

# Remaking History

## The Hood Canal Bridge Project



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KPFF

# Remaking History: The Hood Canal Bridge

## Discussion Topics

- ◆ Introduction to Hood Canal
- ◆ Bridge History
- ◆ Project Overview
- ◆ Pontoon Construction
- ◆ Anchor Construction
- ◆ Pontoon Assembly
- ◆ Elevated Roadway
- ◆ Draw Span Outfitting
- ◆ Transition Spans
- ◆ A-frames
- ◆ Future Widening

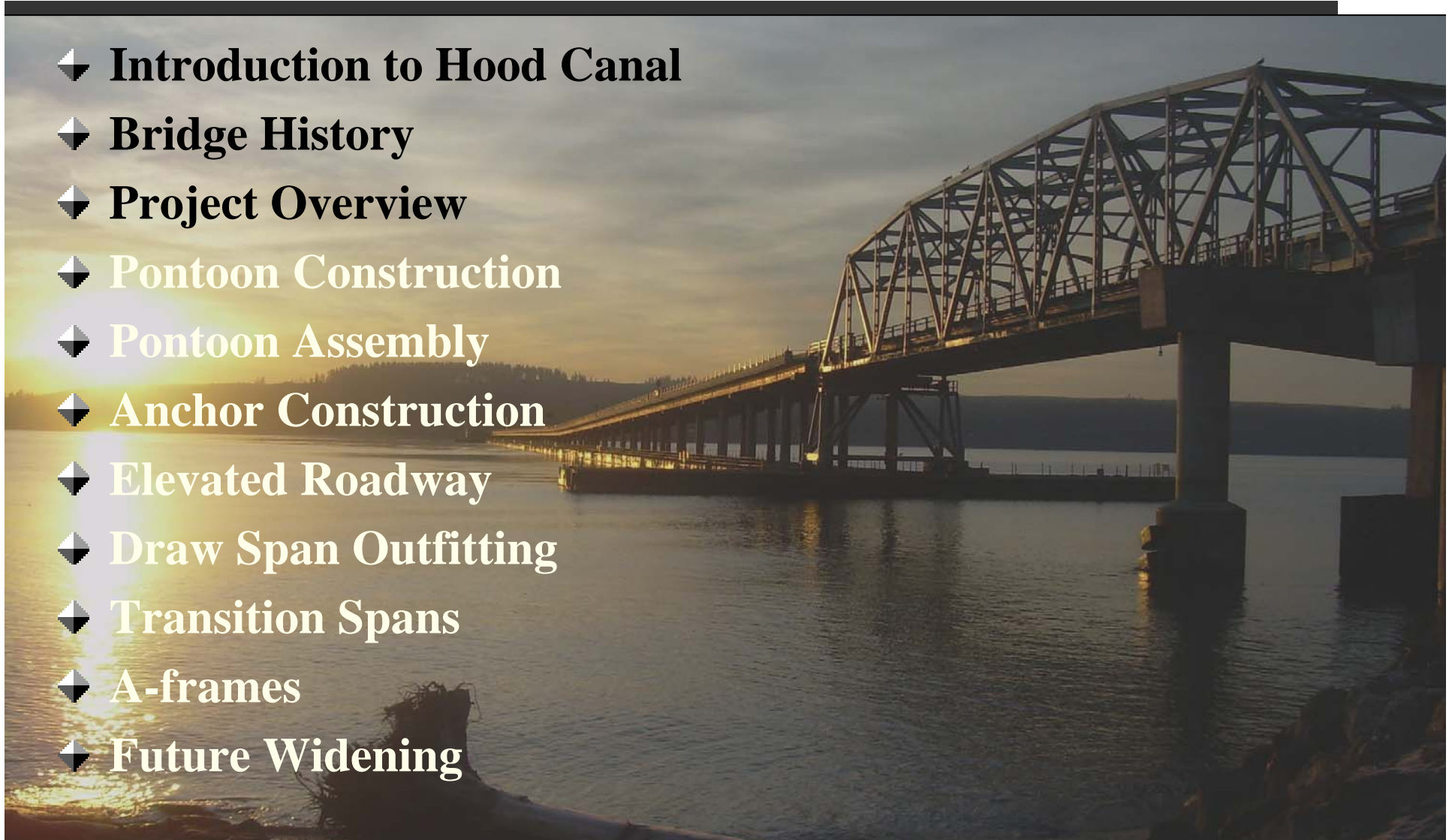




# Remaking History: The Hood Canal Bridge

Michelle Tragesser

- ◆ Introduction to Hood Canal
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Mark Gaines

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# Remaking History: The Hood Canal Bridge

