



**Washington State
Department of Transportation**

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Bridge and Structures Lessons Learned for a Successful Design / Build Project

I-405 South Bellevue Case Study

for:

Western Bridge Engineers Seminar

Stuart Bennion, P.E., S.E. – WSDOT

Jim Schettler, P.E., S.E. – Jacobs Engineering

Mark Silverman, P.E. – Atkinson Construction

September 21, 2009

Agenda

ITEM	TOPIC	PRESENTERS
1.	Meeting Goals	Stuart Bennion
2.	Project Overview – Structural Emphasis	Jim Schettler
LESSONS LEARNED:		
3.	Example Issue #1 – Abutment Pile Driving	Team
4.	Example Issue #2 – Abutment Type	Team
5.	Example Issue #3 – Special Wall Design	Team
BEST PRACTICES		
6.	Engineer Perspective	Jim Schettler
7.	Owner Perspective	Stuart Bennion
8.	Contractor Perspective	Mark Silverman
9.	Closing Comments	Mark Silverman

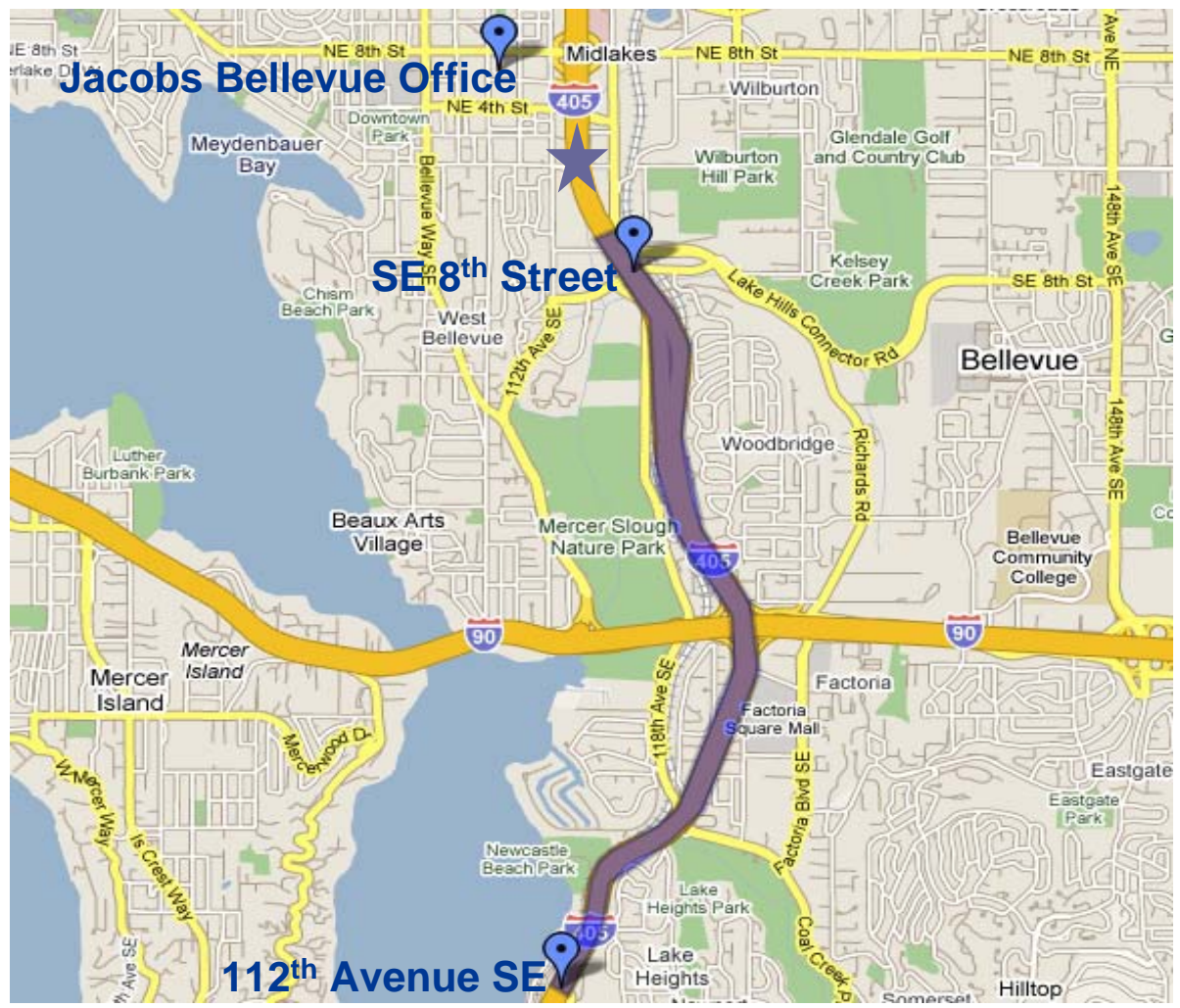


Meeting Goals

- **Understand the Case Study Project Structures**
- **Learn From D/B Construction Challenges & Resolution**
- **Awareness of D/B Best Practices for the Structures / Geotechnical Task Force Team**
- **Gain Insight From Owner / Engr /Contractor Perspectives**



Project Overview – Structural Emphasis



Project Overview – Structural Emphasis

Design / Build Contract Summary

Contract Award:	February 16, 2007
Notice to Proceed:	March 15, 2007
Original Contract Time:	934 Calendar Days
Original Substantial Completion:	October 2009
Original Contract Amount:	\$124,000,000
Revised Contract Amount:	\$124,000,000



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Project Overview – Structural Emphasis

- **New SB I-405 Bridge Over I-90:**
 - **6 spans @ L = 893 ft, W = 56 ft**
 - **PC/PS W & WF 74 G Girders, $S_{max} = 165$ ft**
- **Widened Bridges: 3 spans each**
 - **NB Coal Crk Pkwy Br – W50G @ 76 ft max / +15ft**
 - **SB SE 8th St. Br – W58G @ 90 ft max / +23' +/-**
- **Seismic Retrofit:**
 - **Coal Crk Pkwy Br NB & SB – Col J./Long Restrain**
 - **SE 8th St. Bridge SB – Col Jackets**
 - **Main St. Bridge over I-405 – Col Jackets**



