

OREGON DEPARTMENT OF TRANSPORTATION

HYDRAULIC DESIGN DEVIATION REQUEST

Section:	Pudding River (Whiskey Hill Road) Bridge #01559	Route No:	C.R. 42036
Highway Name:	Whiskey Hill Road	Hwy. No:	N/A
County:	Clackamas & Marion	Milepost:	2.6
Region:	1 & 2	Key No:	17408
Bridge #	01559	EA No:	

PROJECT DATA

Design Frequency	50 Year	Design Precipitation		Design Flow	32,600 cfs
Design Life	75 Years	Current ADT (2007)	1750	Design ADT	2700 (2029)
DAP Date (Final)	08/08/13	Bid Date	12/2014		

HYDRAULIC DESIGN DEVIATIONS

Documentation (Reference Ch. 4)	Culverts (Reference Ch. 9)	Bridges (Reference Ch. 10)	Energy Dissipators (Reference Ch. 11)
<input type="checkbox"/> Reduce documentation requirements	<input type="checkbox"/> Replacement "in-kind" (replace w/calculations) <input type="checkbox"/> Reduce design storm <input type="checkbox"/> Reduce barrel material design life (ref. Ch. 15) <input type="checkbox"/> Exceed allowable headwater <input type="checkbox"/> Use or remove tidegate	<input checked="" type="checkbox"/> Reduce opening clearance <input type="checkbox"/> Reduce design storm	<input type="checkbox"/> Reduce design storm <input type="checkbox"/> Eliminate protection <input type="checkbox"/> Reduce protection

Storage Facilities (Reference Ch. 12)	Storm Drainage (Reference Ch. 13)	Water Quality (Reference water quality tech. bulletin)	Bank Protection (Reference Ch. 15)
<input type="checkbox"/> Reduce Freeboard <input type="checkbox"/> Eliminate Soil Amendment <input type="checkbox"/> Reduce design storm	<input type="checkbox"/> Exceed water spread on pavement <input type="checkbox"/> Allow pressure flow- storm drains <input type="checkbox"/> Reduce design storm	<input type="checkbox"/> Reduce freeboard <input type="checkbox"/> Eliminate Soil Amendment <input type="checkbox"/> Reduce design storm	<input type="checkbox"/> Reduce design storm <input type="checkbox"/> Eliminate protection <input type="checkbox"/> Reduce protection

Other
<input type="checkbox"/> Use an experimental or new technology or material
<input type="checkbox"/>

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Description of Hydraulic Design Exception:		
For the proposed bridge, it is desired to provide 1 foot vertical clearance from the bottom of the bridge to the design surface water during the design flood and 3 feet of clearance if the stream is subject to heavy debris flows. The 50 year design storm for this location results in a water surface elevation of 117.1. The following bottom of beam elevations do not provide the desired minimum clearance:		
Bent 1	Girder B	Elev. 117.33
	Girder C	Elev. 116.15
	Girder D	Elev. 114.87
Bent 2	Girder D	Elev. 117.99
Bent 5	Girder D	Elev. 117.87
Description of Project:		
The Pudding River (Whiskey Hill Road) Bridge #1559 is located on the county line of Whiskey Hill Road in Marion and Clackamas Counties, approximately 0.4 miles to the west of the Meridian Road intersection, and near the City of Hubbard. Whiskey Hill Road is a rural major collector per ODOT functional class mapping connecting OR 99E to the west and Barlow Road, Canby-Marquam Highway, and OR 213 to the east.		
The bridge, built in 1931, is rapidly deteriorating with cracking and spalling throughout. There are also patches of exposed rebar and scour related issues. Inspectors have deemed the bridge as structurally deficient with critical scour and have rated the deck as intolerable, giving the bridge an overall sufficiency rating of 4.5.		
The new Pudding River (Whiskey Hill Road) bridge is a four-span steel plate girder structure spanning the Pudding River, slightly south of the existing bridge. The new bridge will improve the alignment, minimize scour concerns, and provide two (2) 12-foot lanes and two (2) 8-foot shoulders. The travel lanes will be striped so the final outside shoulder will be 6 feet and the inside shoulder will be 10 feet to improve sight distance on the inside of the curve alignment.		
Location of Feature:		
Bent 1, 2, and 5 of new crossing of the Pudding River		
Hydraulic/Hydrologic History:		
It is anticipated that flooding from the Pudding River may encroach onto the Whiskey Hill Road with incipient overtopping flow that has a recurrence interval of approximately 33 years and a high water elevation 116.3 at the upstream face of the bridge. This is approximately the elevation of the existing inside edge of pavement on the westerly approach at the low point of the sag vertical curve. The 50-year design flood is at elevation 117.1. The proposed west and east approach roadway profile is about elevation 117.3 and 118.7, respectively. The replacement structure has been designed to avoid additional backwater during the 100-year base flood. This has been achieved by balancing an increase in both the bridge length and hydraulic opening with a reduction in conveyance of floodwaters that currently overtop the roadway. For the 100-year flood, water will overtop the road by as much as 2.3 feet on the west approach and about 0.9 feet on the east approach. See attached 3-line profile for additional information.		