Geoff Swett

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# Remaking History

## The Hood Canal Bridge Project





# Remaking History

## The Hood Canal Bridge Project



# Original Hood Canal Bridge

## Opened 1961





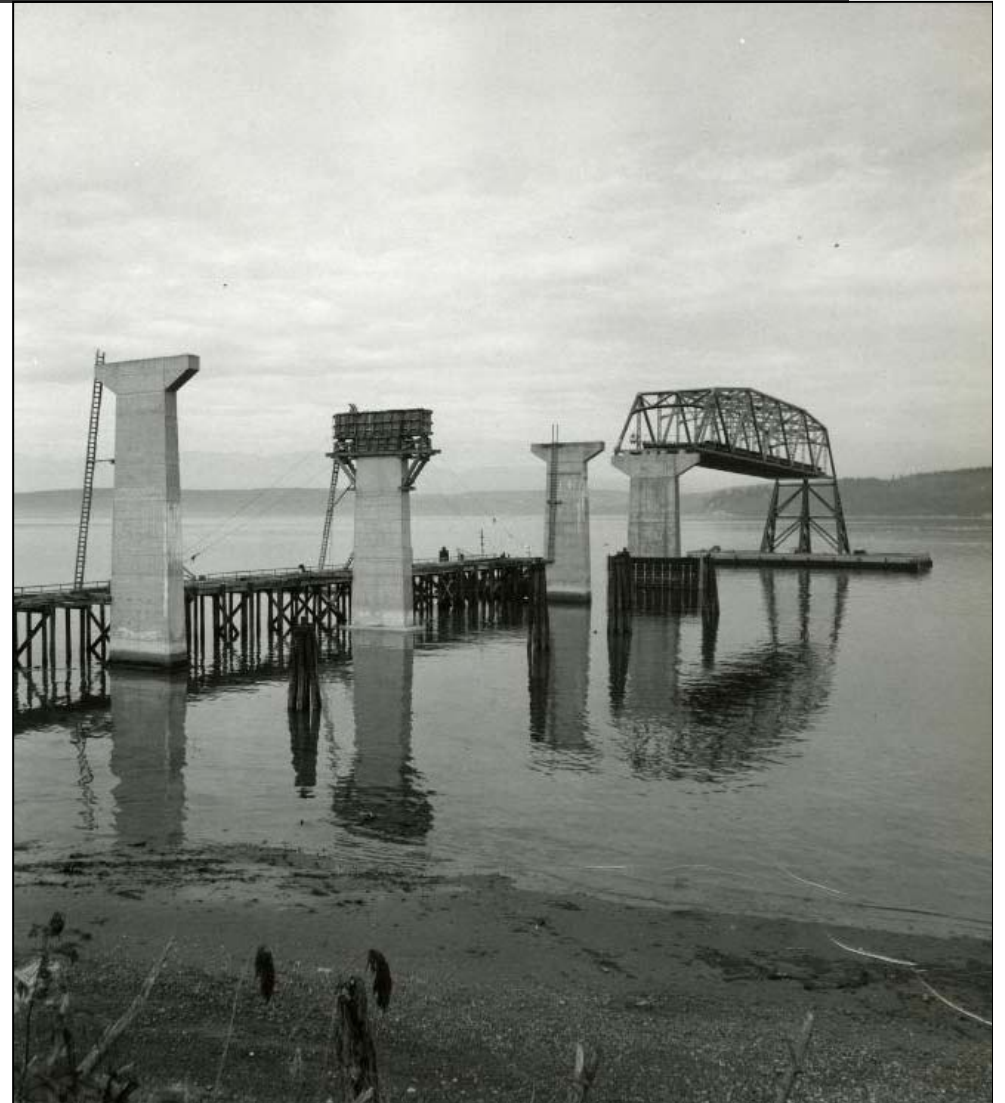
# Original Hood Canal Bridge

Opened 1961



# Original Hood Canal Bridge

Opened 1961





# Winter Storm: Gale Force Winds

February 13, 1979



# West-half Sinks

February 13, 1979





Hood Canal Bridge Project



# Storm Season

October 18, 2007



# West-half Sinks

February 13, 1979





# West-half Rebuilt

1980-1983





# West-half Rebuilt

## 1980-1983





# Hood Canal Bridge Project



Replace 190 foot west-half approach span

Replace 280 foot west-half transition span

Widen 2,967 feet of the west-half roadway

Widen 496 foot west-half draw span

Replace 3,503 feet of the east-half roadway

Replace 280 foot east-half transition span

Replace 640 foot east-half approach span

## Project Overview

2003-2005

2006-2009



# Project Overview

## Port Angeles Graving Dock (2003-2005)





# Project Overview

## Project Budget



<b>Original Commitments</b>	<b>\$206 million</b>
<b>Modified Commitments “Go Forward” Work</b>	<b>\$265 million</b>
<hr/>	
<b>Total Budget</b>	<b>\$471 million</b>
<b>Additional Costs</b>	<b>\$ 40 million</b>
<hr/>	
<b>Total Cost</b>	<b>\$511 million</b>



