indicating allowable safe jacking loads with the designated safety factor. Anticipated jacking loads include the manner in which the anticipated jacking loads were generated. Provide details of pipe joints safely distribute jacking forces and instructions on storage, handling, transporting and installation requirements.
17. Contractors Contingency Plan.
18. Miscellaneous materials to be used on the job.

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Structural designs and other engineered components shall be signed and sealed by a Professional Engineer licensed in the State of Washington.

8-39.3(4) TUNNELING SHIFT LOGS

The Contractor shall maintain shift logs of construction events and observations. Project Engineer shall have access to all logs with regard to following information:

1. Location of boring machine face or shield by station and progress of tunnel drive during shift.
2. Hours worked per shift on tunneling operations.
3. Completed field forms, such as steering control logs, for checking line and grade of tunneling operation, showing achieved tolerance relative to design alignment.
4. Maximum pipe jacking pressures per drive.
5. Location, elevation and brief soil descriptions of soil strata.
6. Groundwater control operations and piezometric levels.
7. Observation of any lost ground or other ground movement.
8. Any unusual conditions or events.
9. Reasons for operational shutdown in the event drive is halted.

8-39.3(5) GROUNDWATER CONTROL / PIPE SEALS

The Contractor shall provide groundwater control measures as necessary to complete the installation of the submarine conduit system. The Contractor shall design, furnish and install pipe seals to be mounted to the exterior walls of the caissons which allow penetration of the pipe casing while restricting infiltration of groundwater and soils.

8-39.3(6) FRE DUCTS

The minimum number of FRE ducts shall be as depicted on the Contract Plans. The Contractor may install contingency duct(s) to be used in case of the primary ducts fail to pass proofing tests.

Ensure that all joints are made as specified by the manufacture and are watertight. Ducts shall be free from defects including delaminations, holes, splits, blisters, inclusions and other performance affecting imperfections. They shall be nominally uniform (as commercially practical) in color, density and physical properties. They shall be straight and the ends cut square to the inside diameter.

The ducts shall be supplied with an integrally wound tapered bell and machined spigot to be used with an adhesive. The ducts and fittings shall meet the dimensional requirements of NEMA TC 2002 and UL 1684. The strength of the joints shall meet or exceed the conduit tensile strength when tested in accordance with ASTM D 2105. The joints shall have a minimum pullout force of 1000 lbs. per Section 5.9 UL 1684. Cementing of ducts shall be in accordance with the manufactures published instructions and watertight and prevent pressurized grout from entering

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the duct during construction. Avoid the use of excessive epoxy adhesive which can build up, and when hardened reduce the internal diameter.

Use only preformed conduit elbows. The radius of curvature of the inner edge of any bend shall not less than 48 inches.

Submit catalog cuts and design manuals for the FRE ducts.

8-39-8.3(7) PROOFING FRE DUCTS

Contractor shall prove that the FRE ducts are free and clear of any obstructions or damage and are able to accept the conductors intended by passing a torpedo through the ducts prior to placement of grout, immediately after placement of grout, and after the grout has cured. The torpedo shall have the same cross-sectional shape as the duct, and 1/4 inch smaller all around than the clear, nominal inside dimensions of the duct. Make no deductions to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, the torpedo shall be at least 24 inches long. For curved ducts, determine the length so that when both ends touch the outermost wall of the duct, the torpedo is 1/4 inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the Project Engineer will reject the duct. The torpedo shall pass through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

Immediately after final proving the, the Contractor shall provide an absolute seal of inlets and outlets by use of temporary installation of a temporary duct cap, plumber's plugs (or equal), or threaded plug as appropriate. The use of duct tape for purposes of sealing the ducts will be considered unacceptable.

8-39.3(8) DUCT SPACERS / SUPPORT DIAPHRAGMS

The Contractor shall design, provide and install Duct Spacers / Support Diaphragms (DSSD) to position the FRE ducts within the pipe casing and pipe sleeves and prevent the ducts from floating during grouting operations. The DSSD shall be dielectric and shall hold the ducts in a proper spacing and alignment and be certified to withstand all handling and grouting pressures and stresses. Provide the DSSD with supplementary opening as needed for permit easy flow of grout and to allow threading or wire guides. Spacing of the DSSDs shall not exceed 5 feet. Install the DSSD perpendicular to the ducts. Design "off center weight" or "grout pipe and slot" or "stabilization cables" to prevent the duct bank from rotating about the longitudinal centerline of the casing. Design the DSSD to accommodate a stationary sacrificial grout injection pipe or extractable injection pipe. Employ a trough or feeder bridge at the leading end of the casing to support sections of the duct bank as they are assembled and pulled through the casing.

8-39.3(9) GROUT

The entire length of the pipe sleeves shall be fully grouted from bottom to top. The ends of the pipe casing measured 8 feet from the extreme ends towards the center of the of the pipe casing, and no more, shall be fully grouted.

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The FRE ducts shall be permanently restrained within the pipe casing and pipe sleeves by entirely filling the void space between the ducts and the pipe with grout within limits described within this Special Provision. Grout for filling the voids in the tendon ducts shall be a mixture of water and a dry cementitious mixture specifically formulated for this purpose and in compliance with the requirements stated herein. Store grout in a location that is both dry and convenient to the work. Storage in the open must be on a raised platform and with adequate waterproof covering.

The Contractor shall submit a grouting operation plan for approval at least 30 calendar days in advance of any scheduled grouting operations. Written approval of the grouting operation plan by the Project Engineer is required before any grouting of the permanent structure takes place. At a minimum, provide the following items in the grouting operation plan:

1. Type, quantity, and brand of materials used in grouting including all certifications required.
2. Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;
3. General grouting procedure;
4. Theoretical grout volume calculations;
5. Mixing and pumping procedures;

The Contractor shall measure and record the volume of grout actually placed within the pipe casing and pipe sleeves.

8-39.3(10) FRE DUCT VERTICAL SUPPORT SYSTEM

The Contractor shall design, furnish and install a support system to restrain the FRE ducts within the caissons between the pipe casing and pipe sleeves. The restraints shall be spaced vertically at distances of 8 feet or less. The duct support system shall be of suitable materials to be permanently exposed to water.

8-39.3(11) PIER FACE PLACARDS

Mount 24 inch square embossed brass placards directly above the submarine conduit system at elevation +10.0 to the channel side face of Piers 3 and 4, to notify utility Contractors of the location of this submarine conduit system. The placards shall conform to the common ground alliance best practices version 6.0 guidelines, the 49 Code of Federal Regulations (CFR) Part 192 & 195, Industry Standards, and APWA, "Guidelines for Uniform Temporary Marking of Underground Facilities and any applicable state or local marking standards".

8-39.3(12) FALSEWORK

The Contractor shall design, provide, install and remove temporary construction platforms as necessary for construction of the submarine conduit system. The Contractor shall design and remain solely responsible for all temporary works/falsework. The Contractor designed falsework shall be in accordance with 6-02.3(16) and 6-02.3(17). Repair any holes in the wall of the

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caisson wall with non-shrink epoxy grout. Any hardware to remain attached to the caisson walls shall be fabricated of stainless steel.

8-39.3(13) SUBMARINE CABLE OBSTRUCTIONS

If obstructions are encountered while tunneling, the Contractor shall notify the Project Engineer promptly. An obstruction is defined as a specific object (including, but not limited to, boulders, logs, and manmade objects) encountered during tunneling operations which prevents or hinders the advance of the tunneling. When efforts to advance past the obstruction to the receiving dredge well result in the rate of advance of the steel pipe casing being significantly reduced relative to the rate of advance for the portion of the casing in the geological unit that contains the obstruction, then the Contractor shall remove, break-up, or push aside, or otherwise remedy the obstruction under the provisions of subsection 8-39.5.B of this Special Provision. The method of dealing with such obstructions, and the continuation of excavation shall be as proposed by the Contractor and approved by the Project Engineer.

8-39.4 MEASUREMENT

Submarine conduit system will not be measured but will be paid for on a lump sum basis as described in 8-39.5.

The lump sum Contract price for “Submarine Conduit System” contains the following approximate quantities of materials and completed Work:

Item	Approx. Quant.	Unit
Pipe Sleeves	2	Each
Pipe Casing	215	L.F.
FRE Duct	1,932	L.F.
Duct Spacers / Support Diaphragms	56	Each
Grout	1	L.S.
Pipe Seals	2	Each
FRE Duct Supports	8	Each

The quantities are listed only for the convenience of the Contractor in determining the volume of Work involved and are not guaranteed to be accurate. The prospective bidders shall verify these quantities before submitting a bid. No adjustments other than for approved changes will be made in the lump sum Contract price for "Submarine Conduit System even though the actual quantities required may deviate from those listed.

No other aspect of Work associated with “Submarine Conduit System”, in place and acceptable to the Project Engineer will be measured for payment. Specifically, submittals and design of the system, excavation and disposal of soils, dewatering, temporary construction platforms, tunnel support equipment, clean up, backfilling of voids due to the Contractor’s tunneling operations, testing of FRE ducts, replacement of unsuitable FRE ducts will not be measured for payment and shall be considered included in the cost of the Contract.

90% Submittal - Not for Construction

8-39.5 PAYMENT

A. Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Submarine Conduit System", lump sum.

No other aspect of Work related to "Submarine Conduit System", in place and acceptable to the Project Engineer, will be paid for except as described in 8-39.5B of this Special Provision. The lump sum Contract price for "Submarine Conduit System" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment for the manufacture, fabrication and construction used in the completed larger work item, including providing of such other items as may be shown, inferred or described in the Contract.

B. Payment for Removing Casing Obstructions

Payment for removing, breaking-up, or pushing aside, shaft obstructions, as defined in subsection 8-39.3(13) of this Special Provision, will be made for the changes in caisson construction methods necessary to deal with the obstruction. The Contractor and the Project Engineer shall evaluate the effort made and reach agreement on the equipment and employees utilized, and the number of hours involved for each. Once these cost items and their duration have been agreed upon, the payment amount will be determined using the rate and markup methods specified in Section 1-09.6. For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount for the item "Removing Caisson Obstructions" in the bid proposal to become a part of the total bid by the Contractor.

If caisson construction equipment is idled as a result of the work required to deal with the obstruction and cannot be reasonably reassigned within the project, then standby payment for the idled equipment will be added to the payment calculations. If labor is idled as a result of the work required to deal with the obstruction and cannot be reasonably reassigned within the project, than all labor costs resulting from Contractor labor agreements and established Contractor policies will be added to the payment calculations.

The Contractor shall perform the amount of obstruction work estimated by the Contracting Agency within the original time of the Contract. The Project Engineer will consider a time adjustment and additional compensation for costs related to the extended duration of the shaft construction operations, provided:

a. The dollar amount estimated by the Contracting Agency has been exceeded, and

b. The Contractor shows that the obstruction removal work represents a delay to the completion of the project based on the current progress schedule provided in accordance with Section 1-08.3.

98% Submittal - Not for Construction

8-40 SALVAGE CONTROL CONSOLE (NEW SECTION)

8-40.1 DESCRIPTION

This Work consists of removing, salvaging, and delivering one complete, intact Control Console.

8-40.2 MATERIALS - VACANT

8-40.3 CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for handling, removing and delivering the Control Console to King County, ensuring all components are protected against damage during both removal and delivery.

The Contractor shall inform the Project Engineer 14 calendar days prior to the intended removal of the Control Console.

Work items include the following:

1. Select, in the presence of the Project Engineer, one (1) existing Control Console to be salvaged;
2. Transport the salvaged Control Console to King County within a twenty (20) mile radius as directed by the Project Engineer; the Contractor shall coordinate the delivery of the console with the Project Engineer.

8-40.4 MEASUREMENT

Salvage control console will be measured per lump sum to include all Work items as described in 8-39.5.

8-40.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Salvage Control Console", per lump sum.

The unit Contract price for "Salvage Control Console" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the removal and delivery to King County, including traffic control and all other items necessary for the Work whether or not such work is shown or specified.

8-41 TREE WATERING SYSTEM (NEW SECTION)

8-41.1 DESCRIPTION

This Work consists of installing a time release watering tube and insert for trees, according to the manufacturers written recommendations and these specifications, and as shown in the Plans.

90% Submittal - Not for Construction

8-41.2 MATERIALS

Materials shall meet the requirements of the following:

1. Dri-WATER tube and insert; as manufactured by DriWater, Inc., Santa Rosa, CA, 1-800-8458; www.driwater.com.
2. Approved equal.

8-41.3 CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for providing the tree watering system and all other essential materials necessary for the complete installation of the product. The Contractor shall be responsible for ensuring that all materials are protected from damage during offloading, handling, storing, and installation of the tree watering system product.

Work items include the following:

1. Install watering tube and insert as recommended by manufacturer at time of planting and at least one additional replacement at the beginning of the dry season, or as directed by the Project Engineer.
2. Place watering tubes with the bottom of the tube as close to the root zone as possible. Backfill with soil as specified. Cut off one end of the gel insert and place the open end down inside the tube. Gently squeeze the top of the insert until the content contacts soil. Place the cap on top of the tube and water the tree thoroughly until root ball is saturated.

8-41.4 MEASUREMENT

Tree watering system will be measured per each to include all Work items as described in 8-41.5.

8-41.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Tree Watering System", per each.

The unit Contract price for "Tree Watering System" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the installation of the product, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

8-42 ROOT BARRIER (NEW SECTION)

8-42.1 DESCRIPTION

This Work consists of installing root barrier in accordance with the manufacturers written recommendations and these specifications, and as shown in the Plans.

98% Submittal - Not for Construction

8-42.2 MATERIALS

Materials shall meet the requirements of the following:

1. Tree Root Control Barrier, recyclable, high density polypropylene or polyethylene plastic with ultra-violet inhibitors and a mean thickness of 0.08", as manufactured by Root Solutions, San Rafael, CA, 1-800-554-0914; www.vesproinc.com.

2. Century Root Barrier, as manufactured by Century Products, Anaheim, CA, 1-714-632-7083; www.centuryrootbarrier.com.

3. DeepRoot Tree Root Barrier, as manufactured by Deep Root Urban Solutions; Contact: Berkey Supply, Inc., Woodinville, WA, 1-425-487-3310; www.berkeysupply.com.

4. Approved equal.

8-42.3 CONSTRUCTION REQUIREMENTS

The Contractor shall be responsible for providing the root barrier and all other materials necessary for the complete installation of the product. The Contractor shall be responsible for ensuring that all materials are protected from damage during offloading, handling, storing, and installation of the root barrier product.

Work items include the following:

1. Install tree root control barrier as recommended by manufacturer before tree installation.

2. Root barrier shall be installed linearly along the adjacent paving edge, with panels firmly connected, and one-half (1/2) inch above the finish grade.

8-42.4 MEASUREMENT

Root barrier will be measured per linear foot to include all Work items as described in 8-42.5.

8-42.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Root Barrier", per linear foot.

The unit Contract price for "Root Barrier" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the installation of the product, and traffic control, including all other items necessary for the Work whether or not such work is shown or specified.

90% Submittal - Not for Construction

8-43 SALVAGE GENERATOR ENGINE (NEW SECTION)

8-43.1 DESCRIPTION

This Work consists of removing, salvaging, and delivering the existing emergency power generator engine and associated apparatus presently located in the north bascule pier of the existing bridge.

8-43.2 MATERIALS - VACANT

8-43.3 CONSTRUCTION REQUIREMENTS

No specific materials are required for this Work other than the equipment necessary for the removal and delivery of the salvaged item. The Contractor shall be responsible for handling, removing and disposing of fuel within the fuel storage tank, removing and delivering the generator engine to King County, ensuring all components are protected against damage during both removal and delivery.

The Contractor shall inform the Project Engineer 14 calendar days prior to the intended removal of the Generator Engine.

Work items include the following:

1. Provide written description of process and timing for complete removal and delivery of the Generator Engine;
2. Remove any fuel present in the existing fuel storage tank.
3. Remove the generator engine and associated components necessary to operate the engine including but not limited to, support frame, radiator, exhaust system, engine starting equipment and engine controls.
4. Hermetically seal all openings to the engine including exhaust, intake, engine oil fill ports and engine breathing apparatus.
5. Crate the generator engine and all associated components on timber crate(s) with provisions to allow fork lift forks to fit below the crates.
6. Seal crate(s) with two layers of clear 6 mil polyethylene sheeting.
7. Transport the salvaged generator engine and associated components to King County within a twenty (20) mile radius as directed by the Project Engineer; the Contractor shall be responsible for coordinating the delivery location and timing.
8. Unload generator engine at the King County facility and place as directed by the Project Engineer.

8-43.4 MEASUREMENT

Salvage generator engine will not be measured but paid on a lump sum basis.

8-43.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

98% Submittal - Not for Construction

"Salvage Generator Engine", per lump sum.

The unit Contract price for "Salvage Generator Engine" shall be full pay for all costs in connection with furnishing all materials, labor, tools, transportation and equipment necessary for the removal and delivery to King County and all other items necessary for the Work whether or not such work is shown or specified.

8-44 WILDLIFE PREDATION STRUCTURE (NEW SECTION)

8-44.1 DESCRIPTION

This Work consists of installing a netted structure over all wetland emergent plants.

8-44.2 MATERIALS

Materials shall meet the requirements of the following:

8-44.2(1) REINFORCING STEEL

Reinforcing steel shall meet the requirements of the Section 9-07.

8-44.2(2) NETTING

Netting shall be knotless made from High Tenacity Polypropylene (HTPP). Cord diameter shall be 1/8 inch (3mm) with 1 ¾ inch (45mm) square opening between mesh joints. HTPP materials shall have extra UV stabilizers added. Color shall be white.

8-44.2(3) NYLON CORD

Nylon cord shall be ¼ inch (6.25mm) round, white solid braid weave.

8-44.2(4) WIRE STAPLES

Wire staples should be made of minimum 11 gauge galvanized steel wire and shall be U-shaped with 11 in. legs and maximum 1 in. crown. Wire staples shall hold down the lower perimeter cord/net and be driven flush to the soil surface. Staples are located and spaced as shown on the plans.

8-44.2(5) SILVER FLAGGING TAPE

Silver flagging tape shall be 2 – 3 inch wide non-adhesive, flexible, metalized plastic flagging tape. Movable ends on either side of knot shall be min 12 inches.

8-44.2(6) NETTING TIE WIRE

Netting tie wire shall be16 gauge black annealed rebar tie wire.

8-44.2(7) REBAR SAFETY CAPS

Rebar safety caps shall be orange colored, square topped, OSHA approved plastic caps sized for #4 rebar.

98% Submittal - Not for Construction

8-44.2(8) EARTH ANCHORS

Earth anchors shall be as indicated on the Plans.

8-44.3 CONSTRUCTION REQUIREMENTS

Include the Wildlife Predation Structure in the Baseline Project Schedule and update those activities as the project progresses.

8-44.4 MEASUREMENT

Wildlife predation structure will not be measured but paid for on a lump sum basis.

8-44.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Wildlife Predation Structure", per lump sum.

The unit Contract price for "Wildlife Predation Structure" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the installation of the product including all other items necessary for the Work whether or not such work is shown or specified.

98% Submittal - Not for Construction

MATERIALS

9-01 PORTLAND CEMENT

9-01.5 CONTROLLED DENSITY FILL (CDF) – PIPE BEDDING AND TRENCH BACKFILL (NEW SECTION)

For filling pipe and for filling the annular space between 2 pipes, see Section 9-05.15.
For pipe bedding, the following CDF mix design shall be used:

PIPE BEDDING CDF	
MATERIAL	**QUANTITY**
Portland Cement Type I-II	94 pounds per cubic yard
Fly Ash	300 pounds per cubic yard
Sand,	2800 pounds per cubic yard
Water	300 pounds per cubic yard
Air Entrainment	10 ounce per cubic yard

Slump shall not exceed 7 inch.
For trench backfill, the following CDF mix design shall be used:

TRENCH BEDDING CDF	
MATERIAL	**QUANTITY**
Portland Cement Type I-II	30 pounds per cubic yard
Fly Ash	300 pounds per cubic yard
Sand,	2860 pounds per cubic yard
Water	300 pounds per cubic yard
Air Entrainment	10 ounce per cubic yard

Slump shall not exceed 7 inch.

Alternate CDF formulation: The Contractor may propose an alternate formulation and shall make a submittal on the alternate formulation in accordance with Section 1-05.3(5). This submittal shall include the following information:

1. Reason for alternate formulation and impact on application;
2. Mix design components and component quantities for a 1 cubic yard batch;
3. Strength data at 24 hours, 7 days and 28 days. The strength at 24 hours shall be not less than 15 psi when tested in accordance with ASTM D 4832.
4. Slump shall not exceed 7 inches;
5. The mixture shall not produce excessive bleed water; and
6. The 28 day strength shall be a minimum 50 psi and a maximum 100 psi when tested in Accordance with ASTM D 4832.

An exception to one or more of items 3, 4, 5, and 6 immediately above may be allowed if the reason provided in item 1 confirms no harm may result from the use of the alternate CDF mix formulation. Use of such alternate CDF formulation will not be allowed unless the Engineer provides written acceptance of the alternate formulation submittal.

98% Submittal - Moser Construction

9-03 AGGREGATES

9-03.2 MINERAL AGGREGATES FOR BIORETENTION SOIL (NEW SECTION)

9-03.2(1) GENERAL

Mineral Aggregate shall be free of wood, waste, coating, or any other deleterious material. All Mineral Aggregate passing the No. 200 sieve size shall be non-plastic.

9-03.2(2) MINERAL AGGREGATE FOR TURF AND LANDSCAPE BIORETENTION SOIL

Mineral Aggregate for turf and landscape bioretention soils shall be analyzed by an accredited lab using the sieve sizes noted below, and shall meet the following gradation:

Sieve Size	Percent Passing
3/8 inch	100
No. 4	95 – 100
No.10	75 – 90
No. 40	25 – 40
No. 100	4 – 10
No. 200	2 – 5

Efforts should be made to have the Mineral Aggregate for turf and landscape bioretention soils meet the following gradation coefficients: Coefficient of Uniformity (Cu = D60/D10) equal to or greater than 6; and Coefficient of Curve (Cc = D302/D60D10) greater than or equal to 1 and less than or equal to 3.

9-03.3 ROCK DUST FOR TREE PITS (NEW SECTION)

Unless otherwise shown on the Plans, Tree Pits shall be topdressed to the thickness noted on the Plans with Mineral Aggregate, ¼" minus "Rock Dust". Supply of the Rock Dust shall come from a yard that specifically produces ¼" minus Rock Dust as a landscape material. Source and material shall be approved by the Project Engineer. Contractor shall submit a minimum of 3 sources and a 60lb bag sample from each source for approval by the Project Engineer.

9-03.8(2) HMA TEST REQUIREMENTS

The following is added at the beginning of this section:

ESAL's

The number of ESAL's for the design and acceptance of the HMA shall be 0.4 million.

9-03.11(2) STREAMBED COBBLES

The following is added at the end of this section:

98% Substantial - Not for Construction

Streambed cobbles shall be indigenous rock from a regional source. Rock shall be Arctic Blend consisting of an equal mix of gray, brown and black colored rocks. Sizes shall range from 9” to 12” and shall consist of an equal mix of sizes unless otherwise shown in the Plans. Total depth of cobbles shall be 12” unless otherwise noted in the Plans.

9-03.11(3) STREAMBED BOULDERS

The following is added at the end of this section:

Boulders for planting and mitigation areas shall be indigenous rock from a regional source. Rock shall be a High Cascade Granite with a naturally occurring shape in accordance with Section and sizes for the boulders placed in the planting areas are as shown in the Plans. Sizes of the boulders for the rockery shall be one-man rocks each 12 to 18 inches in average dimension. Rock for the rockery shall be as nearly rectangular as possible so as to afford the minimum amount of void space between the rocks. The rock material shall be hard, sound, durable, and free from weathered portions, seams, crack, and other defects.

9-03.11(5) ROCKERY BOULDERS (NEW SECTION)

Boulders for rockery shall be indigenous rock from a regional source. Rock shall be a High Cascade Granite with a naturally occurring shape, and as nearly rectangular as possible to minimize the amount of void space between the rocks. Rock sizes for the rockery shall be one-man rocks, 12” to 18” in average dimension. The rock material shall be hard, sound, durable, and free from weathered portions, seams, crack, and other defects.

9-03.12(1)B CLASS B

This section is deleted in its entirety and replaced with the following:

Gravel backfill for foundations for drainage structures shall be Type 9 Mineral Aggregate With Portland Cement. See Section 7-05.3 Bedding and Foundation Support for Precast Base Section and Bedding and Foundation Support for Cast-in-Place Base Section.

9-03.12(3)A GRAVEL AND SAND BACKFILL FOR PIPE BEDDING (NEW SECTION)

The Contract specified class of Sewer and Storm Drain pipe bedding shall comply with both COSP number 285 and Section 7-17.2(4)B, and shall be Mineral Aggregate Type 9 and Type 22 as specified below.

Mineral Aggregate Type 2 (1-1/4" Minus Crushed Rock)

Sieve Size	Percent Passing
1-1/4" square	100
5/8″ square	50-80
1/4″ square	30-50

90% Submittal - Not for Construction

U.S. No. 40	3-18
U.S. No. 200	0-7.5

Sand Equivalent 40 minimum.

Mineral Aggregate Type 4 (1-1/2" Washed Gravel)

Sieve Size	Percent Passing
1-1/2" square	100
1-1/4″ square	90-100
3/4″ square	0-20
3/8″ square	0-2
U.S. No. 200	0-0.5

Mineral Aggregate Type 9 (3/8" Washed Gravel)

Sieve Size	Percent Passing
3/4" square	100
3/8″ square	80-100
U.S. No. 8	0-10
U.S. No. 200	0-3

Mineral Aggregate Type 17 (Bank Run Gravel)

Sieve Size	Percent Passing
3″ square	95-100
¼” square	25-75
U.S. No. 200	0-5

Sand Equivalent 60 minimum and 2/3 dust ratio.

Mineral Aggregate Type 22 (3/4" Crushed Gravel)

Sieve Size	Percent Passing
1/2" square	100
1/4″ square	70-100
U.S. No. 10	40-75
U.S. No. 200	2-12

Mineral Aggregate Type 26 (3/4" Washed Gravel)

Sieve Size	Percent Passing
3/4" square	100
1/4″ square	30-60
U.S. No. 8	20-50

98% Submittal - Not for Construction

U.S. No. 50	3-12
U.S. No. 200	0-1

Pea gravel bedding, Mineral Aggregate Type 9, shall consist of screened sand, gravel, or other inert materials, or combinations thereof, from sources approved by the Project Engineer, and shall have hard, strong, durable particles free from adherent coatings. The material shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances. The amount of deleterious substances remaining in the washed pea gravel shall not exceed values specified in Section 9-03.1(4)A.

Crushed gravel bedding, Mineral Aggregate Type 22 shall be manufactured from screened crushed gravel. The finished product shall be clean, uniform in quality, and free from wood, bark, roots, and other deleterious materials. The crushed screenings shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50 percent of the surface area of any size between successive laboratory sieves. The portion of Mineral Aggregate Type 22 retained on all sieves with a 1/4 inch opening and larger shall not contain more than 0.1 percent deleterious materials by weight.

9-03.12(4) GRAVEL BACKFILL FOR DRAINS

This section is deleted in its entirety and replaced with the following:

Gravel backfill for drains shall meet the requirements for Mineral Aggregate Type 26.

9-04 JOINT AND CRACK SEALING MATERIALS

9-04.3(1) NON-SHRINK CEMENT SAND GROUT (NEW SECTION)

9-04.3(1)A GENERAL

Prior to placing the grout, the contact surface shall be thoroughly cleaned, roughened and wetted with water. The grout shall be covered with burlap sacks after the initial concrete set, promptly wetted, and maintained continuously moist until the required strength is obtained.

9-04.3(1)B GROUT FOR ANCHOR BOLTS, BRIDGE BEARINGS, AND DRAINAGE STRUCTURE

Non-shrink cement sand grout used for grouting anchor bolts and bridge bearings, curb section to pavement anchors, and for use in drainage Structures other than pipe connections, may be a prepackaged grout, or produced using Type I, II, or III Portland cement; fine aggregate Class 1 or Class 2; and sufficient water to make a workable mix with flowability suitable for the intended application. Compressive strength shall be a minimum 4000 psi @ 3 Days.

9-04.3(1)C GROUT FOR PIPE CONNECTIONS AND POLES & PEDESTALS

Non-shrink cement sand grout for pipe connections to manholes, catch basins, inlets, and similar utility appurtenances; installing tees; grouting under poles and pedestals; and similar uses shall meet the following requirements:

95% Submittal - Not for Construction

1. 1-part, by weight, Type III (H.E.S.) cement;

2. 2-parts, by weight, clean fine aggregate Class 1 or Class 2; and

3. Sufficient water to obtain a stiff consistency. The use of calcium chloride will not be allowed.

Unpolished aluminum powder shall be added to the dry cement in the proportion of one heaping teaspoonful per sack of cement no more than 30 minutes before the grout mixture reaches its final in-place position. The required compressive **STRENGTH SHALL BE A MINIMUM 4,000 PSI @ 7 DAYS.**

9-05 DRAINAGE STRUCTURES, CULVERTS, AND CONDUITS

9-05.8 VITRIFIED CLAY SEWER PIPE

This section is deleted in its entirety and replaced with the following:

Vitrified clay pipe shall conform to ASTM C 700, and all joints shall be factory manufactured in accordance with ASTMC 425. When a low-pressure air test is conducted, VCP shall be tested in accordance with ASTM C 828.

Vitrified clay pipe shall be installed as specified in the Contract.

9-05.10 STEEL STORM SEWER PIPE

The following is added at the end of this section:

Pipe, SD, Steel Sch 40, 8 In. shall be Type S Grade B, A53 schedule 40 plain end or grooved end. For grooved end, use only factory, or field-formed square cut or rolled-formed grooves per coupling manufacturer's specifications. The pipe shall be galvanized per ASTM A 123.

Fittings shall be ductile iron grooved end fittings conforming to ASTM A536 and as manufactured by the grooved end coupling manufacturer.

Flanges shall be Class 150 forged steel, ASTM A105, weld neck, raised face or faced to match mating equipment or valves.

Mechanical grooved couplings shall be flexible Victaulic Style 77 or rigid Style 07 type as indicated on the Plans, with hot dip galvanized housings from the factory and with Grade "E" EPDM (-30F to +230F) Flush Seal style gaskets. Coupling housings shall be of ductile iron conforming to ASTM A 536. For couplings 8-inch size use couplings FM rated for 500 psi. Coupling bolts and nuts shall be heat treated, zinc electroplated to ASTM B-633 track-head style conforming to physical properties of ASTM A-183 minimum tensile strength of 110,000 psi.

All couplings used shall be by the same manufacturer.

All pipe and fitting described above shall be hot dip galvanized in accordance with ASTM A 123. All mechanical grooved fittings, ductile iron or steel, shall be furnished hot dip galvanized from the vendors shop.

Draft Submittal - Not for Construction

Where shown on the plans, Flange by Flange Expansion Couplings shall be flanged and meet the requirements of AWWA C221 and be set for a minimum of 10 inches of movement (each) . Joints shall be positioned close to a support hanger and allow for full expansion or compression of the fitting.

Where shown on the plans, Flange by Flange single ball or double ball expansion joints shall be ASTM A536 Ductile Iron with an ethylene propylene diene methylene rubber casing cover, casing gasket, and ball gasket. The sleeve shall be ASTM A536 flanged. The fitting shall be galvanized or epoxy coated and provide a minimum of 17 degrees deflection and 3 inches of expansion.

9-05.10A COATED STEEL CASING (SIZE) IN. DIAM. AND (SIZE) IN. THICK (NEW SECTION)

Coated Steel Casing (Size) In. Diam. and (Size) In. Thick shall be high strength steel casing conforming to the requirements of ASTM A139, Grade B A53 and AWWA C200. All field welding shall be done in accordance with ANSI/AWS D 1.1 for full penetration welds.

Casing pipe shall be placed where indicated on the Contract Plans, and shall have welded connections. After assembly, defects in the coating shall be repaired. This shall specifically include the lining on the interior of the pipe.

The Contractor shall install the carrier pipe inside the casing pipe without damage to the interior lining of the casing or damage to the exterior coating of the carrier. The Contractor shall submit his proposed procedure to the Project Engineer for comments. To ensure proper pipe support between the carrier pipe and the casing pipe a lean mix grout shall be placed inside the annular space from the bottom (invert) of the casing to the middle (spring line) of the casing pipe.

Manholes or catch basins shall be installed for terminal casing pipe, as specified and as shown on the Contract Plans.

The coating shall be epoxy coating 10 mil thick min.

Where drop structures exist on the sanitary sewer line, terminate steel casing pipe a maximum of 3 feet from the manhole to allow proper drop connection installation.

9-05.10B PLASTIC FOAM (ETHAFOAM) (NEW SECTION)

Polyethylene plastic foam used in the underground utility separation shall meet the Federal Specification PPP-C-1752C Type 1, Class 2, (Ethafoam).

9-05.13 DUCTILE IRON SEWER PIPE

The following is added at the end of this section:

Where shown on the plans, Flexible Expansion Joints shall meet the requirements of AWWA C221 and be set for a minimum of 10 inches of movement each. Joints shall be positioned close to a support hanger and allow for full expansion or compression of the fitting.

90% Submittal - Not for Construction

Where shown on the plans, double ball expansion joints shall be ASTM A536 Ductile Iron with an ethylene propylene diene methylene rubber casing cover, casing gasket, and ball gasket. The sleeve shall be ASTM A536 flanged. The fitting shall be galvanized or epoxy coated and provide a minimum of 17 degrees deflection and 3 inches of expansion.

9-05.15(1) MANHOLE RING AND COVER

This section is deleted in its entirety and replaced with the following:

The inside vertical recessed face of the ring and the vertical outside edge of the cover shall be machined or manufactured to the following tolerances:

Ring	+3/32 inch to -3/32 inch
Cover	+3/32 inch to -3/32 inch

Ring and cover casting dimensions shall conform to the Standard. Rings and ring extensions shall be manufactured from cast iron ASTM A 48, Class 30 or ductile iron ASTM A536, Grade 80-55-06. Covers shall be manufactured from ductile iron ASTM A536, Grade 80-55-06. Rings and covers shall be free of defects such as porosity, pitting, shrink cavities, cold shuts, cracks, and other surface defects which would impair serviceability. Repair of defects by welding or by the use of "smooth-on plasticized metals" or similar material will not be accepted. Manufacturer shall certify that the product conforms to the requirements of these Specifications. In accordance with Section 1-06.1, where source of material is different from manufacturer, the Contractor shall also provide the name and location of the manufacturer.

Castings shall be bare metal. Artificially coated or painted castings will be cause for rejection.

Castings shall be machine finished on the horizontal seating surface and the vertical facing surface common to the ring and cover, so as to assure full bearing (non-rocking) for the entire width and circumference of the bearing surface, and permit interchangeability with other castings of the same design, no matter what the source. The vertical face common to the ring and cover shall be beveled as shown on the Standard Plans. Upon request of the Project Engineer, the manufacturer shall furnish at the foundry standard ring and covers for use by Inspectors in testing fit and seating.

All covers shall be labeled with the following information:

1. Name or symbol of the manufacturer;
2. Owner's name (City of Seattle (in the Seattle City limits)), and King County (within the County and Tukwila City Limits) min. 1/2 inch letters recessed flush with adjacent surface);
3. Material label "DUC" for Ductile Iron;
4. Identification of its use in 3 inch high lettering (Sewer, Drain, etc.); and

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5. Country of manufacture/origin. Items 2. and 4. shall be on the exposed face of the cover.

Items 1., 3., and 5. shall be located at the manufacturer's option. If located on the exposed face of the cover, item 1. and 3. shall be adjacent to each other and shall be set in at least 1/2 inch high recessed letters. Where lock-type castings are called for, a locking device shall permit the cover to be readily released from the ring. Movable parts shall be made of non-corrosive metals and be designed to avoid possible binding. Upon request by the Project Engineer, the manufacturer shall furnish testing apparatus at the foundry Capable of applying uplift pressure on the lid of at least 20 foot head of water which the assembly needs to withstand without failure.

All manhole rings shall be labeled with the name or symbol of the manufacturer and the type of material.

Where additional depth to a COSP number 230 frame is required, COSP number 231 ring extensions shall be securely bonded to the frame by epoxy at the manufacturer's facility. The Contractor shall provide a Manufacturer's Certificate of Compliance verifying this prior to installing the built up frame at the Project Site.

9-05.21 DEBRIS CAGE (NEW SECTION)

Debris cage shall be aluminized steel per AASHTO M-274 (ASTM A929) in accordance with Section 9-05.18 (except the steel shall be aluminized). Debris cage shall be shop fabricated in accordance with King County Figure 7-028.

9-05.22 MANHOLES

The following is added at the end of the first paragraph:

Precast manhole components shall conform to ASTM C 478 except as modified in Section 7-05.

The second paragraph is deleted and replaced with the following:

Joints between sections shall be tongue and groove, and shall provide 1/2 inch nominal annular space and a minimum of 1-1/4 inches lap.

9-05.23 STORMWATER WET VAULT (NEW SECTION)

Stormwater Wet Vaults shall be constructed to form a watertight concrete box and concrete lid. The lid for Vaults shall be as indicated on the Plans. Contractor shall provide shop drawings for the Stormwater Wet Vault. Whenever there is a design change to the Vault, a proof test, as defined in this Specification, shall be performed once in the presence of the Project Engineer.

Vaults shall be concrete (conforming to concrete exposed to sea water) constructed in accordance with Section 7-05.3(6)G, and have a minimum load rating for HS-25. Concrete for shall have a minimum compressive strength of 4000 psi. The frame shall be anchored to the vault by welding the wire fabric to the frame or by welding headed studs ⅜ inch x 3 inches long, as specified in

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Section 9-06.15, to the frame. The wire fabric shall be attached to the studs and frame with standard tie practices. The vault shall contain studs located near the centerline of the frame and wall. Studs shall be placed with a minimum of one anchor in each corner, one at the middle of each width and two equally spaced on each length of the vault/box. The steel lid support beam shall be painted with a black paint containing rust inhibiters or painted with a shop applied, inorganic zinc primer in accordance with Section 6-07.3 or hot dip galvanized in accordance with ASTM A 111. Material for Vaults shall conform to the following:

Concrete	Section 6-02 (Concrete exposed to sea water)
Reinforcing Steel	Section 9-07
Lid Support beam	ASTM A36 steel
Anchors (studs)	Section 9-06.15
Bolts, Nuts, Washers	ASTM F593 or A 193, type 304 or 316

Vault Risers

Vault risers shall be concrete with a minimum compressive strength of 4000 psi. Reinforcing steel shall conform to Section 9-07.

Vault Lid Markings

Vault manhole lid markings shall be according to King County Figure 7-022.

Vault Grates Markings

Grates shall not be required to have markings.

9-05.24 REINFORCED CONCRETE (NEW SECTION)

General

Reinforced concrete shall consist of Portland cement, fine and coarse aggregates and water, in which steel has been embedded in such manner that the steel and concrete act together.

All cast-in-place concrete shall be Class 4000. strength determination shall be in accordance with ASTM C 39. Precast components shall conform to the strength requirements of ASTM C 478.

The use of admixtures shall require prior approval of the Engineer. Concrete with air-entraining admixture shall comply with ASTM C 175.

Cement

Portland cement shall conform to the requirements of Section 9-01.

Steel Reinforcement

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Reinforcement shall consist of wire conforming to ASTM A82 or ASTM A496, or wire fabric conforming to ASTM A185 or ASTM A 497, or Grade 60 steel bars conforming to ASTM A615 or Grade 80 steel bars conforming to ASTM A 306.

Aggregates

Aggregates for cast-in-place concrete shall conform to ASTM C 33.

9-06 STRUCTURAL STEEL AND RELATED MATERIALS

9-06.19 METAL TRAFFIC BARRIERS (NEW SECTION)

Metal traffic barriers shall conform to the type and material Specifications set forth in the Plans and Special Provisions. Steel used for metal railings, when galvanized after fabrication in accordance with AASHTO M 111, shall have a controlled silicon content of either 0.00 to 0.04 percent or 0.15 to 0.25 percent. Mill test certificates verifying the silicon content of the steel shall be submitted to both the galvanizer and the Project Engineer prior to beginning galvanizing operations.

9-08 PAINTS AND RELATED MATERIALS

9-08.1(8) STANDARD COLORS

This section is replaced in its entirety and replaced with the following:

When paint is required to match a Federal Standard color, the paint manufacturer or the Contractor may obtain a sample of the required color through the following internet link - http://www.colorserver.net.

When paint is required to match a WSDOT color (Washington Gray, Mt St Helens Gray, Mt Baker Gray or Cascade Green), the paint color shall conform to the Delta E deviation and CIELAB spectrophotometer analysis requirements specified in Section 9-08.3 for the corresponding color.

When paint is required to match a color similar to the proprietary color a specified manufacturer (Tnemec color "Silver Bullet 323MT), the paint color shall conform to the Delta E deviation and CIELAB spectrophotometer analysis requirements specified in Section 9-08.3 for the corresponding color as determined by the Project Engineer.

Unless otherwise specified, all top or finish coats shall be semi-gloss, with the paint falling within the range of 35 to 70 on the 60 degree gloss meter.

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9-12 MASONRY UNITS

9-12.8 STEPS, HANDHOLDS, AND LADDERS (NEW SECTION)

The Material for manhole steps, ladders, and handholds shall be the same material in any individual drainage Structure. See Section 7-05.3(5)Q for submittal requirement. Sizes of components, dimensions and layout shall conform to Standard Plan no. 232.

9-12.9 POLYPROPYLENE ENCAPSULATED REINFORCING STEEL STEPS (NEW SECTION)

Polypropylene steel reinforced steps shall be made of copolymer polypropylene plastic that encapsulates a 1/2 inch diameter grade 60 steel reinforcing steel. Steel reinforcing shall conform to the requirements of ASTM A 615, and copolymer polypropylene plastic shall conform to requirements of ASTM D 4101. Steps shall have serrated tread, measure 13 inches center to center between legs of the step, and be designed to withstand pullout forces of 1500 pounds.

9-13 RIPRAP, QUARRY SPALLS, SLOPE PROTECTION, AND ROCK WALLS

9-13.1(3) HABITAT GRAVEL MIX (NEW SECTION)

Habitat Gravel Mix shall consist of rounded rock with the following gradation:

Percent Less Than (By Weight)	Average Diameter
100	2-inch
80 - 95	1½-inch
50 – 80	¾-inch
30 – 50	No. 4 sieve
0 - 8	No. 200 sieve

9-14 EROSION CONTROL AND ROADSIDE PLANTING

9-14.1(1) TOPSOIL TYPE A

This section is deleted in its entirety and replaced with the following:

Topsoil Type A shall consist of a uniform blend composed by volume of 70-80% aggregate, and 20-30% compost. Ninety five percent of this mixture shall pass through a 1-inch sieve.

Aggregate

Aggregate shall consist of Backfill for Sand Drains, Section 9-03.13 or Fine Aggregate for Portland Cement Concrete, Class 2, Section 9-03.1(2)B. The Contractor shall certify that the material is not detrimental to plant life.

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Compost

Compost shall be fine compost and meet the material requirements as specified in Section 9-14.4(8).

Mixing Requirements

The Contractor shall submit in writing, for the Project Engineers approval, the proposed method of mixing. No mixing shall take place without written approval from the Project Engineer.

Topsoil Type A shall be thoroughly mixed prior to being placed.

9-14.1(3) BIORETENTION SOIL (SPECIAL SOIL MIX) (NEW SECTION

Section 9-14.1(3) is deleted in its entirety along with the title and replaced with this section.

General

Bioretention soil shall be a well blended mixture of Mineral Aggregate and compost measured on a volume basis. For Bioretention Soil used in rain gardens, the bioretention soil shall be protected from all sources of additional moisture at the Supplier, in covered conveyance, and at the project site until incorporated into the Work. The mixing, placement and compaction of Bioretention Soil will not be allowed if the area receiving the soil is frozen, saturated, or has been subject to more than a ½ inch of precipitation within 48-hours prior to mixing or placement. The Project Engineer shall have final authority to determine if wet or saturated conditions exist.

Landscape Bioretention Soil (Special Soil Mix)

Landscape Bioretention Soil shall consist of two parts compost (approximately 35 to 40 percent) by volume meeting the requirements of Section 9-14.4(8) and three parts Mineral Aggregate (approximately 60 to 65 percent), by volume meeting the requirements of Section 9-03.2. The mixture shall be well blended to produce a homogeneous mix. Organic matter content shall be 8 to 10 percent, with the final mix to be determined by the Project Engineer based on samples and test results submitted.

The landscape bioretention soil (special soil mix) shall be installed over the bottom and side slopes of the rain garden facility prior to planting, seeding, and/or erosion control matting to the depths detailed in the plans. Place soil in loose lifts not exceeding 6 inches. Compact the Bioretention Soil to a relative compaction of 85% of modified maximum dry density (ASTM D 1557), where slopes allow, as determined by the Project Engineer. Water shall not be used for settlement.

9-14.4 MULCH AND AMENDMENTS

The following is added at the end of this section:

Soil Amendments

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Soil amendments shall be coarse compost.

Shredded wood mulch for installation in rain garden areas shall meet the following minimum requirements:

Shredded wood mulch shall be chipped and/or shredded tree trimmings containing a combination of whole tree/shrub parts, including but not limited to: bark, woody parts, foliage, needles, and the like, such that a gradation of material size of approximately 3 inch to 4 inch minus [3" - 4" (-)] will be present.

For blown-on application, the shredded mulch material may be screened to a minimum size of 3/8 to ½ inch minus [3/8" -1/2" (-)]. Shredded wood mulch shall be free of root parts and weeds, and shall not contain excessive resin, tannin, rocks, garbage or other ingredients detrimental to plant life.

9-14.4(8) COMPOSTED MATERIAL (NEW SECTION

Section 9-14.4(8) is deleted in its entirety along with the title and replaced with this section.

