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EVALUATION OF OPEN JOINTS IN CONCRETE BRIDGE RAIL SYSTEMS

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Roadside Safety Pooled Fund

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16. Abstract

Concrete bridge rail systems tested and evaluated according to MASH typically include joint openings between ½ to 2 inches. Bridge rail systems with larger joint openings have not been evaluated according to MASH. State DOTs do encounter situations with bridge rail systems having joints larger than 2 inches. Guidance is needed for when these joint openings can be left open or if protection is needed using a cover plate or other solution.

Computer simulations were conducted to evaluate concrete bridge rail systems with different joint openings. Additionally, joint filler material and cover plates were evaluated for use with joint openings.

Guidelines were developed for MASH compliant joint opening widths and solutions to protect joint openings which did not maintain MASH compliance.

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Evaluation of Open Joints in Concrete Bridge Rail Systems

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SI* (MODERN METRIC) CONVERSION FACTORS				
APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5(F-32)/9 or (F-32)/1.8	Celsius	°C
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	Square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lb/in^2

*SI is the symbol for the International System of Units

Chapter 1. INTRODUCTION

Since the adoption of the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) standard, many concrete bridge rails have been designed and evaluated. These bridge rail systems are often tested with an open joint in the barrier to simulate joints that may be present in actual bridge rail installations. The test vehicles are often impacted at or near these open joints to evaluate critical loading scenarios and the possibility of vehicle snagging on the opening. However, there can be joints with larger openings that what was evaluated in the full-scale crash test. This project aimed to develop guidance and recommendations for state DOTs to address these situations.

1.1. OBJECTIVE

The purpose of this research was to evaluate concrete bridge rail systems according to MASH evaluation criteria. The goals are to

1. Determine the width of the concrete bridge rail joints that maintain MASH compliance for the bridge rail system.
2. For widths of concrete bridge rail joints not meeting MASH compliance:
    a. Determine if having compression joint material would prevent vehicle snagging and result in MASH compliance.
    b. Determine details of cover plate and attachment to prevent vehicle snagging and result in MASH compliance.

1.2. BACKGROUND

The 2016 MASH edition is the latest in a series of documents that provided guidance on testing and evaluation of roadside safety features (1). The original MASH document was published in 2009 and represents a comprehensive update to crash test and evaluation procedures to reflect changes in the vehicle fleet, operating conditions, and roadside safety knowledge and technology (2). The MASH documents supersede the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features" standards (3).

The Federal Highway Administration (FHWA) issued a January 7, 2016, memo mandating the AASHTO/FHWA Joint Implementation Agreement for MASH with compliance dates for installing MASH hardware that differ by hardware category. After December 31, 2019, all roadside safety devices must have been successfully tested and evaluated according to the 2016 MASH standard edition. FHWA will no longer issue eligibility letters for highway safety hardware that has not been successfully crash tested according to the MASH edition evaluation criteria.

Various concrete bridge rail systems have been tested and evaluated according to MASH since its implementation (4). These systems are often installed with an open joint in the concrete bridge rail to represent field conditions with open joints. The crash test vehicles are often impacted near the joint as this is often the critical location for structural loading and potential vehicle snag. Figure 1.1 shows an example of a 2-inch joint opening in a vertical concrete bridge rail system.

Figure 1.1. Example of Joint Opening in Concrete Bridge Rail (5).

The concrete bridge rail systems tested and evaluated according to MASH typically include joint openings between ½ to 2 inches. Bridge rail systems with larger joint openings have not been evaluated according to MASH. State DOTs do encounter situations with bridge rail systems having joints larger than 2 inches. They do not have clear guidance on the acceptance of these situations for MASH evaluation criteria. There is potential for components of the vehicles to snag on the joint opening during impact, which may cause excessive occupant risk indices. The solution is often to install a cover plate across the joint or use compression fill material to prevent vehicle snagging. This additional installation step may require additional time and resources.

The Midwest Roadside Safety Facility did develop cover plate details for a concrete bridge rail system with a 6-5/8 inch joint opening (6). The system was tested and evaluated according to MASH Test 5-12 as the main purpose was to evaluate the structural adequacy of the cover plate.

