

2021 OREGON STANDARD DRAWINGS

Standard Distribution
Date of Issue: January 2023

William Lee Woods, PE
Senior Standards Engineer

This is the January 2023 release of the 2021 Oregon Standard Drawings.

For ODOT Projects the details in the standard drawings will be effective on the **June 1, 2023** bid opening where these drawings are called for in the project plans.

These drawings are for use with projects using the **2021 Oregon Standard Specifications**.

You will notice an “effective date” on the lower right bottom of each Standard Drawing. The bid opening date of a project should be in the effective date window of the drawings. This will ensure the correct drawings are being used on the projects.

Electronic PDF files with the effective date for each drawing are on the Web site at:

<http://www.oregon.gov/ODOT/Engineering/Pages/Standards.aspx>

The Standard Drawing Baseline Reports for the drawings contain useful information for the designer as well as updates that occur on the drawing. The link to the report is the title of the specific drawing on the webpage.

These Standard Drawings are the ones that have updates:

Drawing Number	Comment
RD322	
RD324	
RD325	
RD326	
RD327	
RD328	
RD339	
RD345	
RD352	
RD354	
RD406	
RD435	
RD502	Title Change
RD515	
RD516	

Drawing Number	Comment
RD545	
RD546	
BR200	
BR203	
BR206	
BR207	
BR208	
BR216	
BR220	
BR221	
BR222	
BR290	
BR291	
TM466	
TM521	
TM651	
TM656	
TM855	New Drawing

OREGON STANDARD DRAWINGS 2021

NUMBERS AND REVISION DATES

DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE
-------------------	------------------	-------------------	------------------	-------------------	------------------

RD100	
RD101	
RD110	
RD115	
RD120	
RD130	
RD140	
RD150	
RD160	
RD170	01/2021
RD250	
RD254	
RD255	
RD258	
RD262	
RD266	
RD270	
RD274	
RD278	
RD282	
RD286	
RD300	
RD302	
RD304	
RD306	
RD308	
RD310	
RD312	
RD316	
RD317	07/2022
RD318	
RD319	
RD320	
RD321	
RD322	01/2023
RD324	01/2023
RD325	01/2023
RD326	01/2023
RD327	01/2023
RD328	01/2023
RD330	
RD332	
RD334	
RD335	
RD336	
RD338	
RD339	01/2023
RD340	
RD342	
RD343	

RD344	
RD345	01/2023
RD346	
RD348	
RD350	
RD352	01/2023
RD354	01/2023
RD356	07/2022
RD358	
RD360	
RD362	
RD363	
RD364	
RD365	
RD366	
RD367	
RD368	
RD370	
RD371	
RD372	
RD373	
RD374	
RD376	
RD378	
RD380	
RD382	
RD384	
RD386	07/2022
RD388	
RD390	
RD391	
RD393	
RD398	07/2021
RD399	
RD400	
RD401	
RD402	07/2021
RD403	07/2021
RD404	07/2021
RD405	
RD406	01/2023
RD407	07/2021
RD408	
RD409	
RD410	
RD412	
RD415	
RD416	
RD417	
RD419	07/2021

RD420	07/2021
RD421	
RD435	01/2023
RD436	
RD437	
RD438	
RD440	
RD442	01/2022
RD443	
RD444	
RD445	
RD450	
RD451	
RD470	
RD471	
RD481	
RD482	
RD500	01/2022
RD501	07/2021
RD502	01/2023
RD503	01/2022
RD505	
RD510	01/2022
RD515	01/2023
RD516	01/2023
RD520	
RD526	07/2022
RD530	01/2022
RD535	07/2022
RD536	07/2022
RD545	01/2023
RD546	01/2023
RD550	
RD560	01/2022
RD570	01/2022
RD575	07/2022
RD576	07/2022
RD580	
RD581	
RD590	
RD595	07/2022
RD596	07/2022
RD602	
RD610	
RD615	07/2021
RD700	
RD701	
RD702	01/2022
RD705	
RD706	

OREGON STANDARD DRAWINGS 2021 NUMBERS AND REVISION DATES

DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE
-------------------	------------------	-------------------	------------------	-------------------	------------------

RD707	
RD710	01/2022
RD711	01/2022
RD715	
RD720	
RD721	
RD722	07/2022
RD725	
RD730	
RD735	
RD740	
RD745	07/2021
RD750	
RD770	
RD771	
RD780	07/2021
RD781	07/2021
RD782	07/2021
RD810	
RD815	
RD820	
RD825	
RD830	01/2021
RD832	
RD835	
RD840	
RD845	
RD900	01/2022
RD901	09/2021
RD902	07/2021
RD904	
RD905	01/2022
RD906	
RD908	07/2022
RD909	01/2022
RD910	01/2022
RD912	01/2022
RD913	01/2022
RD916	
RD920	01/2022
RD922	
RD930	01/2022
RD932	
RD936	01/2022
RD938	07/2021
RD940	07/2021
RD950	
RD952	07/2021
RD960	07/2021
RD1000	01/2022

RD1005	01/2021
RD1006	01/2021
RD1010	01/2021
RD1015	01/2021
RD1030	01/2021
RD1031	01/2021
RD1032	01/2021
RD1033	01/2021
RD1040	01/2021
RD1045	01/2021
RD1050	01/2021
RD1055	01/2021
RD1060	01/2021
RD1065	01/2021
RD1070	01/2021
RD1140	01/2022
BR115	
BR133	
BR135	
BR136	
BR139	07/2022
BR140	07/2022
BR141	
BR145	
BR157	
BR165	01/2021
BR175	
BR182	
BR190	
BR191	
BR195	
BR200	01/2023
BR203	01/2023
BR206	01/2023
BR207	01/2023
BR208	01/2023
BR209	
BR212	
BR214	
BR216	01/2023
BR220	01/2023
BR221	01/2023
BR222	01/2023
BR223	
BR226	01/2022
BR230	01/2022
BR233	
BR236	01/2022
BR240	

BR241	07/2022
BR242	
BR245	
BR246	
BR250	
BR253	
BR256	
BR260	
BR263	
BR266	
BR270	01/2022
BR273	
BR285	07/2021
BR286	07/2021
BR290	01/2023
BR291	01/2023
BR300	
BR310	01/2022
BR321	01/2022
BR325	
BR330	
BR335	
BR340	
BR350	
BR360	
BR365	
BR375	
BR400	07/2022
BR405	07/2022
BR410	07/2022
BR415	07/2022
BR420	07/2022
BR422	07/2022
BR425	
BR430	
BR435	
BR440	
BR445	07/2022
BR500	
BR505	
BR520	
BR525	
BR550	
BR705	
BR706	01/2021
BR707	
BR708	
BR709	
BR730	
BR740	

OREGON STANDARD DRAWINGS 2021 NUMBERS AND REVISION DATES

DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE
-------------------	------------------	-------------------	------------------	-------------------	------------------

BR750	01/2021
BR751	
BR760	
BR800	
BR805	
BR820	01/2021
BR825	01/2021
BR830	01/2021
BR835	01/2021
BR840	
BR841	
BR970	
BR971	
BR972	01/2022
TM200	01/2022
TM201	01/2022
TM204	
TM206	
TM211	01/2022
TM212	07/2021
TM220	
TM221	07/2021
TM222	
TM223	
TM224	
TM225	
TM230	
TM231	
TM232	
TM233	
TM240	
TM300	
TM301	
TM302	
TM303	07/2021
TM450	07/2021
TM452	07/2021
TM453	07/2021
TM454	07/2021
TM456	07/2021
TM457	07/2022
TM460	07/2021
TM462	07/2021
TM466	01/2023
TM467	07/2022
TM470	07/2021
TM471	07/2021
TM472	07/2022

TM482	07/2021
TM485	07/2021
TM492	07/2022
TM493	07/2022
TM500	
TM501	01/2022
TM502	01/2022
TM503	07/2022
TM504	
TM505	01/2022
TM515	
TM516	
TM517	07/2021
TM520	
TM521	01/2023
TM530	07/2022
TM531	
TM539	
TM547	
TM551	
TM560	
TM561	
TM570	
TM571	
TM575	
TM576	
TM577	
TM600	
TM601	
TM602	
TM606	
TM607	01/2022
TM608	01/2022
TM609	01/2022
TM610	
TM611	
TM612	01/2021
TM614	
TM615	01/2022
TM616	01/2022
TM617	01/2022
TM618	
TM619	
TM620	
TM621	01/2021
TM622	
TM623	01/2022
TM624	
TM625	
TM626	

TM627	01/2021
TM628	07/2022
TM629	07/2021
TM630	07/2021
TM631	07/2021
TM635	
TM650	
TM651	01/2023
TM652	
TM653	
TM654	
TM655	07/2022
TM656	01/2023
TM657	
TM658	
TM670	01/2022
TM671	
TM672	
TM675	
TM676	
TM677	
TM678	01/2022
TM679	
TM680	
TM681	
TM687	
TM688	
TM689	
TM690	
TM691	01/2021
TM693	
TM694	
TM695	01/2021
TM696	
TM697	
TM698	
TM800	07/2022
TM810	
TM820	
TM821	
TM822	
TM830	01/2022
TM831	
TM832	
TM833	
TM840	
TM841	07/2022
TM842	
TM843	
TM844	01/2022

OREGON STANDARD DRAWINGS 2021 NUMBERS AND REVISION DATES

DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE	DRAWING NUMBER	REVISION DATE
-------------------	------------------	-------------------	------------------	-------------------	------------------

TM850	07/2022
TM851	
TM852	
TM853	07/2022
TM854	07/2022
TM855	01/2023
TM860	
TM861	
TM862	
TM870	07/2022
TM871	07/2022
TM880	07/2021

- A -**Access and Ventilation**

Hardware for Concrete Box Girders BR135, BR136

Air Release/Air Vacuum Assembly,

Water System RD266, RD270

Anchors, Pipe Slope RD330, RD332

Approaches RD715

- B -

Barricades (Types I, II, & III) TM820

Barrier, Concrete, Median

35" cast-in-place RD590

Barrier, Concrete, Standard (32" Height)

Around Median Obstacle RD535, RD536

At Bridge Expansion Joints BR263

Buried in Backslope RD526

Cast-In-Place RD505

Median Barrier Anchoring RD515

Precast RD500, RD501, RD502

RD503

Scuppers (Precast) RD595, RD596

Securing Barrier To Roadway RD516

Terminals RD510

Transition To Bridge Rail RD520

Transition To Guardrail RD530, RD580

Barrier, Concrete, Tall (42" Height)

Around Median Obstacle RD575, RD576

Precast RD545, RD546

Securing Barrier To Roadway RD516

Transition to Bridge Rail RD550

Transition To Standard Barrier RD560

Transition To Guardrail RD570, RD581

Barrier, Metal Median RD400, RD405, RD408

Bollards RD130, RD255

Bike Lane

Curb RD702

Crossing RD1140

Box Culvert, Concrete

Cast-in-place BR820, BR825,

BR830, BR835

Double Box Culverts BR840, BR841

Extensions BR805

Modified Type 2A Guardrail BR266

Wingwalls BR800

Boxes

Trapezoidal Box Reinforcement BR133

Bridge End Panel BR165

Bridge Concrete Parapet

32" Vertical BR221

42" Vertical BR222

With Steel Post BR214

Bridge Preservation

Concrete Repair BR500

General Cathodic Protection BR520

2021 OREGON STANDARD DRAWINGS INDEX

Reinforcement Continuity	BR525
Reinforcing Bar Repair	BR505
Rivet Replacement	BR550
Bridge Rail	
2-Tube Curb Mount	BR206, BR207
2-Tube Side Mount	BR226, BR230
3-Tube Curb Mount	BR208, BR209
Combination	BR223
Concrete Post and Beam	BR212
Flush Mount Combination	BR220
Pedestrian	BR246
Pedestrian On Sidewalk Mount	
Parapet	BR250
Sidewalk Mount Combination	BR216
Sidewalk Mount Parapet with	
Chain Link Fence	BR253
Thrie Beam	BR233
Thrie Beam Retrofit	BR273
Trailing End Connection	
To Guardrail	BR236
Transition From Guardrail	BR270
Transition To Guardrail	BR203
Transition To Guardrail,	
3'-6" Height	BR291
Type F	BR200
Type F 3'-6" Height	BR290
Type F with Chain Link	BR260
Type F with Pedestrian Rail	BR256
Type F with Rectangular Tube	BR285, BR286

- C -

Cathodic Protection, General	BR520
Cattle Guard	
Painted	RD110
Steel Tube	BR175
Cattle Pass	RD110
Check Dams	RD1005, RD1006
Concrete Pavement	
Plain Dowelled	RD600
Reinforced	RD600
Concrete Repair, Bridge	BR500
Concrete Truck Wash Out	RD1070
Construction Entrances	RD1000
Coupling Bands for Corrugated Metal Pipe	RD325, RD326, RD327
Cross Slopes, Roadway Superelevations	RD140
Crosswalk Closure	TM240
Curb Inlets	RD366
Curbs, Various Types	RD700, RD170
Drainage	RD701
Bike Lane	RD702
Curb Ramp	
Blended Transition	RD940
Combination	RD930, RD932, RD936, RD938
Components	RD900
Corner Identification	RD901
Detectable Warning Surface	RD902, RD904, RD905
	RD906, RD908
Detectable Guide Strip	RD909
End of Walk	RD950, RD952
Parallel	RD920, RD922
Perpendicular	RD910, RD912, RD913, RD916
Unique	RD960
Cutbanks, Rounding	RD150

2021 OREGON STANDARD DRAWINGS INDEX

Crossing

Bike Lane RD1140

-D-**Delineators**

Installation
 Freeways TM575
 Non-Freeway TM576
 Special Applications TM577
 Layout And Posts Types TM570
 Steel Post Details TM571

Detectable Warning Devices RD902, RD904, RD905,
 RD906, RD908, RD909

Drainage Details

Bore Casing RD308
 Concrete Encasement,
 Cradle, And Cap RD306
 Locator Post RD334
 Street Cut RD302
 Trench Backfill RD300
 Gutter Transition At Inlet RD363

Driveways

Curb Line Sidewalk RD730, RD735
 RD745, RD750
 Non-Sidewalk RD715
 Separated Sidewalk RD725, RD740

-E-

End Pieces, Guardrail RD415, RD417
 Energy Dissipater RD1045, RD1050

Erosion Control

Check Dams RD1005, RD1006
 Concrete Truck Wash Out RD1070
 Construction Entrances RD1000
 Energy Dissipater RD1045, RD1050
 Inlet Protection RD1010, RD1015
 Matting RD1055
 Scour Basin, Temporary RD1050
 Sediment Barrier RD1030, RD1031,
 RD1032, RD1033
 Sediment Fence RD1040
 Sediment Trap RD1065
 Slope Drains, Temporary RD1045
 Tire Wash Facility RD1060

Expansion Joints, Bridge BR139, BR140, BR141,
 BR145

-F-

Feathering A.C. Over Existing Pavement RD610

Fences

Barbed & Woven Wire
 (Types 1, 1-5W And 2) RD810
 Chain Link RD815
 Gates RD820

2021 OREGON STANDARD DRAWINGS INDEX

Pedestrian Protective	RD780, RD781, RD782 BR240, BR241, BR242, BR245
Snow, Metal Wildlife	RD825 RD830, RD832, RD835, RD840, RD845
Field Marker, Storm Water Treatment And Storage Facilities	RD399
Flag Board Mounting Details	TM204
Flashing Beacon (RRFB) Assemblies	TM493
-G-	
Gates, Fence Gateway	RD820, RD832 RD810
Girders	
Precast Prestressed Boxes	BR425, BR430, BR435, BR440, BR445
Bulb-I	BR300
Bulb-T	BR310, BR360, BR365, BR375
BT90 And BT96	BR321
Temporary Diaphragm Beam	BR350
Type II	BR325
Type III	BR330
Type IV	BR335
Type V	BR340
Grade Crossing, Railroad	RD445

Grate	
Inlets Manhole	RD365, RD378 RD356
Guardrail	
29" Rail Height	<i>See Guardrail - 29" Rail Height</i>
31" Rail Height	<i>See Midwest Guardrail system</i>
Anchors, Steel (Types 1 And 1 Mod.)	RD450
Bridges/Rails Installation At Railroad Crossing Placement of Guardrail on Slopes Posts, Wood Breakaway Thrie Beam	(See Rails) RD445 RD406 RD451 RD409, RD410
Guardrail - 29" Rail Height	
Adjustment	RD400
Assembly Details	RD400
Blocks	RD405
End Pieces, Types B And C	RD415
Guardrail and Transitions	RD400, RD481 RD530, RD570
Installation At Bridge Ends	RD440
Over Low-Fill Culverts	RD470
Parts	RD415
Posts	RD405
Terminals, Bridges	RD440
Terminals, Cut And False Cut	RD435
Types 1, 2A, 3 & 4	RD400

2021 OREGON STANDARD DRAWINGS INDEX

Guardrail – 31” Rail Height*See Midwest Guardrail system*

Guide Posts (See Delineators)
 Gutter Transition At Inlet RD363

-H-

Handrail
 Metal RD770, RD771
 Stairway RD120
 Hydrant Installation RD254

-I-

ID Marker, Culvert RD398
 ID Marker, Bridge BR195
 Illumination TM300, TM301
 TM302, TM303

Inlets

Adjusting Existing RD376
 Concrete Cap RD376
 Concrete Type CG-3 RD371, RD372,
 RD373
 Concrete Types G, & G-2M RD364
 Concrete Types CG RD366
 Curb Inlet Channel RD367
 Concrete Types M-E, M-O, And B RD368
 Ditch, Type D RD370

Field or Area Drainage Basin RD374
 Frames and Grates RD365
 Pipe to Structure Connections RD339
 Slotted CMP Drain RD328
 Type 3 RD378

Inlet Protection RD1010, RD1015

Islands

Accessible Route RD710
 Accessible Route Channelized RD711
 Traffic RD705
 Nose Treatments RD707

-J-

Joint Seal, Asphaltic Plug BR157
 Also see Expansion Joints, Bridge

-L-

Locator Post RD334

Luminaire Poles

Breakaway Location Guidelines TM635
 Fixed and Slip Base Supports TM629, TM630, TM631
 Mounting On Structures BR970, BR971, BR972

Lifeline, Fall Arrest BR190, BR191

2021 OREGON STANDARD DRAWINGS INDEX

-M-

Mail Box Support RD100
Mail Box Installation RD101

Manhole, Concrete

24" Manhole RD343
Base, Cast-In-Place And Precast RD344
Carry Through, Storm Sewer RD354
Cover and Frame RD356
Grate RD356
Frame Adjustment RD360
Inside Drop, Sanitary RD350
Outside Drop RD352
Pipe to Manhole Connections RD345
Precast, Large RD346
Precast, Pollution Control RD340
Precast, Sanitary Sewer RD338
Precast, Storm Sewer RD335
Shallow RD342
Slope Protector RD358
Steps RD336
With Inlet RD348

Matting RD1055

Median Barrier, Metal

Barrier and Transitions RD400, RD408, RD481,
RD530, RD570
RD580, RD581
Assembly Details RD400, RD408
Blocks RD403, RD404, RD405
Bridge Deck Expansion Joint RD400, RD412
Parts RD415, RD416, RD417

Posts

RD403, RD404, RD405

Median and Shoulder Barriers, Concrete

Anchoring RD515
Cast-In-Place RD505
Precast RD500
Securing Barrier To Roadway RD516
Terminals RD510

Meter Assembly, Water System RD278
Milepost Signing Details TM221, TM222
Moment Slab on MSE Wall BR760
Monument Box RD115
Multi-Use Path RD602

Midwest Guardrail System

Adjustment RD401
Assembly Details RD407, RD408
Blocks RD403, RD404
Bridges/Rails (See Rails)
Buried in Backslope RD436, RD437
End Pieces, Types B and C RD417
Guardrail and Transitions RD412, RD482
RD580, RD581
Height Conversion RD481
Over Low-Fill Culverts RD471
Parts RD416, RD417
Posts RD403, RD404

Terminals, Bridges RD442
Terminals, Buried in Backslope RD436, RD437
Terminals, Downstream Anchor RD438
Terminals, Energy Absorbing RD420, RD421
Terminals, Grading RD419
Transition to Bridge Rail BR270

Types RD402

2021 OREGON STANDARD DRAWINGS INDEX

Metal Median Barrier	RD408
Thrie beam	RD409, RD410
W-beam	RD407, RD482
Typical Layouts	
At Bridge Ends	RD442
For Embankments	RD443
For Fixed Objects	RD444
-P-	
Pavement	
Asphalt Pavement Details	RD610, RD615
Multi-Layer Construction	RD615
Surface Edge Details	RD615
Pavement Markings	
Alignment Layout	TM560, TM561
Durable Markings	TM520, TM521
Freeway Ramp	TM547, TM551
Intersection	TM530
High Performance Markings	TM521
Left Turn and Median	TM539
Railroad Crossing	TM505
Raised Marking Details	TM515, TM516
Recessed Marking Details	TM517
Standard Details Blocks	TM500, TM501, TM502, TM503, TM504, TM510
Turn Arrow	TM531
Pedestrian	
Aluminum Fence	RD780, RR781, RD782
Metal Handrail	RD770, RD771

Pipe	
Backfill/Compaction Details	RD300, RD304
Connection Details, Unlike Pipe	RD325, RD326, RD327
Corrugated Metal Coupling Bands	RD325, RD326, RD327
Culvert Embankment Protection	RD317
Culvert ID Marker	RD398
Miscellaneous Culvert Details	RD319
Multiple Installations	RD300
Paved End Slopes	RD320
Paved End Slopes	
With Removable Safety Bars	RD321
Safety End Sections, Concrete Pipe	RD324
Safety End Sections, Metal Pipe	RD322
Skew Diagram	RD316
Slope Anchors	RD330, RD332
Sloped Ends, Concrete Pipe	RD318
Sloped Ends, Metal Pipe	RD316
Slotted Drain, Metal Pipe (CMP)	RD328
Pipe Fill Height Tables	
Concrete	RD386
Corrugated HDPE	RD390
Metal, Arch	RD382
Metal, Round	RD380
Metal, Spiral Rib	RD384
Polypropylene	RD393
Poly Vinyl Chloride (PVC)	RD388
Reinforced HDPE	RD391
Poles	
Luminaire Fixed and	
Slip Base Supports	TM629, TM630, TM631
Traffic Signals	TM650, TM651, TM652 TM653, TM654

2021 OREGON STANDARD DRAWINGS INDEX

Portable Barricade TM820

-R-

Railroad At Grade Crossing RD445
 Ramp, Sidewalk RD910, RD920, RD930,
 RD940, RD950, RD960
 Reinforcement Continuity BR525
 Reinforcing Bar Repair BR505
 Rivet Replacement BR550
 Roadway Cross Slopes
 Superelevated Sections RD140
 Rounding Of Cutbanks RD150
 Root Barrier, Water Pipe RD286
 Roundabout Curb Placement RD170

-S-

Safety Edge RD615

Sanitary Sewer

Clean Out RD362
 Manhole RD338
 Piped Inside Drop Connection RD350
 Sampling Station, Water System RD282
 Sanitary Sewer,
 Service Connections RD310
 Scour Basin, Temporary RD1050
 Sediment Barrier RD1030, RD1031,
 RD1032, RD1033
 Sediment Fence RD1040

Sediment Trap RD1065
 Sidewalk RD720, RD721, RD722

Signs

Aluminum Panel TM675
 Attachment TM676
 Bracing Details TM206
 Directional Sign Layout TM223, TM224
 Exit TM225
 Flag Board Mounting Details TM204
 Installation Details TM200, TM201
 Mileposts TM221, TM222
 Mounts TM677, TM678, TM679
 Multi-Post Installations TM220
 Removable Legend
 Mounting Details TM230, TM231,
 TM232, TM233

Signs Con't

Route Makers
 Interstate Route Shields TM211
 Oregon Highways TM212
 U.S. Route Shields TM211

Sign Supports

Breakaway Location Guidelines TM635
 Cantilever TM621, TM622, TM623,
 TM624, TM625, TM626,
 TM627, TM628, TM690,
 TM691
 Multi-Post Breakaway TM600, TM601
 Sign Bridge TM614, TM615, TM616,
 TM617, TM618, TM619,
 TM620, TM693, TM694,
 TM695, TM696, TM697
 Square Tube TM681, TM687,

2021 OREGON STANDARD DRAWINGS INDEX

Temporary	TM688, TM689
Triangular Base Breakaway	TM822
Variable Message Sign	TM602
	TM606, TM607, TM608,
	TM609, TM610, TM611,
	TM612, TM621, TM622,
	TM623, TM624, TM625,
	TM626, TM627, TM628,
	TM690, TM691, TM693,
	TM694, TM695, TM696,
	TM697
Wood Post	TM670
Service Connection, Water System	RD274
Siphon Box	RD376
Slabs, Precast Prestressed	BR400, BR405, BR410,
	BR415, BR420, BR422,
	BR445
Slope	
Drains, Temporary	RD1045
Paving	BR115
Pipe Anchors	RD330, RD332
Protector, Concrete Manhole	RD358
Rounding	RD150
Slotted Drains, Metal Pipe (CMP)	RD328
Snow Fence, Metal	RD825
Soundwalls	
Masonry (Pile Footing)	BR750, BR751
Masonry (Spread Footing)	BR730
Precast Concrete	BR740
Stairway, Concrete	RD120

Steps, Manhole Precast	RD336
Stop Lane, Truck And Bus	
At Railroad Crossing	RD445
Storm Water Treatment and	
Storage Facility Field Marker	RD399
Street Cut	RD302
Subsurface Drain	RD312

-T-

Temporary Traffic Control

2-Lane, 2-Way Roadways	TM850, TM854, TM855
Abrupt Edge	TM800
Barricades	TM820
Blasting Zones	TM871
Bridge Construction	TM870
Closure Details	TM840
Concrete Barrier	TM830
Freeway Sections	TM860, TM861, TM862
Impact Attenuator	TM831, TM832, TM833
Intersection Work Zones	TM841, TM842, TM843
Message Sign	TM800
Non-Freeway Multi-Lane Sections	TM851, TM852, TM853
Pedestrian Accessible Routing	TM844
Reflective Pavement Makers	TM810
Rumble Strips	TM830
Sign Supports	TM689, TM821
Speed Reduction (Moving Operations)	TM880
Tables, Flare Rate, Taper, Spacing	TM800
Temporary Sign Support	TM822

Thrust Blocking, Water Systems RD250

2021 OREGON STANDARD DRAWINGS INDEX

Tire Wash Facility RD1060

Traffic

Island RD705
 Separator, Concrete RD706

Traffic Signals

Color Code Chart TM470
 Controller Cabinet and Foundation TM482
 Fire Preemption Details TM456
 Junction Boxes TM472
 Maintenance Pad Details RD160
 Mast Arm Pole Details TM450
 Mounting Details
 Adjustable Signal Head TM462
 Spanwire TM456
 Pedestrian Signal TM457, TM467
 Pole Footing Details
 Mast Arm Pole TM450
 Strain Pole TM452
 Pole Mounts TM680
 Ramp Meter Details TM492
 Rectangular Rapid Flashing Beacon TM493
 Service Cabinet TM485
 Spanwire Design TM456
 Strain Pole Details TM452
 Supports TM650, TM651, TM652,
 TM653, TM654, TM655,
 TM656,
 TM657, TM658
 Temporary TM453, TM454, TM456
 Trenching & Conduit Installation TM471
 Vehicle Signal Details TM460
 Vehicle Signal Pedestal TM457

Trench Backfill RD300
 Truck Aprons on Roundabouts RD170
 Trucks and Bus Stop Lanes
 At Railroad Crossing RD445
 Truck Scale Pit BR182
 Truncated Dome RD902

-V-

Valve Box And Operator
 Extension Assembly RD258
 VMS Walk-In Bridge TM698

-W-**Walls**

Retaining, Concrete BR705, BR706, BR707,
 BR708, BR709
 Soundwall, Masonry
 Pile Footing BR750, BR751
 Spread Footing BR730
 Soundwall, Precast BR740

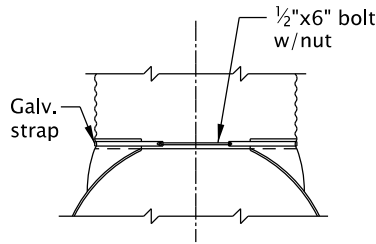
Water Systems

Air Release Assembly, Manual RD266
 Air Release/Air Vacuum
 Valve Assembly RD270
 Hydrant Installation RD254
 Main Dead-End Blowoff Assembly RD262
 Root Barrier RD286
 Thrust Blocking RD250
 Valve Box And Operator

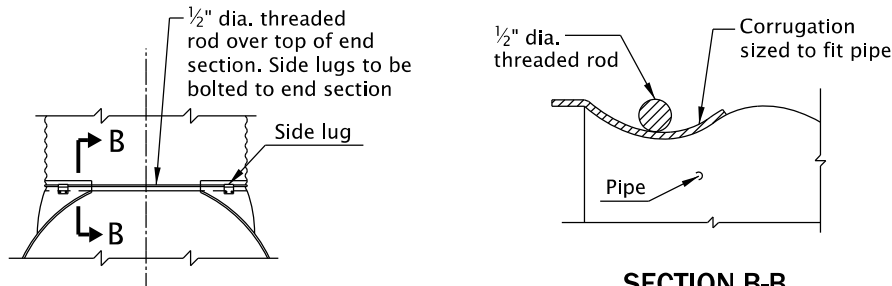
Extension Assembly	RD258
Water Meter Assembly	RD278
Water Sampling Station	RD282
Water Service Connection	RD274
Wingwalls, Concrete Box Culverts	BR800
Wind Pressure Map	TM671
Wind Speed Map	TM672

20-JAN-2023

RD322.dgn

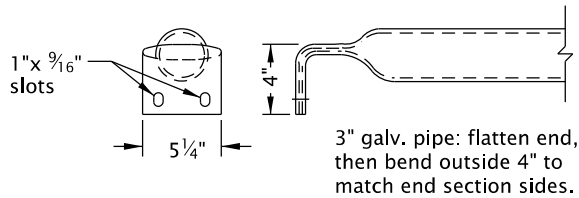


TYPE #1 CONNECTOR DETAIL

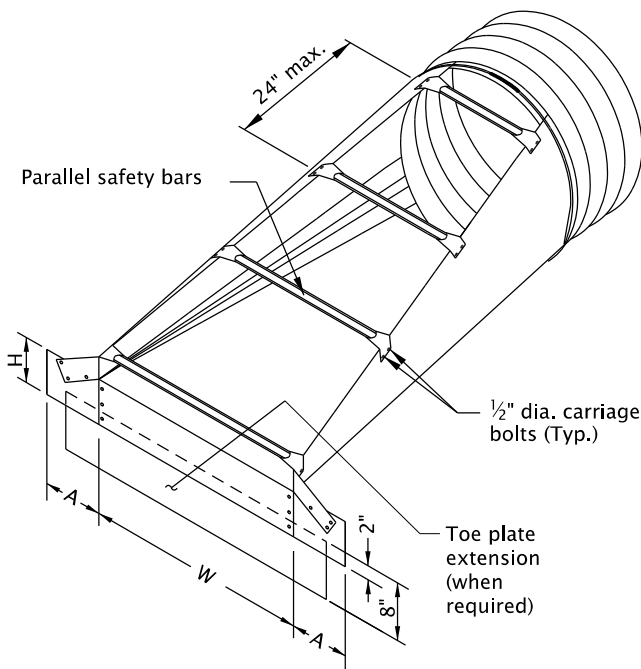


TYPE #2 CONNECTOR DETAILS

SECTION B-B

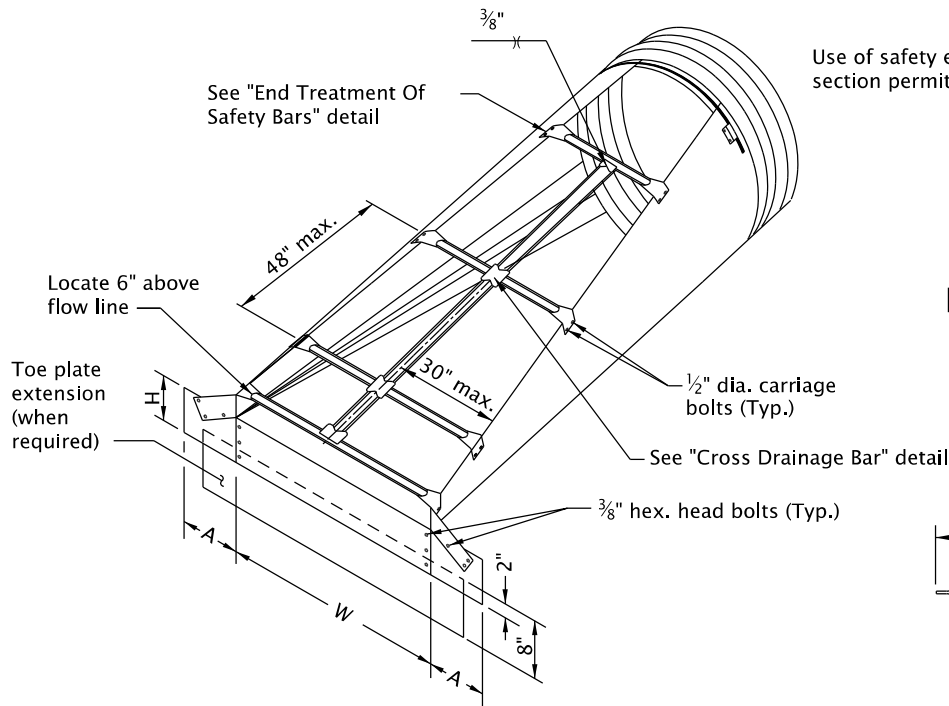


END TREATMENT OF SAFETY BARS DETAIL



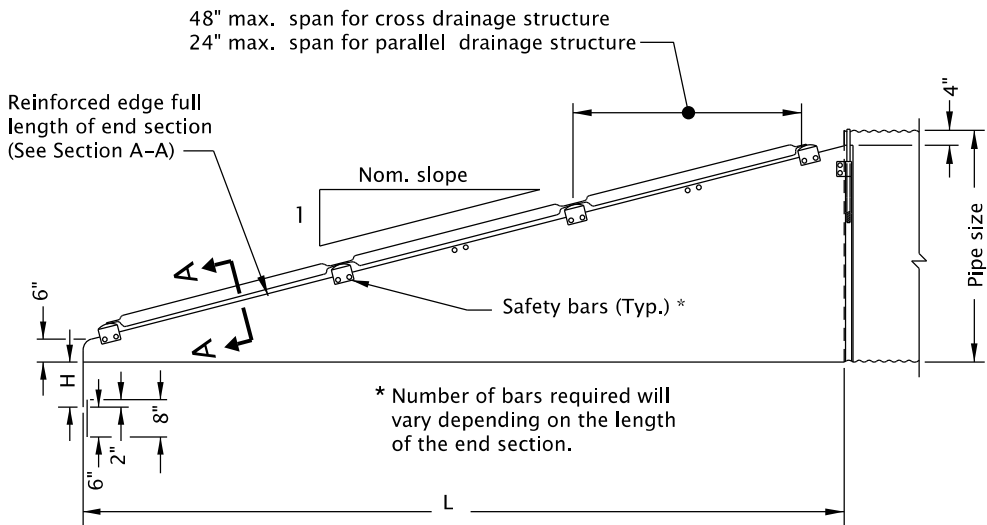
PARALLEL DRAINAGE STRUCTURE

Use with single pipe installations 30" dia. or larger
Use with multiple pipe installations 15" dia. or larger

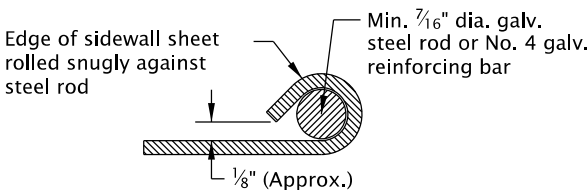


CROSS DRAINAGE STRUCTURE

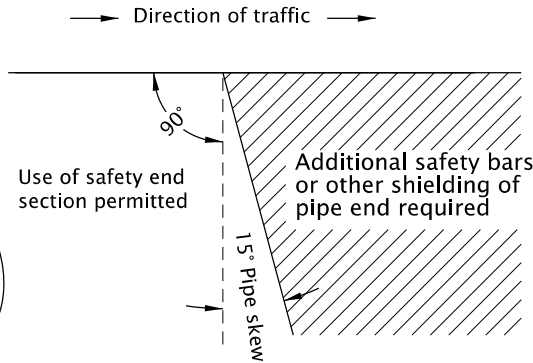
Use with pipe installations 36" dia. and larger



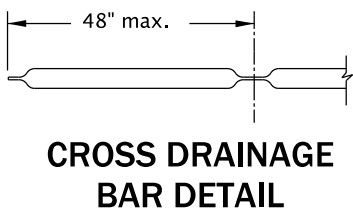
SIDE VIEW



SECTION A-A



LOCATION DIAGRAM



CROSS DRAINAGE BAR DETAIL

STEEL END SECTIONS FOR ROUND PIPE CULVERT

PIPE DIAMETER (In)	METAL THICK (MIN.) (In/Gage)	DIMENSIONS (Inches)					
		A	H	W	OVERALL WIDTH	L	
						Slope=4	Slope=6
15	0.064/16	8	6	21	37	20	30
18	0.064/16	8	6	24	40	32	48
21	0.064/16	8	6	27	43	44	66
24	0.064/16	8	6	30	46	56	84
30	0.109/12	12	9	36	60	80	120
36	0.109/12	12	9	42	66	104	156
42	0.109/12	16	12	48	80	128	192
48	0.109/12	16	12	54	86	152	228
54	0.109/12	16	12	60	92	176	264
60	0.109/12	16	12	66	98	200	300

*** See general note 5

STEEL END SECTIONS FOR ARCH PIPE CULVERT

PIPE SIZE (Inches)			METAL THICK (MIN.) (In/Gage)	DIMENSIONS (Inches)					
EQUIVALENT ROUND DIAMETER	*** SPAN	*** RISE		A	H	W	OVERALL WIDTH	L	
								Slope 1:4	Slope 1:6
18	21	15	0.064/16	8	6	27	43	20	30
21	24	18	0.064/16	8	6	30	46	32	48
24	28	20	0.064/16	8	6	34	50	40	60
30	35	24	0.109/12	12	9	41	65	56	84
36	42	29	0.109/12	12	9	48	72	76	114
42	49	33	0.109/12	16	12	55	87	92	138
48	57	38	0.109/12	16	12	63	95	112	168
54 **	64	43	0.109/12	16	12	70	102	132	198
60 **	71	47	0.109/12	16	12	77	109	148	222
72 **	83	57	0.109/12	16	12	89	121	188	282

** Requires 2 cross drainage bars.

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

- For round pipes with diameters 24" or less use type #1 connector. All arch pipes equivalent round diameter, and round pipes over 24" diameter use Type #2 connector.
- Toe plate extensions are to be the same min. thkn. as end section. Dimensions shall be overall width less 6" by 8" high.
- Cross drainage and safety bars shall be 3" dia. Schedule 40 galv. steel pipe.
- Slotted holes for safety bar attachment shall be provided for all end sections.
- Cross-sectional dimensions of attaching pipe may vary with different materials.
- Open ends of pipes normally require a site specific design, and may require special treatment (Slope ends, culvert embankment protection, paved end slopes, safety end sections, or other measures). See special details or Standard Drawings as called for on plans.
- See Std. Dwg. RD317 for culvert embankment protection and riprap pads (When reqd.).