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Reasons for Not Attaining Standard:
<ul style="list-style-type: none"> The west approach to the bridge would need to be raised 3.23 feet to provide the 1 foot minimum requirement. Overall, the design of the replacement bridge provides 2.3 ft. of freeboard at the crest of the vertical curve to allow for debris passage. The increased length and opening of the new bridge will improve the conveyance of flood water and resulting in a no net-rise for the backwater elevation. The backwater elevation is expected to reduce from 2.05 ft. from the existing bridge to 1.52 ft. for the new bridge meeting the 50-year design flood It would require a much longer continuous structure to offset the loss of conveyance of floodwaters that would otherwise overtop the roadway in order to achieve a no-rise condition during the 100-year base flood. This would also necessitate replacement of the existing overflow structure immediately to the west. The planning level estimated cost to replace the overflow structure is approximately \$2 million. The following is a breakdown of this cost: <ul style="list-style-type: none"> Overflow Bridge – 105 ft x 42.75 ft x \$200/sf = \$897,750 Additional Bridge Length of Proposed Bridge – 20 ft x 42.75 ft x \$400/sf = \$342,000 Retaining walls at road approach to minimize EFU impacts – 2 walls x 150 ft x 5 ft x \$40/sf = \$60,000 Roadway items = \$100,000 Contingencies at 20% = \$279,950 Design/redesign = \$400,000 Furthermore, the existing overflow bridge is approximately 105 feet long. The bridge length cannot be increased to provide additional conveyance of the Pudding River because it is adjacent to private property (zone exclusive farm use). Additional conveyance is required to offset raising the elevation of the road approaches in the floodplain to meet the increased bridge elevation. Therefore, the length of the proposed bridge would need to be increased to provide adequate conveyance of the river. In conversations with adjacent property owners, the owners are supportive of the project but very concerned about river/hydraulic impacts to their properties with the potential changes in the overflow pattern. In summary, the proposed roadway and bridge elevations provide the best balance within this section of the Pudding River floodplain. The proposed design will essentially maintain the current condition for overtopping of the Whiskey Hill Road on the west approach to the bridge. The frequency of overtopping will be slightly increased to a 35-year recurrence interval from the existing of 33 year recurrence interval.

Effect on Other Standards:
Substandard sag vertical curves have been incorporated on either end of the new bridge to provide maximum roadway overtopping area to help achieve a no-rise condition.
Compatibility with Adjacent Sections:
Other sections of Whiskey Hill Road are not subject to flooding as is this section. This is a localized flooding issue not affecting adjacent sections.
Probable Time before Reconstruction:
Unknown at this time, anticipate only preservation type work on this road for the foreseeable future.
Mitigation for Design Deviation Included in the Design:
Slope armoring up to the abutments is included on both ends of the bridge to minimize scour near the bridge abutments. The abutments are founded on concrete drilled shafts to be further protected from scour concerns.
Supporting Documentation:

**OREGON DEPARTMENT OF TRANSPORTATION
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Attachments:

- ☐ Plan sheet 3
- ☐ 3-Line Profile of Proposed Roadway

**OREGON DEPARTMENT OF TRANSPORTATION
HYDRAULIC DESIGN DEVIATION REQUEST**

Signatures:

Prepared by:

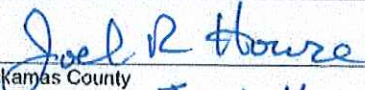

(Engineer of Record)

Date:

4.23.14

Print Name:	Lwin Hwee	Phone:	503-499-0222
Company name:	David Evans & Associates, Inc.		
Company Address:	2100 SW River Parkway		
City:	Portland	ST:	OR
		Zip:	97201

Concurred by:


Clackamas County

Date:

4-24-14

(Print Name)

Joel Howie, Civil Engineering Supervisor

Concurred by:

(Region Hydraulic Engineer)

Date:

(Print Name)

Concurred by:

(Geo-Enviro. Senior Hydraulics Eng. or Senior Bridge Hydraulics Eng.)

Date:

(Print Name)

Approved by:


(State Bridge Engineer or Geo-Environmental Section Manager)

Date:

4.28.14

(Print Name)