Compost products shall be the result of the biological degradation and transformation of Type I or III feedstocks under controlled conditions designed to promote aerobic decomposition, per WAC 173-350-220, which is available at http://www.ecy.wa.gov/programs/swfa/compost. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation. Compost shall be mature with regard to its suitability for serving as a soil amendment or an erosion control BMP as defined below. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.

Compost production and quality shall comply with Chapter 173-350 WAC, and meet the following physical criteria:

1. Compost material shall be tested in accordance with Testing Methods for the Examination of Compost and Composting (TMECC) Test Method 02.02-B, "Sample Sieving for Aggregate Size Classification".

   Compost shall meet the following:

	Min.	Max.
Percent passing 1"	99%	100%
Percent passing 5/8"	90%	100%
Percent passing 1/4"	40%	90%

2. The pH shall be between 5.5 and 8.0 when tested in accordance with TMECC 04.11-A, "1:5 Slurry pH".

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3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight as determined by TMECC 03.08-A "percent dry weight basis".

4. Organic matter content should be between 45 and 65 percent dry weight basis as determined by TMECC 05.07A, “Loss-On-Ignition Organic Matter Method”.

5. Soluble salt contents shall be less than 6.0 mmhos/cm tested in accordance with TMECC 04.10-A, “1:5 Slurry Method, Mass Basis”.

6. Maturity shall be greater than 80% in accordance with TMECC 05.05-A, “Germination and Vigor”.

7. Stability shall be 7 or below in accordance with TMECC 05.08-B, Carbon Dioxide Evolution Rate”.

8. The compost product must originate a minimum of 65 percent by volume from recycled plant waste as defined in WAC 173-350-100 as “Type 1 Feedstocks.” A maximum of 35 percent by volume of other approved organic waste as defined in WAC 173-350-100 as “Type III”, including post-consumer food waste, but not including biosolids, may be substituted for recycled plant waste. The supplier shall provide written verification of feedstock sources.

9. Carbon to nitrogen ratio shall be less than 25:1 as determined using TMECC 04.01 “Total Carbon” and TMECC 04.02D “Total Kjeldhal Nitrogen”. The Project Engineer may specify a C:N ratio up to 35:1 for projects where the plants selected are entirely Puget Sound native species.

10. The Project Engineer may also evaluate compost for maturity using the Solvita Compost Maturity Test at time of delivery. Compost shall score a number 6 or above on the Solvita Compost Maturity Test.

The compost supplier shall test all compost products within 90 calendar days prior to application. Samples shall be collected using the Seal of Testing Assurance (STA) sample collection protocol. The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org. The sample shall be sent to an independent STA Program approved laboratory. The compost supplier shall pay for the test. A copy of the approved independent STA Program laboratory test report shall be submitted to the Project Engineer prior to initial application of the compost. Seven calendar days prior to application, the Contractor shall submit a sample of each type of compost to be used on the project to the Project Engineer.

Compost not conforming to the above requirements or taken from a source other than those tested and accepted shall be immediately removed from the project and replaced at no cost to the Owner.

The Contractor shall submit the following information to the Project Engineer for approval:

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1. A copy of the Solid Waste Handling Permit issued to the supplier by the Jurisdictional Health Department as per WAC 173-350 (Minimum Functional Standards for Solid Waste Handling).

2. The supplier shall verify in writing, and provide lab analyses that the materials comply with the processes, testing, and standards specified in WAC 173-350 and these Specifications. An independent STA Program certified laboratory shall perform the analysis.

3. A list of the feedstock by percentage present in the final compost product.

4. A copy of the producer's STA certification as issued by the U.S. Composting Council.

Acceptance shall be based upon a satisfactory Test Report from an independent STA program certified laboratory and the sample(s) submitted to the Project Engineer.

9-14.6(6) SUBSTITUTION OF PLANTS

The following is added at the end of this section:

The Contractor is advised that a growing Contract may be necessary to secure the required quantities, the specified size, variety, and grade of plant material.

9-16 FENCE AND GUARDRAIL

9-16.9 SECURITY CHAIN LINK FENCE AND GATES (NEW SECTION)

9-16.9(1) GENERAL

The fence shall be chain link fabric supported on a steel frame, the posts of which are embedded in concrete foundations. Barbed wire supported on brackets above the fabric portion shall be installed as indicated on the Plans. Materials shall be heavy industrial chain link fencing in accordance with ASTM F1043, with the additional requirements as follows:

Fencing, gates and appurtenances shall be erected and installed by an organization regularly engaged in this business, employing labor skilled in this type of work to provide a complete security fencing system.

9-16.9(2) SECURITY FENCE TYPES

"Security Chain Link Fence" shall be 8-foot high fence, including barbed-wire overhang as shown on the Plans.

"Security Single Swing Gate" shall be single, 8-foot high gate, barbed wire as shown on the Plans. The gate opening shall be as shown on the Plans.

"Security Double Swing Gate" shall be double, 8-foot high gate, barbed wire as shown on the Plans. The gate opening shall be as shown on the Plans.

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9-16.9(3) FABRIC

Vinyl coated steel fabric shall be woven 9-gauge polyvinyl chloride (PVC) coated aluminum-coated steel wire in 2-inch mesh and shall meet the requirements of ASTM F 668, Class 2b. The fabric shall conform to the requirements of ASTM A 491. Vinyl coating shall conform to the requirements of ASTM F 1043, Paragraph 7.3 Optional Supplemental Color Coating. Color shall be non-reflective black.

Fabric shall be fastened to posts, the top rail and the bottom wire with wire ties.

9-16.9(4) FRAMEWORK

Framework and coating shall be in accordance with ASTM F1083 and F1043.

Framework shall be hot dipped galvanized Schedule-40 pipe conforming to ASTM F1083 or cold rolling and radial frequency welded steel pipe conforming to ASTM A653 or A569 with a minimum yield strength of 50,000 psi. Exterior and interior coatings in accordance with ASTM F1043 Type B outside with a minimum of 0.9 oz. of zinc per sq. ft. after welding, a chromite conversion coating and a clear polymer overcoat; type B inside with a minimum of 0.9 oz. of zinc per sq. ft.

All exterior tubular framework shall be in accordance with ASTM B117 and shall meet the requirements of 1000 hours with a maximum 5% red rust.

Top rail shall be continuous. The Contractor shall provide for expansion or contraction of the continuous rail. Expansion and contraction spring couplings shall be installed at intervals of 100 feet maximum.

Line posts shall be 2.375-inch O.D., 3.65 pounds per foot, or “C” section at 2.70 pounds per foot and shall be installed vertically in the concrete.

End, corner, or pull posts shall be 4-inch O.D., at 9.11 pounds per foot.

Swing gate posts shall be 6.625-inch O.D. at 18.97 pounds per foot.

Top rails and post braces shall be 1.66-inch O.D. at 2.27 pounds per foot.

Tension wire shall be No. 7 gauge, coil spring, high tensile strength wire, Marcelled and coated with not less than 0.80 oz. of zinc per square foot of uncoated wire surface.

9-16.9(5) FITTINGS

All fittings, accessories and hardware for galvanized chain link fence shall conform to the requirements of ASTM F626.

9-16.9(6) GATES

Gates shall be constructed with fabric fastened to the end bars of the gate frame by tension bars and fabric bands, and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric.

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Gate frames shall be constructed in accordance with ASTM F900. The corners of the gate frame shall be welded and coated with two coats of GALVACON or shall be manufacturer's standard galvanized cast corner connections.

Cross-trussing shall be 3/8-inch galvanized steel adjustable rods.

Each gate shall be provided complete with necessary hinges, latch and drop bar locking device designed for the type of gate, posts and lock used.

Gates shall have positive-type latching devices with provisions for padlocking.

9-16.9(7) BARBED WIRE

Each barbed wire shall conform to the requirements of ASTM A121 and shall consist of two strands of 12-1/2 gauge galvanized wire, twisted with 4-point, 14 gauge barbs with the barbs spaced an average of five inches apart. Galvanizing shall be Class 3.

9-16.9(8) CONCRETE

Concrete used in anchorage of posts shall meet the requirements of Section 5-05.

9-16.9(9) DAMAGES

Minor damage to galvanizing of fabric and fence appurtenances shall be repaired by thorough cleaning of the damaged surfaces and the application of coated with zinc rich paint, Galvacon, ZRC, or equal in strict accordance with the manufacturer's recommendations.

9-19 PRESTRESSED CONCRETE GIRDERS

9-19.1 AGGREGATES AND PROPORTIONING

The second paragraph is deleted and replaced with the following:

The Contractor shall submit a Contractor-Provided mix design for each design strength of prestressed girder to the Project Engineer for approval in accordance with Section 6-02.3(2)A, including a Contractor-Provided mix design of high strength concrete for the prestressed girders of "Superstructure - _____ Approach Span".

Approval of the mix design will not preclude any requirements for the concrete placed in the girders.

The Contractor-Provided mix design for high strength concrete shall conform to the following:

Bridge	Minimum Compressive Strength in psi at 56 days in accordance with AASHTO T 22
"Superstructure – _____ Approach Span"	9.7 KSI & 10.0 KSI

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The Contractor may substitute testing for minimum compressive strength at 28 days, provided that the 28 day compressive strength is equal to or greater than 95 percent of the specified 56 day compressive strength.

The Contractor shall test a minimum of three specimens for each of the tests specified. The test specimens for the compressive strength tests shall be four inch by eight inch cylinders cast in molds supplied by the Contractor in accordance with Section 6-02.3(5)D. The Contractor shall include the results of all tests in the high strength concrete mix design submittal to the Project Engineer.

9-29 ILLUMINATION, SIGNAL, ELECTRICAL

9-29.2(1) STANDARD DUTY AND HEAVY DUTY JUNCTION BOXES

The first and second paragraphs in this section are deleted and replaced with the following:

Install standard duty and heavy duty junction boxes in locations shown in the Plans. Standard duty and heavy duty junction boxes shall be concrete junction boxes conforming to details in the WSDOT Standard Plans..

Concrete junction boxes shall have a minimum compressive strength of 6000 psi when reinforced with a welded wire hoop and 4000 psi when reinforced with welded wire fabric or fiber reinforcement. The frame shall be anchored to the box by welding the wire fabric to the frame or by welding headed studs 3/8 inch x 3 inches long, as specified in Section 9-06.15, to the frame. The wire fabric shall be attached to the studs and frame with standard tie practices. The box shall contain ten studs located near the centerline of the frame and box wall. The studs shall be placed one anchor in each corner, one at the middle of each width and two equally spaced on each length of the box. The steel frame, lid support, and lid shall be hot dip galvanized in accordance with AASHTO M 111.

9-29.3(2)A5 SINGLE CONDUCTOR CONTROL (NEW SECTION)

All single conductors shall be Class B or Class C stranded copper. The minimum wire size shall be No. 12 AWG. Insulation shall be as shown in the plans except loop wire.

9-29.6(5) FOUNDATION HARDWARE

The second paragraph in this section is deleted and replaced with the following:

Anchor bolts for Type X, Y and Z signal poles shall meet the requirements of ASTM A 449. Anchor bolts for luminaire poles shall meet the requirements of ASTM A 307. Nuts shall be heavy hex meeting the requirements of AASHTO M 291, Grade C, D, or DH. Washers shall meet the requirements of AASHTO M 293.

9-29.9 BALLAST, TRANSFORMERS

The first paragraph in this section is deleted and replaced with the following:

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Each ballast shall have a name plate attached permanently to the case listing all electrical data. In addition, the Contractor shall provide warranty cards and warranty information for each ballast prior to approval of illumination system by the Electrical Inspector. The warranty duration for each ballast shall be a minimum of 1-year.

9-29.10 LUMINAIRES

The first sentence of the first paragraph in this section is deleted and replaced with the following:

If not listed on the Qualified Products List (QPL) a Certificate of Compliance shall be submitted by the manufacturer with each type of luminaire along with a minimum 1-year warranty on the lamp.

The following is added at the end of this section

Roadway luminaire

1. "Universe Collection" by Architectural Area Lighting.
   a. Model Number: UCL-SR-FLR-H2-400HPS-MAL
   b. Manufacturer Information:

      Architectural Area Lighting
      14249 Artesia Boulevard
      La Mirada, CA 90638
      Telephone: (714) 994-2700

      www.aal.net

Sidewalk luminaire

1. "K56 Post Top" by King Luminaire.
   a. Model Number: K56-C-T-SAR-III-150-(MOG)-HPS-120-XX*

      Paint color shall be "Silverbrite" with "flat" finish.
   b. Manufacturer Information:

      14503 Wallick Road
      Atchison, Kansas 66002
      Telephone: 1-800-837-1024
      Fax: (913) 255-3124

      www.kingluminaire.com

Accent luminaires at rocker locations

1. "Paradox" by Hydrel – Fixture Size 10"

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a. Model Numbers:

1) PDX10 SS 22LED WMW MVOLT MFL FLC

2) PDX10 SS 22LED WMW MVOLT SP FLC

b. Manufacturer Information:

Hydrel Lighting
20660 Nordhoff St., Suite B
Chatsworth, CA 91311
Telephone: (866) 533-9901
Fax: (866) 533-5291

www.hydrel.com

2. "LED InGround Light XIG" by LSI Indutries – Fixture Size 9-1/2"

a. Model Number:

XIG-B-LED-19-CW-120-MSV

b. Manufacturer Information:

LSI Industries
10000 Alliance Road
Cincinnati, OH 45242
Telephone: (513) 793-3200
Fax: (513) 984-1335

www.lsi-industries.com

3. "Centaur CE8" by Designplan Lighting – Fixture Size 7-7/8"

a. Model Number:

CE8-L-1J-4-SS-1-Z-T

b. Manufacturer Information:

Designplan Lighting Inc.
79 Trenton Avenue
Frenchtown, NJ 08825
Telephone: (908) 996-7710
Fax: (908) 996-7042

www.designplan.com

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9-29.11 CONTROL EQUIPMENT

The first paragraph in this section is deleted and replaced with the following:

Illumination circuits shall be controlled by a combination of photoelectric controls and lighting contactors as noted in the Contract. The photocell shall be mounted on top of the luminaire closest to the electrical service. A 3/C #14 IMSA cable shall be provided from the photocell to the electrical service.

9-29.11(2) PHOTOELECTRIC CONTROLS

The first paragraph in this section is deleted and replaced with the following:

The photoelectric control shall be the twistlock type and the light sensitive element shall be a solid state photo diode. The control shall be designed to turn on at 3 foot-candles (32 lux) and turn off at 1.8 foot-candles (20 lux). The lighting control shall not drift by more than 1 percent over a 10-year period. The photoelectric control shall have a minimum 1-year warranty.

9-29.12(1) ILLUMINATION CIRCUIT SPLICES

This section is deleted in its entirety and replaced with the following:

Splices and taps shall be made with solderless crimp connectors on underground circuits to securely join the wires both mechanically and electrically. Aerial splices may employ split bolt connectors. Splices at below grade locations shall employ epoxy resin cast type insulation. Two-way (in-line) splices and three-way (T or wye) splices shall employ clear rigid plastic molds. Clear mylar sheet bonded to butyrate webbing forming a flexible mold shall be used for four-way or more. The material used shall be compatible with the insulation material utilized. Equipment and methods shall be as recommended by the manufacturer of the splicing materials. The component materials of the resin insulation shall be packaged form ready for convenient mixing without removing from the package. Only one conductor or one multi conductor cable per wire entrance will be allowed in any rigid mold splice.

9-29.12(2) TRAFFIC SIGNAL SPLICE MATERIAL

This section is deleted in its entirety.

9-29.12(3) TRAFFIC LOOP WIRE ENCAPSULEMENT (NEW SECTION)

The detector loop sealant shall be a flexible traffic loop wire encapsulement. Encapsulement shall be designated to enable vehicular traffic to pass over the properly filled sawcut within five minutes after installation without cracking of material. The encapsulement shall form a surface skin allowing exposure to vehicular traffic within 30 minutes at 75° F. and completely cure to a tough rubber-like consistency within two to seven calendar days after installation. Properly installed and cured encapsulement shall exhibit resistance to defects of weather, vehicle abrasion, motor oil, gasoline, antifreeze solutions, brake fluid, deicing chemicals and salt normally encountered in such a manner that the performance of the vehicle detector loop wire is not adversely affected.

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One-quarter inch (1/4") sawcuts shall be cleared of debris with compressed air before installing three turns of loop wire. All detector loops shall be six feet square or six-foot diameter with diagonal mini-cut corners of not more than one-inch on the diagonal. From the loops to the junction box, the loop wires shall be twisted two turns per foot and labeled at the junction box in accordance with the loop schematics included in the Plans. A three-eighths inch (3/8") sawcut will be required for the twisted pair. No sawcut will be within three feet of any manhole or utility riser located in the street. Loops and lead-ins will not be installed in broken or fractured pavement. Where such pavement exists it will be replaced in kind with minimum 12-foot square sections. Loops will also be sawed across transverse joints in the road. Loops to be placed in concrete will be located in full panels, a minimum of 18-inches from any expansion joint.

9-29.13(3) EMERGENCY PREEMPTION

This section is deleted in its entirety and replaced with the following:

Immediately after a valid call has been received, the preemption controls shall cause the signals to display the required clearance intervals and subsequent preemption intervals. Preemption shall sequence as noted in the Contract. Preemption equipment shall be installed so that internal wiring of the controller, as normally furnished by the manufacturer, is not altered. Termination of the preemption sequence shall place a call on all vehicle and pedestrian phases. Emergency devices shall be 3M Opticom brand, 700-series, as specified in the Plans, or approved equal.

9-29.16(2)B SIGNAL HOUSING

The first paragraph in this section is deleted and replaced with the following:

The signal head housing, or case, shall consist of an assembly of separate sections, expandable type for vertical mounting, substantially secured together in a weather-tight manner to form a unit of pleasing appearance. Each section shall house an individual optical unit. They shall be designed to withstand winds of 80 mph with a gust factor of 0.25 without permanent distortion or failing (torque at attachment of 6,000 pound-feet).

9-29.16(2)E PAINTING SIGNAL HEADS

This section is deleted in its entirety and replaced with the following:

Traffic signal heads shall be finished with two coats of factory Federal Yellow (FHWA) polyester powder coat, oven baked and comprised of resins and pigments. Aluminum end caps shall be painted to match the color of the signal housing.

9-29.17 SIGNAL HEAD MOUNTING BRACKETS AND FITTINGS

The second paragraph in this section is deleted and replaced with the following:

Fittings for Type N mounts shall be installed unpainted. All other hardware for other mounts shall be painted with two coats of factory-applied traffic signal Federal Yellow (FHWA) baked enamel.

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9-29.18(3) VIDEO DETECTION SYSTEM (NEW SECTION)

The video detection system shall be capable of providing presence vehicle detection and shall be expandable without removing or replacing existing units. All materials furnished shall be new, unused, current production models and shall be items currently in distribution. The video detection system shall have a minimum 18-month warranty against manufacturing defects in materials and workmanship from the date of shipment. The Contractor shall supply the warranty and all documentation necessary to maintain and operate the system to the Electrical Inspector prior to approval of the video detection system by the Electrical Inspector.

Minimum physical properties of the video detection system are as follows:

1. The processor shall be modular by design and fit directly into NEMA TS1 and TS2 type racks. It shall be interchangeable between a shelf or rack mount installation without replacing or modifying existing units.
2. The system shall control up to 8 cameras.
3. The system shall operate reliably in adverse environmental conditions in a roadside cabinet and shall meet all NEMA TS1 and TS2 environmental specifications.
4. Ambient operating temperature shall be –37 to +74 degrees Centigrade at 0 to 95% humidity non-condensing.
5. The system shall be powered by 12 to 40 Volts DC and draw less than 2 amperes.
6. The system shall utilize cabinet 24 Volts DC for rack mount installations or external 24 Volts DC for stand-alone shelf installations.
7. Surge rating shall meet NEMA TS1 and TS2 specifications.
8. Serial communications shall be through an RS232 serial port. This port shall be able to communicate to a modem or a laptop to upload/download detector configurations, count data, and software upgrades.
9. Each processor board shall have 4 opto-isolated open collector outputs. Twenty (20) additional outputs shall be available via the expansion port. The outputs shall be programmed for signaling the presence, the arrival or the departure of vehicles in a minimum of 24 detection zones.
10. Each processor board shall have error detection. An output contact shall be programmable move from open to closed or closed to open if the video signal is bad or the processor board is not functioning properly. A user defined quality level will automatically put the processor into a recall state in cases of severely degraded visibility (i.e. fog, blizzard, etc). Normal detection shall resume when visibility improves above the user defined quality level.

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11. A video select button on the front panel shall switch between camera images.

12. The processor board shall have 1 video input (RS-170 NTSC) and one video out.

13. The processor board shall have separate light emitting diodes (LEDs) that indicate the following:

POWER	Red to verify power supply.
OUT1-OUT4	Green if the corresponding detection group is active.

Minimum functional capabilities of the video detection system are as follows:

1. Capable of monitoring all licensed vehicles on the roadway.

2. Provide video detection for all areas outlined in the Plans.

3. Each processor board shall be capable of processing the video signal of one camera and analyze the video signal in real time (30 times per second).

4. The system shall be capable of displaying detectors on the video image with associated outputs. Outputs/Inputs status will be indicated on the screen. Parameters also include the ability to view raw video without any verbiage and/or detectors for surveillance purposes.

5. Each processor board shall detect within the view of the connected camera the presence of vehicles in user-defined zones. Detector zones shall be presence or data. The processor board shall have 20 presence detector zones and 4 data detection zones per camera. Data zones shall collect and store vehicle counts, volume, speed, gap time, headway, occupancy, and 4 types of classification. Data shall be time-stamped (6713 intervals) and stored onboard (non-volatile memory) from 1 to 60 minutes. Presence zones shall have the capability of delay and/or extension with selectable pulse mode.

6. The processor boards shall be programmed without the use of a supervisor computer. A standard CCTV monitor and keypad plugged into the serial port will facilitate detector programming.

7. The processor board shall store a minimum of 3 detector configurations. It shall be possible to switch between detector configurations manually or automatically by time of day or input from the traffic controller.

8. Detector configurations shall be formatted to allow uploading to a laptop computer and stored on a disk.

9. Detectors shall be able to be linked to 24 outputs and 20 inputs using Boolean Logic features: AND, OR, NOT. It will be possible to generate conditional outputs based on inputs from a controller.

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10. Detectors shall be directionally sensitive. Options shall include an omni-directional detector or a detector that only senses movement: from left to right, right to left, up to down or down to up as you look at the monitor.

11. Changes to all detectors and parameters shall be permitted without interruption of detection.

12. Count data shall be able to be downloaded to a PC and exported to a spreadsheet.

13. Software updates to the processors shall be provided at no additional cost.

14. Password protection shall be standard option.

15. Detection system cameras shall be high resolution, 1/3" image format CCD, designed for professional video surveillance systems. The unit shall provide detailed video without lag, image retention, or geometric distortion. Video cameras shall be available commercially. No sole source cameras will be allowed. In addition, the cameras shall meet or exceed the following specifications:

Temperature range:	-20 to 55 degrees C		
Humidity:	0% to 95% relative, non-condensing		
Dimensions:	50mm x 50mm x 90mm, or smaller		
Weight:	Less than 250 grams		
Connectors:	BNC for video out		
Lens mount:	CS; power in/pressure screw; lens/4-square connector		
Housing:	All metal housing		
Rated Input Voltage:	12 VDC or 24 VAC +/- 10% @ 60 Hz		
Nominal Power:	6 Watts		
Imager:	Interline transfer CCD 1/3" format		
Imager spectral response:	100% @ 550nm; 30% @ 40nm and 80nm		
Sync system:	EIA RS-170		
Active Picture:	768H X 494V		
Horizontal Resolution:	580 TVL		
Sensitivity:	2856 K	Usable Picture	Full Video

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Scene Illumination:	0.012 fc 0.12 lux	0.08 fc 0.8 lux
Imager Illumination :	0.0015 fc 0.015 lux	0.01 fc 0.1 lux

Signal to Noise Ratio:	54 dm Minimum; 58 db Typical
AGC:	18 db
Light Range (AGC on):	1,000,000:1 min. with f/1.4 to 360 auto-iris lens
Video Out:	1.0 Volts peak-to-peak +/- 0.1 volt @ 75 Ohms
Gray Scale:	Minimum of 10 steps

16. Camera Lens shall be a motorized vari-focal 6.5 –39mm with auto iris and meet or exceed the following specifications:

Image Format:	1.3 inch
Focal Length:	6X zoom (6.5-39mm)
Iris Range:	f 1.0 – Approx. 1200
Back Focus Distance:	10.05mm (0.4in.) in air
Weight:	Approx. 500g
Size:	Approx. 60mm x 70mm x 90mm
Lens Mount:	CS
Focus Control:	Motorized
Zoom:	Motorized

17. Environmental Camera Housing shall be an aluminum enclosure designed for outdoor CCD camera installations and meet or exceed the following specifications:

Camera Mounting:	Removable cradle assembly
Cable Entry:	Three liquid-tight fittings that will accept cable diameters as follows: One fitting – 2 to 7mm; Two fittings – 3 to 10mm
Construction:	Extruded aluminum housing, aluminum rear-end cap; aluminum front cap with glass face plate and aluminum cradle; sunshield

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Window:	3mm thick glass that includes a thermostatically-controlled window; heater/defogger strip
Rated input voltage:	115 Volts AC, 60 Hertz
Voltage Range:	108 Volts to 132 Volts AC
Output Voltage:	24 Volts AC, 60 Hertz
Nominal Power:	30 Watts
Enclosure Protection:	Waterproof and dust-tight

18. Surge Protection shall meet or exceed the following specifications:

The suppressor shall provide coaxial cable connection points to an EDCO CX06-BNCY or approved equal transient suppressor for each image sensor.

Peak Surge Current:	(8 X 20 us): 5KA
Technology:	Hybrid, Solid State
Attenuation:	0.1db @ 10Mhz
Response time:	<1 nanosecond
Protection:	Line to Ground
Shield to Ground:	(isolated shield modules)
Clamp Voltage:	6 Volts
Connectors:	BNC
Impedance:	75 Ohms
Temperature:	-40 to +85 degrees C
Humidity:	0% to 95% non-condensing
Dimensions:	4.5” x 1.5” x 1.25”
UL Listed:	UL497B

19. Mounting Brackets: For mast arm mounting, a six (6) foot maximum length of internally reinforced tubing shall be attached to the mast arm bracket. The camera shall be mounted at the top of the tube with the camera manufacturers recommended bracket. For luminaire arm installations, the camera shall be mounted with the camera/video manufacturers recommended brackets.

The bracket shall provide adjustments for both vertical and horizontal positioning of the camera. The camera attachments shall be designed to securely fasten the

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camera to prevent the extension tube from falling into the path of vehicles and/or becoming loose. Miscellaneous hardware shall be stainless steel or galvanized steel. The entire mounting unit shall be designed to withstand a wind load of 90 MPH with a 30-second gust factor.

20. Cable (Coaxial & Power): Coaxial cable shall be suitable for exterior use and in direct sunlight. Power cable shall have a minimum of 5 conductors. The coaxial cable shall be terminated in the surge protector before being connected to the processor boards. Power cable shall be terminated into a fuse panel provided by the manufacturer and connected to 120 Volt AC in the controller cabinet. The remaining three (3) conductors shall be used for zoom/focus for each camera. The three conductors shall be terminated and labeled in the traffic signal cabinet. The outer jacket shall be rated at 600 Volts.

9-29.19 PEDESTRIAN PUSH BUTTONS

The first paragraph in this section is deleted and replaced with the following:

Where noted in the Contract, pedestrian push buttons of substantially tamper-proof construction shall be furnished and installed. They shall consist of a 2.25-inch nominal diameter mushroom plunger and a momentary contact switch assembled with the push button sign shown in the Plans. The switch may have snap action contacts, or magnetic, or piezoelectric switch, or actuated by a three bladed beryllium copper spring, and shall be rated 10 amperes, 125 volts.

9-29.24 SERVICE CABINETS

This section is deleted in its entirety and replaced with the following:

In addition to the requirements for service cabinets indicated in the Contract, the following requirements shall apply:

Overhead electrical service shall be brought to the load center through a conduit riser and a weatherhead on the service pole. The service shall be split into a 120-volt circuit for signals. All circuit breakers shall be clearly marked or labeled.

Underground service shall be brought to the load center in minimum 2-inch conduit. The service shall be split in the load center into a 120-volt circuit for signals. The Contractor shall provide conduit from the electrical service to ten feet up the power pole from which service is provided. Standoff brackets 14-inches long shall be installed on the pole every ten feet. In addition, the Contractor shall provide service conductors from the electrical service to the top of the conduit on the power pole with 30 feet of service wire coiled at the top and provide the local electrical utility with 30 feet of 2-inch conduit to make the service connection, unless otherwise directed by the local electrical utility.

9-29.24(2) ELECTRICAL CIRCUIT BREAKERS AND CONTACTORS

The second paragraph in this section is deleted in its entirety.

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9-30 WATER DISTRIBUTION MATERIALS

9-30.7 WATER LINE PIPE AND METER BOX ASSEMBLY (NEW SECTION)

All materials for water distribution shall be new. Materials used for temporary water line and for temporary service connection purposes may be either new or previously used materials and shall be subject to Seattle Public Utilities' Water Operation's inspection and approval prior to installation.

Prior to ordering any pipe to be installed, the Contractor shall submit the material source as required by Section 1-06 and shall obtain the Project Engineer's approval.

All direct and indirect drinking water system components which come in contact with potable water shall have National Sanitation Foundation certification.

9-30.7(1) WATER LINE PIPE

All pipe and fittings shall be clearly marked with the manufacturer's name, type, class, and thickness as applicable and shall be marked on the component at the place of manufacture. Marking shall be legible and permanent under normal conditions of handling and storage.

Contractor to coordinate with SPU Water Operations for all connections to the water main.

A. Copper Tubing

Copper tubing shall conform to the requirements of ASTM B 88, Type K, annealed. The tubing shall be coupled using compression fittings having a positive external gripping feature to prevent tubing pull-out, conforming to the requirements of AWWA C800, minimum 150 psi working pressure.

B. Miscellaneous Piping

Miscellaneous piping and fittings, including but not limited to ductile iron, steel and plastic pipe shall be submitted to the Project Engineer for approval prior to installation. Pipe and fittings shall have a minimum 150 psi working pressure.

9-30.7(2) SADDLES

Saddles shall be ductile iron, or bronze, double straps with thread standard outlet tapping. Saddles shall be of a size designed by the manufacturer to fit the pipe called for on the Plans.

9-30.7(3) CORPORATION STOPS

Corporation stops for use with saddle shall be of bronze alloy with inlet M.I.P. (male iron pipe) standard thread and outlet thread compatible with connection piping, with no special adapters. Corporation stops for direct tapping shall be bronze alloy with AWWA tapered inlet Outlets on 3/4 inch and 1 inch direct tap corporation stops shall be copper tubing size compression, with an external clamping or anti-pullout feature. Outlets on 1-1/2 inch and 2 inch direct tap corporation stops shall be male iron pipe or tubing to be connected.

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9-30.7(4) COMPRESSION COUPLINGS

Compression couplings for use in connecting plain end water line pipes shall be applicable for the type of pipe being coupled. Compression couplings shall have armored gaskets when similar metal pipes are being joined.

9-30.7(5) METER STOPS AND SETTERS

Contractor shall provide and furnish all materials for the installation of meter stops.

SPU Water Operations will install meter stops and setters.

9-30.7(6) METER BOX AND LID

Contractor shall provide and furnish all materials for the installation of the meter box.

Meter Box and Lid shall be in accordance with the current SPU Water Operation Standards. The Meter Box casting shall conform to ASTM A 48, Class 30 for gray cast iron. The Lid casting shall conform to ASTM A536, Grade 80-55-06 for ductile iron. Castings shall be brushed or dipped with a bituminous coating. Meter Box and Lid shall be Olympic Foundry (1984) Inc. SM-29, or approved equal.

SPU Water Operations will install meter box and lid.

9-30.7(7) VACANT

9-30.7(8) TEMPORARY WATER LINE

All temporary water line shall meet the requirements as outlined in Section 9-30.7(1). PVC Water-Service Pipe and Fittings complying with ASTM D 1785 for schedule 40 pipe with plain ends for solvent-cemented joints and with ASTM D 2466, Schedule 40, socket-type fittings.

9-30.7(9) BEDDING

Pipe zone bedding (Bedding Class B) shall conform to bedding, jointing, backfilling in accordance with 7-08.3(1)C.

9-30.7(10) CEMENT CONCRETE BLOCKING

Concrete thrust blocking, as detailed on COSP number 330a through 331b, shall be placed as indicated on the Plans. When the plans call for pipe size 4-inch diameter and less, thrust blocks for 4-inch pipe shall be installed as detailed in the COSP.

Concrete blocking shall conform to the requirements in Section 7-09.3(21).

The Contractor shall provide the Project Engineer at least 3 calendar day advance notice for inspection and approval of all concrete blocking prior to backfilling. Unacceptable concrete blocking shall be replaced at no expense to the Contracting Agency.

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9-30.8 PIPE INSULATION ON BRIDGE (NEW SECTION)

This special provision describes the requirements for furnishing, installing and testing pipe insulation for the exposed fire line and domestic water line suspended beneath the bridge and within the bascule piers.

9-30.8(1) MATERIALS

Submittals: The Contractor shall submit to the Project Engineer for approval, shop drawings, catalog cuts and manufacturer's data as required by the Project Engineer to evaluate the pipe insulation installation. Shop drawings shall:

a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

b. Detail attachment and covering of heat tracing inside insulation.

c. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

d. Detail removable insulation at piping specialties and equipment connections.

e. Detail application of field-applied jackets.

A. Mineral Fiber Pipe Insulation

Provide preformed mineral fiber pipe insulation for fire protection and domestic water pipe suspended beneath the bridge and within the bascule piers.

Subject to compliance with requirements, provide product by one of the following: Johns Manville, Knauf FiberGlass Gmb H., Owens-Corning Fiberglas Corp. or approved equal.

Preformed pipe insulation: Mineral or glass fibers bonded with a thermosetting resin and complying with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket; Blanket insulation complying with ASTM C 553, Type II, without facing; Fire-resistant adhesive complying with MIL-A-3316C Class 1, Grade A for bonding glass cloth and tape to un-faced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to un-faced glass-fiber insulation; Fire- and water-resistant vapor-retarder mastics for indoor applications complying with MIL-C-19565C, Type II; Expanded or exfoliated vermiculite insulating cements complying with ASTM C 196; and Mineral-fiber, hydraulic-setting insulating and finishing cement complying with ASTM C 449/C 449M.

B. Cellular Glass Pipe Insulation

Provide cellular glass pipe insulation for fire protection and domestic water pipe within the buried casing at each bridge abutment wall.

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Subject to compliance with requirements, provide product by one of the following: Pittsburgh Corning Corporation; Foamglas.

Pipe insulation: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells and complying with ASTM C 552, Type II, Class 2 for preformed pipe insulation with factory applied all service jacket; Two-component thermosetting urethane cellular-glass adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F; Elastomeric joint sealant compatible with insulation material, jackets and substrates, permanently flexible, with a service temperature range of minus 100 to plus 300 deg F.

C. Field-Applied Jackets

Fire line and domestic water line shall be covered with field applied stainless-steel jacket, type 304 or 316 complying with ASTM A 167 or ASTM A 240. Jackets shall be from sheet and roll stock, ready for shop or field sizing, with smooth 2B finish and Z-shaped locking seam, minimum 0.020-inch thick. Moisture barrier shall be 3-mil thick heat-bonded polyethylene and kraft paper. Fitting, flange and valve covers shall be factory fabricated. Field fabricated fitting covers allowed only if factory-fabricated fitting covers are not available.

D. Accessories and Attachments

Glass cloth and tape complying with MIL-C-20079H, Type I for cloth and Type II for tape; Woven glass-fiber fabrics, plain weave pre-sized a minimum of 8 oz/sq. yd.; 3/4-inch wide aluminum bands; and 0.080-inch nickel-copper alloy wire, or 0.062-inch soft-annealed galvanized steel wire.

E. Pipe Insulation Fire-Test-Response Characteristics

As determined by testing materials identical to the those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency. Insulation shall have flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

9-36 PLASTIC LUMBER (NEW SECTION)

9-36.1 GENERAL REQUIREMENTS

All plastic lumber for use in the construction of marine related structures, including pier protection systems, guide walls, dock fenders, bullrails, chocks, camel systems, and rubbing strips shall be fiberglass-reinforced plastic composite marine timber unless specified otherwise in the Contract.

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This Work covers, fiberglass structurally reinforced composite lumber (SCL) and smaller dimensional fiberglass fiber reinforced composite lumber (FFRCL).

Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials shall be seamless with a smooth outer skin. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice.

Manufacturers of structural plastic component, lumbers, fiberglass structurally reinforced composite lumbers shall provide independently certified test reports and certification that the material meets the requirements of this section.

9-36.1(1) SUBMITTALS

With each shipment of plastic lumber, the Contractor shall provide a copy of the manufacturer's field guide. This guide shall include information describing the recommended means for handling, placing, installing, cutting, drilling, and repairing the plastic lumber.

9-36.2 MATERIALS

Use polyethylene made from recycled post consumer or post industrial thermoplastics. Mix the plastic with appropriate colorants, UV inhibitors, hindered amine light stabilizers and antioxidants so that the resulting product meets the material property requirements specified in Tables 1 and 2. Structural Plastic must not corrode, rot, warp, splinter or crack. The outer skin must be smooth and black in color unless otherwise specified in the Contract Documents.

Manufacture Structural Plastic as one continuous piece with no joints or splices to the dimensions and tolerances in accordance with Table 3 and consisting of a dense outer skin surrounding a less dense core. Interior voids shall not exceed 3/4 inch in diameter. Structural Plastic shall be free of twist and curvature.

Reinforce 10”x10” fiberglass structurally reinforced composite lumber for use in heavy duty and medium duty fender systems with a minimum of four 1 1/2 inch reinforcing rods placed in the corners of the section. Reinforce 10”x10” fiberglass structurally reinforced composite lumber for use in light duty fender systems with a minimum of four 1 inch reinforcing rods placed in the corners of the section.

Reinforcing rods must be continuous and offer a minimum flexural strength of 70.0 ksi when tested in accordance with ASTM D 4476 and a minimum compressive strength of 40.0 ksi when tested in accordance with ASTM D 695. Steel reinforcing rods are not permitted.

Reject any sections of structural plastic containing cracks or splits. Also, inspect the ends of the reinforcing rods and reject any sections containing reinforcing rods with voids or cracks.

Add a minimum of 15% (by weight) chopped fiberglass reinforcement to the polyethylene used for fiberglass structurally reinforced composite lumber, a minimum of 5% (by weight) chopped fiberglass reinforcement for components and a minimum of 15% (by weight) chopped fiberglass reinforcement for smaller dimensional fiberglass fiber reinforced composite lumber. The

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fiberglass reinforcement may be reduced when other means of controlling cracking are specified with test results which show long term cracking is nonexistent.

Fiberglass structurally reinforced composite lumber must meet the minimum structural properties listed in Tables 4A and 4B.

Smaller dimensional fiberglass fiber reinforced composite lumber must meet the minimum physical properties listed in Table 5.

Table 1
Plastic Material Properties- CP and SCL

Density	ASTM D792	Skin	55-63 pcf
Density	ASTM E12	Core	34-48 pcf
Water Absorption	ASTM D570	Skin	2 hrs:<1.0% weight increase 24 hrs:<3.0% weight increase
Brittleness	ASTM D746	Skin	No break at -40°F at 5 ft-lbs/in
Impact Resistance	ASTM D746 Modified	Skin	Greater than 4 ft-lbs/in
Hardness	ASTM D2240	Skin	44-75 (Shore D)
Ultraviolet	ASTM D4329 (B Lamp)	Skin Core	500 hours<10% change in Shore D Durometer Hardness 500 hours<10% change in Shore D Durometer Hardness
Abrasion	ASTM D4060	Skin	Weight Loss: <0.02 oz Wear Index: 2.5 to 3.0 Cycles=10,000 Wheel=CS17 Load-2.2 lb
Chemical Resistance	ASTM D543	Skin/Core Sea Water Gasoline No. 2 Diesel	 <1.5% weight increase <7.5% weight increase <6.0% weight increase
Tensile Properties	ASTM D638	Skin/Core	Minimum 500 psi at break
Compressive Modulus	ASTM D695	Skin/Core	Minimum 40 ksi

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Table 1 Plastic Material Properties- CP and SCL			
Static Coefficient of Friction	ASTM F 489-03		Maximum 0.25, wet
Nail Pull-Out	ASTM D1761	Skin/Core	Minimum 60 lb

Table 2 Plastic Material Properties FFRCL		
Density	ASTM D6111	50-65 pcf
Brittleness	ASTM D746	No break at -40°F at 5 ft-lbs/n
Impact Resistance	ASTM D746 Modified	Greater than 4 ft-lbs/in
Hardness	ASTM D2240	44-75 (Shore D)
Ultraviolet	ASTM D4329 (B Lamp)	500 hours <10% change in Shore D Durometer Hardness
Abrasion	ASTM D4060	Weight Loss: <0.02 oz Wear Index: 2.5 to 3.0 Cycles = 10,000 Wheel = CS17 Load -2.2 lb
Chemical Resistance	ASTM D543 Sea Water Gasoline No. 2 Diesel	 <1.5% weight increase <7.5% weight increase <6.0% weight increase
Tensile Properties	ASTM D638	Minimum 3000 psi at break
Static Coefficient of Friction	ASTM C1028 (Neolite-wet)	Minimum 0.50, wet or dry
Nail Pull-Out	ASTM D 1761	Minimum 250 lb
Screw Withdrawal	ASTM D6117	Minimum 450 lb

Table 3 Dimensions and Tolerances		
Structural Plastic	Dimension	Tolerance

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Table 3 Dimensions and Tolerances		
Length	Per order (80 ft Maximum)	0/+6 inch
Width	See Contract Plans	±1/4 inch
Height	See Contract Plans	±1/4 inch
Corner Radius – SCL Corner Radius – FFRCL	1 3/4 inch 1/4 inch	±1/4 inch ±1/16 inch
Outer Skin Thickness	3/16 inch	±1/8
Distance from outer surface to center rebar elements (SCL)	2 inches	±1/4 inch
Distance from outer surface to center rebar elements (CP)	1 3/8 inches	±1/4 inch
Straightness (gap, bend or inside while lying on a flat surface)		<1 1/2 inches per 10 feet

Table 4A Structural Properties for Heavy Duty and Medium Duty SCL	
Member Size	10 inches x 10 inches
Modulus of Elasticity as derived below	521 ksi
Stiffness, E.I.	4.05E+08 lb-inch^2
Yield Stress in Bending	5.8 ksi
Weight	30-37 lb/ft

Table 4B Structural Properties for Light Duty SCL	
Member Size	10 inches x 10 inches
Modulus of Elasticity as derived below	307 ksi
Stiffness, E.I.	2.39E+08 lb-inch^2

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Table 4B Structural Properties for Light Duty SCL	
Yield Stress in Bending	3.4ksi
Weight	28-35 lb/ft

Determine the Modulus of Elasticity of a full size specimen by conducting a three point bend test with a load applied in the center of a simply supported 14-foot span, at a deflection rate of 0.25 inch per minute. The Modulus is to be taken at a strain of 0.01 inch per inch, where strain equals (6) x (depth of cross section) x (deflection) / (span length squared) and where Modulus of Elasticity equals (load) x (span length cubed) / [(48) x (deflection) x (moment of inertia)].

Table 5 Properties for FFRCL	
Modulus of Elasticity ASTM D 6109	306,000 psi
Flexural Strength ASTM D 6109	2,500 psi
Compressive Strength ASTM D 6108	1,960 psi
Compressive Strength Parallel to gain ASTM D 6112	3,500 psi
Compressive Strength Perpendicular to gain ASTM D 6112	700 psi

9-36.3 REINFORCING

The plastic lumber shall be reinforced with fiberglass elements. Steel reinforcing rods are not permitted. The reinforcing elements shall conform to the characteristics shown below.

FIBERGLASS REINFORCING (TYPICAL PROPERTIES)		
Flexural Strength (ASTM D4476)	Flexural Strength	70,000 psi
Compressive Properties (ASTM D695)	Compressive Strength	40,000 psi

Reject any sections of structural plastic containing cracks or splits. Also, inspect the ends of the reinforcing rods and reject any sections containing reinforcing rods with voids or cracks.

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9-36.4 DIMENSIONS

The plastic lumber shall have a square cross section with radiused corners. Both ends shall be cut square. Dimensions shall be as shown below.

MARINE LUMBER DIMENSIONS		
Marine Timber	Dimension	Tolerance
Length	Per order (105 feet maximum)	+/- 12.0 inches
Width	12.0 inches	+/- 0.5 inches
Height	12.0 inches	+/- 0.5 inches
Corner radius	2.0 inches	+/- 0.375 inches
Outer Skin Thickness	0.1875 inches	+/- 0.125 inches
Rebar Quantity/Diameter	(4) /1.25 inches	+/- 0.125 inches
Distance from outer surface to rebar elements	1.75 inches	+/- 1.0 inch
Straightness (gap, bend or bulge inside while lying on a flat surface)		< 1.5 inches per 10 feet of length

9-36.5 MANUFACTURING PROCESS

Plastic lumber shall be manufactured in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by this specification, but which are a part of manufacturer's standard commercial product, may be included in the plastic lumber being furnished. A standard commercial product is one that has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs or brochures, and represents the latest production model. Manufacturer shall provide documentation that it has manufactured the product for a minimum of 10 years.

The plastic lumber shall be manufactured in a continuous process that will result in it having no joints. The plastic lumber shall have a coextruded outer skin of dense, unblown plastic, an inner core of foamed plastic manufactured prior to the manufacture of the timber, and an annulus of foamed plastic encapsulating the reinforcing elements. The plastic lumber shall conform to the design requirements of the specification.

