DESIGN REQUIREMENTS

for the

SOUTH PARK BRIDGE – FINAL DESIGN

November 4, 2009
Revision: Draft F (95% Design Submittal)

For:

KING COUNTY - DEPARTMENT OF TRANSPORTATION

WASHINGTON
Agreement No. E00082E07
CIP 300197

By:

HNTB Corporation

Job No. 45647

PROJECT NAME: SOUTH PARK BRIDGE – FINAL DESIGN

Design Requirement Revision Control Table

Revision	Date of Issue	Author	Description
Draft A	December, 2008	HNTB	Initial document for HNTB internal review
Draft B	February 9, 2009	HNTB	Provided to King County for Review and Comment
Draft C [1]	March 6, 2009	HNTB	This version includes revisions to address King County's and third party comments as well as to document revisions and additions due to advancement of the project design.
Draft D [2]	June 6, 2009	HNTB	This version includes revisions to address King County's and third party comments as well as to document revisions and additions due to advancement of the project design.
Draft E [3]	June 23, 2009	HNTB	This version includes previous revisions and is issued for the Intermediate Design review.
Draft F [4]	Oct. 28, 2009	HNTB	This version addresses Intermediate Design comments and revisions from design advancement and is issued for the 95% submittal.

1: King County's and third party's comments on Revision Draft B, as well as the design team's responses to the comments are available in the electronic version of the Revision Draft B.

2: King County's and third party's comments on Revision Draft C, as well as the design team's responses to the comments are available in the electronic version of the Revision Draft C.

3: Third party's comments on Revision Draft D, as well as the design team's responses to the comments are available in the electronic version of the Revision Draft D.

4: Intermediate review comments and design advancement updates on Draft E are available in the electronic version of the Revision Draft E.

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1. **CONTRACT IDENTIFIED DESIGN REQUIREMENTS** (Current on April 15, 2008, unless noted otherwise) 1.1. Codes, Standards and Specifications 1.1.1. American Association of State Highway and Transportation Officials (AASHTO) Publications: 1.1.1.1. Policy on Geometric Design of Highways and Streets (2004 Edition) 1.1.1.2. Bridge Welding Code: D1.5M/D1.5 2008 1.1.1.3. Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 4th Edition with 2008 interim revisions 1.1.1.4. LRFD Movable Highway Bridge Design Specifications: 2nd edition and 2008 interim revisions 1.1.1.5. Manual for Condition Evaluation of Bridges 2nd Edition, 1994 1.1.1.6. Standard Specifications for Structural		

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Supports for Highway Signs, Luminaries and Traffic Signals: 4th edition with 2002-2003 interim revisions		
1.2. Washington State Department of Transportation (WSDOT) Publications:		
1.2.1. Bridge Design Manual LRFD (BDM, M23-50 – May, 2008)		
1.2.2. Construction Manual (M41-01)		
1.2.3. Design Manual (M22-01)		
1.2.4. Geotechnical Design Manual (GDM, M46-03.01 – Nov. 2008)		
1.2.5. Environmental Procedures Manual (M31-11)		
1.2.6. Highway Runoff Manual (M31-16)		
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1.2.8. Local Agency Guidelines (M36-63)		
1.2.9. Right of Way Manual (M26-01)		
1.2.10. Sign Fabrication Manual (M 55-05)		

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1.2.11. Standard Plans for Road, Bridge, and Municipal Construction (M21-01)		
1.2.12. Standard Specifications for Road, Bridge, and Municipal Construction (M41-10)		
1.2.13. Traffic Manual (M51-02)		
1.3. King County Publications:		
1.3.1. Computer-Aided Design and Drafting (CADD) Standards		
1.3.2. Consultant Geotechnical Report Guidelines for King County Capital Improvement Projects		
1.3.3. General Special Provisions		
1.3.4. King County Code		
1.3.5. Road Design and Construction Standards		
1.3.6. Surface Water Design Manual		

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1.4. City of Seattle Publications:		
1.4.1. Right-of-Way Improvements Manual		
1.4.2. Traffic Control Manual for In-Street Work		
1.5. Other Publications:		
1.5.1. Highway Capacity Manual		
1.5.2. International Building Code [1]	1: Technical aspects to be applied to the design of only the control towers as identified in the design criteria which will be developed early in Phase I. R. Johnson, March 2009	
1.5.3. Manual of Steel Construction LRFD		
1.5.4. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)		
1.5.5. National Electrical Code (NEC)		
1.5.6. Section 106 of National Historic Preservation Act		
1.5.7. Seismic Retrofitting Manual for Highway Structures		
1.5.8. Technical Advisory T 6640.8A		

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2. ADDITIONAL DESIGN SPECIFICATIONS		
2.1. Florida Dept. of Transpiration Standard Heavy Duty Fender System (Index 21910)	2.1: This is a self imposed specification to be used for the fender system / R Johnson / June 6, 2009	
2.2. NFPA – 70 (NEC) National Fire Protection Agency, National Electric Code		
2.3. NFPA – 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways, 2008 Edition		
2.4. U.S. Coast Guard 33 CFR Part 118 – Navigation Lights/Signals		
2.5. AASHTO "Guide Specifications for LRFD Seismic Bridge Design," May 2007 (to be used as a guide for seismic design of the approach structures and selected aspects of the bascule structure)	Application of Guide Specification refined since Revision Draft B – RMJ – 3/6/09	
2.6. South Park Bridge Replacement, Vol. 1: Preliminary Design Report, August 2007 (hereafter referred to as PDR)		
2.7. South Park Bridge Replacement, Vol. 2: Preliminary Design Plans, August 2007 (hereafter referred to as PE plans)		

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2.8. City of Seattle Standards / ROW Manual / Specifications will be applied at the direction of King County when the work is within COS jurisdiction.	Added in accordance with COS request / R Johnson / June 5, 2009	
3. ORDER OF PRECEDENCE		
3.1. The order of precedence will be:		
3.1.1. Design Requirements – South Park Bridge Final Design		
3.1.2. WSDOT Design Specifications		
3.1.3. AASHTO Design Specifications		
3.1.4. Other Specifications		
4. UNITS / TEMPERATURE / DATUM		
4.1. The bridge will be designed using the customary English units of feet, pounds, degrees Fahrenheit, etc.		Verified. Rich Johnson (RMJ)
4.2. The units shown on the final plans and specifications will be English units.		Verified. RMJ
4.3. Dimensions given on the plans are for the bridge at mean temperature of 64˚, unless otherwise noted.		Verified. RMJ
4.4. All plan dimensions are measured horizontally or		Verified. RMJ

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vertically in two orthogonally perpendicular planes as indicated by relative orientation, unless otherwise noted		
4.5. The horizontal datum for the project is NAD 83/91	Added since Revision Draft B – RMJ – 3/6/09	Verified. RMJ
4.6. The vertical datum for the project is NAVD88		
4.7. Elevation of 0.0 on the existing South Park Bridge as-built drawings corresponds to an NAVD88 elevation of 9.6 feet as published in the Preliminary Design Report dated August 2007.		Verified. RMJ
5. CROSS SECTION CONFIGURATION		
5.1. Traffic lanes along South Park Bridge alignment between Dallas Ave S. and the northerly project limits include 11-foot lanes in both northbound and southbound directions for a total of four 11-foot lanes. From Dallas Ave S., the roadway transitions to the existing channelization at Cloverdale Street. A bus stop proposed along the east side of the roadway will be designed to follow King County Metro's design requirements. The pullout for the parking along the east side between Dallas Ave S. and Cloverdale Street will follow the City of Seattle Right of Way Manual.		

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5.2. Bicycle lanes should include one 5-foot lane out board of the traffic lanes in each direction between Dallas Ave S. and the northerly project limits. There will be no bike lanes south of Dallas Ave S. and from the northerly project limits to E. Marginal Way.		
5.3. Sidewalks between Dallas Ave S. and the northerly project will be 6 feet wide on both the east and west sides of the roadway. On the west side of the 14th Ave S. between Dallas Ave S. and Cloverdale Street, the sidewalk width will be 10 feet. Along the east side, at the location of the bus stop, the sidewalk width will be 11 feet. Beyond the bus stop, at the location of the on-street parking, the sidewalk will be 6 feet with a 5-foot planter between the roadway and the sidewalk.		
5.4. Outboard (exterior) railings will be considered a pedestrian railing with a minimum height of 42 inches in accordance with current AASHTO requirements. (Deck space has been allocated to bicycle traffic on the traffic deck of the bridge and approaches.)		Verified. RMJ

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5.4.1. Allow 10 inches width for railing		Verified. RMJ
5.4.2. The pedestrian railing will be designed to conform to AASHTO's 6 inch sphere test.		Verified. RMJ
5.4.3. A pedestrian railing will, at a minimum, be provided when the vertical distance between the sidewalk elevation and the proposed ground elevation is 18 inches or greater.	Self imposed requirement. AASHTO requires railings when the distance between the surface and the adjacent ground exceeds 30 inches. RMJ March, 2009	Verified. RMJ
5.5. Traffic barrier will be a tubular metal traffic rail on concrete base (metal based on bascule span).		Verified. RMJ
6. VERTICAL PROFILE		
6.1. Design Speed is 35 mph		Verified. RMJ
6.2. Posted Speed is 30 mph		Verified. RMJ
6.3. Design Speed for calculating intersection Sight Distance – 40 mph		Verified. RMJ
6.4. Stopping Sight Distance (Max.) is 267 feet		Verified. RMJ
6.5. SSD Calculation based on Vehicle height of 3.5 feet, Object height of 0.5 feet		Verified. RMJ