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

SAFETY END SECTION FOR METAL PIPE

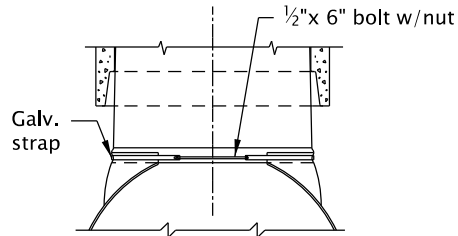
2021

DATE	REVISION	DESCRIPTION
01-2023	REVISED DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE- 20-JAN-2023

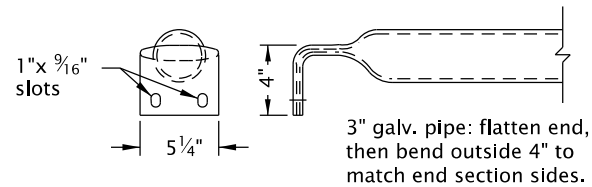
RD322

Effective Date: June 1, 2023 – November 30, 2023

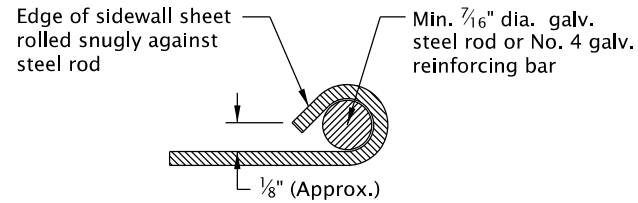
20-JAN-2023
RD324.dgn



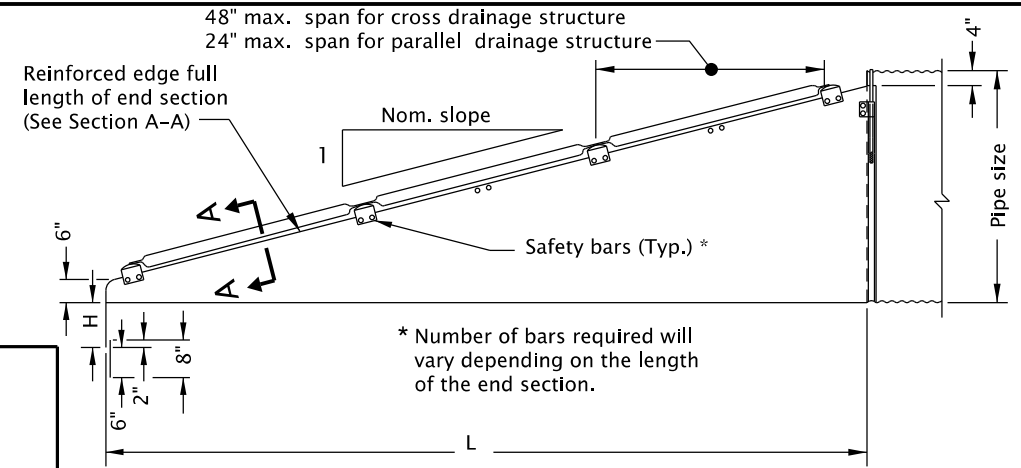
TYPE #1 CONNECTOR DETAIL



END TREATMENT OF
SAFETY BARS DETAIL

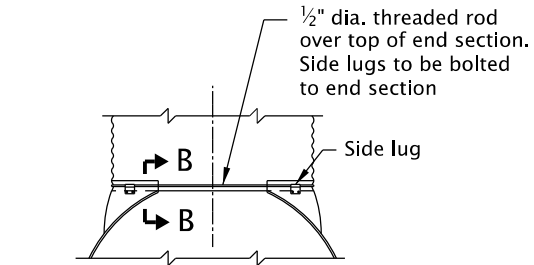


SECTION A-A

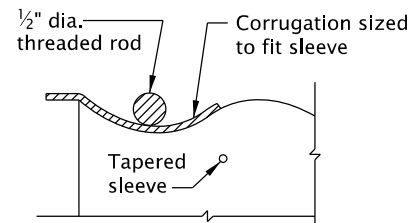


SIDE VIEW

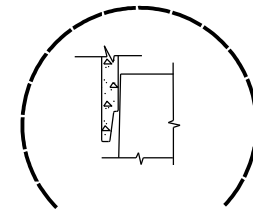
* Number of bars required will vary depending on the length of the end section.



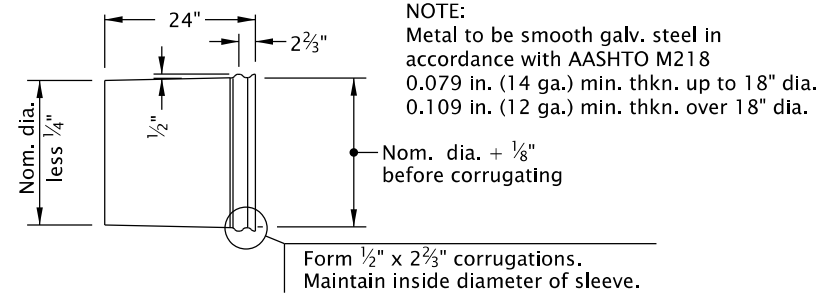
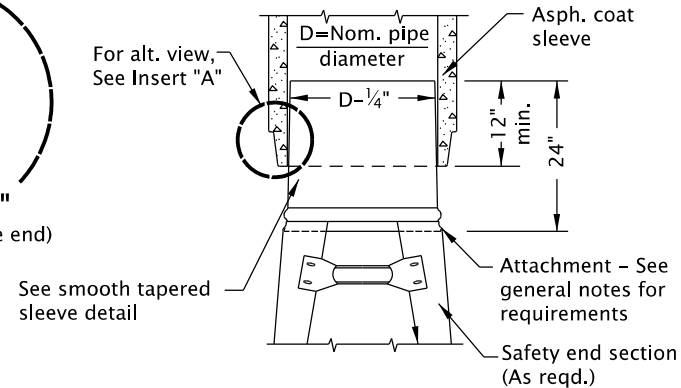
TYPE #2 CONNECTOR DETAILS



SECTION B-B



INSERT "A"
(Alt. view for female end)



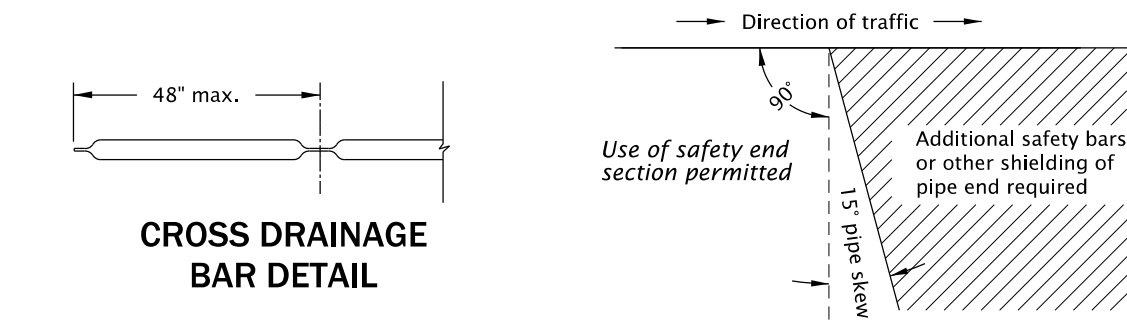
SMOOTH TAPERED SLEEVE FOR ATTACHING
SAFETY END SECTIONS TO SMOOTH PIPE

STEEL END SECTIONS FOR ROUND PIPE CULVERT

PIPE DIAMETER (In)	METAL THICK (MIN.) (In/Gage)	DIMENSIONS (Inches)					
		A	H	W	OVERALL WIDTH	L	
15	0.064/16	8	6	21	37	Slope=4	Slope=6
18	0.064/16	8	6	24	40	20	30
21	0.064/16	8	6	27	43	32	48
24	0.064/16	8	6	30	46	44	66
30	0.109/12	12	9	36	60	56	84
36	0.109/12	12	9	42	66	80	120
42	0.109/12	16	12	48	80	104	156
48	0.109/12	16	12	54	86	128	192
54	0.109/12	16	12	60	92	152	228
60	0.109/12	16	12	66	98	176	264
						200	300

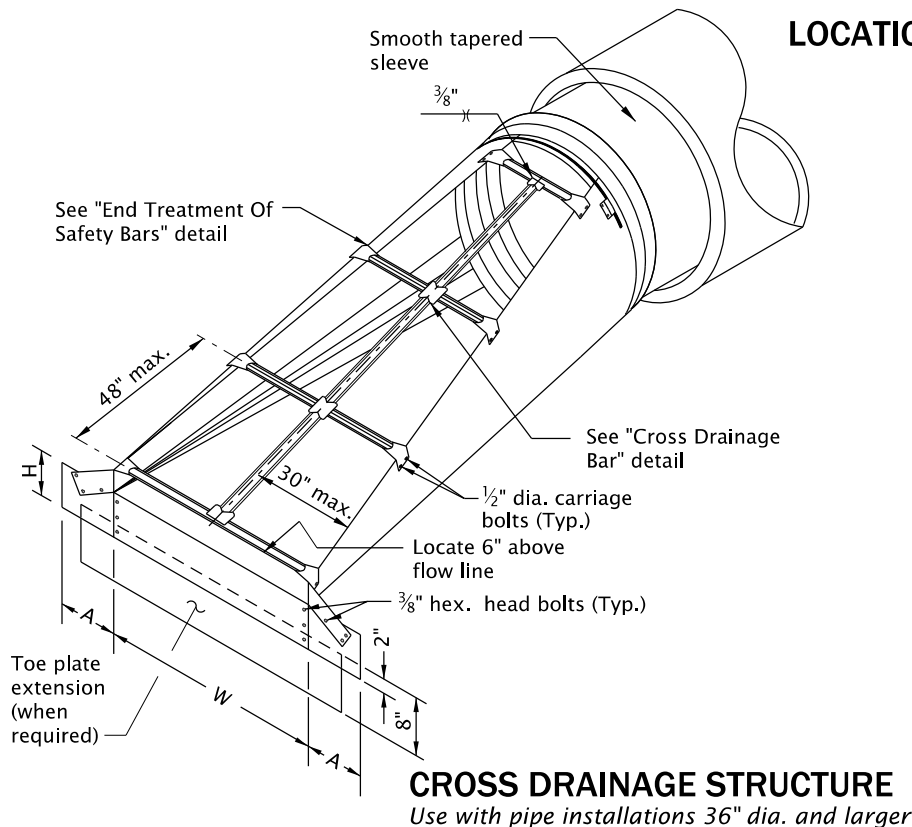
GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

- For round pipes with diameters 24" or less use Type # 1 connector. All arch pipes equivalent round diameter and round pipes over 24" diameter use Type # 2 connector.
- Toe plate extensions are to be the same min. thkn. as end section. Dimensions shall be overall width less 6" by 8" high.
- Cross drainage and safety bars shall be 3" dia. Schedule 40 galv. steel pipe.
- Slotted holes for safety bar attachment shall be provided for all end sections.
- Open ends of pipes normally require a site specific design, and may require special treatment (Slope ends, culvert embankment protection, paved end slopes, safety end sections, or other measures). See special details or Standard Drawings as called for on plans.
- See Std. Dwg. RD317 for culvert embankment protection and riprap pads (When reqd.).

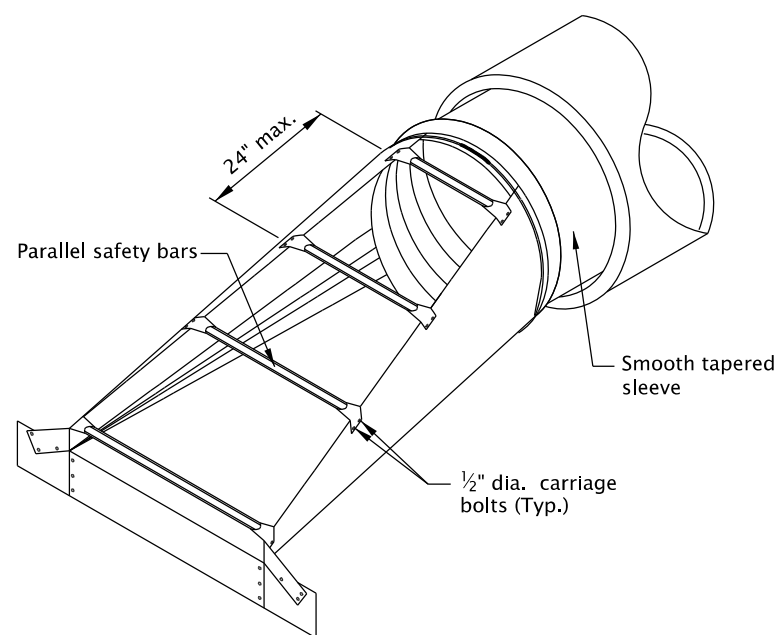


CROSS DRAINAGE
BAR DETAIL

LOCATION DIAGRAM



CROSS DRAINAGE STRUCTURE
Use with pipe installations 36" dia. and larger



PARALLEL DRAINAGE STRUCTURE
Use with single pipe installations 30" dia. or larger
Use with multiple pipe installations 15" dia. or larger

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

SAFETY END SECTION
FOR CONCRETE, PVC, HDPE &
POLYPROPYLENE PIPE

2021

DATE	REVISION	DESCRIPTION
01-2023	REVISED DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE: 20-JAN-2023

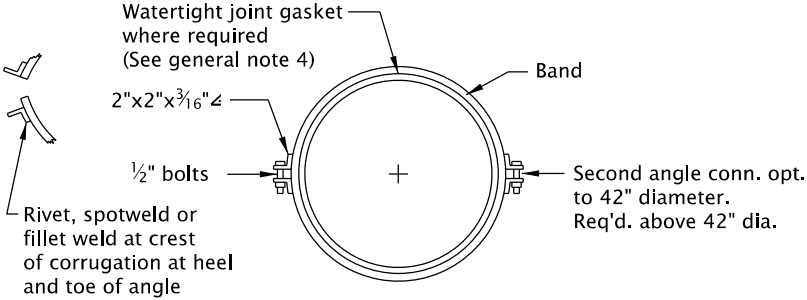
RD324

Effective Date: June 1, 2023 – November 30, 2023

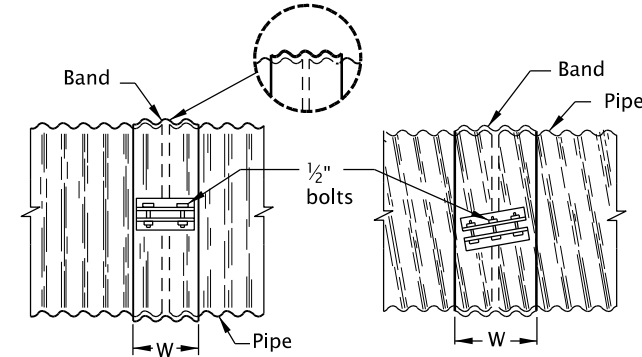
20-JAN-2023

RD325.dgn

2 2/3"x1 1/2" Corrugations				3"x1" Corrugations			
Pipe Dia. (In)	W (In)		# Of 1/2" Bolts	Pipe Dia. (In)	W (in)		# Of 1/2" Bolts
	Ann.	Hel.			Ann.	Hel.	
6-10	7	7	2	36-84	14	14	3
12-15	7	12	2-3	36-120 ③	26	26	5
18-84 ③	12	12	3				
24-84	24	24	5				



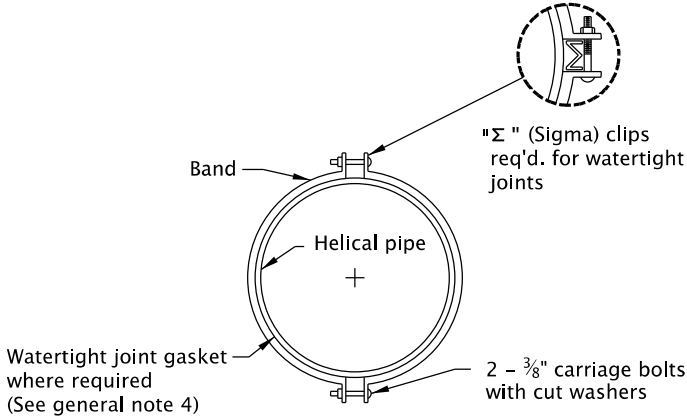
CONNECTION ANGLE DETAIL



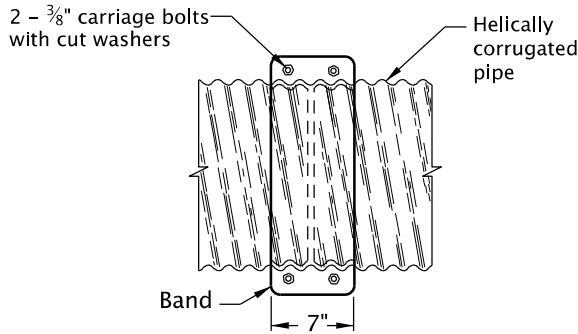
ANNULAR COUPLING

HELICAL COUPLING

TYPE A



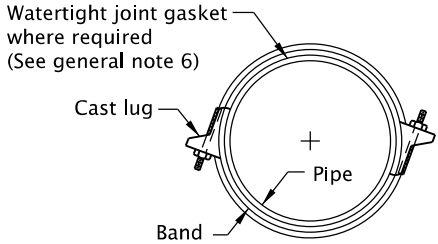
END VIEW



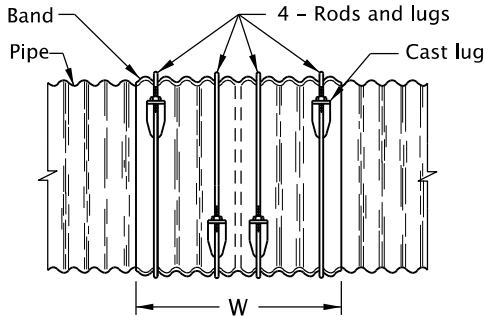
TOP VIEW

TYPE B
(For 6"-10" dia. pipes)

Corrugations	Pipe Dia. (In)	Rod Dia. (In)	Narrow Band		Wide Band	
			W (in)	# Of Rods	W (In)	# Of Rods
2 2/3"x1 1/2"	12-21	3/8	12	2		
	24-54 ③	1/2	12	2	24	4
	60-84 ③	5/8	12	2	24	4
3"x1"	36-54 ③	1/2	14	2	26	4
	60-84 ③	5/8	14	2	26	4
	84-120	5/8			26	4



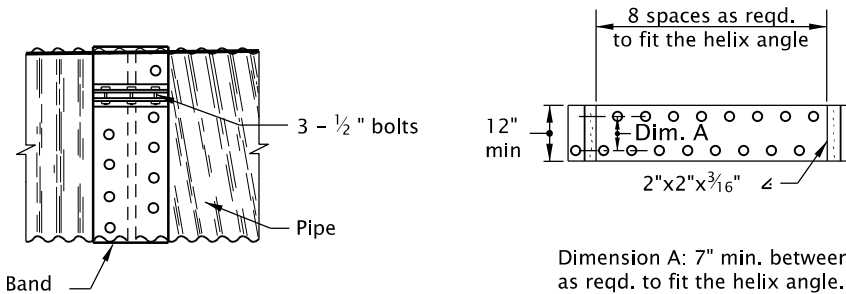
END VIEW



TYPE D

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

- All steel coupling bands and connection hardware shall be galvanized or aluminum coated.
- Coupling bands for corrugated iron and steel pipes may be two numerical thicknesses lighter than that used for the pipe but not more than 0.109" nominal thickness nor less than 0.052" nominal thickness. Coupling bands for corrugated aluminum pipe shall be of the same thickness as that used for the pipe.
- Under conditions where concrete pipe may be used as an acceptable alternate, the minimum width coupling band indicated for the band type, corrugation and pipe diameter shown may be used.
- Watertight joints with gaskets are required for irrigation pipes, storm sewers, and other installations when shown on the plans. Gaskets for all coupling bands shall be (butt-cemented or vulcanized) synthetic, closed-cell sponge rubber 3/8" thick of a width equal to the band width and centering on the joint. For pipes 12" or less in diameter, the gasket thickness may be 3/16".
- Joints for sanitary sewers and siphons are to be tested for water tightness in accordance with the Standard Specifications.
- One or two piece coupling bands are optional for pipe diameters up to and including 42". Coupling bands of two or more pieces are required for pipe diameters over 42".
- To prevent galvanic action when unlike metals are connected, the connecting band shall be used with a full width neoprene gasket or coated with asphalt or other insulating material as approved by the engineer.
- See Std. Dwgs. RD330 and RD332 for pipe slope anchors, when required.



Dimension A: 7" min. between dimples as reqd. to fit the helix angle.

COUPLING BAND DIMPLE DETAIL

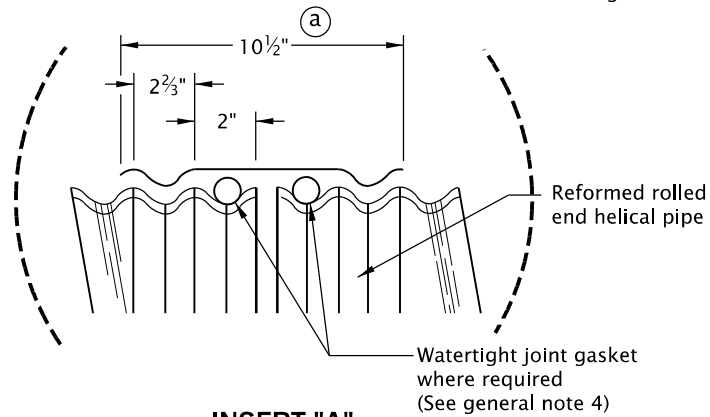
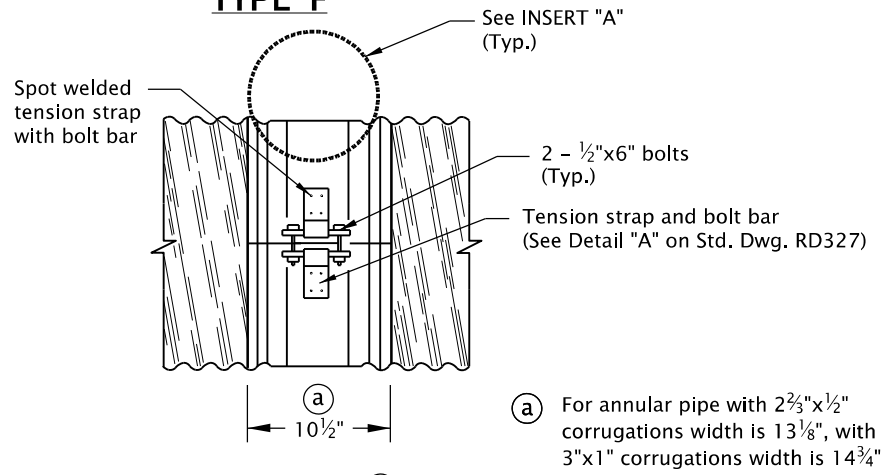
TYPE E

(For 12"-30" dia. pipes)

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

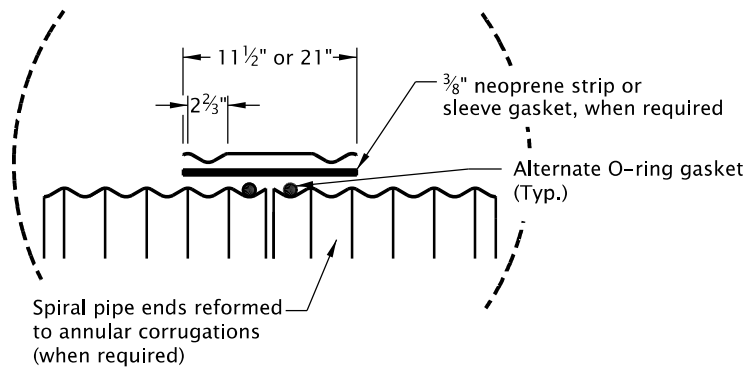
All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
COUPLING BANDS FOR CORRUGATED METAL PIPE			
2021			
DATE	REVISION	DESCRIPTION	
01-2023	REVISED DETAILS AND NOTES		
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023
			RD325

TYPE F

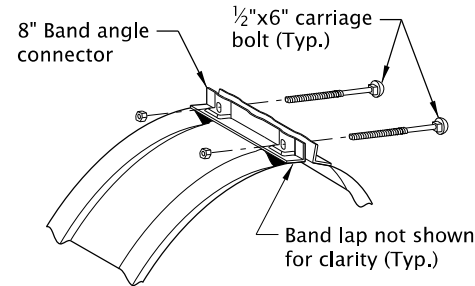


INSERT "A"
JOINT DETAIL (TYPE F)

TYPE F-1



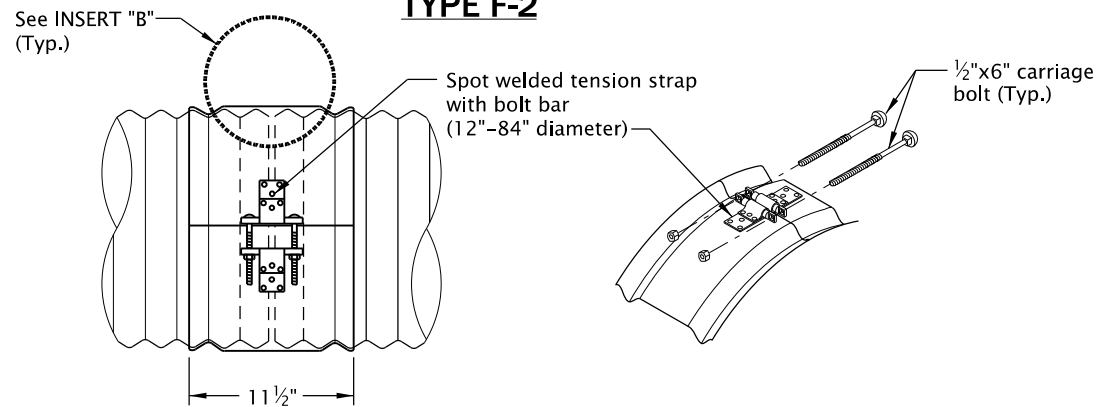
INSERT "B"
JOINT DETAIL (TYPE F1 & F2)



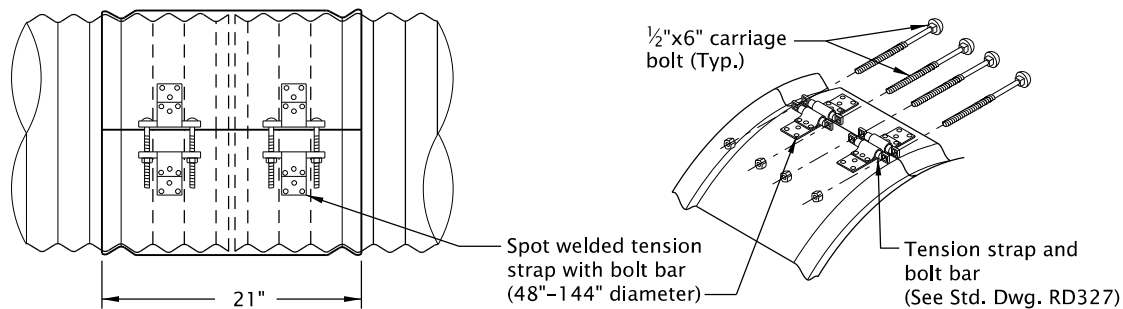
GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

- See Std. Dwg. RD325 for general notes, and details not shown.
- Type F coupling bands shown for pipes 15 inch to 72 inch in diameter are typical to arch pipes of equal peripheral measurement.
- Gaskets for the Type F coupling band shall be "O" rings conforming to ASTM C443 and a mastic sealant strip 1/8 inch by 1-1/2 inch wide by 5 inch (10-1/2 inch band) or 8 inch (13-1/8 inch band) or 9 inch (14-3/4 inch band) shall be placed in lap between bands. "O" ring gaskets shall be 3/16 inch minimum diameter (10-1/2 inch and 13-1/8 inch bands) and 1-3/8 inch minimum diameter (14-3/8 inch bands).
- Watertight joints with gaskets are required for irrigation pipes, storm sewers, and other installations when shown on the plans. Gaskets for all coupling bands shall be (butt-cemented or vulcanized) synthetic, closed-cell sponge rubber 3/8 inch thick of a width equal to the band width and centering on the joint. For pipes 12 inches or less in diameter, gasket thickness may be 3/16 inch.
- Joints for sanitary sewers and siphons are to be tested for water tightness in accordance with the Standard Specifications.
- One or two piece coupling bands are optional for pipe diameters up to and including 42 inches. Coupling bands of two or more pieces are required for pipe diameters over 42 inches.
- To prevent galvanic action when unlike metals are connected, the connecting band shall be used with a full width neoprene gasket or coated with asphalt or other insulating material as approved by the engineer.
- See Std. Dwgs. RD330 and RD332 for pipe slope anchors, when required.

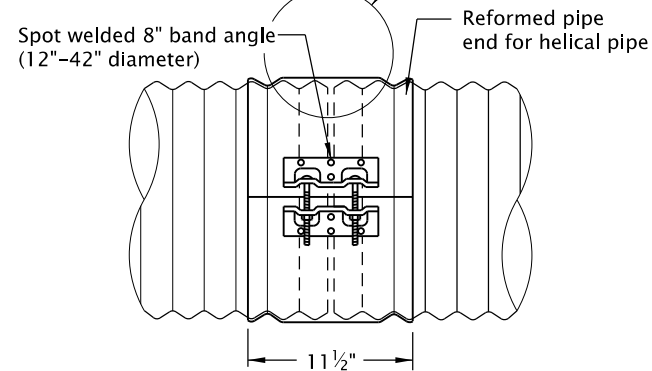
TYPE F-2



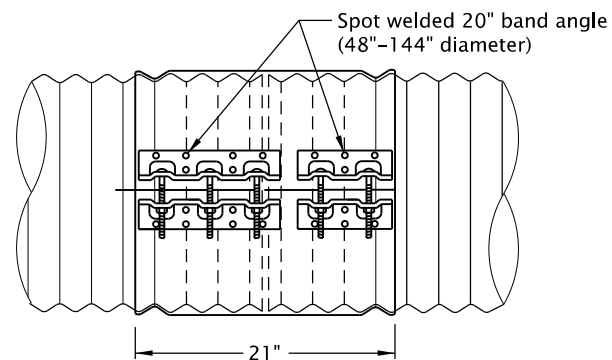
SINGLE BAR & STRAP CONNECTOR



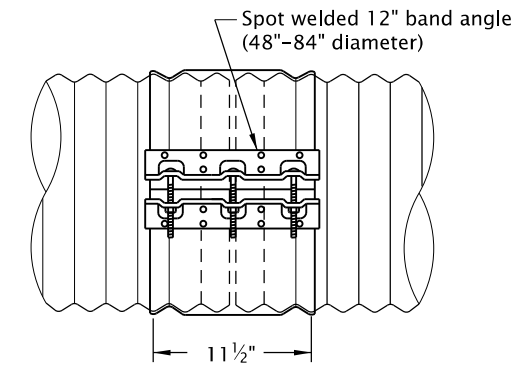
DOUBLE BAR & STRAP CONNECTOR



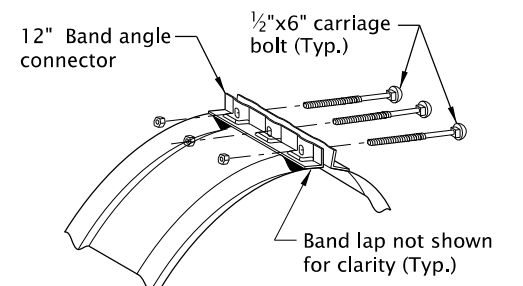
SINGLE 8" BAND ANGLE CONNECTOR



DOUBLE BAND ANGLE CONNECTOR



SINGLE 12" BAND ANGLE CONNECTOR



The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

COUPLING BANDS FOR CORRUGATED METAL PIPE

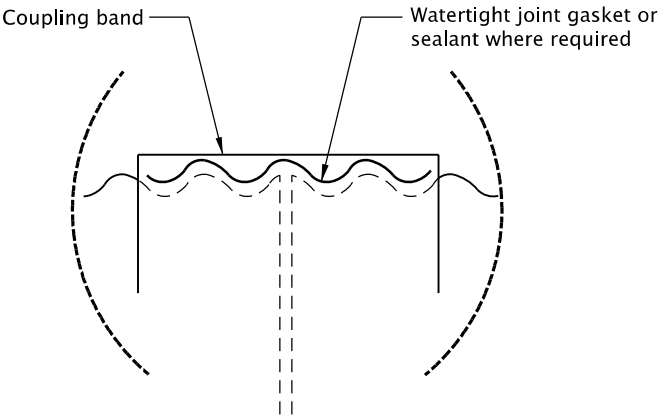
2021

DATE	REVISION	DESCRIPTION
01-2023	REVISED DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE

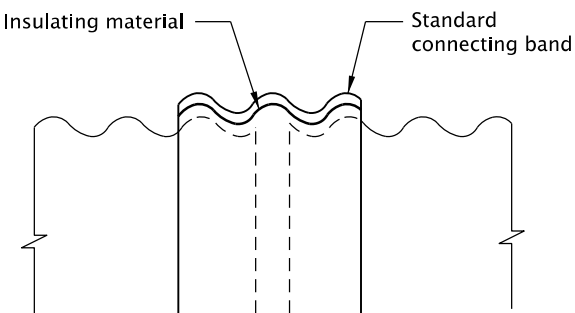
20-JAN-2023

RD326

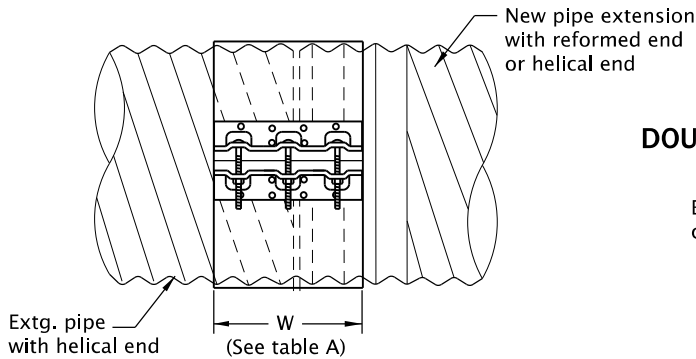
Effective Date: June 1, 2023 – November 30, 2023



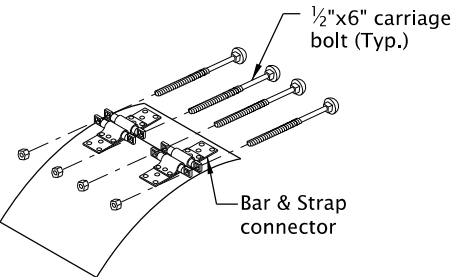
WATERTIGHT JOINT
(See general note 3)



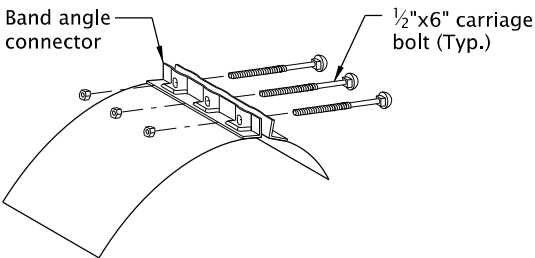
CONNECTION DETAILS
Extending existing pipe culvert
with pipe of unlike material
Type varies
(See general note 2)



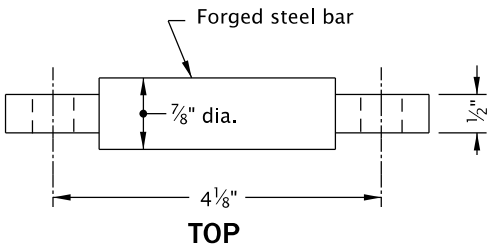
TYPE K
FLAT BAND OR DIMPLE BAND
(FOR PIPE EXTENSIONS ONLY)



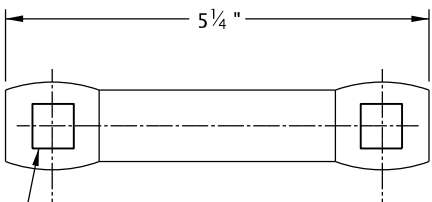
DOUBLE BAR & STRAP CONNECTOR DETAIL



BAND ANGLE CONNECTOR DETAIL



TOP



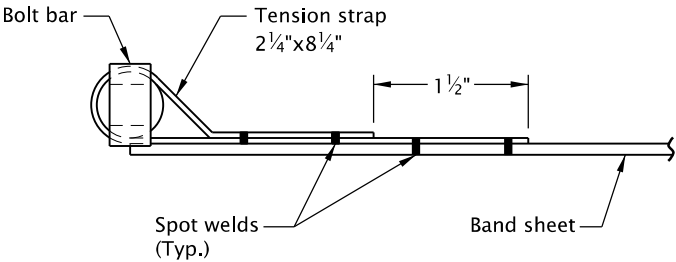
FRONT

BOLT BAR DETAIL

NOTE:
Design variations in fasteners (Straps, bars, & welds) which
provide a tensile strength of 7500 lbs are permissible.

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. See Std. Dwgs. RD325 and RD326 for general notes, and details not shown.
2. To prevent galvanic action when unlike metals are connected, the connecting band shall be used with a full width neoprene gasket or coated with asphalt or other insulating material as approved by the engineer.
3. Watertight joints with gaskets are required for irrigation pipes, storm sewers, and other installations when shown on the plans. Gaskets for all coupling bands shall be (butt-cemented or vulcanized) synthetic, closed-cell sponge rubber $\frac{3}{8}$ " thick of a width equal to the band width and centering on the joint. For pipes 12 inches or less in diameter, the gasket thickness may be $\frac{3}{16}$ ".
4. One or two piece coupling bands are optional for pipe diameters up to and including 42 inches. Coupling bands of two or more pieces are required for pipe diameters over 42 inches.



DETAIL A
TENSION STRAP

NOTE:
Design variations in fasteners (Straps, bars, & welds) which
provide a tensile strength of 7500 lbs are permissible.