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9-36.5(1) COLORED OUTER SKIN

The outer skin shall be colored to Project Engineer's requirements, however it shall be black in color unless otherwise specified in the Contract documents. It shall contain hindered amine light stabilizers to provide sufficient resistance to ultra violet light degradation as to conform to the applicable requirements of Section 9-36.2. The outer skin of the plastic lumber shall be continuous and homogenous throughout the entire length and perimeter of the timber. It shall be formed by co-extruding a plastic material at the same time that the annulus material is extruded. It shall conform to the applicable requirements of Section 9-36.2. The outer skin of the plastic lumber shall be generally smooth but may contain occasional blisters and pockmarks.

9-36.5(2) ANNULUS

The annulus of the timber shall be a continuous foamed structure throughout the entire length of the timber. It shall conform to the applicable requirements of Section 9-36.2 requirements, and shall be black in color. The annulus shall be melt fused to the inner core in such a manner that the joint between the inner core and the annulus develops the full strength of the plastic.

9-36.5(3) INNER CORE

The inner core of the plastic lumber shall be a continuous foamed structure throughout the entire length of the timber. It shall conform to the applicable requirements of Section 9-36.2, and shall be black in color. Butt joints as required for manufacturing may be utilized provided the full strength of the plastic is developed in the joint. The foamed inner core should be homogenous and reflect a consistent cell structure when viewed across the grain. The product shall contain no singular interior void in excess of 1” in diameter or greater than 3” in length.

9-36.5(4) REINFORCING

The reinforcing elements shall be arranged in a square pattern, as described in Section 9-36.4. The reinforcing elements shall be those of standard industry make and appearance, and free from kinks and sharp bends within the annulus of the plastic lumber. All plastic lumber shall have a quantity of four (4) fiberglass reinforcing elements, unless specified otherwise, with the diameter listed in Section 9-36.4. Each individual element shall typically run the entire length of the timber, terminating flush with the ends, with the rebar exposed. No plastic, fiberglass or metal elements or supports for the reinforcing element shall be used in the timber.

9-36.5(5) IDENTIFICATION MARKS

All individual plastic lumber shall be clearly marked with the manufacturer's name and distinct serial number near each end of the product.

9-36.5(6) QUALITY ASSURANCE

The Contractor shall verify that the manufacturer has a Quality Assurance Program in place to ensure the plastic lumber is manufactured to the specifications noted.

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9-36.6 PERFORMANCE

9-36.6(1) STRUCTURAL CHARACTERISTICS

The plastic lumber shall be designed to provide the structural characteristics as specified in the tables in Section 9-36.2 when using the material properties.

The plastic lumber shall be designed to provide the following structural characteristics when using the material properties other than the members as specified in Section 9-36.2:

Flexural Modulus of Elasticity	319,123 psi
Stiffness (EI)	5.17 x 108 lb.in2
Yield Stress in Bending	3,466 psi
Weight	41-50 lb./ft.

9-36.6(2) INTERCHANGEABILITY

All units of the same classification furnished with similar options under a specific Contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

9-36.6(3) REPAIRABILITY

The outer skin must be repairable if chipped or spalled. The Contractor shall provide to the owner a field guide describing the manufacturer's recommended standard repair procedures.

9-36.7 EXAMINATION

Each complete piece of plastic lumber shall be examined by the Contractor for compliance with the appropriate requirements of this specification. This inspection shall encompass all visual examinations and dimensional measurements. Records maintained by the Contractor will be inspected to ensure that the materials used in construction of all Contract items conform to the requirements. In particular, it shall be verified that the material requirements of Section 9-36.2 and Section 9-36.3 and manufacturing tolerances found in Section 9-36.4 are met. Noncompliance with any specified requirements or presence of one or more major defects preventing or lessening maximum efficiency shall constitute cause for rejection.

Tests

The Contractor shall provide manufacturer's documentation showing that the tests described in Section 9-36.2 and Section 9-36.3 have been performed, and that the test results meet the requirements of this specification 65 calendar days prior to ordering the material. The tests shall be conducted entirely by a testing laboratory independent of the manufacturer, under the direction of a testing engineer. The Contractor shall also provide manufacturer's documentation of the test reports that show the results of the physical and mechanical tests listed Section 9-36.2. For these tests, all test specimens shall be extracted from a full-scale product. Test specimens shall not be made by injection or compression molding or calendering, but shall be made from

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plastic cut from the full-scale product (except those tests that require the entire cross section of the product to be tested).

The product shall be tested in bending to quantitatively determine the flexural modulus of elasticity and the bending yield stress. The product shall be tested full-scale. Scale model tests are not acceptable. The test configuration shall be three point or four point bending (the product shall be simply supported at two locations, with the load applied equidistant from the two supports). The product shall be loaded at least until the specified minimum yield stress is reached, or until failure if so desired. During the test, load and corresponding deflection data shall be recorded.

Load and deflection data acquired during the test shall be used to calculate the stiffness (EI), and the bending stress. The flexural modulus of elasticity is calculated by dividing EI by the moment of inertia of the cross section of the product as described in Section 9-36.2.

Calculations of the properties in Section 9-36.2 and 9-36.6(1) shall be made utilizing standard elastic beam flexure formulas. The specified minimum yield stress in bending shall be reached before failure of the product.

Test results may be extrapolated from full scale testing of products with similar cross sectional size for different rebar sizes and configurations. Test results may also be extrapolated to a product of another cross sectional size only if the other size has the same or smaller cross section than the tested product. Smaller cross sections shall not be used to predict the performance of larger cross sections.

9-36.8 SHIPPING

Plastic lumber shall be shipped in a manner to minimize any scratching or damage to the outer surface.

9-37 DETECTABLE WARNING (NEW SECTION)

9-37.1 GENERAL

The detectable warning plate (cast in place with curb ramp) and the detectable warning retrofit plate (surface applied to existing curb ramp) shall meet the requirements for tactile warning surfaces established by the WSDOT Local Agency Guidelines Appendix 42.102, Addressing ADA Accessible Facilities on Road, Street and Highway projects.

The detectable warning plate shall have truncated domes as indicated on COSP number 422a and shall:

1. be “City of Seattle Safety Yellow” in color;
2. resist breakage, fading, permanent deformation, and loss due to abrasion;
3. be durable, high impact resistant, and possess thermal and moisture stability;

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4. possess durable wet and dry slip resistance, and

5. possess a compressive strength of 10,000 psi minimum.

Unless the Contract specifies otherwise, the nominal size of the detectable warning shall be 24 inches by the width of the ramp for the COSP Number 422a curb ramp and 24 inches by the width of the landing for the COSP Number 422b curb ramp.

9-37.2 DETECTABLE WARNING PLATE

9-37.2(1) GENERAL

The detectable warning plate may be either cast-in-place or surface applied and shall meet the following material requirements:

Material Requirement	Concrete		Composite	
Compressive strength	ASTM C 39	10,000 psi min.	ASTM D 695-91	10,000 psi min.
Slip resistance, wet and dry	ASTM D 2047	0.80 min.	ASTM C 1028	0.90 min.[1]

[1] coefficient of friction on top of domes and on field area.

Acceptable cast-in-place materials are:

1. CASTinTACT consisting of precast concrete containing prestressed reinforcement and pre-stained and sealed with Miracote Mirastan II "City of Seattle Safety Yellow" and Mascoseal Silane 40%. A local Supplier of CASTinTACT is MASCO, 425-487-6161 (www.masco.net).

2. Armor-Tile as manufactured by Armor-Tile Tactile Systems. A Seattle Supplier is White Cap Construction Supply, (206) 783-8400 (www.armor-tile.com).

3. Step-Safe as manufactured by Castek Inc (Transpo) (914) 636-1000 (www.transpo.com)

4. Cast-In-Place Composite Tactile by ADA Solutions, (800) 372-0519 (www.adatile.com)

Acceptable surface applied materials are:

1. Armor-Tile as manufactured by Armor-Tile Tactile Systems. A Seattle Supplier is White Cap Construction Supply, (206) 783-8400 (www.armor-tile.com).

2. Top Mark as manufactured by Flint Trading, Inc: (336) 475-6600 (www.flinttrading.com).

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3. Next Step as manufactured by Zumar Industires Inc. (800) 426-7967 (zumar.com)

For products other than named above, the Contractor shall provide the Project Engineer with a submittal on the alternate material as specified in Section 9-37.4. See Section 8-14.3(7)B.

9-37.2(2) DETECTABLE WARNING PLATE COLOR

The color of the detectable warning plate and retrofit plate shall be "City of Seattle Safety Yellow" and shall be uniform in color throughout the plate. The color on the surface of the plate may be enhanced by the manufacturer with an application of an indelible stain.

A representation of "City of Seattle Safety Yellow" may be achieved by the paint mix listed below. Color obtained by a coating will not be acceptable.

Home Depot Custom Color Match:

Base: BEHR Premium Plus Exterior Semi Gloss Accent Base 5670, size 1 quart with the following colorants:

Colorant	OZ	48	96
Perm Yellow	1	15	1
Exterior Red	0	2	1
Brown Oxide	0	5	0

9-37.3 DETECTABLE WARNING RETROFIT PLATE

The detectable warning retrofit plate shall be a composite, shall meet the requirements specified in Sections 9-37.1 and 9-37.2(2), and shall meet the following requirements:

Property	Test Method	Material Requirement
Slip resistance, wet and dry	ASTM C 1028	0.90 min.[1]

[1] coefficient of friction on top of domes and on field area.

9-37.4 "APPROVED EQUAL" REQUIREMENTS

Should the Contractor propose an "or equal" material to those materials named in Sections 9-37.2 and 9-37.3, the Contractor shall make the following submittal to the Project Engineer for approval at least 7 calendar days in advance of starting work in accordance with Section 1-05.3(5):

1. All information required in items 1, 3, 4, and 5 in Section 8-14.3(7)B;
2. Two (2) rectangular or square samples of the "or equal" material with minimum 6 inch by 6 inch dimensions.

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3. For the detectable warning retrofit plate, include information on the bonding material and its performance.

9-38 FIRE PROTECTION WET HYDRANT SYSTEM (NEW SECTION)

9-38.1 GENERAL REQUIREMENTS

This special provision includes the materials for a fire protection wet hydrant system consisting of, but not limited to, buried and exposed fire mains, backflow preventer and precast vault with accessories, valves, dry barrel hydrants for use by the fire department, electric heat trace system including heating cables and controls for freeze protection of exposed wet fire and domestic water mains and all other accessories required for a functional system.

9-38.2 MATERIALS

Submittals: The Contractor shall submit to the Project Engineer for approval, shop drawings, catalog cuts, manufacturer's data and additional data as required by the Project Engineer to evaluate the materials and equipment for use in the wet hydrant system. Shop drawings shall show all dimensions, details, anchorage details, reinforcement and the manner of installation. No material shall be placed prior to approval of shop drawings. Submit special warranty specified in this Section.

The Contractor's fire main layout shall be furnished together with standard details for review and/or approval. The line layout shall show each standard pipe joint and each special joint or fitting by number and each hanger or support. Standard details shall be furnished in sufficient detail to assure that the detail design of the pipe and specials will comply with the design concept and structural requirements of the project. Full details of reinforcement, concrete, cement, joint dimensions, etc, for the straight pipe, special fittings and the connections, shall be furnished.

Submit length of cable, rated capacities, operating characteristics, furnished specialties, power and control wiring, and accessories for each electric heat trace system provided. Include plans, sections, details and attachments to other work.

Submit product data for pipe insulation. Identify thermal conductivity, thickness, and jackets (both factory and field applied).

Submit product data for underground vaults, access hatches and hardware. Provide certificates for concrete and steel used in underground precast manholes in conformance with ASTM C 858.

Submit product data for underground vault sump pump, including certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.

Furnish Operation and Maintenance data for all valves and wiring diagram information for all supervised valves.

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Furnish Operation and Maintenance data for heat trace system, and include in project maintenance manuals.

9-38.2(1) BURIED SERVICE FIRE PIPING SYSTEM

Buried pipe from the connection to the SPU detector check vault to the bridge abutment will be ductile iron. Ductile iron pipe shall be centrifugally cast in 18 foot nominal lengths conforming to AWWA C151, shall be seal coated and shall have a double thickness cement mortar lining conforming to AWWA C104. Pipe shall be standard thickness Class 52 except the pipe inside the casing shall be thickness Class 53. Pipe ends shall be suitable for restrained Mechanical joint fittings unless otherwise indicated.

Fittings for Mechanical joint ductile iron pipe shall be ductile iron of Class 250 gray iron conforming to AWWA C110 and C111; fittings shall be seal coated and shall be double thickness cement mortar lined conforming to AWWA C104.

Where shown on the plans and in other locations where there is a change in the direction of the pipe joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which when activated imparts a multiple wedging action against the pipe increasing its resistance as the pressure increases.

Glands shall be of ductile iron conforming to ASTM A536.80 and shall be seal coated equal to that on the connecting pipe.

The mechanical joint restraint device shall have a minimum working pressure of 250 psi. The mechanical joint restraint device shall be "Megalug" or approved equivalent product.

As an alternate to the joint restraint device described above, ductile iron locking segments inserted through slots in the bell face shall provide a positive axial lock between the bell interior surface and a retainer weldment on the spigot end of the pipe. This restraint device shall be “TR Flex” or approved equal.

Flanged joints shall conform to AWWA C115. Restrained and flanged joint fittings shall be compatible with the restrained and flanged joint pipe specified and used.

Pipe Coating System: The exterior surfaces or the pipe shall have the following coating systems per AWWA C210:

a. Surface preparation shall be Solvent Clean (SSPC-SP-1) followed by abrasive blast-cleaning to Near White Metal (SSPC-SP-10) with an anchor profile between 0.0030-inch and 0.0040-inch. The Contractor shall use caution during external blast cleaning of ductile iron pipe and shall conform to the National Association of Pipe Fabricators (NAPF) Standard 500-03 and consult with the pipe manufacturer prior to any blast cleaning of the ductile iron pipe.

b. Two (2) uniform coats of coal tar epoxy conforming to AWWA C210 shall be applied to a total dry film thickness of 0.020-inch to 0.030-inch.

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c. The drying time between coats shall be 12 hours minimum and 24 hours maximum at 70-deg F. Intercoat drying time shall be in accordance with manufacturer's recommendations.

Pipe Coating System (Contractor's Option): polyethylene wrap over the standard asphalted factory coating, applied in accordance with AWWA C 105, can be used for the pipe and fittings specified in these special provisions.

9-38.2(2) NON-BURIED FIRE PIPING SYSTEM BELOW BRIDGE AND AT BASCULE PIERS

Exposed pipe from the bridge abutment and into the bascule piers shall be an IPS grooved piping system. All grooved components shall be of one manufacturer and conform to local code approval and the requirements of ANSI B31.1, UL/FM, IAPMO, and UMC. Grooved end product manufacturer shall be ISO 9001 certified.

Steel Pipe: ASTM A53, Type S, Grade B, plain end or grooved end, Schedule 40. For grooved end, use only factory- or field-formed square cut or rolled-formed grooves per coupling manufacturer's specifications.

Fittings shall be ductile iron grooved end fittings conforming to ASTM A536 and as manufactured by the grooved end coupling manufacturer.

Flanges shall be Class 150 forged steel, ASTM A105, weld neck, raised face or faced to match mating equipment or valves. Gaskets shall be ANSI B16-21, 1/16-inch thick synthetic finish with nitrate builder. Flange Bolts shall be ASTM A307 Grade B bolts with A 563 Grade A heavy nuts.

Mechanical grooved couplings shall be flexible Victaulic Style 77 or rigid Style 07 type as indicated on the Plans, with hot dip galvanized housings from the factory and with Grade "E" EPDM (-30F to +230F) Flush Seal style gaskets. Coupling housings shall be of ductile iron conforming to ASTM A 536. Couplings from 2-inch through 6-inch size shall be rated for a working pressure of at least 700 psi. Coupling gaskets shall be Grade "E" EPDM suitable for temperatures from –30 degrees F to +230 degrees F. For couplings 8-inch size use couplings FM rated for 500 psi. Coupling bolts and nuts shall be heat treated, zinc electroplated to ASTM B-633 track-head style conforming to physical properties of ASTM A-183 minimum tensile strength of 110,000 psi.

All couplings used shall be by the same manufacturer.

All pipe and fitting described above shall be hot dip galvanized in accordance with ASTM A 123. All mechanical grooved fittings, ductile iron or steel, shall be furnished hot dip galvanized from the vendors shop.

9-38.2(3) BURIED FORCE MAIN PIPING

The buried force main pipe from the backflow preventer vault to the storm sewer shall be pressure-rated PVC Water-Service Pipe and Fittings complying with ASTM D 1785 for schedule

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40 pipe with plain ends for solvent-cemented joints and with ASTM D 2466, Schedule 40, socket-type fittings.

9-38.2(4) HYDRANTS

General: Fire hydrants shall conform to AWWA C502. The name or mark of the manufacturer, size of the valve opening and year made shall be plainly cast in raised letters on the hydrant barrel to be visible after the hydrant is installed. Hydrants of the following manufacture and pattern have been approved for use by the City of Seattle:

1. Pacific States
2. Clow Model 5110 (Iowa)
3. Mueller "Centurion" Model A-423
4. American-Darling Model B-62B
5. Kennedy K81D "Guardian"
6. Or approved equal

The hydrant system shall be as follows:

1. End Connections: End connection shall be 6 inches, standard flange, Class 125 drilling conforming to ANSI B16.1.
2. Hydrant Dimensions: The dimensions and details of hydrant and nozzles shall be as follows:
3. Hydrant connection pipe size inside diameter: 6 inches.
4. Standpipe, minimum inside diameter: 7 inches.
5. Valve opening, minimum diameter: 5-1/4 inches.
6. Size of auxiliary gate valve: 6 inches.
7. Hose nozzles, number and size: two 2-1/2 inches.
8. Thread (National Board of Fire Underwriters): 7-1/2 per inch.
9. Total length of threaded male nipple: 1 inch.
10. Streamer nozzle, number and size: one 4 inch.
11. Hydrants shall be furnished with one pumper nozzle with size and threads conforming to dimensions as identified on Plans.
12. Drain Valve: Drain valve shall be automatic with outlet tapped with 1/4 to 3/4 inch female iron pipe threads.

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13. The threads on the drain valve outlet holes shall be protected with temporary pipe plugs until the hydrant is ready for installation.

14. Breakaway flange (ring) to center of pumper nozzle: 14 inches or more.

15. Face: Pumper port toward the street.

16. All nozzles shall be fitted with cast iron threaded caps with operating nut of the same design and proportions as the hydrant stem nut. Caps shall be threaded to fit the corresponding nozzles and shall be fitted with suitable neoprene gaskets for positive water tightness under test pressures.

Operating Nuts: The operating nuts on hydrant stem and nozzle caps shall be as follows:

1. Pattern of Nut: Tapered pentagonal

2. Height: 1-1/6 inch

3. Size of pentagon: 1.35 inch at bottom of nut, 1.23 inch at top of nut (measured from point to flat)

The direction of opening shall be clearly marked on the operating nut or hydrant and shall be counterclockwise.

Breakaway Flange: Hydrants shall be provided with a breakaway flange assembly and be equipped with breaking devices at the sidewalk flange which allow the hydrant barrel to separate at this point with a minimum breakage of hydrant parts in case of damage. There shall also be provided at this point, a safety stem coupling on the operating stem that shears at the time of impact. All hydrants shall be equipped with 0-ring stem seals.

Hydrant Shop Painting: All iron parts of the hydrant shall be thoroughly cleaned and painted at the factory. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish, Federal Specification TT-V-51a or J.A.N.P-450. The hydrant shall be covered with two coats, the first having dried thoroughly before the second is applied.

Hydrant Field Touch-Up Painting: All iron parts of the hydrant shall be thoroughly cleaned and painted at the factory. All inside surfaces and the outside surfaces below the breakaway flanges shall be coated with asphalt varnish, Federal Specification TT-V-51a or J.A.N.P-450. They shall be covered with two coats, the first having dried thoroughly before the second is applied.

The hydrant curb stand section, including all exposed surfaces of the breakaway flange, shall receive two coats of oil based gloss enamel paint (Kelly-Moore Luxlite or approve equal) in Caterpillar yellow. Based on the elevation of the hydrant within the surrounding pressure zone, if the maximum static pressure at the hydrant is less than 60 psi, the engine port cap on the hydrant shall be painted with two coats of oil based gloss enamel paint (Kelly-Moore Luxlite or approve equal) with the final coat being Red.

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Hydrant Factory Hydrostatic Test: All hydrants shall be tested by the manufacturer, as required in AWWA C502. The Contractors shall furnish to the Owner an affidavit of compliance from the manufacturer for all tests.

Hydrant Connection Pipe: Pipe connections from the hydrant to the Water Main shall be 6 inch Ductile Iron Pipe, Class 52.

Hydrant Vertical Extensions: Barrel extensions shall have a 7 inch minimum inside diameter and shall be gray cast iron or Ductile Iron and shall conform to the AWWA Standards for such castings. The drillings of the connecting flanges on the extensions shall match the drillings of the flanges on the hydrant.

Hydrant vertical extensions shall also include the necessary hydrant operating stem extension, complete with safety stem couplings.

Extensions with threaded flanges shall be ductile iron and shall conform to AWWA C115. The exterior flange lip overlapping the barrel pipe shall be sealed with a bituminous mastic.

Vertical extensions shorter than 18 inches shall be installed at the bottom of the factory supplied barrel pipe.

9-38.2(5) GATE VALVES

Gate valves for general shut off and isolation duty shall be non-rising stem type, ductile iron body, resilient seat conforming to AWWA C509, "O" ring stuffing box and with double disc gates having a bronze wedging device. Valves shall be designed for a working pressure of 250 psi.

Buried valves shall open counterclockwise when viewed from above, and shall be equipped with a standard AWWA 2 inch square operating nut.

Exposed valves shall be equipped with handwheel operator.

Valve ends shall be mechanical joint. Where restrained joints are called out, valve ends shall be flanged with appropriate flange by restrained joint adapters per Section 9-30.2(1).

Bronze for all interior parts of valves shall contain no more than 6 percent zinc.

All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 10 mils. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder AWWA C550, and shall be certified to ANSI/NSF 61.

Valves shall meet or exceed all applicable requirements of AWWA C509, UL 262 and FM 1120/1130.

Valve boxes for buried valves shall be installed on all buried valves. The box and lid shall be cast iron, 2-piece slip type with cast iron extension as necessary. The cover shall have the word "WATER" or the letter "W" cast in it. Each top and lid section shall be tested for accuracy of fit

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and shall be marked in sets for delivery. Valve box extension pieces shall be provided for valves with ground cover in excess of the depth of the standard valve box (see City of Seattle Standard Plan nos. 315a and 315b). Valve boxes, lids, top section, base section and extensions shall be Olympic Foundry Inc. or approved equal.

9-38.2(6) BALL VALVES

Provide ball valves for drain service size as shown in the plans. Where low point drains are not shown in the plans, provide a minimum 1" size drain and ball valve.

Ball drains shall be standard port, female threaded, brass body ball valves. Forged brass body shall conform to ASTM B-16. Ball and stem shall be chrome plated brass. Seat and stem washer shall be of TFE and O Ring of Fluoroelastomer. Provide with lockable carbon steel zinc plated handle.

Ball valve shall be UL Listed and FM approved and rated for 600 psi (WOG)

9-38.2(7) AUTOMATIC AIR VENTS

Provide where shown in the plans, automatic air release valves of 1-inch size.

Furnish Automatic Air Vents, Claval series 34 or approved equal by APCO or Crispin. For Installation on vertical 1/2-inch threaded outlet connections off the top of the selected high points of the wet hydrant main.

Air vents used in fire protection piping shall be UL listed or FM approved for fire protection service and rated for 400 psi working pressure.

9-38.2(8) GROUT

ASTM C 1107, Grade B, factory-mixed and -packaged non-shrink and nonmetallic grout, suitable for interior and exterior applications. Provide hydraulic-cement grout that is post-hardening, volume-adjusting, dry, non-staining, non-corrosive, and non-gaseous. Grout design mix: 5000-psi (34.5-MPa), 28-day compressive strength.

9-38.2(9) BACKFLOW PREVENTERS

Provide a double check valve assembly for each north and south wet hydrant system. Backflow preventer assemblies shall be of a type included in the Washington State Department of Health current listing of "Approved Double Check Valve Assemblies".

General: Backflow preventer shall comply with ASSE 1015 and shall be suitable for continuous-pressure operation and designed for horizontal, straight through flow. Pressure loss shall be 6 psig maximum, through middle 1/3 of flow range. Body construction shall be epoxy coated cast iron with bronze seats and flanged ends. Provide outside screw and yoke gate-type valves with flanged ends on inlet and outlet.

9-38.2(10) UNDERGROUND VAULTS

Underground vaults for the backflow preventers shall consist of furnishing, installing, and testing of precast underground vaults including access hatches ladders, and sumps for sump pumps.

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Precast units shall include the following features:

1. ASTM 478, with interlocking mating sections, complete with accessories, hardware, and features as shown on the plans.
2. Design and fabricate manholes according to ASTM C 858.
3. Design manholes according to sizes shown on the plans.
4. Structural design loading: ASTM C 857, Class A-16 and AASHTO H20 traffic loading.
5. Joint sealant: continuous extrusion of asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
6. Provide minimum 14-inch diameter by 18-inch deep cast-in sump.
7. Source quality control: inspect structures according to ASTM C 1037.
8. Pulling eyes in walls: eyebolt with reinforcing-bar fastening insert 51 mm diameter eye and 25 mm x 102 mm bolt.
9. Working load shall be embedded in 6-inch, 3900 psi concrete shall be 13,000 lbs minimum tension.
10. Pulling and lifting irons in floor: 7/8-inch diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed opening shall be triangular. Ultimate yield strength shall be 40,000 lbs shear and 60,000 lbs tension.
11. Expansion anchors for installation after concrete is cast: stainless-steel-wedge type with stainless-steel expander clip with ½-inch bolt, 5,300 lb rated pullout strength, and minimum 6,800 lb rated shear strength.
12. Grounding materials: comply with "Grounding and Bonding" of these special provisions.
13. Sleeves shall be steel pipe, ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
14. Mechanical sleeve seals in accordance with these specifications.
15. Cover shall be made of non-skid aluminum and have identification label.

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9-38.2(11) SUBMERSIBLE SUMP PUMPS

Provide factory-assembled and -tested, simplex, single-stage, centrifugal, end-suction, submersible, direct-connected sump pumps complying with UL 778 and HI 1.1-1.2 and HI 1.3 for submersible sump pumps.

Pump construction shall be cast iron; with cast-iron inlet strainer, legs that elevate pump to permit flow into impeller, and vertical discharge with companion flange for piping connection. Impeller shall be thermoplastic. Motor shaft shall be steel, with upper sleeve and lower heavy duty ball bearing construction. Motor shall be permanently lubricated motor. Include power cord, 10' standard length, heavy duty 16/3 SJTW with 115 volt grounding plug and vertical switch.

Include automatic vertical float switch, with float and float rod.

Discharge piping shall be schedule 40 galvanized steel pipe, ASTM A53, threaded ends.

Isolation valve in discharge piping shall be standard port, female threaded, brass body ball valve. Forged brass body shall conform to ASTM B-16. Ball and stem shall be chrome plated brass. Seat and stem washer shall be of TFE and O Ring of Fluoroelastomer. Provide with lockable carbon steel zinc plated handle.

Check valve in discharge piping shall comply with MSS SP-71 and shall be Class 125, swing check valves with bronze body with nonmetallic disc, bronze seat and threaded ends.

Dielectric Unions shall be factory-fabricated union assembly for 250 psi minimum working pressure. Dielectric fittings shall be combination fitting of copper alloy and ferrous materials with threaded end connections. Insulating material shall be suitable for system fluid, pressure, and temperature.

AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

9-38.2(12) HEAT TRACING SYSTEM

Provide separate heat trace systems for the exposed 8-inch wet fire lines and 1-1/4-inch domestic water lines within the north and south bascule piers and beneath the bridge sections north and south of the bascule piers (4 heat trace systems total). Monitoring and alarm functions for the fire protection lines shall comply with Seattle Fire Department Administrative Rule 9.03.09.

Provide product by one of the following: Chromalox - Wiegurd Industrial Division - Emerson Electric Company, Raychem Corporation, or Thermon Manufacturing Co.

A. Description

Self-regulating, electric heating cables suitable for freeze protection of metal piping, consisting of pair of parallel No. 14 or No. 16 AWG nickel plated copper bus wires imbedded in radiation cross-linked semi-conductive heating matrix, which varies power output in response to temperature along its length. Cable shall be capable of crossing over itself

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without overheating. Cable cover shall be fabricated of radiation cross-linked, modified, polyolefin dielectric jacket, tinned-copper braid, and fluoropolymer over jacket.

B. Heat Output

Heating cable output shall be 5 watts per lineal foot at an ambient temperature of 50 deg. F and an applied voltage of 208V - single phase. Output shall vary inversely with ambient temperature.

C. Accessories

Cable Installation Accessories: Pipe-mounted non-metallic heat trace power circuit connection box, fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back. Width for markers on pipes with OD, including insulation, 6-inches or larger shall be 1-1/2 inch minimum and for pipes with OD less than 6-inches shall be 3/4 inch minimum.

Cable installation accessories shall include tapes, cable ties, warning labels, end seals, and installation clips.

D. Heat Trace Power Connection (HTPC) Box and Mounting Kit

Includes NEMA 4X junction box, pipe mounted expediter heater cable grommet, stainless steel bands, power connection bolts, ground wire extension lead and lug wire fasteners and RTV adhesive.

E. Heat Trace Controller (HTC)

Provide product by Environmental Technologies or approved equal. All heater trace circuit controllers must be from one manufacturer. The heater trace circuit controller serving the fire lines shall be an automatic electronic controller with provisions for remote temperature sensor input, internal ground fault protection, and monitoring functions for each heat trace circuit.

1. Control Range: 41 degrees F to 77 degrees F adjustable, with 2 degrees F deadband.

2. Electrical Supply: 208 V, 1 phase, 60 hertz; 2-pole contact suitable for 30 amps maximum load.

3. GFI Protection: 30, 60, 90, or 120 mA selectable with automatic reset.

4. Monitoring Functions: Power-on self-check, heater operation, GFI protection and ground leakage current tested every 24 hours, temperature sensor operation, and contactor operation.

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5. Alarm Relay: Single-throw double-pole 1 amp class 2 contact.

6. Indicators: Lights mounted on enclosure for normal power, call for heat, ground fault occurrence, or a failure of the monitored functions.

7. Enclosure: NEMA 3R.

Remote temperature sensor: Resistance Temperature Detector (RTD) supplied for field installation on pipe for direct sensing of pipe-wall temperature at beginning and end of each heat trace circuit.

For extending RTD signal leads, provide silver-plated copper wire with Teflon or PVC insulation and jacket with two or three conductors as required by Heat Trace Circuit Controller manufacturer.

Heat Trace Controllers for Domestic Water Line: Same requirements as above except monitoring functions for power-on self check, heater operation and contactor operation not required.

F. Special Warranty

Written warranty, executed by manufacturer agreeing to repair or replace components of electric heating cables that fail in materials or workmanship within two years from date of Substantial Completion of the Project.

9-38.2(13) EXPANSION JOINTS

Refer to Special Provision 9-05, Drainage Structures, Culverts, and Conduits for Flexible Expansion Joints and Single Ball Expansion Joints. Provide expansion joints and set for expansion and compression as indicated on plans.

9-38.2(13) MECHANICAL SLEEVE SEALS

Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve. Sealing elements shall be EPDM interlocking links shaped to fit surface of pipe. Provide type and number of sealing elements required for pipe material and size of pipe. Pressure two stainless steel pressure plates for each sealing element. Connecting bolts and nuts shall be stainless steel of length required to secure pressure plates to sealing elements. Provide one connecting bolt and nut for each sealing element.

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DIVISION 10

OPERATING MACHINERY

10-01 DRIVE MACHINERY, TRUNNION ASSEMBLY, AND SPAN LOCK MACHINERY (NEW DIVISION)

10-01.1 DESCRIPTION

The Work under this Section shall consist of furnishing all labor, equipment and materials (including spare parts) as shown on the Plans and specified herein. This Work includes manufacturing; shop testing, shipping, installing, adjusting, painting, lubricating and field testing to place in correct, satisfactory operating condition the operating machinery and span locks, lock bars, guide sockets, receiving sockets, and supports.

The Contractor shall supply and install new span locks at each pair of aligned bascule girders for the double leaf bascule span as shown on the plans. All materials and equipment required shall be new. The center locks are designed to provide stability at the transition from one movable leaf to the other when traffic passes over the span.

Apparatus for controlling the operation of the span including conduits, boxes, wiring, cables and other equipment required to extend the necessary circuits from the control house to the respective components is specified in Section 8-19, Bridge Electrical.

10-01.1(1) SPECIFICATIONS AND STANDARDS

The design, material requirements, workmanship, and erection of all machinery components shall meet the applicable requirements of AASHTO LRFD Movable Highway Bridge Design Specifications, 2nd Edition, 2007, with 2008 interim Revisions, hereinafter referred to as the AASHTO Specifications, and any other specification or standard as specified herein or as shown on the Plans.

Portions or all of certain recognized industry or association standards or specifications referred to herein as being a requirement of these Specifications shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements of the Contract Documents. Unless otherwise stated the reference standard or specification is that which is current as of the date of issuance of these Specifications.

10-01.1(2) REQUIRED DRAWINGS AND DATA

The Contractor shall furnish data and drawings on the mechanical equipment as specified herein and as required elsewhere in the Contract Documents within 100 calendar days of receipt of the First Notice to Proceed. Data and charts shall be submitted, and/or installed on the job, as specified for at least 14 calendar days prior to opening the bridge vehicular traffic.

Wiring diagrams shall be furnished for all components that include electrical connections.

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10-01.1(3) WORKING DRAWINGS

Working drawings as necessary for the fabrication and assembly of the operating machinery shall be prepared by the Contractor and shall be submitted to the Project Engineer for approval as described in the Special Provisions, and as required herein. The drawings shall include complete details of fabricated machinery parts, catalog and data sheets of standard components, and a tabulation giving the name of the part, description, function, weight, manufacturer, rating, type, model, and catalog and serial number of each component. Each component shall be identified by an item number and complete assembly layout drawings shall be furnished identifying each component by the item number.

The Plans show general details of the machinery, in keeping with the requirements and in accordance with the AASHTO Specifications. These Plans are not intended to be complete in all details. The ratios of teeth between individual pairs of gears, and the layout and arrangement of parts may be varied to permit maximum use of the Contractor's standard patterns and shop procedures, provided the overall ratios and times of operation for normal and auxiliary power as specified, are maintained, the size and strengths of all machinery parts are proportioned to conform to the requirements of the AASHTO Specifications, and that the standard of quality in details as shown in the Plans is maintained.

Structural support for machinery, and exact positions of parts, shall be detailed by the Contractor after the final machinery layout has been determined. Minor parts, which are required but not shown in detail in the Plans, shall be detailed by the Contractor in accordance with best standard practice.

The working drawings shall show finish tolerances and allowances for all fits.

Working drawings shall show all parts completely detailed and dimensioned. The grade and extent of finish machining, with all tolerances and allowances, shall be stated for each part for which a specific fit is required. Finished surfaces shall be as defined by the ANSI B46.1, Surface Texture; and fits shall be as defined by the ANSI B4.1, Preferred Limits and Fits for Cylindrical Parts, unless otherwise stated herein or on the Plans. ANSI B4.1 shall also apply to fits for non-cylindrical parts.

Manufactured components shall be shown in outline on the drawings, with sufficient dimensions and data to determine the clearances required for installation and operation. Manufacturer's certified dimension prints shall state the name of the job; pertinent ratings of the equipment; and shall indicate, where applicable, the provisions for adding, draining, and checking the level of lubricant; the method of lubrication and type of fittings; and the location of inspection openings.

The Contractor shall furnish complete data regarding the design and construction of all manufactured items to be furnished under this Contract, including material specifications, cross-sectional assembly drawings, detail drawings of component parts, and the dimensions of principal elements.

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Complete shop bills of materials shall be made for all machinery parts. If the bills are not shown on the working drawings, prints of the bills shall be furnished for review in the same manner as specified for the drawings.

Working drawings shall give identifying marks and critical dimensions for locating each part or assembled unit with respect to the bridge or foundation.

The Contractor shall submit to the Project Engineer for review the required number of prints of all working drawings. In case of correction or rejection, the Contractor shall resubmit the required number of prints of working drawings until drawings are approved and such procedure shall not be considered a cause for delay. The Contractor shall bear all costs for damages, which may result from the ordering of any materials prior to the approval of the working drawings; and no work shall be done until the working drawings have been reviewed and approved by the Project Engineer. The Contractor shall supply the Project Engineer with eight (8) sets of prints of the approved drawings.

Contractor shall submit a stress relief heat treatment procedure for all conditions as required and specified herein, to the Project Engineer for approval. The procedure shall include a description of the part and an explanation of the proposed heat treatment, including the rate of heating, the soaking temperature, the time at the soaking temperature, the rate of cooling, and the temperature at which the part is to be withdrawn from the chamber, and any other information to fully explain procedure.

Approval of the working drawings by the Project Engineer shall not relieve the Contractor from full responsibility for the satisfactory construction and operation of the machinery.

10-01.1(4) MAINTENANCE AND OPERATION MANUAL

The Contractor shall furnish to the Project Engineer 8 bound copies of a booklet containing descriptive leaflets and drawings covering all items of the mechanical equipment, with catalog numbers indicated; printed or typewritten statements prepared by the manufacturers of the equipment covering the proper methods of assembly, installation, operation, adjustments, alignment, lubrication, and otherwise maintaining each item; a detailed description of the functions of each item in connection with the various operating steps; charts showing the locations of all lubricating fittings and other points of lubrication; and complete parts lists and replacement parts numbers where applicable.

Manuals shall contain as a minimum the following:

1. Table of Contents in numerical page order.
2. Index, in alphabetical order.
3. Manufacturer's literature describing each piece of equipment and giving complete identification including manufacturer's model numbers and drawing numbers. A set of descriptive leaflets, bulletins and drawings covering all items of equipment. The catalog number of each piece shall be given, to be used in case it becomes necessary to order replacement parts from the original manufacturer.

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4. Operation instructions, including step-by-step description for starting, operating, shutdown, draining and cleaning of all machinery components including manual operation where applicable. Operation instructions shall note all precautions required for correct and safe operation.

5. Maintenance and lubrication instructions for the machinery components as well as reduced size copy of lubrication charts specified herein elsewhere.

6. Local representatives and suppliers' name, addresses and phone numbers.

7. Spare parts data.

8. Reduced size drawings of all approved working drawings that show all as-built corrections.

Manual documents shall be printed on tear resistant paper and be approximately 8 1/2-inch by 11-inch (or 11-inch by 17-inch, folded) and shall be bound in heavy-duty three hole binders which will not be more than 3-inch in thickness. Covers for manuals shall be rigid plastic or other approved material. Drawings shall be contained in the manuals and shall be 11-inch by 17-inch in size and individually Z-folded with the sheet designation appearing face up in the folded configuration so that the drawings may be easily identified and opened. Drawings shall be in black on white background and shall be clearly legible

10-01.1(5) GEAR REDUCER CALCULATIONS

The reducer manufacturer shall furnish calculations demonstrating reducers supplied meet requirements as specified by applicable AGMA standards and herein. Calculations shall be prepared by and sealed by a Professional Engineer licensed in the state of Washington and submitted to the Project Engineer for review. The reducer manufacturer shall also submit a shop testing procedure and arrangement to the Project Engineer for review and approval.

10-01.1(6) MECHANICAL EQUIPMENT ORDERS

Notification is hereby given that some items listed in the machinery schedule are considered long lead items. Within 30 calendar days after the date of the First Notice to Proceed, the Contractor shall furnish evidence to the Project Engineer that the rack pinion pillow block bearings, the secondary gear reducer, the central gear reducer, and the auxiliary gear reducers have been ordered. Evidence may be in the form of copies of purchase orders or a signed written statement showing date and company from which each item was ordered.

10-01.1(7) MACHINERY ALIGNMENT PLAN AND MACHINERY ALIGNMENT REPORT

The Contractor shall prepare a machinery alignment plan that details the methods to align the machinery to the tolerances specified herein and within the tolerances recommended by the manufacturer. The Plan report shall include manufacturers' recommended alignment tolerances, drawings of alignment templates with sufficient detail to verify rigidity of template, calculations of the effect of dead load on trunnion alignment, and calculations of temperature effects on alignment. The alignment plan shall not rely on the use of tapered shims for proper alignment;

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however, tapered shims may be required to correct supports that are not within the machinery tolerances specified in the approved alignment plan. The Plan report shall be submitted to the Project Engineer for final approval within 120 calendar days of award of the First Notice to Proceed.

The Contractor shall prepare a letter report that details the final alignment of the machinery. The report shall list the date and temperature conditions at the time of measurement. The report shall contain a table that lists the components, the components allowable misalignment tolerance as specified by the manufacturer, and the measured alignment. The report shall include final reduction in clearance measurements, measured by the use of feeler gauges, for all pillow block bearing adapters. The report shall be sealed by a Professional Engineer licensed in the state of Washington and submitted to the Project Engineer for final approval and final acceptance of the machinery.

10-01.2 MATERIALS

The materials shall meet the minimum requirements specified herein or as specified on the Plans, if plan requirements are more stringent. The Plans show equipment schedules listing the minimum design requirements for the new equipment.

All equipment and materials furnished under the items specified herein shall be brand new. All equipment, materials and workmanship shall be first class in every particular, and shall be manufactured and installed to the satisfaction of the Project Engineer.

All recognized industry or association standards or specifications referred to herein as being a requirement of these Special Provisions shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements of the Contract Documents. Unless otherwise stated the reference standard or specification which is current as of the date of issuance of these Special Provisions shall be governing. The following abbreviations will be used herein and on the Plans to designate standard specifications for material and workmanship:

American Association of State Highway and Transportation Officials ...AASHTO

American Gear Manufacturers Association .....AGMA

American Iron and Steel Institute .....AISI

American National Standards Institute .....ANSI

American Society of Mechanical Engineers.....ASME

ASTM International (formerly American Society of Testing Materials).ASTM

American Welding Society .....AWS

National Electrical Manufacturers Association .....NEMA

National Lubricating Grease Institute.....NLGI

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Occupational Safety and Health Administration.....OSHA

Society of Automotive Engineers .....SAE

Steel Structures Painting Council .....SSPC

American Bearing Manufacturer's Association.....ABMA

10-01.2(1) STEEL CASTINGS

Steel castings shall conform to the material requirements as shown on the Plans and as specified herein.

Patterns for castings specifically cast for this project, shall be substantially constructed and shall be finished to give a neat appearance to the castings. Unfinished edges and inside corners shall have rounded edges and fillets. Draft in patterns shall assure a minimum thickness equal to that shown on the Plans. Ample thickness of material shall be provided so that after finishing, the thickness of metal at every point will not be less than shown on the Plans. The allowance for draft shall be as small as is practicable. After use, patterns shall be shipped to the site and stored at the location as directed by the Project Engineer.

Each pattern shall have a distinctive mark to correspond with their respective item numbers that will show on the castings.

All steel castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blowholes, and other defects in positions affecting their strength and value for the service intended. All castings shall be sandblasted or otherwise effectively cleaned of scale and sand, to present a smooth, clean, and uniform surface. All unfinished edges of castings shall be neatly cast with rounded corners, and all inside angles shall have ample fillets. All surfaces requiring finish shall have adequate material allowance for machining to finish dimensions. All bolted mating surfaces shall be machined and finished to permit proper alignment as shown on the Plans. Machined bosses shall be provided on cast steel machinery parts to give proper seats for bolt heads and nuts.

Blowholes appearing upon finished castings shall be so located that a straight line laid in any direction will not cut a total length of cavity greater than one inch in any one foot, nor shall any single blowhole exceed one inch in any dimension or have an area greater than one-half square inch. Blowholes shall not have a depth injuriously affecting the strength of the casting. Minor defects that do not impair the strength may, with the approval of the Project Engineer, be welded by an approved process and be inspected by magnetic particle examination. The defects shall be removed to solid metal by chipping, drilling, or other satisfactory method. Castings, which have been welded without the Project Engineer's permission, will be rejected.

10-01.2(2) STEEL FORGING

Steel castings shall conform to the material requirements as shown on the Plans and as specified herein. All forged shafts, including main drive shafts, shall be reduced to size from a single bloom or ingot until homogeneity is secured. The blooms or ingots, from which shafts are to be

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made, shall have a cross-sectional area at least three times that required after finishing. No forging shall be done at less than a red heat. Forged rounds for shafts shall be true, straight, and free from all injurious flaws, seams, or cracks. Forging shall provide adequate material allowance for machining to finish dimensions. All forging shall be fully heat treated before being machined. All ASTM A668 forgings that are to be welded shall meet the requirements of Supplement S4.

10-01.2(3) OPEN GEARS

All open gears, including the rack and rack pinion, shall conform to the requirements of AASHTO Specifications and the requirements for accuracy of the AGMA Standard 2001-C95, "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth", except as otherwise provided herein or on the Plans. The open gears shall conform to AGMA Quality No. 7 or higher. The AGMA quality number shall be stated on the applicable working drawings. All gear teeth shall be 20 degree full depth involute shape. Tooth geometry and backlash shall be specified in the working drawings. Radiographic Inspection shall be performed on the pinions to detect defects.

10-01.2(4) SPEED REDUCERS

Speed reducers with minimum requirements as shown on the Plans shall conform to the requirements of AASHTO and shall also conform with AGMA Product Standard 6010-F97, "Standard for Spur, Helical, Herringbone, and Bevel Enclosed Drives", and as specified herein. The nameplate shall carry the AGMA symbol. The reducers shall be furnished by manufacturers who have provided similar equipment for at least ten (10) years.

Gears and shafts shall be heat-treated alloy steel suitable for the intended service. Gearing in enclosed reducers shall conform to AGMA Quality No. 7 or higher. Speed reducer bearings shall be anti-friction type with a B-10 life of 40,000 hours. Bearing seals shall be selected such that no leakage occurs.