1.3. SURVEY

A survey questionnaire was distributed to members of the Roadside Safety Pooled Fund. The goal of the survey was to gather information on details such as joint widths, filler materials, and cover plates currently being used by state DOTs. The following questions were included in the survey:

1. What is the maximum width that your agency allows for joint openings in concrete bridge rail systems?
2. Does your agency use compression/filler material for joint openings in concrete bridge rail systems?
3. What type of compression/filler material does your agency use?

4. Does your agency use cover plates for joint openings in concrete bridge rail systems?
5. What is the specified minimum joint opening width for using a cover plate?
6. Please provide standard details for the cover plate and attachment to the concrete bridge rail system.

A total of twelve responses were received from state DOT personnel. The maximum width for joint openings that agencies allow ranges from two inches to five inches.

Six of the twelve states indicated usage of filler material. Appendix A includes some state standard details for the use of filler material. The types of materials used varied amongst the states and are summarized as follows:

- Elastomeric compression seal
- Silicone seal
- Expansion joint strip seal
- Rubberized flexible joint filler
- Backer foam
- Bituminous joint sealer
- Preformed joint filler
- Expanded Polyethylene

Eleven of the twelve states indicated usage of a cover plate for joint openings. The details of these cover plates varied and many states design the cover plate on a project-by-project basis. Appendix B includes some of the details which were provided by the states. General characteristics of the cover plates are summarized as follows:

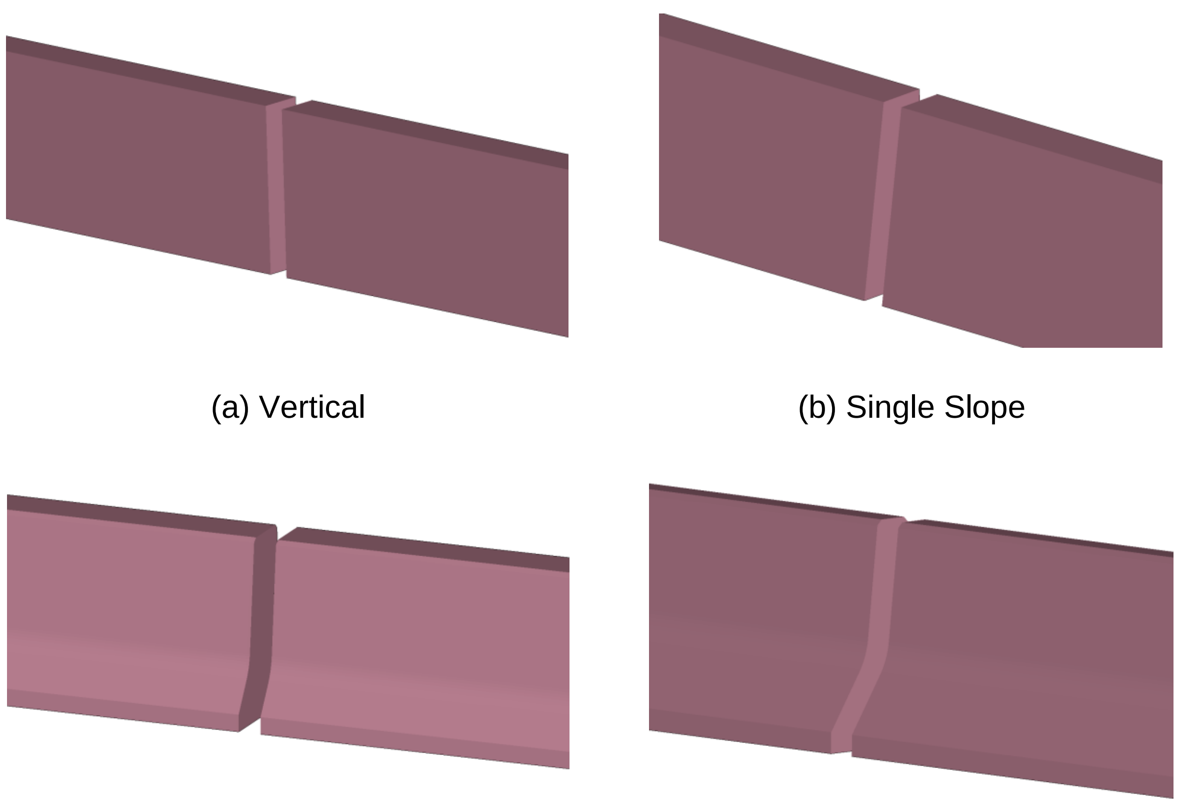
- Steel plate, $^{3}/_{8}$ inch thickness minimum
- Flat head countersunk screws
- Six inches of minimum overlap with concrete barrier
- Recessed into concrete barrier

Chapter 2. COMPUTER SIMULATIONS

This chapter presents the details of the modeling and simulation effort related to the evaluation of open joints in concrete bridge rail systems. Different concrete bridge rail profile shapes (e.g., F-Shape) and rail heights were considered for the evaluation of the open joints. The research team utilized finite element (FE) simulations to aid with the evaluation of the systems according to MASH TL-3.