# Remaking History: The Hood Canal Bridge

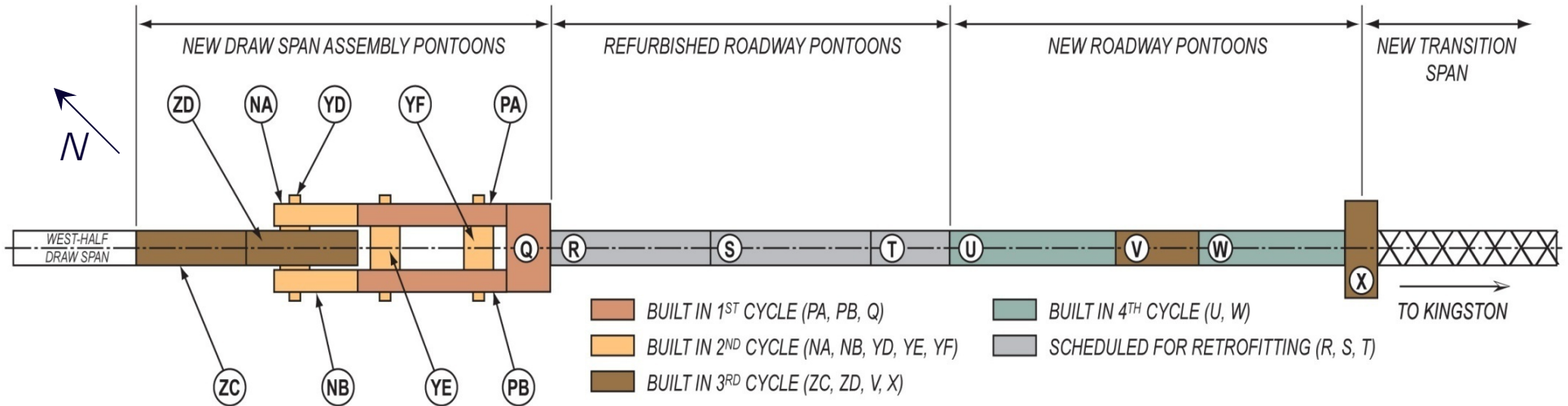
Mark Gaines

- 
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## Project Overview

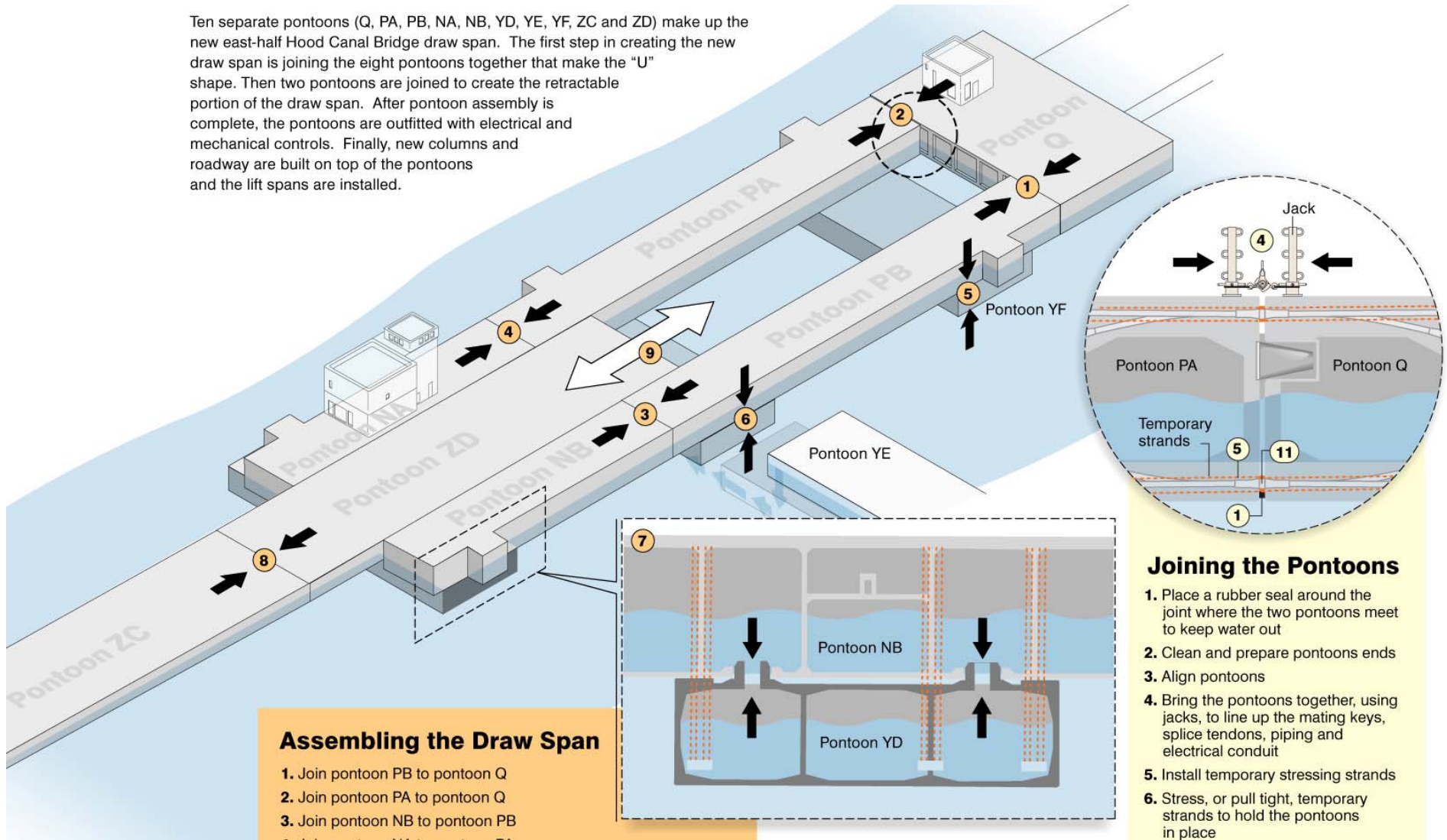
### East-half Floating Portion



## Project Overview

### Floating Draw Span

Ten separate pontoons (Q, PA, PB, NA, NB, YD, YE, YF, ZC and ZD) make up the new east-half Hood Canal Bridge draw span. The first step in creating the new draw span is joining the eight pontoons together that make the "U" shape. Then two pontoons are joined to create the retractable portion of the draw span. After pontoon assembly is complete, the pontoons are outfitted with electrical and mechanical controls. Finally, new columns and roadway are built on top of the pontoons and the lift spans are installed.



#### Assembling the Draw Span

1. Join pontoon PB to pontoon Q
2. Join pontoon PA to pontoon Q
3. Join pontoon NB to pontoon PB
4. Join pontoon NA to pontoon PA

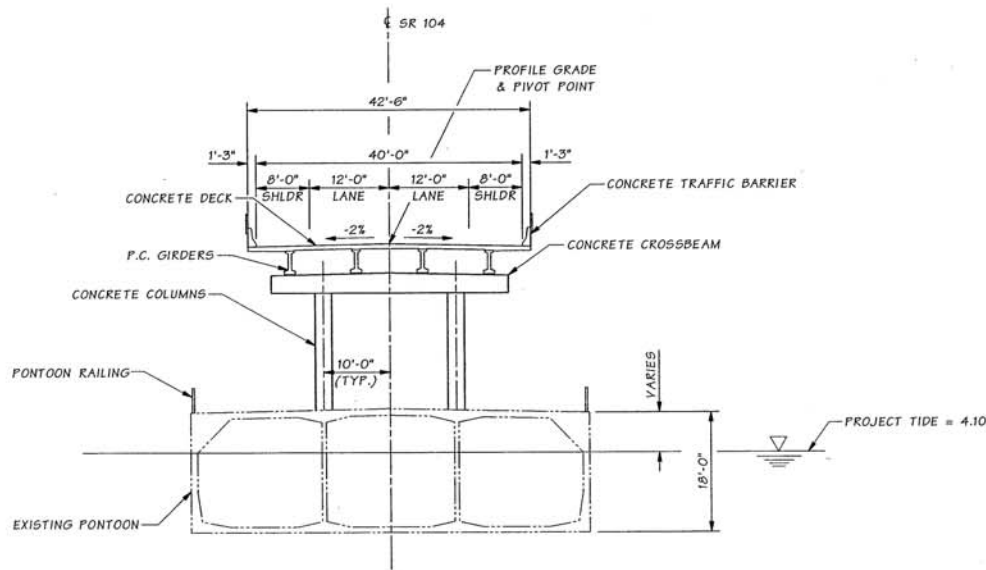
#### Joining the Pontoons

1. Place a rubber seal around the joint where the two pontoons meet to keep water out
2. Clean and prepare pontoons ends
3. Align pontoons
4. Bring the pontoons together, using jacks, to line up the mating keys, splice tendons, piping and electrical conduit
5. Install temporary stressing strands
6. Stress, or pull tight, temporary strands to hold the pontoons in place