AGMA life factors shall be determined assuming 2500 bridge openings and 2500 bridge closings per year for a 100 year life. Bearings shall be designed for a B-10 life of 40,000 hours. Reducer component ratings shall meet or exceed the horsepower specified on the Plans times the service factor at their respective speeds. Minimum service factors shall be as follows:

1.5 for durability and 1.5 for strength.

Case hardened gearing will be allowed on spiral bevel gears and spiral bevel pinions. All remaining gearing shall be through-hardened. All gear sets, including bevel gears, shall be straddle mounted unless noted otherwise. Bevel pinion gears need not be straddle mounted.

Housings shall be of cast steel or welded steel plate construction. An inspection cover shall be provided to permit inspection of the gearing inside the housing. Inspection covers shall be provided with a gasket material that does not require replacement of the gasket when the cover is removed. The inside of the housings shall be sandblasted, cleaned and protected with lubricant prior to assembly to ensure protection from rusting.

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Provisions shall be made for filling, draining, and ventilating the housings; and a sight gauge shall be mounted on each unit to read the recommended lubricant level. Ventilation opening shall come equipped with a moisture (hygroscopic) and particle filtration unit. The drain provisions shall include a shut-off valve between a drain pipe cap and the reducer. A hose bibcock or other device suitable for connecting a 1 inch drain hose shall be provided for each reducer. A drain hose shall be provided for use in the pier when oil must be drained from the reducers. The hose shall be a minimum of 50 feet long. The hose shall be provided with a storage reel and shall be permanently mounted in the pier.

Speed reducers shall be provided with continuous oil bath lubrication at varying speeds and direction. RPM shown on the Plans is maximum rated speed, but machinery shall be capable of reduced speed with no adverse affect and supply of proper lubricant to all portions of the reducer. The lubricant level shall be such that all shaft bearings are submerged or to such higher level as recommended by the reducer manufacturer. The reducers shall be provided with effective seals to retain the lubricant such that no visible or measurable lubricant is detectable on input/output shafts.

Speed reducer shaft deflections shall be less than 0.001 inches per inch of gear face width under full load.

The central reducer shall be a parallel shaft, double reduction, selectable differential / non differential, triple input, and double output unit as shown on the Plans. Total ratio and ratio after auxiliary drive input shall be provided as indicated in the Plans. Differential shall be located, such that, when auxiliary drive is operational, the differential will still be utilized. A shaft extension shall be located, as shown on the Plans, for auxiliary drive input. The main input shafts shall be extended to accommodate the flexible brake coupling, and to provide suitable clearance. The output shaft and reducer bearings shall be designed to withstand overhung loads and sized to accommodate coupling hub and key on either side. The efficiency of the unit shall not be less than 94 percent and shall be stated on the applicable shop drawings.

The central reducer shall have a lever capable of locking the differential such that one output shaft can be utilized in the event of an emergency. To reduce the speed of operation with a locked differential, only auxiliary motor in slow speed will be allowed.

The central reducer manufacturer shall coordinate requirements and limitations associated with the auxiliary drive input shaft with the clutch manufacturer. The central reducer manufacturer shall also design the auxiliary drive input shaft and associated bearings for the overhung load and deflection requirements per clutch manufacturer's requirements to ensure satisfactory clutch operation.

The auxiliary reducer shall be a right angle, single reduction, single input, single output unit as shown on the Plans. Total ratio shall be provided as indicated on the Plans. The auxiliary output shaft reducer bearings shall be designed to withstand overhung loads and extended to accommodate the clutch. The efficiency of the unit shall not be less than 97 percent and shall be stated on the applicable shop drawings.

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The secondary reducer shall be a parallel shaft, double reduction, single input, and single output unit as shown on the Plans. Total ratio shall be provided as indicated on the Plans. The output shaft reducer bearings shall be designed to withstand overhung loads. The secondary reducer input shaft bearings and gears shall be lubricated by an oil pump mounted on the reducer. The remaining gears and bearings may be lubricated either by the oil pump or by splash lubrication. The pump motor shall be 3 phase 480 VAC, and shall be powered and controlled by the electrical contractor.

The secondary reducer shall incorporate the supports for a platform as shown in the plans. The supports shall be designed for platform dead load + 100 psf live load over the platform. The platform itself is paid for with the trunnion frame. The platform grating shall be easily removable for access to reducer inspection covers.

The Contractor shall furnish complete calculations regarding the design of the reducers including gearing, shafts, seals, bearings, and material specifications.

10-01.2(5) SHAFTS

Shafts shall be of forged steel of the size and material as shown on the Plans and as specified herein. Forged rounds for shafts shall be true, straight, and free from all injurious flaws, seams, or cracks. Forgings shall provide adequate material allowance for machining to finish dimensions.

All shafts shall be accurately finished, round, smooth, and straight; and when turned to different diameters, they shall have rounded fillets at shoulders and chamfers at shaft ends. All journal-bearing areas on shafts and pins shall be accurately turned, ground, and polished with no trace of tool marks or scratches on the journal surface or adjoining shoulder fillets.

The shaft journals for roller bearings shall be sized and finished as required by the manufacturer of the mated equipment at that location.

The journals for mounting sheaves, drums, and couplings shall be finished to provide the interference fits specified. The shafts shall have a shop shrinkage fit which may be made by heating the sheave, drum, or coupling to the required temperature and inserting the shaft or by other approved means.

Hot rolled steel may be used for shafting with a finished diameter of 6 inches or less.

Each shaft shall be machine finished for its entire length to obtain a smooth finish concentric with the coupling and bearing centerline. There will be no exceptions or substitutions permitted with regard to concentric machining of the shafts.

All shafts shall have provisions, such that, a hydraulic system for mounting and dismounting spherical roller bearings may be utilized. These provisions shall be coordinated with the bearing manufacturer

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10-01.2(6) TRUNNIONS

Trunnions and trunnion spiders shall conform to the material requirements as shown on the Plans and as specified herein.

Trunnion shafts shall be reduced to size from a single bloom or ingot until homogeneity is secured. The blooms or ingots, from which the trunnions are to be made, shall have a cross-sectional area at least three times that required after finishing. No forging shall be done at less than a red heat. Forged rounds for trunnions shall be true, straight, and free from all injurious flaws, seams, or cracks. Forgings shall provide adequate material allowance for machining to finish dimensions. Trunnions shall be accurately finished, round, smooth, and straight. All areas on shafts shall be accurately turned, ground, polished with no trace of tool marks or scratches, on the journal surface or adjoining shoulder fillets. The ends of each trunnion shall have a bore accurately machined to use for turning and alignment. Each trunnion shall have crossed centerlines scribed at right angles to each other, on each end of the shaft, to be used as a guide in aligning the trunnions. Trunnions shall be fabricated and in conformance to the limits specified in the AASHTO Specifications.

Trunnion spider forgings that are welded shall meet the requirements of ASTM A668 Supplement S4.

10-01.2(7) AUXILIARY DRIVE CLUTCH

An electric clutch with minimum requirements shown on the Plans shall be furnished as a part of the span drive system. The clutch shall be designed to be normally disengaged and electrically engaged. The driven portion of the clutch shall be connected to the central reducer auxiliary input shaft. The driving portion of the clutch shall be connected to the auxiliary reducer output. The clutch hub and shaft fits and finishes shall meet the requirements specified on the plans and AASHTO for hubs on shafts.

The clutch shall be a high torque, low inertia, electromagnetic clutch. The clutch shall be equipped with friction linings, on the driven end only that can be replaced without disturbing related equipment on either side of the clutch, and a spring lock pin to adjust the air gap. The clutch assembly shall also be furnished with a NEMA Type 3R enclosure and strip heater.

The clutch will be turning at approximately 60-RPM base speed under auxiliary drive operation. Under main drive operation the driven portion of the clutch will be turning at approximately 1470-RPM speed. The clutch shall be dynamically balanced for operation at these speeds

10-01.2(9) COUPLINGS

Couplings shall be of the type and size as shown on the Plans and shall include grid type, gear type, brake wheel type and others as noted.

All couplings and shaft fits and finishes shall meet the requirements specified in the plans and AASHTO for hubs on shafts. Couplings shall, in general, be finish-bored and have keyways cut by the Coupling Manufacturer to dimensions and tolerances established on the working drawings

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and then shipped to the manufacturers of the various components for shop installation on the shafts.

The couplings shall have provisions for lubricating all contact surfaces and the housings shall be oil-tight under all operating conditions.

All couplings shall be equipped with giant button head lubrication fittings and purge plugs for lubrication of internal parts as recommended by manufacturer and approved by the Project Engineer.

10-01.2(10) SPHERICAL ROLLER BEARINGS

Bearings shall be anti-friction bearings of the spherical roller type and size as shown on the Plans and as specified herein. All bearing fits and finishes shall be in accordance with ANSI B4.1, Preferred Limits and Fits for Cylindrical Parts and ANSI B46.1, Surface Texture. Bearing loads on rollers shall not exceed loads per linear inch as specified in AASHTO for "Bearing on Rollers". Anti-friction bearings shall be rated with a B-10 life of 40,000 hours.

Bearings shall be made by a manufacturer of established reputation who has made bearings that are of comparable size and capacity, that have been in service for a period of ten years or more. Standards of the ABMA shall be the basis of manufacture, and shall be the basis of equivalency. Each bearing shall have two separate rows of spherical rollers. Complete details of bearing assemblies shall be submitted to the Project Engineer for approval.

Bearing housings shall be ASTM A27 cast steel, or ASTM A36 weldments. Two-piece split construction shall be provided for accurate cap and base registration. Cap bolts shall be secured with double hex nuts and base bolts shall be sub-drilled in the shop 0.030-inch under bolt shank diameter to permit reaming. Seals shall be triple nitrile non-split seals.

All bearings shall be equipped with giant head lubrication fittings and purge plugs for lubrication of internal parts as recommended by manufacturer and approved by the Project Engineer.

Rack pinion bearings shall have hydraulic mount and dismounting system. The hydraulic system shall assist in installation and removal of bearings onto corresponding journals. Bearing manufacturer shall coordinate requirements with shaft manufacturers.

10-01.2(11) SPAN LOCKS

A. Lock Bar Operator

Each system shall include a mechanical bar actuator which drives the rectangular, forged steel lock bar through a bar guide, situated on one leaf tip, into a receiver on the other leaf tip. The gearing shall consist of two reductions using heat-treated, alloy steel helical gears on shafts supported by anti-friction bearings. Linear motion shall be provided by a triple lead ACME threaded stem, pin connected to the lock bar. The lock bar operator shall incorporate a bar guide within the operator housing for the lock bar.

A removable hand crank shall be furnished for manual operation. A removable cover shall be provided over the shaft end. The shaft cover shall have a single pole snap action switch

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which activates on removal of the hand crank shaft cover. All leads for brake cover switch and motor shall be located in the motor conduit box. The operator shall be foot mounted in the vertical position, and attached using turned bolts.

Each operator shall be driven by a high starting torque, induction type, 5 horsepower, 1800 RPM, 3 phase, 60 Hertz, 240/480 volt, D flange mounted, TENV electric motor having a continuous duty rating and equipped with a marine duty disc brake with manual release and safety interlock switch. The motor shall be equipped with ball bearings and designed especially for outdoor applications subjected to adverse weather and corrosion conditions.

Travel of the lock bars in each direction shall be governed by a two pole, snap action limit switch that provides two normally open and two normally closed contacts for each direction of travel. The lock bar shall travel at 1-1/2 inches per second and be capable of delivering a minimum thrust of 8,800 pounds to the lock bar at 50% stall torque of the motor.

Two span lock systems, shall be located at the leaf tips to hold the leaves securely in the closed position and capable of sustaining a maximum shear load transfer of at least 225,000 pounds per girder. The design reaction force due to live load is as follows:

Receiver – 225,000 pounds

Forward Guide – 417,000 pounds

Rear Guide (Integral to Actuator) – 192,000 pounds

Operator components shall be so designed and detailed such that stalling the motor shall not result in any physical damage to the lock bar operator mechanical components.

B. Guides and Receivers

Each span lock shall consist of one integral rear guide, one forward guide and one receiver located as shown on the Plans. The lockbar forward guides and lockbar receivers shall be of the zero clearance, energy absorbing type designed for use in bascule bridge service. The forward guides and receivers shall be flange mounted to the structure as shown in the Plans through the use of turned bolts. The forward lockbar guides and receivers shall have high strength bronze wear shoes supported by a combination of stainless steel springs that permit slight vertical movement of the shoes. When the lockbar is inserted into the forward lockbar guide and/or receiver, it shall cause the shoes to depress the springs slightly resulting in a pre-loaded condition that will provide continuous firm contact between the lockbar and shoes. The selection and design of the system shall be such that the relationship of the minimum and maximum stresses will provide infinite fatigue life of the energy absorbing spring system. Adjustment of the pre-load between the shoes and lock bar shall be possible without disassembly of the guides or receivers.

After installation and alignment of the span lock systems, the lock bar and socket assemblies shall be adjusted to achieve correct clearances as per manufacturer's requirements.

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C. Lock Bars

Forged steel for the lock bars shall conform to the requirements of ASTM Specification A668, Class K. The rectangular lock bars shall be integral with the cylindrical stems. The lock bars shall be subjected to ultrasonic examination in accordance with ASTM A388. Any indications (loss of back reflection) using the straight beam method, which cannot be readily explained by the geometry of the piece, will be cause for rejection. Any forgings which are rejected shall be replaced at no cost to the Department. A hinged joint shall connect the lock bar to the actuator. Material used for the lockbar shall have a yield stress of 75-80 ksi.

Forgings shall provide adequate material allowance for machining to finish dimensions. All forgings shall be fully heat treated before being machined.

10-01.2(12) KEYS AND KEYWAYS

Keys and keyways shall be provided in couplings, clutch hubs, and gears between their respective shafts. Keys and keyways shall conform to the dimensions and tolerances for square and flat keys of ANSI B17.1. All keys shall be effectively held in place, preferably by setting them into closed-end keyways milled into the shaft. The ends of all such keys shall be rounded to a half circle equal in diameter to the width of the key. Subject to the Project Engineers approval, keys that are not set into the closed-end keyways shall be held by safety set screws, or other effective means; in vertical shafts, collars clamped about the shafts, or similar device shall be provided. Keyways shall not extend into any bearing.

All keys for couplings shall conform to the requirements of ASTM A668 Class G unless otherwise noted

10-01.2(13) SHIMS

Where shown on the Plans and required for leveling and alignment of equipment, machinery shims shall be full width and length neatly trimmed to the dimensions of the assembled parts and drilled for all bolts that pass through the shims. Holes for bolts shall be oversized by 1/16-inch. In general, sufficient thickness shall be furnished to secure 1/64-inch variations of the shim allowance plus one shim equal to the full allowance. Shimming of equipment shall be performed with the least amount of shims needed to fill the space. No more than five (5) shims shall be used unless approved by the Project Engineer. Shims shall be fabricated of ASTM A709, Grade 50, except that thickness less than ¼-inch shall be stainless steel. Corrosion resistant precision thickness shims, including tapered shims, shall be provided if required in the alignment plan or if required to achieve correct alignment.

10-01.2(14) FASTENERS

The following requirements for bolts, nuts, studs, cap screws, lock washers and cotter pins, shall apply, except where otherwise called for herein or on the Plans.

Turned bolts shall be quenched and tempered steel conforming to the requirements of ASTM Specifications A449. Turned bolts shall have the diameter of the shank 1/16-inch larger than the diameter of the threads. Hexagonal heads and nuts shall be in accordance with the heavy series in accordance with ANSI B18.2.1 and shall be finished. Two nuts or one nut and a lock-washer

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shall be used on turned bolts. Lock washers will only be permitted if approved by the Project Engineer. Holes for turned bolts shall be carefully reamed to provide for an ANSI B4.1 LC6 fit with the body of the bolt. The surface of the body of turned bolts shall meet the ANSI roughness rating value of 63 microinches.

High strength bolts shall be used for connection of machinery components to the machinery bases wherever turned bolts are not required by the plans or Special Provisions. Machinery connection bolts, nuts, and hardened washers shall conform to the requirements of ASTM Specifications A449, A563, and F436, respectively. Holes for machinery connection bolts shall be 1/32 inch larger than the diameter of the bolt.

High strength structural steel bolts, nuts, and hardened washers shall be used to connect machinery bases to supporting steel. High strength structural steel bolts, nuts, and hardened washers shall conform to the requirements of ASTM Specifications A325, A563, and F436, respectively. Connections using high-strength bolts shall conform to the "Specification for Structural Joints using ASTM A325 or A490 Bolts," approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

Anchor bolts fastening new machinery supports to concrete shall be threaded rods conforming to the requirements as shown on the Plans. Nuts and hardened washers shall conform to the requirements of ASTM Specification A563, and F436, respectively. Double nuts shall be used on all anchor bolts. All anchor bolts, nuts, and washers shall be galvanized with a Class 50 mechanically deposited zinc coating in accordance with the requirements of ASTM B695.

The dimensions of socket-head cap screws, socket flat-head cap screws, and socket-set screws shall conform to ANSI B18.3; and the screws shall be made of heat-treated alloy steel, cadmium-plated and furnished with a self-locking nylon pellet embedded in the threaded section. Unless otherwise called for on the plans or specified herein, set screws shall be of the headless, safety type; shall have threads of the coarse thread series; and shall have cut points. Set screws shall neither be used to transmit torque nor as the fastening or stop for any equipment that contributes to the stability or operation of the bridges.

All threads for bolts, nuts, and cap screws shall conform to the coarse thread series and shall have a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance with the ANSI B1.1, "Unified Screw Threads."

All bolt heads and nuts shall bear on seats square with the axis of the bolt. On castings, except where recessed, the bearing shall be on finished bosses or spot-faced seats. Bolt heads, which are recessed in castings, shall be square. All bolt holes through unfinished surfaces shall be spot-faced for the head and nut, square with the axis of the bolts. Beveled washers shall be used where bearing faces have a slope or more than 1:20 with respect to a plane normal to the bolt axis.

Positive locks shall be furnished for all nuts. If double nuts are used, they shall be of standard thickness. Double nuts shall be used for all connections requiring occasional opening or adjustment. If lock washers are used for securing screws or nuts, they shall be made of tempered

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steel and shall conform to the SAE standard dimensions. The material shall meet the SAE tests for temper and toughness.

10-01.2(15) MACHINERY SUPPORTS AND MANUFACTURED ITEMS

Structural steel for machinery base supports shall conform to the requirements of ASTM A709, Grade 50. Steel components of manufactured items shall conform to the materials recommended by the manufacturer.

The Plans indicate minimum requirements for machinery base supports for the machinery and all other components. The material thickness shown on the Plans are to be considered the minimum acceptable and should be increased if appropriate for the application.

Welded steel machinery supports shall be given a stress relief heat treatment prior to machining.

Top surfaces of all supports shall be milled after fabrication to provide a uniform surface. All surfaces requiring milling shall have adequate material allowance for milling to the minimum finish dimensions as required by AASHTO or as shown on the Plans.

10-01.2(16) WELDMENTS

The fabrication of steel weldments shall conform to the requirements of the AASHTO Specifications and as specified herein.

All welding required herein or called for on the Plans shall be done in accordance with the requirements of AWS D1.5. Weldments shall be stress relieved by heat prior to final machining as specified herein. The fitting up and welding procedure shall be such that distortion of the work will be a minimum. If necessary to obtain this result, suitable welding fixtures shall be used. The Contractor shall submit welding procedures, together with the working drawings for the parts to the Project Engineer for approval.

All fillet welds and partial penetration groove welds shall be tested by the magnetic-particle method in accordance with the requirements of Section 6 of AWS D1.5. Radiographic testing shall be used for examination of complete joint penetration groove welds in butt joints and for complete penetration groove welds in T-joints. Corner joints shall be tested by ultrasonic testing.

All complete joint penetration welds shall be tested in accordance with the requirements of Section 6 of AWS D1.5 for each size and type weld. Inspection and testing of welds and basis of acceptance shall be in accordance with the requirements of Section 6 of AWS D1.5.

All field welds shall be stress relieved by peening unless otherwise indicated within these Special Provisions or within the Plans or unless specific written permission is granted to omit the peening process for each particular weld. The Contractor shall submit his proposed weld procedures for all field welds for review and approval by Project Engineer. The proposed peening procedures will be required to be included in the weld procedures before approval will be granted. In addition, any existing structural steel being field welded shall be tested to determine its chemical composition. The actual chemistry of the existing steel shall be considered when developing the proposed field welding procedures. The chemistry of each and every existing plate or shape shall be determined. No field welding shall begin until the

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approved weld procedures are available. All field welding shall be in accordance with requirements of the Standard Specifications.

Welded steel machinery parts shall be given a stress relief heat treatment. The Contractor shall submit a schedule of the proposed stress relief heat treatment to the Project Engineer for his approval. The schedule shall include a description of the part and an explanation of the proposed heat treatment, including the rate of heating, the soaking temperature, the time at the soaking temperature, the rate of cooling, and the temperature at which the part is to be withdrawn from the chamber. Soaking times less than one hour will not be approved.

Weldments shall be neat and shall have all exposed sharp corners and edges removed. Mounting surfaces shall be straight and flat such that full contact with the equipment being supported or retained is obtained.

10-01.2(17) MACHINERY GUARDS AND SHIELDS

The Contractor shall furnish suitable guards for equipment being installed as required to conform to AASHTO Specifications and OSHA.

All driving mechanisms and power transmission apparatus shall be guarded. Guards and shields must meet the full intent of requirements outlined in OSHA 1910.219. Guards shall be fabricated from stainless sheet (minimum 16 gauge). All hardware shall be stainless steel.

All guards shall be easily removable and replaceable as required for maintenance purposes. Use of hinges and quick disconnect pins to the extent practical. Bolt holes shall be oversized such that assembly and disassembly can be accomplished without interference. Guard supports shall be anchored to the machinery or machinery floor utilizing stainless steel anchors. Guards shall be placed in the passageway to guard the rack pinion maintaining at a minimum of 30 inches of clear space in the passageway to the trunnion frame. The couplings on the output shaft of the secondary reducer shall be guarded. All brakes and the clutch shall be guarded.

Moving parts shall be painted OSHA Safety Color Orange complying with the requirements of this Special Provision. The following, at a minimum, shall be painted OSHA Safety Color Orange: exposed shafts, couplings, exposed non-contact surfaces of the pinions, exposed non-contact surfaces of the racks, clutch, brake hubs, tachometer, live load shoes, live load strike plates, movable elements of limit switches, counterweight hold down devices and bumper blocks.

10-01.2(18) LUBRICATION

A. Manual Lubrication Fittings

Provide all grease lubricated machinery components (not including gear teeth) that are not served by the central automatic lubrication system with NPS 1/4 inch Giant Button Head lubrication fittings.

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Locate the fittings to conveniently facilitate lubrication. If necessary connect the lubrication ports to central stations using 1/4 inch stainless steel, seamless pipe with stainless steel fittings. Use pipe extensions that are as short as possible and securely supported.

Upon completion of fabrication plug all grease fitting locations until the components are installed and regular lubrication is started. Immediately after erection and prior to operation lubricate all rotating and sliding parts; fill the gear reducers with oil and bearing housings and flexible couplings with lubricants as specified on the approved lubrication charts.

Submit plans and specifications of the proposed systems to the Project Engineer for approval.

B. Centralized Automatic Lubrication Systems

Furnish one automatic lubrication system for each pier, a total of two complete systems. Each unit shall be capable of automatically delivering the correct amount of NLGI #2 grease lubricant to the following 28 points on each leaf:

1. Trunnion Bearings – 6 ports on each bearing of 4 bearings (24 points total)

2. Rack Pinion Shaft Bearings – 1 port on each 4 bearings (4 points total)

The positive displacement pumping unit, approved for grease types up to NLGI #3, shall be driven by a 100 220 V, 60 Hz, single phase electric motor, through gear type speed reductions, and be mounted on a base plate. It shall be approved for operation from 5 degrees to 100 degrees F, and have a reservoir capacity of 20 pounds of grade #2 grease and be equipped with a low and high level switch.

Mount the pumping units in a NEMA 4X enclosure, equipped with a low level and high level alarm for the reservoir. Each outlet shall have a liquid filled pressure gage and high pressure relief valves with electrical indication to signal a blockage in the line. The pump shall be sized to deliver the proper amount of lubricant to the farthest doser through lines that have been correctly sized for the flow and pressure required.

Furnish a control unit, installed in the NEMA 4X enclosure, to set the pump running and pause time. Separate alarms, displayed on the outside of the enclosure, with different colored lights, for low level conditions inside the grease reservoir, no signal from the piston sensing proximity switch and signal for blockage in case the pressure relief valve opens, shall be supplied by the controller.

Provision shall be made to permit delivery of different volumes of grease to various ports as required. Where divider valves are used, piston sensing proximity switches shall be mounted onto the feeder and electrically connected to the control unit.

Delivery of grease from the pump to the lubrication ports shall be through stainless steel tubing. Where slight motion of the component being lubricated occurs, such as on the ends of the trunnion shafts, flexible stainless steel, braided hoses shall be used to connect from the tubing to the lubrication ports.

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All tubing and flexible hoses shall have excellent wear, cut, weather and chemical resistance. All fittings shall conform to JIC requirements. All grease fittings shall be brass.

C. Lubricants and Charts

The Contractor shall furnish sufficient lubricant to provide for the initial lubrication of each component on the structure requiring lubrication and such additional lubricant for normal maintenance requirements for a period of at least two years. Maintenance lubricants shall not be required for synthetic reducer oil having an indefinite service life.

All synthetic oils purchased for use on the bridge shall be provided by a manufacturer that has facilities for annual testing of the oil furnished. The manufacturer shall furnish evidence of this capability by providing testing and analysis of oil taken from the reducers at the time of bridge acceptance, at no charge to the owner. Included in the testing and analysis shall include, but not limited to, viscosity, and presence and quantity of water, wear metals, and other contamination. A standard shall be provided by the testing firm regarding acceptable levels of lubricant quality that should be referenced during future testing.

The Contractor shall furnish all equipment necessary for routine maintenance lubrication of the equipment on the bridge. Each grade or class of grease shall be provided with its own separate grease guns or other equipment normally used for application of the lubricant. The Contractor shall coordinate the grease requirements with the various suppliers to attempt to limit the different greases to no more than two. Contractor shall also furnish two grease guns suitable for the furnished lubrication fittings for each bridge. Each grease gun shall be provided with a fitting suitable for the grease fitting installed. If more than one type of grease fitting is used for the same lubricant, grease applicators shall be provided for each type of fitting. Each device shall have a permanently attached nameplate listing the specific lubricant within. Sufficient grease applicators shall be provided to permit storage of all types required in each pier, for each leaf.

Maintenance lubricants shall be stored where specified by the Project Engineer.

The Contractor shall furnish and install, as directed by the Project Engineer, charts for the guidance of the operators, outlining sequences for the operation of the span in all modes of operation. A diagram of all machinery and periodic service points shall be furnished and installed in each machinery room. The diagram shall show the location of all lubricating fittings and other points of the mechanical and electrical equipment, which require lubrication of any kind, and shall show the kind of lubricant to be used at each point and the frequency of lubrication. All charts shall be on Mylar framed under glass in a neat wooden frame and shall be prepared and installed as directed by the Project Engineer.

D. Lubrication Drip Pans

The Contractor shall furnish drip pans constructed of 16 gauge stainless steel and configured such that they are readily removable by maintenance forces. Edges shall be doubled over so that no sharp edges exist. The edges of the pans shall be 2 inches tall, and of sufficient width

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and length to completely cover the area beneath the component. Provide drip pans for: span locks, span lock receivers, span lock guides, rack pinions, pinion shaft bearings, and trunnion bearings. The dip pans shall be attached by 2”x2”x1/8” stainless steel angles welded to the pan and bolted to platforms, or floors with appropriate clips, inserts and fasteners.

10-01.2(19) SPARE PARTS

The Contractor shall furnish the following spare parts for the new span drive.

4	Grid for main motor coupling (CP1)
2	Grid for auxiliary motor coupling (CP5)
2	Complete set of friction discs for auxiliary clutch (CL1)
4	Complete set of (2) brake pads for motor brake (BR1)
4	Complete set of (2) brake pads for machinery brake (BR2)
2	Complete set of seals - rack pinion bearing (B1)
2	Complete set of seals - central reducer (R1)
2	Complete set of seals - secondary reducer (R2)
2	Complete set of seals - auxiliary reducer (R3)
2	Hygroscopic breathers for each reducer type (R1, R2, R3)
2	Complete sets of receiving and guide wear plates including steel springs and shims for the spring-loaded receivers and guides.
2	Lock bar operator motor assembly with integral brake.
2	Lock bars
4	Aoutomatic Lubrication System Dosers

Spare parts shall be lubricated for long term storage and provided in sealed, uniform sized cartons with typed and clearly varnished labels to indicate their contents, and they shall be stored where directed by the Project Engineer. Steel components shall be lubricated for protection from corrosion. The spare parts shall also be marked to correspond with their respective item numbers, as indicated on the lubrication chart.

10-01.2(20) TOOLS

A complete set of tools, each set located in a lockable cabinet, shall be furnished at each bascule pier. The Contractor shall provide one set of wrenches and sockets suitable for machinery maintenance and to fit all nuts and bolt heads in the machinery installation. The Contractor shall also provide all hydraulic equipment necessary to remove spherical roller bearings at rack pinion shafts. In addition, a full set of flat head and Phillips head screwdrivers shall be furnished which

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will fit all machinery and electrical components plus an assortment of punches, files, chisels and a ball peen hammer. All tools shall be professional grade and come with a life time warranty.

The miscellaneous tools, grease, and grease guns shall be stored in a location approved by the Project Engineer in a cabinet or toolbox made of galvanized steel and having provisions for a padlock.

10-01.2(21) WARRANTY AND QUALITY CONTROL

All manufacturers shall warrant all products and associated hardware to be free of defects in material and workmanship for a period of five (5) years from the date of final acceptance of the completed bridge Contract. Final Acceptance shall be in accordance to the requirements of the Standard Specifications. Any defect within this period shall be repaired or replaced by the Manufacturer or Vendor, at total cost to the Manufacturer or Vendor, including labor, parts, and transportation. The Contractor shall provide letters to the suppliers with copies to the Project Engineer, identifying the scheduled date of final acceptance of the bridge and therefore the date the warranty shall begin. If the date of final acceptance is extended, it shall be the Contractors responsibility to extend the commencement of the warranties from the suppliers at no cost to the Owner.

The Owner reserves the right to receive on demand a test report from an independent laboratory certifying that the equipment furnished meets these specifications, at no cost to the Owner.

The Owner reserves the right to reject an entire shipment of material covered by this Section if an item or items are found to be defective within a 30 calendar day period following receipt of materials.

10-01.3 CONSTRUCTION REQUIREMENTS

The machinery specified and as approved on the shop drawings and related electrical equipment shall be installed according to best millwright practice. Millwrights shall provide information that they have performed installations on heavy machinery of a similar character to that required within this project. The millwright foreman shall have successfully installed movable bridge machinery on a previous project.

In addition to the mechanical equipment included within this Special Provision and as shown on the Plans, electrical equipment including the main drive motors, brakes, and limit switches shall be installed as a part of this Special Provision. The Contractor shall coordinate the Work with subcontractors to provide for the necessary shop assembly and field installation of all of the equipment.

Machinery manufacture and installation shall conform to all applicable requirements in AASHTO Specifications and all applicable requirements with special requirements and additions as specified herein or as specified on the Plans.

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10-01.3(1) SERVICE ENGINEER

The Contractor shall be required to have a qualified service engineer from the manufacturer of the bearings present on the job at the time that the bearings are installed, aligned and tested. In addition, the service engineer shall be available for consultation as needed until final acceptance of the Work. Such consultation shall, if considered necessary by the Project Engineer, be at the job site.

As part of this Work, the Contractor shall be required to have the machinery system supplier present on the site during installation and for training of the bridge personnel.

10-01.3(2) INSPECTION AND TESTING

The Contractor shall give a 21 calendar day advance notice to the Project Engineer prior to the beginning of work at the foundries, forge, and machine shops so that inspection may be conducted. No materials shall be cast, forged, or machined before the Project Engineer has been notified where the orders have been placed.

The Contractor shall furnish all facilities for the inspection of material and workmanship in the foundries, forge, and machine shops; and the Project Engineer shall be allowed free access to necessary parts of the premises. Work done while the Project Engineer has been refused access will automatically be rejected.

The Engineer shall have the power to reject materials or workmanship, which do not fulfill the requirements of these Specifications.

Inspection at the foundries, forge and machine shops is intended as a means of facilitating the work and avoiding errors; and it is expressly understood that it will not relieve the Contractor from any responsibility in regard to imperfect material or workmanship and the necessity for replacing the defective materials or workmanship.

The Contractor shall furnish the Project Engineer with as many copies of orders covering work as the Project Engineer may direct.

Unless otherwise provided, the Contractor shall furnish test specimens, as specified herein, and all labor, testing machines, tools, and equipment necessary to prepare the specimens and to make the physical tests and chemical analyses. Copies of all test reports and chemical analyses shall be furnished to the Project Engineer within 60 calendar days after First Notice to Proceed.

The acceptance of any material or finished parts by the Project Engineer shall not bar their subsequent rejection if found defective. Rejected material and workmanship shall be replaced or corrected by the Contractor in a manner satisfactory to the Project Engineer at no additional cost to the Owner.

10-01.3(3) REDUCER TESTING

The reducer manufacturer shall shop test each reducer by running it at the normal operating speed at no load for at least four hours and at 150% full-load torque of two main motors for 1 hour in the presence of the Project Engineer or his duly appointed representative. These tests

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shall be run with the reducers filled to the required mark and with new oil of the viscosity the manufacturer recommends on his lubrication chart for normal operation. Half of the run shall be one direction and the other half in the opposite direction. Immediately before the start of the test, and at half-hour intervals for no-load and ten (10) minute intervals for 150% full-load motor torque thereafter, the following measurements shall be made and recorded and the records shall be submitted with the Certificate of Compliance:

1. Temperature of ambient air
2. Temperature of oil near bottom of crankcase (not to exceed 135°F)
3. Surface temperature of each shaft extension adjacent to shaft seal
4. Sound level at point above and 60 inches distant from center of unit

During testing, each reducer shall be checked for unusual noise (thumping or any non-uniformity), excessive bearing clearance, oil leakage, and any other unusual operating characteristics. The units shall operate smoothly, and without excessive vibration or temperature rise. All malfunctions shall be recorded and corrected, and the units retested, if necessary, before release from the manufacturer's shop. After the unit has passed the test, a Certificate of Compliance shall be submitted by the Contractor to the Project Engineer.

In addition to the test specified above, the proper distribution of load on the gear teeth shall be demonstrated by the wear of blue machinists die applied to each gear. Load distribution shall meet AGMA requirements for all gears.

10-01.3(4) TRUNNION ASSEMBLY

The trunnion, trunnion spider, and girder shall be assembled in the shop. The faying surfaces shall be machined as specified in the Plans. The trunnion spider shall be mounted to the girder web and bored with the web to the tolerances necessary for an ANSI FN2 fit with the trunnion. The trunnion shall be installed in the spider using a combination of heating the trunnion spider and cooling the trunnion with liquid CO2.

After installation of the trunnion, a template shall be manufactured that will be required for trunnion bearing alignment in the field.

10-01.3(5) PAINT AND PROTECTION FOR MACHINERY

All surfaces of the new operating machinery shall be painted using a primer, intermediate coat and final coat (three-coat) paint system.

All unfinished machinery surfaces shall be made free of all chips, dirt, rust, scale, sand, grease, and other foreign matter by sandblasting, wire brushing, or other approved means as stated elsewhere.

After proper surface preparation, all unfinished machinery surfaces, except for those inside reducer housing, shall be given one shop coat of primer.

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Cleaning of surfaces preparatory to shop painting shall not be by sand blasting as specified for structural metal, but shall be by means of wire brushes, scrapers and other suitable hand tools and solvents.

All finished contact surfaces which are not finally assembled in the shop shall be coated with waterproof National Lubricating Grease Institute No. 3 Multipurpose grease as soon as possible after being accepted and before removal from the shop, and shall be adequately protected during shipment by wrapping with burlap or canvas held by wooden bats securely wired together. During erection these surfaces shall be thoroughly cleaned and a field coat of this grease applied. All machinery surfaces shall be protected against any damage by contamination at all times and no sand blasting shall be permitted within the machinery area unless approved by the Project Engineer.

All grease holes shall be adequately plugged for painting and shipment. Careful attention shall be given to the protection of all machinery parts during shipment and while stored before erection.

After installation is complete, all machinery surfaces remaining exposed, except rubbing surfaces, shall be thoroughly cleaned and given two field coats of paint prepared as specified elsewhere for intermediate and finish coat. The color of paint for machinery components shall be as approved by the Project Engineer.

Nameplates on all manufacturers' components shall be readable, clean and free of all paint before acceptance of the machinery.

After completion of the operating tests and acceptance of the machinery, all accumulated oil, grease, dirt, and other foreign matter shall be solvent cleaned in accordance with SSPC-SP1 from exposed machinery surfaces, except rubbing surfaces.

10-01.3(6) PROTECTION FOR SHIPMENT

All finished metal surfaces and unpainted metal surfaces that might be damaged by corrosion shall be coated as soon as practicable after disassembly or finishing with a corrosive-preventative compound. This coating shall be removed from all surfaces prior to assembly and painting after installation.

All machinery parts shall be completely protected from weather, dirt and all other injurious conditions during disassembly, manufacture, shipment and while awaiting erection.

All shaft journals that are shipped disassembled from their bearings shall be protected during shipment and before erection by a packing of oil-soaked fabric secured in place by burlap and covered with heavy metal thimbles or heavy timber lagging securely attached. Every precaution shall be taken to ensure that the bearing surfaces will not be damaged and that all parts shall arrive at their destination in satisfactory condition.

Assembled units shall be mounted on skids or otherwise crated for protection during handling and shipment.

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10-01.3(7) INSTALLATION AND FIELD TESTING

Prior to any work being performed on the machinery, the Contractor shall submit to the Project Engineer for approval a detailed mechanical work procedure. This procedure shall give in detail methods for providing measurements for gear teeth, bearing; detailed explanation for match marking, and installation and testing of machinery. Procedures shall include duration of time involved with the Work and shall show coordination with structural, electrical and architectural contractors, which will be coinciding with the mechanical work.

The trunnion bearing bases are to be installed on the trunnion frame prior to placing the trunnion and girder. The Contractor shall fabricate a template for each trunnion that accurately transfers the alignment of the trunnion and respective girder to the bearing bases. Before the trunnions are put in service, bearings shall be checked for proper lubrication by the Contractor and bearing manufacturer, subject to approval by the Project Engineer.

Using the template, each trunnion bearing shall be carefully aligned and installed to proper elevation. Each end of each trunnion shaft shall be within 0.020 inches from a common transverse centerline on each bascule pier in both the horizontal and vertical directions. The trunnion alignment shall take into consideration the expected deflection of the supporting structural steel once full dead load is applied.

All parts of the machinery shall be installed in accordance with installation marks and match marks. Before final drilling or reaming, all parts shall be adjusted to the alignment as specified in the approved alignment plan by means of shims furnished for each part. The Contractor shall supply tapered shims in the event that machinery components cannot be aligned on their fabricated bases per the approved alignment plan After final alignment and bolting, all parts shall operate smoothly.

All shafts, gears, pinions, racks, bearings, and other parts supported by machinery frames shall be assembled and adjusted in the field in their several frames and tested by operation in place. Field-testing shall be done with the bridge supported on its live load shoes under full dead load.

Bolt holes in structural steel for connecting machinery shall, in general, be drilled from the solid after final alignment of the machinery. Sufficient installation holes, sub-drilled ¼-inch undersize for undersize temporary bolts, may be used for installation and alignment of the machinery. After the machinery has been aligned in its final position, full-size holes for the remaining bolts shall be drilled or sub-drilled and reamed, the full-size bolts installed, and the temporary bolts removed. The undersize holes used for temporary bolts shall then be reamed full-size and full-size bolts installed.

Bolts and studs which are larger than what is covered in standard specifications shall be tensioned to at least 70% of their required minimum tensile strength. The tensioning method and minimum values for each bolt shall be supplied with the mechanical work procedure specified herein.

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The machinery shall be installed and adjusted by competent millwrights skilled in the type of work involved, with qualifications as specified herein. Millwrights shall provide all necessary measuring and leveling instruments, as may be required including but not limited to dial indicators and laser alignment equipment. Contractor shall provide all necessary equipment and methods to the Project Engineer to verify proper alignment of all machinery.

The drive machinery shall be installed with the utmost care in the field. Ropes, slings or other equipment used for installation shall be carefully placed to prevent scratches, abrasions or other damage.

Prior to the installation of the reducers, the Contractor shall install and align the new rack pinion assembly to the new rack. The Contractor shall verify the contact between the rack and rack pinion by opening the span one complete cycle and applying tooth contact tape.Tooth contact of 75% is considered as minimum acceptable. Backlash measurements shall also be obtained on each side of the gears, and shall meet the requirements of the working drawings, approved alignment plan, and standards as specified herein. Backlash shall be measured at every 5th tooth from the closed position to the open position.Once the Project Engineer has approved the rack and rack pinion alignment, the Contractor may continue with the installation of the reducers and remaining mechanical equipment.The main drive motors, brakes, and auxiliary drive machinery shall be aligned with the respective input shaft of the main reducer as shown in the Working Drawings per the approved alignment plan.

The alignment of all components shall be checked by the use of laser alignment tools, dial indicators and/or feeler gages both before and after final bolting up of the machinery in the presence of the Project Engineer. Installation tolerances furnished by the coupling manufacturer shall be considered to be a maximum value and the installation shall be such that the installed tolerances are no more than one-half those recommended unless otherwise approved by the Project Engineer. Any re-adjustment after final bolting required by the Project Engineer in order to conform to this requirement shall be made by the Contractor at no additional cost to the Owner.

After the machinery installation is complete, the Contractor shall make a thorough inspection to insure that all components are clean and free of obstruction, that all parts are aligned and adjusted as closely as practicable without actual operation, and that all bolts are properly tightened. All gear housings shall be filled with lubricant to the proper level, and all rotating and sliding parts shall be supplied with lubricants recommended by the suppliers of the units.

The lubricants listed on the lubrication charts shall conform to the recommendations of the manufacturers of the units and shall be coordinated with the products normally stocked by King County. Information required from the Maintenance Department shall be obtained through the Project Engineer.

10-01.3(8) SPAN LOCK INSTALLATION AND FIELD TESTING

Prior to placing any of the new span locks in operation, the Contractor shall require the system supplier representative to inspect the installation of the new span lock machinery at the site to ensure it is installed to the supplier's requirements and tolerances. System supplier

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representative shall furnish a letter to the Project Engineer after the inspection certifying that the installation is acceptable and in conformance to the requirements of the span lock machinery supplier.

The span lock machinery shall be installed with the utmost care in the field. Ropes, slings or other equipment used for installation shall be carefully placed to prevent scratches, abrasions or other damage.

The alignment of all components shall be checked by the use of laser alignment tools, dial indicators and/or feeler gages both before and after final bolting up of the machinery. To install the span lock machinery, the Contractor shall first vertically align the bascule leaves at the centerline of the bascule span by adjusting the front live load shoes.

The support frames for the span lock bar operators shall then be installed and the operators, with lock bars, temporarily attached with undersized bolts. Holes for these bolts in the operator shall be sub-drilled in the field after the operators have been roughly aligned. The receiving and guide sockets shall likewise be attached with undersized bolts. Holes for these bolts in the sockets shall be sub-drilled in the field after the sockets have been roughly aligned. If necessary, angular alignment of the sockets shall be adjusted with beveled shims placed between the sockets and the supporting structural steel. The lock bars shall then be operated through several cycles by manual cranking and adjustments made to the location of the sockets and lock bar operators as required to align all elements of the span locks. Holes shall then be reamed for turned bolts to permanently fasten the lock bar operators and sockets. Any re-adjustment after final bolting required by the Project Engineer and/or system supplier representative in order to conform to this requirement shall be made by the Contractor at no additional cost to the Owner.

The millwrights responsible for the installation of the lock bar mechanism shall be responsible for proper installation of the guide and receiver sockets. Any additional requirements necessary to provide assurance that the receiver will be installed to the degree of accuracy necessary for proper functioning of the guide and receiver shall be made at no additional cost to the Owner. Any re-adjustment and/or re-machining of the receiver necessary to eliminate any cross bearing between the wear plates and the lock bar shall be at no additional cost to the Owner.

The lock bar operator shall be precisely aligned with the lock bar after final installation of the lock bar guide and receiving sockets. The centerline of the operator shall be collinear to the lock bar. The operator shall be shimmed vertically as shown on the Plans at the location of the operator.

All adjusting, aligning and testing of the new span lock machinery shall be done with no extraneous loads upon the bascule spans.

After installation is complete, the Contractor shall make a thorough inspection to ensure that all components are clean and free of obstruction, that all parts are aligned and adjusted as closely as practicable without actual operation, and that all bolts are properly tightened. All gear housings shall be filled with lubricant to the proper level, and all rotating and sliding parts shall be supplied with lubricants recommended by the suppliers of the units.

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The lubricants listed on the lubrication charts shall conform to the recommendations of the manufacturer of the units and shall be coordinated with the other components on this project to minimize the amount of lubricants to be furnished.

After completion of electrical and mechanical work for span lock installation, and after greasing all lock machinery components as described above, the Contractor shall demonstrate satisfactory operation of the center lock machinery by having them driven and pulled in the presence of the Project Engineer. The span locks shall be operated electrically and by the hand crank with which each unit is equipped. The leaves shall be raised between each cycle to simulate a regular opening of the bridge. The number of such operating cycles for demonstration purposes shall not be less than five cycles. Additional cycles shall be performed as requested by the Project Engineer and shall be sufficient to verify proper adjustment and functioning of the span lock system.

During the foregoing test runs, all parts shall be inspected to detect overheating, misalignment, or incorrect adjustment. All such defects shall be corrected at no cost to the Owner before final acceptance.