TABLE A

Band Type	Corrugations	Pipe Dia. (In)	Min. W (In)	Gasket Type
Steel	$2\frac{2}{3}$ "x $\frac{1}{2}$ "	12-48	12	Sleeve
		54-84	24	
	* 3"x1" 5"x1"	54-144	24	
Aluminum	$2\frac{2}{3}$ "x $\frac{1}{2}$ "	12-48	12	Sleeve
		54-84	24	
	* 3"x1" 5"x1"	54-96	24	

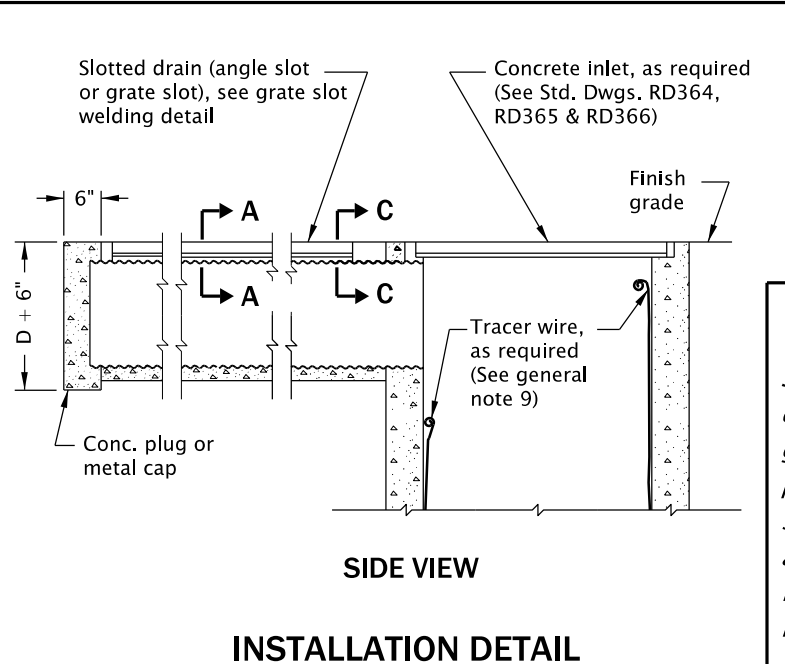
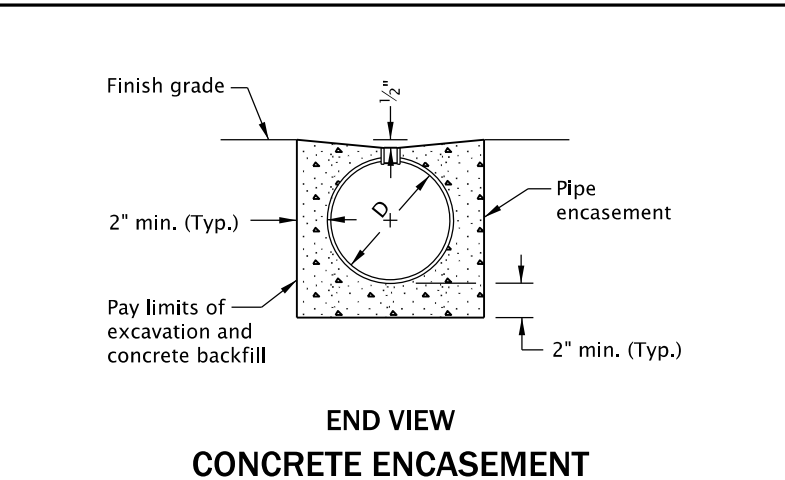
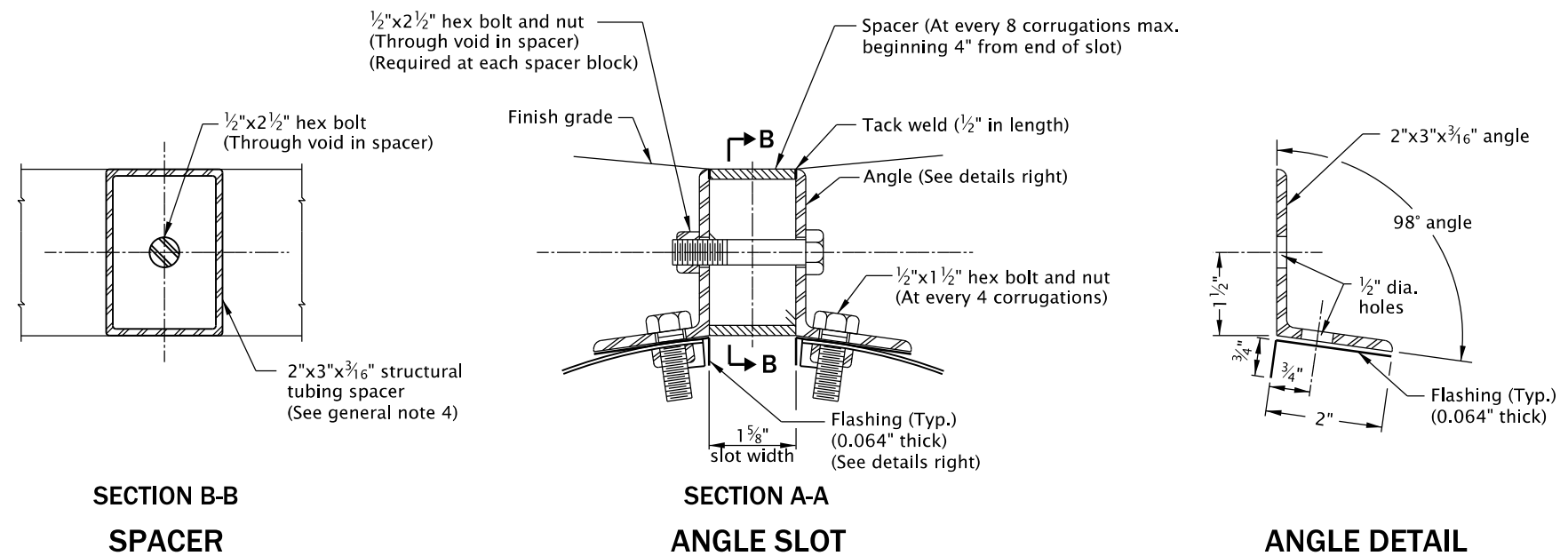
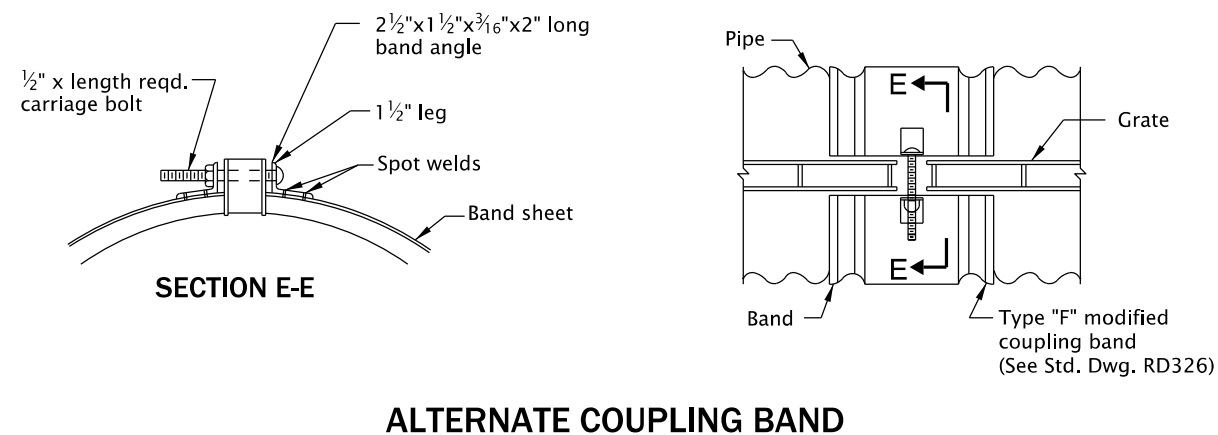
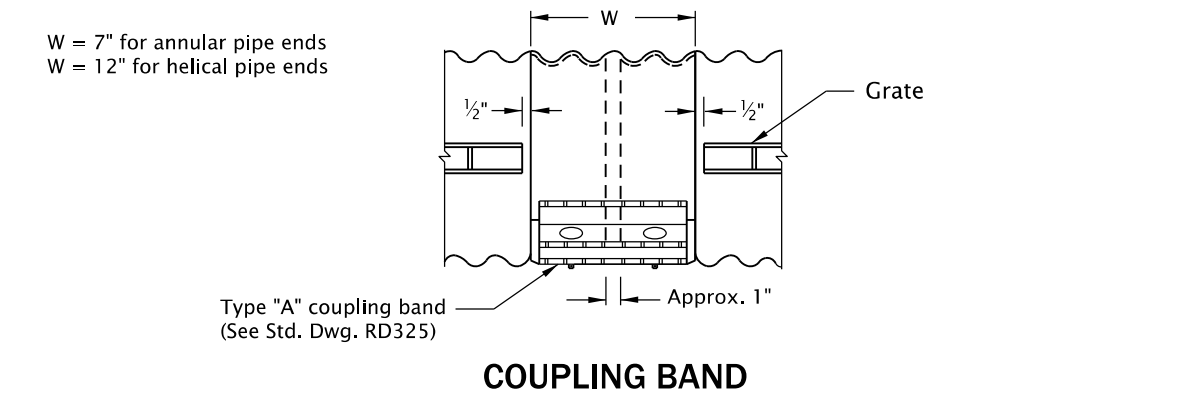
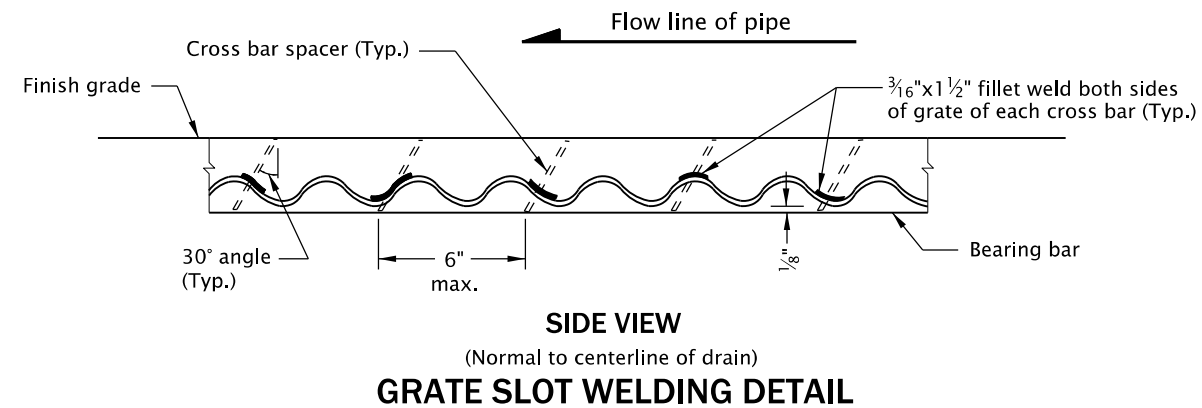
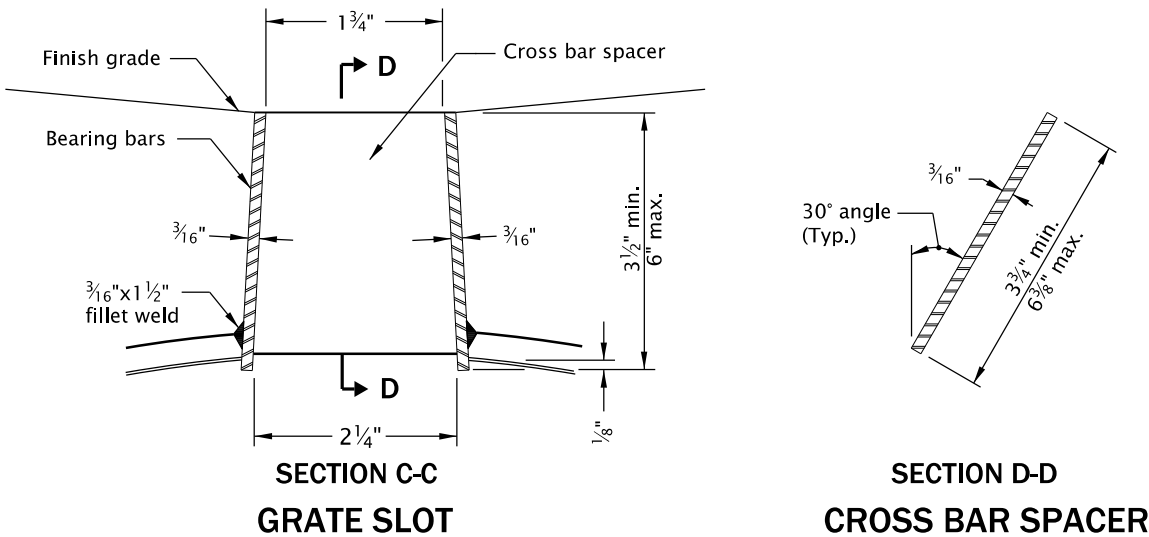
* Arch pipe only

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
2021			
DATE	REVISION	DESCRIPTION	
01-2023	REVISED	DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE	RD327

20-JAN-2023

RD328.dgn



GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

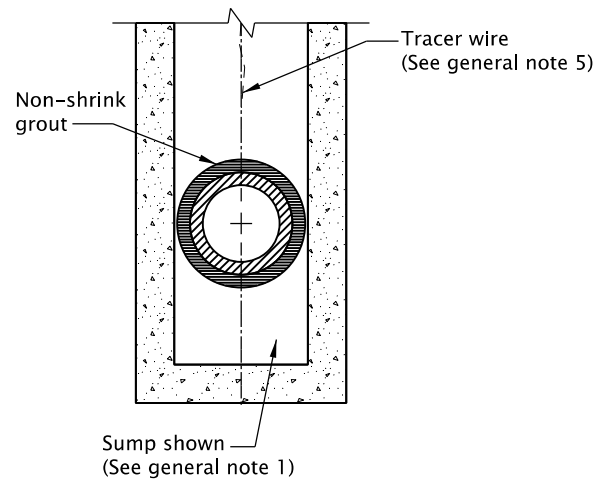
1. Drain pipe seams may be continuous helical lock seam or helical weld seam.
2. Drain sections shall be assembled with either of the coupling bands shown.
3. Units of slotted CMP drains shall be fabricated and all nuts and bolts tightened prior to beginning field installation.
4. Structural tubing to be 5.5 lb/ft or heavier. Structural tubing shall conform to ASTM A501.
5. The cross bar spacer shall be welded to the bearing bars in such a manner as to develop a minimum tensile capacity of 12000 lbs normal to the longitudinal axis of the bearing bars.
6. The maximum variance from a straight line between the extreme top corners of the bearing bars shall be $\frac{1}{2}$ " in 20'.
7. Grate slot assemblies shall conform to the provisions of ASTM A36 and shall be galvanized after fabrication per ASTM A123. Corrugated pipe shall conform to AASHTO M36.
8. Concrete used in encasement shall be commercial grade concrete.
9. See Std. Dwg. RD336 for tracer wire details.
10. See ODOT's QPL for alternates.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

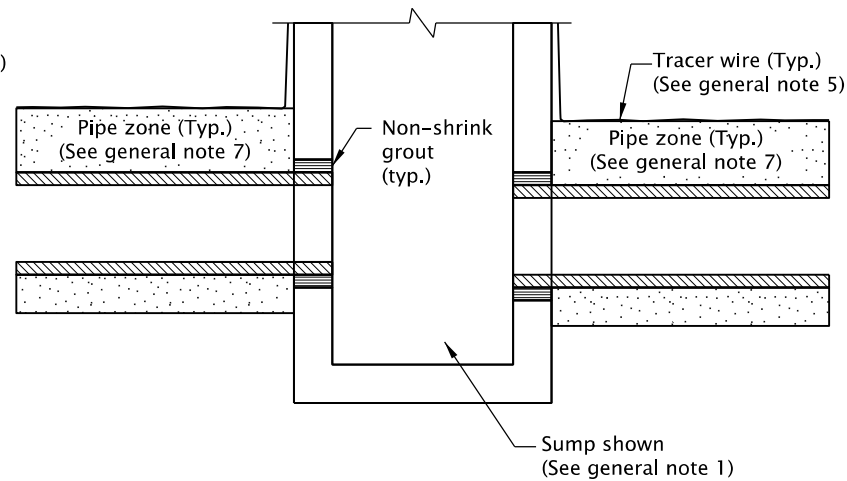
All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
SLOTTED CORRUGATED METAL PIPE (CMP) DRAIN DETAILS			
2021			
DATE	REVISION DESCRIPTION		
01-2023	REVISED NOTE		
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023
RD328			RD328

Effective Date: June 1, 2023 – November 30, 2023

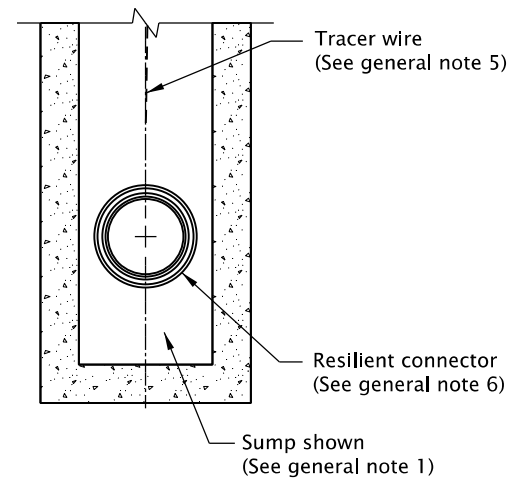
20-JAN-2023
RD339.dgn



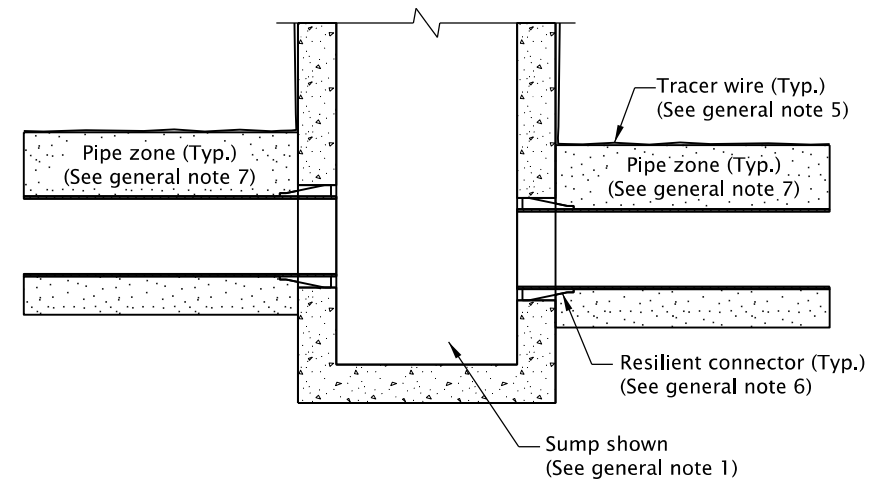
SECTION B-B



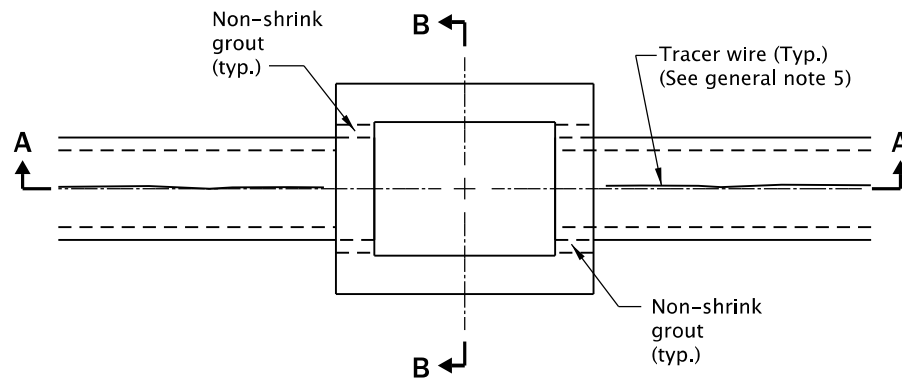
SECTION A-A



SECTION D-D

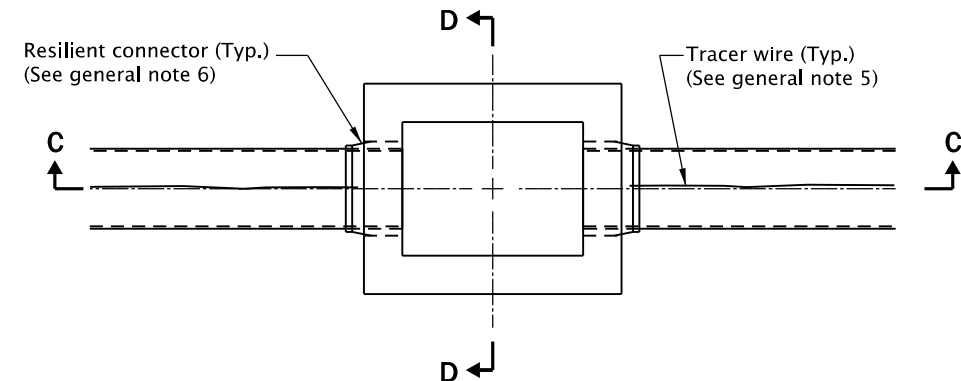


SECTION C-C



PLAN

CONNECTION OF RIGID PIPE TO STRUCTURE



PLAN

CONNECTION OF FLEXIBLE PIPE TO STRUCTURE

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. See Std. Dwgs. RD364, RD365, and RD366 for inlet details not shown.
2. See appropriate standard drawings or special project details for other similar structures.
3. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.
4. Maximum pipe diameter varies with pipe material.
5. All connecting pipes shall have a tracer wire, or approved alternate.
See Std. Dwg. RD336 for tracer wire details.
6. When flexible pipe is used, install resilient connectors conforming to requirements of ASTM C923.
7. Pipe zone varies, see Std. Dwg. RD300.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

PIPE TO STRUCTURE CONNECTIONS

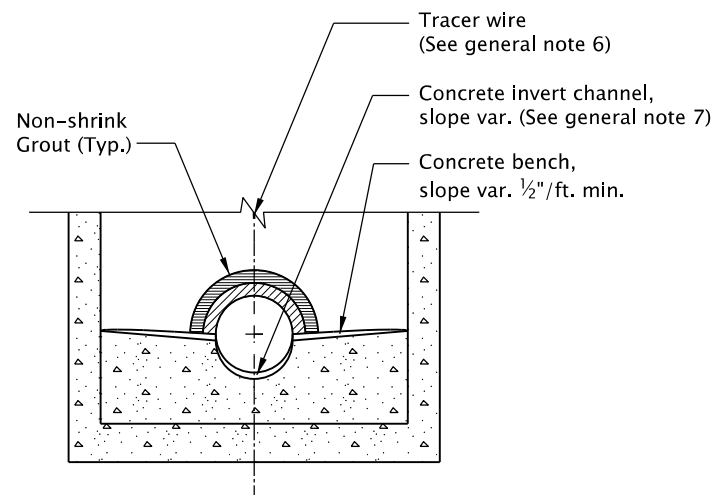
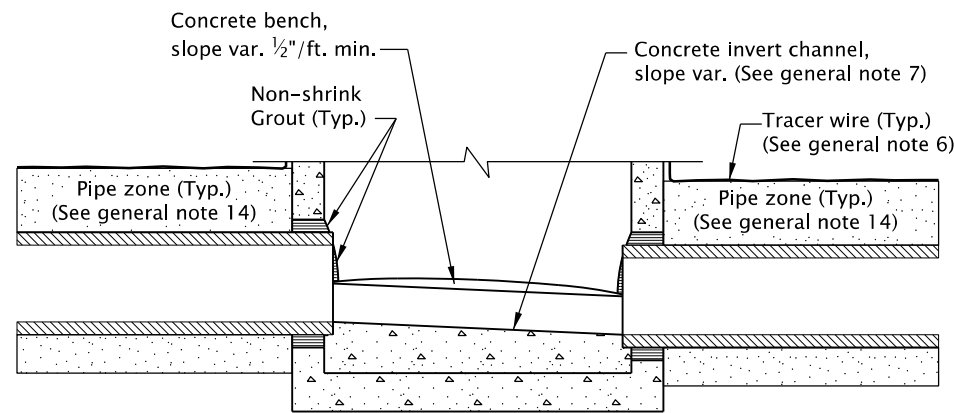
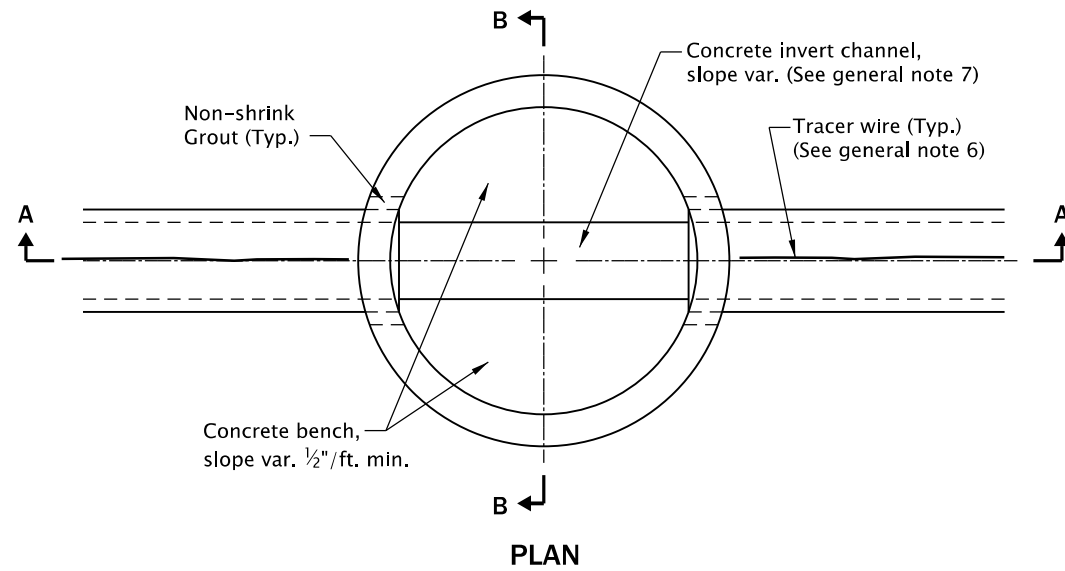
2021

DATE	REVISION	DESCRIPTION
07-2021	REVISED NOTES	
04-2022	REVISED NOTES	
01-2023	REVISED DETAILS AND NOTES	

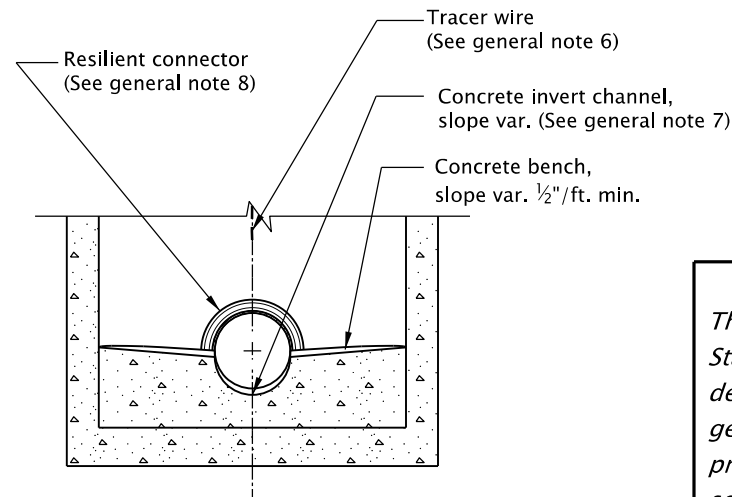
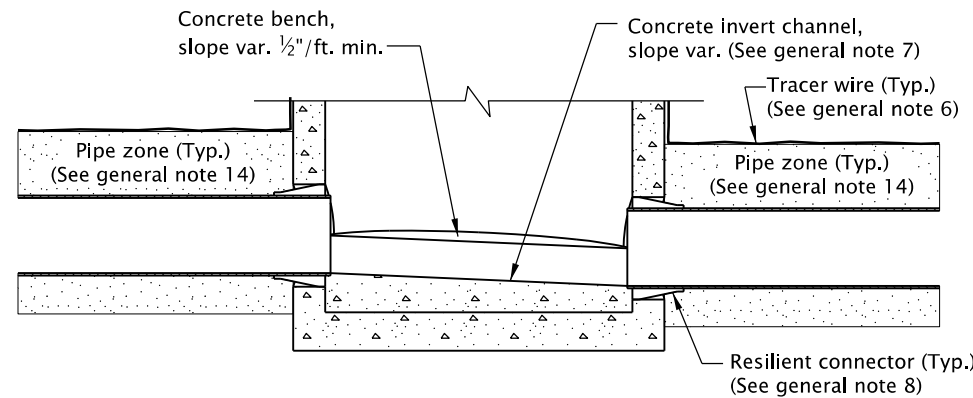
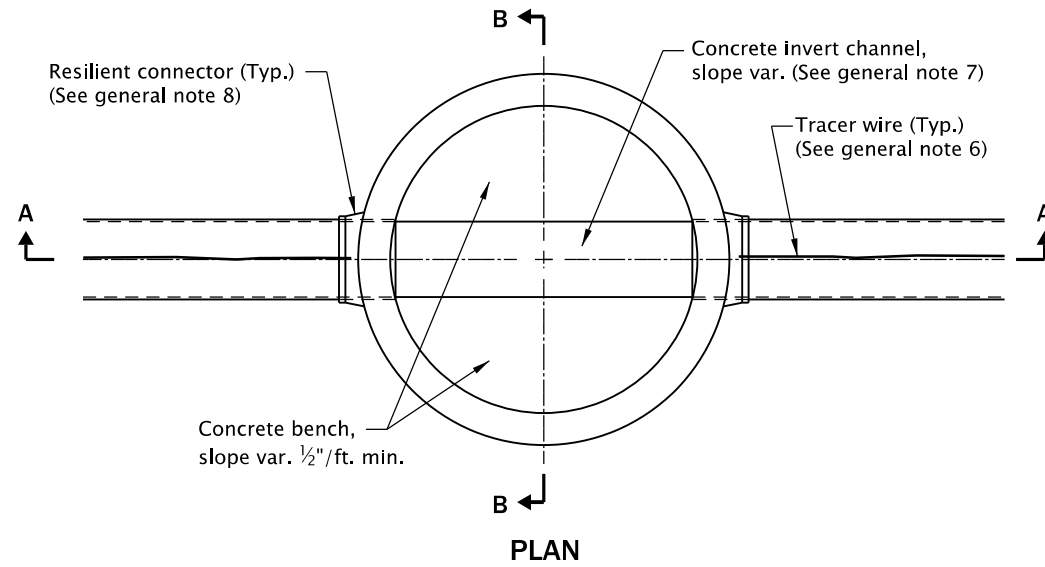
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023	RD339
----------------	-----	----------	-------------	-------

Effective Date: June 1, 2023 – November 30, 2023

20-JAN-2023
RD345.dgn



CONNECTION OF RIGID PIPE TO MANHOLE



CONNECTION OF FLEXIBLE PIPE TO MANHOLE

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. All precast sections shall conform to requirements of ASTM C478.
2. Manhole base sections may be precast or cast-in-place.
3. All concrete shall be commercial grade concrete.
4. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.
5. Maximum pipe diameter varies with pipe material.
6. All connecting pipes shall have a tracer wire, or approved alternate. See Std. Dwg. RD336 for tracer wire details.
7. Invert channels shall be constructed to provide smooth slopes and radii to outlet pipe.
8. When flexible pipe is used, install resilient connectors conforming to requirements of ASTM C923.
9. See Std. Dwg. RD335, RD336, and RD338 for details not shown.
10. See Std. Dwg. RD336 for manhole steps details.
11. See Std. Dwg. RD342 for shallow manholes.
12. See Std. Dwg. RD344 for manhole base section.
13. See Std. Dwg. RD356 for manhole covers and frames, manhole adjustment rings, etc.
14. Pipe zone varies, see Std. Dwg. RD300.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
PIPE TO MANHOLE CONNECTIONS			
2021			
DATE	REVISION	DESCRIPTION	
01-2023	REVISED	DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023
RD345			RD345

Effective Date: June 1, 2023 – November 30, 2023



- ## END VIEW

All materials shall be in accordance with the current Oregon Standard Specifications.

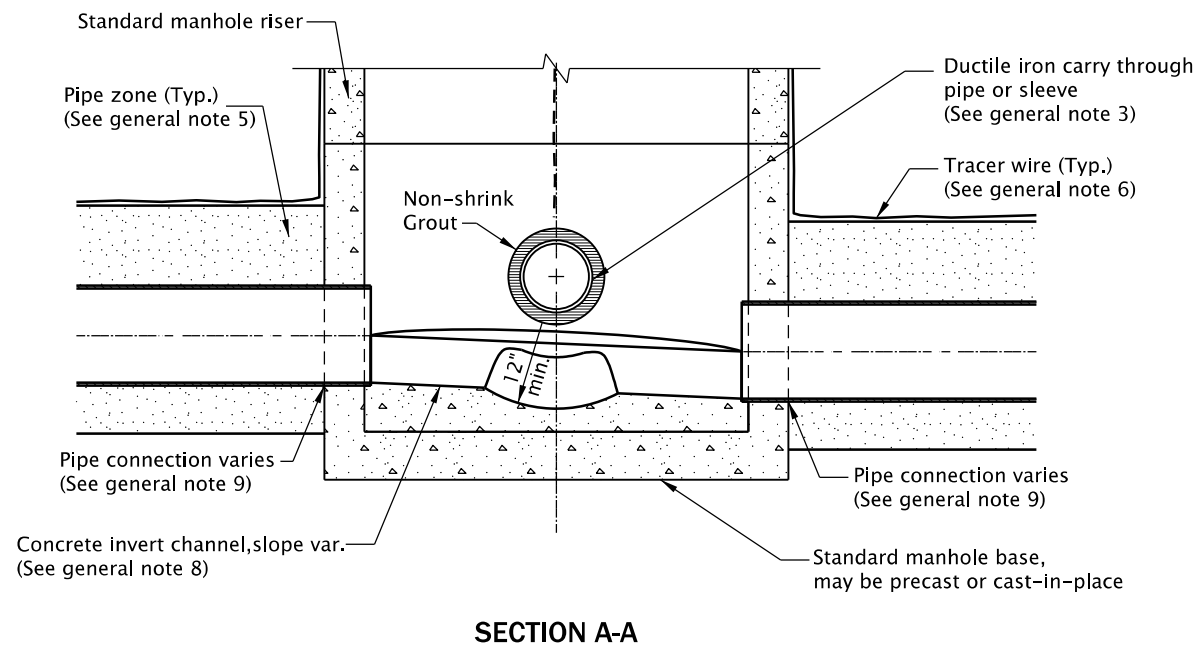
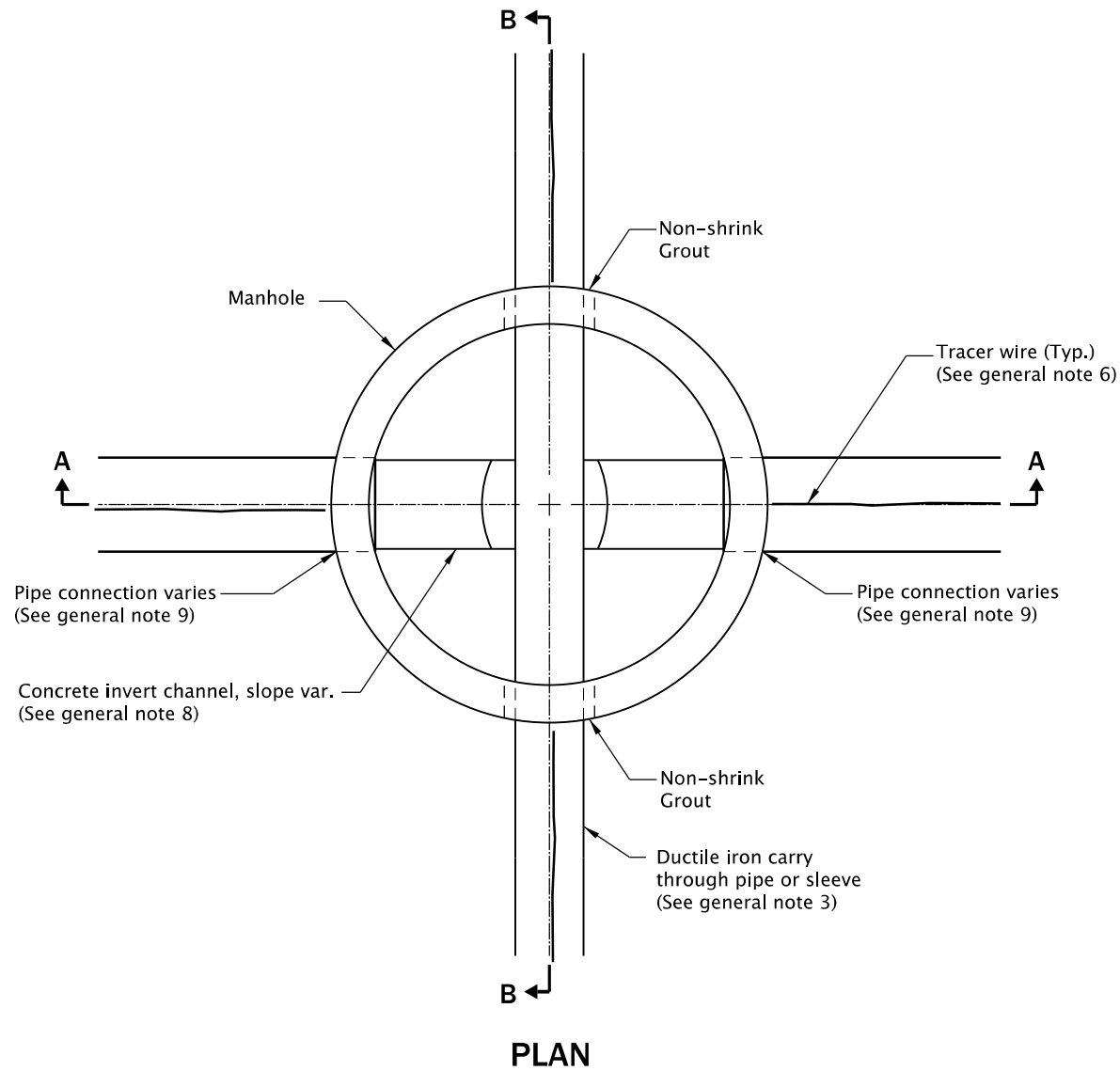
OREGON STANDARD DRAWINGS

OUTSIDE DROP MANHOLES

2021

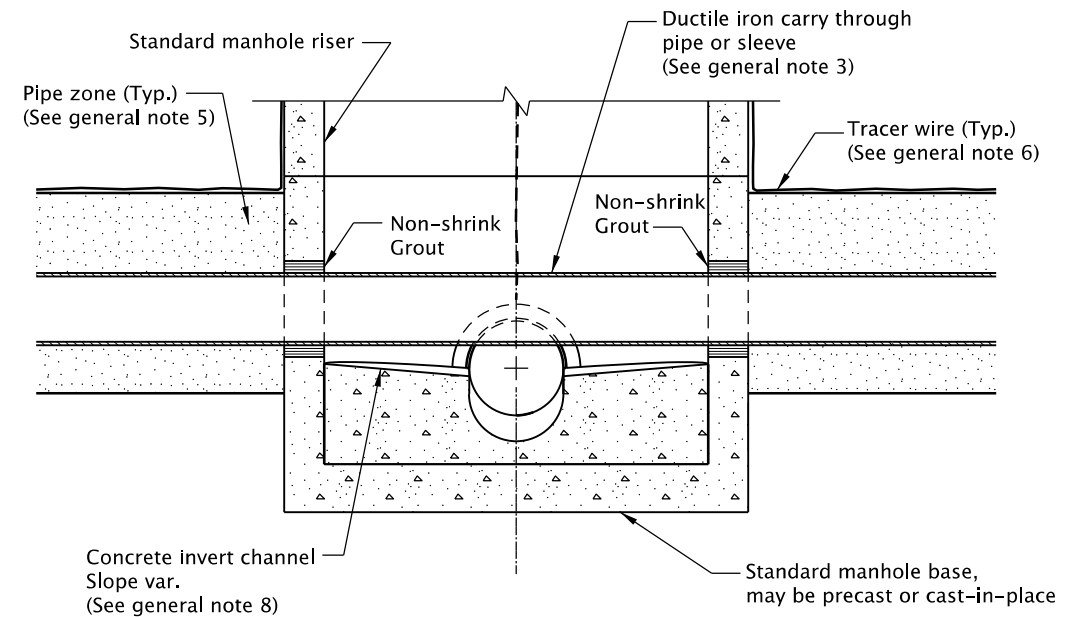
DATE		REVISION DESCRIPTION	
01-2023		REVISED DETAILS AND NOTES	
CALC. BOOK NO. _____ N/A _____		SDR DATE 20-JAN-2023	RD352

20-JAN-2023
RD354.dgn



GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. See appropriate manhole standard drawings for details not shown.
2. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans. See project plans for pipe material.
3. Carry through pipe or sleeve shall be ductile iron, class as specified. No joints allowed on the carry through pipe or sleeve inside the manhole.
4. This manhole design shall be used only as directed by the engineer to mitigate unavoidable grade conflicts.
5. Pipe zone varies, see Std. Dwg. RD300.
6. All connecting pipes shall have a tracer wire, or approved alternate. See Std. Dwg. RD336 for tracer wire details.
7. See Std. Dwg. RD336 for manhole steps details.
8. Invert channels shall be constructed to provide smooth slopes and radii to outlet pipe.
9. See Std. Dwg. RD345 for pipe to manhole connections.



SECTION B-B

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

CARRY THROUGH MANHOLE
STORM

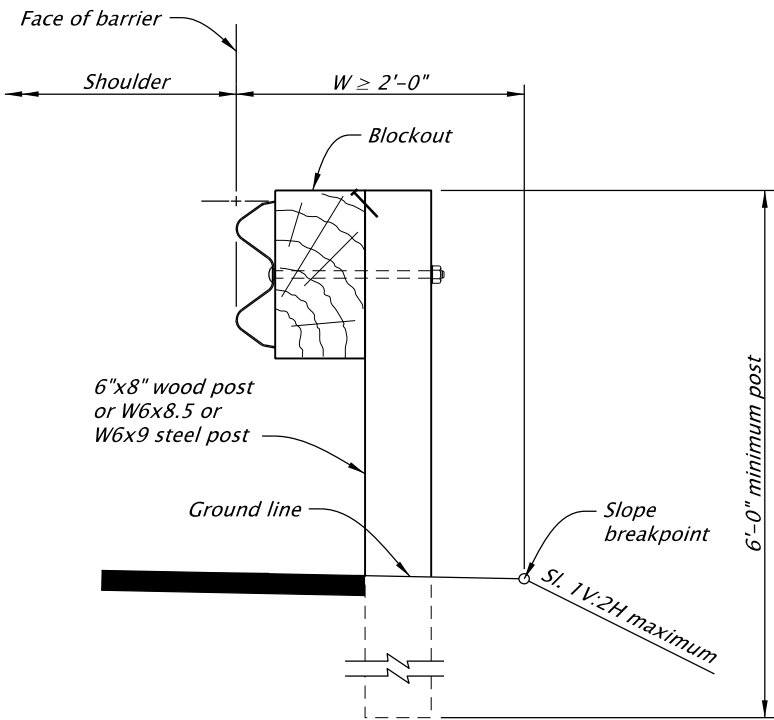
2021

DATE	REVISION	DESCRIPTION
01-2023	REVISED DETAILS AND NOTES	
CALC. BOOK NO.	N/A	SDR DATE

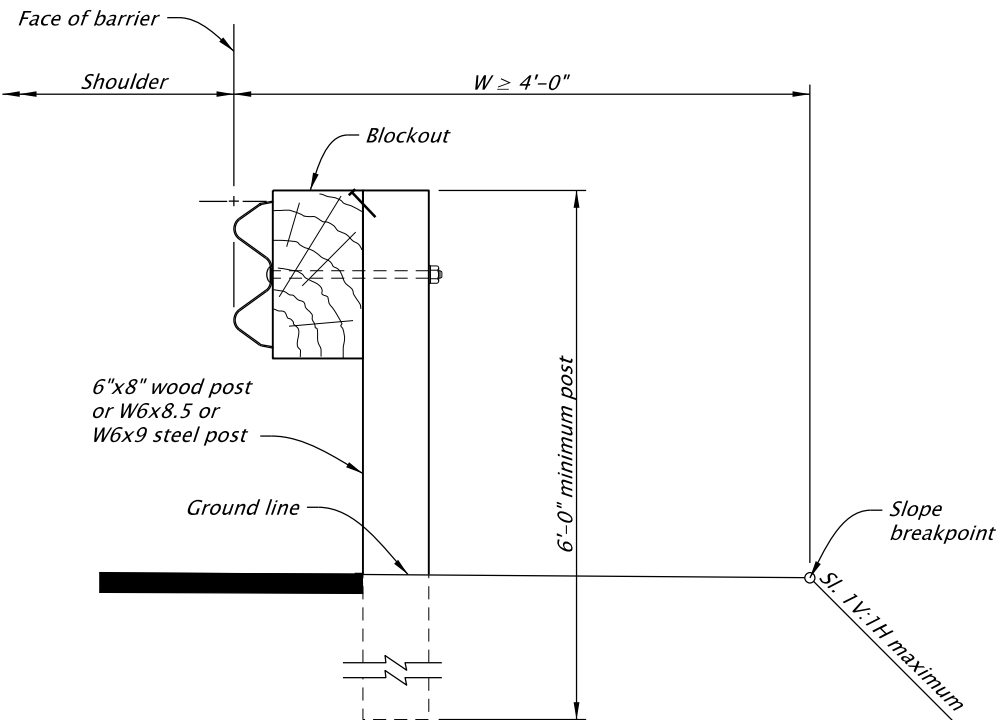
20-JAN-2023

RD354

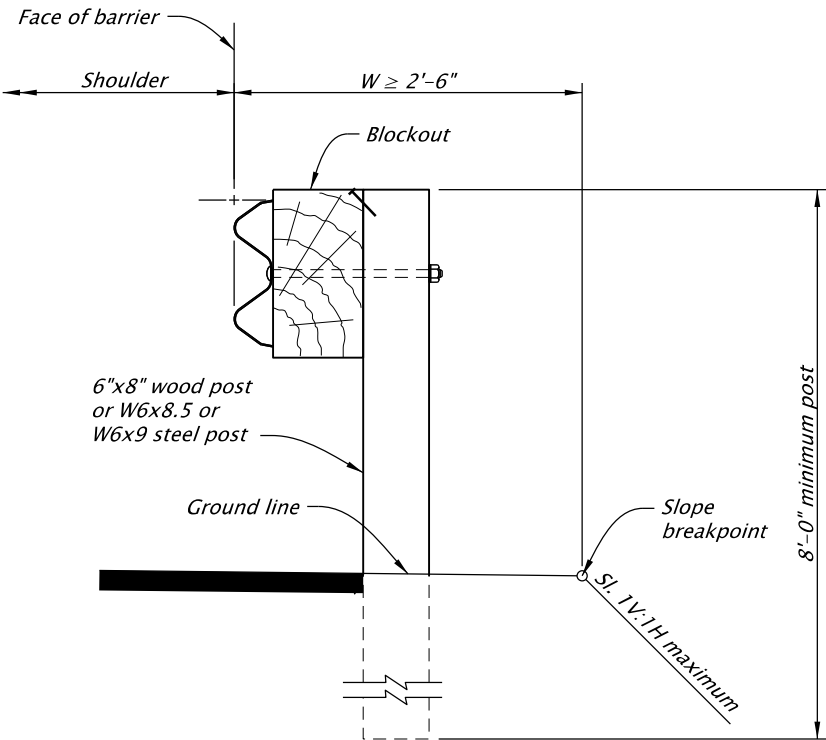
Effective Date: June 1, 2023 – November 30, 2023



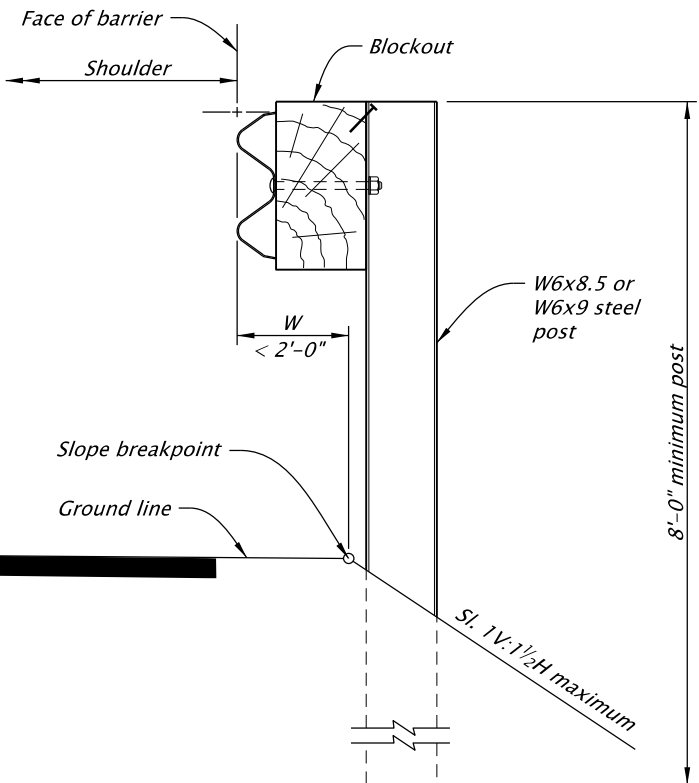
CASE 1
(Wood post shown)



CASE 2
(Wood post shown)
Use when there is a 4'-0" or greater shoulder widening
from face of guardrail to the slope breakpoint



CASE 3
(Wood post shown)
Use when there is a 2'-6" or greater shoulder widening
from face of guardrail to the slope breakpoint



CASE 4
(Steel post shown)
Do not use in weak soil conditions.
Use when there is less than a 2'-0" shoulder widening
from face of guardrail to the slope breakpoint

PLACEMENT OF GUARDRAIL ON SLOPES

NOTE: Cases shown do not apply to terminals,
transition sections or anchors.

- GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:**
- See appropriate guardrail standard drawing(s) for details not shown.
 - Wood blocks shown. Blocks of an approved alternate material may be used. See ODOT's QPL.
 - All posts for guardrail run shall be of the same type: wood or steel.

SLOPE / EMBANKMENT TABLE			
POST LENGTH (ft)	POST TYPE	SLOPE (V:H)	W (ft) (Face of barrier to slope of breakpoint)
6	Wood/Steel	1:2 or flatter	2'-0" minimum
6	Wood/Steel	1:1 or flatter	4'-0" minimum
8	Wood/Steel	1:1 or flatter	2'-6" minimum
8	Steel	1:1 1/2 or flatter	Less than 2'-0"

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
PLACEMENT OF GUARDRAILS ON SLOPES			
2021			
DATE	REVISION DESCRIPTION		
07-2021	NEW DRAWING CREATED		
12-2021	REVISED DETAILS AND NOTES		
12-2022	REVISED NOTE		
CALC. BOOK NO.	N/A	SDR DATE	RD406
— — — —	— —	20-JAN-2023	

20-JAN-2023

RD435.dgn

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. See appropriate guardrail standard drawing(s) for details not shown.
2. On two way, two lane highways, both ends of guardrail runs shall be provided with a flared or non-flared terminal from ODOT's QPL if not buried, as detailed on plans.
3. Type 2A guardrail shown.
4. Where terminal end is buried, a Type 1 modified anchor will be attached to the end post.
5. Trailing ends (freeways, multilane and similar one-way facilities) not exposed to opposing traffic:
 - (a) Guardrail terminals, use a Type 1 modified anchor, Type B end piece and do not flare.
 - (b) At bridge ends, omit Transition Guardrail & Type 3 guardrail and substitute the normal required guardrail.
6.
 - (a) All bolts except adjustment bolts shall be drawn tight on rails and components on initial installation.
 - (b) Final tightness check on rail and component bolts and retightening as required to be done 30 days after initial installation.
7. If the cut or false cut slope is flatter than 1:1 ensure that there is a clear recovery area behind the guardrail, with no funneling effect to the back of the obstruction.
8. "W" distance is measured to face of guardrail at end post.

NOTE:
THIS DRAWING IS RETAINED FOR MAINTENANCE PURPOSES.
DO NOT USE FOR NEW CONSTRUCTION.

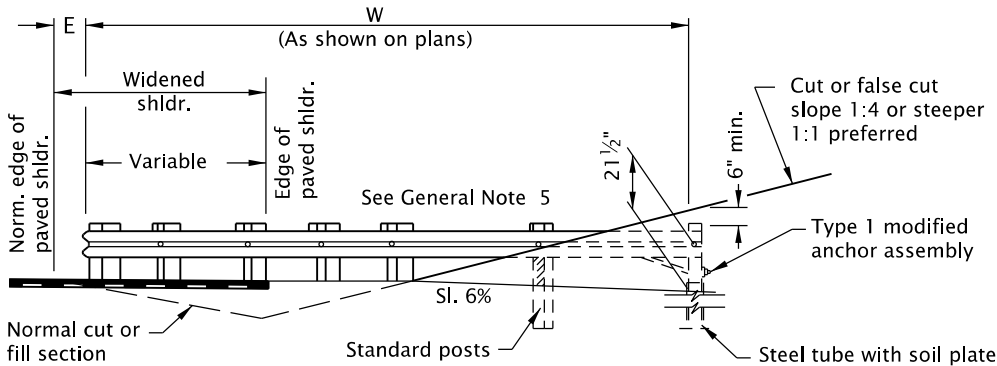
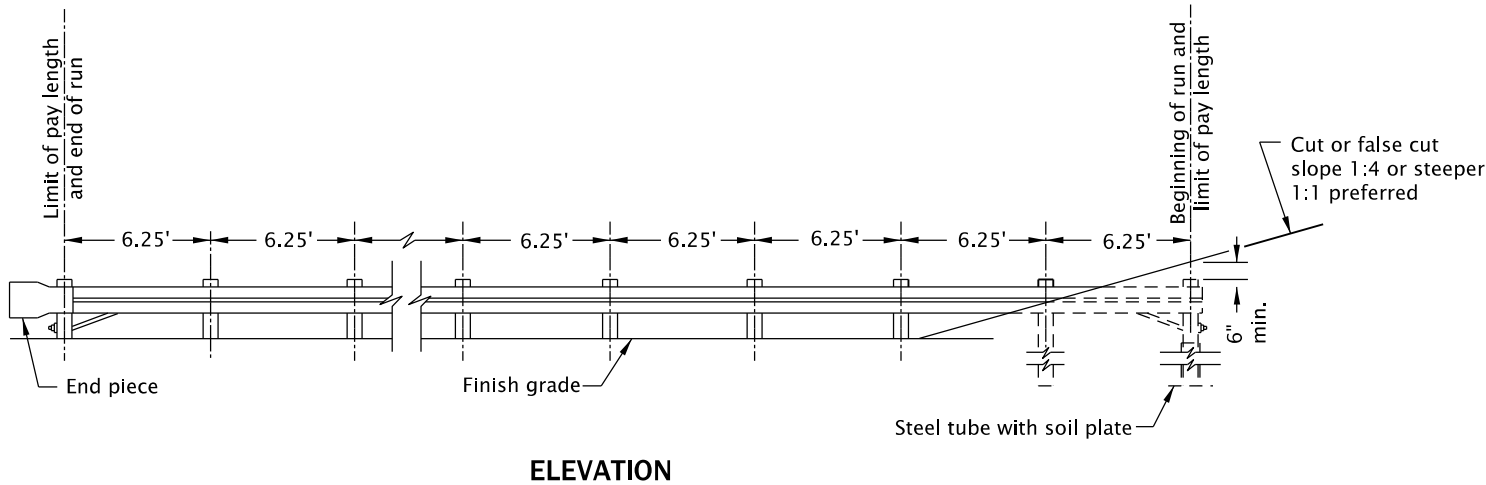
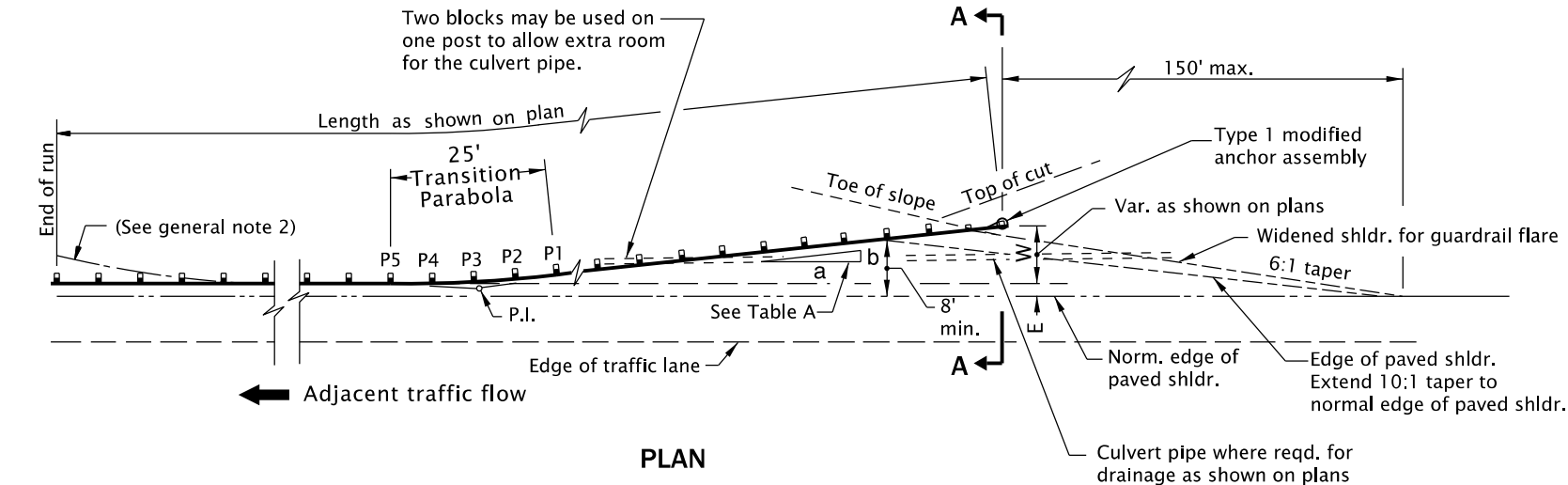
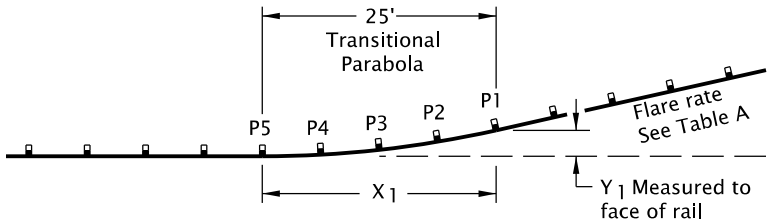


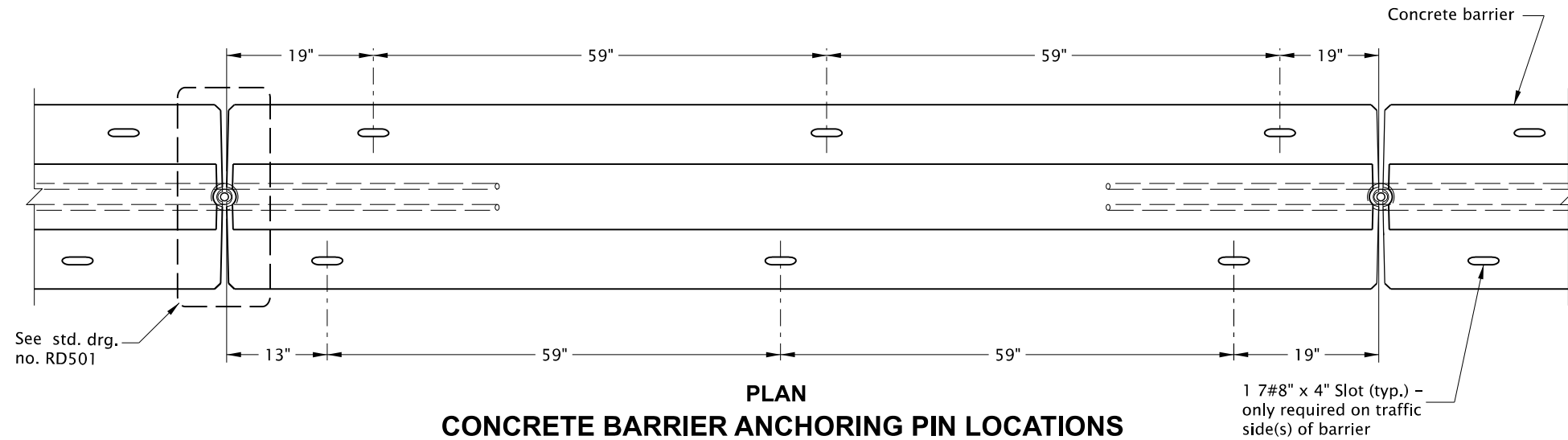
TABLE A FLARE RATE & 25' TRANSITION PARABOLA						
FLARE RATE a : b		POST NUMBER				
		P5	P4	P3	P2	P1
15:1	X (ft)	0	6.25	12.49	18.72	24.92
	Y (ft)	0	0.05	0.21	0.47	0.83

E= 2' where shown on plans.



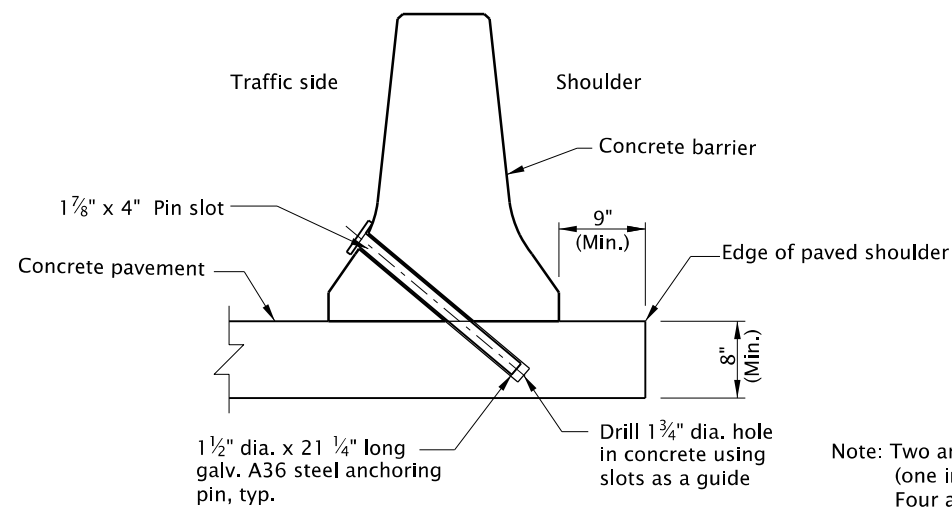
The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS GUARDRAIL INSTALLATION TERMINAL (CUT OR FALSE-CUT) (29" RAIL HEIGHT) 2021			
DATE	REVISION DESCRIPTION		
01-2023	REVISED NOTES		
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023
RD435			



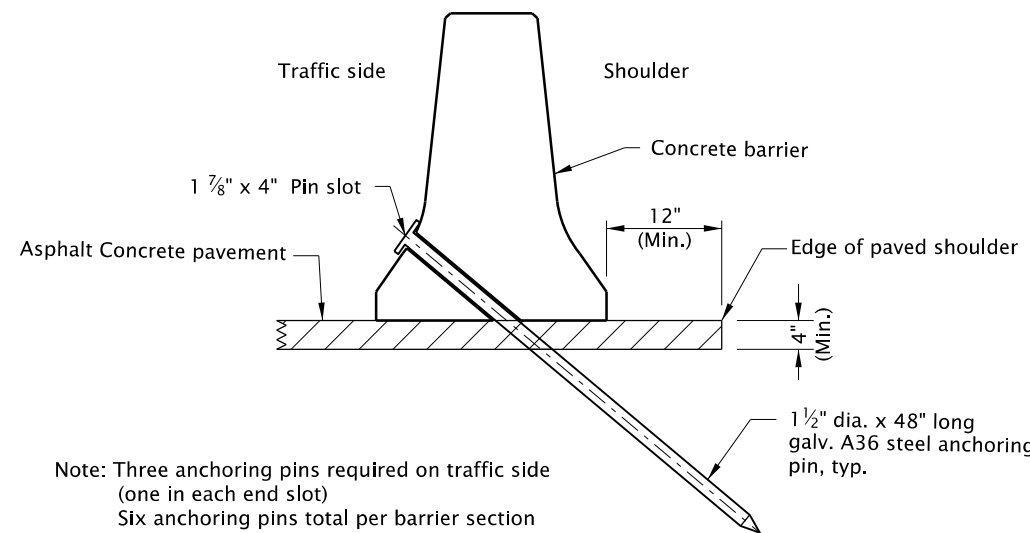
GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. See Std. Dwgs. RD500 and RD501 for details not shown.
2. Conc. grout for grouting over pins, pinning holes or grouting of scuppers shall be portland cement grout, weak in strength and of thick consistency, as directed.
3. All pins, bolts, dowels, loop bars, and connectors shall be hot-dip galvanized after fabrication.



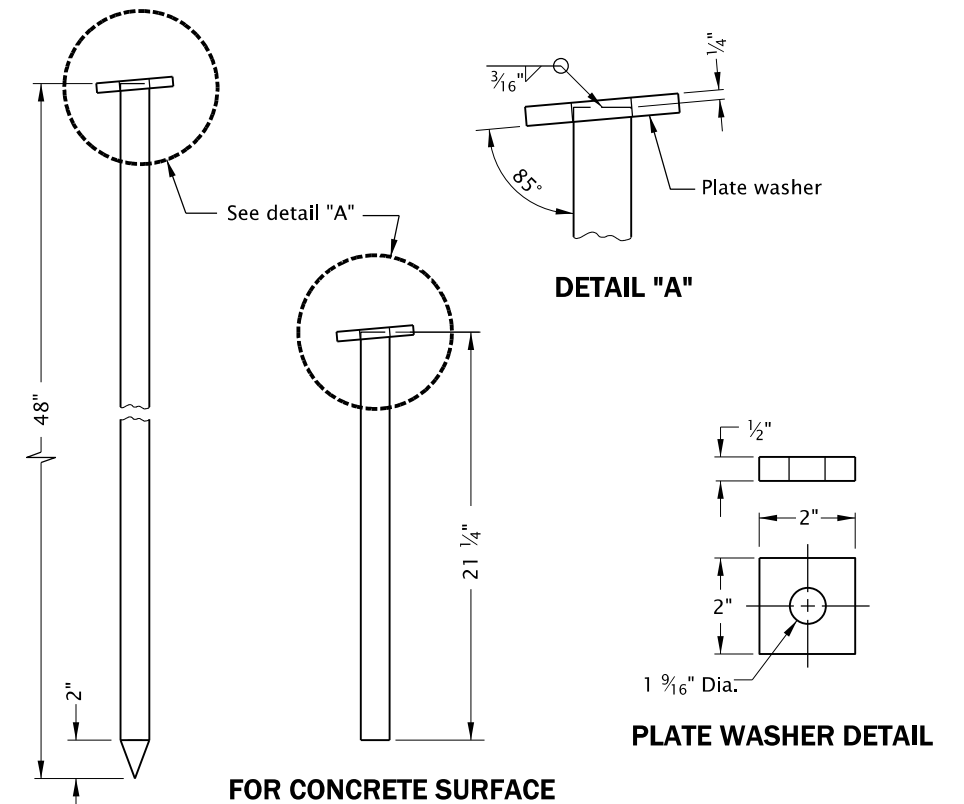
Note: Two anchoring pins required on traffic side (one in each end slot)
Four anchoring pins total per barrier section

CONCRETE ANCHORING PIN DETAILS



ASPHALT ANCHORING PIN DETAILS

METHODS OF SECURING CONCRETE BARRIER TO ROADWAY

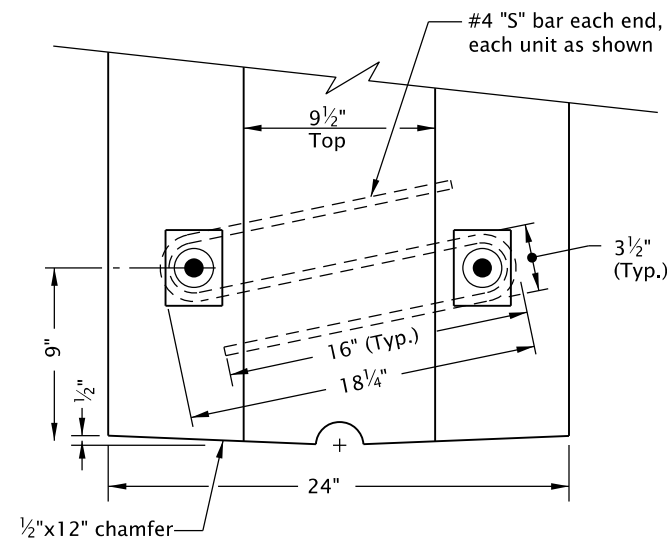


The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

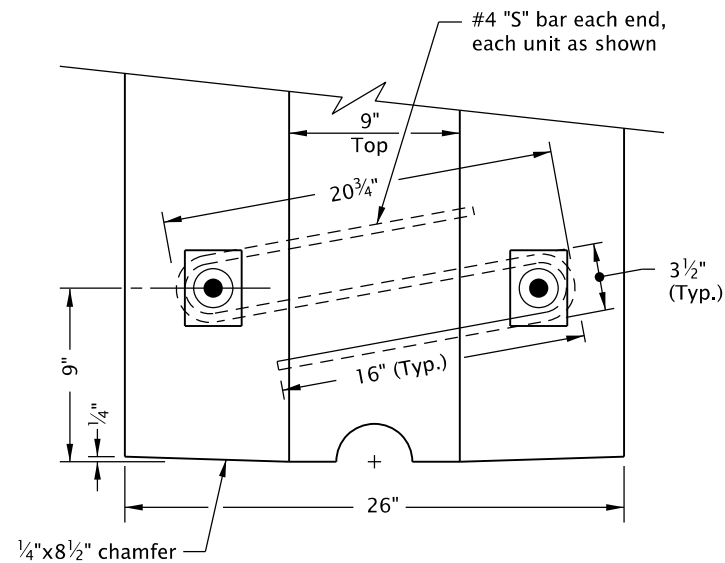
All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
SECURING 32" TYPE "F" AND TALL 42" PRECAST CONCRETE BARRIER TO THE ROADWAY			
2021			
DATE	REVISION DESCRIPTION		
10-2020	NEW DRAWING CREATED		
01-2022	REVISED NOTES		
01-2023	TITLE CHANGE		
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023
			RD502

MEDIAN CONCRETE BARRIER ANCHORING DETAILS

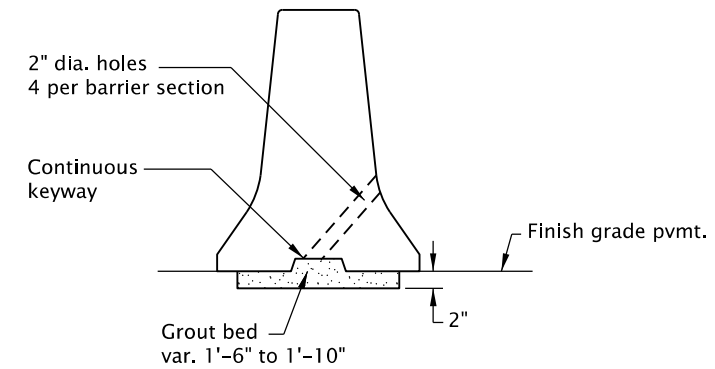
(See general note 1)



PLAN VIEW AT S BAR
STANDARD BARRIER



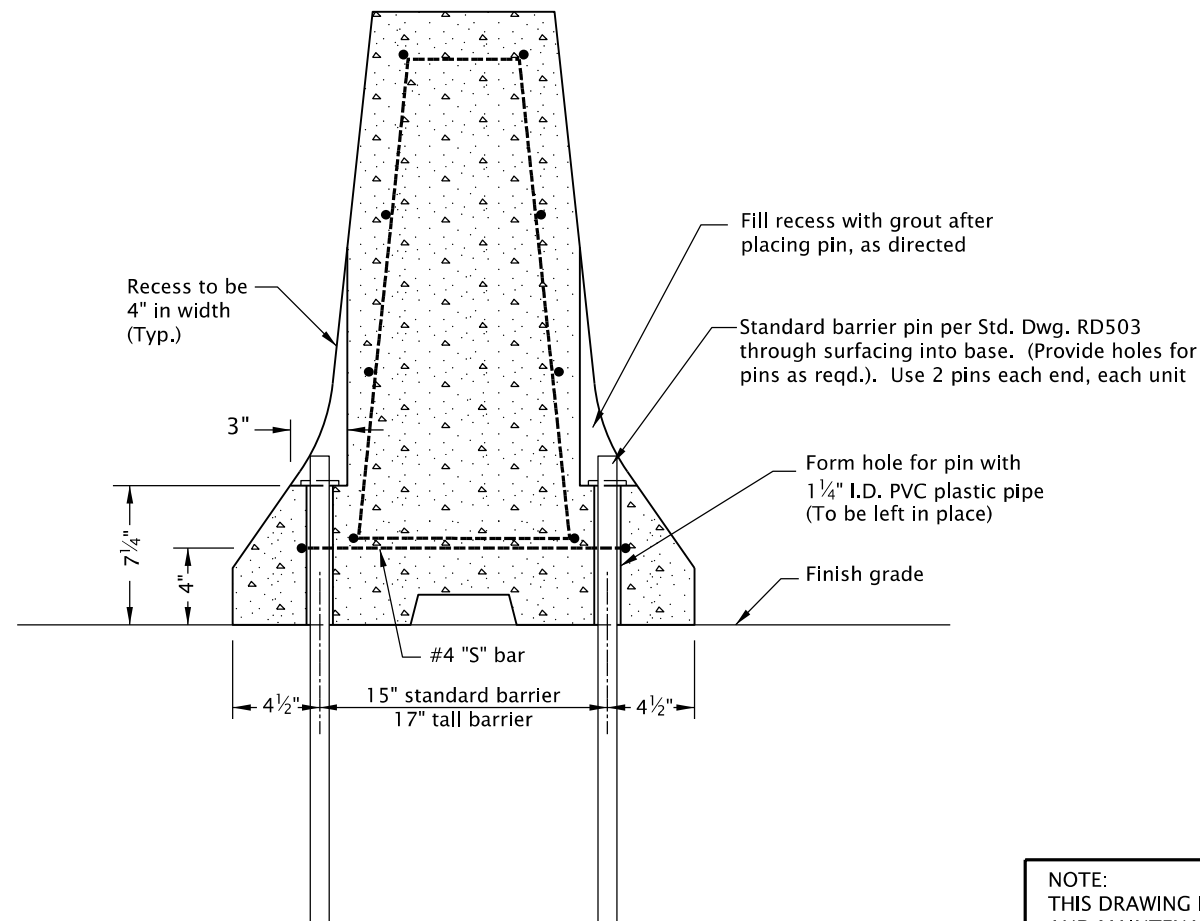
PLAN VIEW AT S BAR
TALL BARRIER



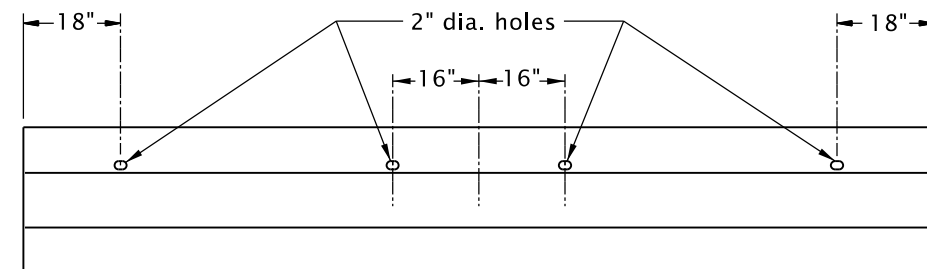
GROUT DETAIL
FOR PRECAST CONCRETE BARRIER

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. For use in medians with width less than 8' (as measured between nearest fog lines). THIS STANDARD DRAWING IS RETAINED FOR TEMPORARY INSTALLATION AND MAINTENANCE PURPOSES ONLY.
2. See Std. Dwgs. RD503 and RD546 for reinforcement and other details not shown.
3. See Std. Dwg. RD516 for securing concrete barrier to roadway.
4. All pins, bolts, dowels, loop bars, and connectors shall be hot-dip galvanized after fabrication.
5. S bars to be full length as shown.



ELEVATION VIEW AT ANCHOR RODS
SECURING TO PAVEMENT OPTION



GROUTING HOLES PLAN

GROUTING OPTION

(Dimensions between 2" dia. holes are nominal)

This detail is retained for maintenance purposes.
Do not use for new construction.

NOTE:
THIS DRAWING IS RETAINED FOR TEMPORARY INSTALLATION
AND MAINTENANCE PURPOSES ONLY.
DO NOT USE FOR NEW PERMANENT INSTALLATIONS.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

MEDIAN BARRIER ANCHORING DETAILS

2021

DATE	REVISION	DESCRIPTION
07-2022	REVISED DETAILS AND NOTES	
01-2023	REVISED NOTES	
CALC. BOOK NO.	N/A	SDR DATE

20-JAN-2023

RD515

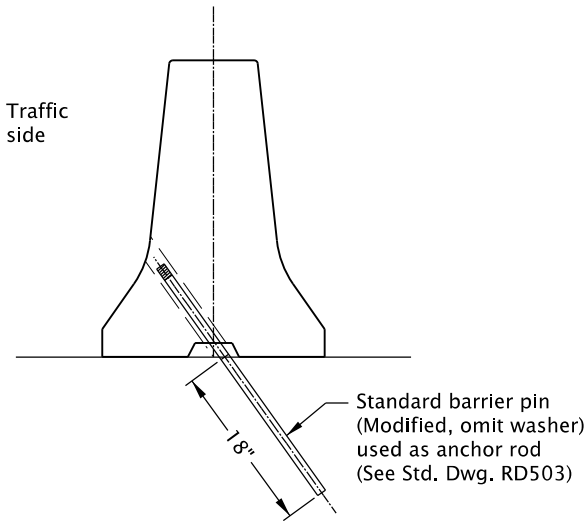
Effective Date: June 1, 2023 – November 30, 2023

20-JAN-2023

RD516.dgn

METHODS OF SECURING PRECAST CONCRETE BARRIER TO ROADWAY

(See general note 1)

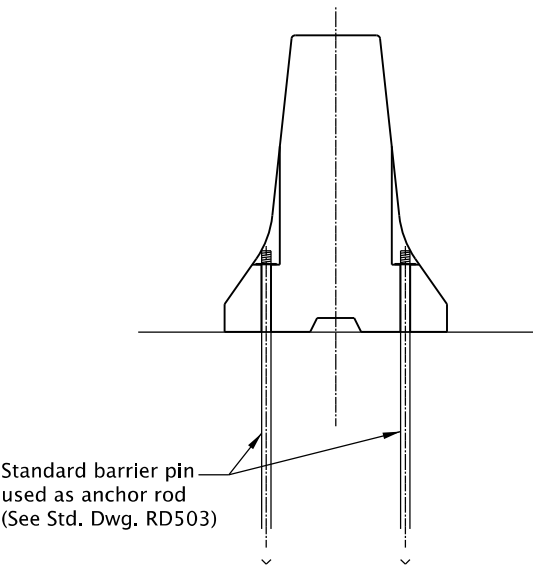


SHOULDER INSTALLATION

Secured using anchor rods (Angled)
Not allowed in narrow medians, see general notes 1 and 6

PRECAST
CONCRETE BARRIER

(See Std. Dwg. RD503)

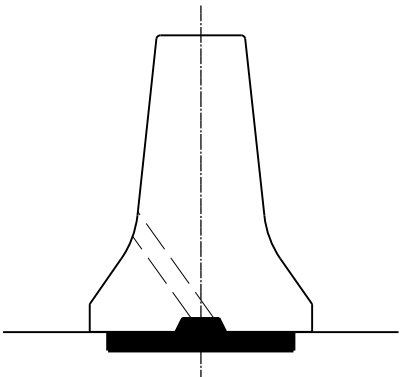


MEDIAN INSTALLATION

Secured using anchor rods (Vertical)
(See general note 1)

PRECAST
CONCRETE BARRIER

(See Std. Dwgs. RD503 & RD515)



THIS DETAIL IS RETAINED FOR MAINTENANCE PURPOSES.

SHOULDER OR MEDIAN INSTALLATION

Secured using grout
(See general note 1)

PRECAST
CONCRETE BARRIER

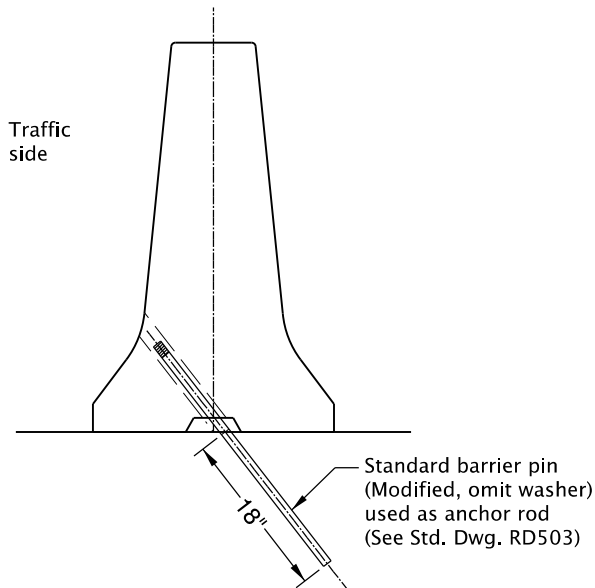
(See Std. Dwg. RD503)

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. This standard drawing is intended to show acceptable methods of securing concrete barrier to roadway and is RETAINED FOR TEMPORARY INSTALLATION AND MAINTENANCE PURPOSES.
2. Secure concrete barrier to roadway when any of the following conditions exist:
 - a) Barrier deflection requirements per Std. Dwg. RD503 cannot be obtained, or
 - b) When required by plans, or
 - c) As directed by the Engineer.
3. Select one of the securing methods shown.
For details not shown, see the standard drawing(s) referenced for the selected method.
4. Securing concrete barrier to roadway is in addition to connections between adjacent concrete barrier sections, bridge rails, retaining walls, and similar existing or constructed objects.
5. Temporary concrete barrier to be precast concrete median barrier with pin and loop assembly.
6. Precast concrete barrier used in medians less than 8 feet in width (as measured between nearest fog lines) shall be secured to roadway to resist impacts from both sides.
7. Anchor rods are standard barrier pins, modified for shoulder installation, as shown.
8. Normal permanent installation of concrete barrier is on top of finish grade, to provide 3 inch vertical reveal. Modify placement when required by plans, or as directed.
9. All pins, bolts, dowels, loop bars, and connectors shall be hot-dip galvanized after fabrication.

METHODS OF SECURING PRECAST TALL (42") CONCRETE BARRIER TO ROADWAY

(See general note 1)

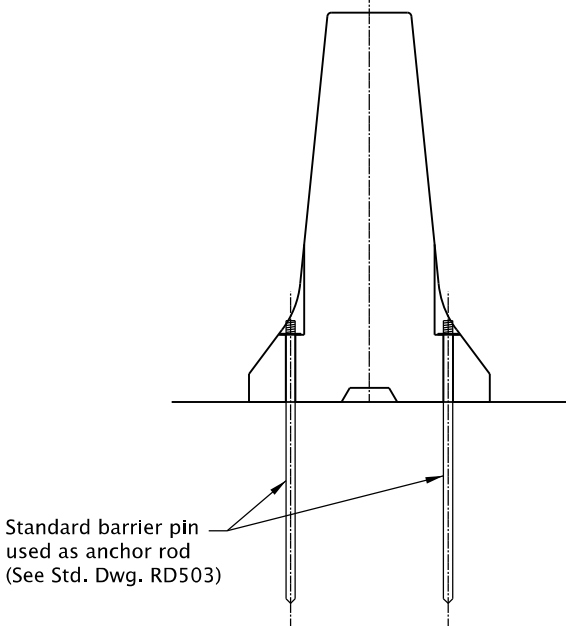


SHOULDER INSTALLATION

Secured using anchor rods (Angled) not allowed
in narrow medians, see general notes 1 and 6

PRECAST TALL (42")
CONCRETE BARRIER

(See Std. Dwgs. RD545 and RD546)

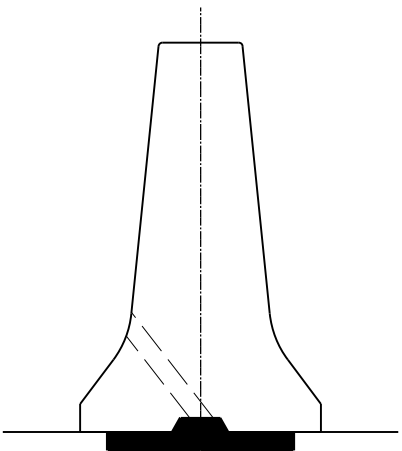


MEDIAN INSTALLATION

Secured using anchor rods (Vertical)
(See general note 1)

PRECAST TALL (42")
CONCRETE BARRIER

(See Std. Dwgs. RD545 and RD515)



THIS DETAIL IS RETAINED FOR MAINTENANCE PURPOSES.

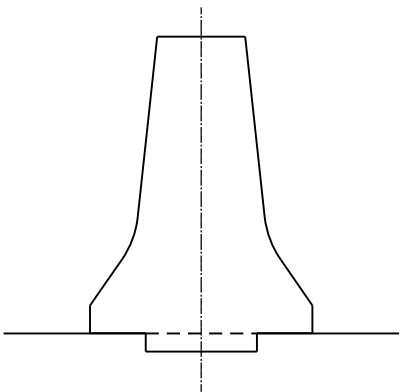
SHOULDER OR MEDIAN INSTALLATION

Secured using grout
(See general note 1)

PRECAST TALL (42")
CONCRETE BARRIER

(See Std. Dwgs. RD545 and RD546)

NOTE:
THIS DRAWING IS RETAINED FOR TEMPORARY INSTALLATION
AND MAINTENANCE PURPOSES ONLY.
DO NOT USE FOR NEW PERMANENT INSTALLATIONS.