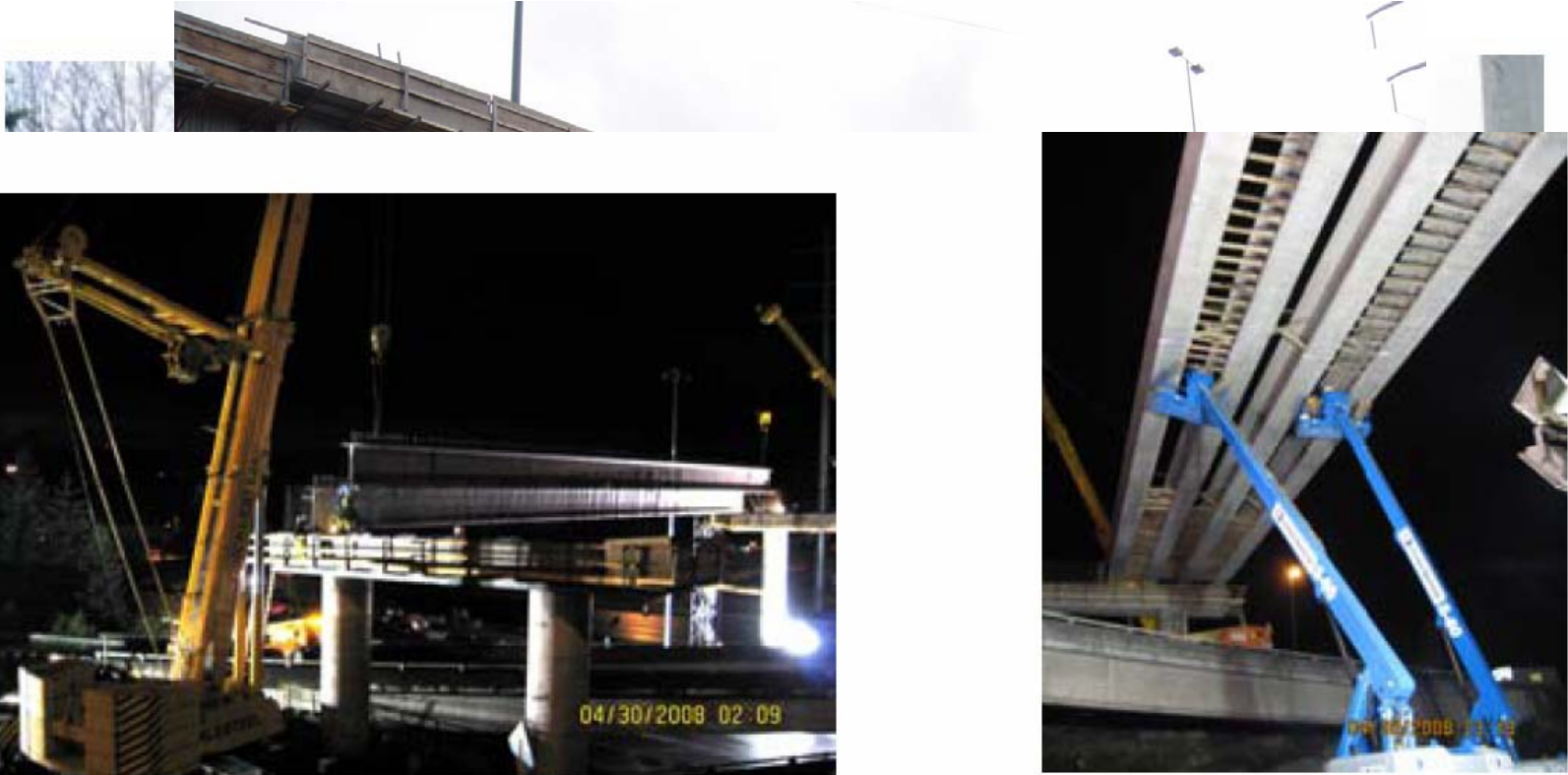
Project Overview – Structural Emphasis

- **Misc Structures: Walls**
 - **Soldier Pile Walls**
 - **Non-Std CIP Conc Walls**
 - **MSE Walls**
 - **Noise Walls**
- **Misc. Structures: Sign Bridges**
 - **15 Total w/ 3 Cantilever**
- **Misc. Structures: Specialty Foundations**
 - **SCL Tower, Light Poles & CCTV Poles**
- **Misc Structures:**
 - **Specialty Traffic Barriers, Signs**



Project Overview – Structural Emphasis

- New SB I-405 Bridge Over I-90 - Photos

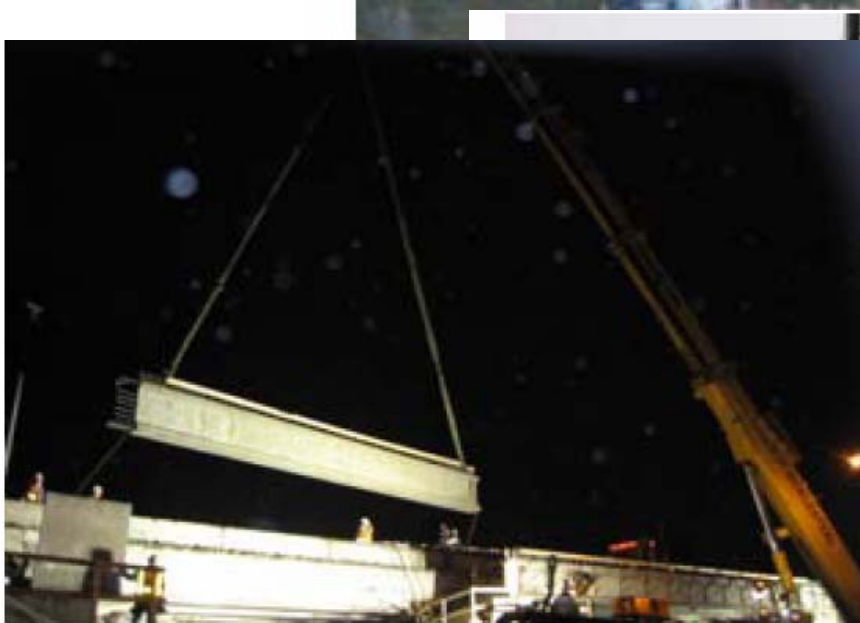


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Project Overview – Structural Emphasis

- Coal Creek Parkway Bridge - Photos



Crew members setting the girders for the I-405 Coal Creek Parkway bridge.



Girder set in place for the I-405 Coal Creek Parkway bridge.