10-01.3(9) INSTALLATION OF ELECTRICAL ITEMS

The Contractor shall coordinate the work of the subcontractors supplying and installing components under electrical and machinery as well as structural items of the Contract. The Contractor will be held fully responsible for supplying all work necessary to provide a complete installation, properly fitted together, adjusted and satisfactorily operating as one unit.

A. Motor Couplings

The flexible couplings at the main drive motors shall be furnished under "Operating Machinery". The coupling half at the motors shall be shipped to the supplier of the motors and shall be fitted and installed on the motor shafts under "Bridge Electrical System".

10-01.3(10) TESTS AND PRELIMINARY OPERATION

The bascule span is an operating machine. The Contractor shall fabricate, construct, install and adjust or modify the operating machinery so that the machine will function and operate satisfactorily in accordance with Contract Documents to the satisfaction of the Project Engineer. The Contractor shall make all necessary tests of the completed structure and all trial operations so that the completed structure, ready for acceptance, in acceptable operating condition and in accordance with Contract Documents and to the satisfaction of the Project Engineer. During testing and adjustment of the operating machinery and bascule span, representatives of the manufacturer of mechanical and electrical components shall be present at the bridge site and available for consultation as may be required.

During the preliminary test runs, all parts shall be inspected by the Contractor to detect overheating, misalignment, or incorrect adjustment. All such defects shall be corrected at no cost to the County.

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The Contractor shall supply all grease, oil, fuel, maintenance, and other incidentals necessary for testing, adjustments, and preliminary testing, validation testing and operation. Until final acceptance, the Contractor shall operate the bascule span as required for marine and vehicular traffic.

The Contractor shall develop and submit to the Project Engineer a testing and certification plan for all aspects of the operating machinery. The operating machinery testing and certification plan shall systematically check the requirements of the operating machinery to verify the operating machinery is operating correctly and in conformance with the Contract requirements. The Contractor shall submit the testing and certification plan to the Project Engineer for review and approval. The Contractor shall develop and utilize Project Engineer approved testing and certification forms to provide objective evidence of successfully testing the operating machinery. The Contractor shall successfully complete all testing of the operating machinery independent of the Project Engineer and submitted signed certification forms attesting to the successful testing of the operating machinery to the Project Engineer.

Once the Contractor has successfully tested the operating machinery of the bascule spans and submitted the corresponding certification forms, the Contractor shall again test the operating machinery of the bascule spans for validation purposes in the presence of the Project Engineer and the County's agents consisting of not more than two representatives of the bridge designer to demonstrate the operating machinery meets the Contract requirements. During the validation testing, the Contractor shall operate the machinery not less than ten complete and consecutive cycles. If the initial validation testing in the presence of the Project Engineer and the designer's representatives is unsuccessful and cannot be remedied and successfully re-tested with 24 hours, the Contractor shall reschedule subsequent validation testing and shall reimburse the County for the direct cost associated with re-mobilizing and participation in all subsequent operating machinery validation testing events by the bridge designer's representatives at a cost of up to $12,500 each subsequent operating machinery validation event.

10-01.3(11) MAINTENANCE TRAINING

The Contractor shall provide a minimum of two training sessions, each eight hours of classroom and field operation, maintenance and trouble shooting instruction. The number of attendees shall be ten attendees each training session. The Contractor shall provide each attendee the Operation and Maintenance Manuals for the training. The final approved manuals shall be furnished to the attendees no later than two weeks prior to the training session.

The County will provide a conference room located in the vicinity of the bridge (not to exceed five miles away) for the purpose of holding classroom the training sessions. Other training sessions shall be held at the bridge site.

One of the eight hour training sessions shall cover the mechanical portion of the bridge and the course shall consist of the following; plus any additional subjects required:

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1. Mechanical Drive Basics
2. Mechanical System Configuration specific to the project
3. Mechanical Component Layout and Location
4. Preventive Maintenance Procedures
5. Trouble Shooting, Minor Repairs and Emergency Operations
6. Mechanical Operation of the Bridge
7. Sump pump assemblies, water system, and sewer system
8. HVAC.
9. Reducers and operating machinery, span locks,
10. Automatic Lubrication System

Contractor shall provide a qualified engineer(s) as a representative to train the County's personnel.

One of the eight hour sessions will be for onsite instruction for topics previously covered in the classroom. Faults will be introduced into the systems, which the trainees will diagnose and correct. These faults will include the most common failures, which are likely to be encountered in the operations of the bridge.

The Contractor shall submit to the Project Engineer for approval the qualifications of the system supplier's engineers that conduct the training. These qualifications shall include the representatives' name, company they work for and a breakdown of the representative's specific experience to the portion of the project they will be covering.

10-01.4 MEASUREMENT

No measurement will be made for the items of Work under this Section but paid for on a lump sum basis.

10-01.5 PAYMENT

All Work specified in Division 10 Sections will be paid in accordance with Section 1-04.1 under one of the following Bid items:

"Drive Machinery", per lump sum

The lump sum Contract price for "Drive Machinery" shall be full pay for manufacturing, furnishing, shipping, installing, inspecting, testing, and adjusting all operating machinery including such accessories as auxiliary drive system, shims within machinery parts, and bolts for connecting machinery parts together and to structural supports. The cost shall include painting the operating machinery along with all materials; bolts, shims, keys, and lubricants; labor; equipment; tools, tool cabinets, spare parts, drip pans, warranties, and for furnishing all drawings, manuals,

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charts, guarantee, and other data and services; including adjusting and aligning, required to properly execute and place in complete working order the operating machinery in accordance with the Plans, Specifications and Special Provisions. The cost shall also include installing, adjusting and aligning of related electrical equipment including motors, brakes and limit switches and training. Payment for furnishing electrical work associated with the "Drive Machinery", including motors, brakes and limit switches is not part of this item, but is paid for under "Bridge Electrical System".

"Trunnion Assembly", per lump sum

The lump sum Contract price for "Trunnion Assembly" shall be full pay for manufacturing, furnishing, shipping, installing, inspecting, testing, and adjusting all trunnion machinery including such accessories as shims within machinery parts, and bolts for connecting machinery parts together and to structural supports. The cost shall include painting the trunnion assembly machinery along with all materials; bolts, shims, keys, and lubricants; labor; equipment; tools and for furnishing all drawings, manuals, charts, guarantee, and other data and services; including adjusting and aligning, required to properly execute and place in complete working order the trunnion machinery in accordance with the Plans, Specifications and Special Provisions.

"Span Lock", per lump sum

The lump sum Contract price for "Span Lock" shall be full pay for manufacturing, furnishing, shipping, installing, inspecting, testing, and adjusting all span lock machinery including such accessories as shims within machinery parts, and bolts for connecting machinery parts together and to structural supports. The cost shall include painting the span lock machinery along with all materials; bolts, shims, keys, and lubricants; labor; equipment; tools and for furnishing all drawings, manuals, charts, guarantee, and other data and services; including adjusting and aligning, required to properly execute and place in complete working order the span lock machinery in accordance with the Plans, Specifications and Special Provisions.

Payment for furnishing electrical work associated with the "Span Lock Machinery", is not part of this item, but is paid for under "Bridge Electrical System".

10-02 TEMPORARY DRIVE SYSTEM (NEW SECTION)

10-02.1 DESCRIPTION

This Work consists of designing, furnishing, installing, operating and removing a temporary drive system for the bascule leaves to be utilized by the Contractor during construction of the South Park Bridge until such time as the permanent drive system is assembled, tested and accepted, if the Contractor chooses to use a temporary drive system.

Use of a temporary drive system is not a requirement of the Contract. The Contractor may choose not to utilize a temporary drive system. This Section of the Special Provisions shall apply if the Contractor chooses to utilize a temporary drive system.

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The temporary drive system shall be completely removed prior Substantial Completion and prior to opening the bridge to pedestrian and/or vehicular traffic.

10-02.2 VACANT

10-02.3 CONSTRUCTION REQUIREMENTS

A temporary drive system will be considered the mechanical, electrical, structural and hydraulic components contained within and/or on the bascule piers that is designed and assembled explicitly to raise and lower the bascule leaves while the bridge is under construction. The temporary drive system shall be completely independent of the permanent mechanical system. The temporary drive system shall be capable of operating both bascule leaves simultaneously and independently. The temporary drive system shall control the rate of opening and closing the bascule leaves and shall not rely on gravity forces to close the leaves. Mobile cranes will not be considered a temporary drive system.

The Contractor shall warrantee the in-service performance of the temporary drive system during all phases of construction of its intended use. Upon completion and acceptance of the permanent mechanical and electrical systems, the Contractor shall remove the temporary drive system.

The Contractor shall design the temporary drive system to withstand all applicable loads in accordance with the Contractor's means and methods of construction and Engineer approved design criteria. The Contractor shall specify the design code(s) in the design calculations and working drawings. The Contractor shall be solely responsible for design, fabrication, assembly and operation of all equipment to be used for constructing the superstructure including any temporary drive system.

The Contractor's design of the temporary drive system shall include all loads and load combinations indentified in AASHTO's LRFD Movable Highway Bridge Design Specifications including interim revisions through 2009 unless noted otherwise. The temporary drive system shall be designed to operate with sustained winds up to 39 miles per hour. If winds exceed 39 miles per hour, the temporary drive system shall be operated.

The Contractor shall provide complete details covering the temporary drive system for operating the bascule leaves, construction and operation methods to be used, the sequence of operation and methods to control the bascule leaves while being raised and lowered. The Contractor shall identify the locations, loads, load combinations, stresses and methods of connection to any permanent components of the bridge. Indicate any portions of temporary drive system, which will remain permanently in the structure as well as temporary supports and/or falsework.

The design, working drawings and design calculations and for the temporary drive system shall be prepared under the direction of, and signed and certified by a Professional Engineer licensed in the State of Washington. The calculations shall demonstrate that the loads imposed on the permanent structure by the temporary drive system will not adversely affect the structural adequacy of the permanent structure, nor exceed allowed stresses during the construction process. The Contractor is advised that the design of the proposed bridge and the Contract Plans do not include supplemental structural strength, support or reinforcement to resist local stresses induced on the permanent structure from a the temporary drive system.

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The Contractor shall be responsible designing and providing any supplemental structural strengthening and reinforcement of the permanent structure beyond that shown in the Contract Plans which is necessary because of the temporary drive system. No additional payment will be made to the Contractor for any cost incurred due to modifying the permanent structure for the temporary drive system.

The Contractor shall submit design calculations and working drawings to the Project Engineer for review and approval. The Project Engineer's review will be for purposes of ascertaining the affects of the temporary drive system on the permanent structure. Contractor shall not rely on the Project Engineer's review for purposes of validating, checking or endorsing of structural adequacy, function and operating characteristics of the temporary drive system.

The temporary drive system shall be equipped with a dead man switch to prevent unintentional operation of the system. The temporary drive system shall be equipped with an emergency stop button(s) interlocked with a reset buttons at the drive system plant and the control station such that both reset buttons must be depressed simultaneously to restore power to the temporary drive system. The temporary drive system shall be interlocked with limit switches to prevent the bascule leaves from being opened beyond its intended and travel and to prevent the bascule leaves from be being driven past the fully closed position. The temporary drive system shall operate the leaves at slow speeds when the leaves are within 5 degrees of the full open and full closed positions.

The Contractor shall provide shop drawings of the temporary drive system that fully integrate the proposed permanent structure with the temporary drive system including any modifications to the permanent structure.

The Contractor shall provide training in the use of the temporary drive system for all personnel who will operate the system. All operators shall have a minimum of 3 years experience with the appropriate skills and competence in operating machinery of similar size and complexity as the temporary drive system. The training shall be conducted in the presence of the Project Engineer.

10-02.4 MEASUREMENT

Temporary drive system will not be measured but will be paid for on a lump sum basis in accordance with Section 1-04.1 if and only if the Contractor uses a temporary drive system as deemed functional and meeting the Contract requirements by the Project Engineer.

10-02.5 PAYMENT

Payment will be made in accordance with Section 1-04.1, for the following Bid item:

"Temporary Drive System", lump sum.

The lump sum Contract price for "Temporary Drive System" shall be full pay for all costs in connection with furnishing all materials, labor, tools, and equipment necessary for the manufacture, fabrication, transportation, erection, operation and removal of all aspects of the temporary drive system, if and only if the Contractor utilizes a temporary drive system.

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SUPERSTRUCTURE – BASCULE PIER

11-01 GENERAL REQUIREMENTS FOR BASCULE PIER SUPERSTRUCTURE (NEW DIVISION)

11-01.1 DESCRIPTION

This item includes fixed portion of the bascule piers and control towers complete, in place and serviceable as indicated in the Contract Documents to the satisfaction of the Project Engineer. This item includes, but is not limited to, the bascule pier exterior walls above elevation +13.5 feet, all other concrete not included in other payments above the top of the caisson cap (elevation +3.0 feet).

Also included in this item are bascule pier related: shop drawing preparation and submittals, furnishing, fabrication, testing, storage, handling, transportation, erection, construction, painting (where applicable) of components including, but not limited to, bascule pier structural slabs, the bascule pier walls, stairwells, stairs, stair landings, stair handrails, interior floor slabs, Roadway Level concrete decks, pedestrian railing curb, pedestrian railing embedded anchorages, resistance gate foundations, Roadway Level access doors, bascule pier windows, bascule pier doors, fire extinguishers, work benches, and bird control and final finish for the caisson cap final slab.

This item also includes control tower related: shop drawing preparation and submittals, furnishing, fabrication, testing, storage, handling, transportation, erection, painting (where applicable), of components including, but not limited to: concrete support brackets, concrete walls and floors, cast-in-place concrete, integral thin brick veneer, structural steel framing, standing seam roofs, roof drainage systems (gutters), Operator Level cantilevered observation decks, cantilevered deck floor doors, windows, exterior and interior doors, insulation, interior finish walls and flooring and exterior clocks.

This item also includes control tower furnishings related: fabrication, testing, storage, handling, transportation, painting (where applicable), of items including, but not limited to: lockers, desks, chairs, tables, cabinets, sinks, countertops, mirrors, refrigerators, microwave ovens, handrails, window coverings, shelving, hardware and towel bars.

Division 11 Special Provisions are written mostly in the imperative and streamlined form. Unless indicated otherwise, this imperative is directed to the Contractor. The words “Provide” and “Furnish” shall mean supplying, installing, and incorporating into the Work including all labor, materials, supplies and equipment necessary to do so.

Sections of Division 11 are generally formatted to provide: 1 – General Information, 2 – Products and 3- Construction Requirements.

All Division 11 measurement and payment information is provided in Section 11-01 and is not addressed within the other individual Sections of Division 11.

Division 11 shall be considered to supplement other provisions of the Contract Documents and not to limit the Contractor’s requirements.

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11-01.2 MATERIALS

Unless otherwise specified in Division 11, materials shall be in accordance with the Contract Documents.

11-01.3 CONSTRUCTION REQUIREMENTS

Unless otherwise specified in Division 11, construction requirements shall be in accordance with the Contract Documents.

11-01.4 MEASUREMENT

"Superstructure – Bascule Pier" will not be measured but will be paid for on a lump sum basis as described in 11-01.5.

The lump sum Contract price for "Superstructure – Bascule Pier" contains the following approximate quantities of materials and completed Work:

Item	Approximate Quantity	Unit
Concrete Class 4000	2051	C.Y.
Concrete Class 4000D	69	C.Y.
Epoxy-Coated St. Reinf. Bar	508,420	LB.
St. Reinf. Bar	389,312	LB.
Metal Stairs and Handrails	1,116	S.F.
Metal Stair Landings	292	S.F.
Cleaning and Painting – Control Tower Structural Steel	1	L.S.
Lifting Lugs (See Sheet BP08)	6	Each
Bascule Pier Windows	8	Each
Bascule Pier Exterior Doors	2	Each
Roadway Level Access Hatch	2	Each
Fire Extinguishers	6	Each
Work Bench	2	Each
Structural Carbon Steel	25,262	LB.
Structural Low Allow Steel	7,524	LB.
Standing Seam Roof	1,505	S.F.
Roof Drainage Collection (Gutters)	205	L.F.
Cantilevered Deck Floor Door	2	Each
Control Tower Windows	26	Each
Control Tower Exterior Doors	4	Each
Control Tower Interior Doors	6	Each
Brick Veneer	1,995	S.F.
Flooring	1,412	S.F.
Exterior Clocks	2	Each
Lockers	20	Each
Desks	2	Each
Tables	2	Each

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Chairs	8	Each
Base Cabinets	4	L.F.
Wall Cabinets	12	L.F.
Countertops	24	S.F.
Countertop Sinks	2	Each
Wall Mounted Sinks	2	Each
Mirrors	2	Each
Microwave Ovens	1	Each
Window Coverings	656	S.F.
Towel Bars	2	Each
Toilets	2	Each
Refrigerators	1	Each
File Cabinets	2	Each
Bridge Name Plate	1	Each
Drain Line	47	L.F.
Drain Inlets	8	Each
Bird Control	1	L.S.
FRP Maintenance Walkway	5	S.F.

The quantities are listed for the convenience of the Contractor in determining the Work involved and are not guaranteed to be accurate. The prospective bidders shall verify these quantities before submitting a bid. All items shown or noted in the plans which are not specifically listed here are considered ancilliary items and will be included in the lump sum Contract price for Superstructure – Bascule Span. No adjustments other than approved changes will be made in the lump sum Contract price for the Superstructure - Bascule Pier even though the actual quantities required may deviate from those listed.

Item does not include: “Superstructure - Bascule Span”, “Superstructure - Approach Span”, , “Bridge Electrical System”, “Drive Machinery”, “Control House HVAC”, “Control House and Bascule Pier Plumbing” or operators level cantilevered deck railing.

11-01.5 PAYMENT

All Work specified in Division 11 Sections will be paid in accordance with Section 1-04.1 for the following Bid item:

“Superstructure – Bascule Pier”, lump sum

The Contract lump sum price for "Superstructure - Bascule Pier", which price shall be payment in full for furnishing and fabricating all materials necessary for the construction of the bascule pier superstructure and control towers in accordance with the Contract Documents; and for furnishing all labor, tools, equipment and incidentals necessary to complete the Work in accordance with the Contract.

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11-02 CAST-IN-PLACE CONCRETE

11-02.1 GENERAL

11-02.1(1) SUMMARY

This Section includes details regarding cast-in-place concrete that are supplemental to the Contract Documents.

11-02.2 PRODUCTS (NOT USED)

11-02.3 CONSTRUCTION REQUIREMENTS

11-02.3(1) JOINTS

Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Project Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs. Construction joints shall be located at inside corner of rustications for exterior bascule pier walls.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

11-02.3(2) FINISHING FORMED SURFACES

Reference Section 6-02.3(14).

Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as paint unless noted otherwise.
2. Do not apply rubbed finish to smooth-formed finish.

11-02.3(3) FINISHING SLABS

Reference Section 5-05.3(11).

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General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring.

2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

   A. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot-long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch.

Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Project Engineer before application.

11-02.3(4) MISCELLANEOUS CONCRETE ITEMS

Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Contract Plans. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Contract Plans. Screed, tamp, and trowel-finish concrete surfaces.

11-02.3(5) LIQUID FLOOR TREATMENTS

The Contractor shall apply liquid floor treatments to the horizontal concrete within the interior of the bascule piers including the top of the caisson cap.

Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's published instructions.

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1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply to concrete with seven calendar days of concrete placement.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's published instructions.

11-03 BRICK EMBEDDED CONCRETE PANELS

11-03.1 GENERAL

11-03.1(1) SUMMARY

This Section includes products, methods and installation for thin brick inlay system for the exterior site-cast concrete, formliners for the setting of brick on the control towers as depicted in the Contract Plans. Thin brick is specified in Section 11-04 “Brick Masonry”

Related Sections include the following:

1. Section 11-02 "Cast-in-Place Concrete."
2. Section 11-04 “Brick Masonry”.
3. Section 11-23 “Gypsum Board Assemblies” for stud wall and glass-mat, water-resistant backing board.

11-03.1(2) REFERENCES

ASTM C 1088 - TBX Select Specification for Thin Veneer Brick Units Made From Shale or Clay.

ASTM D 2240 - Standard "A Scale" Test Method for Rubber Property -Durometer Hardness (Shore A).

11-03.1(3) SUBMITTALS

Product Data: Provide manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

Shop Drawings: Provide locations of brick panels in project and submit elevation drawings that indicate:

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1. Panel sizes.
2. Panel joint locations and dimensions.
3. Corner details.
4. Horizontal and vertical brick coursing.
5. Alignment of brick coursing to adjacent construction.
6. Special conditions.

Selection Samples: For each finish product specified, provide two complete sets of samples, representative of full range of color and finish for each brick type.

1. For each finish product specified, two complete sets of samples, representative of full range of color and finish for each brick type.
2. Form Liner Samples representing all brick gasket form liners which will be used.
3. Bond breaker sample on brick chip representing bond breaker which will be used.

Verification Samples: For each finish product specified, provide two samples, representative of selected color range and finish of each brick type.

Qualification Data: For installers, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

11-03.1(4) QUALITY ASSURANCE

Mock-Up: Provide mock-ups for evaluation of surface preparation techniques and application workmanship.

1. Mock-up panels for areas as shown on the Contract Plans of specified brick type. Mock-up one shall include brick template application utilized in concrete application. Mock-up two shall include brick application utilized in metal stud and cement board framing above concrete walls.
2. Do not proceed with remaining work until workmanship, color, and detail are approved by the Project Engineer.
3. Modify mock-up area as required to produce acceptable work.

11-03.1(5) DELIVERY, STORAGE, AND HANDLING

Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

Store products in manufacturer's unopened packaging in dry storage area, with ambient temperature between 30 degrees F and 120 degrees F, until installation.

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Do not use damaged products. Do not install products not bearing product trade name and manufacturer's name.

Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

11-03.1(6) PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Do not install products under environmental conditions outside manufacturer's limits.

11-03.2 PRODUCTS

11-03.2(1) MANUFACTURERS

Products: Subject to compliance with requirements, an acceptable manufacturer of the brick embedded panels is:

1. Metrobrick, Scott System, Inc.,
2. Or approved equal that meet the Contract requirements and provide color, texture, size, visual appearance, installation procedures and maintenance requirements of Metrobrick, Scott System, Inc.

11-03.2(2) MATERIALS

Complete thin brick assembled in single-use brick embed system.

1. Brick template system: Single-use template system for brick embedded concrete application. Modular templates formed of recyclable styrene plastic to surround single brick units, having factory-applied face wax.
2. Brick inlay system: Multi-use template for vertically poured walls and corner returns. Modular templates formed styrene plastic and polyurethane rim to surround single brick units, having factory-applied bond breaker.
3. Brick gasket form liner system: Elastomeric gasket form liner for integrally casting brick into precast concrete.
4. Maximum variation from indicated nominal dimensions of brick cavities:
   A. Length: Plus or minus 1/32 inch (0.8 mm).
   B. Height: Plus or minus 1/32 inch (0.8 mm).
   C. Depth: Plus or minus 1/32 inch (0.8 mm).
5. Maximum variation from square, measured diagonally across non-adjacent comers: Plus or minus 1/16 inch (1.6 mm).

Brick: Brick is specified in Section “Brick Masonry”.

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Brick Coating: Wax or other brick coating will be applied to each brick face to facilitate the cleaning of the cast brick surface. Retarder papers may be substitute.

Brick Gasket: Single Use Formliner: Brick faces will be coated with wax or approved bond breaker to prevent grout staining.

11-03.2(3) FABRICATION

Inlay Installation Tolerances:

1. Variation in alignment of horizontal or vertical mortar joints maximum 1/4 inch (6 mm) in 10 feet (3 m), non-cumulative.
   - A. Maximum offset in plane of adjacent form liner units: 1/16 inch (1.6 mm).
   - B. Maximum misalignment between adjacent form liner units: 3/64 inch (1.2 mm).

Install brick in accordance with manufacturer's published installation instructions.

1. Clean brick pockets free of foreign material.
2. Install in accordance with manufacturer's printed installation instructions.

Form, cast, strip and cure concrete per requirements of sections referenced.

11-03.3 CONSTRUCTION REQUIREMENTS

11-03.3(1) EXAMINATION

Do not begin installation until supporting structures have been properly prepared.

Notify Project Engineer of unsatisfactory preparation before proceeding.

11-03.3(2) INSTALLATION

Field erect panels in accordance with manufacturer's instructions and Project requirements. Refer to related specification sections for field installation requirements.

11-03.3(3) PROTECTION

Protect installed products until completion of project. Touch-up, repair or replace damaged products before opening the bridge to vehicular traffic.

11-04 BRICK MASONRY

11-04.1 GENERAL

11-04.1(1) SUMMARY

Section Includes:

1. Products, methods and installation for thin brick system for application to metal stud and cement board framing above concrete walls as scheduled and drawn.

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2. Concrete facing thin brick. Thin brick with required custom brick shapes.
3. Stone trim units.
4. Latex portland cement mortar.
5. Colored grout.
6. Miscellaneous masonry accessories.

Related Sections:

1. Section 11-03"Brick Embedded Concrete Panels" for installation and mockups of thin brick facing on concrete.
2. Section 11-23 "Gypsum Board Assemblies" for stud wall and glass-mat, water-resistant backing board.

11-04.1(2) SUBMITTALS

Product Data: Provide for each type of product indicated the following:

Shop Drawings for the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

Samples for Initial Selection:

1. Concrete facing brick, in the form of small-scale units.
2. Stone trim.
3. Colored grout.

Samples for Verification: For each type and color of the following:

1. Concrete facing brick.
2. Special brick shapes.
3. Stone trim.
4. Colored grout. Make Samples using same sand and mortar ingredients to be used on Project.
5. Accessories embedded in masonry.

98% Submittal - Not for Construction

List of Materials Used in Constructing Mockups: Provide a list of generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates. Submittal is for information only. Neither receipt of list nor approval of mockup will constitute approval of deviations from the Contract Documents.

Material Certificates: For each type and size of the following:

1. Masonry units.
   - A. Include data on material properties.
   - B. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   - C. For exposed brick, include test report for efflorescence according to ASTM C 67.
   - D. For surface-coated brick, include test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, portland cement mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

11-04.1(3) QUALITY ASSURANCE

Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 32 inches long by 24inches.

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2. Clean one-half of exposed faces of panels with masonry cleaner indicated.

3. Protect approved sample panels from the elements with weather-resistant membrane.

4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Project Engineer in writing. Approval of sample panels does not constitute approval of deviations from the Contract Documents.

Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Contract Plans.

   A. Include lower corner of window opening with stone sill at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.

   B. Include metal studs, sheathing, and air barrier in mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.

4. Protect accepted mockups from the elements with weather-resistant membrane.

5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

   A. Approval of mockups is also for other material and construction qualities specifically approved by Project Engineer in writing.

   B. Approval of mockups does not constitute approval of deviations from the Contract Documents.

11-04.1(4) DELIVERY, STORAGE, AND HANDLING

Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

98% Submittal - Not for Construction

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

11-04.1(5) PROJECT CONDITIONS

Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.

Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven calendar days after completing cleaning.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

98% Submittal - Not for Construction

11-04.2 PRODUCTS

11-04.2(1) MASONRY UNITS, GENERAL

Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

11-04.2(2) BRICK

General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing including, but not limited to corners.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

Brick: Exterior grade conforming to ASTM C 1088, fabricated to TBX tolerance.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
2. Thin brick shall be “Metrobrick - X35 Main Street Flashed Ironspot Velour Texture as manufactured by Scott System, Denver, Colorado. (303) 373-2500, or approved equal
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
6. Sheer Bond Strength to Portland Cement: Provide brick that has been tested according to ASTM C 482 and is rated greater than 150psi.
7. Application: Use where brick is exposed unless otherwise indicated.

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A. Installation for thin brick inlay system for site-cast concrete.

B. Installation for thin field applied with thin set method.

8. Color and Texture: Metrobrick, mixture of bricks described as; X35 – Main Street, Flashed Iron Spot, Velour Texture. Match sample provided by Project Engineer

11-04.2(3) STONE TRIM

Limestone: ASTM C 568, Classification III High Density. Variety and Sources: Indiana limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana, or approved equal. Grade and Color: Select, buff, according to grade and color classification established by ILI.

Finish: Machine tooled, 8 bats per 1 inch (25 mm). Finish for Tops of Sills: Sand rubbed.

Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

11-04.2(4) WATERPROOF MEMBRANE

General: Manufacturer's standard product selected from the following that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Boiardi Products; a QEP company; Elastiment 323 Cement Based Waterproofing, Anti-Fracture/Crack Suppression Membrane.

2. C-Cure; UltraCure 971.

3. MAPEI Corporation; Mapelastic (PRP 315).

4. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.

5. Or approved equal.

11-04.2(5) MORTAR MATERIALS

Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International, Inc. or comparable product by one of the following, or approved equal:

A. Boiardi Products; a QEP company.

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B. Bostik, Inc.

C. C-Cure.

D. Custom Building Products.

E. MAPEI Corporation.

F. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.

4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

11-04.2(6) GROUT MATERIALS

Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required producing color indicated. Color shall match concrete joints at brick on cast-in-place concrete.

11-04.2(7) MASONRY CLEANERS

Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Manufacturers: Subject to compliance with requirements, manufacturers offering products incorporated into the Work include, but are not limited to, the following, or approved equal:

1. Diedrich Technologies, Inc.

2. EaCo Chem, Inc.

3. ProSoCo, Inc.

11-04.3 CONSTRUCTION REQUIREMENTS

11-04.3(1) GENERAL

See Section 11-03 "Brick Embedded Concrete Panels" for installation and mockups of thin brick facing on concrete.

11-04.3(2) EXAMINATION

The Contractor shall examine substrates, areas, and conditions where brick will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed brick.

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1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind brick has been completed.

11-04.3(3) INSTALLATION, GENERAL

Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

11-04.3(4) TOLERANCES

Dimensions and Locations of Elements: Match dimensions and locations of elements in Section 11-07 "Brick Embedded Concrete Panels".

Lines and Levels: Match line and levels in Section 11-03 "Brick Embedded Concrete Panels".

Joints: Match joint height and width in Section 11-03"Brick Embedded Concrete Panels".

11-04.3(5) LAYING MASONRY WALLS

Lay out walls in advance of starting work for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

11-04.3(6) INSTALLATION

Comply with Tile Council of North America; TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108.5 Series "Specifications for Installation of Ceramic Tile with Latex Portland Cement Mortar" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

98% Submittal - Not for Construction

Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

11-04.3(7) MASONRY BACKING PANEL INSTALLATION

Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

11-04.3(8) WATERPROOFING INSTALLATION

Install waterproofing to comply with ANSI A108.13 and manufacturer's published instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

Do not install materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

11-04.3(9) REPAIRING, POINTING, AND CLEANING

Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Project Engineer's approval of sample cleaning before proceeding with cleaning of masonry.

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3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."

6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

8. Clean stone trim to comply with stone supplier's written instructions.

9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

11-05 METAL FABRICATIONS – CONTROL TOWER

11-05.1 GENERAL

11-05.1(1) SUMMARY

This Section includes the following:

1. Steel framing and supports for mechanical and electrical equipment not related to the bascule machinery.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections or the Contract Documents.

3. Structural-steel door frames.

4. Metal ladders.

Products furnished, but not installed, under this Section include the following: Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

Related Sections include the following:

1. Section 11-02 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.

2. Section 11-06 "Metal Stairs."

3. Section 11-07 "Pipe and Tube Railings."

98% Submittal - Not for Construction

11-05.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For the following:

1. Paint products.
2. Grout.

Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

11-05.1(3) QUALITY ASSURANCE

Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."

11-05.1(4) PROJECT CONDITIONS

Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

11-05.1(5) COORDINATION

Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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11-05.2 PRODUCTS

11-05.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

11-05.2(2) METALS, GENERAL

Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

11-05.2(3) FERROUS METALS

Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

Rolled-Stainless-Steel Floor Plate: ASTM A 793.

Steel Tubing: ASTM A 500, cold-formed steel tubing.

Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

11-05.2(4) FASTENERS

General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 2.

Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

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Eyebolts: ASTM A 489.

Machine Screws: ASME B18.6.3.

Lag Bolts: ASME B18.2.1.

Wood Screws: Flat head, ASME B18.6.1.

Plain Washers: Round, ASME B18.22.1.

Lock Washers: Helical, spring type, ASME B18.21.1.

Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488.

11-05.2(5) MISCELLANEOUS MATERIALS

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Shop Primers: Provide primers that comply with Section 11-26 "Painting".

Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products:

   A. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.

   B. Carboline Company; Carbozinc 621.

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C. ICI Devoe Coatings; Catha-Coat 313.

D. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.

E. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.

F. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

G. Tnemec Company, Inc.; Tneme-Zinc 90-97.

H. Or approved equal.

Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

11-05.2(6) FABRICATION, GENERAL

Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Form exposed work true to line and level with accurate angles and surfaces and straight edges.

Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

98% Submittal - Not for Construction

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use countersunk Phillips flat-head screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches on center, unless otherwise indicated.

11-05.2(7) MISCELLANEOUS FRAMING AND SUPPORTS

General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

Galvanize miscellaneous framing and supports where indicated.

Prime miscellaneous framing and supports with zinc-rich primer unless galvanized or noted otherwise.

11-05.2(8) LOOSE BEARING AND LEVELING PLATES

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

Galvanize plates after fabrication.

90% Submittal - Not for Construction

11-05.2(9) STEEL WELD PLATES AND ANGLES

Provide steel weld plates and angles for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

11-05.2(10) STRUCTURAL-STEEL DOOR FRAMES

Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches on center. Reinforce frames and drill and tap as necessary to accept finish hardware. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

Prime exterior steel frames with zinc-rich primer.

11-05.2(11) MISCELLANEOUS STEEL TRIM

Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

Galvanize exterior miscellaneous steel trim.

Prime interior miscellaneous steel trim with zinc-rich primer unless galvanized or noted otherwise.

11-05.2(12) METAL DOWNSPOUT BOOTS

Provide lambstongue downspout boots made from finish painted cast gray iron in heights indicated with inlets of size and shape to suit downspouts. Outlet: At 35 degrees from horizontal, to discharge onto splash block or pavement.

11-05.2(13) FINISHES, GENERAL

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

11-05.2(14) STEEL AND IRON FINISHES

Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

90% Submittal - Not for Construction

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Stripe paint corners, crevices, bolts, welds, and sharp edges.

11-05.2(15) STAINLESS-STEEL FINISHES

Remove tool and die marks and stretch lines or blend into finish.

Dull Satin Finish: No. 6.

When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

11-05.3 CONSTRUCTION REQUIREMENTS

11-05.3(1) INSTALLATION, GENERAL

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

98% Submittal - Not for Construction

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, through bolts, lag bolts, wood screws, and other connectors.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

11-05.3(2) INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

General: Install framing and supports to comply with requirements of items being supported, including manufacturers' published instructions and requirements indicated on Shop Drawings.

Anchor supports for operable partitions securely to and rigidly brace from building structure.

Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" provision.

Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" provision.

Grout baseplates of columns supporting steel girders after girders are installed and leveled.

11-05.3(3) INSTALLING BEARING AND LEVELING PLATES

Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

98% Submittal - Not for Construction

11-05.3(4) ADJUSTING AND CLEANING

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 11-26 "Painting".

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

11-06 METAL STAIRS

11-06.1 GENERAL

11-06.1(1) SUMMARY

This Section includes the following:

1. Preassembled steel stairs with concrete-filled treads.
2. Industrial-type stairs with steel grating treads.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Preassembled alternating tread metal stairs.
5. Metal stair landings.

Related Sections include the following:

1. Section 11-02 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 11-07 "Pipe and Tube Railings" for pipe and tube railings not attached to walls adjacent to metal stairs.
3. Section 11-08 "Miscellaneous Carpentry" for wood blocking for anchoring railings.
4. Section 11-23 "Gypsum Board Assemblies" for metal backing for anchoring railings.
5. Section 11-26 “Painting” for finish painting of exposed, shop primed metal components.

11-06.1(2) PRODUCT REQUIREMENTS

Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

98% Submittal - Not for Construction

1. Uniform Load: 100 lb./sq. ft.
2. Concentrated Load: 300 lb. applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:
   - A. Uniform load of 50 lb./ ft. applied in any direction.
   - B. Concentrated load of 200 lb. applied in any direction.
   - C. Uniform and concentrated loads need not be assumed to act concurrently.
2. Top Rails of Guards:
   - A. Uniform load of 50 lb./ ft. applied in any direction.
   - B. Concentrated load of 200 lb. applied in any direction.
   - C. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Guards:
   - A. Concentrated load of 50 lb. applied horizontally on an area of 1 sq. ft.
   - B. Infill load and other loads need not be assumed to act concurrently.

Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to the International Building Code (IBC 2006).

11-06.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For metal stairs and the following:

1. Nonslip aggregates and nonslip-aggregate finishes.
2. Steel grating treads.
3. Paint products.
4. Grout.

98% Submittal - Not for Construction

Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.

2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Stair treads with nonslip-aggregate surface finish.

2. Grating treads.

11-06.1(4) QUALITY ASSURANCE

Installer Qualifications: Fabricator of products.

NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

Preassembled Stairs: Service class.

Industrial-Type Stairs: Industrial class.

Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

2. AWS D1.3, "Structural Welding Code--Sheet Steel."

11-06.1(5) COORDINATION

Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

11-06.2 PRODUCTS

11-06.2(1) MANUFACTURERS

In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

98% Submittal - Not for Construction

11-06.2(2) METALS, GENERAL

Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

11-06.2(3) FERROUS METALS

Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

Grating Treads: 12 GA. pre-galvanized steel with serrated surface, 4 diamond depth with abrasive nosing. Products: Grip Strut or approved equal.

Steel Bars for Grating Treads: ASTM A 36/A 36M.

Wire Rod for Grating Crossbars: ASTM A 510.

Iron Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30, unless another grade is required by design loads.

11-06.2(4) FASTENERS

General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

11-06.2(5) MISCELLANEOUS MATERIALS

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

95% Submittal - Not for Construction

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products:

   A. ICI Devoe Coatings; Catha-Coat 313.

   B. Moore, Benjamin, & Co.; Epoxy Zinc-Rich Primer CM18/19.

   C. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.

   D. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

   E. Tnemec Company, Inc.; Tneme-Zinc 90-97.

   F. Or approved equal.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

3. Concrete Materials and Properties: Comply with requirements in Section 11-02 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

4. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

5. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

11-06.2(6) FABRICATION, GENERAL

Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

90% Submittal - Not for Construction

Form exposed work true to line and level with accurate angles and surfaces and straight edges.

Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

11-06.2(7) STEEL-FRAMED STAIRS

Stair Framing:

1. Fabricate stringers of steel channels. Provide closures for exposed ends of channel stringers.
2. Construct platforms of steel tube headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

1. Steel Sheet: Uncoated hot-rolled steel sheet.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.
4. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.

98% Submittal - Not for Construction

5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing. Smooth Soffit Construction: Construct subplatforms with smooth soffits.

Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch on center and crossbars at 4 inches on center, NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL.

2. Fabricate treads and platforms from pressure-locked steel grating with 1-by-3/16-inch bearing bars at 11/16 inch on center and crossbars at 4 inches on center, NAAMM designation: P-11-4 (1 x 3/16) STEEL.

3. Surface: Serrated.

4. Finish: Galvanized.

5. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

6. Fabricate grating platforms with nosing matching that on grating treads. Provide toe plates at open-sided edges of grating platforms. Weld grating to platform framing.

11-06.2(8) STEEL TUBE RAILINGS

General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacing, and anchorage, but not less than that needed to withstand indicated loads.

Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

Form changes in direction of railings as follows:

1. As detailed.

2. By bending or by inserting prefabricated elbow fittings.

Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

Close exposed ends of railing members with prefabricated end fittings.

98% Submittal - Not for Construction

Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing by direct welding, unless otherwise indicated.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

11-06.2(9) FILLERS

Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

11-06.2(10) FINISHES

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Finish metal stairs after assembly.

Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products: Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Stripe paint corners, crevices, bolts, welds, and sharp edges.

98% Submittal - Not for Construction

11-06.3 CONSTRUCTION REQUIREMENTS

11-06.3(1) INSTALLATION, GENERAL

Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Place and finish concrete fill for treads and platforms to comply with Section 11-02 "Cast-in-Place Concrete."

11-06.3(2) INSTALLING STEEL TUBE RAILINGS

Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

90% Submittal - Not for Construction

Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

11-06.3(3) ADJUSTING AND CLEANING

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

11-07 PIPE AND TUBE RAILINGS

11-07.1 GENERAL

11-07.1(1) SUMMARY

This Section includes steel pipe railing.

Related Sections include the following:

1. Section 11-06 "Metal Stairs" for steel tube railings associated with metal stairs.
2. Section 11-26 “Painting” for finish painting of exposed, shop primed metal components.

11-07.1(2) PRODUCT REQUIREMENTS

Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:
   - A. Uniform load of 50 lb./ ft. applied in any direction.
   - B. Concentrated load of 200 lb. applied in any direction.
   - C. Uniform and concentrated loads need not be assumed to act concurrently.

90% Submittal - Not for Construction

2. Top Rails of Guards:

   A. Uniform load of 50 lb./ ft. applied horizontally and concurrently with 100 lb./ ft. applied vertically downward.

   B. Concentrated load of 200 lb. applied in any direction.

   C. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

   A. Concentrated load of 50 lb. applied horizontally on an area of 1 sq. ft.

   B. Uniform load of 25 lb./ ft. applied horizontally.

   C. Infill load and other loads need not be assumed to act concurrently.

Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials. Galvanize all ferrous metal exposed to weather, min G60.

11-07.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For the following:

1. Manufacturer's product lines of welded railings.

2. Grout, anchoring cement, and paint products.

Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.

2. Fittings and brackets.

Welding certificates.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

98% Submittal - Not for Construction

11-07.1(4) QUALITY ASSURANCE

Source Limitations: Obtain each type of railing through one source from a single manufacturer.

Welding: Qualify procedures and personnel according to the following: AWS D1.1, "Structural Welding Code--Steel."

11-07.1(5) PROJECT CONDITIONS

Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

11-07.1(6) COORDINATION AND SCHEDULING

Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

11-07.2 PRODUCTS

11-07.2(1) METALS, GENERAL

Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

11-07.2(2) STEEL AND IRON

Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. Provide galvanized finish for exterior installations and where indicated.

Plates, Shapes, and Bars: ASTM A 36/A 36M.

Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

11-07.2(3) FASTENERS

General: Provide the following: Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

98% Submittal - Not for Construction

Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2. Provide Manufacturer's standard flat-head machine screws for exposed fasteners, unless otherwise indicated.

Anchors: Provide torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

11-07.2(4) MISCELLANEOUS MATERIALS

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

11-07.2(5) FABRICATION

General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

Form work true to line and level with accurate angles and surfaces.

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Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

Form changes in direction as follows: By bending or by inserting prefabricated elbow fittings.

Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

Close exposed ends of railing members with prefabricated end fittings.

Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

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For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

11-07.2(6) FINISHES, GENERAL

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

11-07.2(7) STEEL AND IRON FINISHES

Galvanized Railings:

1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

11-07.3 CONSTRUCTION REQUIREMENTS

11-07.3(1) INSTALLATION, GENERAL

Fit exposed connections together to form tight, hairline joints.

Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

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2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

Adjust railings before anchoring to ensure matching alignment at abutting joints.

Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

11-07.3(2) RAILING CONNECTIONS

Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" provision whether welding is performed in the shop or in the field.

Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

11-07.3(3) ANCHORING POSTS

Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

11-07.3(4) ADJUSTING AND CLEANING

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

90% Submittal - Not for Construction

11-07.3(5) PROTECTION

Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of opening the bridge to vehicular traffic.

Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

11-08 MISCELLANEOUS CARPENTRY

11-08.1 GENERAL

11-08.1(1) SUMMARY

This Section includes the following:

1. Wood blocking, cants, and nailers.
2. Interior wood trim.
3. Plywood backing panels.

11-08.1(2) DEFINITIONS

Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

11-08.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

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2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

Research/Evaluation Reports: For the following, showing compliance with Building Codes of King County in effect for Project:

1. Preservative-treated wood.

2. Fire-retardant-treated wood.

3. Power-driven fasteners.

4. Expansion anchors.

11-08.1(4) DELIVERY, STORAGE, AND HANDLING

Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

11-08.2 PRODUCTS

11-08.2(1) WOOD PRODUCTS, GENERAL

Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

3. Provide dressed lumber, S4S, unless otherwise indicated.

4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

Wood Structural Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.

3. Factory mark panels according to indicated standard.

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11-08.2(2) WOOD-PRESERVATIVE-TREATED MATERIALS

Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
   a. Ammoniacal, or amine, copper quat (ACQ).
   b. Copper bis (dimethyldithiocarbamate) (CDDC).
   c. Ammoniacal copper citrate (CC).
   d. Copper azole, Type A (CBA-A).
   e. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.

Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

Application: Treat items indicated on Contract Plans, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches above grade.

11-08.2(3) MISCELLANEOUS LUMBER

General: Provide lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Cants.
3. Nailers.

For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:

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1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.

11-08.2(4) INTERIOR WOOD TRIM

Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of the following species and grades: Grade A Finish alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA.

11-08.2(5) PANEL PRODUCTS

Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.

Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

11-08.2(6) FASTENERS

General: Provide fasteners of size and type indicated that comply with requirements specified in this provision for material and manufacture. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

Nails, Wire, Brads, and Staples: FS FF-N-105.

Power-Driven Fasteners: CABO NER-272.

Wood Screws: ASME B18.6.1.

Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

Lag Bolts: ASME B18.2.1.

Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

11-08.3 CONSTRUCTION REQUIREMENTS

11-08.3(1) INSTALLATION, GENERAL

Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

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Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

11-08.3(2) WOOD BLOCKING AND NAILER INSTALLATION

Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

11-08.3(3) PANEL PRODUCT INSTALLATION

Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

11-08.3(4) WOOD TRIM INSTALLATION

Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

1. Match color and grain pattern across joints.
2. Install trim after gypsum board joint-finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

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11-09 INTERIOR ARCHITECTURAL WOODWORK

11-09.1 GENERAL

11-09.1(1) SUMMARY

This Section includes the following:

1. Manufactured wood cabinets as shown on the Plans.
2. Wood window sill stools.

11-09.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Submit product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices, louvers/grilles, connections to grounding system, and other components. Obtain field dimensions prior to and include in preparing shop drawings.