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6.6. Vertical Clearance at ORR Street – 14.5 feet		Verified. RMJ
6.7. Vertical Clearance at Boeing Access Rd – 14 feet min., 14.5 feet desirable		Verified. RMJ
6.8. Maximum grade is 5%.		Verified. RMJ
7. HORIZONTAL ALIGNMENT		
7.1. The new bridge will be roughly parallel to the existing bridge		Verified. RMJ
7.2. Design based on AASHTO Low-Speed Urban criteria		Verified. RMJ
7.3. Design Vehicle – WB 50		
7.4. Curb Radii – King County – 35 feet R, City of Seattle – 25 feet R. Design to accommodate WB-40 truck turning movement at NW and SW corner of Dallas Ave S. / 14th Ave S. Actual radius to be used was determined in coordination between COS, KC and HNTB.		
7.5. The distance between the new and old bridge will be controlled by the ability to construct the new		Verified. RMJ

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bridge without significantly affecting the operation of the existing bridge		
7.6. The minimum distance between Boeing's 2-15 building in the northwest quadrant of the project area, and the project west R/W will be 30 feet.		Verified. RMJ
8. NAVIGATION CLEARANCE		
8.1. The lateral navigation clearance will be a minimum 125-foot clear channel centered on the Duwamish Waterway, with unlimited vertical clearance while the bridge is in the full open position in accordance with the PDR.		Verified. RMJ
8.2. The center channel vertical navigation clearance will be a minimum of 34 feet above elevation 7.64 (MHW) within a 58-foot wide channel centered on the Duwamish Waterway as shown in the PE plans measured parallel to the bridge (51.9 feet measured normal to the centerline of channel).		Verified. RMJ
8.2.1. MHW level defined as -2.1 feet relative to City of Seattle.		Verified. RMJ
8.2.2. For purposes of this project, the more conservative (higher) MHW elevation		Verified. RMJ

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converted from the King County datum will be used and set at a value of 7.64 feet (NAVD88) in accordance with the PDR.		
8.3. The vertical clearance at the edge of the navigation channel will be a minimum of 27.75 feet above elevation 7.64 (MHW).		Verified. RMJ
9. STRUCTURE TYPE		
9.1. The main span structure will be a two-leaf trunnion bascule bridge		Verified. RMJ
9.1.1. The counterweight will be under-slung with vehicular deck spanning the counterweight well.		Verified. RMJ
9.2. The approach spans will be two-span prestressed concrete girder with CIP deck structures similar to that shown in the PE Plans.		Verified. RMJ
9.3. The bascule foundations will be constructed of sunken concrete caissons bearing on competent soils and will support the bascule piers.		Verified. RMJ
9.4. The approach structures will be founded on drilled shafts		Verified. RMJ

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10. BASCULE SUPERSTRUCTURE		
10.1. The bascule span girders will be fabricated of conventional welded plate steel girders with triangles cut out of the web to simulate a “truss”. Steel edges of the cuts will be dressed to mitigate potential of accelerating paint deterioration and corrosion.		Verified. RMJ
10.2. Splice Location: A field splice will be located roughly 21 feet on the channel side of the trunnion to allow the superstructure joined at mid-span by temporary works, floated on barges and hoisted vertically into position with use of heavy cranes or wenches.		Verified. RMJ
10.3. Emergency Operation: The bascule superstructure and trunnion frames will be designed to be capable of operating a bascule leaf driven from one pinion gear (assuming one gear reducer is out of service) under a normal balance condition and wind speeds limited to 30 mph.		
10.4. Deck: The superstructure deck will be solid to reduce tire noise and divert surface water from		Verified. RMJ

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direct discharge into the waterway.		
10.5. If surface (deck) mounted bolts are used for joints, only recessed hex head bolts will be used. (Countersunk flat screws will not be used.)	To be verified. RMJ 10/31/09	
10.6. Joints within the sidewalk and bicycle lane will be detailed to accommodate bicycle and foot traffic.	To be verified – need to address longitudinal joint at approach to bascule pier interface. RMJ 10-31-09	
10.7. Deck joints over the trunnion (heel joint) will not be used. The heel joint will be located to the landside of the trunnion and positioned to reduce the potential from a vehicle from fall within the joint when the bridge is in the full open position.		Verified. RMJ
10.8. Pockets will be provided within the counterweight below the center of gravity in the full up position to allow placement of balance blocks and fine tuning of the leaf balance near the full open position.		
10.9. Normal access will be provided to the counterweight pockets in the closed position. Two rows of pockets will be located in the front of the counterweight to allow adjustment of the balance between the counterweight and bascule		

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span, and adjustment of the centroid of the counterweight.		
10.9.1. Additional pockets will be provided along the sides or top of the counterweight to allow gross adjustments to be made primarily prior to initial commissioning of the bridge in either the open or closed position.		
11. BASCULE PIERS		
11.1. Height clearance		
11.1.1. Minimum height clearance for personnel will be 6-feet 8-inches where possible in accordance with the PDR		Verified. RMJ
11.1.2. Minimum height clearance for machinery removal and replacement operations will be 8- to 10-feet in accordance with the PDR		
11.2. Lift Points: Lifting equipment and lifting eyes (pick points) or overhead chain hoist rail will be provided to aid in machinery maintenance	Not included in the 95% submittal. Needs to be addressed prior to the 100% submittal. RMJ 10-31-09.	
11.3. Stairs:		
11.3.1. Stairway width will be a minimum of 36	Minimum stair width is 36 inches. Provide up to 48 inches if possible – RMJ – 3/6/09	Verified. RMJ

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	inches, measured between walls, as specified by the IBC 1009.1 – Exceptions for occupant load of 50 or less. Where possible, the stairs will be 48 inches, measured between, to allow two people to pass or one person to navigate the stairs carrying equipment.		
11.3.2.	Stairs within the bascule piers will be provided on both sides (east or west) of the bascule piers.		Verified. RMJ
11.3.3.	Stairs will be in accordance with the requirements of the AASHTO specifications and current OSHA Standards.		Verified. RMJ
11.3.4.	Stairs over the drive train shafts will be provided for maintenance personnel to step over the components if personnel cannot walk around the equipment.		
11.3.5.	Stairs will be considered the preferred method to access the counterweight pit, and will be provided if practical. If stairs are not practical, ladders will be provided in lieu of stairs.	Stairs provided. RMJ 10-31-09	Verified. RMJ

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11.4. Access:		
11.4.1. Control Towers' vicinity ladders, platforms, and walkways provided will be in accordance with the requirements of the AASHTO specifications and current OSHA Standards. (Railings within the Control Towers will be in accordance with the IBC.)		Verified. RMJ
11.4.2. Access to the center locks will be from a below deck catwalk. An opening in the end floor beams will not be provided to allow maintenance forces to traverse from one bascule leaf to the other at mid-span due to the need to provide a collapsible center joint.		
11.4.3. Access to the trunnion bearings will be from ships stairs, ladders, and/or platforms accessed from the Machinery Level for the interior bearings and from the Equipment Level for the exterior bearings.		
11.4.4. A uniform 4-foot horizontal (lateral) clearance to the operating machinery for maintenance purposes is desirable but cannot be provided due to space		Verified. RMJ

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constraints. The operating machinery will be layout to provide as much lateral clearance as practical.		
11.4.5. Bascule pier personnel access will be provided as follows:		Verified. RMJ
11.4.5.1. No provisions will be made to get between the east and west of the bascule piers at the Roadway Level.		
11.4.5.2. Maintenance forces will be required to go down the Machinery Level to get from the one side of the Equipment of the bascule pier to the other side.		Verified. RMJ
11.4.5.3. Access between the west and east sides of the bascule piers will be provided at the Machinery and Footing Levels only.		Verified. RMJ
11.4.5.4. A floor door (access hatch) will be provided in the “look out” areas of the bascule piers to allow the bridge tender to gain access to the Roadway Level from the Equipment Level on the side of the bascule pier opposite the Control		Verified. RMJ

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Tower.		
11.5. Curtain walls will be provided on the channel side of the bascule pier to minimize unauthorized access to the interior of the pier, enclose the machinery from the elements and mitigate the potential for birds to nest within the pier. Bird control will be provided at entry points to the interior of the bascule piers.	Details of bird control to be verified. RMJ 10-31-09.	
11.6. Interior floors and walkways of the bascule pier will be sloped, to a maximum of 2%, to drain to the low point sump within the counterweight pit.		Verified. RMJ
12. CONTROL TOWERS		
12.1. Control Tower Level Nomenclature:		Verified. RMJ
12.1.1. Operator Level: Bridge operations level (up one flight of stairs from the Roadway Level)		
12.1.2. Roadway Level: Level at or near roadway elevation		
12.1.3. Equipment Level: One level below the roadway level		
12.1.4. Machinery Level: Two levels below the		

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roadway level		
12.2. Two control towers will be provided, one on each bascule pier		
12.2.1. Operation of the bascule leaves will be under the control of the bridge tender that will be located in Operator Level of the control tower located on the west side of the north bascule pier		Verified. RMJ
12.2.2. The non-operational (maintenance and equipment) control tower will be located on the east side of the south bascule pier		Verified. RMJ
12.3. IBC Occupancy Group: For purposes of technical design, the control towers are considered to be two story buildings with the following Occupancy Group Classification.		Declarative statement.
12.3.1. Operators Level		
12.3.1.1. North Tower: Occupancy Grp. B (Business IBC 304.1) with occupancy of 2.		
12.3.1.2. South Tower: Occupancy Grp. B (Business IBC 304.1) with occupancy of 2.		
12.3.2. Roadway Level:		

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12.3.2.1. North Tower: Occupancy Group B (Business IBC 304.1)		
12.3.2.2. South Tower: Occupancy Group B (Business IBC 304.1)		
12.3.3. Equipment Level:		
12.3.3.1. North Tower: Occupancy Group U (Utility)		
12.3.3.2. South Tower: Occupancy Group U (Utility)		
12.4. Space Heat Type: For purposes of determining building envelop requirements, the control towers will be designed with the following space heat type:		Verified. RMJ
12.4.1. Operators Level – Conditioned space.		
12.4.2. Roadway Level – Conditioned space:		
12.4.3. Equip. Level – Unconditioned space:		
12.5. Building Envelope: The building envelope of the conditioned spaces of the control towers will be design to the general requirements of Chapter 6 of the Washington State Energy Code, 2006, for Group R-3, Zone 1 as a conservative measure for		