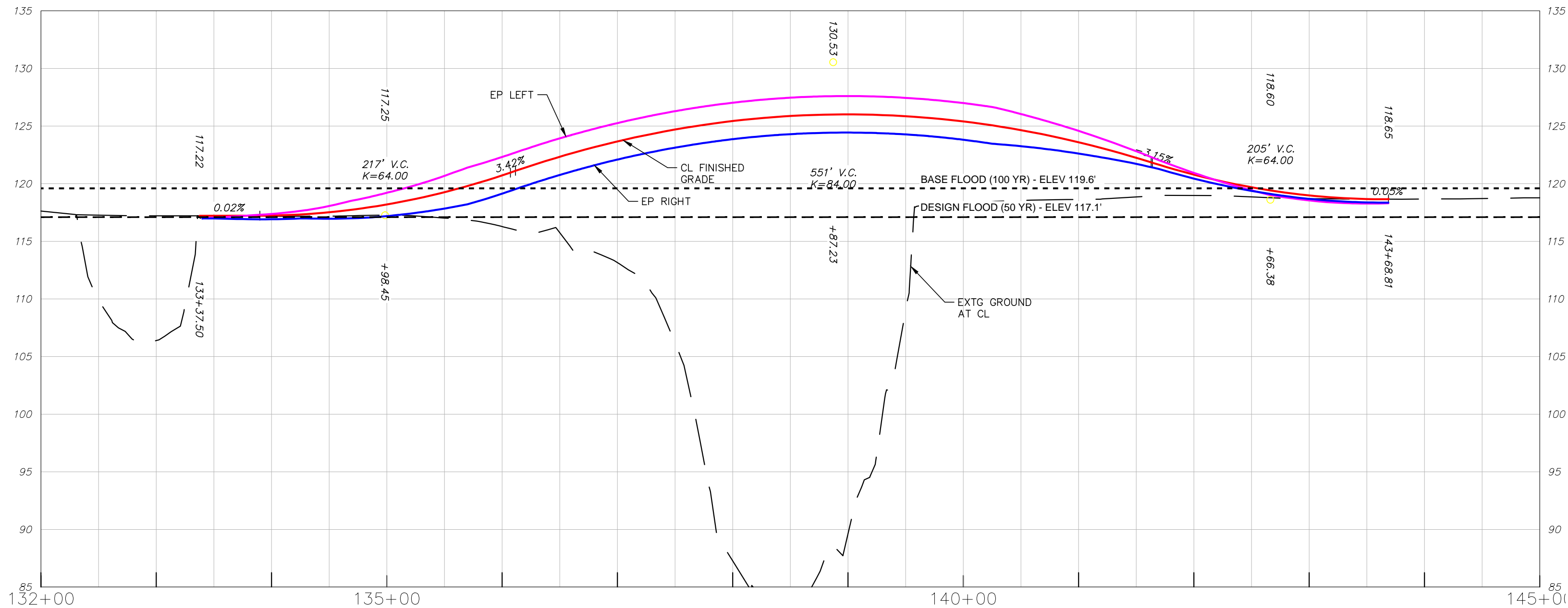
Bruce Johnson, State Bridge Engineer

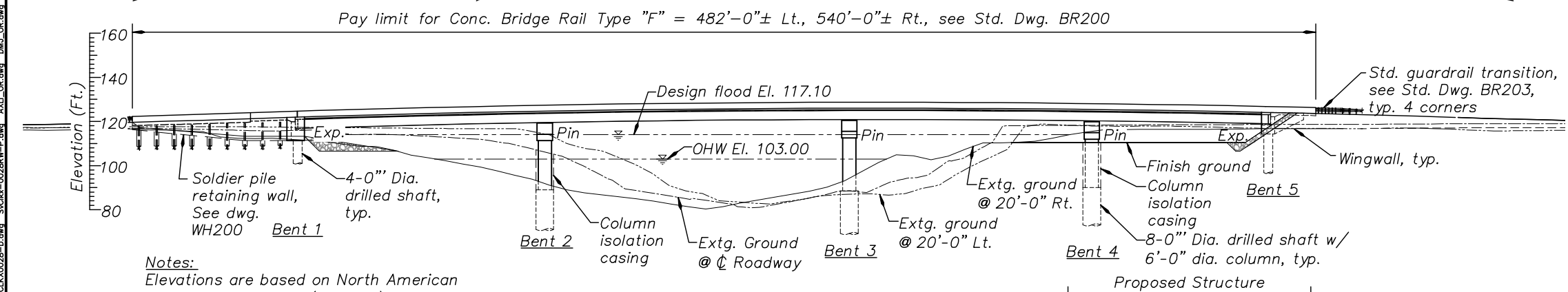