SHOULDER OR MEDIAN INSTALLATION

Secured by continuous shear key
(See general note 1)

METHODS OF SECURING CAST-IN-PLACE
CONCRETE BARRIER TO ROADWAY

(See Std. Dwg. RD505)

*The selection and use of this
Standard Drawing, while
designed in accordance with
generally accepted engineering
principles and practices, is the
sole responsibility of the user
and should not be used without
first consulting a Registered
Professional Engineer.*

All materials shall be in accordance with
the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

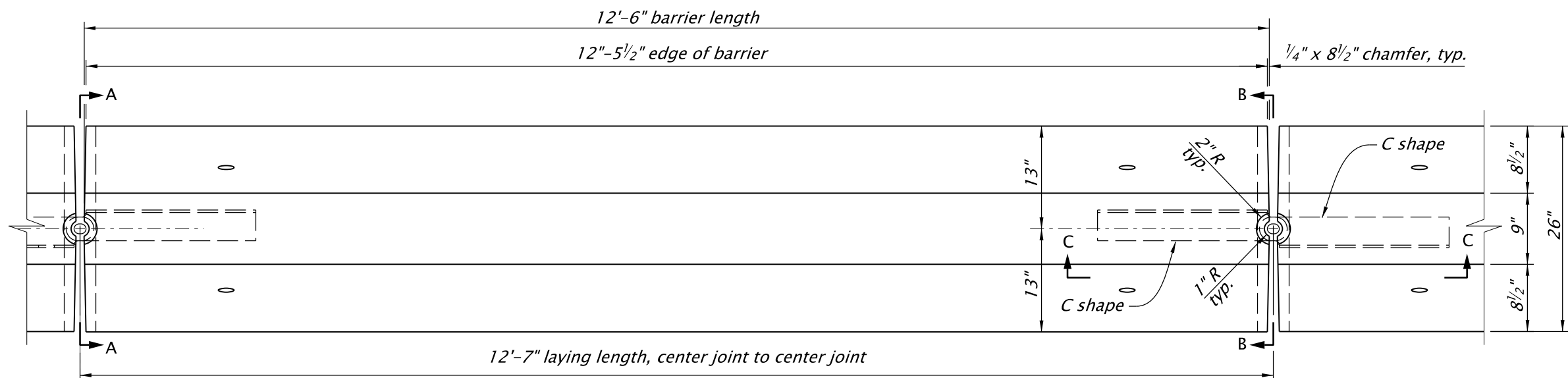
SECURING CONCRETE BARRIER
TO ROADWAY

2021

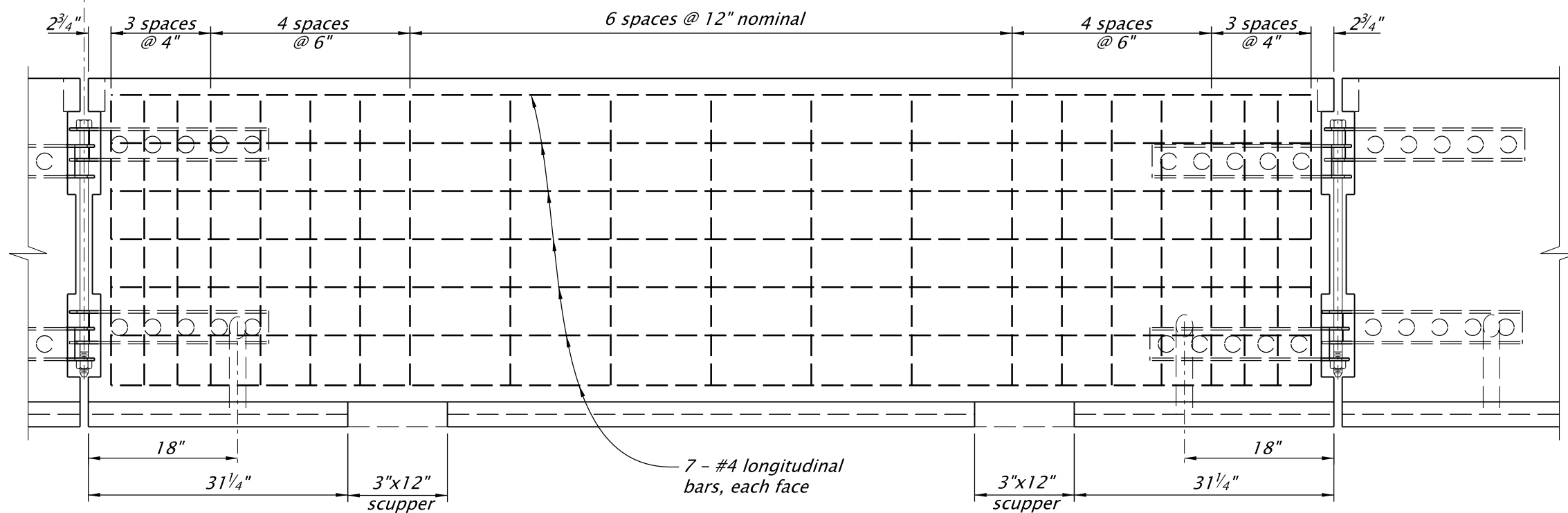
DATE		REVISION DESCRIPTION	
01-2023	REVISED NOTES		
CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023

RD516

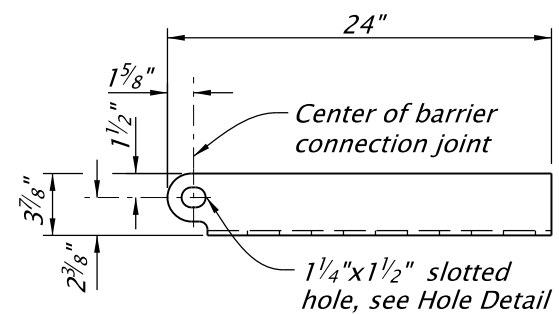
Effective Date: June 1, 2023 – November 30, 2023



PLAN

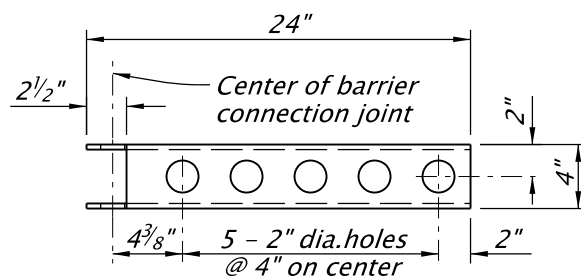


ELEVATION



PLAN

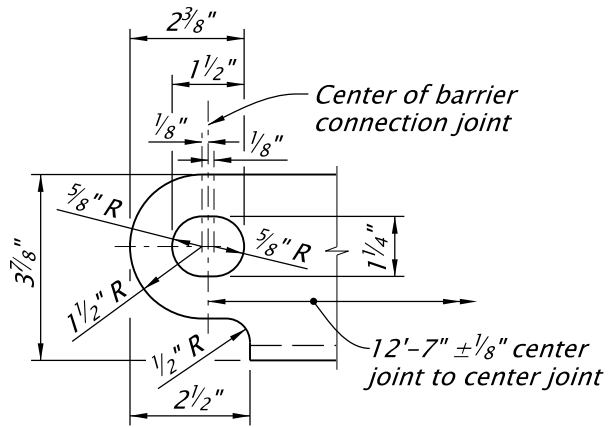
Cut from 5/16" thick steel plate
(See note 5 for casting instructions)



ELEVATION

Perforated C-shape

C-SHAPE DETAIL



HOLE DETAIL

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. All reinforcing bars shall be full length as shown and shall be 2 inches clear of the nearest face of concrete unless shown otherwise.
2. All pins, bolts, dowels, loop bars, and connectors shall be hot-dip galvanized after fabrication.
3. Normal use of precast tall median barrier is restricted to curves with radii greater than 770'.
4. Chamfer all edges 3/4 inch, typical.
5. Perforated C-shape shall be placed in location shown to a tolerance of 3/32 inch.
6. Estimated barrier weight is 8070 pounds per 12.5 foot unit length, estimated narrow base barrier weight is 6550 pounds.
7. To anchor median barrier see Std. Dwg. RD502.
8. Narrow base shoulder barrier to be used only at locations with backfill behind barrier as shown on plans.
9. For barrier location details, see Std. Dwg. RD500.
10. When scuppers are not required, plug them with a minimum 2" of grout, as directed.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

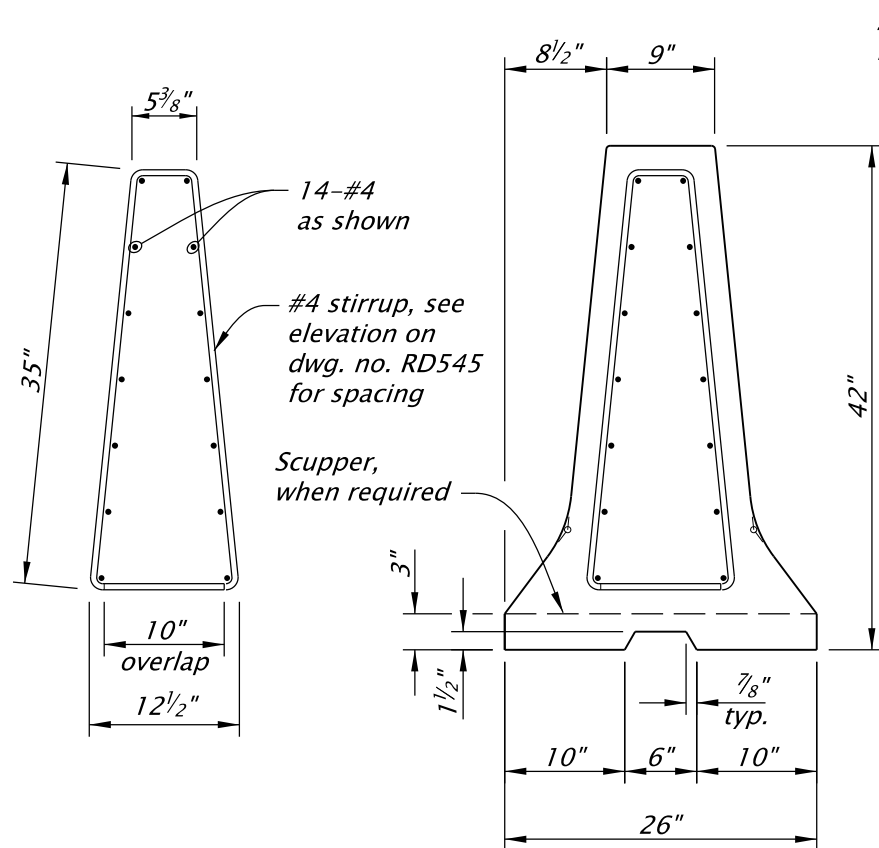
PRECAST TALL (42")
CONCRETE BARRIER

2021

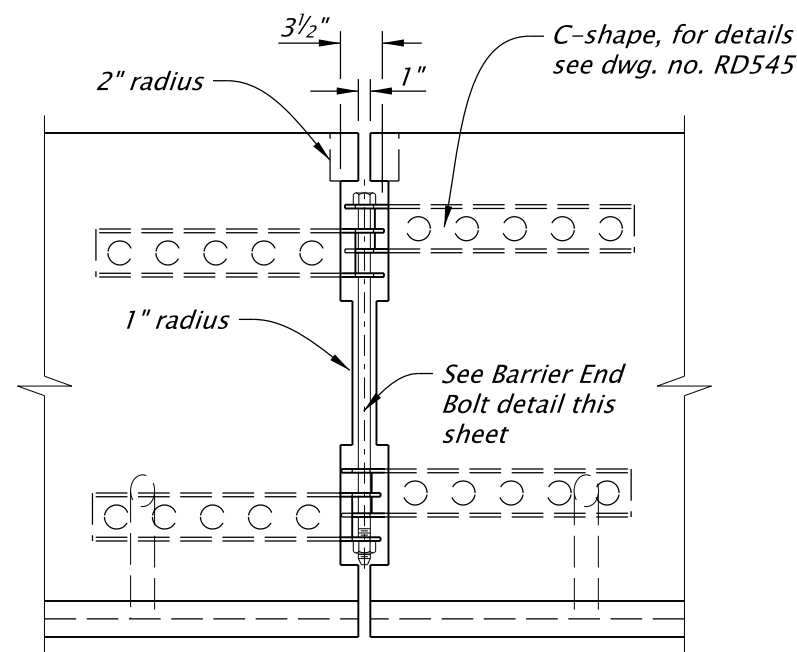
DATE	REVISION	DESCRIPTION
07-2022	UPDATED DRAWING TO CONNECT	
01-2023	REVISED NOTES	
CALC. BOOK NO.	N/A	SDR DATE
		20-JAN-2023

RD545

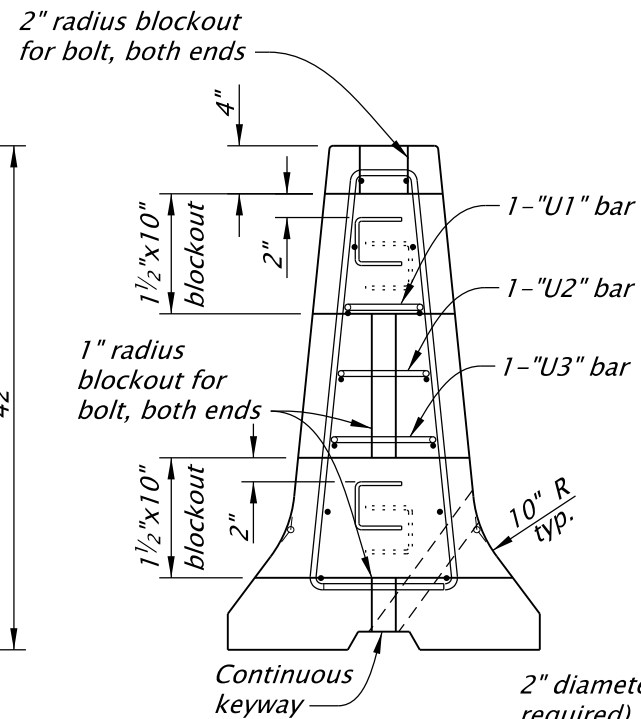
Effective Date: June 1, 2023 – November 30, 2023



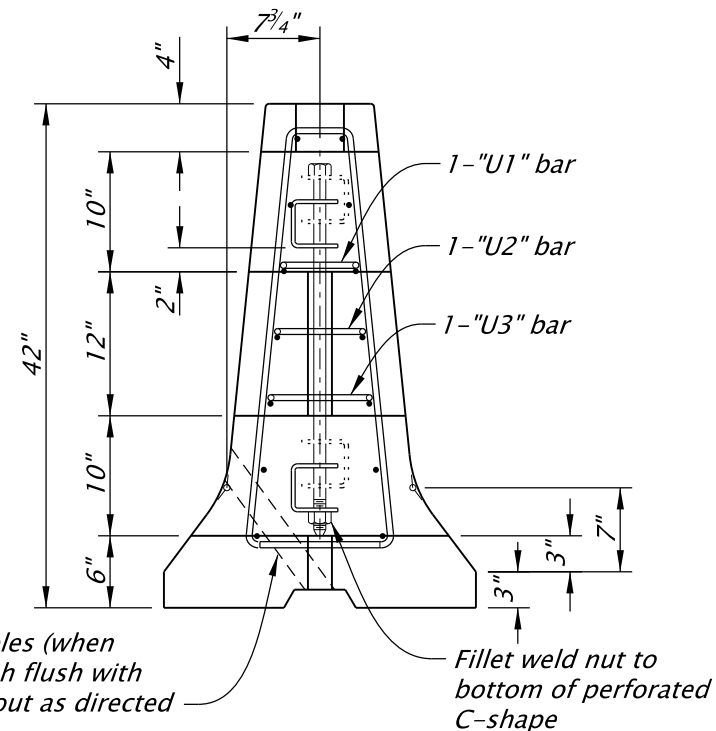
TYPICAL SECTION



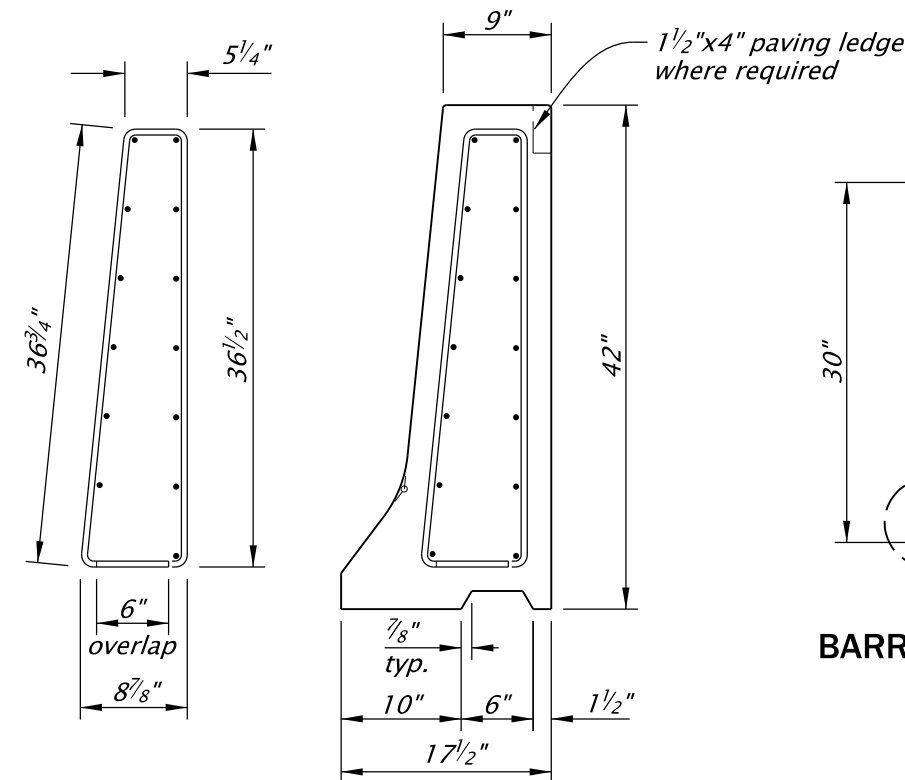
SECTION C-C



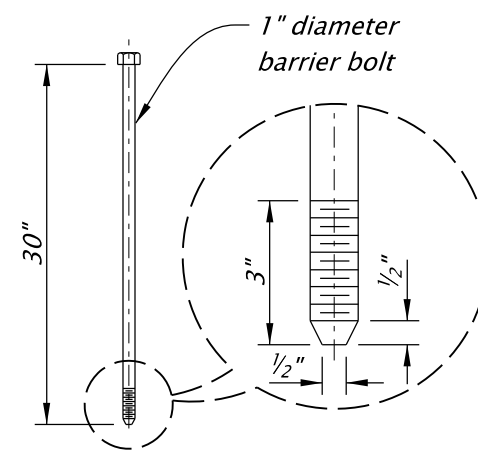
END VIEW A-A



END VIEW B-B

TALL NARROW BASE
SHOULDER BARRIER

Only use against retaining walls or as directed. For details not shown, see other barrier details on this drawing and on dwg. no. RD545.

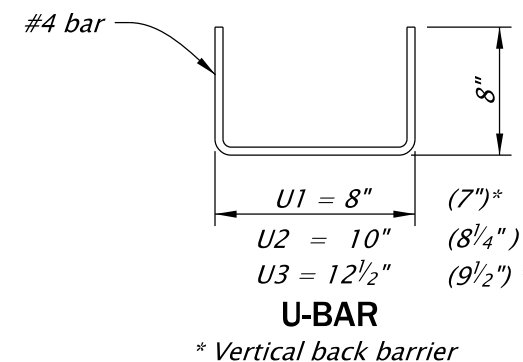


BARRIER END BOLT

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:

1. All reinforcing bars shall be full length as shown and shall be 2" clear of the nearest face of concrete unless shown otherwise.
2. All pins, bolts, dowels, loop bars, and connectors shall be hot-dip galvanized after fabrication.
3. Normal use of precast tall median barrier is restricted to curves with radii greater than 770'.
4. Chamfer all edges $\frac{3}{4}$ inch, typical.
5. Perforated C-shape shall be placed in location shown to a tolerance of $\frac{3}{32}$ inch.
6. Estimated barrier weight is 8070 pounds per 12.5 foot unit length, estimated narrow base barrier weight is 6,550 pounds.
7. To anchor median barrier see Std. Dwg. RD502.
8. Narrow base shoulder barrier to be used only at locations with backfill behind barrier as shown on plans.
9. For barrier location details, see Std. Dwg. RD500.
10. When scuppers are not required, plug them with a minimum 2" of grout, as directed.



All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

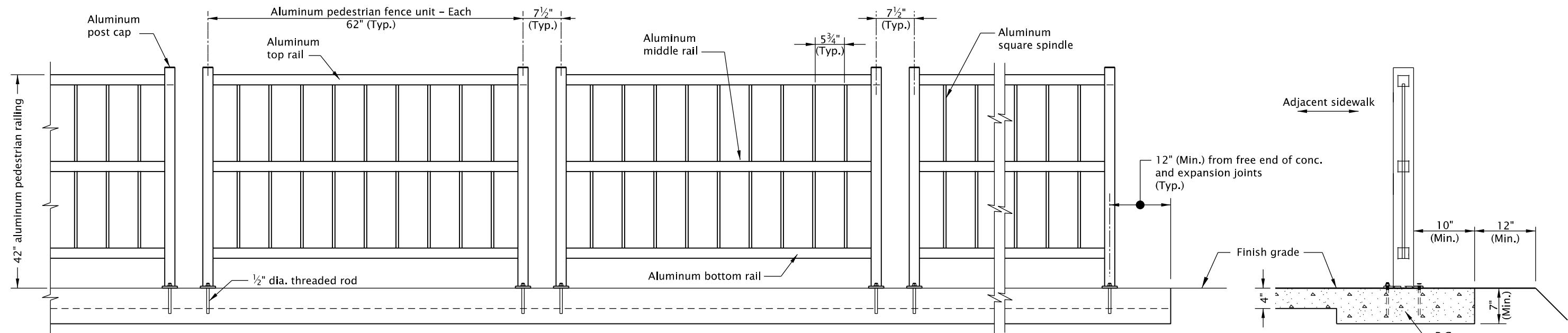
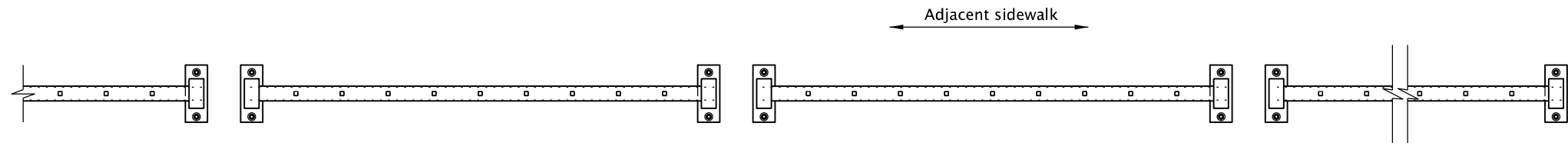
PRECAST TALL (42")
CONCRETE BARRIER

2021

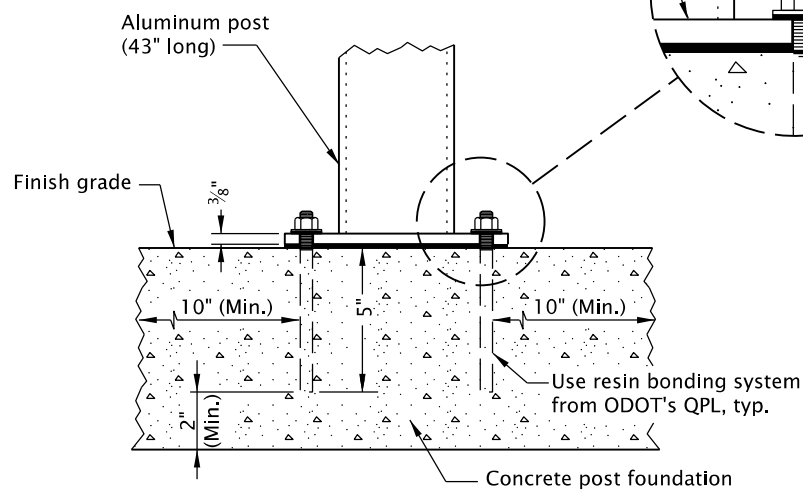
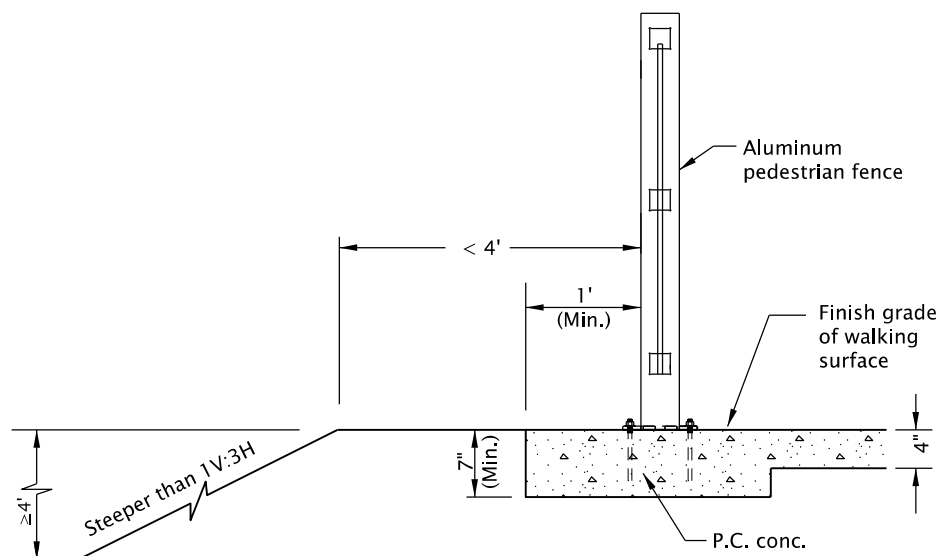
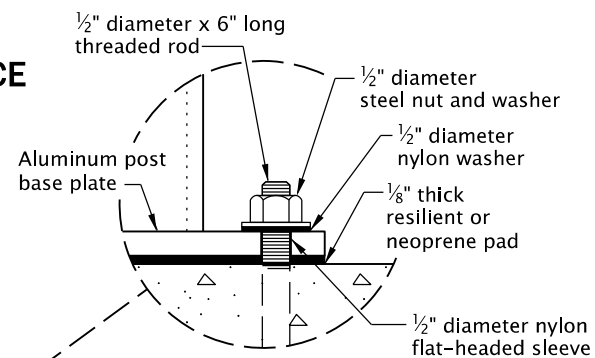
DATE	REVISION	DESCRIPTION
07-2022	CREATED NEW DRAWING	
01-2023	REVISED NOTES	

CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023	RD546
----------------	-----	----------	-------------	-------

Effective Date: June 1, 2023 – November 30, 2023



ALUMINUM PEDESTRIAN FENCE



POST BASE PLATE BOLT DOWN ANCHOR

- GENERAL NOTES FOR ALL DETAILS ON THIS SHEET:
1. See Std. Dwgs. RD781 & RD782 for details not shown.
 2. Structure varies, see project plans.
 3. All concrete shall be commercial grade concrete.
 4. See project plans for details not shown.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

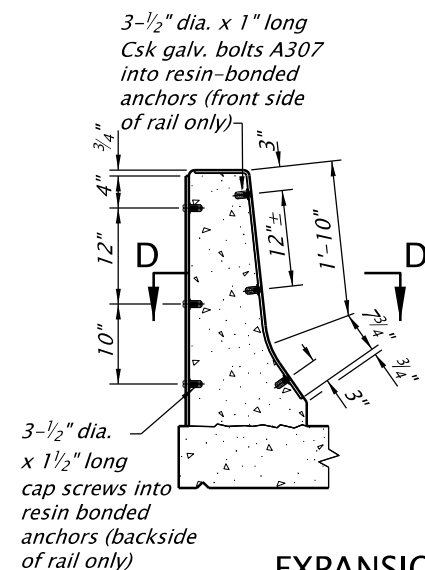
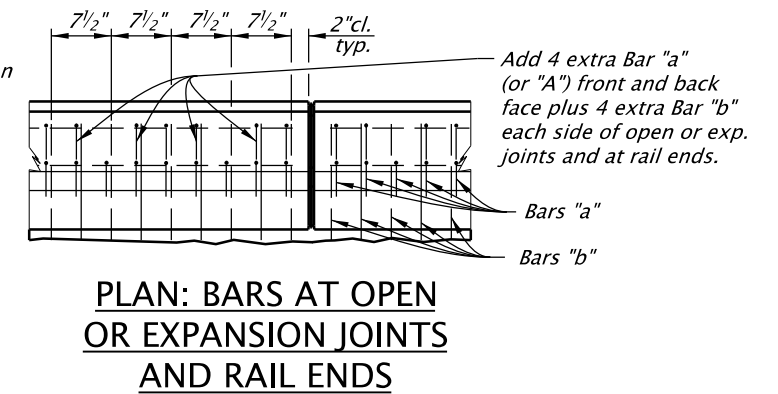
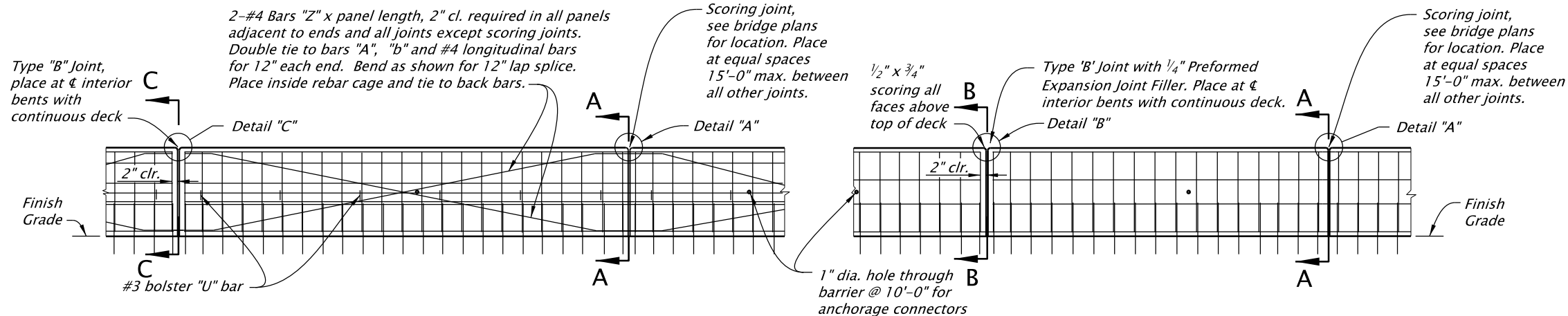
ALUMINUM PEDESTRIAN FENCE (MASH, TL-2)

2021

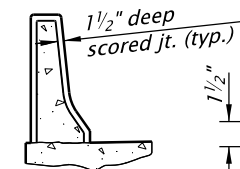
DATE	REVISION	DESCRIPTION
07-2020	NEW DRAWING CREATED	
07-2021	REVISED DETAILS AND NOTES	
01-2023	REVISED NOTE	

CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023	RD780
----------------	-----	----------	-------------	-------

Effective Date: June 1, 2023 – November 30, 2023

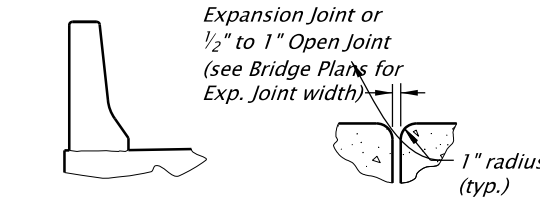


EXPANSION JOINT COVER PLATE
(When Required by Bridge Plans)

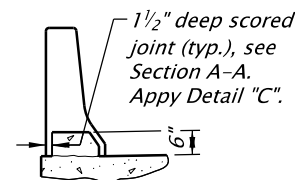


Detail "A"

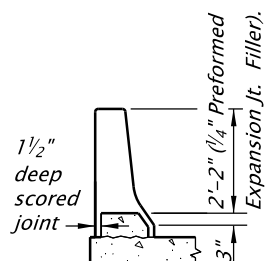
SCORING JOINT DETAIL
(Slip-Formed)
(Fixed Forms)



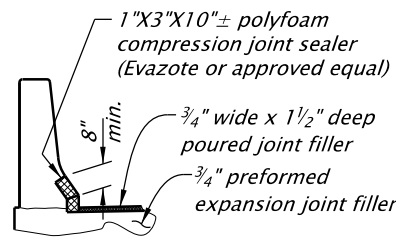
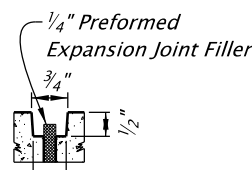
OPEN OR EXPANSION JOINT DETAIL



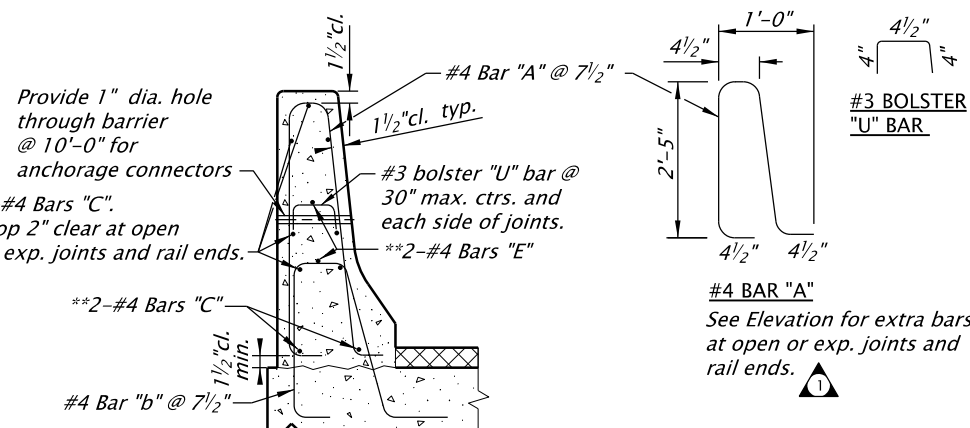
TYPE "B" JOINT DETAIL
(Slip-Formed)



TYPE "B" JOINT DETAIL
(Fixed Forms)



DETAIL "D"



TYPICAL SECTION (Slip Formed)

See TYPICAL SECTION (Fixed Forms) and Elevation for details not shown, "Z" bars not shown for clarity.

ESTIMATED QUANTITIES

		2'-8" Ht.	1" added Ht.
Fixed Forms	Concrete	2.23 ft. ³ /ft.	0.11 ft. ³ /ft.
	Bars "a" & longit.	10.81 #/ft.	—
Slip Formed	Concrete	2.23 ft. ³ /ft.	0.11 ft. ³ /ft.
	Bars "A, C & E"	14.83 #/ft.	—

Bar weight assume scoring joints at 15'-0" ctrs.

NOTES

- * Place top of parapet 2'-8" above finish grade. Increase dimensions marked thus (*) by depth of ACWS.
- ** Continuous thru scoring and Type "B" joints, stop 2" clear at ends and open or exp. joints. See dwg. BR203 for rail on approach slab.
- *** See PLAN: BARS AT OPEN OR EXPANSION JOINTS AND RAIL ENDS.

GENERAL NOTES

- Rail designed and crashed tested to meet NCHRP 350 TL-4 requirements. Provide all reinforcing steel conforming to ASTM A706 or AASHTO M31 (ASTM A615) Grade 60.
- Place all bars 2" clear of the nearest face of concrete unless shown otherwise. Provide Class 3300 - 1/2 or 3/4 concrete.
- Provide steel cover plates conforming to AASHTO M183 (ASTM A36). Hot dip galvanize after fabrication.
- At skewed bents up to 20° make joints parallel to the bent center line. For skews greater than 20° make joints normal to rail.

Accompanied by dwg. BR203

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

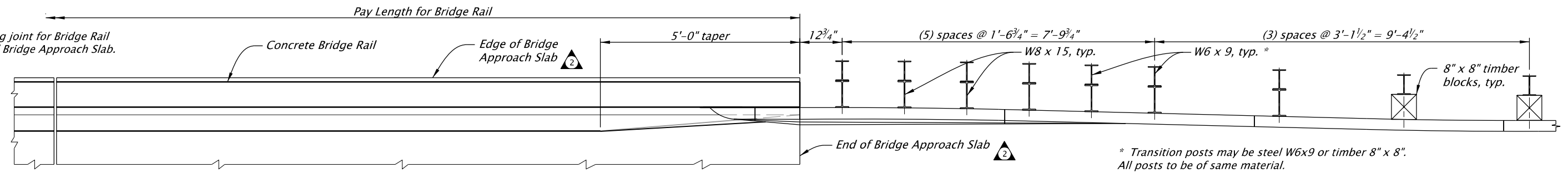
TYPE "F" CONCRETE RAIL

2021

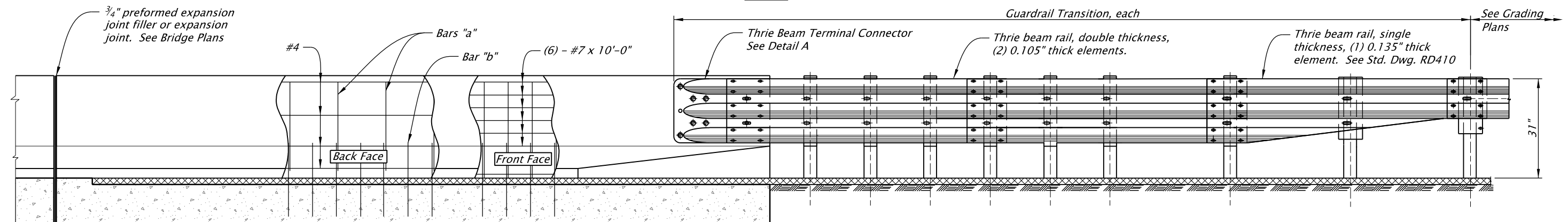
DATE	REVISION	DESCRIPTION
01-2023	Revised notes and rebar callouts.	
CALC. BOOK No. —	N/A —	SDR DATE: 20-JAN-2023
		BR200

Effective Date: June 1, 2023 – November 30, 2023

NOTE:
*No scoring joint for Bridge Rail
on 20'-4" Bridge Approach Slab.*

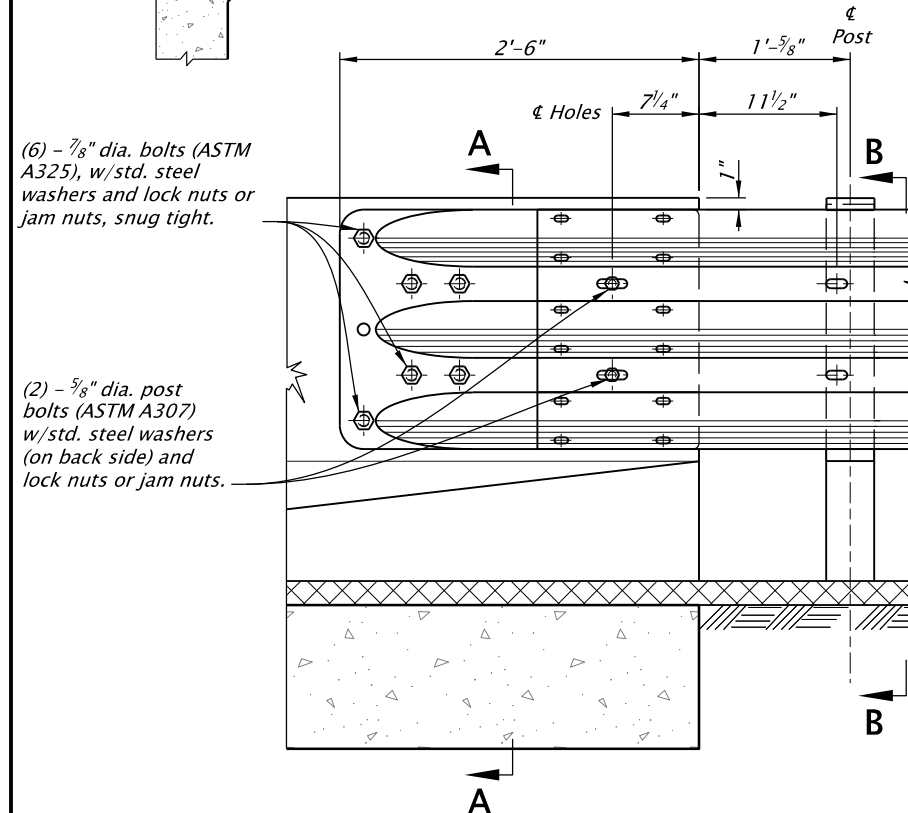


PLAN

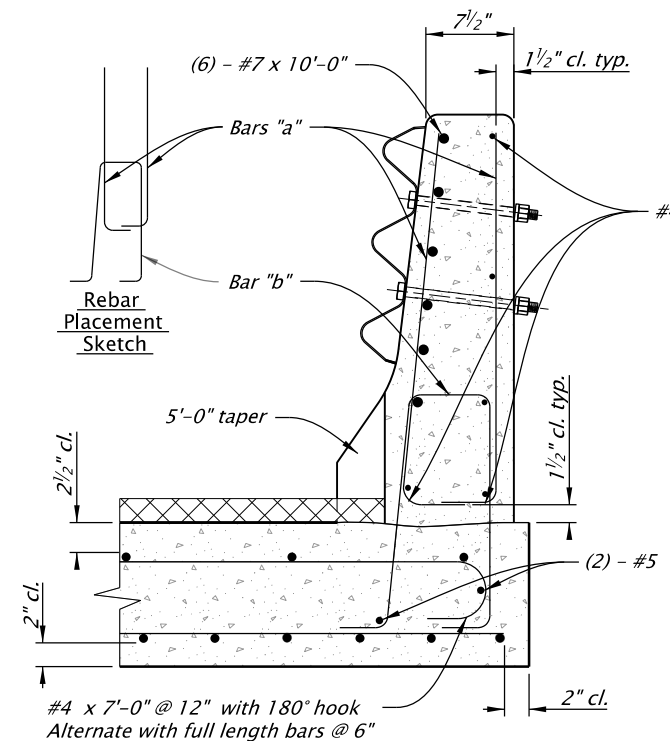


ELEVATION

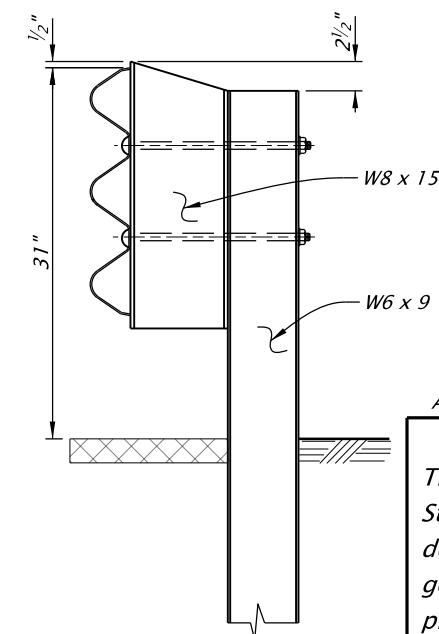
NOTE:
Drill horizontal bolt holes (bolt dia. + $\frac{1}{8}$ ") in hardened concrete with low-impact rotary drill. Cut bolts after installation so they extend $\frac{3}{4}$ " max. beyond nut. Grind smooth and cold galvanize.