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energy conversation. The design will conform to the following requirements:		
12.5.1. Operator Level Ceiling: Min. R-38		
12.5.2. Operator Level Walls: Min. R-19		
12.5.3. Operator Level Floor:: No requirements		
12.5.4. Roadway Level Ceiling: No requirements		
12.5.5. Roadway Level Walls: R-19		
12.5.6. Roadway Level Floor: R-19 (insulated below from Equipment Level.	The HVAC equipment is located in the Equipment Level, but this level is not conditioned – RMJ – 3/6/09	
12.5.7. Equipment Level Ceiling: No requirements		
12.5.8. Equipment Level Walls: No requirements		
12.5.9. Equipment Level Floor: No requirements		
12.6. Windows:		
12.6.1. Configuration: Windows will consist of plate glass on the lower light, and operable awing lights with muntins on the upper light.		Verified. RMJ

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12.6.2. Energy Conservation: 12.6.2.1. North Tower: Windows will have a maximum U-factor of 0.35 to reduce heating and cooling demand. 12.6.2.2. South Tower: Windows will have a maximum U-factor of 0.35 to reduce heating and cooling demand.		Verified by discipline lead. RMJ
12.6.3. Operation: All lower lights of glass will be fixed. Awning windows above the fixed glass of the control towers will be operable and hinged at the top of the window..		Verified by discipline lead. RMJ
12.6.4. Security Glazing – Control Tower: 12.6.4.1. The exterior glazing of windows will be shatterproof glass in accordance with AASHTO Movable 2.1.5.	The bullet resistant glass requirement was removed based on development of the design – RMJ – 3/6/09	
12.7. Doors 12.7.1. The roadway level entrance doors will be an insulated metal door without glazing. The		

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door will have a maximum U-Factor of 0.20.		
12.8. Vapor Retarders: Vapor retarders will be installed on the warm side (in winter) of insulation in conditioned spaces within the control towers.		
12.9. HVAC		
12.9.1. An electric central HVAC system composed of a heat pump with supplementary electrical resistance heat will be provided in both the control towers. The HVAC system will be located in the Equipment Level, but will not condition the Equipment Level.		Verified with discipline lead. RMJ
12.9.2. The heating system will be sized to provide heating of the Operators and Roadway Levels to a design temperature of 72 ºF, based on ASHRAE climate data for the area.		Verified with discipline lead. RMJ
12.9.3. The cooling system will be sized to provide cooling of the Operators and Roadway Levels (both towers) to a design temperature of 78ºF, based on ASHRAE climate data for the area.		Verified with discipline lead, RMJ

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12.9.4. Temperature controls will be used to control both heating and cooling, and be set for a range of 55 ºF to 85 ºF and will be capable of operating the system heating and cooling in sequence. The temperature control will have an adjustable deadband of not less than 10 ºF.	Needs to be specified prior to 100% documents. RMJ 10-30-09	
12.9.5. A programmable thermostat will be provided for the heat pump system. The cut-on temperature for the compression heating will be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating will be higher than the cut-off temperature for the supplementary heat.	Needs to be added prior to specifications prior to 100% documents. RMJ 10-30-09	
12.10. Details:		
12.10.1. A cantilevered catwalk will be on the Control Towers to allow the tender to view pedestrian in accordance with the City of Seattle request.		Verified by review of documents. RMJ
12.10.2. An access hatch will be provided within the		Verified by review of

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catwalk over the clock in the tower to provide an initial means of accessing the exterior of the clocks. No additional means of access (bosoms chairs, lifting wenches, etc.) will be provided as part of the project.		documents. RMJ
12.10.3. Control towers will be fitted with a refrigerator, microwave oven, countertop, sink, cabinets, bathroom and personnel lockers.		Verified by review of documents. RMJ
12.11. Flooring: The flooring of all levels of the control towers will be manufactured of electrically insulating material such as resilient flooring in accordance with AASHTO Movable 1.1.6.		Verified by review of documents, RMJ
12.12. Water Heating		
12.12.1. The electric water heaters will be on-demand systems and not require storage of heated water in unheated spaces.	95% plans call for tank heater. Needs to be revised prior to 100% documents. RMJ 10-31-09	
12.13. Electrical:		
12.13.1. Lighting over the control console will be on		Verified with

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	a dimmer switch to reduce window reflections and glare.		discipline lead. RMJ
12.13.2.	20 amp outlets will be provided throughout the control towers as convenience outlets.		Verified with discipline lead. RMJ
12.13.3.	A minimum of two 120 v circuits will be provided in each level of the control towers in addition to the dedicated circuits.		Verified with discipline lead. RMJ
12.13.4.	The electrical system will be configured such that a 240 volt circuit may be added, initiating at the circuit panel, in the future.		Verified with discipline lead. RMJ
12.13.5.	A one-way communications system will be provided to allow the bridge tender to communicate with pedestrians near the traffic gates areas.		Verified with discipline lead. RMJ
12.13.6.	A voice communication system (intercom) between the exterior service door at the Roadway Level and bridge tender in the Operators Level in the north control tower will be provided.	Not included in the 95% submittal. Will be added to the 100% submittal. RMJ 10-31-09	
12.14. Fire protection and Detection:			

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12.14.1. Fire Protection: Fire sprinklers are not required based on section 903.2.10 of IBC and the IFC because of the low occupancy and will not be provided.		Declarative statement. RMJ
12.14.2. Fire detection is not required by the IBC or the IFC because of the low occupancy. Heat detection alarms will be provide in all three levels of the control tower as protection beyond that required by codified regulations. Neither heat detection nor smoke detection alarms will be provide within the "bascule piers" themselves. Said differently, except for the individual rooms within the control towers, no form of fire detection will be provided.		Verified with discipline lead. RMJ
12.15. ADA Requirements:		
12.15.1. King County's bridge tender job description requires able body personnel to complete the duties.	The job duties of the bridge tenders and the similarities of the Control Towers to airfield Control Towers are deemed to demonstrate that the ADA requirement of traditional buildings are not practical to impose on the Control Towers and are exempt from full ADA requirements. RMJ 10/31/09	Supporting documents provided by KC. RMJ
12.15.2. City of Seattle's bridge tender job description		Supporting

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requires able body personnel to complete the duties.		documents provided by KC. RMJ
12.15.3. ADA Curb Ramps standards 1:12 maximum slope.		
12.15.4. No elevator will be required in the control towers in accordance with the PDR		Verified. RMJ
12.16. Exterior Finishes		
12.16.1. Exterior of control towers to be finished with thin-set brick to reflect character of the existing bridge control towers.		Verified. RMJ
12.16.2. Roof of control towers to be finished with metal treated with factory applied coating (power coating / paint) to prevent leaching of leachable materials. Galvanizing will not be considered an acceptable coating. The factory applied coating is considered to be consistent with the definition of “treated to prevent leaching” in accordance King County’s 2005 Surface Water Design Manual.		Verified by review of documents. RMJ

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12.16.2.1. A layer of sound insulation will be provided beneath the metal roofing mitigate the sound from rain and hail on metal roof.		Verified. RMJ
12.16.3. Roof Drainage System:		Verified. RMJ
12.16.3.1. Roof drains (gutters) will be provided on all sides of the control towers.		
12.16.3.2. Roof drains (gutters) will be allowed to discharge onto flat areas provided the storm water flows away from the building in accordance with the provision of the 2003 International Plumbing Code for one- and two-family dwellings.		Declarative statement.
12.16.3.3. Downspouts will be provided in the roof drains (gutters) to discharge the stormwater collected by the roof drain system.		Verified by review of documents. RMJ
13. AESTHETIC CONSIDERATIONS		
13.1. SHPO has no architectural design requirements for the project		Declarative statement. RMJ
13.2. The configuration of the pedestrian railing will be developed by project artist, administered by		Declarative statement.

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4Culture, as communicated to HNTB.		RMJ
14. FENDER SYSTEM (PIER PROTECTION)		
14.1. Design Philosophy		
14.1.1. The fender system is considered to be sacrificial		Verified. RMJ
14.1.1.1. The fender system is designed to be a flexible, energy absorbing structure to mitigate damage to vessels and fenders during minor collisions and redirect some vessel impacts that would otherwise damage the bascule pier		Verified by review of documents. RMJ
14.2. Manufactured materials such as Sea Timber, Structural Composite Lumber, or Plastic Lumber will be used for planking of the fender system rather than natural timber to the extent deem practical.		Verified by review of documents. RMJ
15. UTILITIES		
15.1. Utilities on Bridge		

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15.1.1. Provisions for future utilities to be carried on the bridge, other than those required for operation and maintenance of the bridge will not be made except that noted below.		Verified. RMJ
15.1.1.1. Two un-used (spare) 4 inch ducts will be carried from end of project to end of project, including within the submarine conduit.	Need to verify the ducts are carried to the ends of the project. RMJ 10-31-09.	
15.1.2. Potable Water:		
15.1.2.1. Potable water will be provided to the Roadway level of both control towers for wash rooms and toilet facilities.		Verified. RMJ
15.1.2.2. Potable water for maintenance will be provided:	Not included in the 95% documents. Needs to be added prior to 100%. RMJ 10/31/09.	
15.1.2.2.1. In each quadrant of each bascule pier at the Machine Level and Footing Level.		
15.1.2.2.2. At one location on the east and west side at the Equipment Level.		
15.1.2.2.3. At one location on the east and west side at the Roadway Level.		
15.1.3. 120 V duplex service receptacles will	Needs to be verified. RMJ 10/31/09.	