Samples: Submit samples for selection of colors and styles: Swatches of plastic laminate showing color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

Certification of Grade: Submit certificates on graded but unmarked lumber or plywood (unmarked for reasons of appearance) attesting that these materials meet the grade requirements herein specified.

11-09.1(3) QUALITY ASSURANCE

Manufacturer's Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

AWI Quality Standard: Comply with applicable requirements of AWI except as otherwise indicated.

Take field measurements and ensure proper fit in-place of all woodwork.

Any items not given a specific quality grade shall be "Custom" grade, as defined in the latest edition of AWI Quality Standards.

Grade Marking:

1. Lumber: Each piece or each bundle (include millwork and wood trim) shall be identified by the grade mark of a recognized association or independent inspection agency that specializes in the particular species used. Such association

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or independent inspection agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used.

2. Plywood: Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark for softwood plywood shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with the U.S. Department of Commerce PS 1.

Sizes and Patterns of Wood Products: Yard and board lumber sizes shall conform to U.S. Department of Commerce PS 20. Except as indicated or specified otherwise, sizes are nominal. Provide shaped lumber and millwork in the patterns indicated and which conform to standard patterns of the association recognized as covering the species used. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

11-09.1(4) DELIVERY, STORAGE, AND HANDLING

Sizes and Patterns of Wood Products: Yard and board lumber sizes shall conform to U.S. Department of Commerce PS 20. Except as indicated or specified otherwise, sizes are nominal. Provide shaped lumber and millwork in the patterns indicated and which conform to standard patterns of the association recognized as covering the species used. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

Do not deliver architectural woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If architectural woodwork must be stored in other than installation areas, store only in areas with controlled environmental conditions to limit moisture and temperature limits.

11-09.2 PRODUCTS

11-09.2(1) MATERIALS

General: Provide materials that comply with recommendations of the AWI woodworking standard for type and quality grade indicated.

1. Plywood, veneer core, premium grade, conforming to U.S. Product Standard PS-1, exterior exposure durability classification.

2. Particle board for interior use, premium grade, conforming to Commercial Standard CS-236.

3. High Pressure Laminate:

   a. High Pressure Decorative Laminate for countertops and exposed cabinet surfaces. NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard. Colors as indicated in the Plans.

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b. High Pressure Decorative Laminate for countertops and exposed cabinet surfaces. NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard. Colors as indicated in the Plans.

11-09.2(2) FABRICATION, GENERAL

Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

Fabricate architectural woodwork to dimensions, profiles, and details indicated. Round corners of sills as noted. Ease edges of running and standing trim.

Complete fabrication, including, but not limited to, assembly, finishing, and hardware application, before shipment to the Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

Complete fabrication, including, but not limited to, assembly, finishing, and hardware application, before shipment to the Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

11-09.2(2) CABINET HARDWARE AND ACCESSORY MATERIALS

General: Provide cabinet hardware and accessory materials associated with manufactured architectural cabinets

Cabinet Hardware Schedule: As a minimum comply with the following hardware style and quality:

1. Hinges: Concealed, three (3) way adjustable, self-close.
2. Pulls: Satin chrome wire pulls.
3. Drawer suspension: Epoxy coated with 100 pounds load capacity, drawer slide.
4. Door catch: Self aligning magnetic catch.
5. Shelving support: Heavy duty shelf clips inserted in predrilled holes or aluminum side pilasters with supports.

11-09.2(3) ARCHITECTURAL CABINET TOPS

Quality Standard: Comply with AWI Section 400 and its Division 400C.

Type of Top: Provide high pressure decorative laminate complying with the following:

1. Grade: Premium.

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2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:

   a. Colors, Patterns, Texture and Finishes as scheduled on Plans.

   b. Grade: GP-50 (0.050 inch nominal thickness).

3. Grade: GP-50 (0.050 inch nominal thickness).

   a. Plastic laminate with postformed edge for countertops and sills.

11-09.2(4) FASTENERS AND ANCHORS

Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent architectural woodwork anchorage.

11-09.3 CONSTRUCTION REQUIREMENTS

11-09.3(1) EXAMINATION

Examine areas and conditions under which the Work is to be installed, and notify the Owner in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected.

11-09.3(2) PREPARATION

Condition architectural woodwork to average prevailing humidity conditions in installation areas before installing.

11-09.3(3) INSTALLATION

Quality Standard: Install architectural woodwork to comply with AWI Section 1700 for same grade specified in Products of this section for type of architectural woodwork involved.

Install architectural woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8 feet.

Scribe and cut architectural woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

Anchor architectural woodwork to blocking built in or directly attached to substrates. Secure to grounds, stripping, and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

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Install cabinets without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

Install cabinets without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

11-09.3(4) ADJUSTING AND CLEANING

Repair damaged and defective architectural woodwork where possible to eliminate defects functionally and visually. Where not possible to repair, replace architectural woodwork. Adjust joinery for uniform appearance.

Clean, lubricate, and adjust hardware.

Clean architectural woodwork on exposed and semi-exposed surfaces. Touch up factory applied finishes to restore damaged or soiled areas.

11-09.3(5) WOOD TRIM INSTALLATION

Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

1. Match color and grain pattern across joints.
2. Install trim after gypsum board joint-finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.

Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

11-09.3(6) ADJUSTING AND CLEANING

Repair damaged and defective architectural woodwork where possible to eliminate defects functionally and visually. Where not possible to repair, replace architectural woodwork. Adjust joinery for uniform appearance.

Clean, lubricate, and adjust hardware.

Clean architectural woodwork on exposed and semi-exposed surfaces. Touch up factory applied finishes to restore damaged or soiled areas.

98% Submittal - Not for Construction

11-09.3(7) PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to the manufacturer that shall ensure that architectural woodwork shall be without damage or deterioration at time of opening the bridge to vehicular traffic.

11-10 BUILDING INSULATION

11-10.1 GENERAL

11-10.1(1) SUMMARY

This Section includes the following: Concealed building insulation.

Related Sections include the following:

1. Section 11-14 "Sheet Metal Roofing" for insulation specified as part of roofing construction.
2. Section 11-23 "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
3. Section 11-23 "Gypsum Board Assemblies" for installation in metal-framed assemblies of vapor retarder.

11-10.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of product indicated.

Research/Evaluation Reports: For foam-plastic insulation.

11-10.1(3) QUALITY ASSURANCE

Source Limitations: Obtain each type of building insulation through one source.

Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

11-10.1(4) DELIVERY, STORAGE, AND HANDLING

Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

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2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

11-10.2 PRODUCTS

11-10.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Foil-Faced, Polyisocyanurate Board Insulation:
   a. Atlas Roofing Corporation.
   b. Owens Corning.
   c. Rmax, Inc.
   d. Or approved equal.
2. Glass-Fiber Insulation:
   a. CertainTeed Corporation.
   b. Johns Manville Corporation.
   c. Knauf Fiber Glass.
   d. Owens Corning.
   e. Or approved equal.

11-10.2(2) INSULATING MATERIALS

General: Provide insulating materials that comply with requirements and with referenced standards. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

11-10.2(3) VAPOR RETARDERS

Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: is the work of Section 11-23 "Gypsum Board Assemblies".

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11-10.2(4) AUXILIARY INSULATING MATERIALS

Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

11-10.3 CONSTRUCTION REQUIREMENTS

11-10.3(1) EXAMINATION

Examine substrates and conditions for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-10.3(2) PREPARATION

Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

11-10.3(3) INSTALLATION, GENERAL

Comply with insulation manufacturer's written instructions applicable to products and application indicated.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

11-10.3(4) INSTALLATION OF GENERAL BUILDING INSULATION

Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping. Tape joints and ruptures in

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vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

11-10.3(5) INSTALLATION OF VAPOR RETARDERS

General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches on center.

Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

11-10.3(6) INSTALLATION OF FOIL FACED, POLYISOCYANURATE BOARD INSULATION

Install Foil-Faced, Polyisocyanurate Board Insulation on metal stud framing and metal “zee” framing on underside of concrete floor slabs.

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Verify surfaces to receive Foil-Faced, Polyisocyanurate Board Insulation have been framed to receive 2 foot wide insulation panels.

Fasten unsupported edge of insulation with friction fit or adhesive to hold insulation in place until covered with gypsum board.

11-10.3(7) PROTECTION

Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation. Cover insulation with gypsum board as necessary to conform to local building code and protection of insulation.

11-11 FLUID-APPLIED MEMBRANE AIR BARRIERS

11-11.1 GENERAL

11-11.1(1) SUMMARY

This Section includes the following: Fluid-applied membrane air barrier, vapor retarding.

Related Sections include the following:

1. Section 11-14 "Sheet Metal Roofing" for sheet metal flashings.
2. Section 11-15 "Joint Sealants" for joint-sealant materials and installation.
3. Section 11-23 "Gypsum Board Assemblies" for wall sheathings, wall sheathing joint-and-penetration treatments.

11-11.1(2) DEFINITIONS

ABAA: Air Barrier Association of America.

Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

11-11.1(3) PRODUCT REQUIREMENTS

General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

Air Barrier Assembly Air Leakage: Not to exceed 0.01 cfm x sq. ft. of surface area at 1.57 lb./sq. ft. ASTM E 283 and ASTM E 783.

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11-11.1(4) SUBMITTALS

Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.
2. Include details of mockups.

Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

Qualification Data: For Applicator.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers

Provide the submittals not less than 30 calendar days before ordering material.

11-11.1(5) QUALITY ASSURANCE

Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is a licensed contractor.

Preinstallation Conference: Conduct conference at Project site prior to installation.

1. Include installers of other construction connecting to air barrier, including composite metal wall panels.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

11-11.1(6) DELIVERY, STORAGE, AND HANDLING

Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

Remove and replace liquid materials that cannot be applied within their stated shelf life.

Store rolls according to manufacturer's written instructions.

Protect stored materials from direct sunlight.

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11-11.1(7) PROJECT CONDITIONS

Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

11-11.2 PRODUCTS

11-11.2(1) FLUID-APPLIED MEMBRANE AIR BARRIER

Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
   a. Synthetic Polymer Membrane:
      1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.
      2) Henry Company; Air-Bloc 21 or 21S.
      3) Rubber Polymer Corporation; Rub-R-Wall Airtight.
3. Physical and Performance Properties:
   a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lb./sq. ft. pressure difference; ASTM E 2178.
   b. Membrane Vapor Permeance: Not to exceed 0.1 perm; ASTM E 96.

11-11.2(2) AUXILIARY MATERIALS

General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.

Butyl Strip: Vapor-retarding, 30- to 40-mil- thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

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Modified Bituminous Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms.

Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 11-15, Joint Sealants.

11-11.3 CONSTRUCTION REQUIREMENTS

11-11.3(1) EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.

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3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

4. Verify that masonry joints are flush and completely filled with mortar.

5. Proceed with installation only after unsatisfactory conditions have been corrected.

11-11.3(2) SURFACE PREPARATION

Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

Remove excess mortar from masonry ties, shelf angles, and other obstructions.

At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

11-11.3(3) JOINT TREATMENT

Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

Glass-Mat Gypsum Board Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

11-11.3(4) TRANSITION STRIP INSTALLATION

Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

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1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.

At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply compatible modified bituminous transition strip, adhesive-coated transition strip, elastomeric flashing sheet, or preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous or Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.

2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches on center. Apply lap sealant over exposed edges and on cavity side of flashing sheet.

3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, modified bituminous counterflashing strip.

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Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

11-11.3(5) AIR BARRIER MEMBRANE INSTALLATION

Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

Apply air barrier membrane within manufacturer's recommended application temperature ranges.

Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties. Vapor-Retarding Membrane Air Barrier: 120-mil dry film thickness.

Apply strip and transition strip a minimum of 1 inch onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.

Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

11-11.3(6) FIELD QUALITY CONTROL

Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.

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6. Surfaces have been primed, if applicable.

7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction or mastic has been applied on exposed edges, with no fishmouths.

8. Termination mastic has been applied on cut edges.

9. Strips and transition strips have been firmly adhered to substrate.

10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.

12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.

13. All penetrations have been sealed.

11-11.3(7) CLEANING AND PROTECTION

Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 calendar days.

2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction. Remove masking materials after installation.

11-12 COMPOSITE WALL PANELS

11-12.1 PRODUCTS

11-12.1(1) SUMMARY

Section includes metal-faced composite soffit and wall panels in a “rain-screen” assembly system.

Related Sections:

1. Section 11-11 “Fluid-Applied Membrane Air-Barrier” for the waterproofing of the rain-screen wall system.

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2. Section 11-23 "Gypsum Board Assemblies" for metal framing and glass-mat gypsum wall sheathing supporting metal-faced composite wall panels.

11-12.1(2) DEFINITION

Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete "rain-screen" wall system.

Rain-Screen Wall System: The rainscreen principle is the management of water and air-infiltration in a building envelope system for eliminating the air-pressure differential across wall openings that allows the creep of water into the building interior.

11-12.1(3) PRODUCT REQUIREMENTS

General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

Delegated Detail: Detail metal-faced composite wall panel assembly using performance requirements and criteria indicated.

Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330: Wind Loads:

1. Design loads in accordance with the International Building Code and note V on sheet BG06, acting inward or outward.

Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference: Test-Pressure Difference: 1.57 lb./sq. ft.

Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference: Test-Pressure Difference: 6.24 lb./sq. ft.

Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lb./sq. ft. and not more than 12 lb./sq. ft.

1. Water Leakage: As defined according to AAMA 501.1. Water Leakage: Uncontrolled water infiltrating the system or appearing on systems normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

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Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change (Range): 120 deg F, ambient; 180 deg , material surfaces.

Base detail on the Rainscreen Principle. Proper joinery and spacing to allow effective back ventilation and pressure equalization. No exposed sealants, gaskets, tapes or battens unless specifically detailed in the Plans.

11-12.1(4) SUBMITTALS

Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Anchorage systems.
2. Include similar Samples of trim and accessories involving color selection.
3. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches. Include fasteners, closures, and other metal-faced composite wall panel accessories. Composite Panels: Include four-way joint.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- long Samples for each type of accessory.
4. Exposed Gaskets: 12 inches long.
5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of

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material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

Delegated-Detail Submittal: For metal-faced composite wall panel assembly indicated to comply with performance requirements and design criteria.

Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Soffit and wall panels and attachments.
2. Girts and stud framing.

Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

Product Test Reports: Based on evaluation of tests performed by a qualified testing agency, for each product.

Maintenance Data: For metal wall panels to include in maintenance manuals.

The Contractor shall provide submittals not less than 35 calendar days prior to ordering material.

11-12.1(5) QUALITY ASSURANCE

Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.

Preinstallation Conference: Conduct conference at Project site.

1. Meet with Project Engineer, metal-faced composite wall panel installer, structural-support installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of window. Meeting no later than 1 working day prior to start of installation.
2. Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

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11-12.1(6) DELIVERY, STORAGE, AND HANDLING

Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

11-12.1(7) PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

11-12.1(8) COORDINATION

Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

11-12.1(9) WARRANTY

Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures, including rupturing, cracking, or puncturing.
    b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion of the Project.

Warranty on Panel Finishes: Provide manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

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1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion of the Project.

11-12.2 PRODUCTS

11-12.2(1) PANEL MATERIALS

Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.

2. Exposed Coil-Coated Finishes: FEVE Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish containing 100 percent FEVE resin in color coat and a clear-coat finish. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Panel Sealants: Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

11-12.2(2) MISCELLANEOUS MATERIALS

Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

11-12.2(3) METAL-FACED COMPOSITE WALL PANELS

General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.

98% Submittal - Not for Construction

1. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

    a. Flame-Spread Index: 25 or less.

    b. Smoke-Developed Index: 450 or less.

2. Products: Subject to compliance with requirements, provide one of the following, or approved equal:

    a. Alcan Composites USA Inc.; Alucobond ACM.

    b. Alcoa Inc.; Reynobond FR.

    c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC ACM.

Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, anodized aluminum sheet facings.

1. Panel Thickness: 0.236 inch.

2. Core: Fire retardant.

3. Exterior Finish: fluoropolymer. Color: Custom color to match Project Engineer's samples.

Attachment System Components: Formed from extruded aluminum. Adjust components in subparagraph below to suit Project and to coordinate with installation. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips and anchor channels.

11-12.2(4) ACCESSORIES

Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

Flashing and Trim: Formed from 0.018-inch- minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

90% Submittal - Not for Construction

11-12.2(5) FABRICATION

General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

Metal-Faced Composite Wall Panels: Factory form panels in a batch process by laminating each sheet using glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.

1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
4. Dimensional Tolerances:
   a. Panel Bow: 0.8 percent maximum of panel length or width.
   b. Squareness: 0.25 inch maximum.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

98% Submittal - Not for Construction

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal-faced composite wall panel manufacturer. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

11-12.2(6) GENERAL FINISH REQUIREMENTS

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

11-12.3 CONSTRUCTION REQUIREMENTS

11-12.3(1) EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.

3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

Prepare written report listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

90% Submittal - Not for Construction

11-12.3(2) PREPARATION

Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

11-12.3(3) METAL-FACED COMPOSITE WALL PANEL INSTALLATION

General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Contract Plans. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
2. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
3. Install flashing and trim as metal-faced composite wall panel work proceeds.
4. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

Fasteners: Aluminum Soffit and Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer. Prepare joints and apply sealants to comply with requirements in Section 11-15, Joint Sealants.

Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

68% Submittal - Not for Construction

2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacing's, and with fasteners recommended by manufacturer. Attach wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of wall panels. Leave horizontal and vertical joints with open reveal.

1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

2. Do not apply sealants to joints unless otherwise indicated on Contract Plans.

11-12.3(4) ACCESSORY INSTALLATION

General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

11-12.3(5) ERECTION TOLERANCES

Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

98% Submittal - Not For Construction

11-12.3(6) FIELD QUALITY CONTROL

Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Water Penetration: Test areas of installed system indicated on Contract Plans for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lb./sq. ft.

Water-Spray Test: After completing the installation of 75-foot- by-2-story minimum area of metal-faced composite wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Project Engineer.

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal-faced composite wall panel installation, including accessories.

Metal-faced composite wall panels will be considered defective if they do not pass tests and inspections.

Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Provide test and inspection reports.

11-12.3(7) CLEANING

Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

Replace metal-faced composite wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

11-13 TRAFFIC COATING

11-13.1 GENERAL

11-13.1(1) SUMMARY

Scope: This section includes, but shall not be limited to, the following:

1. Fluid-applied membrane traffic coating for application on concrete Control Level exterior walkway.
2. Flashing and miscellaneous accessories.

98% Submittal - Not for Construction

11-13.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Submit product data for type of application specified in this section and special requirements for conditions under which this product will perform, including precautions on flammability and toxicity. Submit for:

1. Fluid-applied membrane components and primers.
2. Cleaner, activating solvent.
3. Moisture meter.

11-13.1(3) DELIVERY, STORAGE, AND HANDLING

Deliver manufacturer's traffic coating materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by a referenced specification number, type, and class of the contents must be visibly indicated.

Deliver materials in sufficient quantity to continue work without interruption.

Store and protect materials in accordance with the manufacturer's instructions and use within their indicated shelf live.

When hazardous materials are involved, adhere to the special precautions of the manufacturer, unless they conflict with local, state, and federal regulations. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture or freezing. Use pallets and waterproof tarpaulins to cover stored materials top to bottom.

11-13.1(4) PROJECT CONDITIONS

Apply materials when air temperature has been above 40 degrees F. for a period of 24 hours prior to the application and when there is no ice, frost, surface moisture, or visible dampness on the substrate surface. Ensure the air temperature of the substrate is maintained at a minimum 40 degrees F for 24 hours during the application and cure period recommended by the manufacturer.

11-13.2 PRODUCTS

11-13.2(1) TRAFFIC COATING

Urethane based traffic coating, 2-component or 3-component liquid membrane waterproofing material, self-bonding to concrete substrate, and compounded specifically for application and slope of substrate. Provide membrane with not less than 90 percent solids, minimum 6 month shelf life in uncured state (1-component type) and tested by the manufacturer to comply with requirements of ASTM C957.

11-13.2(2) MISCELLANEOUS MATERIALS

Joint Sealant: Multi-component urethane sealant complying with ASTM C920 as recommended by the manufacturer for the substrate, and compatible with the traffic coating specified, Type M, Class 25, Grade NS for sloping and vertical application, Grade P for deck application.

90% Submittal - Not for Construction

Aggregate: Uniformly graded washed silica sand of practical sizes and shape as recommended by the traffic coating manufacturer, with minimum hardness of 6 on the Moh Scale.

Sheet Flashing: 50 mils minimum non-staining uncured sheet neoprene.

Adhesive: Manufacturer's recommended contact adhesive.

11-13.3 CONSTRUCTION REQUIREMENTS

11-13.3(1) PREPARATION

Coordinate the Work with that of trades to assure components to be incorporated into the traffic coating system are available when needed. Proceed with installation only after unsatisfactory conditions have been corrected.

Inspect and approve surfaces immediately before the application of the traffic coating materials. Free concrete surfaces of laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the fluid-applied membrane to the concrete surface.

Do not begin application until penetrations through or attachments to the structural slab are in place.

1. Flash penetrations and projections, if any, through the structural slab with neoprene sheet adhered to the concrete slab or wall and the penetration. Leave the neoprene sheet un-adhered for one inch over the joint between the penetration and the concrete slab or wall. The neoprene sheet shall be adhered a minimum of 4 inches onto the horizontal deck. Cover this portion of the neoprene sheet with fluid-applied traffic coating during application.

2. Flash wall intersections which are not of monolithic pour or constructed with reinforced concrete joints with neoprene sheet adhered to both the vertical wall surface and the concrete slab. Intersections which are of monolithic pour or constructed with reinforced concrete joints with a neoprene sheet adhered to both vertical wall surface and the concrete slab can be flashed with a vertical grade of fluid-applied traffic coating membrane. Leave the sheet un-adhered for a distance of one inch from the corner on both the vertical and horizontal surfaces. Cover the neoprene sheet with fluid-applied traffic coating during application.

3. Prepare visible cracks and joints in the substrate to receive application of the traffic coating membrane per manufacturer's recommendations.

4. Prime surfaces to receive the fluid-applied traffic coating membrane. Apply the Primer as required by the membrane manufacturer's printed instructions.

11-13.3(2) SPECIAL PRECAUTIONS

Protect components during transport and application of waterproofing materials. Do not dilute primers and other materials, unless specifically recommended by the materials manufacturer.

98% Submittal - Not for Construction

Keep containers closed except when removing the contents. Do not allow contact of various materials through mixing of remains and the dual use of application equipment for mixing and transporting materials. Do not permit equipment on the project site that has residue of materials used on previous projects.

11-13.3(3) APPLICATION

Over the primed surfaces, provide a uniform, wet, monolithic coating of fluid-applied membrane by following the manufacturer's printed instructions.

Apply material by trowel, squeegee, roller, brush, spray apparatus, or other method acceptable to the membrane manufacturer.

Check wet thickness as specified under Field Test and adjust application rate as necessary to provide a uniform coating of the thickness specified. Where possible, mark off surface to be coated in even units to facilitate proper coverage.

At control joints, prepare cracks and terminations; carry the membrane over the preformed Elastomeric sheet in a uniform 40 mils thick, plus or minus 5 mils, wet thickness to provide a monolithic coating.

When work has stopped long enough for the membrane to cure, begin the next application by wiping the previously applied material with a solvent so that accumulated dirt and dust, which could inhibit adhesion of the overlapping membrane coat, is removed. Use solvent recommended by the membrane manufacturer, as approved.

Work sequence: Move material storage areas as work progresses to prevent abuse of the membrane and overloading the structural deck. Flashing shall be completed prior to the application of fluid-applied membrane.

11-13.3(4) FIELD TESTING

Moisture test: Prior to application of the fluid-applied traffic coating, check moisture content of substrate with a moisture meter. Only meters which are suitable for the purpose and manufacturer approved may be used. Do not begin application until the meter reading indicates "dry" range or similar reading indicating that substrate is suitably dry in the presence of the Project Engineer.

Film thickness: Check wet film thickness during application by placing flat metal plates on the substrate or using a mil-thickness gauge especially manufactured for the purpose.

11-14 SHEET METAL ROOFING

11-14.1 GENERAL

11-14.1(1) SUMMARY

This Section includes the following custom-fabricated sheet metal roofing: Standing-seam metal roofing.

98% Submittal - Not for Construction

Related Sections include the following: Section 11-08 "Miscellaneous Carpentry" for wood roof deck supporting sheet metal roofing, blocking, underlayment, and nailers installed as part of the roofing system.

11-14.1(2) DEFINITIONS

Sheet Metal Roofing Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

11-14.1(3) PRODUCT REQUIREMENTS

General: Provide complete sheet metal roofing system, including, but not limited to, custom-fabricated metal roof pans, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.

Delegated Design: Design metal roof panel assembly using performance requirements and design criteria indicated.

Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference: Test-Pressure Difference: Positive and negative 1.57 lb./sq. ft.

Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lb./sq. ft. (300 Pa) and not more than 12.0 lb./sq. ft. (575 Pa).

2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lb./sq. ft. (720 Pa) and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.

3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings. Fire/Windstorm Classification: Class 1A-90.

Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Design loads in accordance with the International Building Code and note V on sheet BG06.

90% Submittal - Not for Construction

Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base design on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

11-14.1(4) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each product indicated. Include details of construction relative to materials, dimensions of individual components and profiles, and finishes.

Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of roof penetrations.
5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
6. Details of special conditions.
7. Details of connections to adjoining work.

Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:

1. Sheet metal roofing and attachments.
2. Purlins and rafters.
3. Roof-mounted items including pipe supports and penetration.

Qualification Data: For fabricator.

Warranties: Specified in this Section.

11-14.1(5) QUALITY ASSURANCE

Installer Qualifications: Fabricator of sheet metal roofing.

98% Submittal - Not for Construction

Custom-Fabricated Sheet Metal Roofing Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of typical roof eave, including fascia, and gutter as shown on Contract Plans; approximately 48 inches square by full thickness, including attachments, underlayment, and accessories.

2. Approval of mockups is for other material and construction qualities specifically approved by Project Engineer in writing.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Project Engineer in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of opening the bridge to vehicular traffic.

Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to sheet metal roofing including, but not limited to, the following:

1. Meet with Project Engineer, sheet metal roofing installer, wood deck installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.

2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review methods and procedures related to sheet metal roofing installation.

4. Examine wood deck conditions for compliance with requirements, including flatness and attachment to structural members.

5. Review structural loading limitations of wood deck during and after roofing.

6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.

7. Review temporary protection requirements for sheet metal roofing during and after installation.

8. Review roof observation and repair procedures after sheet metal roofing installation.

98% Submittal - Not for Construction

9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

11-14.1(6) DELIVERY, STORAGE, AND HANDLING

Deliver sheet metal roofing pans, components, and other sheet metal roofing materials so as not to be damaged or deformed. Package sheet metal roofing materials for protection during transportation and handling.

Unload, store, and erect sheet metal roofing materials in a manner to prevent bending, warping, twisting, and surface damage.

Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store sheet metal roofing materials to ensure dryness. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

Store metal roofing materials away from uncured concrete and masonry.

Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

11-14.1(7) COORDINATION

Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of metal decks, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

11-14.1(8) WARRANTY

Warranty: Contractor agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Loose parts.
   c. Wrinkling or buckling.
   d. Failure to remain weathertight, including uncontrolled water leakage.
   e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
   f. Galvanic action between sheet metal roofing and dissimilar materials.
2. Warranty Period: Ten years from date of Substantial Completion of the Project.

98% Submittal - Not for Construction

Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty years from date of Substantial Completion of the Project.

11-14.2 PRODUCTS

11-14.2(1) PANEL MATERIALS

Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.

3. Surface: Embossed finish.

4. Exposed Coil-Coated Finish: 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Embossed finish.

2. Exposed Coil-Coated Finish: 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in

98% Submittal - Not For Construction

color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

11-14.2(2) FIELD-INSTALLED THERMAL INSULATION

Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 aluminum foil, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core.

11-14.2(3) UNDERLAYMENT MATERIALS

Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F ; ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following, or approved equal:

   a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.

   b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.

   c. Henry Company; Blueskin PE200 HT.

11-14.2(4) SUBSTRATE BOARDS

Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: Regular, 1/4 inch.

2. Product: Subject to compliance with requirements, provide Dens-Dek by Georgia-Pacific Corporation, or approved equal.

Substrate-Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

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11-14.2(5) MISCELLANEOUS METAL FRAMING

Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

Hat-Shaped, Rigid Furring Channels: Nominal Thickness: As required to meet performance requirements.

Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), and depth required to fit insulation thickness indicated. Nominal Thickness: As required to meet performance requirements.

Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

11-14.2(6) STANDING-SEAM METAL ROOF PANELS

General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Design Span HP or comparable product by one of the following, or approved equal:

    a. AEP-Span.

    b. Architectural Building Components.

    c. CENTRIA Architectural Systems.

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d. Petersen Aluminum Corporation.

3. Material: Zinc-coated (galvanized) steel sheet, 0.028-inch nominal thickness.

a. Exterior Finish: 2-coat fluoropolymer.

b. Color: Custom color as scheduled.

4. Material: Aluminum-zinc alloy-coated steel sheet, 0.028-inch nominal thickness.

a. Exterior Finish: 2-coat fluoropolymer.

b. Color: Custom color as scheduled.

5. Material: Aluminum sheet, 0.032 inch thick.

a. Exterior Finish: 2-coat fluoropolymer.

b. Color: Custom color as specified on Sheet BG05.

6. Clips: Floating to accommodate thermal movement.

a. Material: 0.028-inch-nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

b. Material: 0.025-inch-thick, stainless-steel sheet.

7. Panel Coverage: 12 inches.

8. Panel Height: 1.75 inches.

11-14.2(7) ACCESSORIES

Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.

2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.018 inch thick. Provide flashing and trim as required to seal against weather and to

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provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

Gutters: Formed from same material roof panels. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches on center, fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

Gutter scuppers: Formed from same material as roof panels. Fabricate complete with bent offsets, bottom of opening shall be 1.5 inch above gutter bottom, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish gutter scuppers to match gutters.

11-14.2(8) FABRICATION

Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. End Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. End Seams for Other Than Aluminum: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

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5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

Fabricate cleats and attachment devices of size and metal thickness recommended by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

11-14.2(9) FINISHES

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

11-14.3 CONSTRUCTION REQUIREMENTS

11-14.3(1) EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, sheet metal roofing supports, and other conditions affecting performance of work.

1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for flashings, and penetrations through sheet metal roofing.

3. Prepare written report, endorsed by installer, listing conditions detrimental to performance of work.

Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-14.3(2) THERMAL INSULATION INSTALLATION

Polyethylene Vapor Retarder: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Repair tears or punctures immediately before concealment by other work.

Board Insulation: Extend insulation in thickness indicated to cover entire roof. Erect insulation and hold in place with Z-shaped furring members spaced 24 inches on center. Securely attach narrow flanges of furring members to roof deck with screws at spacing to meet uplift criteria.

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Substrate: Extend glass-mat gypsum sheathing board in thickness indicated to cover entire roof. Fasten glass-mat gypsum sheathing board to Z-shaped furring members with screws at spacing to meet uplift criteria.

11-14.3(3) UNDERLAYMENT INSTALLATION

Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof substrate under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 calendar days. Extend underlayment indicated to cover entire roof.

Apply slip sheet over underlayment before installing sheet metal roofing.

11-14.3(4) INSTALLATION, GENERAL

General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.
2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
3. Provide metal closures at each side of ridge and hip caps.
4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install ridge and hip caps as sheet metal roofing work proceeds.
7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.

Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying

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rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal sheet metal roofing with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

11-14.3(5) SHEET METAL ROOFING INSTALLATION

Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant. Gutters: Fabricate gutter from same material as roof. Install gutter with continuous support.

1. Install self-adhering sheet underlayment and slip sheet between continuous wood blocking and copper.
2. All joints are to be riveted and soldered.

11-14.3(6) ACCESSORY INSTALLATION

General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type

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expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3. Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by manufacturer.

11-14.3(7) ERECTION TOLERANCES

Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

11-14.3(8) CLEANING AND PROTECTION

Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

Clean and neutralize flux materials. Clean off excess solder and sealants.

Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

11-15 JOINT SEALANTS

11-15.1 GENERAL

11-15.1(1) SUMMARY

This Section includes joint sealants for the following applications and as indicated in the Joint-Sealant Schedule at the end of Part 3.

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Joints between plant-precast architectural concrete units.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   e. Other joints as indicated.

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2. Exterior joints in the following horizontal traffic surfaces:
   a. Joints in precast and cast-in-place slabs.
   b. Other joints as indicated.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a. Perimeter joints of exterior openings where indicated.
   b. Joints on underside of plant-precast structural concrete beams and planks.
   c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   d. Other joints as indicated.
4. Interior joints in the following horizontal traffic surfaces:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Other joints as indicated.

Related Sections include the following: Section 11-22 "Glazing" for sealing glass lites in door and window assemblies.

11-15.1(2) PRODUCT REQUIREMENTS

Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

11-15.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each joint-sealant product indicated.

Color Selection: Sealant color is to match adjacent substrate.

Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

Qualification Data: For Installer.

Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

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2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

Warranties: Specified in this Section.

11-15.1(4) QUALITY ASSURANCE

Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than four pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

11-15.1(5) PROJECT CONDITIONS

Do not proceed with installation of joint sealants under the following conditions:

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1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

11-15.1(6) WARRANTY

Warranty: The Contractor agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty Period: Two years from date of Substantial Completion of the Project.

Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty Period: Twenty years from date of Substantial Completion of the Project.

Warranties specified in this provision exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

11-15.2 PRODUCTS

11-15.2(1) MATERIALS, GENERAL

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

Colors of Exposed Joint Sealants: As selected by the Project Engineer from manufacturer's standard colors.

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11-15.2(2) ELASTOMERIC JOINT SEALANTS

Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

Single-Component Mildew-Resistant Acid-Curing Silicone Sealant ES-1:

1. Available Products:
   a. Dow Corning Corporation; 786 Mildew Resistant.
   b. GE Silicones; Sanitary SCS1700.
   c. Tremco; Tremsil 200 White.
   d. Type and Grade: S (single component) and NS (nonsag).
   e. Or approved equal.
2. Class: 25.
3. Use Related to Exposure: NT (nontraffic).
4. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O. Use O Joint Substrates: Porcelain, tile, and painted gypsum board.

Single-Component Nonsag Urethane Sealant ES-2:

1. Available Products:
   a. Sika Corporation, Inc.; Sikaflex - 1a.
   b. Sonneborn, Division of ChemRex Inc.; NP 1.
   c. Tremco; Vulkem 116.
   d. Or approved equal.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).

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5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O. Use O Joint Substrates: Precast concrete, galvanized steel, hollow metal door frames, and steel window frames.

Single-Component Pourable Urethane Sealant ES-3:

1. Products:
   a. Sika Corporation, Inc.; Sikaflex - 1CSL.
   b. Sonneborn, Division of ChemRex Inc.; SL 1.
   c. Tremco; Vulkem Nova 300 SSL.
   d. Or approved equal.
2. Type and Grade: S (single component) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O. Use O Joint Substrates: Precast and cast-in-place concrete.

Single-Component Neutral-Curing Silicone Sealant ES-4:

1. Products:
   a. Dow Corning Corporation; 795
   b. GE Silicones; SilPruf NB SCS9000.
   c. Pecora Corporation; 895.
   d. Or approved equal.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O. Use O Joint Substrates: Aluminum coated with a high performance coating.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

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11-15.2(3) LATEX JOINT SEALANTS

Latex Sealant LS-1: Comply with ASTM C 834, Type P, Grade NF.

Available Products:

1. Pecora Corporation; AC-20+.
2. Sonneborn, Division of ChemRex Inc.; Sonolac.
3. Tremco; Tremflex 834.
4. Or approved equal.

11-15.2(4) JOINT-SEALANT BACKING

General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) O (open-cell material) B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

11-15.2(5) MISCELLANEOUS MATERIALS

Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

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11-15.3 CONSTRUCTION REQUIREMENTS

11-15.3(1) EXAMINATION

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-15.3(2) PREPARATION

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following: Concrete.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

    b. Glass.

    c. Porcelain enamel.

    d. Glazed surfaces of ceramic tile.

Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning

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methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

11-15.3(3) INSTALLATION OF JOINT SEALANTS

General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

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5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193 and as shown on the Plans. Use masking tape to protect surfaces adjacent to recessed tooled joints.

Installation of Preformed Tapes: Install according to manufacturer's written instructions.

11-15.3(4) CLEANING

Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

11-15.3(5) PROTECTION

Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of opening the bridge vehicular traffic. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

11-15.3(6) JOINT-SEALANT SCHEDULE

Joint-Sealant Application JS-1: Exterior horizontal traffic isolation and contraction joints in cast-in-place concrete slabs.

1. Joint Sealant: Single-component pourable urethane sealant ES-3.
2. Joint-Sealant Color: As selected by Project Engineer from manufacturer's full range.

Joint-Sealant Application JS-2: Exterior vertical and horizontal nontraffic joints between plant-precast architectural concrete and plank units.

1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
2. Joint-Sealant Color: To match substrate and as approved by Project Engineer.

Joint-Sealant Application JS-3: Exterior butt joints between metal panels.

1. Joint Sealant: Single-component neutral-curing silicone sealant ES-4.
2. Joint-Sealant Color: To match substrate and as approved by Project Engineer.

Joint-Sealant Application JS-4: Exterior vertical joints between different materials listed above.

1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
2. Joint-Sealant Color: To match substrate and as approved by Project Engineer.

Joint-Sealant Application JS-#5: Exterior perimeter joints between pre-cast concrete and frames of doors windows.

98% Submittal - Not for Construction

1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
2. Joint-Sealant Color: To match substrate and as approved by Project Engineer.

Joint-Sealant Application JS-6: Interior perimeter joints of exterior openings.

1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
2. Joint-Sealant Color: White.

Joint-Sealant Application JS-7: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant acid-curing silicone sealant ES-1.
2. Joint-Sealant Color: White.

Joint-Sealant Application JS-8: Perimeter joints between interior wall surfaces and frames of interior doors and windows.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: White.

Joint-Sealant Application JS-9: Interior control, expansion, and isolation joints in horizontal traffic surfaces of retroplated cast-in-place concrete.

1. Joint Sealant: Single-component pourable urethane sealant ES-3.
2. Joint-Sealant Color: As selected by Project Engineer from manufacturer's full range.

11-16 STEEL DOORS AND FRAMES

11-16.1 GENERAL

11-16.1(1) SUMMARY

This Section includes the following:

1. Steel doors.
2. Steel door frames.

Related Sections include the following:

1. Section 11-17 "Stainless Steel Doors and Frames" for stainless steel doors.
2. Section 11-21 "Door Hardware" for door hardware and weather stripping.
3. Section 11-22 "Glazing" for glass in glazed openings in doors.

98% Submittal - Not for Construction

4. Section 11-23 "Gypsum Board Assemblies" for spot-grouting frames installed in steel-framed gypsum board partitions.

5. Section 11-26 "Painting" for field painting factory-primed doors and frames.

11-16.1(2) DEFINITIONS

Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

11-16.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

Door Schedule: Use same reference designations indicated on Contract Plans in preparing schedule for doors and frames.

11-16.1(4) QUALITY ASSURANCE

Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

11-16.1(5) DELIVERY, STORAGE, AND HANDLING

Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Project Engineer. Remove and replace damaged items that cannot be repaired as directed.

Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

11-16.2 PRODUCTS

11-16.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Doors and Frames:

   a. Ceco Door Products; a United Dominion Company.

Submittal - Not for Construction

b. Curries Company.

c. Steelcraft; a division of Ingersoll-Rand.

d. Or approved equal.

11-16.2(2) MATERIALS

Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

11-16.2(3) DOORS

General: Provide doors of sizes, thicknesses, and designs indicated.

Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush).

Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

Louvers: At doors indicated, provide louvers fabricated of same material as the door with insect screen. Louvers are unpowered and shall have fixed blades. The factory-assembled louver section shall be designed to withstand wind loadings of 20 pounds per square foot (90-mph equivalent) and provide a minimum free area of 75%. Provide complete assembly to doors.

11-16.2(4) FRAMES

General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

Frames of 14 gauge steel sheet for:

1. Level 3 steel doors.

2. Level 4 steel doors.

90% Submittal - Not for Construction

Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

Plaster Guards: Provide 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

11-16.2(5) FABRICATION

General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:

1. Cold-rolled steel sheet.

Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

Single-Acting, Door-Edge Profile: Square edge.

Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

98% Submittal - Not For Construction

Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.24 Btu/sq. ft. x h x deg F or better.

Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

Frame Construction: Fabricate frames to shape shown.

1. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.

2. For interior applications, fabricate knock-down frames with mitered or coped corners, for field assembly.

Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

11-16.2(6) FINISHES

Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

11-16.3 CONSTRUCTION REQUIREMENTS

11-16.3(1) INSTALLATION

General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

90% Submittal - Not for Construction

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. Install fire-rated frames according to NFPA 80.

Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

11-16.3(2) ADJUSTING AND CLEANING

Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

11-17 STAINLESS STEEL DOORS AND FRAMES

11-17.1 GENERAL

11-17.1(1) RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

11-17.1(2) SUMMARY

This Section includes the following:

1. Stainless steel doors.
2. Stainless steel door frames.

Related Sections include the following:

1. Section 11-16 "Steel Doors and Frames" for steel doors.
2. Section 11-21"Door Hardware" for door hardware and weather stripping.
3. Section 11-26 "Painting" for field painting factory-primed doors and frames.

90% Submittal - Not for Construction

11-17.1(3) DEFINITIONS

Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

11-17.1(4) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

11-17.1(5) QUALITY ASSURANCE

Steel Door and Frame Standard: Comply with NAAMM / HMMA Technical Manual, unless more stringent requirements are indicated.

11-17.1(6) DELIVERY, STORAGE, AND HANDLING

Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Project Engineer. Remove and replace damaged items that cannot be repaired as directed.

Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

11-17.2 PRODUCTS

11-17.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Doors and Frames:
   a. Krieger Specialty Products.
   b. Ambico Limited.
   c. Stainless Doors Incorporated.

90% Submittal - Not for Construction

11-17.2(2) MATERIALS

Stainless Steel: Level, cold rolled sheet steel conforming to ASTM A 240, commercial quality.

1. Type: 316.
2. Finish: No. 2D Paint Grade.

Reinforcing Material, Sleeves, Jamb Anchors, Dust Cover Boxes: Stainless Steel.

11-17.2(3) DOORS

General: Provide doors of sizes, thicknesses, and designs indicated.

Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush).
2. Construction: Full flush seamless construction all sides.
3. Hinge and Lock Edges: 12 gage stainless steel channels fastened to both sheets full height of doors.
4. Stiffen doors with foamed-in-place polystyrene, cured and chemically bonded to interior surfaces.
5. Factory-prepare fully for all template hardware.
6. Provide reinforcing in doors scheduled for surface-mounted hardware.

11-17.2(4) FRAMES

General: Provide steel frames for doors that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

Frames of 14 gauge steel sheet for:

1. Level 4 steel doors.
   a. Reinforce with 18 gage galvanized or stainless steel liners for hardware and anchor attachment.
   b. Form liners to a tight fit, slide into stainless steel formed sections, and TIG weld on returns to support the total frame and lintel.
2. Reinforcing:
   a. Hinge and Lock Tabs: 7 gage.
   b. Surface Reinforcing: 14 gage.

98% Submittal - Not for Construction

3. Construction, General:

   a. Smooth surfaces, true planes, free of warp and buckle.

   b. Miters true, aligned, continuously TIG welded.

   c. Metal edges straight, true, with sharp edges of metal sheets uniformly dulled.

   d. Exposed welded joints ground smooth and flush, matching specified finish.

   e. Sub-frames continuously welded and tacked to skins.

   f. Factory-prepared for all template mortised hardware; reinforced for surface mounted and non-templated mortised hardware.

4. Butt Joined Corner Construction.

5. Jamb Anchors: 16 gage minimum, every 16 inches (400 mm) provided for the type of wall construction.

6. Dust Cover Boxes (Mortar Guards): 22 gage minimum.

7. Cutoff Stops: Terminate jamb stops above floor, fill with weld plate, grind and polish.

   a. Terminate at 90 degrees.

Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

11-17.2(5) FABRICATION

General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.24 Btu/sq. ft. x h x deg F or better.

Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

90% Submittal - Not for Construction

11-17.2(6) FINISHES

Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

11-17.3 CONSTRUCTION REQUIREMENTS

11-17.3(1) INSTALLATION

General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

Placing Frames: Comply with provisions in NAAMM-HMMA 840, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.

2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.

11-17.3(2) ADJUSTING AND CLEANING

Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

11-18 ACCESS DOORS AND FRAMES

11-18.1 GENERAL

11-18.1(1) SUMMARY

This Section includes the following:

1. Wall access doors and frames.

2. Floor doors and frames.

Related Sections include the following:

1. Section 11-02 "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.

11-18.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

98% Submittal - Not for Construction

Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes for access doors and frames.

Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

11-18.1(3) QUALITY ASSURANCE

Source Limitations: Obtain doors and frames through one source from a single manufacturer.

Size Variations: Obtain Project Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

11-18.1(4) COORDINATION

Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" provision.

11-18.2 PRODUCTS

11-18.2(1) MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following, or approved equal:

1. Access Doors (Sheet CT08):
    a. J. L. Industries, Inc.
    b. Larsen's Manufacturing Company.
    c. Milcor Limited Partnership.
2. Floor Doors (Sheet CT13 and BP42):
    a. U.S.F. Fabrication, Inc.
    b. Babcock-Davis Hatchways, Inc.
    c. Bilco Company (The).
    d. Nystrom Building Products Co.

11-18.2(2) METAL PAINT

Shop Primers: Provide primers that comply with Section 11-26 "Painting."

98% Submittal - Not for Construction

Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

11-18.2(3) ACCESS DOORS AND FRAMES

Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Gypsum board wall surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Latch: Knurled-knob-operated cam latch.
6. Other: As shown in the Contract Plans

11-18.2(4) FLOOR DOORS

Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle. Fabricate from aluminum.