2.1. MODEL

FE models of the concrete bridge rail systems were developed for evaluation according to MASH TL-3. The models consisted of a vertical shape, single slope (10.8-degree slope), F-Shape, and NJ-shape concrete bridge rail. Each concrete barrier was modeled using rigid material representation. The rigid material assumption was made to reduce simulation run time and focus the simulation efforts on potential vehicle snag with an open joint. The intent of the simulations was not to evaluate structural adequacy of the concrete bridge rail systems. Figure 2.1 shows the bridge rail models (32-inch height) with an open joint.



(a) Vertical (b) Single Slope

(c) F-Shape (d) NJ-Shape

Figure 2.1. Concrete Bridge Rail Models.

2.2. SIMULATIONS

All simulations were performed using the finite element method. LS-DYNA, which is a commercially available general purpose FE software, was used for all the analyses. An 1100C small car and 2270P pickup truck vehicle model were used for the simulations. Figure 2.2 and Figure 2.3 show the vehicle models.

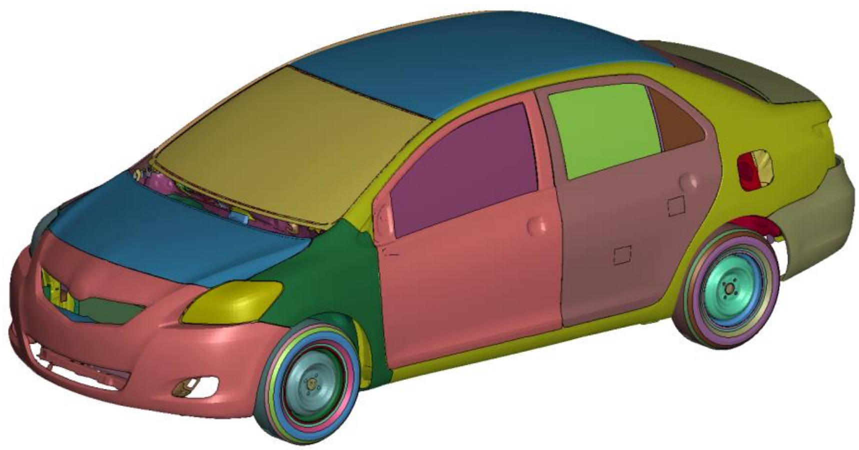


Figure 2.2. FE 1100C Small Car Vehicle Model.

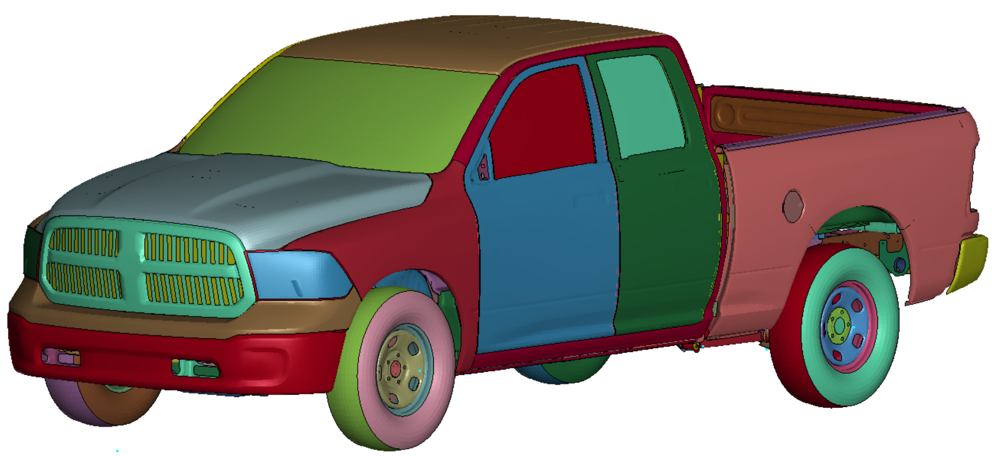


Figure 2.3. FE 2270P Pickup Truck Vehicle Model.