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be provided for maintenance purposes as follows		
15.1.3.1. In each quadrant of each bascule pier at the Equipment Level, Machine Level and Footing Level.		
15.1.3.2. At one location on the east and west side at the Roadway Level.		
15.1.4. Sanitary sewer service will be provided to both north and south control towers		Verified. RMJ
15.1.5. Telephone service will be provided to both north and south control towers.	Needs to be verified. RMJ 10/31/09.	
15.1.6. Either cable (Comcast) or fiber optics (Qwest) for communications with the bridge owner's computer will be provided to both the north and south control towers.	Needs to be verified. RMJ 10/31/09.	
16. DRAINAGE		15.1 & 15.2 Verified by discipline lead. RMJ
16.1. General Drainage Requirements		
16.1.1. Per KCSWDM, the project will preserve existing drainage patterns. The project will also restore the natural drainage paths in the City of		

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Seattle and reduce flows to the combined storm/Sewer system.		
16.1.2. Per KCSWDM, the project is Flow Control Exempt due to the proximity to the river.		
16.1.3. Per KCSWDM and City of Seattle Flow Control Manual, The pipe network and outfall system has been designed according to King County and City of Seattle conveyance criteria.		
16.1.4. Per KCSWDM and DOE manuals, Basic water quality treatment is required; enhanced treatment is not required.		
16.1.5. Per King County and the DOE, only new added Pollution Generating Impervious Surface needs to be treated because the project reduces net PGIS, and the new impervious surface is less than 50% of the existing impervious surface.		
16.1.6. Conveyance will meet the 25 year storm event and a check is required to make sure that the 100 year event will not cause flooding.		

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16.1.7. A backwater analysis will evaluate 100-year floodwater conditions.		
16.1.8. Water quality treatment – 60% of 2 year storm event for the targeted treatment area.		
16.1.9. Oil control is not required per KCSWDM; but spill control needs to be included.		
16.2. General TESC requirements		
16.2.1. Consider all areas including staging areas		
16.2.2. Consider 2 year and 10 year storm events for sediment trap design.		
17. LANDSCAPE		16 verified by discipline lead. RMJ
17.1. Plantings will be native species and drought tolerant		
17.2. No artificial irrigation will be provided		
17.3. Soils for planting will consist of imported topsoils/compost		
17.4. LID techniques in the form of a rain garden will be included in the design phase of the project		

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17.5. Habitat enhancement techniques will be utilized for riverbank restoration.		
17.6. Street trees will be sized as 2 1/2 inch caliper		
18. STREET LIGHTING		
18.1. Illumination Requirements		
18.1.1. Roadway/Bicycle Lanes:		
18.1.1.1. The roadway will be considered “major” (over 3,500 ADT) with “high” pedestrian conflict potential as described within Illuminating Engineering Society (IES) publication RP-8		
18.1.1.2. The roadway/bicycle surface will be illuminated to a minimum average level of 1.7 foot candles (fc).		
18.1.1.2.1. Average light level of 1.7 fc exceeds the WSDOT and IES RP-8 requirements of 1.2 and 1.3 fc respectively.		
18.1.2. Walkway/Sidewalk:		
18.1.2.1. The walkway/sidewalk surface will be illuminated to a minimum average level of 1.5 fc.		
18.1.2.1.1. Average light level of 1.5 fc		

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exceeds the IES RP-8 requirement of 1.0 fc.		
18.2. Light Fixtures will be Architectural Area Lighting (AAL)		
18.2.1. Fixture: Universe Collection Large (UCL)		
18.2.2. Solid Rings (SR)		
18.2.3. Flared Hood (FLR)		
18.2.4. Optics: H2 (Type 2 horizontal reflector, flat glass lens)		
18.2.5. Lamp: 400HPS mogul base, ED-18 lamp		
18.2.6. Mounting height will be 38.5 feet above sidewalk surface		
18.2.7. Lighting shields and/or cutoff luminaires will be utilized, as deemed practical and effective, to reduce the light overflow into the waterway and adjacent communities		
18.2.8. Lighting shields and/or cutoff luminaires will be utilized, as deemed practical and effective, to reduce the glare within the visual field of the bridge tenders.		
18.2.9. Full cutoff horizontal reflectors		
18.3. Light Poles will be Valmont DS50		
18.3.1. Manufactured of steel		
18.3.2. Fluted - 16 flat		
18.3.3. Base Plate		

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18.3.3.1. Bolt circle: 11-1/2 inch 18.3.3.2. No. of Bolts: 4 bolts each base plate 18.3.3.3. Bolt Size: 1 inch 18.4. Mast Arms 18.4.1. Mast arms will be limited to 2 lengths, approximately 4 feet adjacent to the bascule span, and 8 feet elsewhere 18.4.2. Connection of the mast arm to the light pole will consist of a 3-bolt pattern currently used as a standard by Seattle City Light. 18.5. Light Pole Mounting/Connection 18.5.1. The light pole mounting surface / bridge connection will be designed similar to WSDOT's "STEEL LIGHT STANDARD ELBOW MOUNTING ON BRIDGE & RETAINING WALL – STANDARD PLAN J-28.45-00". 18.5.1.1. The connection will be custom designed to allow the Seattle City Light standard 4-bolt mounting connection. 18.5.1.2. The elbow will consist of a 10 inch diameter standard steel short radius pipe elbow with mounting flanges attached at 90 degrees from each		

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other.		
18.6. Light Pole Spacing		
18.6.1. Light poles will not be mounted on the movable bascule span to minimize the future maintenance associated with vibration, torsion and metal fatigue associated with the movable span.		
18.6.2. Light poles immediately adjacent to the bascule span will be located at all four corners of the bridge, in the bascule piers, forward of the Control Towers. The fixtures will be mounted in excess of 20 feet above the elevation of the Operator's Level floor.		
19. MATERIALS		
19.1. Concrete Class:		Verified. RMJ
19.1.1. Caisson: Class 4000P		
19.1.2. Caisson seal (mass concrete): Class 4000W,		
19.1.3. Caisson cap (mass concrete): Class		

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4000P		
19.1.4. Barrier, approach wing wall, approach columns: Class 4000		
19.1.5. Drilled shafts and caisson cap: Class 4000P		
19.1.6. Approach bridge deck and bascule pier deck: Class 4000D		
19.1.7. Sidewalk, curb, gutter: Class 4000		
19.1.8. Bascule pier below El. 13.5: Class 4000WT		
19.1.9. Bascule pier: Class 4000		
19.1.10. Bascule deck: Class 4000LW (Light Weight)		
19.1.11. Precast Prestressed Concrete Girder: Class 9500 or higher		
19.1.12. Counterweight: Class 4000HW (Heavy Weight)		

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19.2. Reinforcing Steel:		Verified. RMJ
19.2.1. Deformed Steel Bars: ASTM A 706, Grade 60, Modulus of elasticity, Es = 29,000ksi		
19.2.2. Epoxy coated reinforcement will be used in the following locations: 19.2.2.1. Approach span deck 19.2.2.2. Caisson / Caisson Cap / Bascule Pier Wall from approximately elevation -20 feet and up.		
19.3. Prestressed Reinforcing Steel:		
19.3.1. Prestressing Strand: AASHTO M 230, Grade 270, Low relaxation strand, Es = 28,500ksi		
19.3.2. Prestressing Bar: AASHTO M 275, Tensile strength 150 ksi, Es = 30,000ksi		
19.4. Structural Steel:		Verified. RMJ
19.4.1. AASHTO M 270, Grade 50 unless noted otherwise in plans.		

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19.4.1.1. Grade 70 used for portions of bascule leaves. 19.4.1.2. Grade 36 used for architectural faux trusses on approach spans. 19.4.2. Mechanical couplers will be required to develop no less than 125% of the yield strength of the bar 19.4.3. Structural steel will be painted with a 3-coat solid color in accordance with WSDOT pre-qualified methods and paint suppliers. Bridge rail will be galvanized before a 3-coat paint system is applied. 19.4.3.1. Duplex coating required for the pedestrian railings. 19.5. Bolts: 19.5.1. High strength bolts: AASHTO M164 (ASTM A 325) 19.5.2. Friction type connection with Class B coating on fraying surfaces 19.5.3. Anchor bolts: ASTM F1554 (AASHTO		

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M314) Bolts Grade 105, galvanized per AASHTO M 232		
19.6. Bearings and Expansion Joints:		Verified. RMJ
19.6.1. Concrete: Temperature range 0^{o}F to $+100^{o}$F		
19.6.2. Steel: Temperature range 0^{o}F to $+120^{o}$F with fabrication temperature at 64^{o}F		
19.6.3. Elastomeric Bearing: Durometer hardness 60		
19.7. Architectural faux trusses: Non-functional elastomeric pad.		
20. STRUCTURAL DESIGN METHOD		
20.1. Load Resistance Factor Design will be used for structural design unless noted otherwise.		
20.2. Load Resistance Factor Design will be used for Caisson Foundations		
20.3. Expansion joints:		

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20.3.1. Expansion joints and their supports shall be designed using LRFD design method.		
20.3.2. Expansion devices and their support systems will be designed for 100% impact and over 2,000,000 cycles for fatigue.		
20.3.3. Vertical live load displacements at the transverse roadway joints on the counterweight spans will not exceed 0.5 inches.		
21. APPROACH STRUCTURE SEISMIC DESIGN		
21.1. Importance Category: Essential bridge located within 6 miles of active Seattle Fault Zone		
21.2. Ground Improvement Requirements		
21.2.1. Structural Earth Walls (MSE walls)		
21.2.2. Abutments		
21.2.3. Approach piers		
21.3. Design Earthquake: 7.5% probability of exceedance in 75 years (975-year return period)		

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21.4. Performance Level: Life safety without collapse		
21.5. Seismic Ground Shaking Hazard: Response spectrum was developed by Shannon & Wilson, Inc. and was presented in “Supplement Geotechnical Report, Phase II, South Park Bridge Project, King County, Washington, June 22, 2007”.		
21.5.1. The 0.2-second period spectral acceleration, Ss = 1.03		
21.5.2. The 1-second period spectral acceleration, S1 = 0.35		
21.5.3. Site Classification: E with liquefiable soil layers		
21.5.4. Site coefficient for the short-period range, Fa = 0.90		
21.5.5. Site coefficient for the long-period range, Fv = 2.64		
21.6. Lateral spreading of soils around the approach		