Watertight Floor Door: Extruded aluminum trough frame with NPS drainage coupling and aluminum, diamond-pattern plate door; watertight; loading capacity to support 300-lb./sq. ft. pedestrian live load, odor-reducing gasket and continuous anchor flange on all four sides.

Provide:

1. Hinges: Heavy-duty, 316 stainless-steel butt hinges with stainless-steel pins.
2. Latch: Stainless-steel slam latch.
3. Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.
4. Safety Accessories: Safety chains.

11-18.2(5) FABRICATION

General: Provide door assemblies manufactured as integral units ready for installation.

Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

98% Submittal - Not for Construction

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.

2. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction.

Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

11-18.2(6) STEEL FINISHES

Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

11-18.3 CONSTRUCTION REQUIREMENTS

11-18.3(1) INSTALLATION

Install in accordance with the manufacturer's published instructions for installing access doors and frames and floor doors and frames.

Install floor doors frames flush with adjacent finish surfaces.

11-18.3(2) ADJUSTING AND CLEANING

Adjust doors and hardware after installation for proper operation.

Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

11-19 ALUMINUM ENTRANCES AND STOREFRONTS

11-19.1 GENERAL

11-19.1(1) SUMMARY

This Section includes the following:

1. Aluminum thermal glazed fixed type storefront and window system. Storefront system optionally factory glazed.

2. Aluminum entrance doors.

Related Sections include the following:

98% Submittal - Not for Construction

1. Section 11-15 "Joint Sealants" for sealing perimeter joints between windows and adjacent materials.

2. Section 11-22 “Glazing” for glass in entrance doors.

11-19.1(2) PRODUCT REQUIREMENTS

Delegated Detailing: Detail aluminum thermal glazed fixed type storefront, window system, and entrance doors using performance requirements and design criteria indicated.

Structural Performance: Provide system capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated:

1. Wind Loads: Design loads in accordance with the International Building Code and note V on sheet BG06, acting inward or outward.

2. Provide window framing that limits lateral deflection of glass edges at uniform design pressures as noted below.

Performance Requirements:

1. Storefront units to conform to the following performance requirements:

   a. Air Infiltration: Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 psf when tested in accordance with ASTM E283.

   b. Water Resistance: Test in accordance with referenced ASTM E331. No water penetration at a test pressure difference of 8 PSF as defined in AAMA 501.

   c. Uniform Load: Static air design loads noted as windload and indicated on the Plans under window schedule shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

   d. Thermal Performance: AAMA 1503 – U (Thermal Transmittance) shall not be more than: 0.35 BTU/hr/ft^2/°F.

Installer Qualifications: Engage an experienced installer who has specialized in installing storefront systems similar to those required for this Project.

Pre-Installation Conference: The Project Engineer will call a pre-installation conference at the site with the Contractor to review and discuss conditions of preparation, installation, and coordination with related work.

98% Submittal - Not for Construction

11-19.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum entrances and storefronts.

Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:

1. Layout and installation details, including anchors.
2. Elevations of continuous work at 1/4 inch = 1 foot scale and typical window unit elevations at 3/4 inch = 1 foot scale.
3. Half-size section details of typical composite members, including reinforcement.
4. Hardware, including operators.
5. Accessories.
6. Glazing details.

Maintenance Data: For operable window sash to include in maintenance manuals.

Warranties: Specified in this Section.

11-19.1(4) PROJECT CONDITIONS

Field Measurements: Verify aluminum entrances and storefronts openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating steel windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

11-19.1(5) WARRANTY

Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection.
   c. Water leakage or air infiltration.
   d. Faulty operation of operable sash and hardware.

98% Submittal - Not for Construction

e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

f. Insulating-glass failure.

2. Warranty Period: One year(s) from date of Substantial Completion of the Project.

3. Warranty Period for Metal Finishes: Ten (10) years from date of Substantial Completion of the Project.

4. Warranty Period for Glass: Ten (10) years from date of Substantial Completion of the Project.

11-19.2 PRODUCTS

11-19.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

Storefronts:

1. Manufacturers

a. Kawneer

b. EFCO

c. US Aluminum

d. Vistawall

2. Provide following types:

a. Trifab VG 450, 4 ½ inch, center glazed.

b. Framing Member Profile: 1-3/4-inch x 4 1/2-inch nominal dimensions, thermally improved, front glazed, screw splined fabrication.

Aluminum Entrance Doors:

1. Manufacturers

a. Kawneer or other approved manufacturers.

2. Provide following types:

a. Kawneer's "350 Heavy Wall Door" entrance doors are specified for type, quality, and construction required.

b. Doors shall be 2-inches thick and stile and rail face dimensions of:

1) Vertical Stile: 3-1/2-inches.

98% Submittal - Not for Construction

2) Rail: 3-17/32-inch.

3) Bottom Rail: 10-1/4-inches.

11-19.2(2) MATERIALS

Glass: See Section 11-22 ”Glazing” for glazing.

Storefront Materials:

1. Extrusions: 6063-T5 alloy and temper (ASTM B221).
2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
3. Fasteners: Where exposed, shall be stainless steel.
4. Glazing gaskets shall be EPDM elastomeric extrusions and be type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
5. Perimeter anchors of aluminum or steel isolate dissimilar metals to prevent galvanic corrosion.
6. Finish: Finish storefront assemblies with Kynar fluoropolymer coating meeting AAMA 2604-05, similar to Kawneer Permadize Hardcoat finishes, color as shown on Sheet BG05.

Aluminum Entrance Doors:

1. Materials: 6063-T6 alloy and temper extruded aluminum (ASTM B221).
2. Glazing gaskets for doors and frames shall be EPDM extrusions.
3. Screws and miscellaneous fasteners shall be aluminum, stainless steel or zinc plated steel.
4. Finish: Finish entrance door assemblies with Kynar fluoropolymer coating meeting AAMA 2604-05, similar to Kawneer Permadize Hardcoat finishes, color as scheduled on the Plans.
5. Hardware: See Section 11-37 “Door Hardware”.
6. Provide weatherstripping, moldings and miscellaneous items for a complete assembly.

11-19.2(3) FABRICATION

Manufacturer's standard methods.

Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

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Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

Prepare components to receive anchor devices. Fabricate anchors.

Arrange fasteners and attachments to conceal from view.

Storefront and Window System: Provide for flush glazing appearance, with no projecting stops. Vertical and horizontal members to have nominal dimensions as detailed on the Plans.

Aluminum Entrance Doors: Manufacturer's standard methods. Fabricate components with minimum clearances and shim spacing around perimeter of assembly. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof. Prepare components to receive anchor devices. Fabricate anchors. Arrange fasteners and attachments to conceal from view.

11-19.3 CONSTRUCTION REQUIREMENTS

11-19.3(1) EXAMINATION

Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances, rough opening dimensions, levelness of sill plate, coordination with wall flashings and vapor retarders, and other conditions affecting performance of work.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-19.3(2) INSTALLATION

Install in accordance with "Quality Assurance" provisions, "References", Specifications, and Manufacturer's directions. Where these may be in conflict, the more stringent requirements govern.

1. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

2. Provide alignment attachments and shims to permanently fasten system to building structure.

3. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

4. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

5. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

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6. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Install perimeter sealant. Comply with Section 11-15 "Joint Sealants".

7. Install entrances plumb and true and in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturer's written instructions.

8. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

   a. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

   b. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

11-19.3(3) CLEANING

Clean aluminum and glazing both sides at completion of work. Leave premises clean and free of residue of work of this Section. Provide protective treatment and other precautions required through remainder of construction period, to ensure entrances and storefronts will be without damage or deterioration at time of acceptance.

11-19.3(4) PROTECTION

Provide final protection and maintain conditions for the duration of the project, in a manner to ensure entrance and storefront systems are without damage or deterioration at the time of opening the bridge to vehicular traffic. Scratches, marks and blemishes will not be acceptable and will be cause for rejection. Remedial work will be at no cost to the Owner.

11-20 ALUMINUM WINDOWS

11-20.1 GENERAL

11-20.1(1) SUMMARY

This Section includes the following:

1. Heavy commercial architectural aluminum thermal glazed projecting-in window system. System is factory glazed.

Related Sections include the following:

1. Section 11-15 "Joint Sealants" for sealing perimeter joints between windows and adjacent materials.

2. Section 11-22 "Glazing" for glass for aluminum windows.

98% Submittal - Not for Construction

11-20.1(2) PRODUCT REQUIREMENTS

Delegated Detailing: Detail aluminum windows using performance requirements indicated.

Performance Requirements:

1. Wind Loads: Design loads in accordance with the International Building Code and note V on sheet BG06, acting inward or outward.

2. Aluminum window units shall conform to the following performance requirements:

   a. Aluminum Windows shall meet requirements of AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) North American Fenestration Standard for Windows, Doors and Skylights Specifications for a Class and Grade of P-HC90 / P-AW90.

   b. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283 at a minimum window size of 60" x 36". The air infiltration rate shall not exceed 0.10 cfm/ft at a static air pressure differential of 6.24 psf.

   c. Water Resistance: The test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331 at a minimum window size of 60" x 36". There shall be no leakage as defined in the test method at a static air pressure differential of 12 psf.

   d. Uniform Load Deflection: A minimum static air pressure difference of 90 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member.

   e. Uniform Load Structural Test: A minimum static air pressure difference of 135 psf shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.

   f. Condensation Resistance Test (CRF): When tested in accordance with AAMA 1503, the condensation resistance factor (CRF) shall not be less than:

      1) Project-In: (CRF) not less than 52.

   g. Thermal Transmittance Test (U-Factor): When tested in accordance with AAMA 1503, the conductive thermal transmittance (U-Factor) shall not be more than:

      1) Project-In: U-Value not more than 0.35 BTU/hr/sf/°F.

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Installer Qualifications: Engage an experienced installer who has specialized in installing entrance and storefront systems similar to those required for this Project.

Pre-Installation Conference: The Project Engineer will call a pre-installation conference at the site to review and discuss conditions of preparation, installation, and coordination with related work.

11-20.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum windows.

Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:

1. Layout and installation details, including anchors.
2. Half-size section details of typical composite members, including reinforcement.
3. Hardware, including operators.
4. Accessories.
5. Glazing details.

Samples for Initial Selection: For units with factory-applied color finish.

1. Include Samples of window hardware and accessories involving color selection.

Samples for Verification: For aluminum window, prepared on Samples of size indicated below.

Maintenance Data: For operable window sash to include in maintenance manuals.

Warranties: Specified in this Section.

11-20.1(4) PROJECT CONDITIONS

Field Measurements: Verify aluminum windows openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

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11-20.1(5) WARRANTY

Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of steel windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection.
   c. Water leakage or air infiltration.
   d. Faulty operation of operable sash and hardware.
   e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   f. Insulating-glass failure.
2. Warranty Period: One year(s) from date of Substantial Completion of the Project.
3. Warranty Period for Metal Finishes: Ten (10) years from date of Substantial Completion of the Project.
4. Warranty Period for Glass: Ten (10) years from date of Substantial Completion of the Project.

11-20.2 PRODUCTS

11-20.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

Aluminum Windows:

1. Manufacturers
   a. Kawneer
   b. EFCO
   c. US Aluminum
   d. Vistawall
2. Provide following types:
   a. Kawneer Series: 8225TL ISOLOCK®, Thermally Broken, 0.125 Wall Thickness, Project-In Window, or approved equal.

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b. Framing Member Profile: 1-3/4-inch x 4 1/2-inch nominal dimensions, thermally improved, front glazed, screw splined fabrication.

11-20.2(2) MATERIALS

Glass: See Section 11-22 "Glazing" for glazing.

Aluminum Window Materials:

1. Extrusions: 6063-T5 alloy and temper (ASTM B221).
2. Steel Reinforcement: Complying with ASTM A 36/ A 36M for structural shapes, plates and bars; ASTM A 611 for cold-rolled sheet and strip or ASTM A 570/ A 570M for hot-rolled sheet and strip.
3. Fasteners: Where exposed, shall be stainless steel.
4. Weather-stripping: Ventilators shall be double weather-stripped with a resilient foam core clad with UV-resistant elastomer.
5. Glazing Gaskets: Standard glazing gaskets shall be a dry glazed elastomer in accordance with ASTM C509-91.
6. Glazing Sealant: Glazing material shall be a 100 percent silicone, neutral-cure sealant in accordance with AAMA 805.2-94, Group A.
7. Thermal Barrier: The thermal barrier shall be Kawneer ISOLOCK® or equal, with a minimum 3/8" separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.
8. Perimeter anchors of aluminum or steel, isolate dissimilar metals to prevent galvanic corrosion.
9. Finish: Finish storefront assemblies with Kynar fluoropolymer coating meeting AAMA 2604-05, similar to Kawneer Permadize Hardcoat finishes, or approved equal, color as shown on the Plans.

11-20.2(3) HARDWARE

Typical Hardware:

1. Locking:
   a. Cast White Bronze Cam Lockswith pole ring
   b. Sash pole with hanger for pole.
2. Hinging: 4-Bar Hinge

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11-20.2(4) ACCESSORIES

Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

Sealants and joint fillers for joints at perimeter of window system as specified in Section 11-15 "Joint Sealants."

Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

Muntin Grids: Extruded aluminum profiles, 6063-T6 alloy and temper.

Glazing: Factory glazing as specified in Section 11-22 “Glazing”.

Optional Exterior Panning and Interior Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. Seal exterior joints with manufacturer’s standard sealant to assure water-tight joints.

Mullions and Cover Plates: Shall be extruded aluminum of 6063-T6 alloy and temper of profile and dimensions indicated on Plans. Mullions shall provide structural properties to resist wind pressure required by performance criteria and standards.

11-20.2(5) COMPONENTS

The frame depth shall be not less than 1-3/4".

All frame members shall have minimum wall thickness of 0.125" and shall provide the structural strength sufficient to meet the specified performance requirements.

Glazing beads shall be extruded aluminum and shall be a minimum thickness of 0.060".

Reference to tolerances for wall thickness and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.

11-20.2(6) FABRICATION

General: Fabricate components per manufacturer’s installation instructions. When assembled, components will have accurately fitted joints to produce hairline joints.

11-20.3 CONSTRUCTION REQUIREMENTS

11-20.3(1) EXAMINATION

Examine openings, substrates, structural support, anchorage, and conditions, with installer present, for compliance with requirements for installation tolerances, rough opening dimensions,

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levelness of sill plate, coordination with wall flashings and vapor retarders, and other conditions affecting performance of work.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-20.3(2) INSTALLATION

Install in accordance with "Quality Assurance" provisions, "References", Specifications, and Manufacturer's directions. Where these may be in conflict, the more stringent requirements govern.

1. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

2. Provide alignment attachments and shims to permanently fasten system to building structure.

3. Align assembly free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

4. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

5. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

6. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Install perimeter sealant. Comply with Section 11-15 “Joint Sealants”.

7. Install windows in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturer’s written instructions.

8. Erection Tolerances: Install aluminum windows to comply with the following maximum tolerances:

    a. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.

    b. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

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c. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

11-20.3(3) ADJUSTING

Adjust operating window components to provide a tight fit at contact points and at weather-stripping for smooth operation and a weather tight closure.

11-20.3(4) PROTECTION

Provide protection and maintain conditions for the duration of the project. Scratches, marks and blemishes will be cause for rejection. Remedial work will be at no cost to the County.

11-21 DOOR HARDWARE

11-21.1 GENERAL

11-21.1(1) SUMMARY

This Section includes the following:

1. Commercial door hardware for swinging doors

Related Sections include the following:

1. Section 11-18 "Access Doors and Frames" for access door hardware, except cylinders.

11-21.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:
   a. Hinges.
   b. Locks and latches.
   c. Cylinders and keys.
   d. Thresholds.
   e. Miscellaneous items.

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2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

Door Hardware Schedule: Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.

   b. Manufacturer of each item.

   c. Fastenings and other pertinent information.

   d. Location of each door hardware set, cross-referenced to Contract Plans, both on floor plans and in door and frame schedule.

   e. Explanation of abbreviations, symbols, and codes contained in schedule.

   f. Mounting locations for door hardware.

   g. Door and frame sizes and materials.

3. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

4. Warranties: Warranties specified in this Section.

11-21.1(3) COORDINATION

Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

11-21.2 PRODUCTS

11-21.2(1) SCHEDULED DOOR HARDWARE

General: Provide door hardware for each door to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.

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Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

11-21.2(2) MANUFACTURERS AND ACCEPTABLE SUBSTITUTES

Item:	Manufacturer:	Acceptable Substitute:
Hinges/Butts:	Ives (IVE)	Hager, McKinney,Stanley, Baldwin
Continuous Hinges:	Ives (IVE)	Pemko, Markar
Locks/Latches:	Schlage (SCH)	Best 35H
Cylinders:	Schlage Everest Primus (SCH)	Kaba, Medeco
Surface Closers:	LCN (LCN)	Norton 7500
Stops/Catches:	Ives (IVE)	Trimco
Overhead Stops:	Glynn Johnson (GLY)	Rixson
Kickplates:	Ives (IVE)	Trimco, Tice
Weatherstripping/ Gasketing:	Pemko (PEM)	Reese, Steelcraft
Door Bottoms:	Pemko (PEM)	Reese
Thresholds:	Pemko (PEM)	Reese
Silencers:	Ives (IVE)	Trimco

11-21.2(3) HINGES

Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Hinges:
   a. Ives (IVE)
   b. Baldwin Hardware Corporation (BH).
   c. Hager Companies (HAG).

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d. McKinney Companies (MCK).

Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.
3. Self-Closing Hinges: BHMA A156.17.

Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches.
2. Three Hinges: For doors with heights 61 to 90 inches.

Size: Provide 4 ½ inch high x 0.180 inch thick Heavy Weight, with hinge widths sized for door thickness and clearances required:

Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads.

11-21.2(3) LOCKS AND LATCHES

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:
   a. Best Lock Corporation (BLC).
   b. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
   c. Medeco High Security Locks, Inc. (MED).
   d. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
   e. Schlage (SCH)

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Standards: Comply with the following:

1. Mortised Locks and Latches: BHMA A156.13.

Certified Products: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

Lock Trim: Comply with the following:

1. Knob: Wrought, forged, or cast.
2. Escutcheon (Rose): Wrought, forged, or cast.
3. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:
    a. Mortised Locks: Schlage “L” Series and 42 (knob, “D Orbit”) series.

Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Mortised Locks: BHMA A156.13.

Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortiseded Locks: Minimum 3/4-inch latchbolt throw.

Backset: 2-3/4 inches unless otherwise indicated.

11-21.2(4) CYLINDERS AND KEYING

Manufacturers:

1. Cylinders:
    a. Schlage ‘Everest Primus’
    b. Medeco High Security Locks, Inc. (MED) - KeyMark cylinder.

Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
    a. Replace construction cores with permanent cores, as directed by County.
    b. Furnish permanent cores to County for installation.

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Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Existing System: Master key or grand master key locks to County's existing system.

Keys: Provide nickel-silver keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

   a. Notation: Information to be furnished by County.

2. Quantity: In addition to one extra blank key for each lock, provide the following:

   a. Master Keys: Five.

11-21.2(5) CLOSERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Surface-Mounted Closers:

   a. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).

   b. LCN Closers; an Ingersoll-Rand Company (LCN).

   c. Norton Door Controls; Div. of Yale Security Inc. (NDC).

Standards: Comply with the following:

1. Closers: BHMA A156.4.

2. Closer Holder Release Devices: BHMA A156.15.

Surface Closers: BHMA Grade 1, unless Grade 2 is indicated.

Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."

Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

11-21.2(6) STOPS AND HOLDERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

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1. Architectural Builders Hardware Mfg., Inc. (ABH).
2. Hager Companies (HAG).
3. Ives: H. B. Ives (IVS).
4. Rockwood Manufacturing Company (RM).

Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Door Silencers: BHMA A156.16.

Stops and Bumpers: BHMA Grade 1.

Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide overhead holders.

Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch ; fabricated for drilled-in application to frame.

11-21.2(7) DOOR GASKETING

Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Door Gasketing:
   a. Hager Companies (HAG).
   b. Pemko Manufacturing Co., Inc. (PEM).
   c. Zero International, Inc. (ZRO).
2. Door Bottoms:

   Hager Companies (HAG).
   a. Pemko Manufacturing Co., Inc. (PEM).
   b. Zero International, Inc. (ZRO).

Standard: Comply with BHMA A156.22.

General: Provide continuous weather-strip gasketing on exterior. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

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2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

11-21.2(8) THRESHOLDS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Hager Companies (HAG).
2. Pemko Manufacturing Co., Inc. (PEM).
3. Zero International, Inc. (ZRO).

Standard: Comply with BHMA A156.21.

11-21.2(9) FABRICATION

Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Surface hinges to doors.
   b. Closers to doors and frames.

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c. Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow metal doors.

4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

11-21.2(10) FINISHES

Standard: Comply with BHMA A156.18.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 613: Oil rubber bronze on bronze base metal.

11-21.3 CONSTRUCTION REQUIREMENTS

11-21.3(1) EXAMINATION

Examine doors and frames, with installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.

Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-21.3(2) PREPARATION

Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

11-21.3(3) INSTALLATION

Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

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2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Section 11-26 "Painting". Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 11-15 "Joint Sealants."

11-21.3(4) ADJUSTING

Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

Six-Month Adjustment: Approximately six months after date of opening the bridge vehicular traffic, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

2. Consult with and instruct County's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

11-21.3(5) DOOR HARDWARE SCHEDULE

HW SET: DS-1
EACH TO HAVE:

1	EA	CONTINUOUS HINGE 112HD	313	IVE
1	EA	CLASSROOMSECURIT L9477R 07A	613	SCH

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		Y HOLDBACK LOCK			
1	EA	EVEREST PRIMUS CORE	20-740	606	SCH
2	EA	BULLET STAND-OFF	912016	613	FOR
1	EA	CONCEALED CLOSER	5011	695	LCN
1	EA	OVERHEAD STOP	100S	695	GLY
1	SET	WEATHERSTRIP	PROVIDED BY DOOR MANUFACTURER	DKB	
1	EA	DOOR SWEEP	3452DNB	DKB	PEM
1	EA	THRESHOLD	255D	DKB	PEM

DOOR CLOSER REQUIRES 4" TALL HEADER ON DOOR FRAME.

HW SET: DS-2
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	613	IVE
1	EA	CLASSROOMSECURITY HOLDBACK LOCK	L9477R 07A	613	SCH
2	EA	EVEREST PRIMUS CORE	20-740	606	SCH
1	EA	SURFACE CLOSER	4011EDA	695	LCN
1	SET	WEATHERSTRIP	S88D (HEAD & JAMBS)	DKB	PEM
1	EA	DOOR SWEEP	3452DNB	DKB	PEM
1	EA	RAIN DRIP	346D	DKB	PEM
1	EA	THRESHOLD	255D	DKB	PEM

HW SET: DS-3
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	641	IVE
1	EA	STOREROOM LOCK	L9080R 07A	613	SCH
1	EA	EVEREST PRIMUS CORE	20-740	606	SCH

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1	EA	SURFACE CLOSER	4011	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	EA	WALL STOP	WS407CCV	613	IVE
1	SET	GASKETING	S88D (HEAD, JAMBS & ASTRAGAL)	DKB	PEM

HW SET: DS-4
EACH TO HAVE:

3	EA	HINGE	5PB1 4.5 X 4.5	641	IVE
1	EA	EVEREST PRIMUS CORE	20-740	606	SCH
1	EA	PRIVACY W/INDICATOR	L9496R 07A L583-363	613	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	EA	WALL STOP	WS407CCV	613	IVE
1	SET	SOUND SEAL	S88D (HEAD & JAMBS)	DKB	PEM

HW SET: DS-5
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	641	IVE
1	EA	PASSAGE SET	L9010 07A	613	SCH
1	EA	SURFACE CLOSER	4111	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	613	IVE
1	EA	WALL STOP	WS407CCV	613	IVE
1	SET	GASKETING	S88D (HEAD, JAMBS & ASTRAGAL)	DKB	PEM

HW SET: DS-6
EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	DOUBLE CYLINDER DEADLOCK WITH	L9462Xxl 11-886 17A	630	SCH

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		PULL			
2	EA	EVEREST PRIMUS CORE	20-740		SCH
1	EA	SURFACE CLOSER	4011 EDA		LCN
1	SET	WEATHERSTRIP	S88D (HEAD & JAMBS)	DKB	PEM
1	EA	DOOR SWEEP	3452DNB	DKB	PEM
1	EA	RAIN DRIP	346D	DKB	PEM
1	EA	THRESHOLD	255D	DKB	PEM

11-22 GLAZING

11-22.1 GENERAL

11-22.1(1) SUMMARY

This Section includes glazing for the control towers and bascule piers, including those specified in other Sections where glazing requirements are specified by reference to this Section:

11-22.1(2) DEFINITIONS

Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include

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edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

11-22.1(3) PRODUCT REQUIREMENTS

Delegated Detailing: Detail glazing using performance requirements.

General: Provide glazing systems capable of withstanding normal thermal movement and wind loads without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

Glass Design: Determine glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

    a. Wind Loads: Design loads in accordance with the International Building Code and note V on sheet BG06, acting inward or outward..

Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components: Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.

2. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch- wide interspace.

3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

    a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.

Solar Heat Gain Coefficient: NFRC 200.

Solar Optical Properties: NFRC 300.

11-22.1(4) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

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Product Data: For each glass product and glazing material indicated.

Samples: 12-inch-square samples for glass and of 12-inch- long samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

Glazing Schedule: Use same designations indicated on Contract Plans for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

Warranties: Specified in this Section.

11-22.1(5) QUALITY ASSURANCE

Qualifications: Provide experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project.

Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

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11-22.1(6) DELIVERY, STORAGE, AND HANDLING

Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

11-22.1(7) WARRANTY

Warranty on Glass: Provide warranty agreeing to replace glass units within 10 years from date of Substantial Completion of the Project.

11-22.2 PRODUCTS

11-22.2(1) GLASS PRODUCTS

Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.
    a. Products:
        1) AFG Industries Inc.; Krystal Klear.
        2) Pilkington Building Products North America; Optiwhite.
        3) PPG Industries, Inc.; Starphire.
        4) Schott Corporation; Amiran.
        5) Or approved equal.

Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, and complying with other requirements specified.

Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
    a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

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Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this provision and in "Insulating-Glass Units" provision.

1. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

2. Sealing System: Dual seal, with primary and secondary sealants as follows:

   a. Manufacturer's standard sealants.

3. Spacer Specifications: Manufacturer's standard spacer material and construction.

11-22.2(2) GLAZING SEALANTS

General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: Match Project Engineer's samples.

Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants GS-1:

   a. Available Products: Provide one of the following or approved equal:

      1) Dow Corning Corporation; 790.

      2) GE Silicones; SilPruf LM SCS2700.

   b. Type and Grade: S (single component) and NS (nonsag).

   c. Class: 100/50.

   d. Use Related to Exposure: NT (nontraffic).

   e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

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1) Use O Glazing Substrates: Coated glass and galvanized and painted steel.

f. Applications: Door and window glazing.

11-22.2(3) GLAZING GASKETS

Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. EPDM, ASTM C 864.
2. Silicone, ASTM C 1115.
3. Thermoplastic polyolefin rubber, ASTM C 1115.

Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. EPDM.
2. Silicone.
3. Thermoplastic polyolefin rubber.

11-22.2(4) MISCELLANEOUS GLAZING MATERIALS

General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

11-22.2(5) FABRICATION OF GLAZING UNITS

Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

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11-22.2(6) MONOLITHIC FLOAT-GLASS UNITS

Uncoated Clear Float-Glass Units MG-#1: Class 1 (clear) annealed glass.

1. Thickness: 6.0 mm.

Coated Clear Float-Glass Units MG-1: Class 1 (clear) annealed glass.

1. Available Products:
   a. PPG Industries; Starphire.
2. Thickness: 6.0 mm.
3. Visible Light Transmittance: 91 percent minimum.
4. Winter Nighttime U-Factor: 1.09 maximum.
5. Summer Daytime U-Factor: 1.00 maximum.
6. Solar Heat Gain Coefficient: 0.9 maximum.
7. Outdoor Visible Reflectance: 8 percent maximum.

11-22.2(8) LAMINATED-GLASS UNITS

Laminated-Glass Units LG-#1:

1. Basis-of-Design Product: Pilkington Optilam or a comparable product by one of the following:
   a. PPG Industries.
   b. Oldcastle Glass.
   c. Viracon
   d. Or approved equal.
2. Kind LA, consisting of two lites of annealed float glass.
3. Outer Lite: Class 1 (clear) float glass.
   a. Thickness: 3.0 mm.
4. Plastic Interlayer:
   a. Thickness: 0.030 inch.
   b. Interlayer Color: Clear.
5. Inner Lite: Class 1 (clear) float glass.
   a. Thickness: 3.0 mm.

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Laminated-Glass Units LG-#2:

1. Basis-of-Design Product: Pilkington Optilam or a comparable product by one of the following:
   a. PPG Industries.
   b. Oldcastle Glass.
   c. Viracon
   d. Or approved equal.
2. Kind LA, consisting of two lites of annealed float glass.
3. Outer Lite: Class 1 Coated Spandrel Float Glass : Coated spandrel float glass comprised of 1/4 inch outer lite with Ceramic frit coating to simulate sandblast finish on number 2 surface, Kind FT (fully tempered). The basis of design product for the lite with the ceramic frit coating is Pilkington Optifloat Opal (simulated acid-etch).
   a. Thickness: 3.0 mm.
   b. Light transmittance 82%
4. Plastic Interlayer:
   a. Thickness: 0.030 inch.
   b. Interlayer Color: Clear.
5. Inner Lite: Class 1 (clear) float glass.
   a. Thickness: 3.0 mm.

11-22.2(7) INSULATING-GLASS UNITS

Passive Solar Low-E Insulating-Glass Units IG-#1:

1. Basis-of-Design Product: PPG Industries, Sungate 500 (3)
2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
3. Interspace Content: Air.
4. Outdoor Lite: Class 1 (clear) float glass.
5. Laminated (LG-#1).
6. Indoor Lite: Class 1 (clear) float glass.
7. Annealed.

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8. Low-E Coating or Film: Pyrolytic on third surface.
9. Visible Light Transmittance: 74 percent minimum.
10. Winter Nighttime U-Factor: 0.35 maximum.
11. Summer Daytime U-Factor: 0.38 maximum.
12. Solar Heat Gain Coefficient: 0.60 maximum.
13. Outdoor Visible Reflectance: 16 percent maximum.

Passive Solar Low-E Insulating-Glass Units IG-#2:

1. Basis-of-Design Product: PPG Industries, Sungate 500 (3)
2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
3. Interspace Content: Air.
4. Outdoor Lite: Class 1 Coated Spandrel Float Glass.
5. Laminated (LG-#2).
6. Indoor Lite: Class 1 (clear) float glass.
7. Annealed.
8. Low-E Coating or Film: Pyrolytic on third surface.
9. Visible Light Transmittance: 75 percent minimum.
10. Winter Nighttime U-Factor: 1.02 maximum.
11. Summer Daytime U-Factor: 0.93 maximum.
12. Solar Heat Gain Coefficient: 0.74 maximum.
13. Outdoor Visible Reflectance: 10 percent maximum.

11-22.3 CONSTRUCTION REQUIREMENTS

11-22.3(1) EXAMINATION

Examine framing glazing, with installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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Proceed with installation only after unsatisfactory conditions have been corrected.

11-22.3(2) PREPARATION

Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

11-22.3(3) GLAZING, GENERAL

Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Glazing channel dimensions, as indicated on Contract Plans, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

11-22.3(4) GASKET GLAZING (DRY)

Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

Install gaskets so they protrude past face of glazing stops.

11-22.3(5) CLEANING AND PROTECTION

Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.

Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

Wash glass on both exposed surfaces not more than four calendar days before date scheduled for inspections that establish date of opening the bridge vehicular traffic. Wash glass as recommended in writing by glass manufacturer.

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11-23 GYPSUM BOARD ASSEMBLIES

11-23.1 GENERAL

11-23.1(1) SUMMARY

This Section includes the following:

1. Interior gypsum wallboard.
2. Non-load-bearing steel framing.

Related Sections include the following:

1. Section 11-10 "Building Insulation" for insulation installed in gypsum board assemblies.

11-23.1(2) DEFINITIONS

Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

11-23.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of product indicated.

Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

11-23.1(4) DELIVERY, STORAGE, AND HANDLING

Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

11-23.1(5) PROJECT CONDITIONS

Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

11-23.2 PRODUCTS

11-23.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. Steel Framing and Furring:

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a. Dietrich Industries, Inc.

b. National Gypsum Company.

c. Scafco Corporation.

d. Unimast, Inc.

2. Gypsum Board and Related Products:

a. American Gypsum Co.

b. G-P Gypsum Corp.

c. National Gypsum Company.

d. United States Gypsum Co.

11-23.2(2) STEEL PARTITION AND SOFFIT FRAMING

Components, General: As follows:

1. Comply with ASTM C 754 for conditions indicated.

2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.

Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.027 inch.

2. Depth: As indicated.

Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: 1-1/2 inches.

2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.

1. Depth: 1-1/2”.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.

3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.

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Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and 3 inch depth required to fit insulation thickness.

Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

11-23.2(3) INTERIOR GYPSUM WALLBOARD

Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

Gypsum Wallboard: ASTM C 36.

1. Type X:
   a. Thickness: 5/8 inch.
   b. Long Edges: Tapered.
   c. Location: Vertical surfaces, unless otherwise indicated.

Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.
3. Location: Ceiling surfaces.

11-23.2(4) WATER-RESISTANT PANELS

Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated. All gypsum board used below the operator level shall be water-resistant panels.

Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.

1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp, or approved equal.

11-23.2(5) EXTERIOR GYPSUM SHEATHING

Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

Gypsum Wall Sheathing:

1. 5/8 inch “USG” Fiberock® Brand Sheathing, or approved equal.

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2. Nominal Size: Standard width and length to suit conditions of construction.

3. Composition: Gypsum sheathing board core in conformance with referenced ASTM C79, C1177, and C1278 with glass mats both sides and along edges.

4. Flame spread 5, smoke developed 0 per reference ASTM E84.

11-23.2(6) TRIM ACCESSORIES

Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes: Cornerbead at outside corners.

11-23.2(7) JOINT TREATMENT MATERIALS

General: Comply with ASTM C 475.

Joint Tape:

1. Interior Gypsum Wallboard: Paper.

2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.

Joint Compound for Water-Resistant Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.

11-23.2(8) AUXILIARY MATERIALS

General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

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Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

Thermal Insulation: As specified in Section 11-10 "Building Insulation."

Vapor Retarder: Available Products: Subject to compliance with requirements, products incorporated into the Work shall include the following, or approved equal:

1. Reinforced-Polyethylene Vapor Retarders:

   a. Raven Industries, Inc.; DURA-SKRI

   b. Reef Industries, Inc.; Griffolyn T-65.

11-23.3 CONSTRUCTION REQUIREMENTS

11-23.3(1) EXAMINATION

Examine areas and substrates, with installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

11-23.3(2) INSTALLING STEEL FRAMING, GENERAL

Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

1. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

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11-23.3(3) INSTALLING STEEL PARTITION AND SOFFIT FRAMING

Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

Install steel studs and furring at the following spacing's:

1. Single-Layer Construction: 16 inches on center, unless otherwise indicated.
2. Multilayer Construction: 16 inches on center, unless otherwise indicated.
3. Cementitious Backer Units: 16 inches on center, unless otherwise indicated.

Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb.
2. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

Frame underside of concrete floor slabs to receive board insulation with Zee-furring members.

1. Erect insulation specified in 11-10 "Building Insulation" vertically and hold in place with Z-furring members spaced 24 inches on center.
2. Except at exterior corners, securely attach narrow flanges of furring members to underside of concrete slab with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center.
3. At exterior corners, attach wide flange of furring members to underside of concrete slab with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At

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interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

11-23.3(4) APPLYING AND FINISHING PANELS, GENERAL

Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

Attach gypsum panels to framing provided at openings and cutouts.

Form control and expansion joints with space between edges of adjoining gypsum panels.

Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes, and conduits.
2. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches on center for vertical applications.

11-23.3(5) PANEL APPLICATION METHODS

Single-Layer Application:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of board.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

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Fastening Methods: Apply gypsum panels to supports with steel drill screws.

Glass-Mat, Water-Resistant Backing Panel:

1. These panels are applied to metal stud wall framing for the application of thin brick veneer. Comply with manufacturer's written installation instructions and install at exterior wall areas where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

Gypsum Wall Sheathing:

1. These panels are applied to metal stud soffit and wall framing for the application of composite metal panels. Comply with manufacturer's written installation instructions and install at exterior soffit and wall areas where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

11-23.3(6) INSTALLING TRIM ACCESSORIES

General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

11-23.3(7) FINISHING GYPSUM BOARD ASSEMBLIES

General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

Prefill open joints and damaged surface areas.

Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

11-24 ACOUSTICAL PANEL CEILINGS

11-24.1 GENERAL

11-24.1(1) SUMMARY

This Section includes acoustical panels and exposed suspension systems for ceilings.

98% Submittal - Not for Construction

11-24.1(2) DEFINITIONS

AC: Articulation Class.

CAC: Ceiling Attenuation Class.

LR: Light Reflectance coefficient.

NRC: Noise Reduction Coefficient.

11-24.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of product indicated.

Coordinate Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

11-24.1(4) QUALITY ASSURANCE

Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

11-24.1(5) DELIVERY, STORAGE, AND HANDLING

Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

95% Submittal - Not for Construction

11-24.1(6) PROJECT CONDITIONS

Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

11-24.1(7) COORDINATION

Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

11-24.1(8) EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed, minimum 1 carton.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

11-24.2 PRODUCTS

11-24.2(1) ACOUSTICAL PANELS, GENERAL

Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Project Engineer from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

11-24.2(2) MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

Product:

1. Armstrong, Ultima RH90, or approved equal.

98% Submittal - Not for Construction

Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IV, Form 2
2. Pattern: E (lightly textured)

Color: White.

LR: Not less than 0.80.

NRC: Not less than 0.70

CAC: Not less than 35.

Edge Detail: Beveled.

Thickness: ¾ inch.

Size: 24 by 24 inches.

11-24.2(3) METAL SUSPENSION SYSTEMS, GENERAL

Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

11-24.2(4) METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

Products:

Armstrong World Industries, Prelude, or approved equal.

98% Substantial - Not for Construction

Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, hot-dip galvanized according to ASTM A 653/A 653M, G60 coating designation, with prefinished, cold-rolled, 15/16-inch- wide, aluminum caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Face Finish: Painted to match color of acoustical unit

11-24.2(5) METAL EDGE MOLDINGS AND TRIM

Manufacturers:

1. Armstrong World Industries, Inc. or approved equal.

Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

11-24.3 CONSTRUCTION REQUIREMENTS

11-24.3(1) EXAMINATION

Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

Proceed with installation only after unsatisfactory conditions have been corrected.

11-24.3(2) PREPARATION

Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

90% Submittal - Not for Construction

11-24.3(3) INSTALLATION, GENERAL

General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not attach hangers to roof deck wood sheathing. Attach hangers to structural members.

6. Space hangers not more than 48 inches on center along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

98% Submittal - Not for Construction

Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

11-24.3(4) CLEANING

Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

11-25 RESILIENT FLOOR TILE

11-25.1 GENERAL

11-25.1(1) SUMMARY

This Section includes the following:

1. Solid vinyl floor tile.

2. Resilient wall base and accessories.

3. Stair tread.

11-25.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of product indicated.

1. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

2. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

3. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.

4. Stair Tread: Full-size units of each color and pattern of stair tread required.

98% Submittal - Not for Construction

Maintenance Data: For resilient products to include in maintenance manuals.

11-25.1(3) QUALITY ASSURANCE

Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

11-25.1(4) DELIVERY, STORAGE, AND HANDLING

Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

11-25.1(5) PROJECT CONDITIONS

Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

After post installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

Close spaces to traffic during floor covering installation.

Close spaces to traffic for 48 hours after floor covering installation.

Install resilient products after other finishing operations, including painting, have been completed.

11-25.1(6) EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box of each type, color, and pattern of floor tile installed.
2. Resilient Wall Base and Accessories: Furnish not less than 20 linear feet, of each type, color, pattern, and size of resilient product installed.
3. Stair Tread: Furnish 5% of total installed but not less than two full-size units.

11-25.2 PRODUCTS

11-25.2(1) COLORS AND PATTERNS

Colors and Patterns: As indicated by manufacturer's designations.

98% Submittal - Not for Construction

11-25.2(2) SOLID VINYL FLOOR TILE – FL1.

Solid Vinyl Floor Tile: ASTM F 1700.

1. Armstrong World Industries, Inc.; Perspectives; 34300-Antiqued Metal.
2. Lonseal; Lonfloor Galvanized; No. 246-Gold.
3. Parterre; Vinyl Stone Tile; Tuscany; 22129-Chianti.

11-25.2(3) RESILIENT WALL BASE - WB-1.

Wall Base: ASTM F 1861.

1. Johnsonite; 63-Burnt Umber; or approved equal.

Style: Cove (with top-set toe).

Minimum Thickness: 0.125 inch.

Height: 4 inches.

Lengths: Coils in manufacturer's standard length.

Outside Corners: Premolded.

Inside Corners: Premolded.

Surface: Smooth.

11-25.2(4) RESILIENT STAIR ACCESSORIES

Treads: FS RR-T-650.

1. Johnsonite; 2" hinged nosing; service weight (ST-Sq.); 63-Burnt Umber; or approved equal.

11-25.2(5) RESILIENT MOLDING ACCESSORY -RM-1.

Description: Reducer strip for resilient floor covering.

1. Johnsonite; 63-Burnt Umber; or approved equal.

Material: Vinyl.

11-25.2(6) INSTALLATION MATERIALS

Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

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Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

11-25.3 CONSTRUCTION REQUIREMENTS

11-25.3(1) EXAMINATION

Examine substrates for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

11-25.3(2) PREPARATION

Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3. Moisture Testing:

   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

   b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

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1. Do not install resilient products until they are same temperature as space where they are to be installed.

Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

11-25.3(3) TILE INSTALLATION

Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

Extend tiles into toe spaces, door reveals, closets, and similar openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

11-25.3(4) RESILIENT WALL BASE INSTALLATION

Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch wall base during installation.

Premolded Corners: Install premolded corners before installing straight pieces.

98% Submittal - Not for Construction

11-25.3(5) RESILIENT ACCESSORY INSTALLATION

Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.

Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

11-25.3(6) CLEANING AND PROTECTION

Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
   a. Do not wash surfaces until after time period recommended by manufacturer.

Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Cover products installed on horizontal surfaces with undyed, untreated building paper until opening the bridge to vehicular traffic.
2. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

11-26 PAINTING

11-26.1 GENERAL

11-26.1(1) SUMMARY

This Section includes surface preparation and field painting of exposed architectural exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned,

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paint the item or surface the same as similar adjacent materials or surfaces. If a color or finish is not indicated, Project Engineer will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical (except bascule machinery) and electrical equipment (except electrical equipment within the interior of the bascule pier) that do not have a factory-applied final finish.

2. Painting includes field painting of exposed structural steel including pan stair systems.

Do not paint prefinished items, concealed surfaces, surfaces more than 6 feet above walking surfaces within the interior of the bascule pier, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Insulated aluminum panels
   b. Finished mechanical and electrical equipment.
   c. Light fixtures.
2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Furred areas.
   b. Ceiling plenums.
   c. Utility tunnels.
   d. Pipe spaces.
   e. Duct shafts.
3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Copper.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.

98% Submittal - Not for Construction

c. Sensing devices.

d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

Related Sections include the following:

1. Section 11-05 "Metal Fabrications" for shop priming ferrous metal.

2. Section 11-16 "Steel Doors and Frames" for factory priming steel doors and frames.

3. Section 11-23 "Gypsum Board Assemblies" for surface preparation of gypsum board.

4. Paint structural steel in accordance with Section 6-07.

11-26.1(2) DEFINITIONS

General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.

3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

11-26.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

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3. After color selection, Project Engineer will furnish color chips for surfaces to be coated.

Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

3. Submit Five (5) Samples on the following substrates for Project Engineer's review of color and texture only:

   a. Concrete: 4-by-8-inch Samples for each color and finish.

   b. Painted Wood: 4-by-8-inch Samples for each color and material on hardboard.

   c. Ferrous Metal: 4-by-8-inch Samples of flat metal and 8-inch long Samples of solid metal for each color and finish.

Qualification Data: For Applicator.

11-26.1(4) QUALITY ASSURANCE

Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Project Engineer will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

   a. Wall Surfaces: Provide samples on at least 20 sq. ft.

   b. Small Areas and Items: Project Engineer will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

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a. After finishes are accepted, Project Engineer will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

11-26.1(5) DELIVERY, STORAGE, AND HANDLING

Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

11-26.1(6) PROJECT CONDITIONS

Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

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11-26.1(7) EXTRA MATERIALS

Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

11-26.2 PRODUCTS

11-26.2(1) MANUFACTURERS

Products: Subject to compliance with requirements, provide one of the products listed section Interior Finish Schedule.

Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in section Interior Finish Schedule:

1. Benjamin Moore & Co. (Benjamin Moore).
2. Tnemec Company Inc. (Tnemec).
3. Pratt & Lambert (P&L).
4. Sherwin Williams Co (SW).
5. Or approved equal.

11-26.2(2) PAINT MATERIALS, GENERAL

Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

Colors: Match Project Engineer’s samples.

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11-26.3 CONSTRUCTION REQUIREMENTS

11-26.3(1) EXAMINATION

Examine substrates, areas, and conditions for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Project Engineer about anticipated problems when using the materials specified over substrates primed by others.

11-26.3(2) PREPARATION

General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

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b. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.

b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat

11-26.3(3) APPLICATION

General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar

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components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Sand lightly between each succeeding enamel or varnish coat.

Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

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3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.

Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

11-26.3(4) CLEANING

Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

11-26.3(5) PROTECTION

Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Project Engineer.

Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

11-26.3(6) EXTERIOR PAINT SCHEDULE

Provide products listed or approved equal.