*Cre Crews drive piles near Coal Creeks
near Parkway*



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Project Overview – Structural Emphasis

- SE 8th St. Bridge Widening - Photos



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Project Overview – Structural Emphasis

- Seismic Retrofit - Photos



*Bridge Column Seismic Retrofit at
Coal Creek Parkway.*



Project Overview – Structural Emphasis

- Walls & Moment Slab Barrier - Photos



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Example Issue #1 – Pile Driving

- **Description:**
 - **One bridge widening required 8 H-piles per abutment**
 - **Access was tight and would require expensive benching methods to use fixed leads**
 - **WSDOT had a specification – No swinging leads / PDA test at piles**
 - **Contractor proposed methodology for – Semi-fixed leads with no PDA at piles**
- **Resolution: An agreed to methodology was accepted for Semi-fixed leads with no PDA**



Example Issue #1 – Pile Driving

- **Owner Lessons Learned –**
 - **Establish conflict resolution procedures prior to first conflict**
 - **Resolve issues at lowest level**
 - **Argue only for points of interest – NOT PRIDE**
 - **Be flexible in evaluation of design practices & procedures w/ new industry / construction methods and practices**
 - **Build Trust Quickly**
- **Engineer Lessons Learned –**
 - **Concurrence of AGC/WSDOT Structures committee is important to deviate from specifications**
 - **Collaboration between contractor, geotech, struct, and WSDOT const / bridge / geotech is critical for success**
- **Contractor Lessons Learned –**
 - **Be judicious I challenges to state specifications - DON'T battle over every nickel**
 - **Relationships matter. Engineer's relationship w/ WSDOT can make or break you**

Example Issue #2 – Abutment Type

- **Description:**
 - **Abutment original design showed pipe pile supported abutment with 50ft MSE wall**
 - **Challenge: Minimize costly pile installation and address strap zone issues**
 - **Issue: How to change design to address the challenge**
- **Resolution: Abutment type was change to a spread footing**



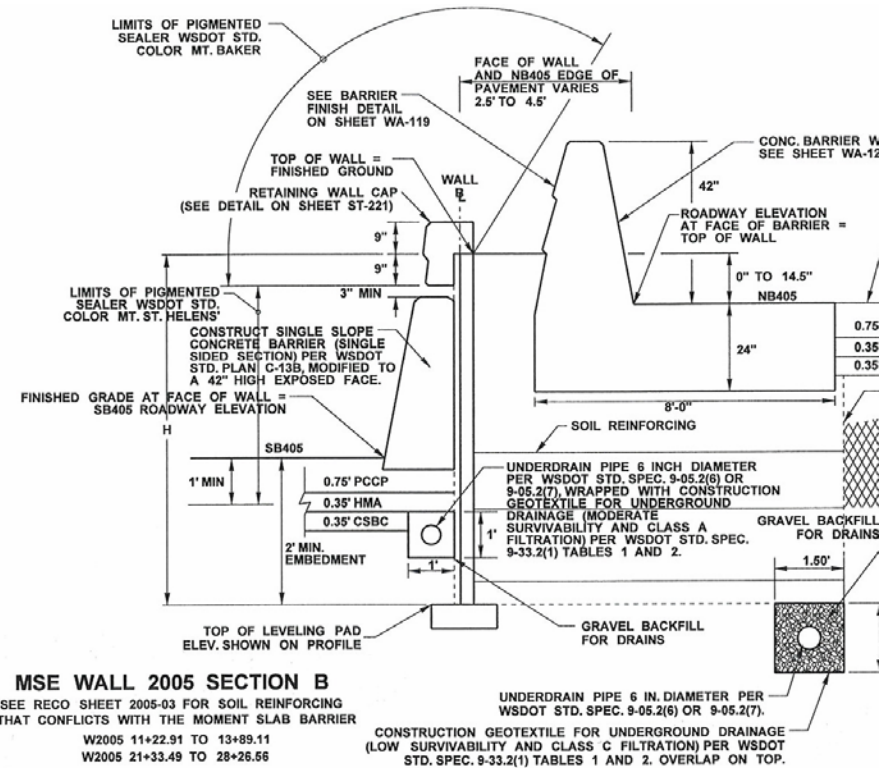
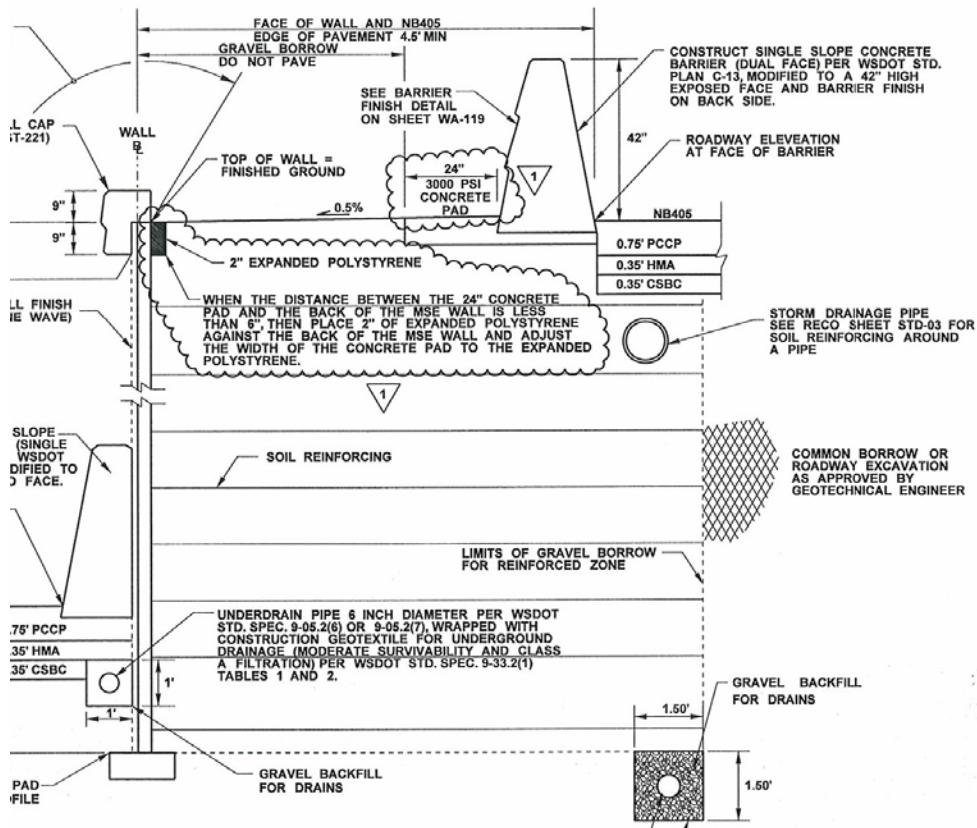
Example Issue #2 – Abutment Type