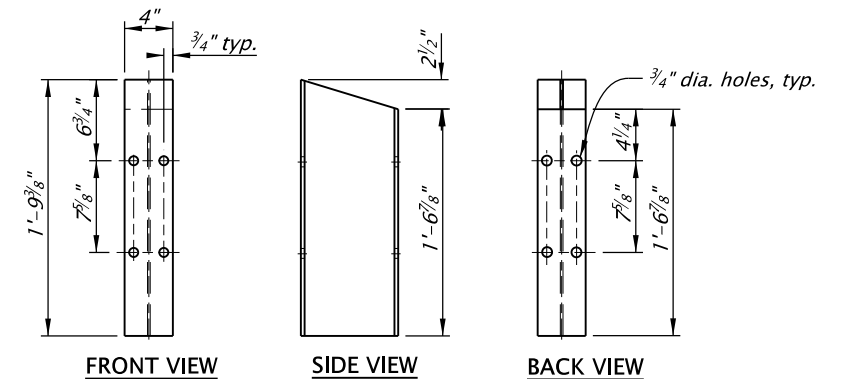
DETAIL A



SECTION A-A



SECTION B-B



THREE BEAM BLOCK (W8 x 15)

GENERAL NOTES:
Provide steel for wide-flange posts conforming to AASHTO M183 (ASTM A36).
Hot dip galvanize after fabrication.

Accompanied by dwgs. BR165, BR200, RD401, RD402, RD407, RD408, RD410, RD412

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

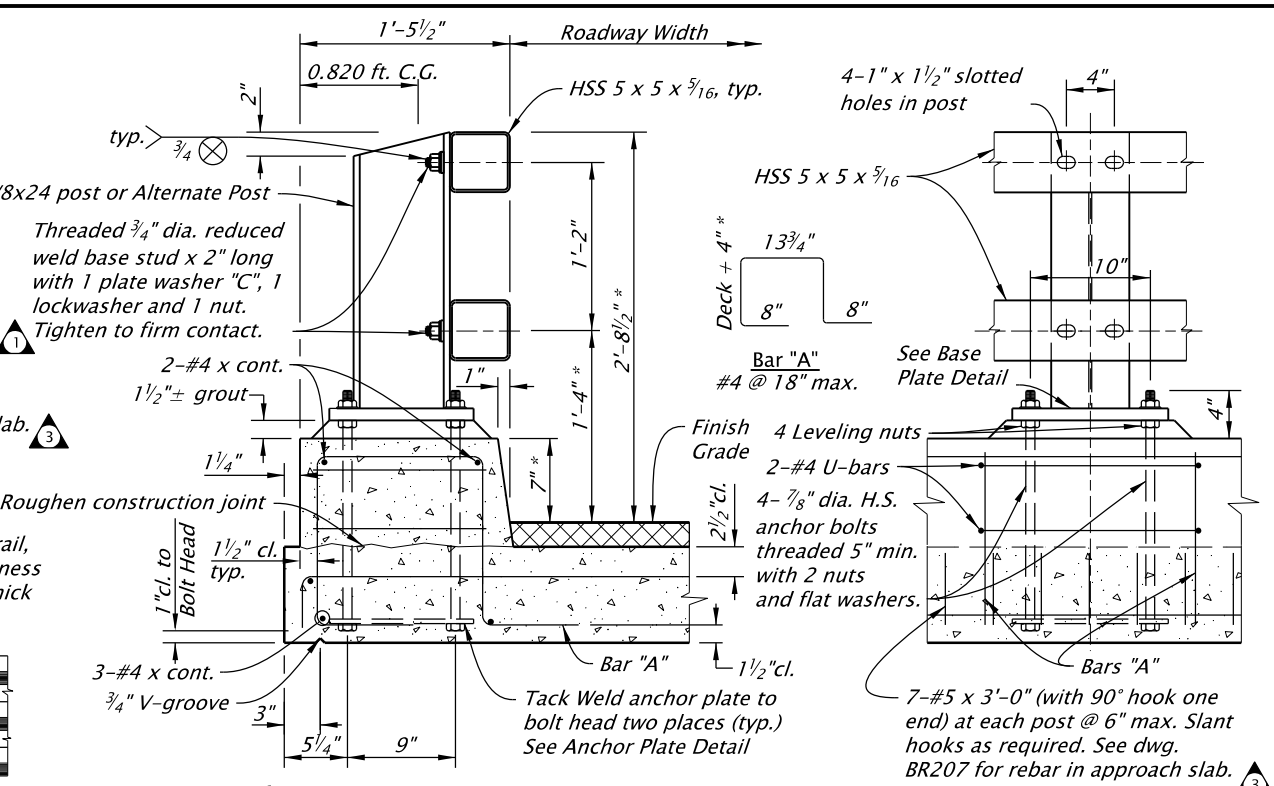
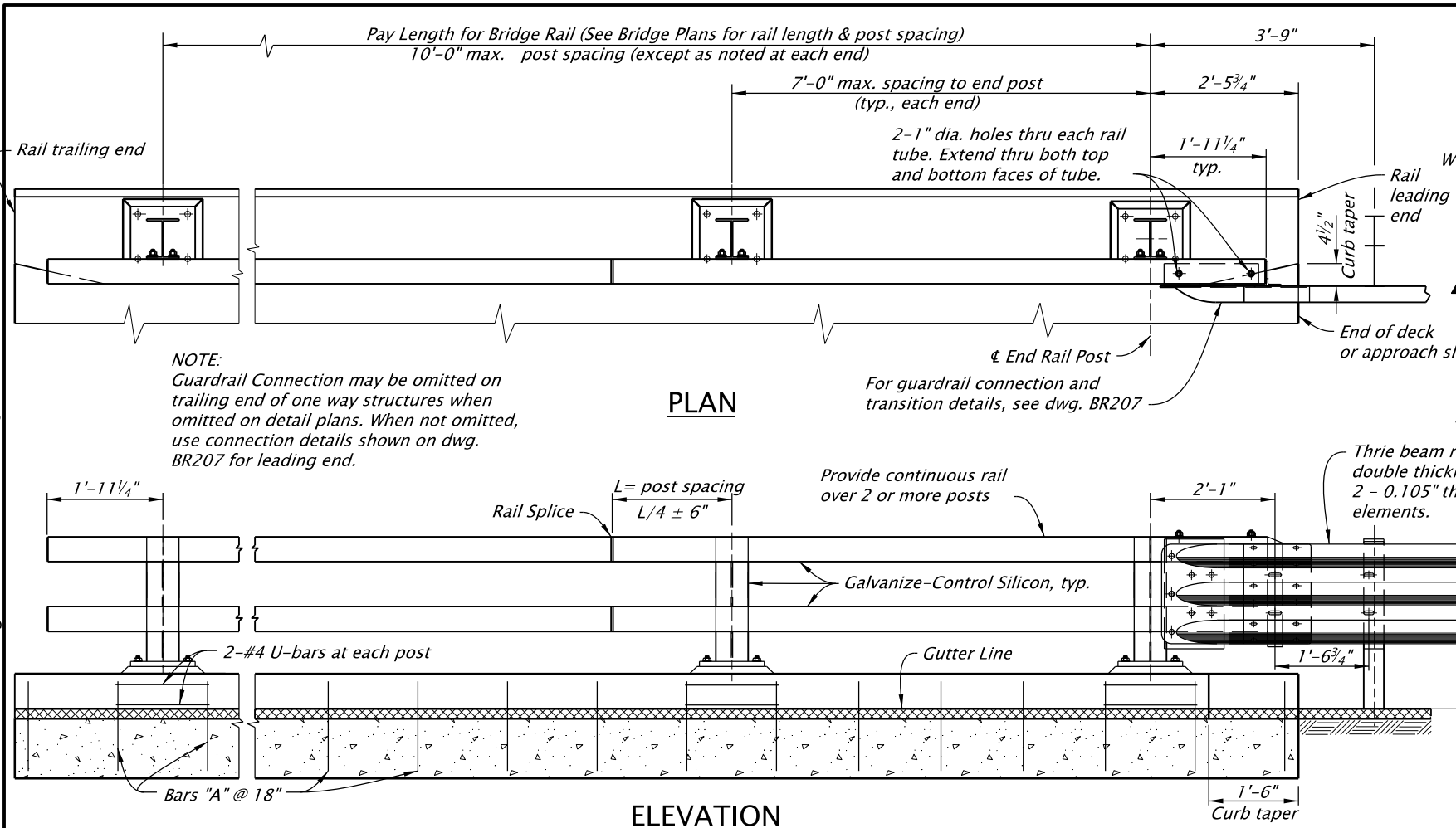
All materials shall be in accordance with the current Oregon Standard Specifications.

TRANSITION TYPE "F" CONCRETE RAIL TO GUARDRAIL

2021

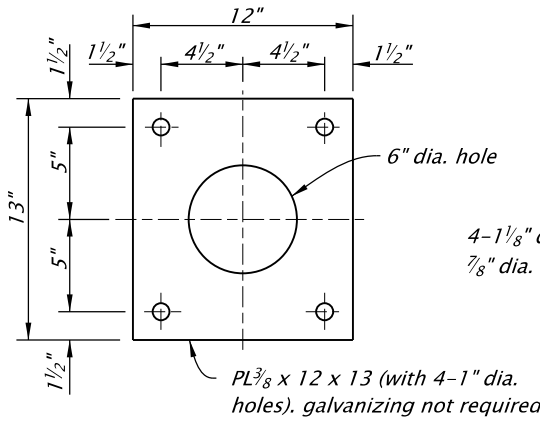
DATE		REVISION DESCRIPTION	
10-2020		Update: Changed RD480 to RD482	
01-2023		Revised accompanied by dwg references, General text revisions.	
CALC. BOOK NO. - - - N/A - - -		SDR DATE - 20-JAN-2023 -	BR203

Effective Date: June 1, 2023 – November 30, 2023

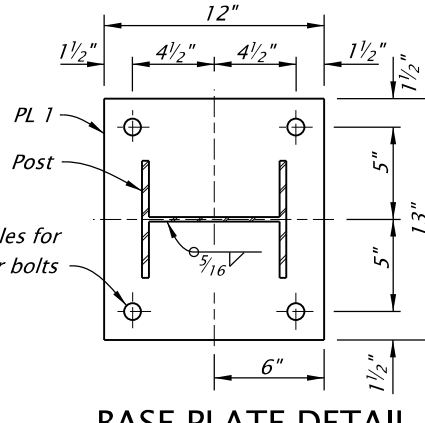


CURB AND POST DETAIL

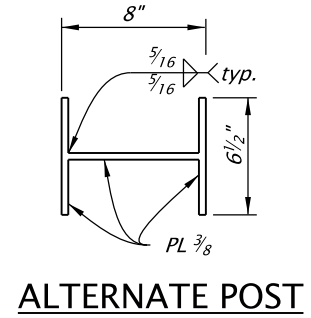
- GENERAL NOTES:**
1. Rail designed and crash tested to meet NCHRP 350 TL-4 requirements.
 2. Provide structural tubing according to Oregon Standard Specification 2810.20.
 3. Provide steel posts and plates conforming to AASHTO M183 (ASTM A36) unless otherwise noted.
 4. Provide High Strength anchor bolts (Grade 105) according to Oregon Standard Specification 02560.30 (b). Tighten top and leveling nuts for the base plate to 1/4 turn past snug tight.
 5. Provide reinforcing steel conforming to ASTM A706 or AASHTO M31 (ASTM A615) Grade 60.
 6. Provide concrete Class 3300 - 1 1/2 or 3/4.
 7. Construct railing conforming to the horizontal and vertical alignment of the structure. Install posts normal to grade in longitudinal direction and vertical in transverse direction.
 8. Payment for the railing will include compensation for furnishing and installing the necessary guardrail connection plates and terminal connectors.
 9. Hot-dip galvanize all structural steel including fasteners after fabrication, except as noted. Provide Galvanize-Control Silicon according to Oregon Standard Specification 02530.70.
 10. Fabricate steel studs with material, welding and inspection according to AWS D1.1.



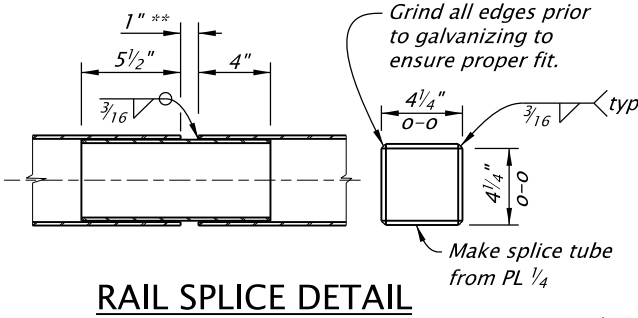
ANCHOR PLATE DETAIL



BASE PLATE DETAIL



ALTERNATE POST



RAIL SPLICE DETAIL

** 1" gap unless noted otherwise on detail plans. Provide a Rail Splice in panel that has a deck expansion joint. If more than 2" of movement is needed, increase length of the inner member.

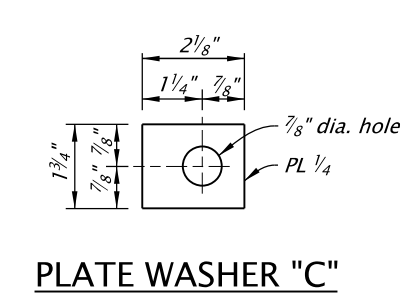
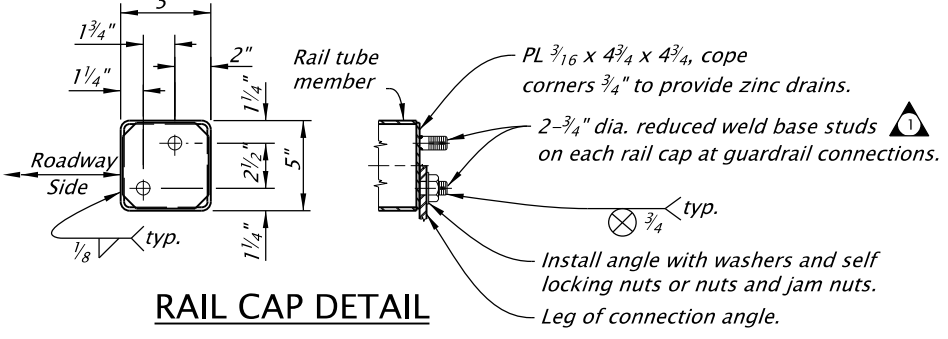


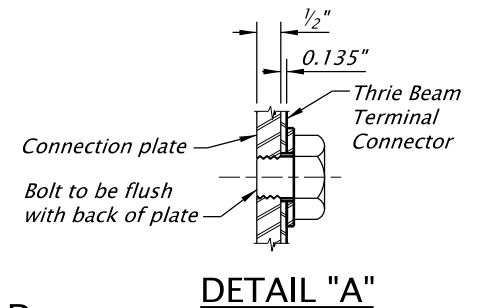
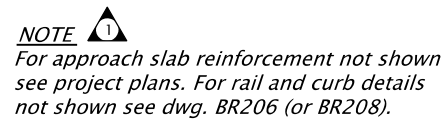
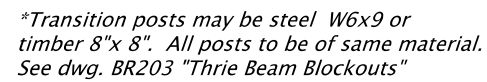
PLATE WASHER "C"



RAIL CAP DETAIL

Accompanied by dwg. BR207

<p>The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.</p>		<p>All materials shall be in accordance with the current Oregon Standard Specifications.</p>	
		<p>OREGON STANDARD DRAWINGS</p>	
		<p>2-TUBE CURB MOUNT RAIL</p>	
		<p>2021</p>	
DATE	REVISION	DESCRIPTION	
12-2020	1	Modified detail note text; added General Note 10; CAD updates	
01-2022	2	Modified General Note 10; removed "Clause 7" notation.	
01-2023	3	Revised various notations.	
CALC. BOOK NO. 4057 & 4058		SDR DATE 20-JAN-2023	
		BR206	



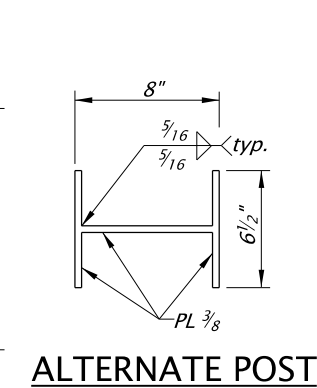
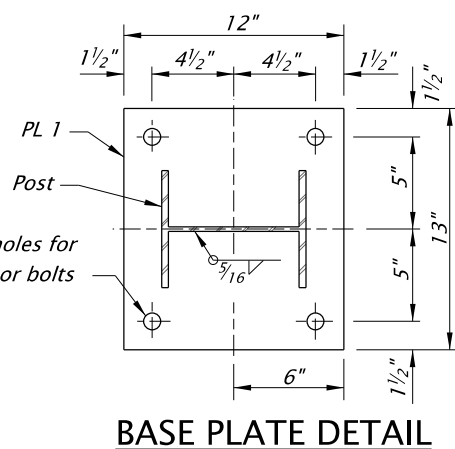
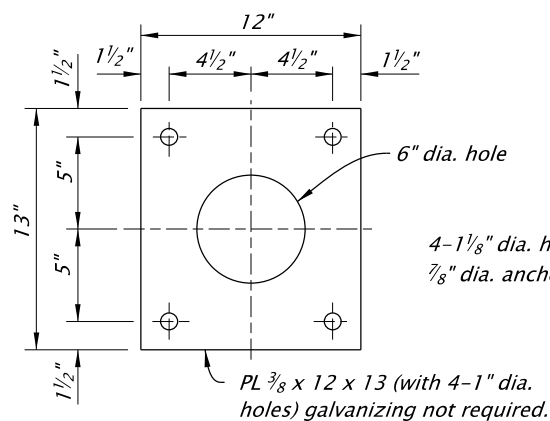
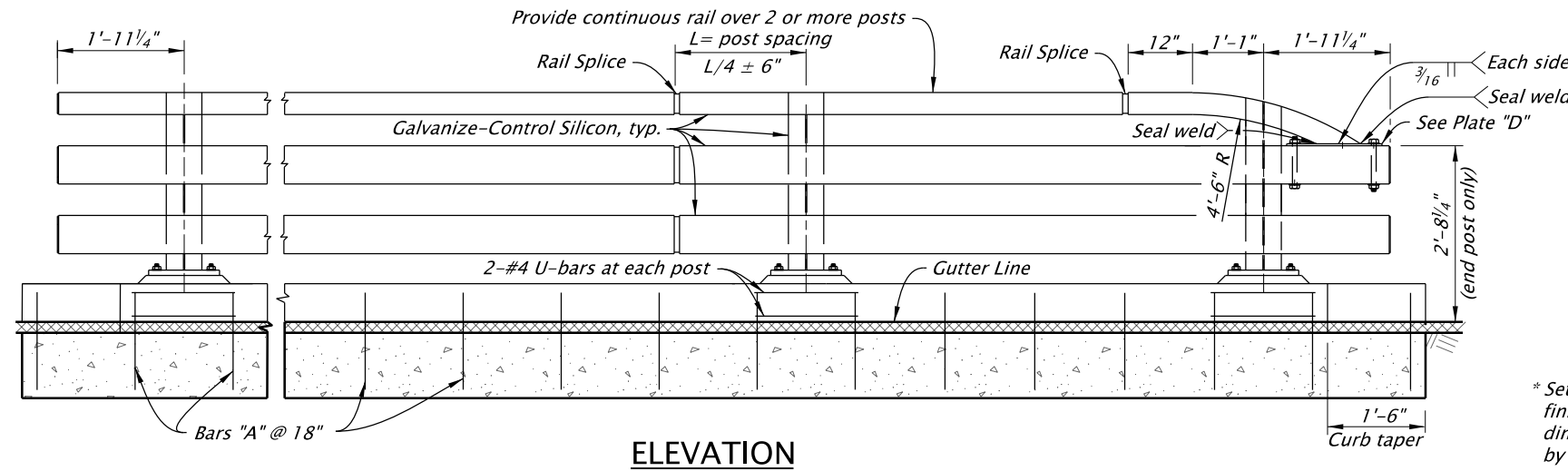
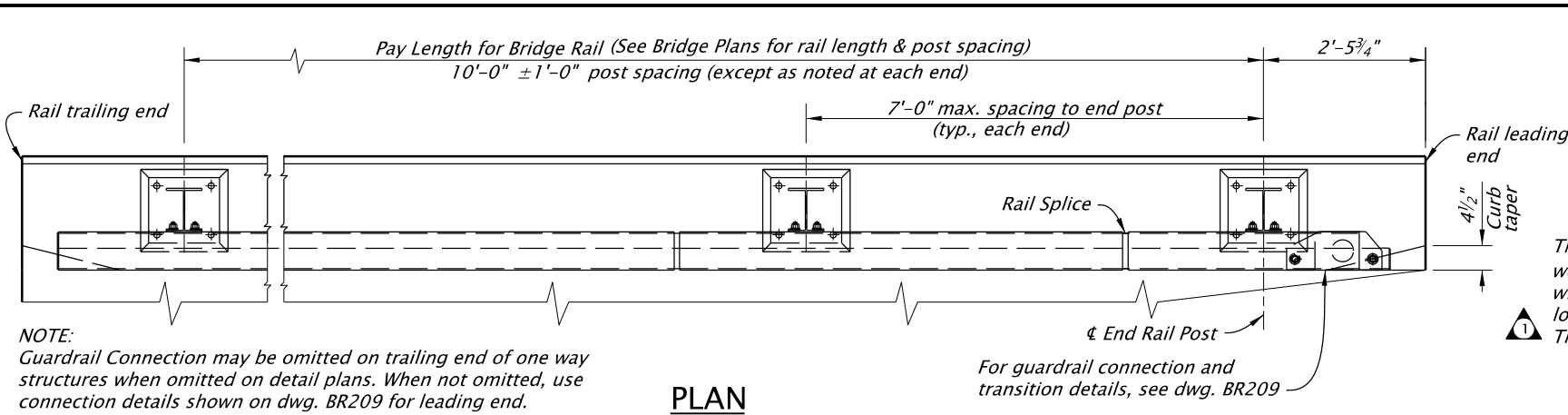
Rail designed and crash tested to meet NCHRP 350 TL-4 requirements.
Provide steel plates and wide-flange posts conforming to AASHTO M183 (ASTM A36).



Effective Date: June 1, 2023 – November 30, 2023

20-JAN-2023

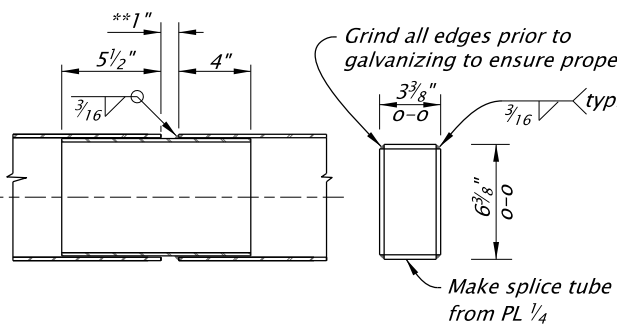
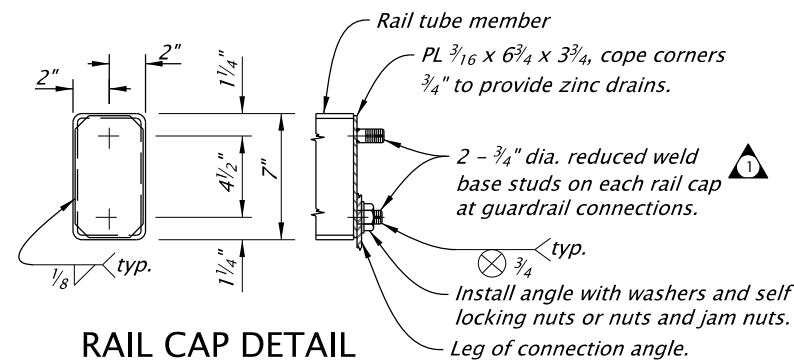
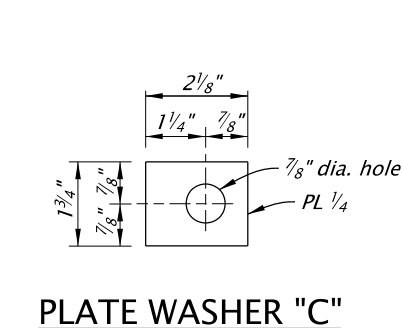
BR208.dgn



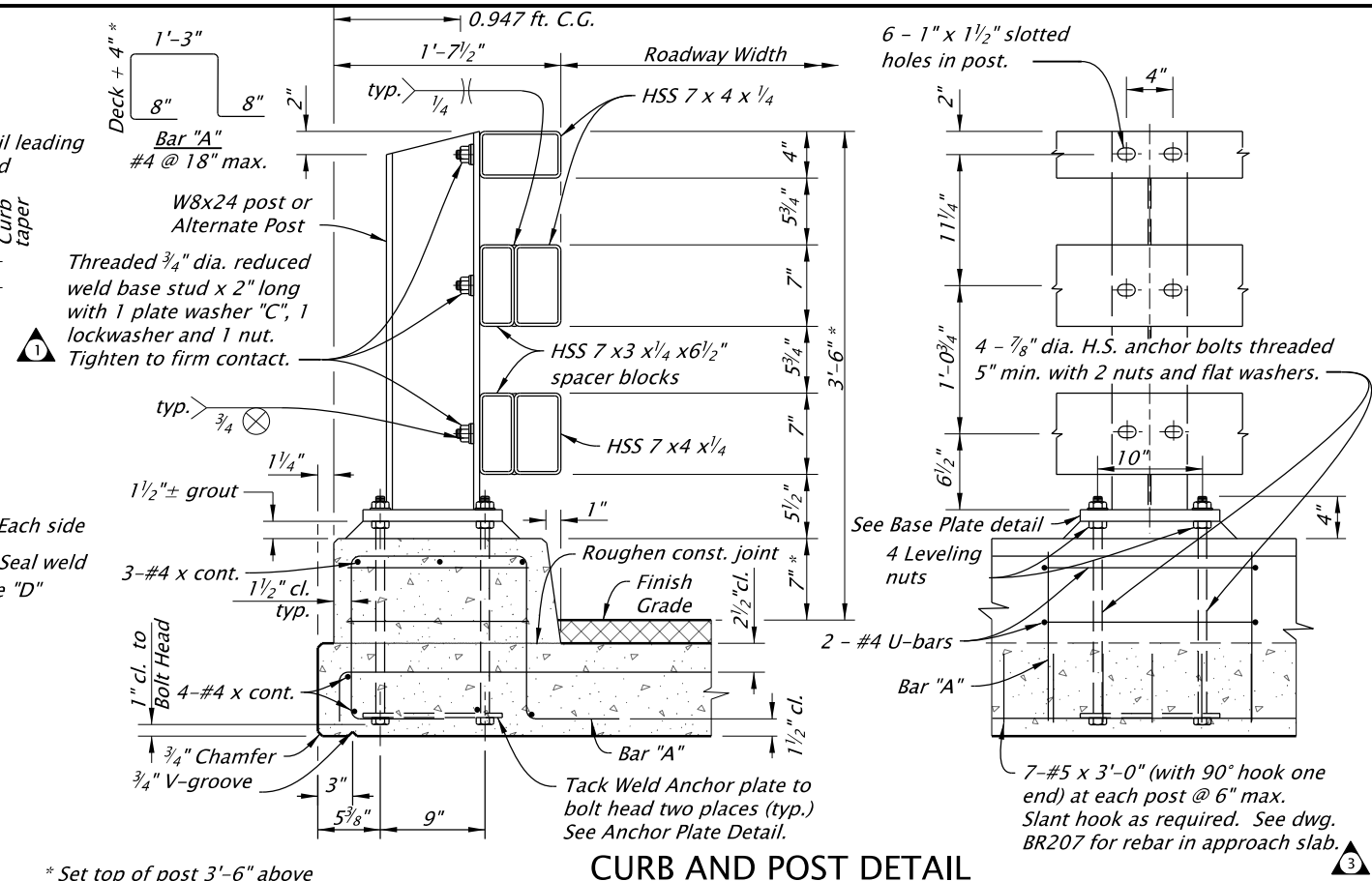
ANCHOR PLATE DETAIL

BASE PLATE DETAIL

ALTERNATE POST



RAIL SPLICE DETAIL
**1" gap unless noted otherwise on detail plans. Provide a Rail Splice in panel that has a deck expansion joint. If more than 2" movement needed, increase length of inner member.



* Set top of post 3'-6" above finish grade. Increase dimensions marked thus (*) by depth of ACWS.

GENERAL NOTES:

1. Rail designed and crash tested to meet MASH TL-4 requirements. Transition designed to meet MASH TL-3.
2. Provide structural tubing, steel posts and plates according to Oregon Standard Specification 2810.20.
3. Provide steel posts and plates conforming to ASTM A572 Grade 50.
3. Provide High Strength anchor bolts (Grade 105) according to Oregon Standard Specification 02560.30 (b). Tighten top and leveling nuts for the base plate 1/4 turn past snug tight.
3. Fabricate steel studs with material, welding and inspection according to AWS D1.1.
5. Provide reinforcing steel conforming to ASTM A706 or AASHTO M31 (ASTM A615) Grade 60.
6. Provide concrete Class 3300 - 1 1/2" or 3/4"
7. Construct railing conforming to the horizontal and vertical alignment of the structure. Install posts normal to grade in longitudinal direction and vertical in transverse direction.
8. Payment for the railing will include compensation for furnishing and installing the necessary guardrail connection plates and terminal connectors.
9. Hot-dip galvanized structural steel including fasteners after fabrication, except as noted. Provide Galvanize-Control Silicon according to Oregon Standard Specification 02530.70.

Accompanied by dwgs. BR207, BR209

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

3-TUBE CURB MOUNT RAIL

2021

DATE	REVISION	DESCRIPTION
12-2020	Modified detail note text; added General Note 4; CAD updates	
01-2022	Modified General Note 4, removed "Clause 7" notation.	
01-2023	Revised general notations.	

CALC.	BOOK NO.	N/A	SDR	DATE	20-JAN-2023	BR208
-------	----------	-----	-----	------	-------------	-------

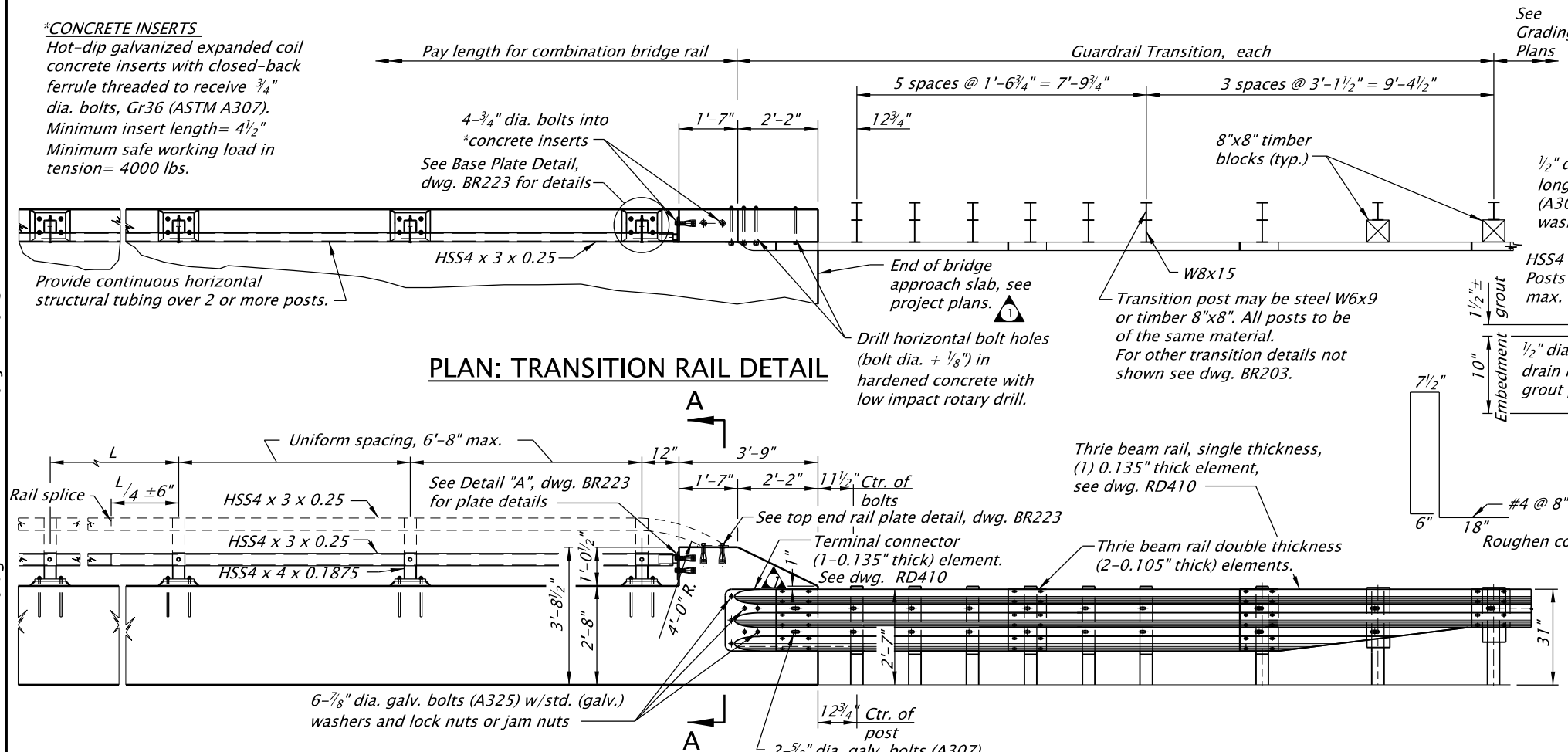
Effective Date: June 1, 2023 - November 30, 2023

20-JAN-2023

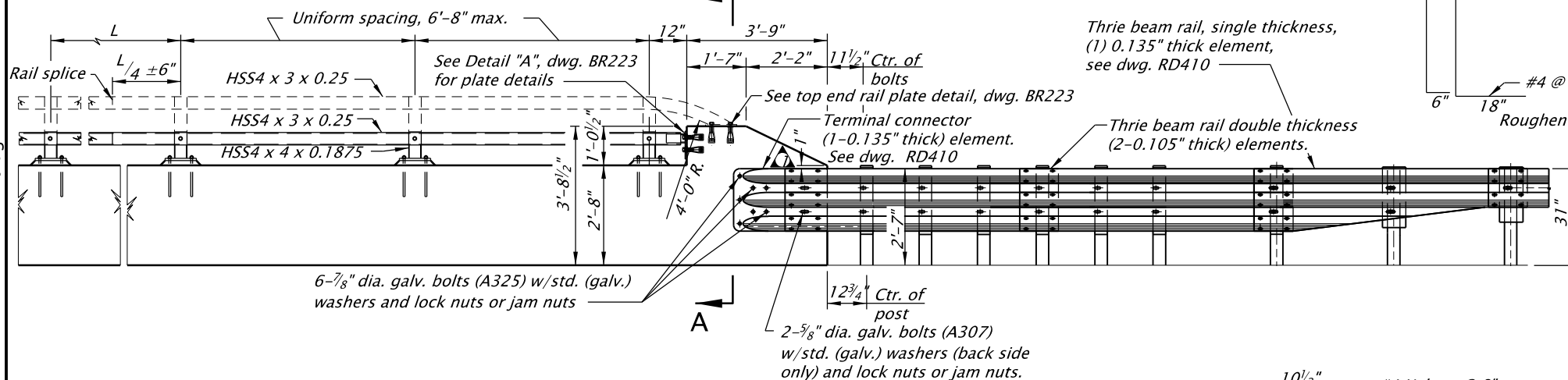
BR216.dgn

*CONCRETE INSERTS

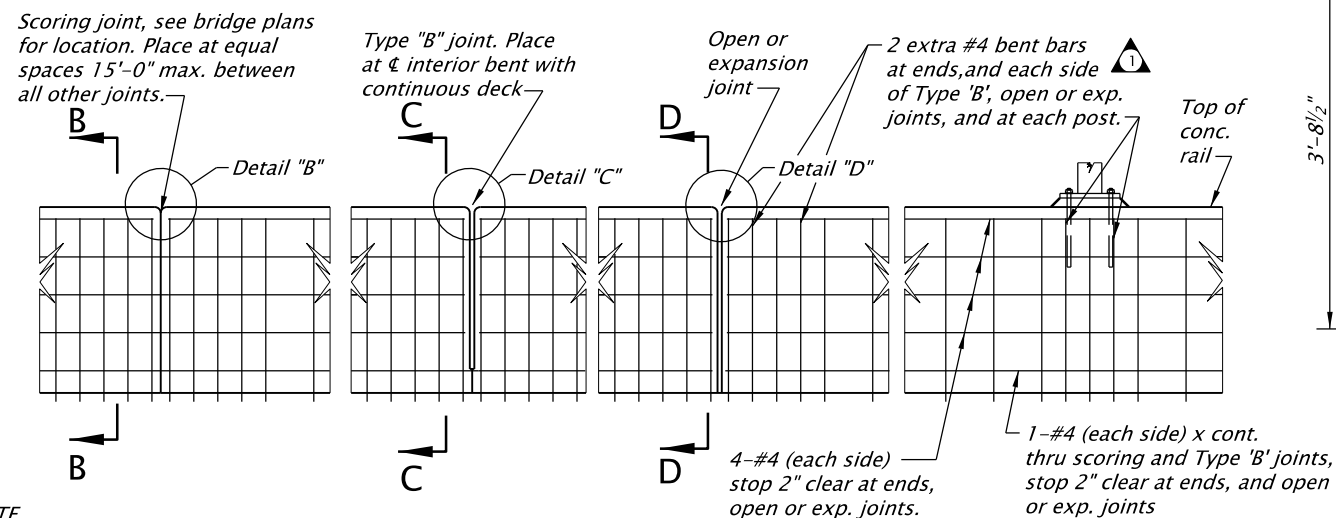
Hot-dip galvanized expanded coil concrete inserts with closed-back ferrule threaded to receive 3/4" dia. bolts, Gr36 (ASTM A307). Minimum insert length= 4 1/2" Minimum safe working load in tension= 4000 lbs.