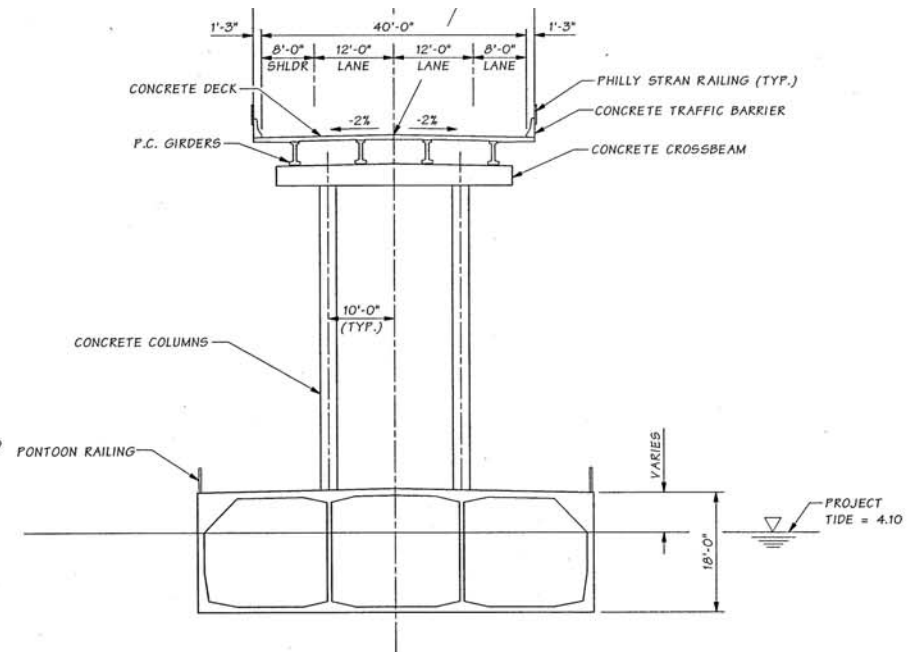


## Project Overview

### Roadway Pontoons



TYPICAL SECTION @ PONTOONS R, S & T



TYPICAL SECTION @ PONTOONS U & W



# New East-half Draw Span

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**Video**



# Pontoon Construction

## Lifting in Forms and Pre-Fabbed Components





# Pontoon Construction

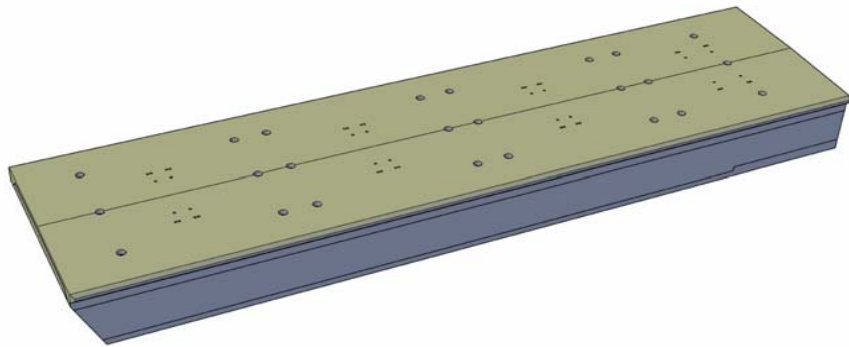
## Steel Reinforcement & Templating





# Pontoon Construction

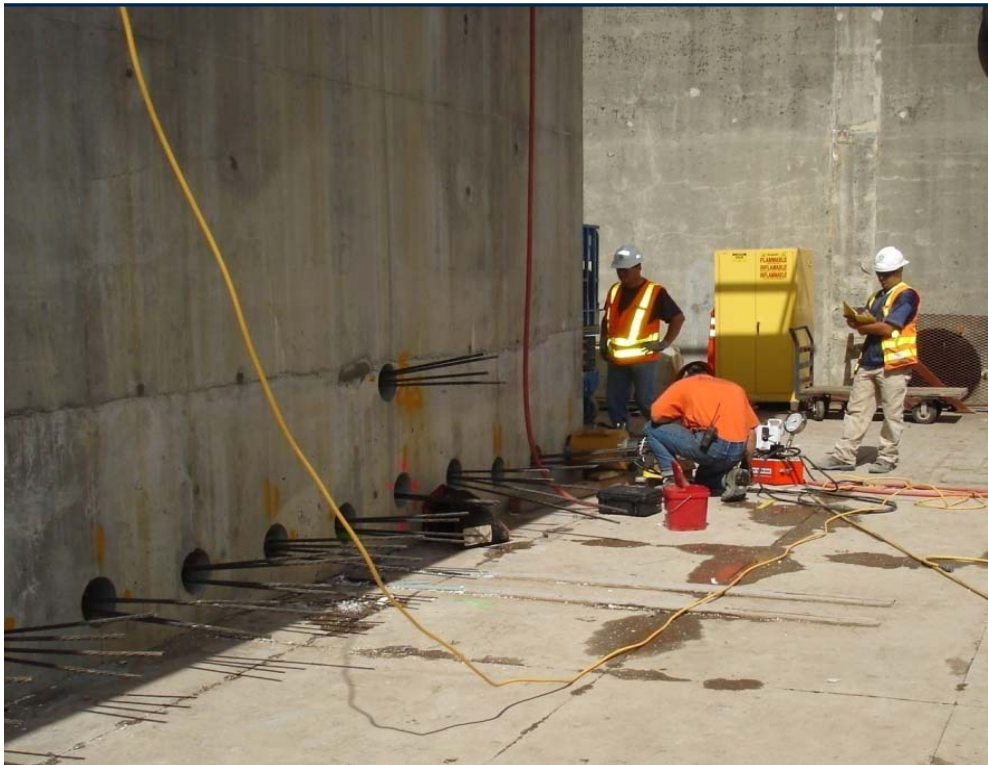
## Top Slab & Soffit Forms





## Pontoon Construction Post Tensioning

- Vertical Bar Tendons (1-3/8")
- Transverse Tendons (4 x 0.6")
- Longitudinal Tendons (19 x 0.6")





# Pontoon Construction

## Launch Preparation





# Anchor Construction

## Floating Dry Dock



Pour # 5:



Pour # 4:



Pour # 3:



Pour # 2:



Pour # 1:



# Anchor Construction

## Lower Wall and Hawse Pipe





## Anchor Construction Completed Anchors





# Anchor Construction

## Setting with DB Pacific in Summer 2007



# Anchor Cable System

## Anchor Gallery

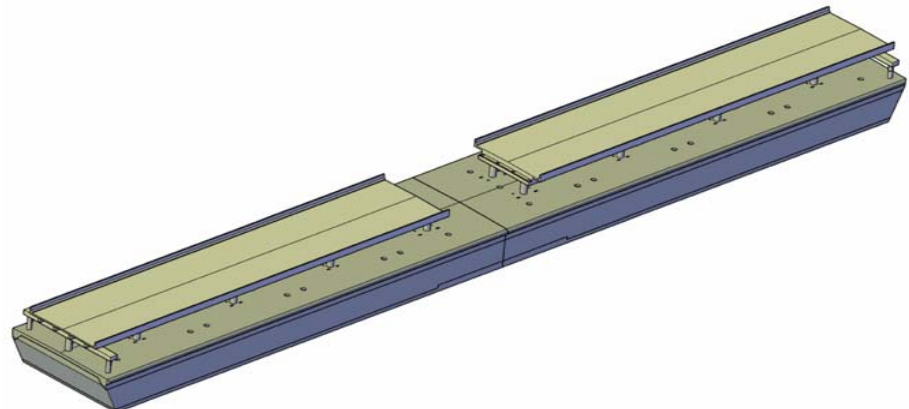






# Pontoon Assembly

## Vertical Joints



# Pontoon Construction

## Building the Superstructure





# East Draw Span Control Tower/Maintenance Shop



# East Draw Span

## Machinery Building, Lock Bar, & Idler Gear





# Float-In Closure

## Cutting Old East-Half

36"  $\phi$



# Float-In Closure

## Pontoon Removal





# Float-In Closure

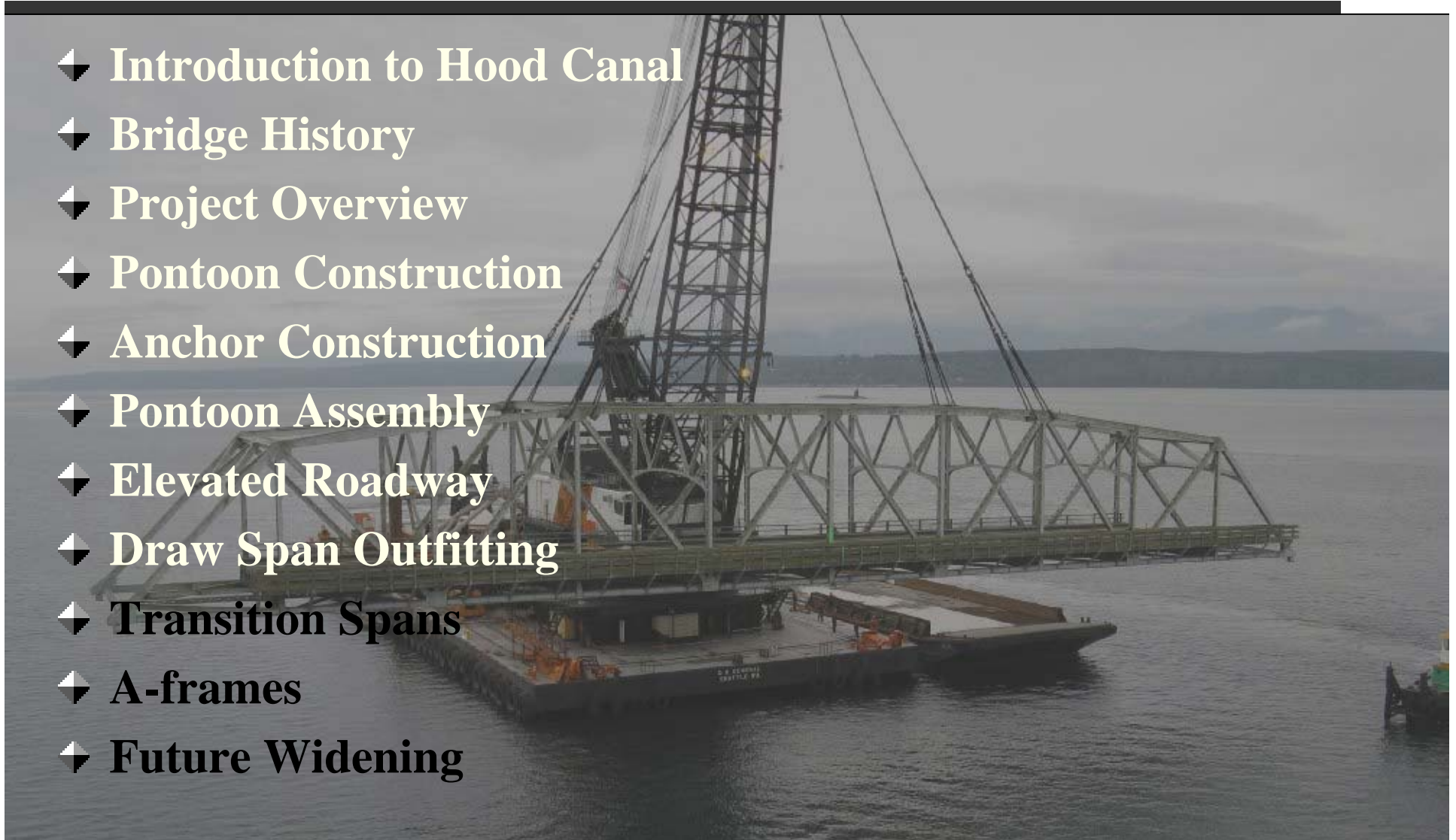
## Pontoon Installation



# Remaking History: The Hood Canal Bridge

Geoff Swett