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structures due to liquefaction is expected. The drilled shafts will be designed to resist the forces of the lateral spreading of soils. Design of the drilled shafts will consider one-half of the seismic loads due to the design level earthquake combined with the lateral spreading forces.		
21.6.1. Approach pier shafts will be designed for lateral forces due to soil liquefaction combined with 1/2 of the design earthquake loads in the extreme event limit state.		
21.7. Seismic Design Category, SDC = D, Seismic Performance Zone 4		
21.8. Vertical Ground Motion Effects in accordance with vertical ground response spectrum.		
21.9. The γ_{EQ} load factor for the live load in the extreme event limit state shall be taken as 0.5. The γ_{EQ} factor should be applied to the live load force effect obtained from the bridge live load analysis. Live load mass should be ignored in the dynamic analysis		
22. BASCULE STRUCTURE SEISMIC DESIGN		
22.1. The bascule seismic design will follow AASHTO		

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"LRFD Movable Highway Bridge Design Specifications," 2nd Edition, 2008, which utilizes a force-based design approach.		
22.2. Importance Category: Essential bridge located within 6 miles of active Seattle Fault Zone		
22.3. Seismic Loads		
22.3.1. The bridge will be designed using two levels of design earthquakes; 1) Design Earthquake: An upper level seismic event that has ground motions corresponding to a 7.5% probability of exceedance in 75 years, or an approximate return period of 975 years, 2) Operational Earthquake: A lower level seismic event that has ground motions corresponding to 50% probability of exceedance in 75 years, or an approximate return period of 108 years.		
22.3.2. One-half of the seismic loads due to the design level earthquake may be used for other positions other than the closed position. Seismic loads resulting from operational level earthquake shall not be reduced. During bridge operation, seismic		

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effects on operating components may be ignored – interpreted to mean the bridge need not be protected seismically while the bridge is opening or closing.		
22.3.3. Seismic loads shall include vertical accelerations in both event levels.		
22.3.4. The Seismic Performance Zone is 4		
22.4. Ground Motions		
22.4.1. The response spectra for the design level and operational level earthquakes were generated by Shannon & Wilson, Inc. The response spectra by SWI are in "Geotechnical Report, Final Design, South park Bridge" dated June 09, 2009. The time histories developed by EMI are in "Technical Memorandum – Caisson Analysis of South Park Bridge" date February 06, 2009		
22.4.2. The site-specific time histories for the design level and operational level earthquakes were generated by EMI, Inc.		

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22.5. Geotechnical Parameters		
22.5.1. Site Class is classified as “E” by Shannon & Wilson, Inc. based on site average shear wave velocity.		
22.5.2. Lateral spreading of soils adjacent to the bascule pier caissons from liquefaction is expected. The caissons have adequate lateral capacity to resist the lateral spreading. Therefore, no ground improvement is need for protection of the caissons.		
22.6. Limit States		
22.6.1. The Design earthquake and Operational Earthquake shall be considered at the extreme event limit states.		
22.6.2. The γ_{EQ} load factor for the live load in the extreme event limit state shall be taken as 0.5. The γ_{EQ} factor should be applied to the live load force effect obtained from the bridge live load analysis. Live load mass should be ignored in the dynamic analysis.		
22.7. Design Earthquake (upper level) Performance		

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Criteria 22.7.1. After a Design Earthquake the damage to the bridge may be described as “minor to moderate damage with some loss of operation, “Moderate” damage will be interpreted to mean visible and significant signs of damage with repairs or stabilization likely to be required under emergency efforts. The design will be governed by: 22.7.1.1. Minimal damage to the majority of the bascule superstructure including the bascule girders and trunnion frame will be allowed. 22.7.1.2. Repositioning of the trunnion frame to compensate or mitigate permanent set of the caissons will be allowed. 22.7.1.3. Moderate damage due to plastic deformations of traffic barriers, pedestrian railings and heel joints that may require removal/replacement and emergency measures to return the bridge to serviceable conditions will be		

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allowed.		
22.7.1.4. Limited damage to piers, including yielding of reinforcement and spalling of concrete cover.		
22.7.1.5. Minimal damage to Caissons and Distribution Caps.		
22.7.1.6. Small permanent deformations that may interfere with the serviceability of the bridge will be allowed.		
22.7.1.7. Damage to center expansion joints that can be temporarily bridged with steel plates and repaired/replaced with relative ease will be allowed. Re-setting the collapsible center joint will be allowed.		
22.7.1.8. The operating machinery will be supported by the trunnion frame to limit the differential movement between the trunnions and the pinions during a seismic event. The design will be intended to result in minimal or no		

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damage to the motors, reducers, shafts, couplings, trunnions, racks, pinion shafts. The machinery will be designed to be replaceable.		
22.7.1.9. Significant damage requiring removal or replacement of the center span locks will be allowed. The center span locks will be designed to be replaceable.		
22.7.2. Limitations for the Design Earthquake expressed in terms of permanent lateral displacement or drift resulting from soil deformations at the pier are as follows:		
22.7.2.1. Long. Dir. Trans. Dir. Btwn. Top/Bot. of Caisson 3 inches 3 inches Bottom of Caisson 3 inches 3 inches		
22.7.2.2. Caisson settlement under the Design Earthquake will be designed to not exceed 3 inches.		
22.7.2.3. Current condition of the waterway floor as well as one half (1/2) the full depth of scour from the scour analysis shall		

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be considered with the design level earthquake.		
22.8. Operational Earthquake (lower level) Performance Criteria		
22.8.1. After an Operational Earthquake the bridge will be designed to suffer limited loss of operations that may require emergency temporary measures to restore the bridge to serviceable condition, with minor damage to structure. Minor damage implies predominately elastic performance. The design will be governed by:		
22.8.1.1. Minor inelastic response allowed.		
22.8.1.2. Narrow cracking in concrete allowed.		
22.8.1.3. Limited apparent permanent deformations allowed.		
22.8.1.4. Damage to deck joints that can be bridged with steel plates allowed.		
22.8.1.5. Re-setting of the center joint allowed.		

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22.8.2. Caisson permanent settlement under the Operational Earthquake will be design not to exceed 1 inch.		
22.9. RESPONSE MODIFICATION FACTORS		
22.9.1. The R-factors are designed to achieve the performance goals previously identified.		
22.9.2. R-factors for steel superstructure components will be taken as 1.0 for main structural members and connections for mechanical components, 0.8 for critical connections, including trunnions and shafts, and 1.2 for secondary members for the Design Earthquake.		
22.9.3. R-factor for caissons and pier walls will be taken as 1.5 for the Design Earthquake.		
22.9.4. R-factors greater than 1.0 will not be used for the Operational Earthquake.		
22.10. Seismic Analysis		
22.10.1. Demands on structural components of the bridge will be determined by analysis of		

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	global three dimensional computer models of the bridge that represent its dominant linear and nonlinear behavior and the effects of soil-structure interaction. Demands will be evaluated as load-type quantities (forces and moments) or as displacement-type quantities (displacements, relative displacements, and rotations) as required by the evaluation criteria for various components.		
22.10.2.	Seismic demands will be determined by non-linear multi-support dynamic time-history analysis. Three sets of ground motions will be used for the Design Earthquakes; one set of ground motions shall be used for Operational Earthquake. The design will be based on the maximum response obtained from these analyses in conjunction with the performance goals for the two levels of events.		
22.10.3.	The nonlinear structural model will explicitly consider the geometric nonlinearity, nonlinear boundary conditions, other inelastic elements (e.g.		

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dampers), and inelastic structural components if any.		
22.10.4. Rayleigh damping will be incorporated into the model with values for each element group representing the expected extent of inelastic energy dissipation in that group.		
22.10.5. Soil-Structure Interaction shall be considered using nonlinear springs in the global model. The properties of the springs will be determined from local models.		
22.10.6. For seismic evaluation, reinforced concrete strength will be calculated as 10% higher than the 28-day concrete strength.		
22.11. Soil Structure Interaction		
22.11.1. The approach to Soil-structure interaction (SSI). SSI will conform to the following requirements:		
22.11.1.1. For caisson foundations, the unbounded soil medium is conceptually substructured into two domains: a near-field domain and a		

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far-field domain.		
22.11.1.2. The behavior of the far field as a region remote from the foundation is dominated by the propagation of seismic waves. An elasto-dynamic approach will be used to derive this far-field model.		
22.11.1.3. The behavior of the near field domain is dominated by the interaction with the foundation where nonlinear stress-strain behavior of the nearfield soil and nonlinearity due to foundation uplift from structural inertia forces will be accounted for. Static push-over analyses will be conducted using 3-dimensional nonlinear finite element techniques for the soil to derive the near-field model.		
22.11.1.4. A resultant rheologic model (including nonlinear load-deflection springs for each component of generalized displacements) will be generated, in terms of uncoupled nonlinear		

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rotational and translational springs along with viscous dashpots for global structural response analysis. For shallow foundations, cross-coupling between rotation and lateral translational springs will be neglected.		
23. LOADS AND LOAD COMBINATIONS		
23.1. Permanent Loads:		
23.1.1. WSDOT Bridge Design Manual LRFD, M 23-50, Section 3.8		
23.1.2. AASHTO LRFD Bridge Design Specifications, Section 3.5		
23.2. Live Loads (Vehicular and Pedestrian)		
23.2.1. WSDOT Bridge Design Manual LRFD, M 23-50, Sections 3.9 and 3.10		
23.2.2. AASHTO LRFD Bridge Design Specifications, Section 3.6.		
23.3. Water Loads: AASHTO LRFD Bridge Design Specifications, Section 3.7		

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23.4. Wind Loads:		
23.4.1. WSDOT Bridge Design Manual LRFD, M 23-50, Section 3.11		
23.4.2. AASHTO LRFD Bridge Design Specifications, Section 3.8		
23.5. Down drag		
23.5.1. Supplemental Geotechnical Report, Phase II, South Park Bridge Project, Shannon & Wilson, Inc.		
23.5.2. Geotechnical Report, Final Design, South Park Bridge Project, Shannon & Wilson, Inc., 2009		
23.6. Earth Pressure		
23.6.1. AASHTO LRFD Bridge Design Specifications, Section 3.11		
23.6.2. Geotechnical Report, Phase II, South Park Bridge Project, Shannon & Wilson, Inc., 2004		