The research team performed impact simulations using MASH Test 3-10 and 3-11 impact conditions. This involves the vehicle models impacting the bridge rail system at an impact speed and angle of 62 mi/h and 25 degrees. The vehicle impacted the bridge rails with the centerline of the front impact side tire aligned with the downstream edge of the open joint. Figure 2.4 shows an example of the impact setup. This impact location was selected to maximize the potential for the vehicle wheel snagging on the bridge rail joint opening.

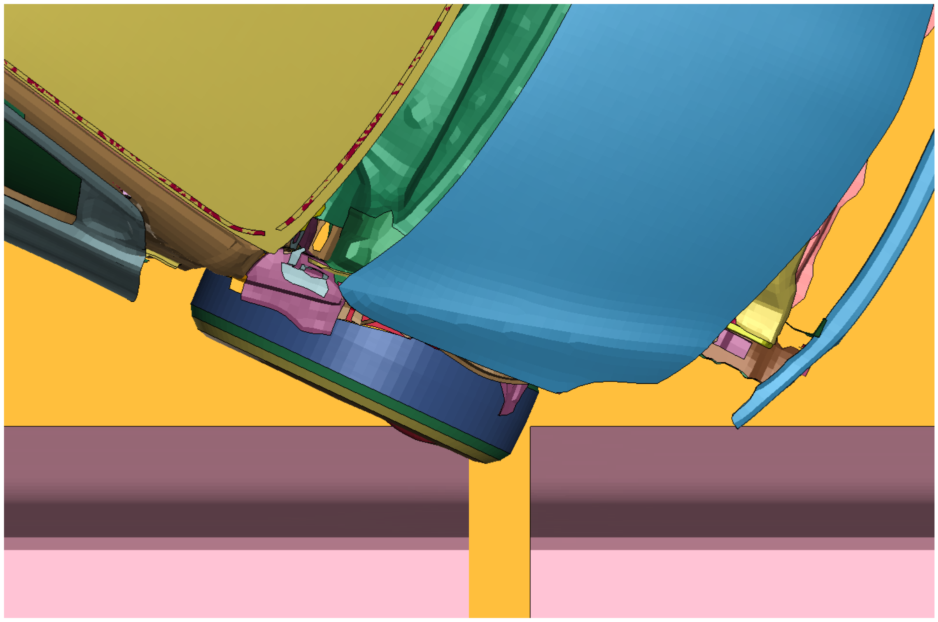


Figure 2.4. Example of Impact Location (Vehicle Parts Removed for Clarity).

The initial simulations were conducted with MASH Test 3-10 impact conditions. The small car vehicle impact was expected to have higher occupant risk values due to excessive snagging on the open joint. MASH Test 3-11 impact simulations were also performed once the critical barrier shape, height, and joint width were determined.

2.2.1. Critical Concrete Bridge Rail Profile Shape and Height

Prior to evaluating different open joint widths, simulations were performed to determine the critical barrier profile shape and critical barrier height. Once determined, the critical barrier profile shape and height would be used to evaluate different joint opening widths.

MASH Test 3-10 simulations were conducted on each of the barrier profile shapes. The height of each barrier was 32 inches and the joint opening was 4 inches. Figure 2.5 shows sequential images for the single slope concrete bridge rail. The overall behavior of the small car vehicle was similar during impact with the other barrier shapes.

Figure 2.6 shows the maximum vehicle snag on the bridge joint for each concrete bridge rail. Table 2.1 summarizes the occupant risk results for each concrete bridge rail. The vertical concrete bridge rail resulted in the highest longitudinal OIV value. Thus, it was selected as the most critical barrier profile shape.