Substrate	1st Coat	2nd Coat	3rd Coat	Notes
Ferrous Metal	Tnemec Series	Tnemec Series	Tnemec Series	

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	88 HS Azeron H.S. Primer	23 Enduratone	23 Enduratone	
Carbon Steel framing and all other structural steel members exposed to view.	Tnemec Series 90-97 at 2.0-3.0 mils	Tnemec Series 1075 Endura-Shield II at 3.0-5.0 mils		Mil thickness are dry film for all Tnemec systems
Zinc-Coated (Galvanized) Steel (except railing not indicated to receive paint finish)	Galvanized Iron, Primer, Tnemec Series 27 F.C. Typoxy	Tnemec Series 1075 Endura-Shield II		

11-26.3(7) INTERIOR PAINT SCHEDULE

Provide products listed or approved equal.

Substrate	**1st Coat**	**2nd Coat**	**3rd Coat**	**Notes**
Concrete		Tnemec Series 84 Ceramlon ENV	Tnemec Series 84 Ceramlon ENV	Use for exposed concrete walls at machine room and pit levels for Pier 3 Forward Right and Pier 4 Rear Left
Galvanized Deck	Tnemec Series 115 Tneme-Deck			Use for exposed deck at ceilings.
Gypsum Drywall System	SW Pro-Mar 400 Latex Wall Primer, B28	SW Pro-Mar 400 Latex Flat Wall Primer, B30	SW Pro-Mar 400 Latex Flat Wall Primer, B30	Use for drywall soffit
Gypsum Drywall System	SW Pro-Mar 400 Latex Wall	SW Pro-Mar 200 Interior Alkyd Egg-	SW Pro-Mar 200 Interior Alkyd Egg-	Use for vertical wall/partition surfaces except

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	Primer, B28	Shell Enamel, B33	Shell	at wet areas.
Gypsum Drywall System	SW Pro-Mar 400 Latex Wall Primer, B28	SW Tile-Clad High Solids Epoxy B62	SW Tile-Clad High Solids Epoxy B62	Use for vertical wall surfaces in wet areas.
Ferrous Metal	SW Kem-Kromik Universal Metal Primer, B50NZ6/B50WZI	SW Pro-Mar 200 Alkyd Semi-Gloss B34	SW Pro-Mar 200 Alkyd Semi-Gloss B34	Use for metal fabrications, structural steel, sheet metal, hollow metal frames and doors, and other ferrous metal items. 1st coat may be omitted if item has properly applied factory prime coat.

11-27 IDENTIFYING DEVICES

11-27.1 GENERAL

11-27.1(1) SUMMARY

This Section includes the following:

1. Standard Interior Modular Sign System.

11-27.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include; elevations, and large scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

1. Provide message list for each sign required, including large scale details of wording and layout of lettering. Include full size details of special graphics.

Samples: Provide samples of each sign component for initial selection of color, pattern, and surface texture, and for verification of compliance with requirements indicated.

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1. Submit samples for initial selection of color, pattern, and texture, as follows:

   a. Cast Acrylic Sheet: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

2. Submit samples for verification of color, pattern, and texture selected, and compliance with requirements indicated, as follows:

   a. Cast Acrylic Sheet: Provide a sample panel not less than 8-1/2”x 11” for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

11-27.1(3) QUALITY ASSURANCE

Installer's Qualifications: Engage an experienced Installer who is an authorized representative of the sign manufacturer and has completed installation of signs similar in material, design, and extent to those indicated for this Project and that has resulted in construction with a record of successful in service performance.

Single Source Responsibility: For each separate type of sign required, obtain signs from a single source from a single manufacturer.

11-27.1(4) DELIVERY, STORAGE, AND HANDLING

Proved protective covering or crating as recommended by the manufacturer to protect sign components and surfaces against damage during transportation and delivery.

Handle signs carefully to prevent breakage, surface abrasion, denting, soiling, and other defects. Comply with the manufacturer's handling instructions for unloading components subject to damage.

1. Inspect sign components for damage upon delivery. Do not install damaged sign components. Repair minor damage to signs, provided the finished repair is equal in all respects to the original work and is acceptable to the Project Engineer, otherwise remove and replace damaged sign components.

11-27.1(5) MAINTENANCE

Maintenance Instructions: Furnish maintenance manual to instruct the Owner's personnel in procedures to be followed in operating, cleaning, and maintaining the work. Provide manufacturer's brochures describing the actual materials used in the work, including, but not limited to, metal alloys, finishes, and other major components.

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11-27.2 PRODUCTS

11-27.2(1) MATERIALS

Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 °F and of the following general types:

1. Opaque Sheet: Where sheet material is indicated as opaque, provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

Vinyl Film: Provide opaque nonreflective vinyl film, 0.0035 inch minimum thickness, with pressure sensitive adhesive backing, suitable for exterior as well as interior applications.

Sealants and Joint Fillers: Refer to Section 11-15 Joint Sealants.

11-27.2(2) STANDARD INTERIOR WALL PLAQUE:

All plaques to be fabricated in accordance with Fed Spec. P 387, Type NDP 1/8 inch thick.

Size: Signage used primarily for room identification and information, and standardized at 4 3/8" x 7 3/4" or as indicated on the Plans, each with a 1/2 inch border.

Graphics: Typically, character shall be 5/8 inch tall letter forms unless indicated otherwise on the Plans. Type to be Transbold. Characters shall be raised 1/32 inch minimum, upper and lower case.

Character Proportion: Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.

Construction: Signs to be constructed of 1/8 inch plastic with raised characters and symbols. The character and background of signs shall be eggshell, matte, or other non-glare finish. All signs shall have white letters. Colors of signs indicated by reference to manufacturer's name and designations are for color identification only, and are not intended to limit selection of other manufacture's products with similar colors.

Mounting: Signs should be positioned eye level, 60 inches from floor to the centerline of the sign, on the latch side of the door or at Owner's direction. Double faced foam tape adhered to the back of the sign shall be the mounting method for interior signs.

Message: applicable signs are all room identifications and informational sign, as noted or shown in the Room Finish Schedules in the Tower.

1. Message: applicable signs are all room identifications and informational sign, as noted or shown in the Room Finish Schedules in the control towers.

98% Submittal - Not for Construction

11-27.2(3) FINISHES

Colors and Surface Textures: For exposed sign material that require selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated on Color and Material Schedule.

11-27.3 CONSTRUCTION REQUIREMENTS

11-27.3(1) EXAMINATION

Examine areas and conditions under which the work is to be installed, and notify the Owner in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected.

11-27.3(2) INSTALLATION

Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl Tape Mounting: Use double sided foam tape, of thickness indicated, to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl covered or rough surfaces.

2. Silicone Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl covered surfaces. Use double sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cure

11-27.3(3) CLEANING

At completion of the installation, clean soiled surfaces of sign units in accordance with the manufacturer's instructions.

11-27.3(4) PROTECTION

Protect installed sign units from damage until acceptance by the Owner.

11-27.3(5) SIGN SCHEDULE

Graphic	Floor	Detailed Location
Control Room	Ground Floor	Wall Adjacent to Door DS3
Equipment Room	Ground Floor	Wall Adjacent to Door DS5
Toilet	Ground Floor	Wall Adjacent to Door DS4

90% Submittal - Not for Construction

11-28 FIRE EXTINGUISHER CABINETS AND ACCESSORIES

11-28.1 GENERAL

11-28.1(1) RELATED DOCUMENTS

Related Sections: The following sections contain requirements that relate to this section:

1. Section 11-23 "Gypsum Board Assemblies."

11-28.1(2) SUMMARY

This Section includes the following:

1. Fire extinguisher cabinets.
2. Fire Extinguishers.
3. Fire extinguisher mounting brackets.

11-28.1(3) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Submit product data for fire extinguisher cabinets including, but not limited to, rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

Samples: Submit samples of manufacturer's standard colors and texture for selection by the Project Engineer.

11-28.1(4) QUALITY ASSURANCE

Coordination: Verify that extinguisher cabinets are sized to accommodate type and capacity of extinguishers indicated.

Single Source Responsibility: Obtain products in this section from one manufacturer.

Provide new portable fire extinguishers which are UL listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

Provide new portable fire extinguishers which are approved by Factory Mutual Research Corp. for type, rating, and classification of extinguisher indicated and carry appropriate FM marking.

11-28.2 PRODUCTS

11-28.2(1) MOUNTING BRACKETS

Brackets: Provide brackets designed to prevent accidentally dislodging extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.

95% Submittal - Not for Construction

1. Provide brackets for extinguishers not located in cabinets and for those located in cabinets.

11-28.2(2) FIRE EXTINGUISHERS

Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes which comply with requirements of governing authorities.

Abbreviations indicated below to identify extinguisher types related to UL classification and ratings system and not necessarily to type and amount of extinguishing material contained in extinguisher.

Multi-purpose Dry Chemical Type: UL rated 4A:60B:C, 10 lbs. nominal capacity, in enameled steel container, for Class A, Class B, and Class C.

Carbon Dioxide Type: UL rated 10B:C, 15 lbs. capacity, in enameled steel container, for Class B and Class C. Provide wall brackets for mounting extinguishers.

11-28.2(3) FIRE EXTINGUISHER CABINETS

General: Provide fire extinguisher cabinets of suitable size for housing multipurpose dry-chemical type fire extinguishers of capacities indicated above.

Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.

    a. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch thick, cold-rolled steel sheet lined with minimum 5/8-inch thick, fire-barrier material.

    b. Provide factory-drilled mounting holes.

Cabinet Type: Cabinet box (tub) semi recessed or surface mounted on walls of sufficient depth to suit style of trim indicated.

Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

    a. Trim: Square-edge trim with 1/4 inch to 5/16 inch backbend depth.

    b. Trim Metal: Of same metal and finish as door.

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Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Material: Manufacturer's standard flush, hollow aluminum door construction.

2. Door Glazing: Clear float glass, 1/8 inch thick, complying with ASTM C1036, Type I, Class 1, Quality q3.

Identification:

1. Identify bracket-mounted extinguishers with "FIRE EXTINGUISHER" in red letter decals applied to wall surface. Use letter size, style, and location as selected by the Project Engineer.

Door Style: Provide manufacturer's standard “Vertical Duo-Panel” design.

Door Hardware: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180 degrees.

11-28.2(4) FINISHES

General: Comply with NAAMM MFM for recommendations relative to applying and designating finishes. Protect finishes on exposed surfaces from damage by applying strippable, temporary protective covering prior to shipping, in accordance with manufacturer's recommendations.

Aluminum Finishes:

1. Finish Designation: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

2. Class I Clear Anodized Finish: AA-M12C22A41 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil complying with AAMA 607.1.

Steel Finishes:

1. Surface Preparation: Solvent clean surfaces complying with SSPC SP-1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel complying with SSPC SP-5 or SSPC SP-8.

2. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked enamel finish consisting of prime coat and thermosetting topcoat, a minimum dry film thickness of 2.0 mils.

98% Submittal - Not for Construction

a. Color and Gloss: Manufacturer's standard color and gloss designations. Paint the interior of cabinet.

11-28.3 CONSTRUCTION REQUIREMENTS

11-28.3(1) EXAMINATION

Examine areas and conditions under which the work is to be installed, and notify the Owner in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected.

11-28.3(2) INSTALLATION

Follow manufacturer's printed instructions for installation.

1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and wall type to comply with manufacturer's instructions.

2. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and wall type to comply with manufacturer's instructions.

11-28.3(3) ADJUSTING AND CLEANING

Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

Remove temporary labels and protective coatings.

Clean and polish exposed surfaces according to manufacturer's written recommendations.

11-29 METAL LOCKERS

11-29.1 GENERAL

11-29.1(1) SUMMARY

This Section includes standard metal lockers.

Related Sections include the following:

1. Section 11-08 "Miscellaneous Carpentry" for wood blocking and grounds for mounting lockers and accessories.

11-29.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Product data and installation instructions for metal locker units.

Three color samples on squares of same metal to be used for fabrication of lockers.

98% Submittal - Not for Construction

Shop drawings that show metal lockers in dimensioned relation to adjacent surfaces. Show lockers in detail, method of installation, fillers, trim, base, and accessories. Include locker numbering sequence information.

Manufacturers Certificates of Conformance: Attesting that materials meet the requirements specified herein.

11-29.1(3) DELIVERY, STORAGE, AND HANDLING

Deliver shades in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Contract Plans and in a window treatment schedule.

11-29.1(4) PROJECT CONDITIONS

Do not deliver metal lockers until building is enclosed and ready for locker installation. Protect from damage during delivery, handling, storage, and installation.

Field Measurements: Where metal lockersare indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings.

11-29.2 PRODUCTS

11-29.2(1) MATERIALS:

Sheet Steel: Mild cold-rolled and leveled furniture steel, free from buckle, scale, and surface imperfections.

Fasteners: Cadmium, zinc, or nickel-plated steel; exposed bolt heads, slotless type; self-locking nuts or lock washers for nuts on moving parts.

Equipment: Hooks and hang rods of cadmium-plated or zinc-plated steel.

Body: Fabricate back and sides of minimum 24-gage steel, with double-flanged connections extending full height. Form top and bottom of not less than 24-gage steel, with flanged edges. Provide 24-gage steel sheet hat shelf. Form exposed ends of non-recessed lockers of minimum 16-gage steel.

Door: One-piece, minimum 18-gage sheet steel, flanged at all edges, constructed to prevent springing when opening or closing. Fabricate to swing 180 degrees. Provide no fewer than 6 stamped, louvered vent openings in full-height locker face top and bottom.

1. Hinges: Steel, full-loop, 5-knuckle, tight pin. Weld to inside of frame and secure to door with not less than 2 factory-installed fasteners that are completely concealed and tamperproof when door is closed. Provide at least 3 hinges for each door.

2. Projecting Handle and Latch: Positive automatic, prelocking, pry-resistant latch and pull with rubber silencers; chromium-plated, heavy-duty, vandal-proof lift-up handle, containing strike and eye for padlock. (Padlock N.I.C.)

98% Submittal - Not for Construction

11-29.2(2) FABRICATION

Construction: Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld, bolt, or rivet other joints and connections. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors or frames. Locker configuration and dimensions to be as shown on the Contract Plans.

Locker style to be single tier 12 inch wide x 15 inch deep x 72 inch high. Provide one shelf, hanging coat storage rod and 3 single prong hooks. The door pull shall serve as padlock hasps (padlocks not included). Each compartment will have space for a number place above the louver openings.

Frames: Fabricate of 16-gage channels or 12-gage angles, minimum, with continuous stop/strike formed on vertical members.

Finishing: Chemically pre-treat metal with degreasing and phosphatizing process. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plates and nonferrous metal.

Color: Concealed parts may be manufacturer's standard color. Visible color shall be as scheduled on the Contract Plans.

Uniformity: Provide metal lockers that are standard products of single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.

11-29.2(3) ACCESSORIES

Furnish each locker with the following items:

One shelf 9 inches from the top.

Coat rod.

Not less than 3 single-prong hooks.

Number Plates: Manufacturer's standard etched, embossed, or stamped, nonferrous metal number plates with numerals not less than 3/8 inch high. Number lockers in sequence as directed by Owner. Attach plates to each locker door, near top, centered, with at least 2 fasteners of same finish as number plate.

Continuous Metal Base: Minimum 12-gage cold-rolled steel, fabricated in lengths as long as practicable to enclose base of lockers without additional fastening devices. Base to be 4" high recessed "Z" style base. Factory-finish metal base to match lockers.

Continuous Sloping Tops: Not less than 20-gage sheet steel, approximately 25 degrees pitch, in lengths as long as practicable but not less than 4 lockers. Provide closures at ends. Finish to match lockers. Locate as indicated on the Contract Plans.

98% Submittal - Not for Construction

Filler and End Panels: Provide filler panels where indicated, and end panels at end locations, of not less than 18-gage steel sheet, factory fabricated and finished to match locker units.

11-29.3 CONSTRUCTION REQUIREMENTS

11-29.3(1) INSTALLATION:

Install metal lockers at locations shown in accordance with manufacturer's instructions for plumb, level, rigid, and flush installation.

Space fastenings about 48 inches on center, unless otherwise recommended by manufacturer, and apply through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners. Any attachment to acoustically treated partitions to have resilient grommet.

Install trim, metal base, sloping top units, and metal filler panels and end panels, using concealed fasteners. Provide flush, hairline joints against adjacent surfaces.

11-29.3(2) ADJUST AND CLEAN:

Adjust doors and latches to operate easily without binding.

Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

11-30 TOILET AND BATH ACCESSORIES

11-30.1 GENERAL

11-30.1(1) SUMMARY

This Section includes the following:

1. Toilet accessories.
2. Underlavatory guards.

11-30.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

98% Submittal - Not for Construction

11-30.1(3) QUALITY ASSURANCE

Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers with equal characteristics, as judged solely by Project Engineer, may be provided.

2. Do not modify aesthetic effects, as judged solely by Project Engineer, except with Project Engineer's approval. Where modifications are proposed, submit comprehensive explanatory data to Project Engineer for review.

11-30.1(4) COORDINATION

Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

11-30.2 PRODUCTS

11-30.2(1) MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide accessories by one of the following, or approved equal:

1. Toilet Accessories:
   a. A & J Washroom Accessories, Inc.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. General Accessory Manufacturing Co. (GAMCO).
   f. McKinney/Parker Washroom Accessories Corp.
2. Underlavatory Guards:
   a. Brocar Products, Inc.
   b. Truebro, Inc.
   c. Approved equal.

98% Submittal - Not for Construction

11-30.2(2) MATERIALS

Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

11-30.2(3) FABRICATION

General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Project Engineer, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

98% Submittal - Not for Construction

11-30.3 CONSTRUCTION REQUIREMENTS

11-30.3(1) INSTALLATION

Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

Install grab bars to withstand a downward load of at least 250 lb., when tested according to method in ASTM F 446.

11-30.3(2) ADJUSTING AND CLEANING

Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

Remove temporary labels and protective coatings.

Clean and polish exposed surfaces according to manufacturer's written recommendations.

11-30.3(3) TOILET AND BATH ACCESSORY SCHEDULE

Toilet Tissue Dispenser TBA-1: Where this designation is indicated, provide toilet tissue dispenser complying with the following:

1. Products: Available products include the following:
   a. ASI Model No. 7305-S.
   b. Bobrick No. B-7685.
2. Type: Single-roll dispenser.
3. Mounting: Surface mounted with concealed anchorage.
4. Material: Stainless steel.
5. Operation: Noncontrol delivery with mfr's standard spindle.
6. Capacity: Designed for 4-1/2- or 5-inch- diameter-core tissue rolls.

Waste Receptacle TBA-2: Where this designation is indicated, provide stainless-steel waste receptacle complying with the following:

1. Products: Available products include the following:
   a. ASI No. 0810.

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2. Freestanding Type: With swing top and minimum 13-gal. capacity, reusable, vinyl liner.

Multipurpose Unit TBA-3: Where this designation is indicated, provide stainless-steel combination unit complying with the following:

1. Products: Available products include the following:

   a. ASI Model No. 0430.

2. General: Provide multipurpose unit with seamless wall-flange; mirrored door with continuous hinge and tumbler lockset; paper towel dispenser; minimum 80-oz. capacity soap dispenser; sight gage and tumbler lockset for servicing; shelf above soap dispenser; and the following features:

   a. Soap Valve: For dispensing soap in liquid form.

   b. Towel Dispenser: Designed to dispense minimum of 600 C-fold or 800 multifold paper towels without special adapters.

   c. Mounting: Recessed, designed for nominal 4-inch wall depth.

Robe Hook TBA-4: Where this designation is indicated, provide robe hook complying with the following:

1. Products: Available products include the following:

   a. ASI No. 8425.

   b. Bobrick B-2333.

2. Single-prong Unit: Stainless-steel, single-prong robe hook with rectangular wall bracket and backplate for concealed mounting.

Underlavatory Guard TBA-5: Where this designation is indicated, provide underlavatory guard complying with the following:

1. Products: Available products include the following:

   a. Lav-Guard as manufactured by Trubro, Inc.

2. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

98% Submittal - Not for Construction

11-31 RESIDENTIAL APPLIANCES

11-31.1 GENERAL

11-31.1(1) SUMMARY

This Section includes undercounter refrigerator and microwave oven.

1. Appliances as specified and shown on Plans, including all required miscellaneous parts and accessory items for complete installations.

11-31.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: Submit copies of Manufacturer's product data, installation, and maintenance instructions for each appliance. Transmit extra copies of installation instructions to installer.

Provide templates, instructions, and directions required to insure accurate location of utility rough-in and anchorage devices.

1. Operation and Maintenance Data: Submit Manufacturer's printed directions.

11-31.1(3) QUALITY ASSURANCE

Conform to the requirements of the National Electric Code (NEC) for installation of powered equipment and Uniform Plumbing Code (UPC) for all plumbed equipment. All fixtures and connections must be UL labeled.

Energy Ratings: Comply with Federal Trade Commission regulations.

11-31.1(4) DELIVERY, STORAGE, AND HANDLING

Carefully crate and insulate against marring, and other damage in transit.

11-31.1(5) SERVICE AND WARRANTY

Warranty each unit against defects in function and appearance for a period of two years minimum from date of opening the bridge to vehicular traffic.

11-31.2 PRODUCTS

11-31.2(1) MANUFACTURERS

Available Products: Subject to compliance with requirements, products incorporated into the Work include, but are not limited to, the following:

1. General Electric or other reviewed and approved manufacturers.

11-31.2(2) EQUIPMENT LISTS

Available Products: Subject to compliance with requirements, products incorporated into the Work include, but are not limited to, the following:

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1. CPFilms, Inc, polyester film shade impregnated with ultra-violet absorbers, non-reflective construction, or approved equal.

Refrigerator: GE Compact Refrigerators, Model GMR04HASCS, CleanSteel™ Exterior, or approved equal.

1. 3 Wire Cabinet Shelves.
2. 1 Mini Ice 'N Easy Tray.
3. 3 Fresh Food Door Shelves.
4. Can Rack.
5. Recessed handles.

Microwave: GE Profile Spacemaker II® Microwave Oven, Model PEM31DMWW, or approved equal.

1. 1.0 cu. ft. capacity, 800 watts.
2. Sensor cooking controls.
3. Auto and Time Defrost.

11-31.2(3) EXAMINATION

Inspection:

1. Prior to all work of this Section, carefully inspect work of all other trades and verify conditions as complete and satisfactory for appliance installations.
2. Verify that equipment may be installed in accordance with original design and Manufacturer's recommendations.

11-31.2(4) INSTALLATION/POSITION

Contractor shall verify all rough-in locations, electrical and mechanical connections and ascertain that sufficient clearances are provided for proper operation of all appliances provided under this Contract.

Install in accordance with all referenced regulation requirements, and Manufacturer's directions.

1. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
2. Check operation. Appliances are to be in perfect operating service.

11-31.2(5) ADJUSTING AND CLEANING

Adjust units as required for proper operation.

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Leave installations clean; premises free from residue of work of this Section.

11-32 ROLLER SHADES

11-32.1 GENERAL

11-32.1(1) SUMMARY

This Section includes roller shades.

Related Sections include the following:

1. Section 11-08 "Miscellaneous Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

11-32.1(2) SUBMITTALS

Provide submittals as outlined in Section 1-05.3, as applicable.

Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension system members and attachment to building structure.
2. Shade mounting assembly and attachment.
3. Size and location of access to shade operator and adjustable components.
4. Minimum Drawing Scale: 1/4 inch = 1 foot.

Samples for Initial Selection: For each colored component of each type of roller shade indicated.

1. Include similar Samples of accessories involving color selection.

Samples for Verification:

1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
2. For the following products:
    a. Shade Material: Not less than 12-inch- square section of film.

98% Submittal - Not for Construction

Window Treatment Schedule: Include roller shades in schedule using same room designations indicated on Contract Plans.

Product Certificates: For each type of roller shade product, signed by product manufacturer.

Product Test Reports: For each type of roller shade product.

Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.

11-32.1(3) QUALITY ASSURANCE

Source Limitations: Obtain roller shades through one source from a single manufacturer.

11-32.1(4) DELIVERY, STORAGE, AND HANDLING

Deliver shades in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Contract Plans and in a window treatment schedule.

11-32.1(5) PROJECT CONDITIONS

Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Project Engineer of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

11-32.1(6) EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed, but not fewer than 2 units.

11-32.2 PRODUCTS

11-32.2(1) MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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1. CPFilms, Inc., (818) 882-5744.
2. Plastic-View (800) 468-6301.
3. SeeSawUSA, (800) 561-9250.
4. Or approved equal.

11-32.2(2) ROLLER SHADES [RS-1]

Available Products: Subject to compliance with requirements, products incorporated into the Work include, but are not limited to, the following:

1. CPFilms, Inc, polyester film shade impregnated with ultra-violet absorbers, non-reflective construction.

Shade Band Material: Tinted film.

1. Material Width: 60 inches.
2. Bottom Hem: Straight.
3. Shading Coefficient: 0.42.
4. Solar Transmittance: 19.86 percent.
5. Ultraviolet Transmittance: 0.27percent.
6. Material Color: Smoke.

Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Contract Plans.

Direction of Roll: Regular, from back of roller.

Mounting Brackets: Galvanized or zinc-plated steel.

Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

Bottom Bar: Steel or extruded aluminum,. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

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Shade Operation: Manual; with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.

1. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Contract Plans.
2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
3. Lift Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
4. Loop Length: Length required to make operation convenient from floor level.
5. Bead Chain: Stainless steel.
6. Cord Tensioner Mounting: Wall.
7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

Mounting: Inside mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

11-32.2(3) ROLLER SHADE FABRICATION

Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting Mechanism: With permanently lubricated moving parts.

Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/2 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headbox, roller, and operating hardware and for hardware position and shade mounting method indicated.

Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

98% Submittal - Not for Construction

Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

Colors of Metal and Plastic Components Exposed to View: As selected by Project Engineer from manufacturer's full range, unless otherwise indicated.

11-32.3 CONSTRUCTION REQUIREMENTS

11-32.3(1) EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

11-32.3(2) ROLLER SHADE INSTALLATION

Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

11-32.3(3) ADJUSTING

Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

11-32.3(4) CLEANING AND PROTECTION

Clean roller shade surfaces after installation, according to manufacturer's written instructions.

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that roller shades are without damage or deterioration at time of opening the bridge vehicular traffic.

Replace damaged roller shades that cannot be repaired, in a manner approved by Project Engineer, before time of opening the bridge to vehicular traffic.

11-33 SKELETON CLOCK SYSTEM

11-33.1 GENERAL

11-33.1(1) SUMMARY

This Section includes the following:

1. Outdoor skeleton clocks and interior pilot clocks including clock control system.

11-33.1(2) SUBMITTALS

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of clock required.

98% Submittal - Not for Construction

Shop Drawings: Product data to include overall physical clock dimensions, clock mechanism, dial style, hand style, installation detail and electrical wiring detail. Include; elevations, and large scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

11-33.1(3) QUALITY ASSURANCE

Installer's Qualifications: Engage an experienced installer that has completed installation of clocks or other devices similar in material, design, and extent to those indicated for this Project and that has resulted in construction with a record of successful in service performance.

11-33.1(4) DELIVERY, STORAGE, AND HANDLING

Provide protective covering or crating as recommended by the manufacturer to protect clock components and surfaces against damage during transportation and delivery.

Handle clocks carefully to prevent breakage, surface abrasion, denting, soiling, and other defects. Comply with the manufacturer's handling instructions for unloading components subject to damage.

1. Inspect clock components for damage upon delivery. Do not install damaged clock components. Repair minor damage to clocks, provided the finished repair is equal in all respects to the original work and is acceptable to the Project Engineer, otherwise remove and replace damaged clock components.

11-33.1(5) MAINTENANCE

Maintenance Instructions: Furnish maintenance manual to instruct the County's personnel in procedures to be followed in operating, cleaning, and maintaining the work. Provide manufacturer's brochures describing the actual materials used in the work, including, but not limited to, metal alloys, finishes, and other major components.

11-33.1(6) REGULATORY REQUIREMENTS

Conform to requirements of the current recognized National Electric Code.

11-33.2 PRODUCTS

11-33.2(1) MANUFACTURER

Basis-of-Design Product: Subject to compliance with requirements, provide National Time & Signal Corporation products as described below or comparable equal products of other manufacturers. Product numbers listed are those of National Time & Signal Corporation.

11-33.2(2) MASTER CLOCK UNIT

Provide surface mounted National Time & Signal Corporation, model MC3 microprocessor based master clock controller with a 10 year lithium battery standby.

Provide automatic daylight saving time correction.

In the event of power loss. Provide automatic correction of clock upon restoration of power.

98% Submittal - Not for Construction

Provide individual control of clocks in multi clock systems.

Provide perpetual leap year calendar.

The master clock shall be powered from 120 VAC 60 Hz with user selected time base of power line frequency, crystal oscillator, optional GPS or LAN interface utilizing the time based on the NIST atomic clock.

Provide (Select: GPS or LAN) interface equipment as required. In the event of signal loss or fault, the MC100 shall automatically switch to its internal crystal oscillator for time keeping until the fault is cleared.

11-33.2(3) CLOCK COMPONENTS

Type KMR clock mechanism with shaft extension for wall penetration.

Style "A" dial markers shall be constructed of .250" aluminum plate with wall stand-offs and studs for masonry mounting. Markers shall be clear anodized with Teflon coating. Provide marker mounting template.

Type M02 hands shall be clear anodized with Teflon coating.

Furnish 115V 60HZ heavy duty, synchronous motor driven clock mechanism. The clock mechanism shall employ worm/worm gear drive technology to protect the mechanism from wind shear and provide smooth positive drive of the hands. Clock shall be constructed of precision machined, heavy wall, cast aluminum gear housings with permanent lubricating oil reservoir. Clock mechanisms utilizing stamped plate and pillar construction do not meet the quality standards for clocks of this size.

11-33.2(4) PILOT CLOCK

Provide manufacturer's standard enclosed face pilot clock with 10 inch diameter.

Colors and Surface Textures: For exposed sign material that require selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated on Color and Material Schedule.

11-33.3 CONSTRUCTION REQUIREMENTS

11-33.3(1) EXAMINATION

Examine areas and conditions under which the work is to be installed, and notify the Project Engineer in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected.

11-33.3(2) INSTALLATION

Provide labor to install markers per manufacturer instructions.

Wire in accordance with manufacturer's instructions. Three 14AWG conductors for each unit between reset control panel or master clock. All wiring shall be in approved metal raceway.

90% Submittal - Not for Construction

11-33.3(3) CLEANING

At completion of the installation, clean soiled surfaces of clock units in accordance with the manufacturer's instructions.

11-33.3(4) PROTECTION

Protect installed clock units from damage until acceptance by the Project Engineer.

11-34 FURNISHINGS

11-34.1 GENERAL

11-34.1(1) SUMMARY

This Section includes the following:

1. Desk task chairs.
2. Side chairs.
3. Desks.
4. Mobile pedestals.
5. File cabinets
6. Side tables.

11-34.1(2) SUBMITTALS

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of furnishing required.

Product Certificates: For each type of flame-retardant treatment of fabric, from manufacturer.

11-34.1(3) QUALITY ASSURANCE

Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.

1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.

11-34.1(4) DELIVERY, STORAGE, AND HANDLING

Proved protective covering or crating as recommended by the manufacturer to protect furnishing components and surfaces against damage during transportation and delivery.

Handle furnishings carefully to prevent breakage, surface abrasion, denting, soiling, and other defects. Comply with the manufacturer's handling instructions for unloading components subject to damage.

90% Submittal - Not for Construction

11-34.1(5) MAINTENANCE

Maintenance Instructions: Furnish maintenance manual to instruct the County's personnel in procedures to be followed in operating, cleaning, and maintaining the work. Provide manufacturer's brochures describing the actual materials used in the work, including, but not limited to, metal alloys, finishes, and other major components.

11-34.2 PRODUCTS

11-34.2(1) MANUFACTURER

Basis-of-Design Product: Subject to compliance with requirements, provide Haworth products as described below or comparable equal products of other manufacturers. Product numbers listed are those of Haworth.

11-34.2(2) DESK TASK CHAIR

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Haworth – Zody Task Chair. Alternative manufacturer's product include Steelcase "Think" and Teknion "T3 with mesh back".

Description: Task chair with height adjustable arms (4 inch), adjustable foam seat (3 inch), balanced 3-point tilt mechanism with 24 degrees back recline, hard dual wheel casters, passive torsional flex for upper back support, PAL Back System, including a patent pending asymmetrical lumbar adjustment and passive pelvic support for low-back support, pneumatic seat height adjustment, easy to reach/activate tilt tension adjustment, 6-position back-stop and forward-tilt adjustment that allows the user to control their positions throughout the day, and aluminum five-star base.

Finishes:

1. Upholstered seat pad: COM
   a. Designtex
   b. Bliss 2770-701, Canyon Sunset, 54 inch wide
   c. 100% Zeftron nylon, nanotex resists spills finish, 90,000 wyzenbeek.
2. Trim: Base and arm color – metallic gunmetal.
3. Mesh back: Haworth, support 001, black
4. Plastic seat shell, arm pad and base: Black

11-34.2(3) SIDE CHAIR

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Haworth – x99 Guest Chair. Alternative manufacturer's product include Knoll "Open Up side sled base and mesh back with arm caps" and Steelcase " Protégé, sled base fully upholstered back with arm caps".

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Description: Guest chair with solid base tube metal frame, hard arm caps and upholstered seat and back.

Finishes:

1. Upholstered seat pad: COM
   a. Maharam
   b. Tai 463790, 001 Glowt, 54 inch wide
   c. 47% Acrylic, 18% Nylon, 15% Cotton, 12% Polyester, 8% Rayon, Teflon/Acrylic backing.
2. Trim: COM seat and back – metallic gunmetal.

11.34.2(4) DESK

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Knoll "Propeller Training Table.. Alternative manufacturer's product include Fixtures Syllabus "C-fixed leg except with height adjustment manual pin option to32 inch height" and Haworth "Tactic C-legs adjustable height table..

Description: Rectangular training room table with C-legs and adjustable height. Equity work surface cable basket. Top: 1 3/16 inch thick, 3-ply, solid core construction. Plastic laminate top and baker sheet on bottom. Threaded inserts are die-cast zinc. Edges: all table edges are finished. 3mm flat PVC edgeband. Legs: All height adjustable legs feature the Propeller C leg design allowing enhanced leg space and incorporating a vertical channel for wire management. Locking casters are black nylon. Manual crank mechanism: Propeller hand crank adjustable height tables include an intuitive manual mechanism that allows one person to raise and lower the table top from a height of 28 to 41 inches. A discreet hand crank is located under the work surface for easy access and operation. ADA compliant.

Size 60 inch wide x 30 inch deep x adjustable height 28 to 41 inches.

Finishes:

1. Laminate top: Wilsonart 4622-60 Grey Nebula.
2. Flat edgeband: 3mm black.

11-34.2(5) MOBILE PEDESTAL

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Haworth "X-series mobile pedestal". Alternative manufacturer's product include Steelcase "900 series" and Herman Miller "Tu lateral file".

Description: Three drawer, freestanding mobile pedestal with black nylon lockable casters. Painted metal.

Dimensions 15 inch wide x 23inch deep.

90% Submittal - not for Construction

Finishes:

1. Painted metal: Silver.
2. Drawer interiors: Black finish color.
3. Drawer eclipse pull: Satin finish

11-34.2(6) FILE CABINET

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Haworth "X-series lateral file". Alternative manufacturer's product include Steelcase "900 series" and Herman Miller "Tu lateral file".

Description: Two-high lateral file, freestanding. Painted metal.

Dimensions 42 inch wide x 18 ¾ inch deep.

Finishes:

1. Painted metal: Silver.
2. Drawer interiors: Black finish color.
3. Drawer eclipse pull: Satin finish

11-34.2(7) SIDE TABLE

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Haworth "Planes, small cart".

Description: One drawer with storage below, freestanding mobile small cart with laminate top, side panels, drawer and cabinet door faces. Black nylon lockable casters. Painted metal.

Dimensions 15 inch wide x 23inch deep.

Finishes:

1. Painted metal: Gunmetal.
2. Laminate: Platinum H-3P.
3. Drawer eclipse pull: Satin finish

11-34.2(8) WORK BENCH

Manufacturer: Basis-of-Design Product: Subject to compliance with requirements, provide Lyons "Adjustable Slide Bolt Leg Work Bench" and accessories.

Description: Work bench with stringer, 1 ½ inch graphite composite top and perfect-fit drawer, Lyons catalogue number 2411AS. Accessories include shelf / stringers, shelf riser, back and end stops, pick racks for plastic bins, blue plastic bins, and low profile drawer set.

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Work bench is cold rolled, sheet steel with 14 gauge adjustable legs and adjustable foot for leveling. Stringer is 18 gauge steel with rounded corners.

Dimensions 60 inch wide x 28inch deep with legs set for 36 inch countertop height.

Accessories:

1. Shelf / stringer: 13 ¼ inch deep shelf with 1 inch high flange at rear for attaching to legs with steel stringers. Lyons catalogue number 2642.
2. Shelf riser: 18 inch high x 14 inch deep steel shelf riser for attachment to work bench top. Lyons catalogue number 2628.
3. Back and end stops: Steel perimeter edge that extends 3 inches above top and tapers to 1 ½ height at front. Lyons catalogue number 2602.
4. Pick racks for plastic bins and blue plastic bins: Blue plastic bins shall be 4 inch wide a 6 ½ inch deep x 5 inch high. There shall be 6 each plastic bins. Lyons catalogue number 78206.
5. Low profile drawer set: Four 15 3/4 inch wide steel drawer set with attachment angles and hardware for attachment to work bench under counter top. . Lyons catalogue number 2788-4 with lock kits for each drawer.

Finishes:

1. Workbench steel frame: Lyon gray.

11-34.3 CONSTRUCTION REQUIREMENTS

11-34.3(1) EXAMINATION

Examine areas and conditions under which the work is to be installed, and notify the Project Engineer in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected.

11-34.3(2) INSTALLATION

Deliver furnishings to spaces identified on plans.

11-34.3(3) ADJUSTING

Adjust chair backs so that they are aligned with each other in [straight] [uniformly curved] rows.

Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.

Verify that all components and devices are operating properly.

Verify that seating returns to correct at-rest position.

Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

98% Submittal - Not for Construction

Replace upholstery fabric damaged during installation.

11-34.3(4) CLEANING

At completion of the installation, clean soiled surfaces of furnishings in accordance with the manufacturer's instructions.

11-34.3(5) PROTECTION

Protect installed furnishings from damage until acceptance by the Project Engineer.

11-35 PRE-ENGINEERED COLD-FORMED STEEL TRUSSES

11-35.1 GENERAL

11-35.1(1) SUMMARY

This Section includes the following:

1. Pre-engineered cold-formed steel trusses
2. Cold-formed steel framing accessories.

11-35.1(2) REFERENCES

A. AISI SG-671 - Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; August 19, 1986 Edition with December 11, 1989 Addendum.

B. AISI RG-9518 - Design Guide for Cold-Formed Steel Trusses; American Iron and Steel Institute; December 1995.

C. ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products; 1997a.

D. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 1999.

E. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1999a.

F. LGSEA - Field Installation Guide for Cold-Formed Steel Trusses; Light Gauge Steel Engineers Association; October 1999.

G. LGSEA 551d - Design Guide for Construction Bracing of Cold-Formed Steel Trusses; Light Gauge Steel Engineers Association; February 1997.

H. LGSEA 551e - Design Guide for Permanent Bracing of Cold-Formed Steel Trusses; Light Gauge Steel Engineers Association; February 1998.

11-35.1(3) SUBMITTALS

A. Submit under provisions of Section 1-05.3.

98% Submittal - Not for Construction

B. Product Data: Truss Component Manufacturer's descriptive literature for each item of cold-formed metal framing and each accessory specified in this section.

C. Shop Drawings: Detailed drawings prepared by Truss Fabricator and sealed by a Professional Engineer licensed in the state of Washington that:

1. Indicate special components and installations not fully detailed in product data.

2. Indicate in the layout placement drawings the number, types, location, and spacings of trusses and other framing members.

3. Indicate details of truss loading, reactions, uplifts, support locations, material sizes and gauges, permanent truss web bracing, and splices as required for a complete installation.

D. Design Data: Results of design analysis, bearing the seal and signature of a Professional Engineer licensed in the state of Washington.

E. Installation Instructions: Truss Component Manufacturer's printed instructions for handling, storage, and installation of each item of cold-formed metal framing and each accessory specified in this section.

11-35.1(4) QUALITY ASSURANCE

A. Provide design of trusses by Truss Component Manufacturer, using design methodologies recommended in AISI and LGSEA references.

1. Determine mechanical properties of load bearing components by testing in accordance with ASTM A 370.

2. Provide design by Professional Engineer registered in the State in which project is located.

3. Provide Truss Fabricator's shop drawings.

B. Pre-Installation Meeting: Meet at job site prior to scheduled beginning of installation to review requirements:

1. Attendees: Require attendance by representatives of the following:

a. Truss Fabricator, if requested by installer.

b. Installer of this section.

c. Other entities directly affecting, or affected by, construction activities of this section, including but not limited to, the following:

1) Installer of truss support framing.

2) Installer of mechanical systems.

3) Installer of electrical systems.

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2. Review potential interface conflicts; coordinate layout and support provisions.

11-35.1(5) DELIVERY, STORAGE, AND HANDLING

A. Pack, ship, handle, unload, and lift shop products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage or distortion.

B. Store and protect products in accordance with Truss Component Manufacturer's recommendations and in manner necessary to prevent damage, distortion and moisture buildup.

11-35.2 PRODUCTS

11-35.2(1) COMPONENTS

A. Pre-Engineered Cold-Formed Steel Trusses: TrusSteel truss component system by Alpine Engineered Products, Inc.; providing a complete horizontal framing system, ready for deck installation, meeting specified requirements.

1. Truss Type, Span, and Height: As indicated on Plans.

2. Comply with requirements of the Contract Documents and the International Building Code.

3. Shop fabricate in accordance with shop drawings, using jigging systems to ensure consistent component placement and alignment of components, and to maintain specified tolerances; field fabrication is strictly prohibited unless performed by authorized Truss Fabricator using Truss Fabricator's shop assemblers and proper jigging systems.

4. Shop fabrication of other cold-formed steel framing components into assemblies prior to erection is permitted; fabricate assemblies in accordance with shop drawings.

5. Fasten connections within truss assembly with Truss Component Manufacturer's screws only and as shown on the shop drawings; welding and other fasteners are prohibited.

6. Fabricate straight, level, and true, without rack, and to following tolerances:

a. Trusses up to 30 feet long: Maximum 1/2 inch variation from design length.

b. Trusses over 30 feet (9 m)long: Maximum 3/4 inch variation from design length.

c. Trusses up to 5 feet high: Maximum 1/4 inch variation from design height.

d. Trusses over 5 feet high: Maximum 1/2 inch variation from design height.

B. Truss Chord and Web Components: chord and web components without rolled edges are prohibited.

1. Shapes, Sizes, and Thicknesses: As required to suit design and as indicated on shop drawings.

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2. Chords: Cold-formed from ASTM A 653 galvanized steel sheet, minimum G60 coating; minimum yield strength of 55,000 psi.
    a. Nominal 22 gage members:
        1) Minimum bare metal thickness: 0.0284 inch
        2) Maximum design thickness: 0.0299 inch
    b. Nominal 20 gage members:
        1) Minimum bare metal thickness: 0.0329 inch
        2) Maximum design thickness: 0.0346 inch
    c. Nominal 18 gage members:
        1) Minimum bare metal thickness: 0.0428 inch
        2) Maximum design thickness: 0.0451 inch
    d. Nominal 16 gage members:
        1) Minimum bare metal thickness: 0.0538 inch
        2) Maximum design thickness: 0.0566 inch
3. Webs: Cold-formed ASTM A 500 steel structural tubing; minimum yield strength of 45,000 psi
    a. Nominal 20 gage members:
        1) Minimum bare metal thickness: 0.033 inch
        2) Maximum design thickness: 0.035 inch
    b. Nominal 18 gage members:
        1) Minimum bare metal thickness: 0.047 inch
        2) Maximum design thickness: 0.049 inch
    c. Nominal 16 gage members:
        1) Minimum bare metal thickness: 0.063 inch
        2) Maximum design thickness: 0.065 inch

C. Fasteners Used in Fabricating Trusses: Screw fasteners recommended by Truss Component Manufacturer, bearing stamp of Truss Component Manufacturer for ready identification.

98% Submittal - Not for Construction

11-35.3 CONSTRUCTION REQUIREMENTS

11-35.3(1) EXAMINATION

A. Verify that bearing surfaces and substrates are ready to receive steel trusses.

B. Verify that truss bearing surfaces are within the following tolerances:

1. Variation from Level or Specified Plane: Maximum 1/8 inch in 10 feet (6 mm in 3 m).
2. Variation from Specified Position: Maximum 1/4 inch (6 mm).

C. Verify that rough-in utilities and chases that will penetrate plane of trusses are in correct locations and do not interfere with truss, bracing, or bridging placement.

D. Inspect conditions under which installation is to be performed and submit written notification if such conditions are unacceptable to installer.

1. Notify Project Engineer within 24 hours of inspection.
2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
3. Beginning construction activities of this section indicates installer's acceptance of conditions.

11-35.3(2) INSTALLATION

A. Install trusses in accordance with Truss Component Manufacturer's instructions, Truss Fabricator's shop drawings and the design engineer.

B. Place components at spacings indicated on the shop drawings.

C. Install all erection (temporary installation) bracing and permanent bracing and bridging before application of any loads; follow recommendations of LGSEA Field Installation Guide for Cold-Formed Steel Roof Trusses.

D. Install erection bracing.

1. Provide bracing that holds trusses straight and plumb and in safe condition until decking and permanent truss bracing has been fastened to form a structurally sound framing system.
2. All subcontractors shall employ proper construction procedures to insure adequate distribution of temporary construction loads so that the carrying capacity of any single truss or group of trusses is not exceeded.

E. Install permanent bracing and bridging as shown in the Plans and as shown in the Truss Fabricator's shop drawings.

98% Submittal - Not for Construction

F. Removal, cutting, or alteration of any truss chord, web or bracing member in the field is prohibited, unless approved in advance in writing by the Project Engineer and the Truss Designer.

G. Repair or replace damaged chords, webs, and complete trusses as directed and approved in writing in advance by the Project Engineer and the Truss Component Manufacturer.

98% Submittal - Not for Construction