PLAN: TRANSITION RAIL DETAIL



ELEVATION: TRANSITION RAIL DETAIL

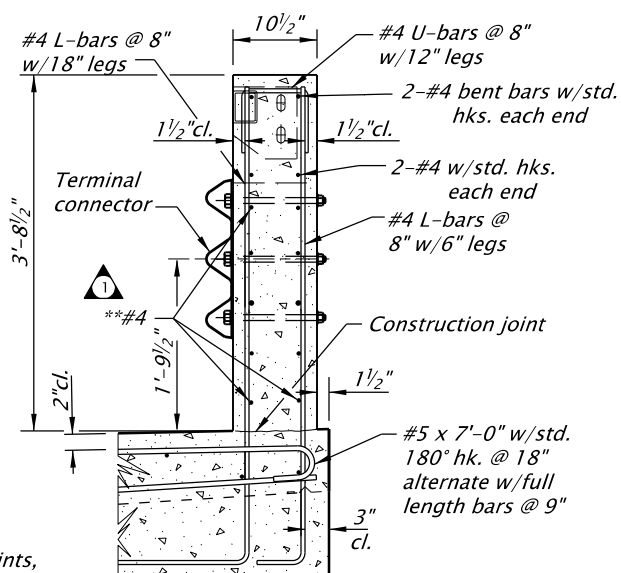


NOTE
For Sections B-B, C-C, and D-D
and Details A, B, C, and D
see dwg. BR223

ELEVATION: CONCRETE BRIDGE RAIL

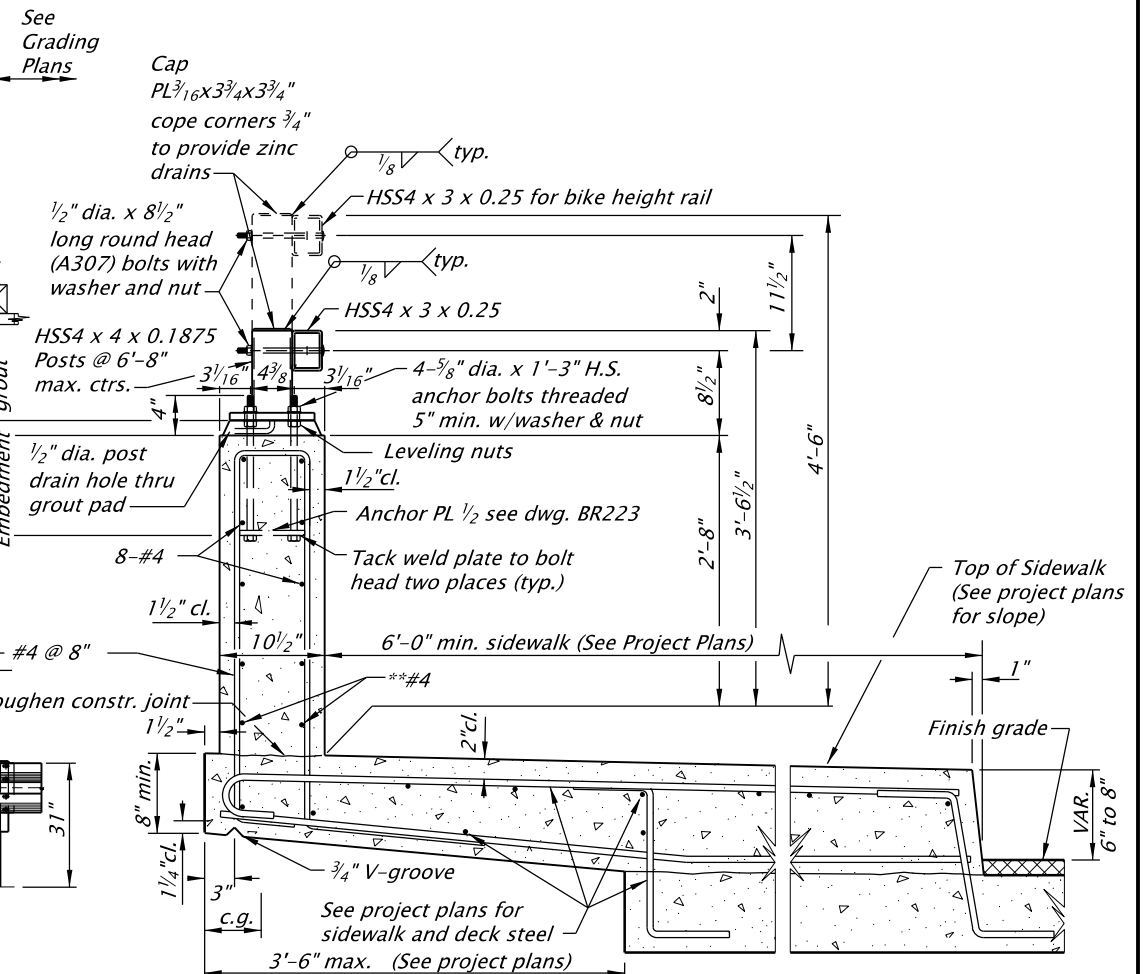
ESTIMATED QUANTITIES		
	3'-6½" Rail	4'-6" Rail
Concrete Volume (ft³ / ft)	2.26	2.26
Reinforcement Weight (lbs/ft)	23.39	23.39
Structural Steel Weight (lbs/ft)	18.0	30.0
Total Rail Weight (lbs/ft)	357	369
Center of Gravity (cg, ft)	0.572	0.581

ESTIMATED QUANTITIES



SECTION A-A

****Continuous thru scoring joints, stop
2" clear at ends and open or exp. joints.**



TYPICAL RAIL SECTION

GENERAL NOTES

Provide steel tubing conforming to ASTM A500, Grade B, A501 or A618.

Provide reinforcing steel conforming to ASTM A706, or AASHTO M31 (ASTM A615) Grade 60. Splice #4 bars 1'-4" min.

Provide concrete Class 3300 - 1½ or ¾.

Provide steel posts and plates conforming to AASHTO M183 (ASTM A36) unless otherwise noted.

Provide High Strength anchor bolts (Grade 105) according to Oregon Standard Specification 02560.30 (b).

Construct rail (posts and parapet) normal to grade in the longitudinal direction and vertical in the transverse direction.

Hot-dip galvanize structural steel including fasteners after fabrication. Provide Galvanize-Control Silicon posts and horizontal rail steel tubing according to Oregon Standard Specification 02530.70. Tap nuts and inserts 0.021" oversize after galvanizing in accordance with ASTM A563.

Use 4'-6" height for bikeways when called for on project plans.

Accompanied by dwgs. BR203, BR223, RD401, RD402, RD407, RD408, RD410, RD412

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS
SIDEWALK MOUNTED
COMBINATION BRIDGE
RAIL

2021

DATE	REVISION DESCRIPTION
01-2023	Revised accompanied by dwg references, General text revisions.

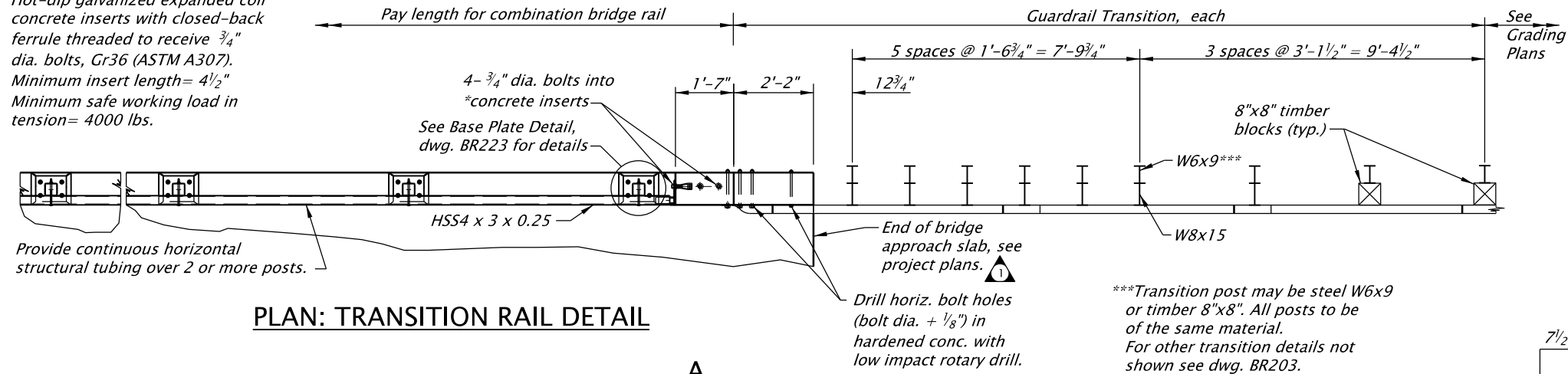
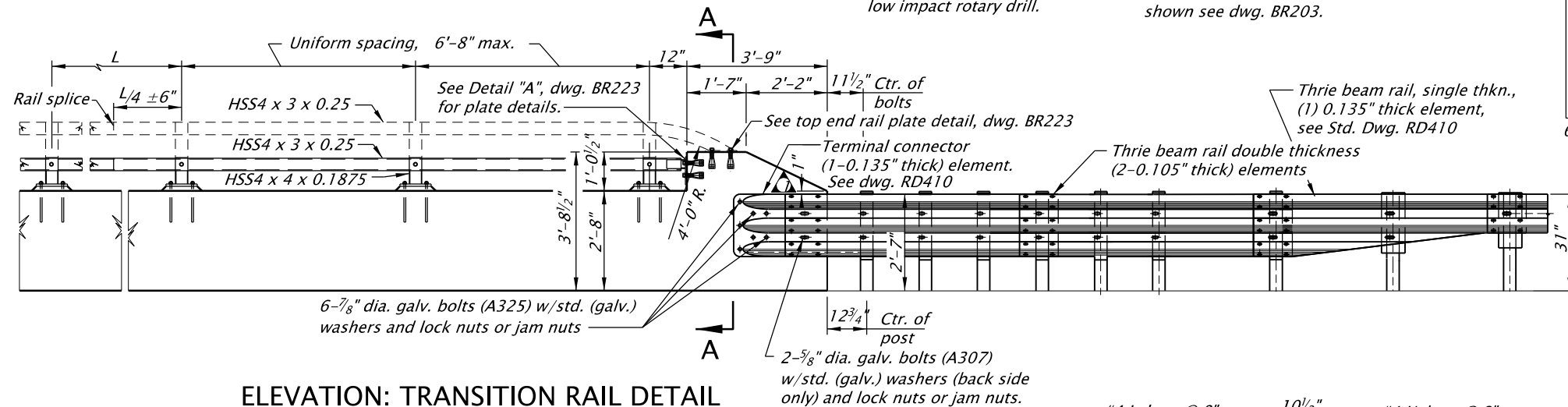
CALC. BOOK NO. - - - -	N/A - - - -	SDR DATE - 20-JAN-2023	BR216
---------------------------	-------------	---------------------------	--------------

CALC. BOOK NO.	N/A	SDR DATE	20-JAN-2023	BR216
-------------------	-----	-------------	-------------	--------------

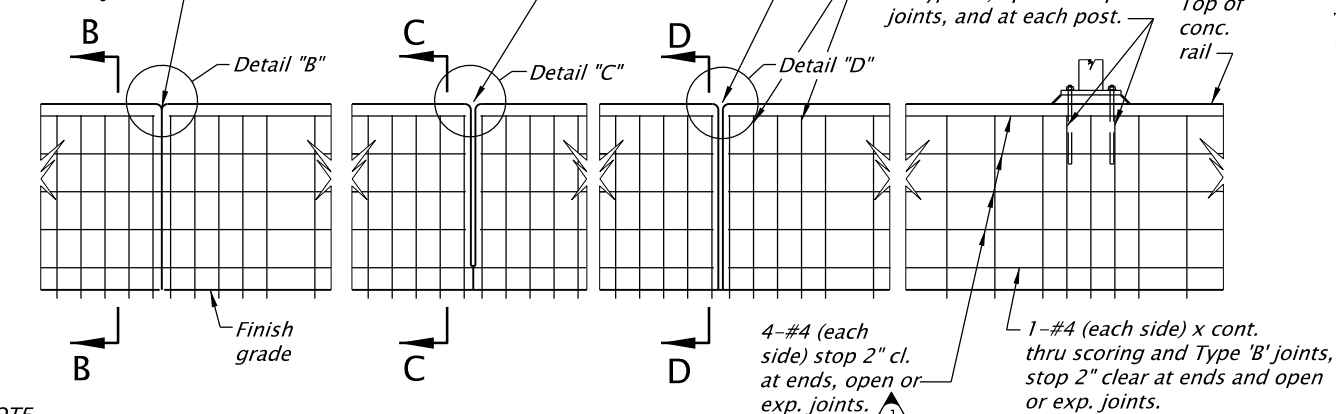
Effective Date: June 1, 2023 – November 30, 2023

***CONCRETE INSERTS**

Hot-dip galvanized expanded coil concrete inserts with closed-back ferrule threaded to receive $\frac{3}{4}$ " dia. bolts, Gr36 (ASTM A307). Minimum insert length = 4½" Minimum safe working load in tension = 4000 lbs.

**PLAN: TRANSITION RAIL DETAIL****ELEVATION: TRANSITION RAIL DETAIL**

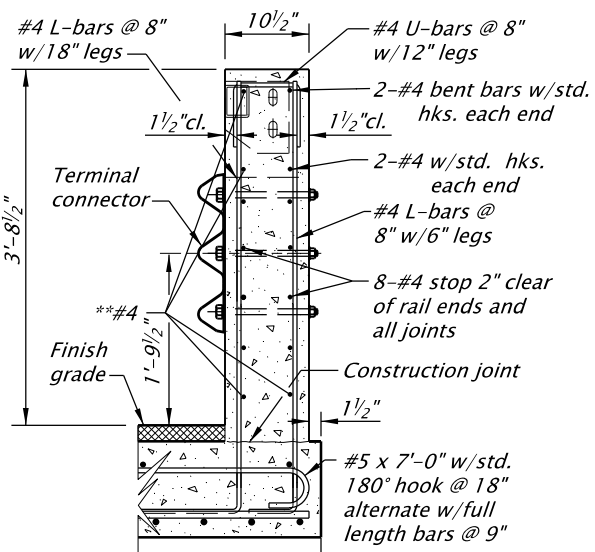
Scoring joint, see bridge plans for location. Place at equal spaces 15'-0" max. between all other joints.

**NOTE**

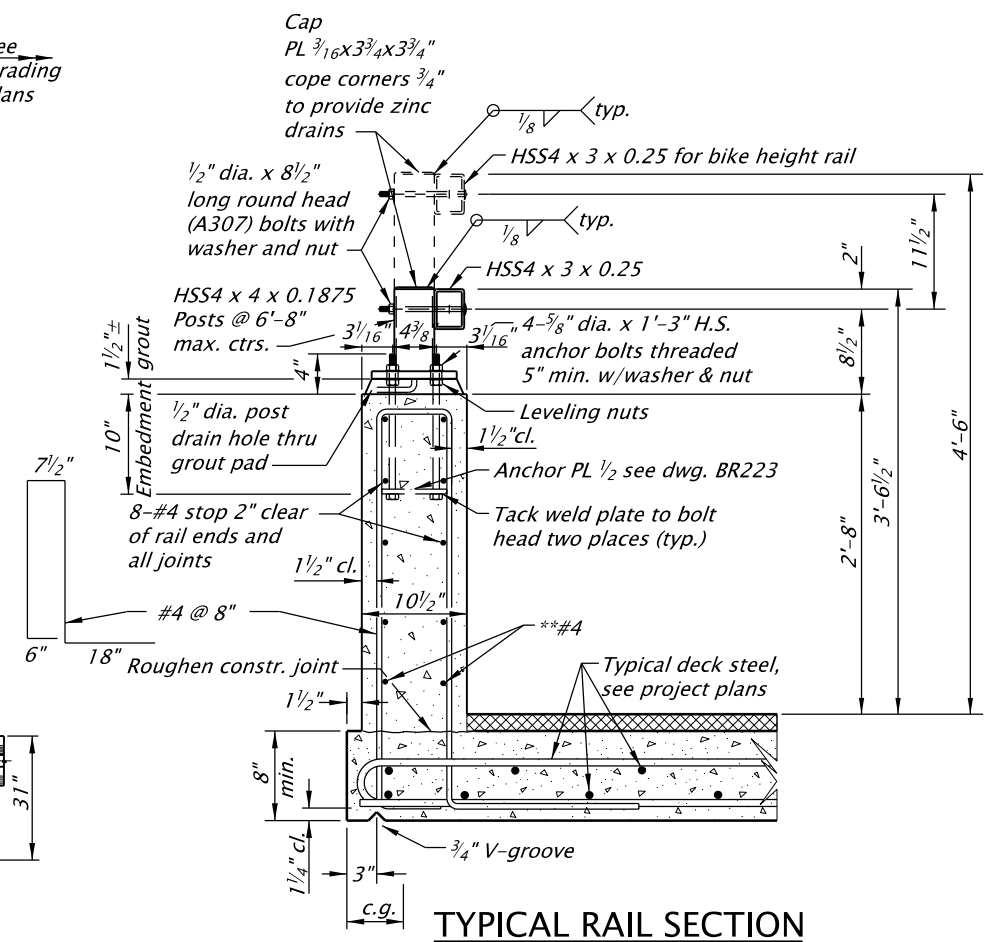
For Sections B-B, C-C, and D-D and Details A, B, C, and D see dwg. BR223

ELEVATION: CONCRETE BRIDGE RAIL**ESTIMATED QUANTITIES**

	3'-6½" Rail	4'-6" Rail
Concrete Volume (ft³/ft)	2.26	2.26
Reinforcement Weight (lbs/ft)	23.39	23.39
Structural Steel Weight (lbs/ft)	18.0	30.0
Total Rail Weight (lbs/ft)	357	369
Center of Gravity (cg, ft)	0.572	0.581

**SECTION A-A**

**Continuous thru scoring joints, stop 2" clear at ends and open or exp. joints.

**TYPICAL RAIL SECTION****GENERAL NOTES**

- Provide steel tubing conforming to ASTM A500, Grade B, A501 or A618.
- Provide reinforcing steel conforming to ASTM A706, or AASHTO M31 (ASTM A615) Grade 60. Splice #4 bars 1'-4" min.
- Provide concrete Class 3300 - 1½ or ¾.
- Provide steel posts and plates conforming to AASHTO M183 (ASTM A36) unless otherwise noted.
- Construct rail (posts and parapet) normal to grade in the longitudinal direction and vertical in the transverse direction.
- Hot-dip galvanize structural steel including fasteners after fabrication. Provide Galvanize-Control Silicon posts and horizontal rail steel tubing according to Oregon Standard Specification 02530.70. Tap nuts and inserts 0.021" oversize after galvanizing in accordance with ASTM A563.
- Use 4'-6" height for bikeways when called for on project plans.
- Provide High Strength anchor bolts (Grade 105) according to Oregon Standard Specification 02560.30 (b).

Accompanied by dwgs. BR203, BR223, RD401, RD402, RD407, RD408, RD410, RD412

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

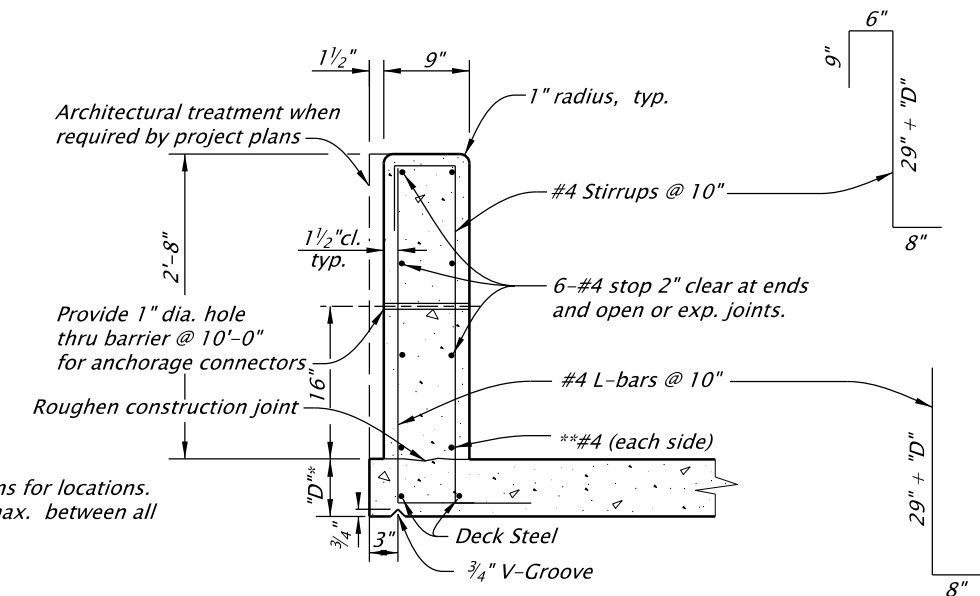
FLUSH MOUNTED COMBINATION BRIDGE RAIL

2021

DATE	REVISION	DESCRIPTION
01-2023	Revised	accompanied by dwg references, General text revisions.
CALC. BOOK NO.	N/A	SDR DATE: 20-JAN-2023

BR220

Effective Date: June 1, 2023 – November 30, 2023



ELEVATION

TYPICAL SECTION

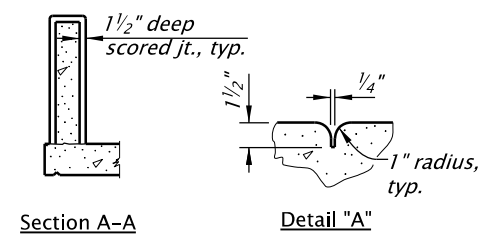
Note
See dwg. BR203 for
Transition Concrete
Bridge Rail to Guardrail.

NOTES

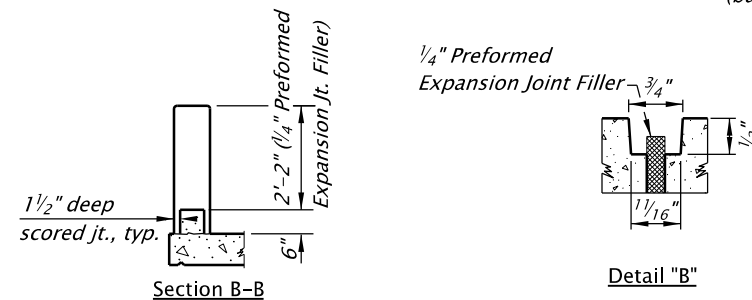
*Depth varies, see project plans
**Continuous thru scoring and Type 'B' joints, stop 2" clear at ends and open or exp. joints. ▲

GENERAL NOTES

*Rail designed and crash tested to meet NCHRP 350 TL-4 requirements.
Provide all reinforcing steel conforming to AASHTO M31 (ASTM A615),
Grade 60 or ASTM A706.
Place all bars 2" clear of the nearest face of concrete unless shown
otherwise.
Provide Class 3300 -1½ or ¾ concrete.
Provide steel cover plates conforming to AASHTO M183 (ASTM A36).
Hot dip galvanize after fabrication.
At skewed bents up to 20° make joints parallel to the bent center line.
For skews greater than 20° make joints normal to rail.*

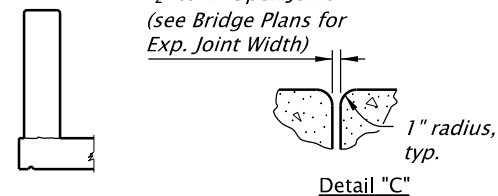


SCORING JOINT DETAIL

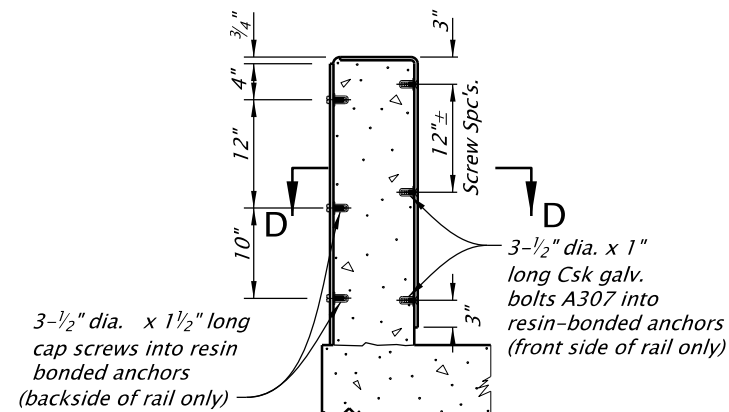


TYPE 'B' JOINT DETAIL
(Fixed Forms)

*Expansion Joint width or
1/2" to 1" Open Joint
(see Bridge Plans for
Exp. Joint Width)*

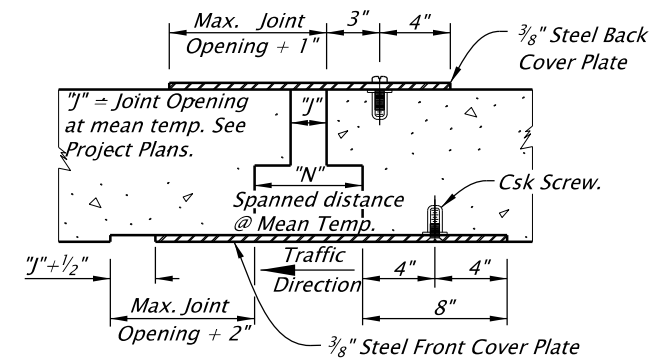


OPEN OR EXPANSION JOINT DETAIL

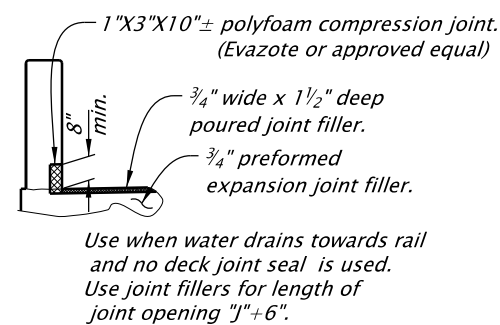


NOTE
Details shown are general details only and should be modified as needed to fit specific project requirements.

SECTION D-D



EXPANSION JOINT COVER PLATE (When Required by Bridge Plans)



DETAIL "D"

Accompanied by dwg. BR203

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

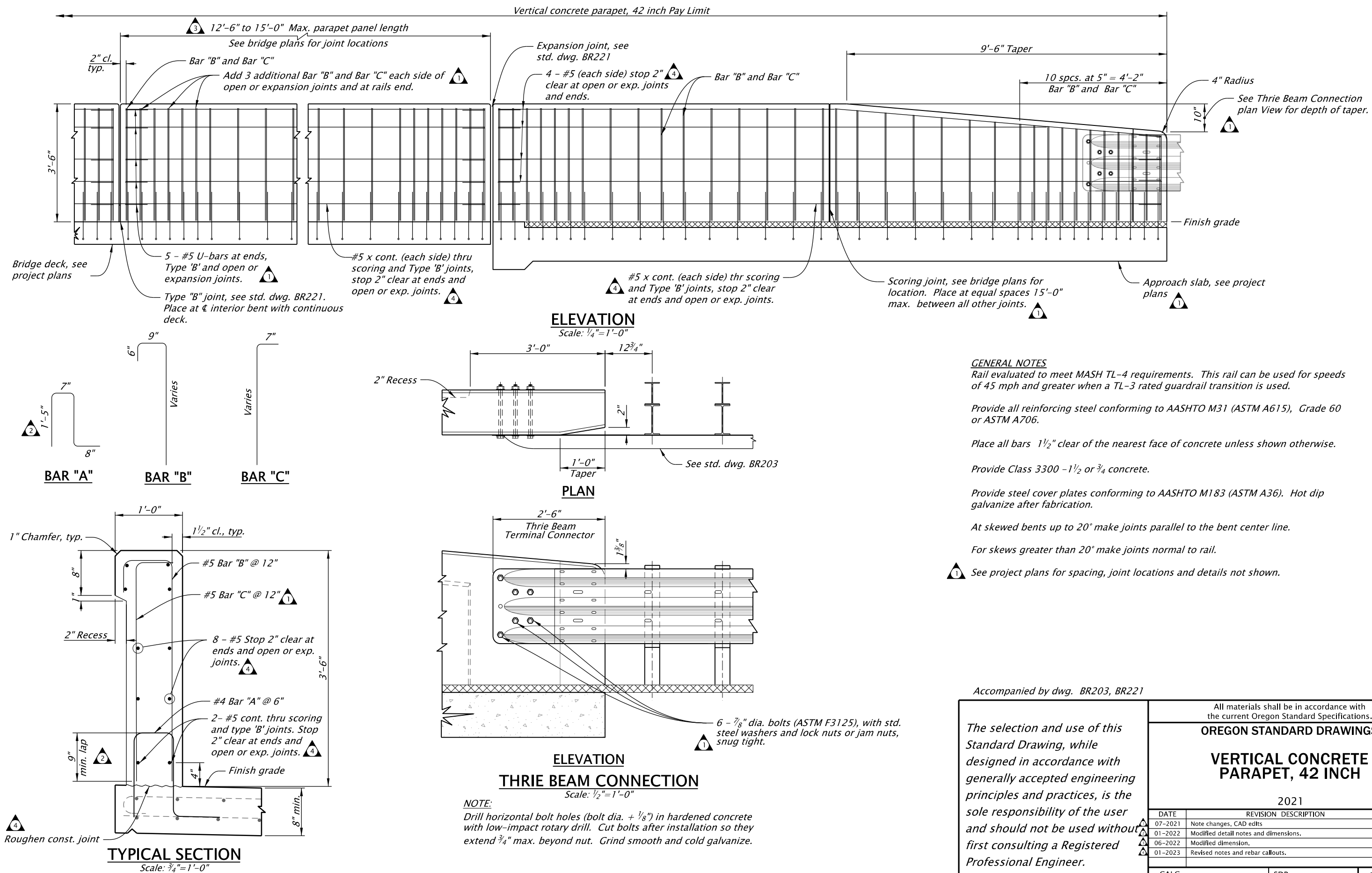
All materials shall be in accordance with the current Oregon Standard Specifications.

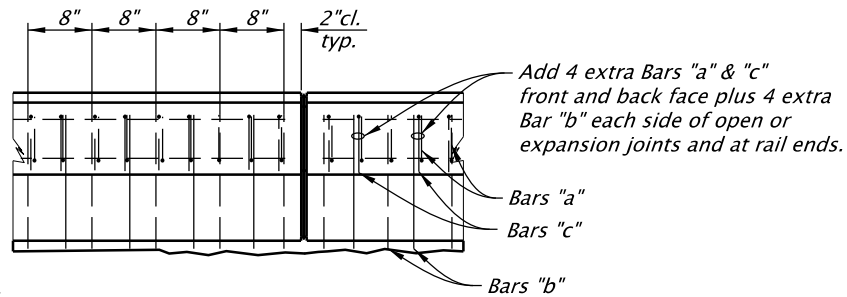
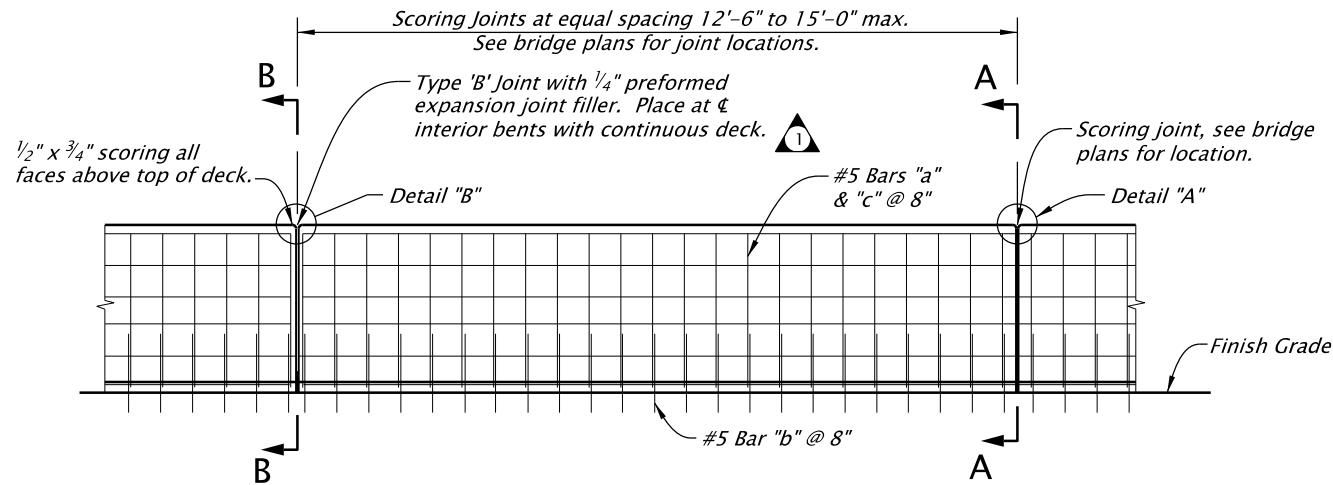
OREGON STANDARD DRAWINGS

**32" VERTICAL CONCRETE
PARAPET**

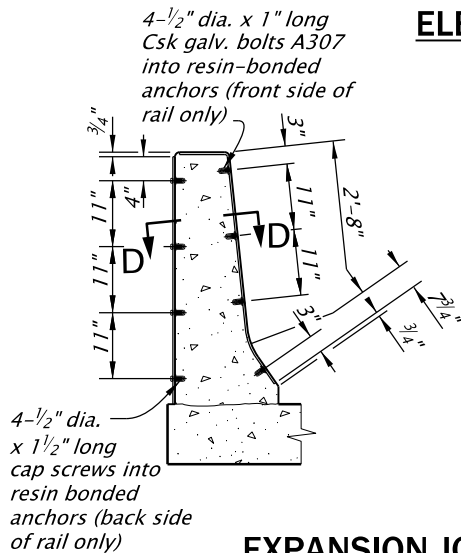
2021

DATE		REVISION DESCRIPTION	
01-2023		Revised notes and rebar callouts.	
CALC. BOOK NO. - - - N/A - - -		SDR DATE - 20-JAN-2023 -	BR221

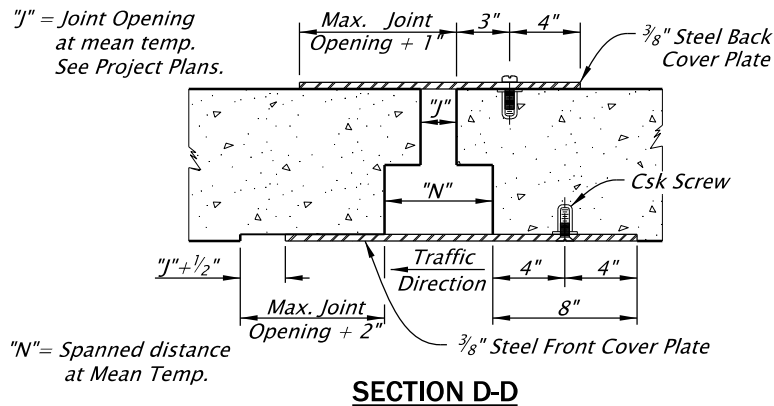




PLAN: BARS AT OPEN OR EXPANSION JOINTS AND RAIL ENDS

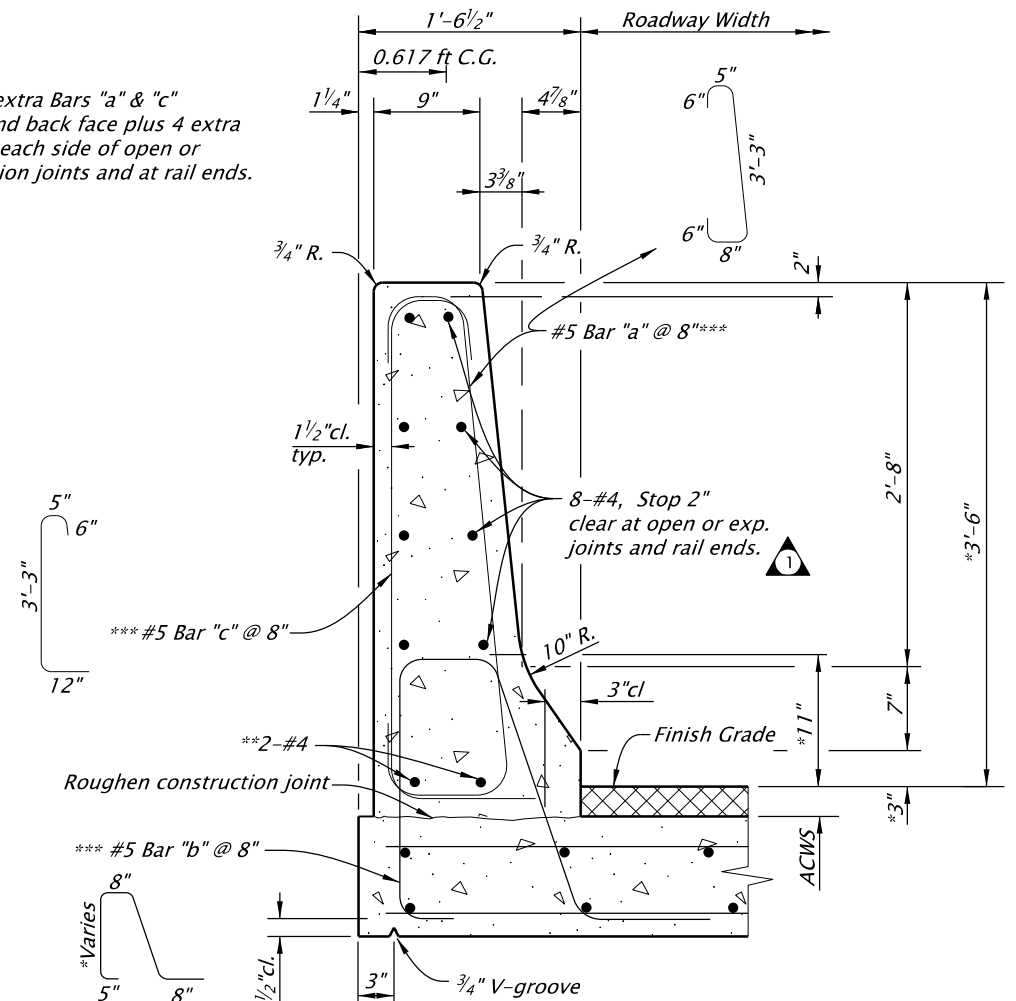


ELEVATION: CONCRETE BRIDGE RAIL (FIXED FORMS)



SECTION D-D

NOTES:
Place top of parapet 3'-6" above finish grade. Increase dimensions marked thus () by depth of ACWS.
**Continuous thru scoring and Type 'B' joints. Stop 2" clear at ends and open or exp. joints.
See dwg. BR291 for rail on approach slab.
***See PLAN: BARS AT OPEN or EXPANSION JOINTS AND RAIL ENDS



TYPICAL SECTION (FIXED FORMS)

GENERAL NOTES:
Rail designed and crash tested to meet NCHRP 350 TL-5 requirements. Provide all reinforcing steel conforming to ASTM A706 or AASHTO M31 (ASTM A615) Grade 60. Place all bars 2" clear of the nearest face of concrete unless shown otherwise. Splice #4 bars 1'-4" min., splice #5 bars 1'-8" min. Provide Class 3300 - 1 1/2 or 3/4 concrete. Provide steel cover plates conforming to AASHTO M183 (ASTM A36). Hot-dip galvanize after fabrication. At skewed bents up to 20° make joints parallel to the bent center line. For skews greater than 20° make joints normal to rail.

Accompanied by dwg. BR291

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

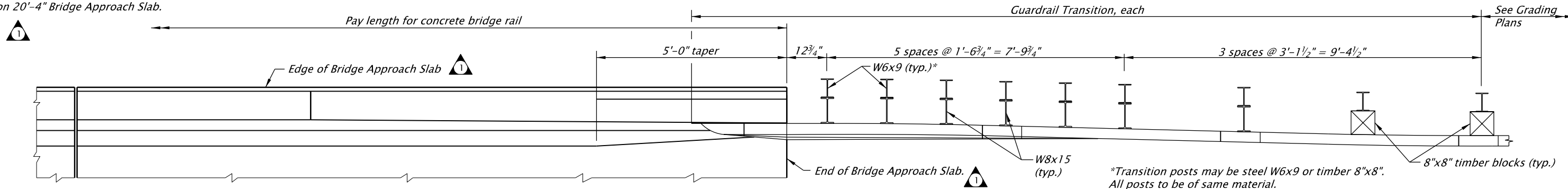
OREGON STANDARD DRAWINGS
TYPE "F" CONCRETE RAIL, 42 INCH

2021

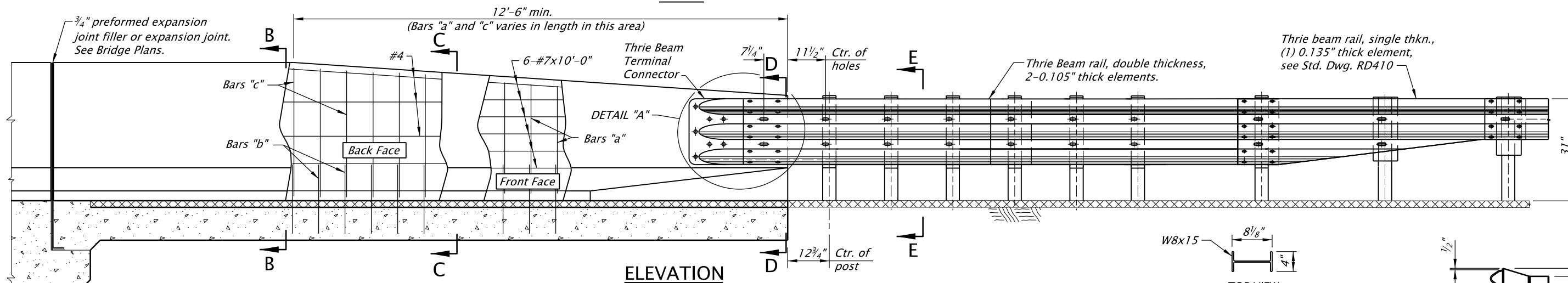
DATE	REVISION	DESCRIPTION
01-2023	Revised notes and rebar callouts.	
CALC. BOOK NO.	N/A	SDR DATE: 20-JAN-2023
		BR290

Effective Date: June 1, 2023 – November 30, 2023

NOTE:
No scoring joint for Bridge Rail
on 20'-4" Bridge Approach Slab.