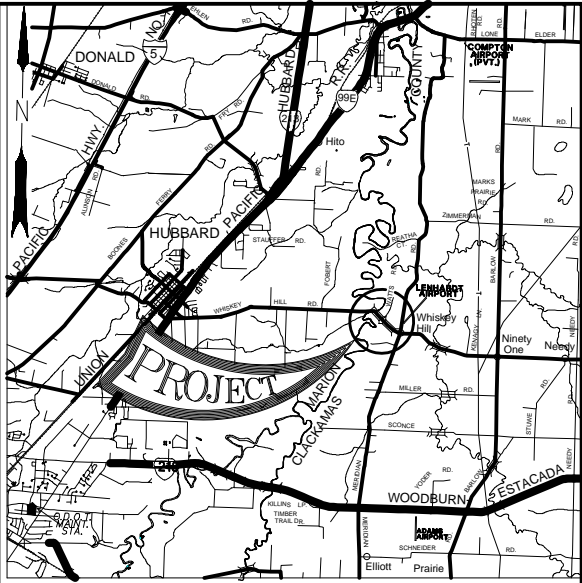
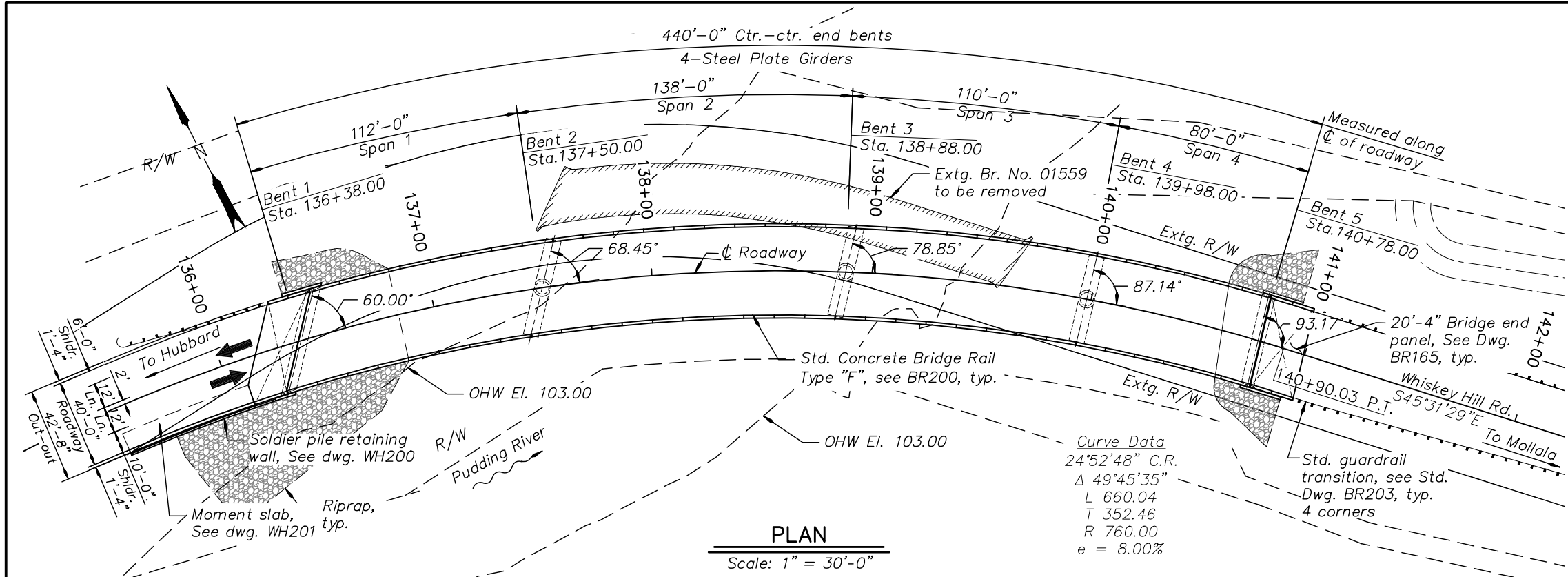
PREPARED BY:



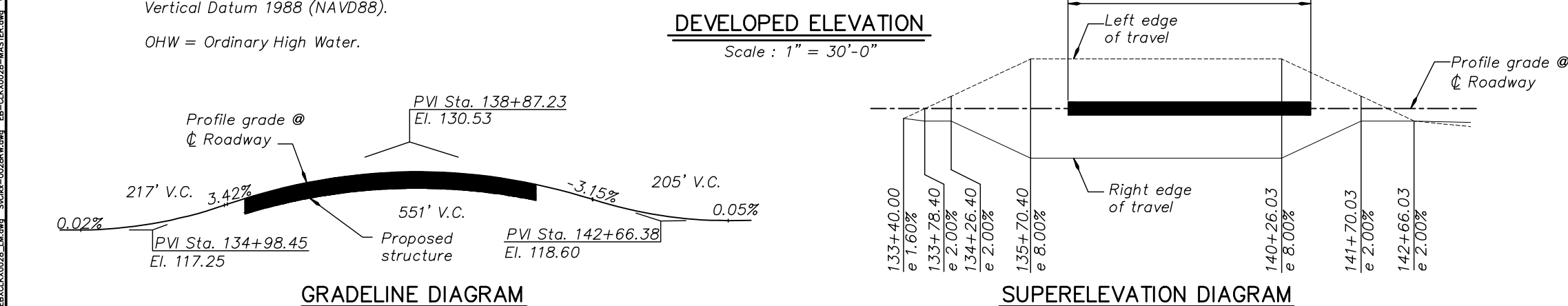
Expires 6.30.15

WHISKEY HILL 3-LINE PROFILE

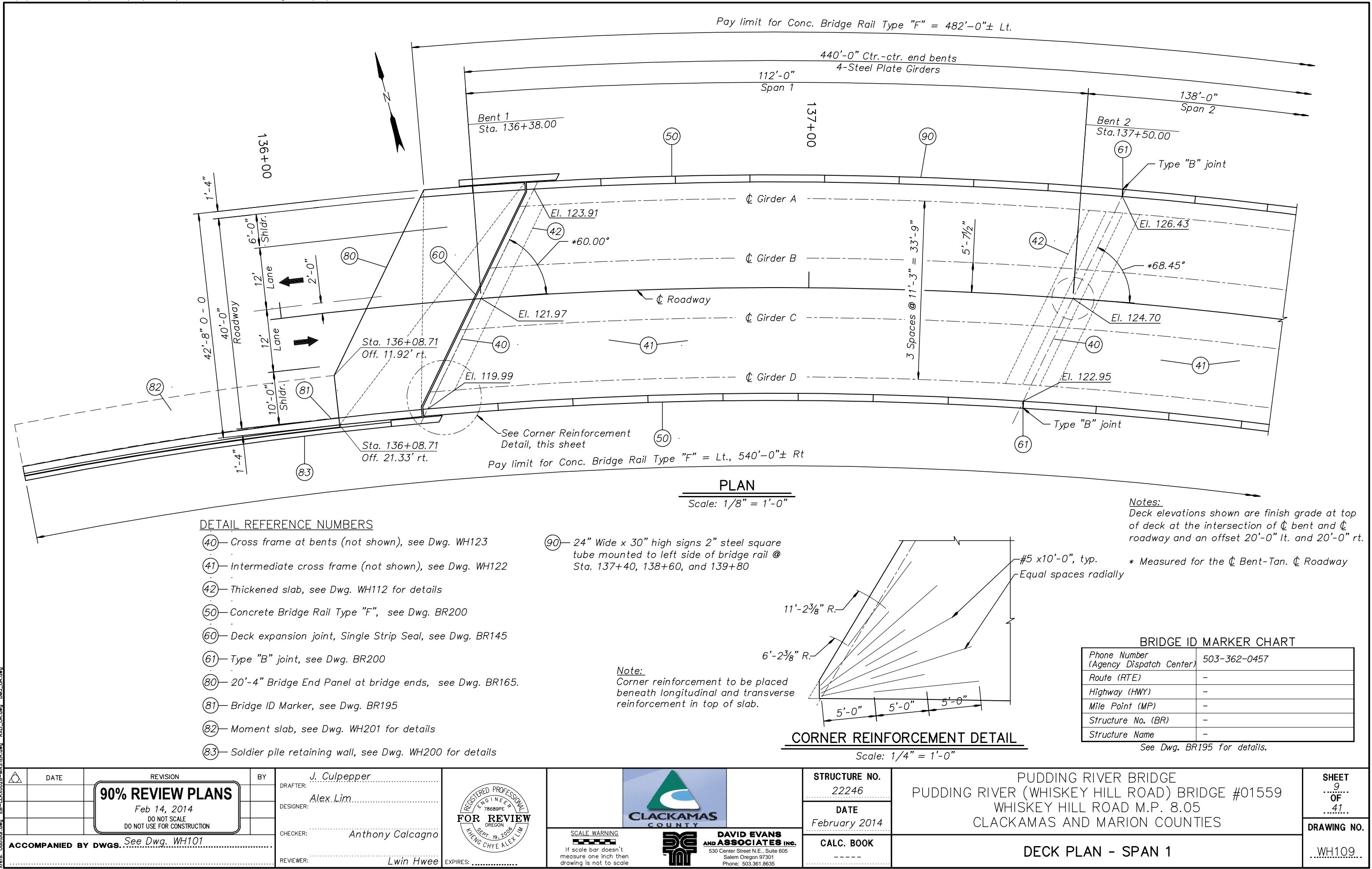


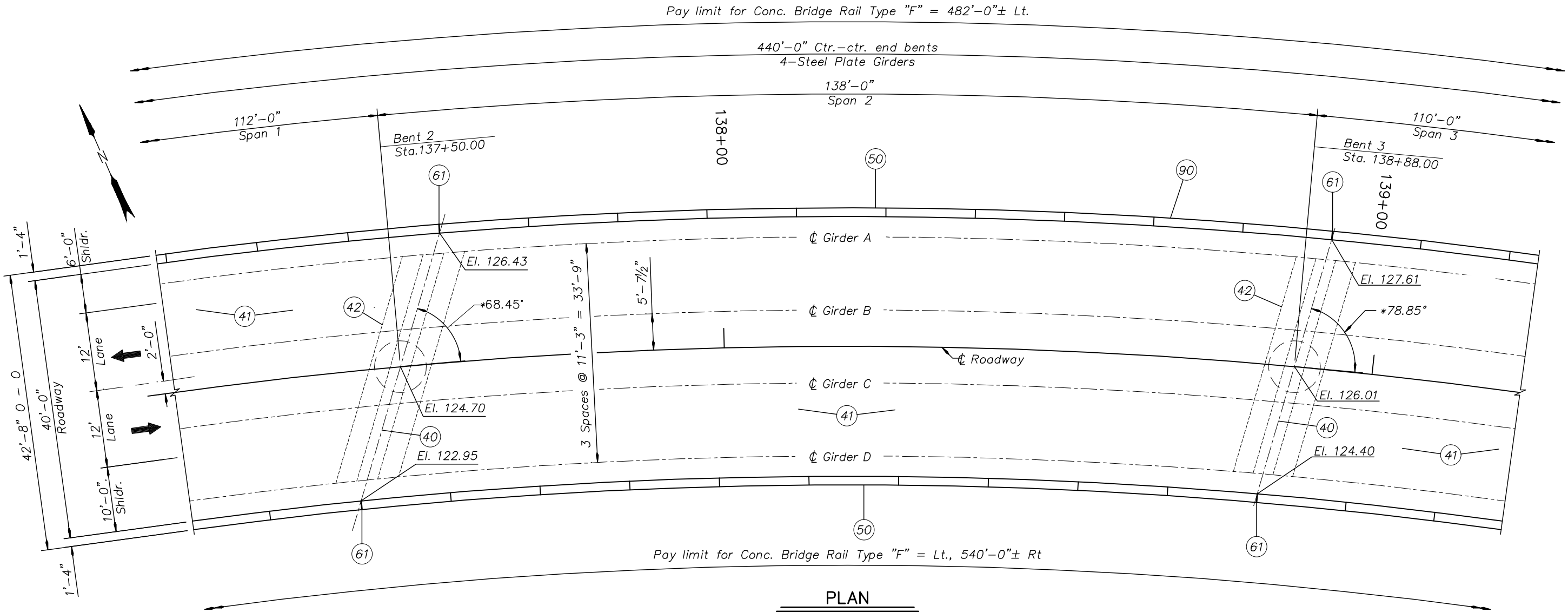


HYDRAULIC DATA				
ITEMS	UNIT	DESIGN FLOOD	BASE FLOOD	INCIPIENT OVERTOPPING
DISCHARGE	ft. ³ /s	32,600	43,520	28,750
RECURRENCE INTERVAL	yrs.	50	100	35
HIGH WATER ELEVATION AT UPSTREAM FACE OF BRIDGE ALONG EMBANKMENT	ft.	117.1	119.6	116.3
BACKWATER	ft.	1.5	1.7	1.3
SCOUR ELEVATION	ft.	N/A	N/A	63.1



	DATE	REVISION	BY	J. Culpepper DRAFTER: Alex Lim DESIGNER: Anthony Calcagno CHECKER: Lwin Hwee REVIEWER:				STRUCTURE NO. 22246	PUDDING RIVER BRIDGE PUDDING RIVER (WHISKEY HILL ROAD) BRIDGE #01559 WHISKEY HILL ROAD M.P. 8.05 CLACKAMAS AND MARION COUNTIES	SHEET 1 OF 41
								DATE February 2014		DRAWING NO.
								CALC. BOOK		
ACCOMPANIED BY DWGS. WH102 - WH201 BR145, BR165, BR200, And BR203								PLAN AND ELEVATION	WH101	