- **Engineer Lessons Learned –**
 - Brain storm alternative solutions with senior engineers and construction personnel
 - Design agreement through technical evaluation of alternative (pro's & con's) with senior Owner technical engineers
 - Recognize the design methodologies and specialization of MSE vendors for special designs
- **Owner Lessons Learned –**
 - Get the experts involved early
 - Look at all factors (design procedure, calculations, and constructability)
 - Stay conservative only where it matters
- **Contractor Lessons Learned –**
 - Vendors are not use to out of the box applications of their product – go through it slowly with them
 - Get the designers and vendors in the same room early

Example Issue #3 – Special Wall Design

- **Description:**

- **Challenge:** Minimize costly moment slab and extra paving on 2000 ft MSE wall



Example Issue #3 – Special Wall Design

- **Engineer Lessons Learned –**
 - Brain storm alternative solutions with senior engineers and construction personnel need to include construction sequencing
 - Trust is an important basis for technical evaluation support of ideas
 - Design agreement through technical evaluation of alternative (pro's & con's) with senior Owner technical engineers
- **Owner Lessons Learned –**
 - Realize the time it takes to re-invent a new wheel
 - Spend time early in “over-the-shoulder” review to get all the issues out
 - Understand code shortcomings
- **Contractor Lessons Learned –**
 - Be consistent with construction methods to reduce impact from learning curve
 - Manage temptation to design your way out of every problem
- **Resolution: Special wall design was accepted but it resulted in construction delays due to complex constructability**



Best Practices – Contractor Perspective

- 1. DO – Respect constructability reviews**
- 2. DO – Be consistent with construction methods to reduce impact from learning curve**
- 3. DO – Manage temptation to design your way out of every problem**
- 4. DO – Don't battle over every nickel**
- 5. DO – Know your vendor expertise and limitations**



Best Practices – Engineer Perspective

- 1. DO – Create a team that recognizes individual strengths**
- 2. DO – Take advantage of the Contractor’s knowledge during design**
- 3. DO – Detail for constructability** (tolerances / constraints / simplicity)
- 4. DO – Hold regular Over-The-Shoulder Reviews with the Owner** (established trust and expedited review process with minimal comments)
- 5. DO NOT - “Sharpen your pencil” too much**

Best Practices – Owner Perspective

- 1. DO – Establish conflict resolution procedures early**
- 2. DO – Spend time in “over-the-shoulder” reviews**
- 3. DO – Get the “experts” involved early**
- 4. DO – Be flexible in evaluation of design**
- 5. DO – Establish Correct Co-location parameters**



Closing Comments

Questions /
Additional
Comments ?