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23.6.3. Supplemental Geotechnical Report, Phase II, South Park Bridge Project, Shannon & Wilson, Inc., 2007		
23.6.4. Geotechnical Report, Final Design, South Park Bridge Project, Shannon & Wilson, Inc., 2009		
23.7. Thermal Effects		
23.7.1. Temperature Range: WSDOT Bridge Design Manual LRFD, M 23-50, Section 3.15		
23.7.2. Concrete: Coefficient of thermal Expansion will be 6x10-6/ ºF		
23.7.3. Steel: Coefficient of thermal Expansion will be 6.5x10-6/ ºF		
23.8. Fatigue Limit State: AASHTO LRFD Bridge Design Specifications, Section 3.6.1.4		
23.9. Live Load Surcharges: AASHTO LRFD Bridge Design Specifications, Section 3.11.6.4		

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23.10. Load Factors and combinations		
23.10.1. WSDOT Bridge Design Manual LRFD, M23-50, Section 3.5		
23.10.2. AASHTO LRFD Bridge Design Specifications, Section 3.5		
23.10.3. AASHTO LRFD Movable Highway Bridge Design Specifications, Section 2.4		
24. BASCULE SPAN MECHANICAL OPERATIONS		
24.1. A central type drive system mounted in each pier will be used to raise and lower the bascule spans. Electric motors will drive oil-filled enclosed gear drives that provide power to two pinion gears that each engage a longitudinal rack mounted to each girder. The rack will be inverted.		Verified. RMJ
24.2. Normal Operation: Under normal conditions, operating power for each leaf will be supplied by a D.C. electric motor with a D.C. drive controller.		Verified. RMJ
24.3. Auxiliary Operation: In the event of a failure of the normal operating system, the central reducers will		Verified. RMJ

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be driven by an auxiliary drive A.C. electric motor with across the line starting capabilities.		
24.4. Emergency Operation: The operating machinery will be design to operate a bascule leaf using only a single reducer per leaf assuming normal balance conditions with wind speeds limited to 30 mph.	Since locking out the differential will cause the remaining output shaft to run at twice the speed, only auxiliary motor operation at slow speed will be allowed. Lockout of the differential not included in the 95% documents. Needs to be added prior to 100%. MWG 11/2/09	
24.5. Trunnion Journal: The trunnion journal will be supported by a bronzed bushed bearing that meets the requirements of AASHTO. Lubrication of the bushing/journal interface will be provided by straight longitudinal grease grooves that are milled in the bushing surfaces.		Verified MWG
24.6. Operation Time:		Verified. RMJ
24.6.1. General: The approximate time of operation is the time required to either raise or lower the span exclusive of any time for pedestrians to traverse the bridge or navigation traffic to pass beneath the bridge.		
24.6.2. Normal Operation: The operation time		

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using main drive motors will be targeted to not exceed the durations identified below: 24.6.2.1. Set Traffic Signal to Red 0.0 to 6.9 sec. 24.6.2.2. Lower Southbound On-coming Gate 8.9 to 22.7 sec. 24.6.2.3. Lower Northbound On-coming Gate 24.7 to 38.5 sec. 24.6.2.4. Lower Southbound Off-going Gate 37.7 to 51.5 sec. 24.6.2.5. Lower Northbound Off-going Gate 53.5 to 67.3 sec. 24.6.2.6. Lower N Traffic Barrier 69.3 to 90.0 sec. 24.6.2.7. Lower S Traffic Barrier 71.3 to 92.0 sec. 24.6.2.8. Pull Span Locks 92.0 to 109.0 sec. 24.6.2.9. Raise Spans 109.0 to 212.5 sec. 24.6.2.10. Marine Traffic Passes 24.6.2.11. Lower Spans 212.5 to 321.8 sec. 24.6.2.12. Drive Span Locks 321.8 to 338.8 sec. 24.6.2.13.Raise N Traffic Barrier		

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340.8 to 361.5 sec. 24.6.2.14. Raise S Traffic Barrier 342.8 to 363.5 sec. 24.6.2.15. Raise SB & NB Off-going Gates 365.5 to 379.3 sec. 24.6.2.16. Raise Southbound On-Coming Gate 381.3 to 395.1 sec. 24.6.2.17. Raise Northbound On-Coming Gate 383.3 to 397.1 sec. 24.6.2.18. Set Traffic Signals to Green 383.3 to 397.1 sec.		
24.6.3. The resulting normal operation duration from traffic signal red to the full- open position is 3.54 minutes		
24.6.4. The resulting normal operation duration from full-open to traffic signal green is 3.15 minutes		
24.6.5. Auxiliary Operation: The operation time using the auxiliary motor will be about 5-6 minutes.	The time specified is the operation of the spans to either open or close and should not be compared to the total time of operation as listed for the main drive above. MWG. 11/2/09.	Verified. RMJ
24.7. Slow seating speeds will be provided at the fully down position to provide for a soft final seating.		
25. MECHANICAL FEATURES		

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25.1. Shaft Couplings: All couplings will be gear type couplings, either flex-rigid or flex-flex, as determined appropriate for each specific application, unless otherwise noted.		
25.2. Motor Couplings: Motor couplings will be fully flexible tapered grid couplings to reduce shock during motor starts.		Verified. RMJ
25.3. Brakes:		
25.3.1. General: Spring set, electro-hydraulic thruster released drum shoe brakes will be provided for the motor and machinery brakes.		Verified. RMJ
25.3.2. Motor Brakes: One motor brake will be provided on each of two input shafts of the central reducer. No motor brake is required on the auxiliary motor.		Verified. RMJ
25.3.3. Machinery Brakes: One machinery brakes on each of two input shafts will be supplied on the central reducer output shaft, downstream of the differential.		Verified. RMJ

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25.4. Central Reducer: A totally enclosed parallel shaft reducer with dual input shafts and dual differential output shafts will be provided.		Verified. RMJ
25.5. Auxiliary Reducer: A totally enclosed in-line shaft reducer with single input and single output shafts will be provided.		Verified. RMJ
25.6. Reducer Bearings: Reducers will be specified to be provided with roller element bearings having an L-10 life of at least 40,000 hours.		Verified. MWG
25.7. Reducer Lubrication: Reducers will be specified to use synthetic oil for reduced maintenance replacement requirements.	Not included in the 95% documents. Needs to be added prior to 100%. MWG 11/2/09.	
25.8. Reducer Lubrication: Oil level within reducers will be as recommended by the reducer manufacturer.		Verified. MWG
25.9. Reducer Breathers: Air breathers for reducers will be specified to be hygroscopic type with automatic indication when replacement is required.		Verified. MWG
25.10. Auxiliary Clutch: A spring released, electrically		Verified.

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engaged disc clutch will be specified to isolate the auxiliary drive from the main drive and to engage the auxiliary drive system.		RMJ
25.11. Shafting: Hot rolled steel or forged steel shafting will be specified as appropriate for the final diameter of each shaft.		Verified. MWG
25.12. Center Span Locks: Two span locks will be provided, one each bascule girder. The center locks will be Cushionloks® manufactured by Steward Machine Co. (Birmingham, AL). Provisions will be made for emergency manual operation.		Verified. RMJ
25.13. Sight glass on reducers to allow “at a glance” confidence that adequate lubrication is provided will be provided.		Verified. MWG
25.14. Counterweight heel locks on underside of counterweight will be provided to allow the bridge to be locked into the fully open position to allow for deck or machinery replacement.	Not included in the 95% submittal. Needs to be provided prior to 100% submittal. RMJ 10/30/09.	
25.15. Consideration will be given to incorporate acoustic monitoring into the mechanical drive	Owner(s) like this provision – RMJ – 3/6/09 Not included in the 95% submittal. Needs to be	

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system to compare real-time operating values to a baseline and alert operating personnel if the operating values exceed a pre-determined threshold.	included prior to 100% submittal. RMJ 10-31-09.	
25.16. Removable drip pans and associated supports will be detailed for the pinions gears and the entire length of the pinion racks.		Verified. RMJ
25.17. Ready reference drawings of the mechanical components (span locks, etc.) will be displayed in proximity of the equipment.	Not included in the 95% submittal. Needs to be included prior to 100% submittal. RMJ 10-31-09.	
25.18. The machinery supports (pedestals) will be designed and detailed such that there is easy access to the machinery bolts.		Verified. MWG
25.19. Miscellaneous:		
25.19.1. The control houses will house spare parts and tools that will be supplied in accordance with the AASHTO Specifications.		Verified. MWG
25.19.2. A workbench complete with vise and storage cabinet complete with necessary	Not included in the 95% submittal. Needs to be included prior to 100% submittal. RMJ 10-31-09.	