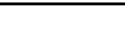



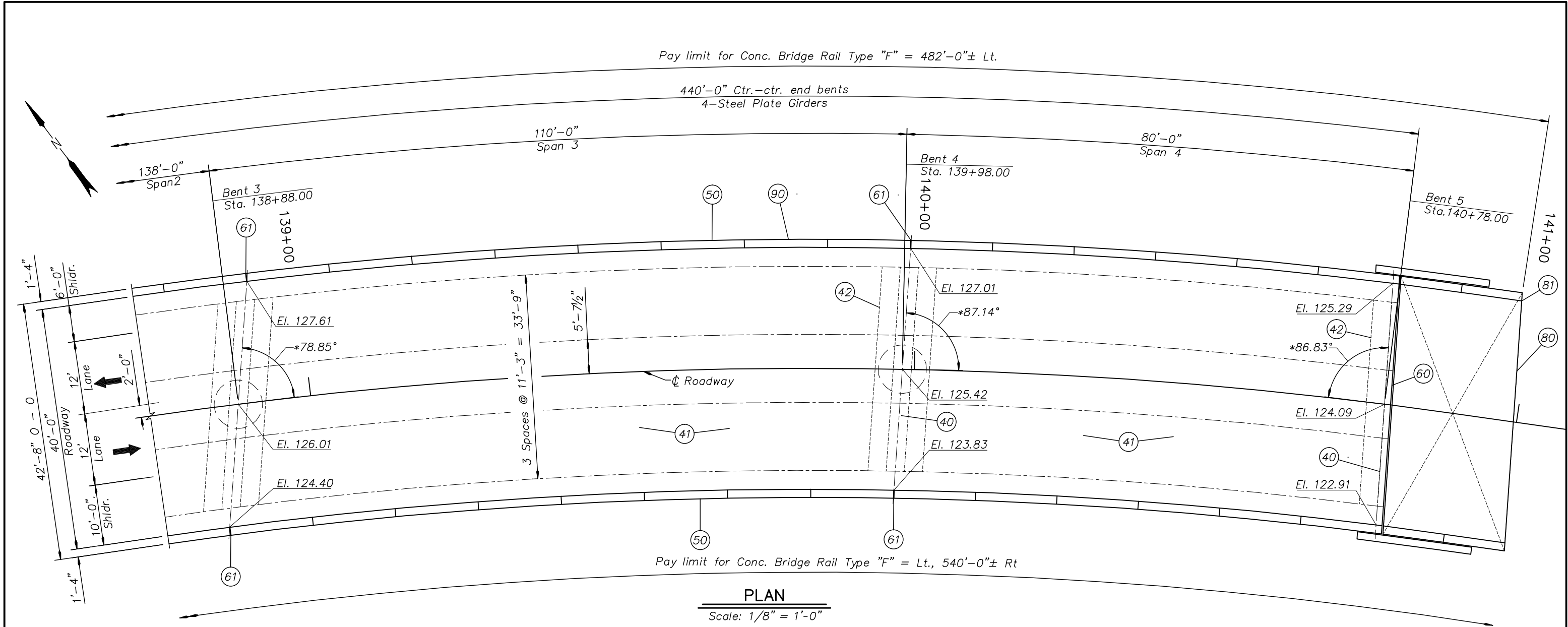


Note:
See Dwg. WH109 for Detail Reference Numbers.

Deck elevations shown are finish grade at top of deck at the intersection of ϕ bent and ϕ roadway and an offset 20'-0" lt. and 20'-0" rt.

* Measured for the ϕ Bent-Tan. ϕ Roadway

	DATE	REVISION	BY	J. Culpepper					STRUCTURE NO.	PUDDING RIVER BRIDGE PUDDING RIVER (WHISKEY HILL ROAD) BRIDGE #01559 WHISKEY HILL ROAD M.P. 8.05 CLACKAMAS AND MARION COUNTIES			SHEET
		90% REVIEW PLANS Feb 14, 2014 DO NOT SCALE DO NOT USE FOR CONSTRUCTION		Alex Lim					22246				10 OF 41
				Anthony Calcagno					DATE				DRAWING NO.
				Lwin Hwee					February 2014				WH110
ACCOMPANIED BY DWGS. See Dwg. WH101				REVIEWER:		EXPIRES:		DAVID EVANS AND ASSOCIATES INC. 530 Center Street N.E., Suite 605 Salem Oregon 97301 Phone: 503.361.8635		DECK PLAN - SPAN 2			
								SCALE WARNING  If scale bar doesn't measure one inch then drawing is not to scale					CALC. BOOK