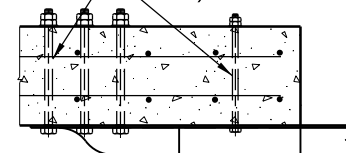


PLAN

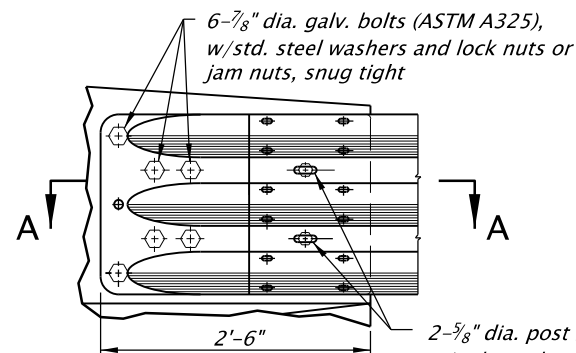


ELEVATION

Drill horizontal bolt holes (bolt dia. + 1/8")
in hardened concrete with low-impact rotary drill.
Cut bolts after installation so they extend 3/4" max.
beyond nut. Grind smooth and cold galvanize.



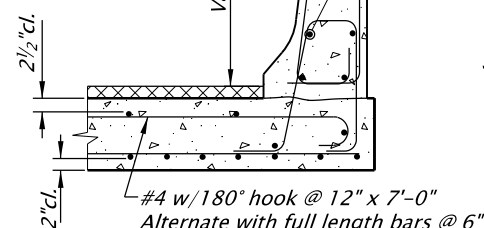
SECTION A-A



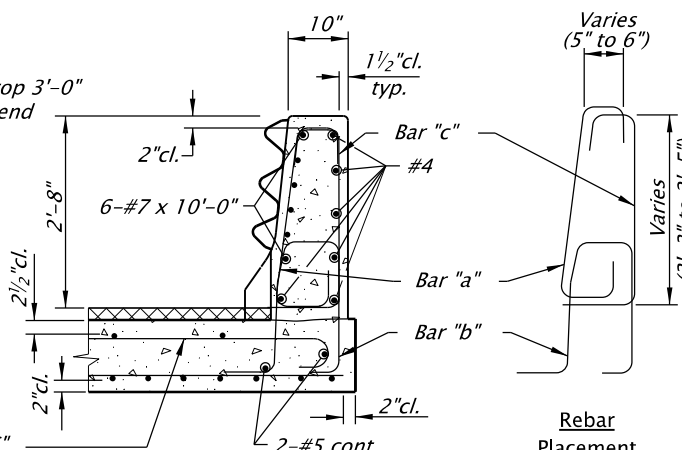
DETAIL "A"

NOTE
For Thrie Beam Terminal
Connector details not shown,
See dwg. RD410

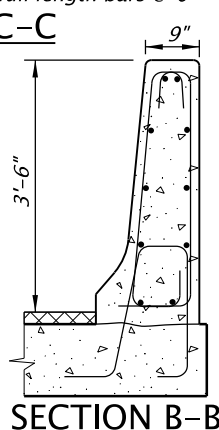
Varies
(9" to 10")
For Rail details
not shown,
see dwg. BR290



SECTION C-C

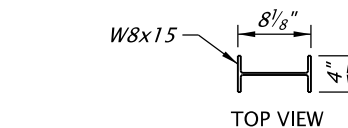


SECTION D-D

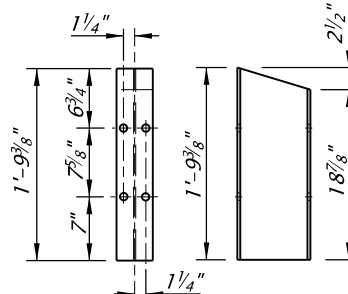


SECTION B-B

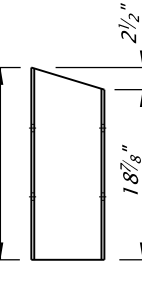
NOTES:
Provide steel for wide-flange posts
conforming to AASTHO M183 (ASTM A36).
Hot dip galvanize after fabrication.



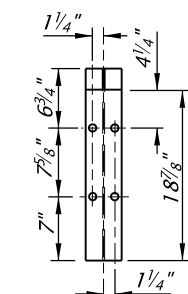
TOP VIEW



FRONT VIEW

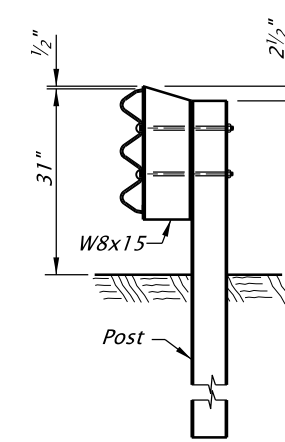


SIDE VIEW



BACK VIEW

THRIE BEAM BLOCKS



SECTION E-E

Accompanied by dwgs. BR290, RD401, RD402, RD407, RD408, RD410, RD412

The selection and use of this
Standard Drawing, while
designed in accordance with
generally accepted engineering
principles and practices, is the
sole responsibility of the user
and should not be used without
first consulting a Registered
Professional Engineer.

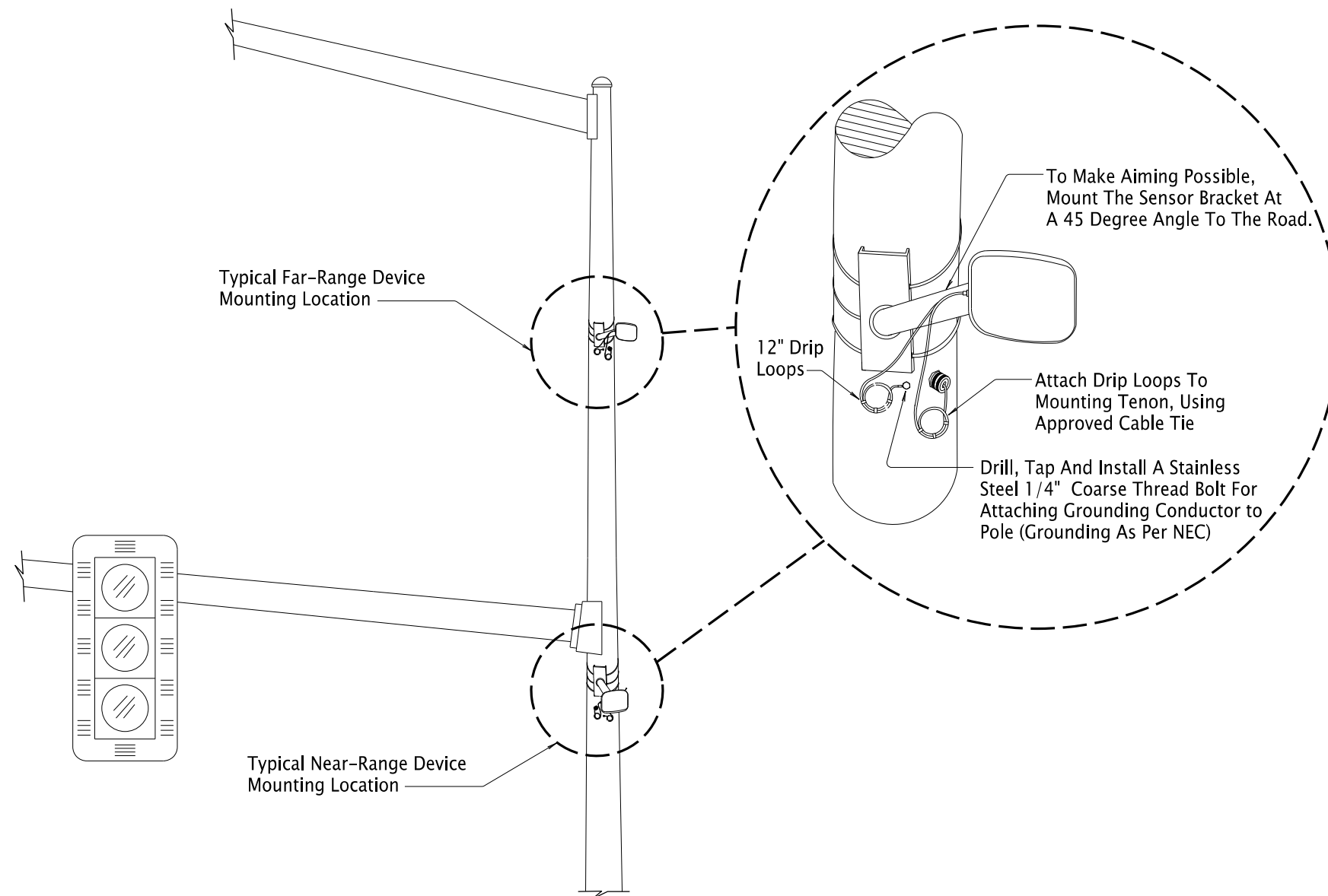
All materials shall be in accordance with
the current Oregon Standard Specifications.
OREGON STANDARD DRAWINGS
TRANSITION TYPE "F"
CONCRETE RAIL, 42 INCH
TO GUARDRAIL

2021

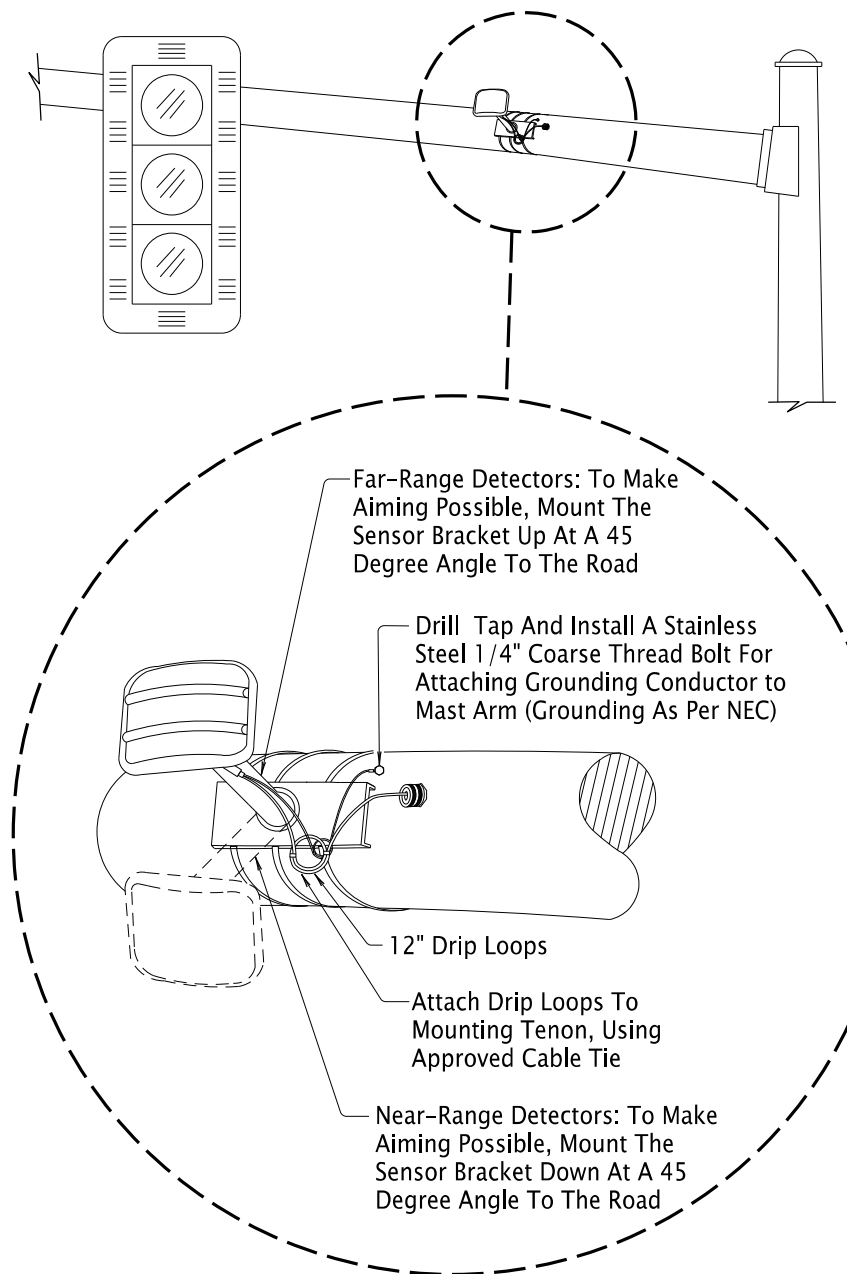
DATE	REVISION	DESCRIPTION
01-2023	Revised	accompanied by dwg references, General text revisions.
CALC.	BOOK NO.	N/A
SDR	DATE	20-JAN-2023

BR291

Effective Date: June 1, 2023 – November 30, 2023



VERTICAL SIGNAL POLE MOUNT

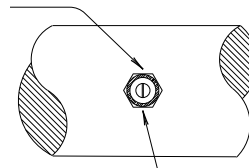


HORIZONTAL MAST ARM MOUNT

GENERAL NOTES:

1. All Bolts, Nuts And Washers Shall Be 304, Or 316 Stainless Steel Unless Noted Otherwise.
2. Mount Radar Detector Assembly As Per Manufacturers Recommendations.

Drill, Tap And Install A Galvanized Metallic Strain Relief For Wiring Entrance From Radar Detector Into Mast Arm, Or Pole



CABLE GRIP

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

RADAR MOUNTING DETAILS

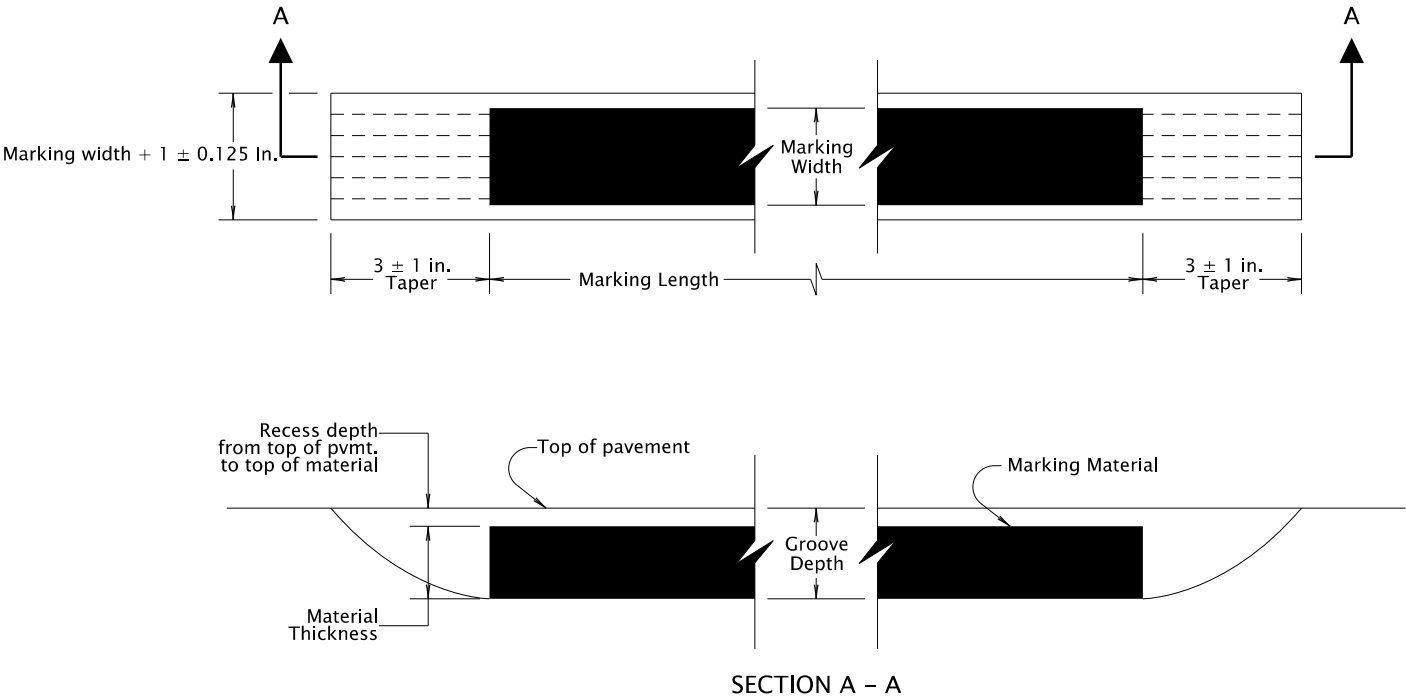
2021

DATE	REVISION	DESCRIPTION
01-2023	ADDED NEAR RANGE DETECTOR INFORMATION	
CALC. BOOK NO.	N/A	SDR DATE

20-JAN-2023

TM466

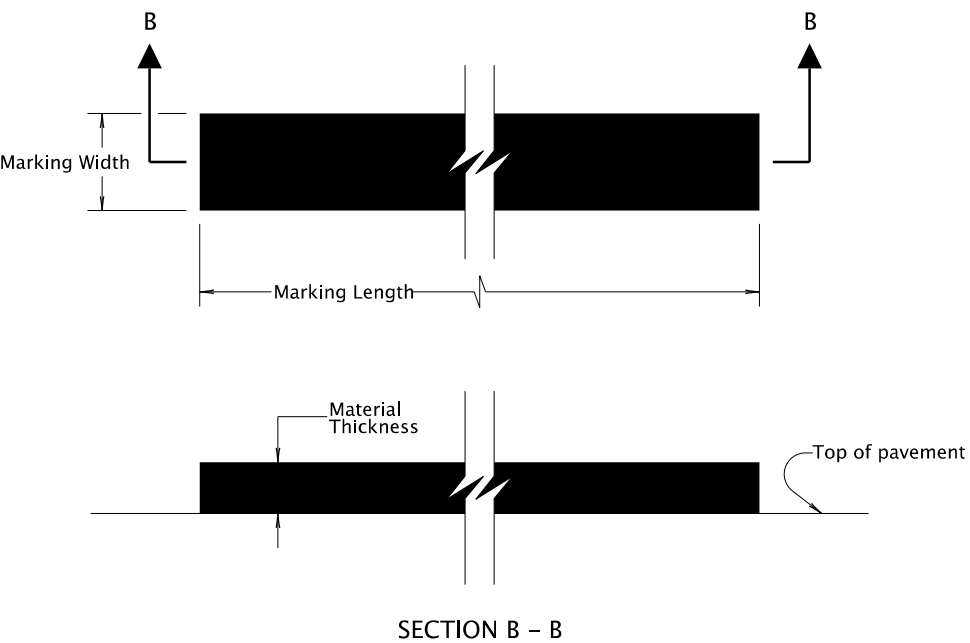
Effective Date: June 1, 2023 – November 30, 2023



GROOVE INSTALLED GROOVE AND MATERIAL DIMENSIONS

Pavement Marking Material Type	Groove Depth	Recess Depth	Material Thickness
Durable Method 'A' & Method 'D'	220 ± 20 mils	45 ± 5 mils	Var.
High Performance	60 ± 10 mils	Var.	25 mils

GROOVE INSTALLED MARKINGS



SURFACE INSTALLED MATERIAL THICKNESS

Pavement Marking Material Type	Thickness
Durable Method 'A' & Method 'B' & Method 'D'	120 mils
High Performance	25 mils

SURFACE INSTALLED MARKINGS

- General Notes:
- 1) See Standard Drawing TM500 and/or project plans for marking length and width dimensions.
 - 2) See Standard Specification 00850.46 for marking installation tolerances.

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS
DURABLE & HIGH PERFORMANCE
PAVEMENT MARKINGS
SURFACE & GROOVE INSTALLED
NON-PROFIED
2021

DATE	REVISION	DESCRIPTION
07-2021	Changed groove width for 4 in. markings	
01-2023	Changed groove width back to previous width for 4 in. markings	

CALC. BOOK NO. — — — N/A — — —

SDR DATE— 20-JAN-2023 —

TM521

GENERAL NOTES

1. Signal supports shall be designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 4th edition, 2001, 2002, and 2003 interim revisions.

2. All traffic signal supports shall conform to the design criteria and details shown on these drawings except as approved by the Engineer.

3. The design basic wind speed (3 second gust) shall be 110 mph, gust factor $G = 1.14$, $I_r = 1.0$ (50 year recurrence interval), Fatigue Category II, no galloping, and truck speed = 55 mph.

4. Signal poles from this standard are not allowed over highways I-5, I-84, I-205, I-405, US 26 (Sunset Hwy.) between milepoints 64.3 – 73.0, I-105, and I-82. Signal poles on these highways require a Fatigue Category I.

5. Pole and arm shafts may be either round, hexdecagonal, dodecagonal, or octagonal but shapes shall not be mixed on a project. Dimensional tolerances of ASTM A595 shall apply to all tapered steel tubing members. Additionally, the diameter of round tapered steel tubing members or the dimensions across the flats of octagonal tapered steel tubing members shall not vary more than 2 percent from specified dimension. Two ply and fluted poles or arms are not permitted.

6. Pole taper shall be equal to .0117 in/in.

7. Anchor rods shall conform to ASTM Specification F1554 Gr. 55, Supplementary Requirement "S2" that include grade and manufacturer's identification.

8. High strength bolts shall conform to ASTM F3125 Grade A325 Type 1.

9. Nuts for high strength bolts shall be heavy hex and conform to ASTM A563 Grade DH with supplementary requirements "S1" and "S2".

10. Hardened steel washers shall conform to ASTM F436 Type 1.

11. Direct Tension Indicators (DTI) shall be the compressible washer type, mechanically galvanized, conforming to ASTM F959.

12. Steel sheet for poles and arm shall conform ASTM A595, Grades A or B, ASTM A572 Gr. 50, or approved equal. All other steel sheet and plate shall conform to AASHTO specification M223 (ASTM A572), or approved equal. Supplement S18 of ASTM A6 regarding maximum tensile strength shall apply.

13. All structural steel including fasteners shall be hot-dip galvanized after fabrication unless otherwise noted.

14. Galvanize-Control Silicon, typical. Silicon content of the base metal shall be in the range of 0 to 0.04 percent or 0.15 to 0.25 percent.

15. Footing concrete shall be Commercial Grade Concrete ($f_c=3000$ psi) per Specification Section 440. Grout in grout pad shall be non-shrink high early strength grout (non-ferrous) with a minimum strength of 5000 psi.

16. Reinforcing steel shall conform to AASHTO M31, Grade 60 (ASTM A615 or A706). A minimum lap splice length of 32 bar diameters shall be used unless shown otherwise.

17. Computed deflection of these poles at full design loading shall be limited to 5 percent of the pole length. Computed dead load deflection of the poles shall be limited to 1 percent of the pole length. Pole shall be raked to offset the computed dead load deflection. Computed deflection (ignoring pole bending and/or rotation) of signal arms shall not exceed that listed in the Signal Arm Deflection Table on TM650. Additionally, the amplitude (maximum up to maximum down as measured at the tip of the arm) of wind induced vertical oscillations shall not exceed 1.5 percent of the signal arm length. Luminaire arms and pole extensions to support luminaire arms shall meet requirements of standard drawing TM629.

18. Hubs for cabinets and/or other appurtenances shall be welded into the pole prior to galvanizing. Poles may be tapped for up to 1" galvanized bolts after pole has been galvanized.

19. Longitudinal seam welds within 6 inches of a circumferential weld shall be complete penetration welds. Weld inspection shall be in accordance with AWS D1.1 and the special provisions. Inspect seam welds using cyclically loaded criteria. Hubs shall be 3000# threaded forged carbon steel flat weld hubs by Anvil Products Inc., Phoenix Forging Co., Bonney Forge & Tool Works or approved equal.

20. Grounding terminal shall be 1/2" UNC x 1 1/2" Type 308, 309 or 310 threaded stainless steel weld studs.

21. Assemble support, tighten anchor bolts, tighten HS thru bolts and tighten HS bolts in tapped holes according to 00962.46(j)(2).

22. Round and smooth all edges along electrical way.

23. The minimum arm flange thickness shall be equal to the value where prying action is not included in the bolt calculation.

Standard Maximum Base Reactions (Unfactored)								
Signal Pole Type	Signal Arm Lengths	Wind Load Case II				Controlling Fatigue		
		Axial (Kips)	Shear (Kips)	Moment (Kip-ft)	Torque (Kip-ft)	Shear (Kips)	Moment Kip-ft)	Torque (Kip-ft)
SM1	15'	2.10	5.15	80.39	16.95	0.68	10.39	2.13
SM2	20', 25'	2.66	6.23	105.41	42.54	0.82	13.35	5.37
SM3	30', 35'	3.49	7.77	138.43	82.87	1.00	17.10	10.31
SM4	40', 45'	4.51	9.00	173.46	132.72	1.16	20.54	16.50
SM5	50', 55'	5.69	9.23	190.91	181.60	1.18	21.62	22.55
SM1L	15'	2.96	6.09	113.28	23.22	0.79	14.08	2.84
SM2L	20', 25'	3.69	7.23	139.41	48.81	0.94	17.17	6.08
SM3L	30', 35'	4.39	8.80	176.51	87.88	1.14	21.43	11.02
SM4L	40', 45'	5.94	10.14	215.11	136.97	1.31	25.27	17.21
SM5L	50', 55'	7.34	10.56	241.17	187.96	1.34	26.49	23.26

Standard Maximum Mast Arm Reactions						
Signal Pole Type	Signal Arm Lengths	Wind Load Case II			Controlling Fatigue	
		Axial (Kips)	Shear (Kips)	Moment (Kip-ft)	Shear (Kips)	Moment (Kip-ft)
SM1, SM1L	15'	0.06	1.98	18.44	0.23	2.18
SM2, SM2L	20', 25'	0.10	3.14	46.20	0.37	5.48
SM3, SM3L	30', 35'	0.15	4.51	89.42	0.53	10.51
SM4, SM4L	40', 45'	0.23	5.91	146.67	0.67	16.82
SM5, SM5L	50', 55'	0.34	6.78	211.94	0.70	22.99

Luminaire Arm Reactions					
Arm Lengths	Wind Load Case II			Controlling Fatigue	
	Axial (Kips)	Shear (Kips)	Moment (Kip-ft)	Shear (Kips)	Moment (Kip-ft)
6'	0.03	0.31	1.49	0.03	0.15
10'	0.06	0.38	2.85	0.04	0.29
15'	0.08	0.47	4.96	0.05	0.51
20'	0.05	0.55	7.24	0.06	0.74

Accompanied by drawings TM650, TM652, TM653, TM654

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.	All materials shall be in accordance with the current Oregon Standard Specifications.				
	OREGON STANDARD DRAWINGS				
	TRAFFIC SIGNAL SUPPORTS NOTES AND REACTIONS				
	2021				
	DATE	REVISION DESCRIPTION			
	07-2020	ADDED ACCOMPANIED BY STANDARD DRAWING TM654			
	07-2021	ADDED "(UNFACTORED)" TO THE TABLE HEADING			
	01-2023	CHANGED HIGH STRENGTH BOLT TIGHTENING TO 00962.46(j)(2)			
CALC. BOOK NO. _ _ _ 5301 _ _ _		SDR DATE- 06-JAN-2023 _	TM651		

06-JAN-2023
TM656.dgn

GENERAL NOTES

1. Signal supports shall be designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals LRFD 1st edition with 2017 and 2018 interim revisions.

2. All traffic signal supports shall conform to the design criteria and details shown on these drawings except as approved by the Engineer.

3. The design basic wind speed (3 second gust) shall be 145 mph, gust factor $G = 1.14$, 50 year recurrence, Fatigue Category I, no galloping, and truck speed = 65 mph.

4. The design service basic wind speed (3 second gust) shall be 91 mph.

5. Signal poles from this standard are not allowed over highways I-5, I-84, I-205, I-405, US 26 (Sunset Hwy) between milepoints 64.3 – 73.0, I-105, and I-82.

6. Pole and arm shafts must be round. Dimensional tolerances of ASTM A595 shall apply to all tapered steel tubing members. Additionally, the diameter of round tapered steel tubing members shall not vary more than 2 percent from specified dimension. Two ply and fluted poles or arms are not permitted.

7. Pole taper shall be equal to .0117 in/in.

8. Anchor rods shall conform to ASTM Specification F1554 Gr. 55, Supplemenetary Requirement "S2" that include grade and manufacturer's identification.

9. High strength bolts shall conform to ASTM F3125 Grade A325 Type 1.

10. Nuts for high strength bolts shall be heavy hex and conform to ASTM A563 Grade DH with supplmentary requirements "S1" and "S2".

11. Hardened steel washers shall conform to ASTM F436 Type 1.

12. Direct Tension Indicators (DTI) shall be the compressible-washer type, mechanically galvanized, conforming to ASTM F959.

13. Steel sheet for poles and arm shall conform ASTM A595, Grades A or B, ASTM A572 Gr. 50, or approved equal. All other steel sheet and plate shall conform to AASHTO specification M223 (ASTM A572), or approved equal. Supplement S18 of ASTM A6 regarding maximum tensile strength shall apply.

14. All structural steel including fasteners shall be hot-dip galvanized after fabrication unless otherwise noted.

15. Galvanize-Control Silicon, typical. Silicon content of the base metal shall be in the range of 0 to 0.06 percent or 0.13 percent to 0.25 percent.

16. Footing concrete shall be according to TM628.

17. Reinforcing steel shall conform to AASHTO M31, Grade 60 (ASTM A615 or A706). A minimum lap splice length of 32 bar diameters shall be used unless shown otherwise.
18. Computed deflection of these poles at full design loading shall be limited to 5 percent of the pole length. Computed dead load deflection of the poles shall be limited to 1 percent of the pole length. Rake pole, apply mast arm and appurtenance loads, and verify final pole position is plumb.

19. Luminaire arms and pole extensions to support luminaire arms shall meet requirements of drawing TM629.

20. Hubs for cabinets and/or other appurtenances shall be welded into the pole prior to galvanizing. Poles may be tapped for up to 1" galvanized bolts after pole has been galvanized.

21. Longitudinal seam welds within 6 inches of a cirumferential weld shall be complete penetration welds. Weld inspection shall be in accordance with AWS D1.1 and the special provisions. Inspect seam welds using cyclically loaded criteria. Hubs shall be 3000# threaded forged carbon steel flat weld hubs by Anvil Products Inc., Phoenix Forging Co., Bonney Forge & Tool Works or approved equal.

22. Grounding terminal shall be 1/2" UNC x 1 1/2" Type 308, 309 or 310 threaded stainless steel weld studs.

23. Assemble support, tighten anchor bolts, tighten HS thru bolts, and tighten HS bolts in tapped holes according to 00962.46(j)(2).

24. Round and smooth all edges along electrical way.

	Reaction At Base Plate (Factored)				Reaction At Base Plate (Service)			
Signal Pole Type	Axial (lb)	Shear (lb)	Moment (ft-lb)	Torsion (ft-lb)	Axial (lb)	Shear (lb)	Moment (ft-lb)	Torsion (ft-lb)
SM6L	7,430	13,000	301,000	322,000	6,520	5,200	163,000	127,000
SM7L	8,860	13,100	349,000	385,500	8,080	5,190	212,720	153,000

Note:
The base plate reactions shown in the table are worst case Extreme I and Service I loads. Engineer of Record to specify shaft depth and confirm shaft design for local soil conditions based on a site specific geotechnical study and loads shown in table. If shaft size or reinforcement shown in the table on TM628 for the required design number are not adequate for local soil conditions, Engineer of Record must adjust the shaft design accordingly.

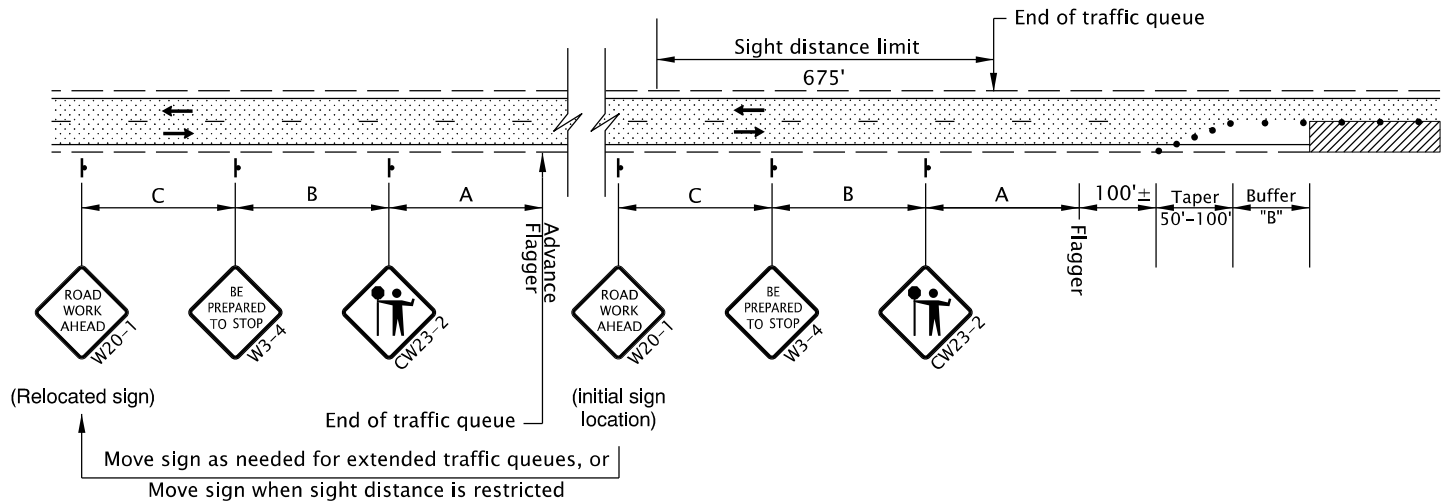
Accompanied by drawings TM628, TM654, TM655, TM657, TM658

<div>The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.</div>	All materials shall be in accordance with the current Oregon Standard Specifications.							
	OREGON STANDARD DRAWINGS							
	TRAFFIC SIGNAL 60' THROUGH 75' MAST ARM SUPPORTS							
	NOTES AND REACTIONS							
	2021							
	DATE	REVISION DESCRIPTION						
	07-2020	ADDED ACCOMPANIED BY STANDARD DRAWING TM654						
07-2022		ADDED REACTIONS TO TITLE AND ADDED REACTIONS TABLE						
01 / 2023		CHANGED HIGH STRENGTH BOLT TIGHTENING TO 00962.46(j)(2)						
CALC. BOOK NO. -- -- 7088 -- --		SDR DATE-- 06-JAN-2023 --		TM656				

Effective Date: June 1, 2023 – November 30, 2023

NOTES:

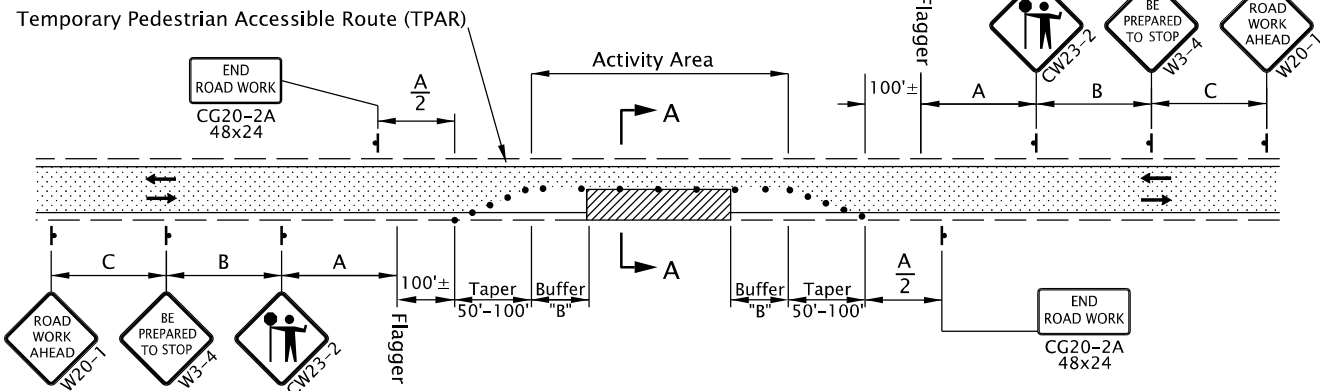
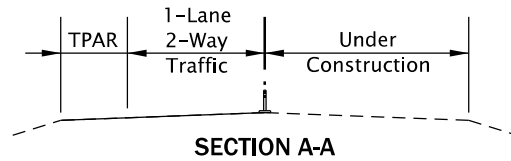
- Place Advance Flagger and additional signing when traffic queues extend beyond initial warning signing OR when sight distance is restricted.
- Relocate initial "ROAD WORK AHEAD" (W20-1) sign in advance of additional "BE PREPARED TO STOP" (W3-4) and Flagger Ahead (CW23-2) signs, as shown.
- Place additional Tubular Markers for Flagger and Advance Flagger Stations according to FLAGGER STATION DELINEATION detail.



ADVANCE FLAGGER FOR EXTENDED TRAFFIC QUEUES

NOTE:

- When using pilot cars with flaggers to control traffic during paving operations, the Tubular Marker spacing along centerline may be increased to 200' within the Activity Area, as shown or as directed.
- Include "WAIT FOR FLAGGER" (CR4-23) signs mounted on Type II Barricade located approx. 50' before each Flagger.
- Coordinate and control pedestrians movements through the TPAR using Flaggers, other TCM, or as directed. When the existing shoulder is greater than or equal to 4' wide, provide a minimum of 4' of width for the TPAR.



2-Lane, 2-Way Roadway
ONE LANE CLOSURE

GENERAL NOTES FOR ALL DETAILS:

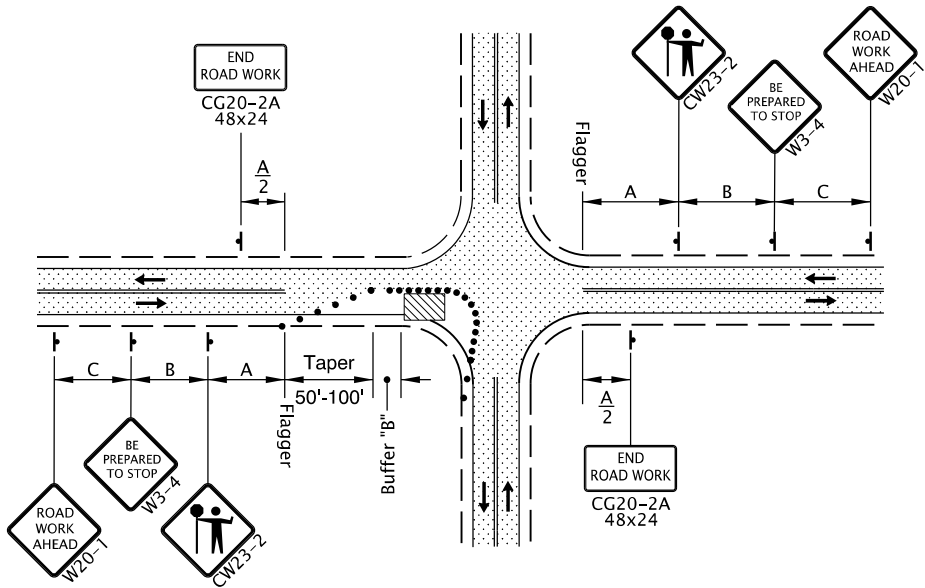
- This drawing is only intended to be used where an Automated Flagger Assistance Device (AFAD) cannot be utilized.
- The "FLAGGER" (CW23-2) symbol sign shall be used only in conjunction with the "BE PREPARED TO STOP" (W3-4) sign.
- Cover existing passing zone signing, as directed.
- Install temporary striping as required.
- To determine Taper Length ("L") and Buffer Length ("B"), use the "MINIMUM LENGTHS TABLE" shown on Dwg. No. TM800.
- To determine sign spacing A, B, and C, use "TRAFFIC CONTROL DEVICES (TCD) SPACING TABLE" on Dwg. No. TM800.
- Install a "BICYCLES ON ROADWAY" (CW11-1) sign in advance of the closure when a bike lane is closed, or when the shoulder is closed and bikes are expected.
- At night, flagger stations shall be illuminated according to the FLAGGER STATION LIGHTING DELINEATION detail on Dwg No. TM800.
- To be accompanied by Dwg. Nos. TM820 & TM821.

- 28" Tubular Markers on 10' max. spacing around intersection radii.
- 28" Tubular Markers on 20' max. spacing for flagger tapers and stations
- 28" Tubular Markers See TCD Spacing Table on TM800 for max. spacing.

..... UNDER TRAFFIC
..... UNDER CONSTRUCTION

NOTE:

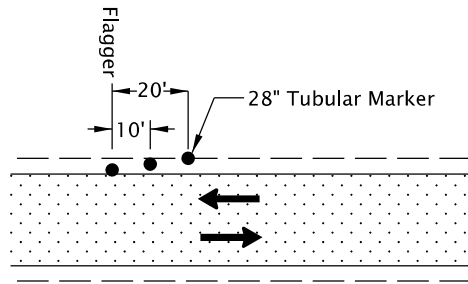
- Additional Traffic Control Measures (TCM) may be required for all legs of the intersection



2-Lane, 2-Way Roadway
ONE LANE CLOSURE, INTERSECTION

NOTE:

- Use a minimum of 3 tubular markers in shoulder taper on 10' spacing for flagger station delineation.



FLAGGER STATION DELINEATION

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.			
OREGON STANDARD DRAWINGS			
2-LANE, 2-WAY ROADWAYS			
2021			
DATE	REVISION DESCRIPTION		
CALC. BOOK NO.	N/A	SDR DATE	13-JAN-2023
			TM855