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# Steel Fabrication

## Existing Transition Spans

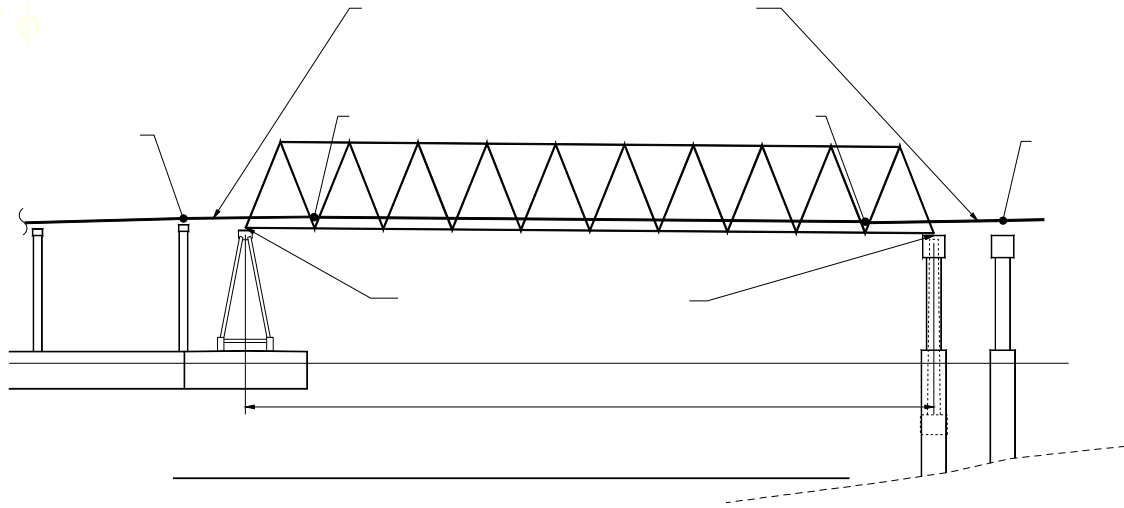


# Steel Fabrication

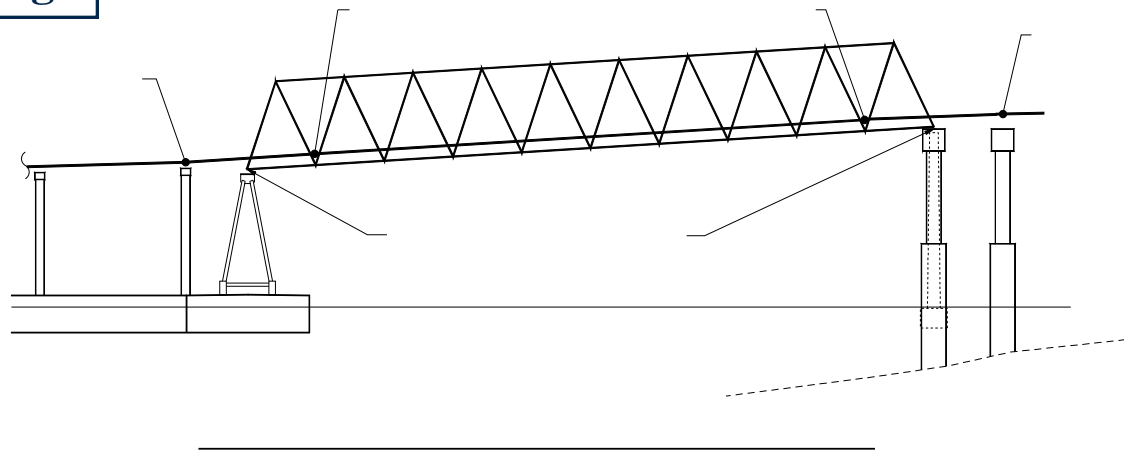
## Purpose of Transition Spans

36"  $\phi$

20"  $\phi$



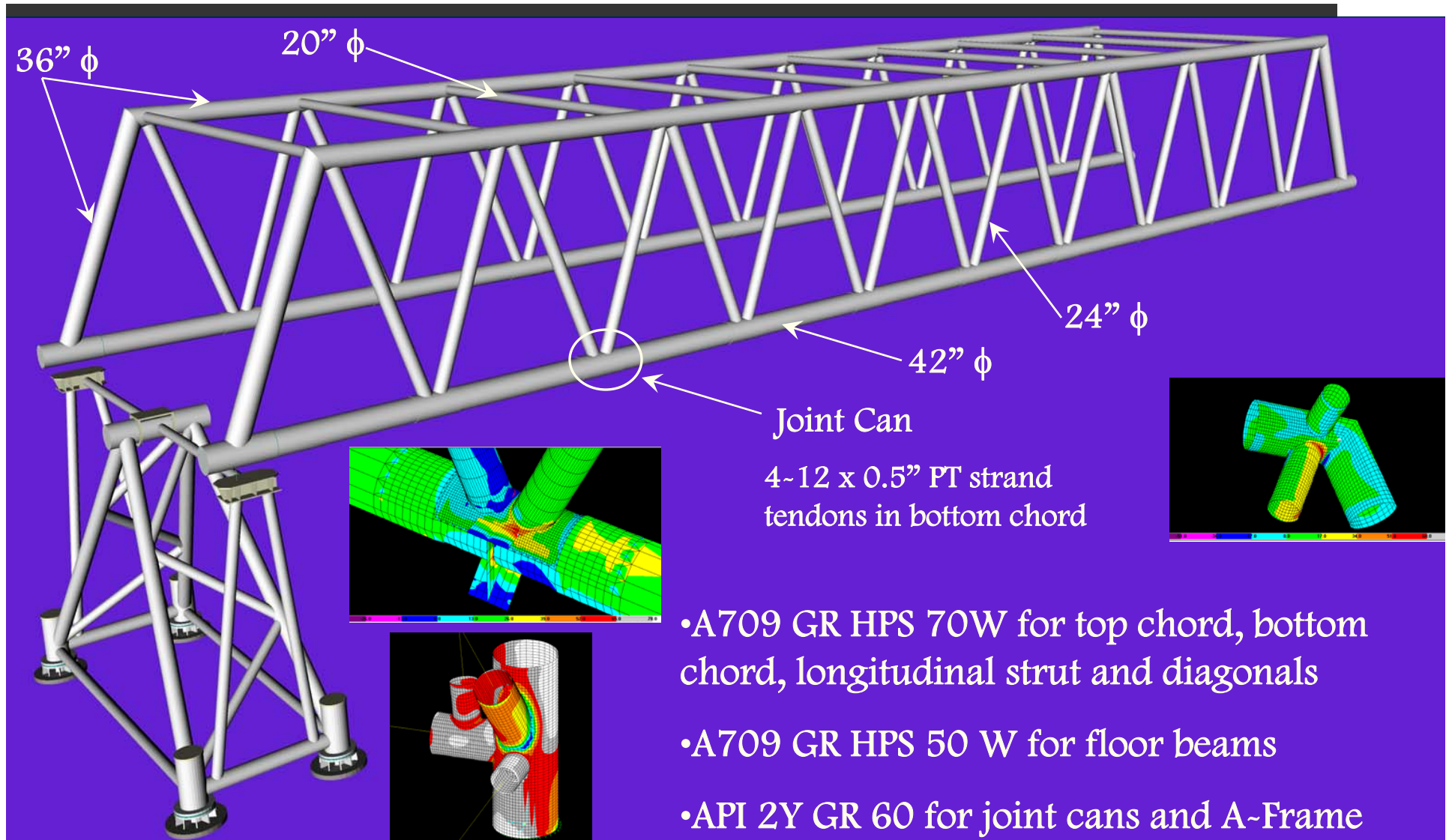
18.5' max tide change





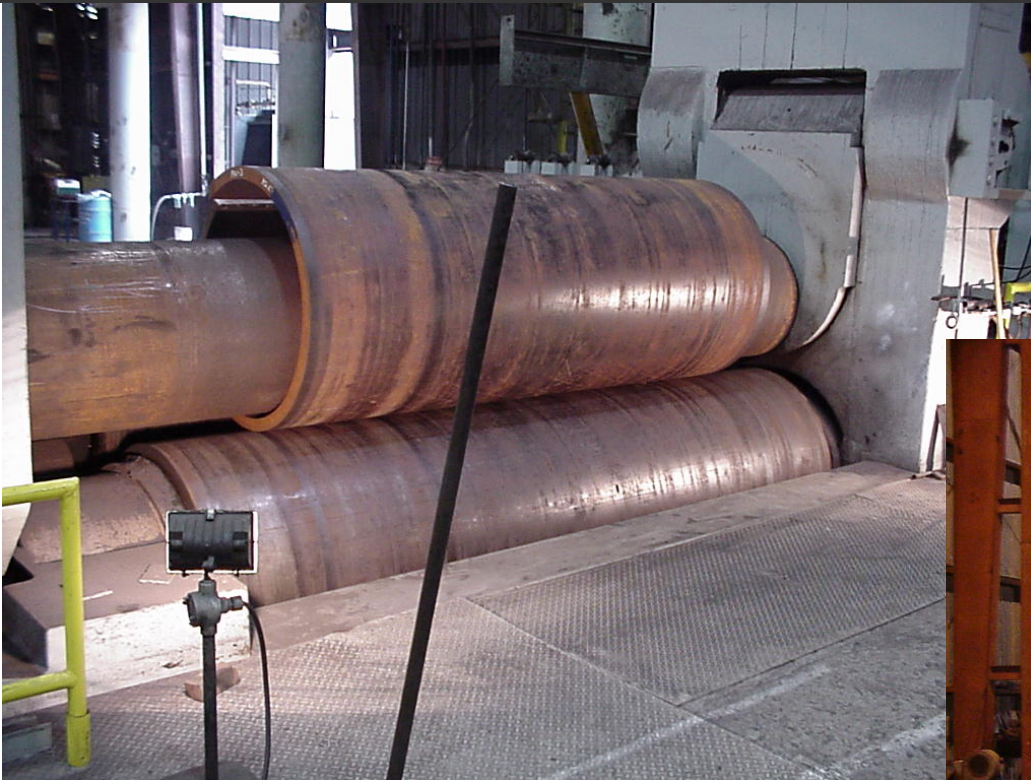
# Transition Spans

## DESIGN - Space Frame Truss & A-Frame



# Truss & A-frame Fabrication

## Rolled and Press Break Pipe



3000 ton press





# Truss Fabrication

## Fabrication of sub-assemblies and prep of T-Y-K Joints



# Truss Fabrication

## Drilling Floor Beam Connections



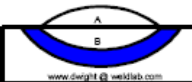