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maintenance tools will be provided in both control houses.		
26. ELECTRICAL		
26.1. **Electrical Service**:		
26.1.1. Commercial electric secondary service will be obtained from the utility transformer that will be sited near the west side of the south face of the north abutment		Verified GLP
26.1.2. The transformer and primary electric service will be provided by the electric utility company. HNTB will coordinate with King County. King County will coordinate directly with the electric utility representatives on specific requirements.		Verified GLP
26.1.3. Secondary commercial electric services for the bridge distribution system will be 480 volts, 3-phase, 4-wire, grounded neutral.		Verified GLP
26.1.4. Secondary service will be extended from the utility transformer to the north control tower using single conductor cables in conduit by the project. Service		Verified GLP

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	connections will be in accordance with utility requirements.		
26.1.5.	Main service disconnects will be fuse protected for 125% of the required maximum demand load. Branch circuits will be protected by circuit breakers.		Verified GLP
26.1.6.	The required interrupting rating for the main service fuses will be as required by the fault circuit requirements.		Verified GLP
26.1.7.	Main disconnect switches will be mounted in separate cabinets or enclosures at the utility transformer and at the entrance to each electrical distribution room.		Verified GLP
26.1.8.	All distribution circuit breakers as well as all motor starters for traffic gates, traffic barriers, span locks, tail locks, auxiliary drive motors, thruster brakes and other A.C. motors will be housed in motor control center cabinets located the electrical distribution rooms (within control towers).		Verified GLP
26.1.9.	Power circuits to traffic gate motors, traffic		Verified

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barrier motors, span lock motors, main drive motor controllers, auxiliary drive motors and brake thrusters will be 480 volt, 3-phase, 3-wire grounded service.		GLP
26.1.10. Lighting branch circuits will be 120 volt A. C.		Verified GLP
26.1.11. Control and interlocking circuits will be 120 volt A. C.		Verified GLP
26.1.12. The bridge structure, control tower and electric service will be grounded and inter-bonded integral with a lightning protection system.		Verified GLP
26.1.13. Conduits will be located in an organized fashion, overhead and out of the way of maintenance activities and walkways.	Added at the request of the owner(s) – RMJ – 3/6/09	Verified GLP
26.1.14. Generator Set		
26.1.14.1. In the event of commercial power failure from the utility service feed, standby electrical power will be provided by diesel fueled generator		Verified. RMJ

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set with an automatic transfer switch.		
26.1.14.2. The generator set will be located near the west side of the south face of the north abutment.		Verified GLP
26.1.14.3. The standby generator will be sized to operate the bridge using the auxiliary drive motor only. The main drive motors will be interlocked to prevent operation when the generator is operating. The standby generator and auxiliary drive motor will be sized to operate both leaves simultaneously.		Verified. RMJ
26.1.14.3.1. The control system of the main drives will be supported with an UPS to eliminate the need for a re-boot when the grid power returns and the standby generator is no longer needed.		Verified GLP

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26.2. **Main Drive System**		
26.2.1. Two main drive motors will be provided for the operation of each bascule span.		Verified. RMJ
26.2.2. Each main drive motor will be heavy duty D.C. Motors, 60 minute intermittent rating, totally enclosed, non-ventilated, with Class F insulation. Base speed of the motors will be 850 RPM.		Verified GLP
26.2.3. Main drive motor bearings will be end-shield mounted grease lubricated ball bearings.		Verified GLP
26.2.4. Rather than utilizing condensation space heaters, the purpose of them will be achieved by maintaining the field windings in a reduced-current condition during non-use period in order to protect against corrosion within the motors.		Verified GLP
26.2.5. Normal operation will be to operate both drive motors operating at an overspeed of 1100 RPM. Load sharing will be utilized when operating in the two motor mode of		Verified. RMJ

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operation.		
26.2.6. The span will be capable of being operated with one main drive motor at the base speed of 850 RPM under normal loading conditions.		Verified. RMJ
26.2.7. The electric bridge drive will be a Solid State D.C. drive capable of stepless speed control. Counter torque will be provided using regenerative braking circuitry within the drive controller.		Verified GLP
26.2.8. A separate drive controller will be provided for each main drive motor.		Verified GLP
26.3. **Auxiliary Drive Motors**		
26.3.1. One auxiliary drive motor will be provided on each bascule leaf.		Verified. RMJ
26.3.2. The auxiliary drive motor will be a severe duty, continuous duty rated 480 volt 3 phase A.C. squirrel cage induction motor.		Verified GLP
26.3.3. The auxiliary drive motor will be an 1800 RPM, 900 RPM two speed constant torque		Verified GLP

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motor with a service factor of 1.15.		
26.3.4. Motor bearings will be end-shield mounted grease lubricated ball bearings.		Verified GLP
26.3.5. Power will be applied by a 2-speed, reversing motor starter within the motor control center located in the electrical distribution rooms of each control house. The auxiliary motors will be controlled from control console located in the north control tower.		
26.3.6. Condensation space heaters will be provided to protect against corrosion within the motor.		Verified GLP
26.4. **Miscellaneous Motors**		Verified GLP
26.4.1. Motors for thruster brakes will be 480 volt 3 phase continuous duty rated A. C. squirrel cage induction motors.		
26.4.2. Motors for span locks, traffic gates, resistance gates and other miscellaneous motors will be 480 volt, 3 phase intermittent duty rated squirrel cage		Verified GLP

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induction motors unless more severe requirements are indicated for specific applications.		
26.4.3. Condensation space heaters will be provided in the span lock motors to protect against corrosion within the motors.		Verified GLP
26.5. **Bridge Control Features**		Verified GLP
26.5.1. The normal operation of the bridge will be by automatic mode. The operator will have the option of going to the completely manual mode if necessary. The operator will have full control of the navigation sound signals and bridge traffic control equipment at all times. Operation of the span locks, and the span raise and lower sequences are capable when in the manual mode of operation.		
26.5.2. Once the operator sets the traffic signals to 'STOP', the traffic signals will activate and change to YELLOW for five seconds and then automatically change to RED.		Verified GLP
26.5.2.1. The 5 second hold on yellow will be		Verified

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automated and not require bridge tender input.		GLP
26.5.3. The operator initiates the command to lower the north bound and south bound on-coming traffic gates followed by lowering the off-going traffic gates. The off going traffic gates will be interlocked to prevent lowering until the on-coming traffic gates are fully lowered. Operation of the resistance gates will be interlocked to prevent lowering until all traffic gates are fully lowered. Bypass switches will be provided to permit out of sequence gate operation.		Verified GLP
26.5.4. When operating in the automatic mode of operation, once the operator initiates the raising sequence, the span locks will automatically withdraw, and the leaves will rise, automatically slow to approach speed and stop at full open position without further operator action.		**Verified GLP**
26.5.4.1. Two raise switches will be provided – one for the near leaf, and one for the far		Verified GLP

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leaf.		
26.5.4.2. The raise switches will be a spring loaded “return to neutral” upon release thus providing the equivalent of a dead-man switch.		Verified GLP
26.5.5. When operating in the automatic mode of operation, once the operator initiates the lowering sequence, the leaves will lower, automatically slow to seating speed at the neat seat position and continue until the spans are fully seated.		Verified GLP
26.5.6. Once the leaves are fully seated, the span locks will be set by the bridge tender.		Verified GLP
26.5.7. Separate control switches will be provided on the control console for operation and control of span locks, brakes and other miscellaneous control functions for maintenance and emergency operations.		Verified GLP
26.5.8. A maintenance speed switch will be provided in the control console to operate the spans at reduced speed when and if		Verified GLP

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	desired.		
26.5.9.	A normal stop switch on the control console will permit stopping the span in any position by normal deceleration using the main drive motor counter torques before applying thruster brakes.		Verified GLP
26.5.10.	An emergency stop switch on the control console will stop the span in any position by removing power and applying thruster brakes. The E-Stop will be hard wired.		Verified GLP
26.5.11.	General position of each pair of leaves will be signaled on the control desk by indicating lights for closed, near closed, near open and fully open.		Verified GLP
26.5.12.	The precise position of each pair of leaves will be indicated on the control console by a digital display under the control of a position resolver.		Verified GLP
26.5.13.	Position indication will be provided by indicating lights on the control console for the traffic signals, traffic gates, resistance		Verified GLP

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gates, span locks, brakes, and span seating. All indicating lights will utilize LED lamps to reduce power consumption and extend the service life of each lamp.		
26.5.14. Meters will be provided on the control console to monitor voltage and power requirements. Individual current meters will be provided to monitor current draw of each main drive motor.	At the request of the City of Seattle, line voltage, line current and line wattage will be monitored and displayed on the Panel View display panel.	Verified GLP
26.5.15. An air horn will be provided for communication with marine traffic. The air compressor and air storage tank will be housed in the control house. The air horn will be located a good distance away from the normal travel paths of maintenance forces.	At the request of the City of Seattle, the air horn compressor and horn assembly will be mounted on the north side fender system.	Verified GLP
26.6. **Bridge interlocking features**		Verified GLP
26.6.1. Automatic sequencing and most interlocking will be accomplished using an industrial grade programmable logic controller (PLC) having math handling capabilities. Redundant or machine tool relays will be used to augment the PLC		

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	where deemed advisable. Allen/Bradley SLC series will be call for to the extent procurement procedures allow.		
26.6.2.	The primary PLC equipment will be located in the north side control house with remote PLC equipment to be located in the south control house.		Verified GLP
26.6.3.	Primary span control functions will be monitored from position sensing resolvers and geared rotary limit switches mounted on the line shaft within the machinery areas on the north leaf and the south leaf. The span control equipment will be driven through a gear system.		Verified GLP
26.6.4.	Heavy-duty limit switches will provide additional position sensing inputs at critical control locations.		Verified GLP
26.6.5.	Machine tool relays will be provided to provide necessary control inputs for the auxiliary drive system when the PLC is inoperable.		Verified GLP

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26.6.6.	Main drive motors will automatically reduce and maintain the speed of each leaf in the near closed zone and the near open zone to 15 percent of full speed.		Verified GLP
26.6.7.	Main drive motors will automatically reduce the speed of each leaf to a creeping speed at the near seat position, for precise stopping of the span.		Verified GLP
26.6.8.	At the fully open position, the leaves will be stopped, the brakes set automatically, and the navigation lights will change from red to green.		Verified GLP
26.6.9.	When under auxiliary drive operation, the slow speed of the auxiliary drive motor will be automatically energized at each end of travel.		Verified GLP
26.6.10.	When the bridge is locked in the fully closed position for vehicular traffic, all indicating lights will show GREEN.		Verified GLP
26.6.11.	Complete manual operation of the bridge will be capable from the control room		Verified GLP

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	without requiring the operator to leave the control station.		
26.6.12.	The traffic signals will be inoperable until the bridge control system has been activated.		Verified GLP
26.6.13.	The on-coming traffic gates will be inoperable to lower until the traffic signals are set to ‘STOP’.		Verified GLP
26.6.14.	The off-going traffic gates will be inoperable to lower until the on-coming traffic gates are lowered. Resistance gates will be inoperable to lower until all traffic gates are lowered.		Verified GLP
26.6.15.	Span locks will be inoperable until the traffic gates and resistance gates are lowered.		Verified GLP
26.6.16.	Main drive motors and auxiliary drive motors will be inoperable until the span locks are fully withdrawn.		Verified GLP
26.6.17.	Span locks will be inoperable until the		Verified