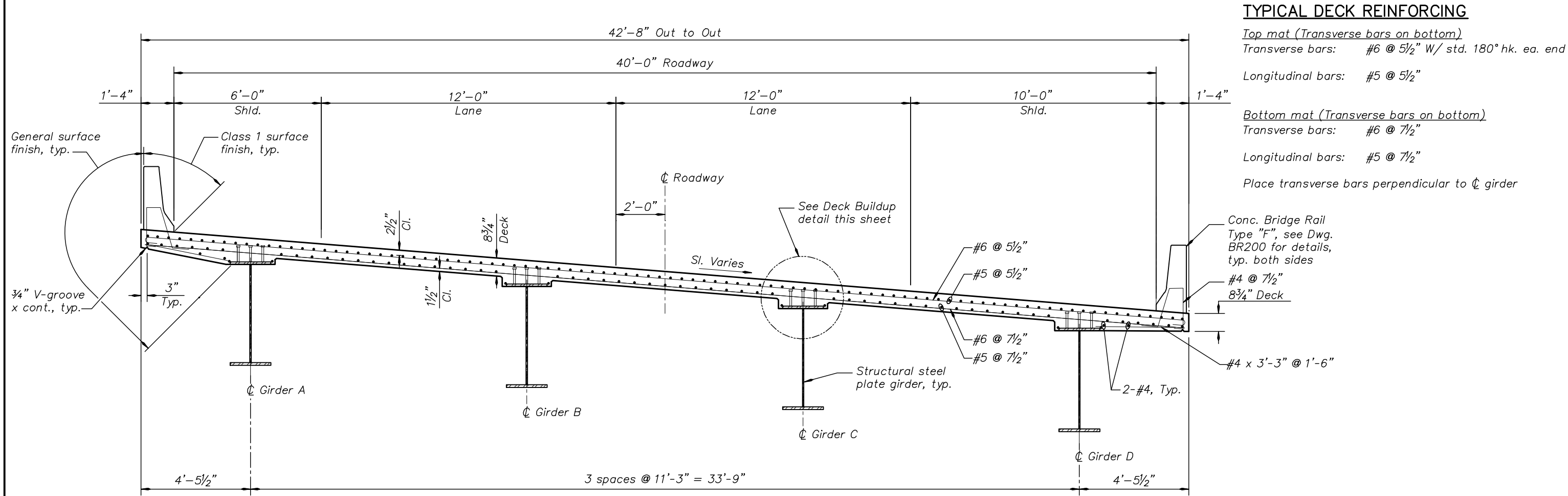


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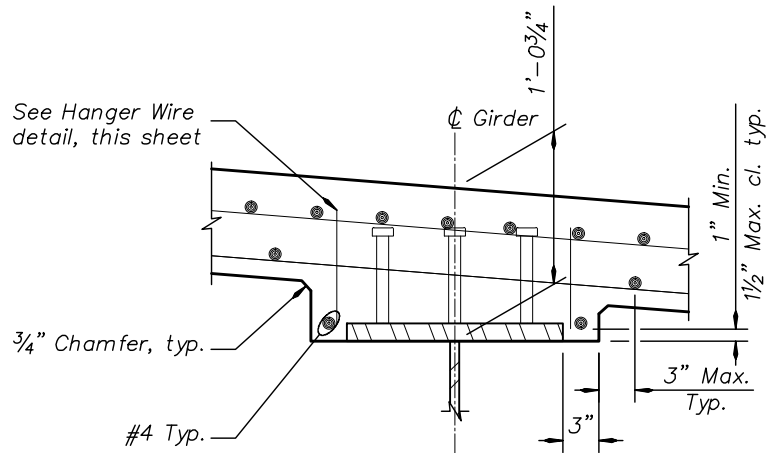
* Measured for the ∇ Bent-Tan. ∇ Roadway

	DATE	REVISION	BY	DRAFTER: J. Culpepper		STRUCTURE NO. 22246	PUDDING RIVER BRIDGE PUDDING RIVER (WHISKEY HILL ROAD) BRIDGE #01559 WHISKEY HILL ROAD M.P. 8.05 CLACKAMAS AND MARION COUNTIES	SHEET 11 OF 41
		90% REVIEW PLANS Feb 14, 2014 DO NOT SCALE DO NOT USE FOR CONSTRUCTION		DESIGNER: Alex Lim		DATE February 2014		
ACCOMPANIED BY DWGS. See Dwg. WH101				CHECKER: Anthony Calcagno		CALC. BOOK ----	DECK PLAN - SPAN 3 AND 4	DRAWING NO. WH111
				REVIEWER: Lwin Hwee				



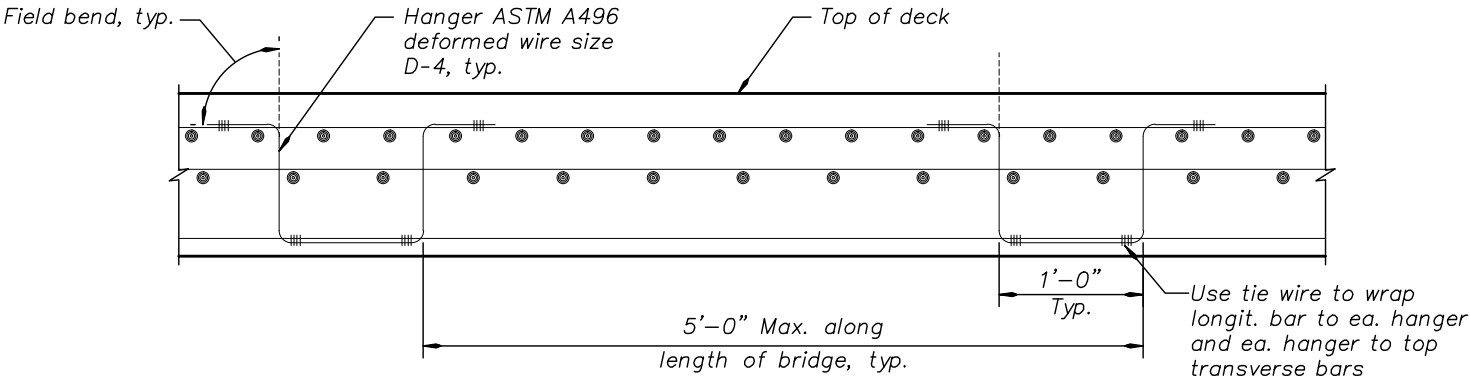
TYPICAL DECK SECTION

Scale: 1/2" = 1'-0"



DECK BUILDUP

Scale: 1 1/2" = 1'-0"



HANGER WIRE DETAIL

Scale: 1 1/2" = 1'-0"

	DATE	<div>REVISION</div> <div>90% REVIEW PLANS</div> <div>Feb 14, 2014</div> <div>DO NOT SCALE</div> <div>DO NOT USE FOR CONSTRUCTION</div>	BY	J. Culpepper DRAFTER: Alex Lim DESIGNER: Anthony Calcagno CHECKER: Lwin Hwee REVIEWER:		 DAVID EVANS AND ASSOCIATES INC. 530 Center Street N.E., Suite 605 Salem Oregon 97301 Phone: 503.361.8635	STRUCTURE NO. 22246 DATE February 2014 CALC. BOOK ----	PUDDING RIVER BRIDGE PUDDING RIVER (WHISKEY HILL ROAD) BRIDGE #01559 WHISKEY HILL ROAD M.P. 8.05 CLACKAMAS AND MARION COUNTIES TYPICAL DECK SECTION	SHEET 13 OF 41 DRAWING NO. WH113
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