# Truss Fabrication

## Mock-Up Welds, NDE, & Destructive Testing



**DWIGHT COMPANY, Inc.**  
**WELDING LABORATORY SERVICE**  
 414 HEWITT RD, CHEHALIS, WASHINGTON, 98532 Voice: 360 - 262 - 9844, FAX : 360 - 262 - 9404



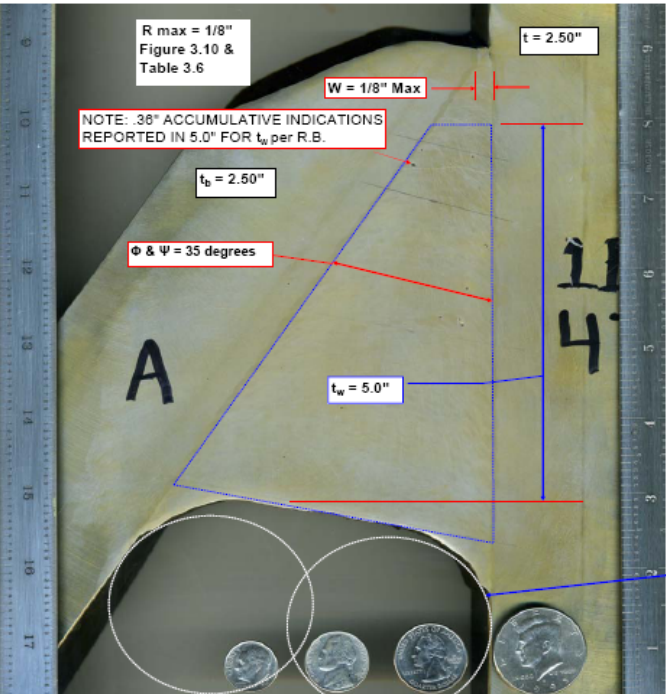
www.dwright@weldlab.com

**MAYES TESTING ENGR'S** October 2, 2007  
 917 134 th Street S.W. PO # e-mail  
 Suite A - 1  
 Everett, WA., 98204  
 ATTN: Mr. Mayes & Mr. G. Swett **Material:** Macro Test Mock-ups  
**Managers:** Geoff Swett @ Mike Mayes

### CERTIFIED TEST REPORT

MOCK-UP #1

MACRO PHOTO of POSITION 1B - SIDE A



**DETAIL D JOINT TYPE**

Evaluation Per  
 AWS D1.1 - 4.12.4.1 (3)

Acceptable = A  
 Unacceptable = U

a.	Cracks	A
b.	Fusion	A
c.	Weld Detail *	U
d.	Undercut	A
e.	Slag	A

\* See below for weld detail information per Figure 3.10 & Table 3.6.