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leaves are fully closed and the brakes are set.		GLP
26.6.18. The four resistance gates will be inoperable to raise until the span locks are fully driven. The four traffic gates will be inoperable to raise until the resistance gates are full raised.		Verified GLP
26.6.19. The traffic signals will not be allowed to turn to GREEN until all traffic gates are raised.		Verified GLP
26.6.20. Main drive motors will be inoperable if any motor or machinery brake is released by its hand release. This action will be monitored with indicating lights on the control console.		Verified GLP
26.7. **Miscellaneous Additional Features**:		Verified GLP
26.7.1. Spare parts will be specified for essential equipment as required and specified by AASHTO.		
26.7.2. Control towers, machinery areas and bascule pier areas will be provided with		Verified GLP

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	overhead lighting conforming to minimum requirements for service lighting levels.		
26.7.3.	Convenience power outlets will be provided in both east and west ends of each level of the bascule piers.		Verified GLP
26.7.4.	Maintenance stairways and walkways will be provided with lights for nighttime visibility. Light switches will be located at top and bottom of each stairway.		Verified GLP
26.7.5.	All outdoor outlets and all outlets within bascule piers (excluding control tower) will be in weatherproof outlet boxes with weather tight cover plates.		Verified GLP
26.7.6.	An intercom system will be provided to permit communication between the machinery areas, equipment rooms, control tower, roadway level, and counterweight pit level.		Verified GLP
26.7.7.	New submarine cable will be provided in the form of a bored steel micro-tunnel casing with fiberglass reinforced epoxy		Verified GLP

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	inner ducts below the river channel from Pier 3 to Pier 4.		
26.7.8.	A fire detection system will be provided to monitor each level of the both control houses. Alarm notification will be directed to the operator's level of the north Control Tower.		Verified GLP
26.7.9.	A closed circuit television (CCTV) system will be provided to enhance and improve the bridge operator's visibility of the traffic gate areas, upstream, downstream and channel area beneath the bascule piers. Cameras will be provided with pan/tile/zoom capabilities with monitors located on the operator's level of the north control house. All cameras will be high resolution color type for improved visibility of the viewed image. CCTV monitors shall be located such that operator can easily view the monitors while operating the bridge.		Verified GLP
26.7.10.	Intrusion Alarms: An intrusion alarm (as well as door ajar) system will be provided	Not specified in 95% but will be for the 100%	

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for selected points of access to the piers and Control Towers, including the south Control Tower. Alarm notification will be directed to the operator's level of the north Control Tower.		
26.7.11. A new marine band radio will be provided in the operator's room to provide radio communications with the marine traffic in the river channel. The radio will continually monitor the marine band emergency channel and the designated channel for the South Park Bridge.		Verified GLP
26.7.12. The mountings and mounting details for limit switches will be robust and detailed in the construction documents rather than left to the construction contractor's imagination and preference.	Owner(s) like this provision – RMJ – 3/6/09 Details not included with 95% but will be for 100% submittal	
27. **CONSTRUCTION CONTRAINTS**		
27.1. All work below MHHW of the Duwamish Waterway that is not isolated from flowing waters by a cofferdam or other means will be considered in-water work.		

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27.2. All in-water work will be completed between August 1 through February 15		
27.3. All in-water pile driving by means of an impact hammer that exceeds an accumulation of 45 minutes per hour will be completed between August 15 through November 15 .	Dates to be verify once final opinion is provided by NMFS.	
27.4. All pipe piles will be driven by means of a pile driving vibratory hammer until the pile reaches geologic glacial formations or to greater depths. Pile driving impact hammers may be used to drive pipe piles into the geologic glacial formations and to proof test pipe piles unless noted otherwise .		
27.5. A temporary noise attenuation pile (TNAP) will be used while driving all pipe pile installed by means of a pile driving impact hammer.		
27.6. The contractor will install the pipe piles for the temporary construction trestles on the north and south banks of the Duwamish Waterway simultaneously to limit the duration of noise attenuation within the water column.		

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27.7. All pipe piles installed prior to opening of the proposed bridge will be driven open ended.		
27.8. All pipe piles installed prior to opening of the proposed bridge will be 24 inch or less in diameter.		
27.9. The contractor will place no more than 175 temporary pipe piles within the Duwamish Waterway to be utilized for construction of the temporary construction trestles.		
27.10. The contractor will limit the location pipe pile install prior to opening of the proposed bridge as such that installation is 40 to 50 feet from the existing bascule piers.		
27.11. All temporary contractor designed piles and existing fender system piles will be extracted by means of a vibratory hammers in their entirety and disposed in accordance with county, state and federal requirements. If existing piles are damaged such that practical use of extract methods precludes removal of the pile will be cut off at the mud line at no additional cost to the project.		

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27.12. All cofferdam sheet pile immediately adjacent to the existing bascule piers will be driven to the depth of geologic glacial formation or refusal to mitigate the potential of disturbing the foundations of the existing bridge.		
27.13. The contractor will seal the interlocks of all sheeting used for cofferdams to mitigate the potential of turbid water inside the cofferdam from migrating into the Duwamish Waterway.		
27.14. The contractor will use WSDOT 2 1/2 inch max. shoulder ballast or an engineer approved alternate as backfill material for the contractor designed caisson cofferdams.		
27.15. The area of each caisson cofferdam will not exceed 5600 square feet as projected on to a horizontal surface.		
27.16. The contractor will continuously monitor the existing bridge for settlement, translation and vibration from a period of time starting 21 calendar day prior to placement of temporary trestles pipe piles or caisson cofferdams,		

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whichever occurs first, through completion of the placement of caisson caps.		
27.17. The contractor will install and maintain containments systems beneath the temporary trestles, existing bridge, proposed bridge and other temporary works to prevent debris from falling into the Duwamish Waterway.		
27.18. Motorized vessel operations shall be restricted to tidal elevations adequate to prevent bottoming of vessels and prop scour disturbance to the floor of the waterway. Minimal propulsion power shall be used when maneuvering vessels to prevent prop scour disturbance to the floor of the waterway.		
27.19. Site Constraints		
27.19.1. The U.S. Coast Guard requires the navigation channel to be maintained operational for marine traffic.		
27.19.2. Full channel closures for up to a week could be arranged on a case-by-case basis according to the PDR.		
28. SEISMIC REPAIR CONSIDERATIONS		

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28.1. Inclinometer tubes: 28.1.1. Inclinometer tubes have been provided in the caissons to detect and quantify potential permanent set of the caissons from a seismic events. See Sheet BC31 and BP10. 28.1.2. Baseline readings should be taken and recorded upon completion of construction 28.1.3. Providing the inclinometer instrument has not been included in the construction documents. 28.2. Mud Jacking 28.2.1. The bearing pressure of the caissons is less than 100 psi. It is conceivable that mud jacking could be used to remedy or mitigate permanent set from a seismic event. Injection ports would need to cored through the caisson seals to inject grout. 28.2.2. Provisions for mud jacking have not been included in the construction documents. 28.3. Trunnion Frame		

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28.3.1. The trunnion frame has been designed to remain elastic during a seismic event.		
28.3.2. The trunnion frame has been designed to be adjustable, within limits, relative to the bascule piers to allow for re-positioning if there is permanent set of the caissons.		
28.3.3. The operating machinery is supported by the trunnion frame to minimize the relative movement between the trunnions and the operating machinery. The operating machinery is anticipated to remaining operable after a seismic event.		
28.3.4. Provisions for jacking the trunnion frame to reset it after a seismic event will be provided. The pancake jacks required to lift the trunnion frame will not be provided in the construction documents.		
28.4. Bascule Center Joint		
28.4.1. Potential differential longitudinal movement at the center joint was determined to be on the order of 11 inches for the 108 year event and 18 inches for the 975 year event.		

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28.4.2. The center bascule joints have been designed to be collapsible to mitigate the potential for permanent damage to remaining portions of the bridge.		
28.4.3. The center bascule joints will need to be re-set after a seismic event if the event results in out of phase longitudinal movement of 2 inches or more.	To be verified upon completion of final detailing	
28.5. Bascule Center Lock		
28.5.1. The span lock – lockbars are anticipated to remain elastic during the 108 year seismic event and remain operable.		
28.5.2. The span locks – lockbars are anticipated to yield during the 975 year seismic event and require replacement.		
28.5.3. One set of 2 spare lockbars are required to be provided in the construction documents		
29. BRIDGE WET HYDRANT FIRE PROTECTION		
29.1. The wet system will conform to City of Seattle Ordinance 122491 and it's amendments to NFPA		

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502, "Standard for Road Tunnels, Bridges, and other Limited Access Highways", 2004 edition, except that the system shall be wet instead of dry. The design of a wet hydrant system was approved by the City of Seattle in a 30 September, 2009 letter.		
29.2. The fire protection system would be divided into two sections south and north of the bascule span, each completely independent of each other. Each fire protection system will include 8-inch longitudinal mains and fire hydrants located at the bascule piers and at the ends of the north and south approach roads for four (4) hydrants per system and eight (8) hydrants total.		
29.3. Each of the two systems are fed from independent City Water Mains and will be provided with double gate double check (DGDC) back flow preventers located in underground vaults. A bypass detector check will be incorporated into the back flow preventer assembly or a separate upstream detector check and vault will be provided and installed by SPU.		
29.4. The hydrants located at the ends of the approach roads would be dry barrel hydrants served		

Design Requirement	Comment / Reviewer / Comment Date	Verification
by buried fire mains. The hydrants located on the bascule piers would be dry barrel hydrants. The parts of the wet pipe system subject to freezing, such as the sections suspended from the underside of the bridge would be insulated and heat traced. The heat trace would be monitored by alarm panels located in the control tower building at each bascule pier. The heat trace power connections will be accessible from the equipment level of the bascule pier.		