**Groove Minimum Radius**  
 $t_b / 2 = 1.25"$  Required, See 1.25" radius disks for contour shape.

**Effective Throat ( $t_e$ )**  
 $t_w \Rightarrow 2 t_b$   
**Min. Groove ( $t_w$ ) = 5.0"**  
**Actual Groove ( $t_w$ ) = 5.7"**

Recommend bead contour or fill to meet 1mm max wire diameter check.

$\Phi$  = phi = weld joint included angle.  
 $\Psi$  = psi = tube wall local dihedral angle.

# Truss & A-frame Fabrication

## Assembly of Truss and A-frames





# Truss Fabrication

## Lifting Trusses



## Truss Fabrication Diagonal and Longitudinal Struts





# Truss Fabrication

Truss Completed – transported using SPMT



## Transition Spans Truss Move and Mooring

36"  $\phi$





# Transition Spans

## Removal of Existing A-frames and Trusses

36



# Transition Spans

## Pick and set A-Frames





# Transition Spans

## Truss Pick

36"  $\phi$

**DB Bremerton & DB LA  
(160 ton pick each)**

**DB General  
(480 ton pick)**



Hood Canal Bridge Project

**Transition Spans**  
**Truss Pick**





# Steel Fabrication

## New Transition Spans – Final Product

36" d



# Future Widening To 4 Lanes





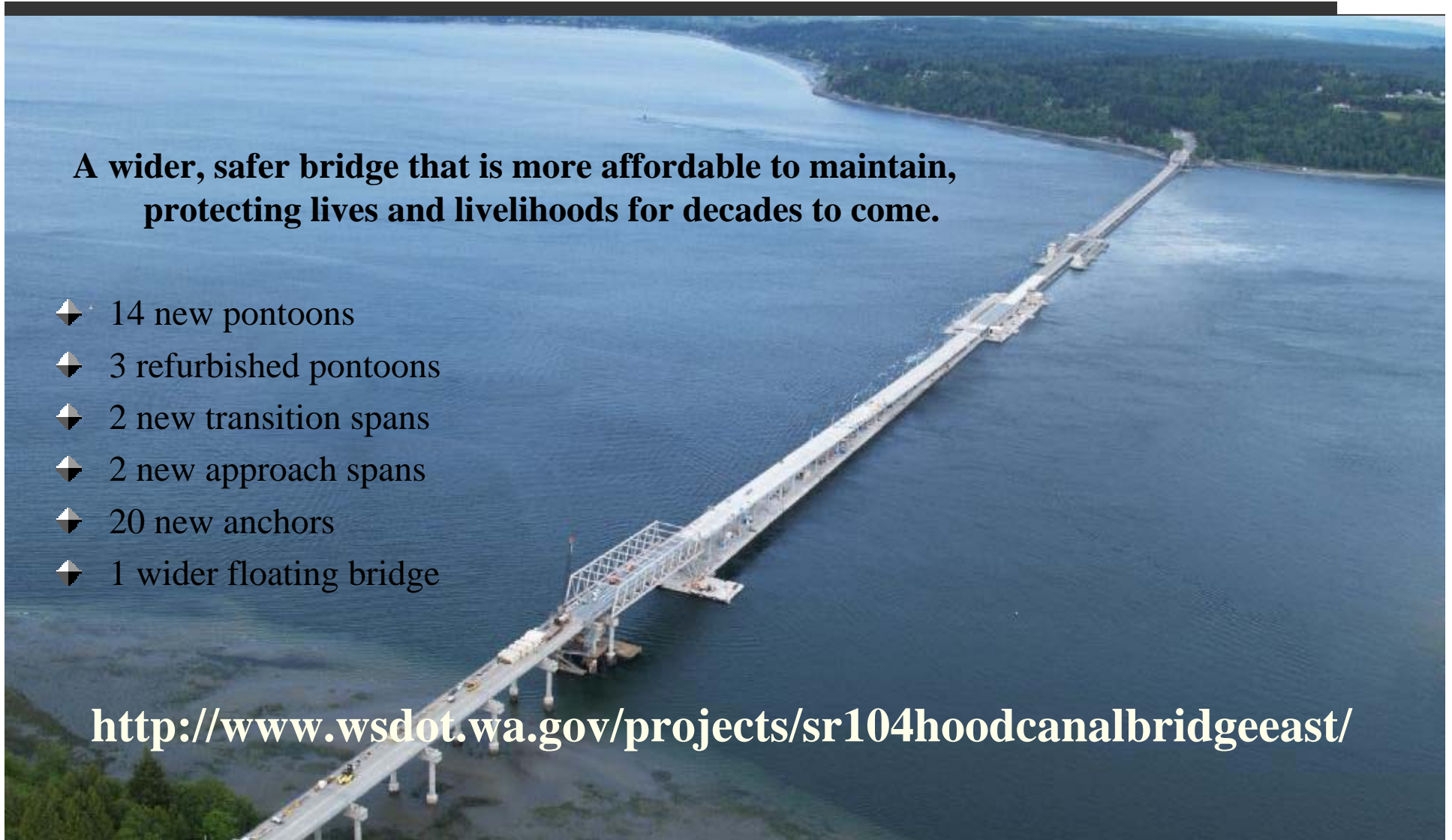
# The Hood Canal Bridge

## East Half Replacement

**A wider, safer bridge that is more affordable to maintain,  
protecting lives and livelihoods for decades to come.**

- ◆ 14 new pontoons
- ◆ 3 refurbished pontoons
- ◆ 2 new transition spans
- ◆ 2 new approach spans
- ◆ 20 new anchors
- ◆ 1 wider floating bridge

<http://www.wsdot.wa.gov/projects/sr104hoodcanalbridgeeast/>



# The Hood Canal Bridge Project Team

Thank You



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