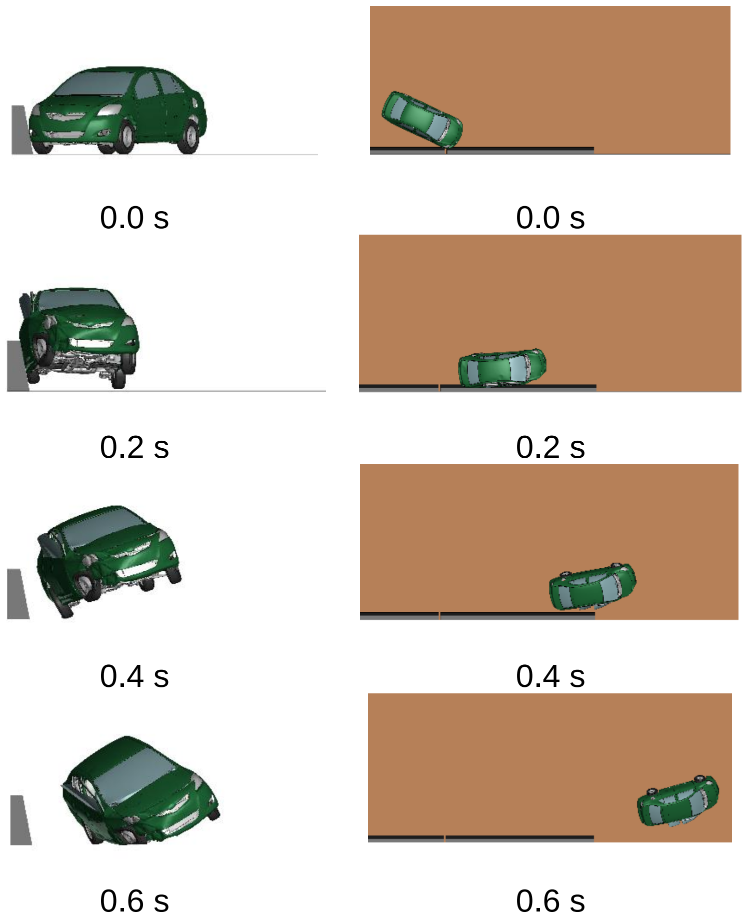
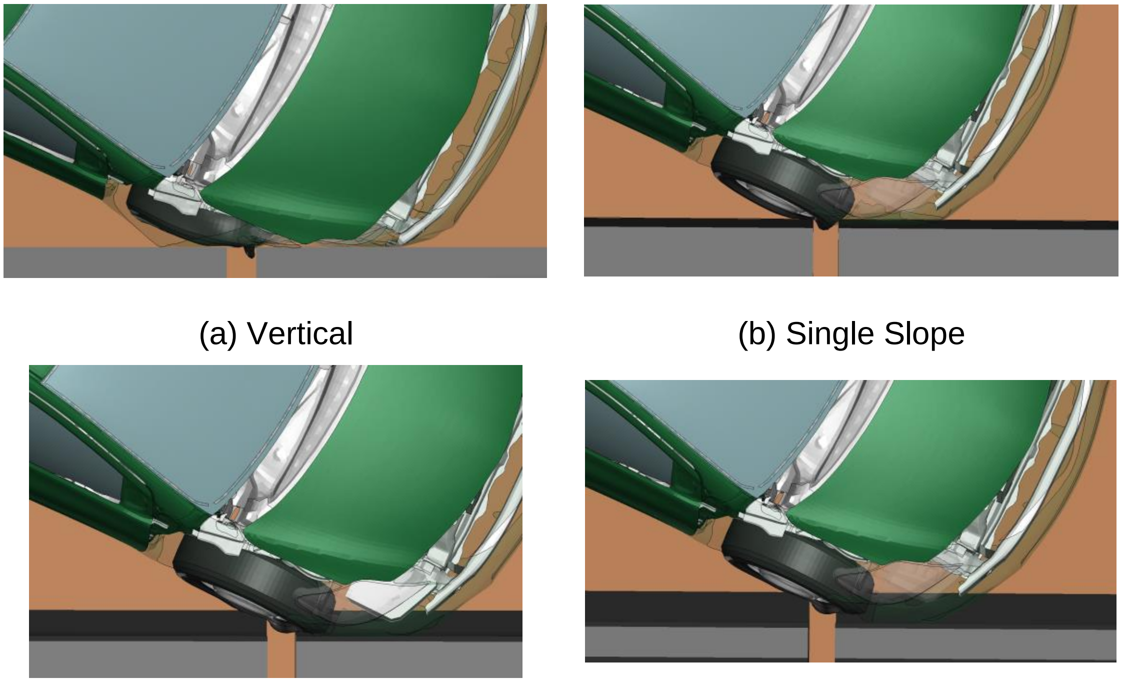


Figure 2.5. Sequential Images for MASH Test 3-10 Simulation – 32in Single Slope Bridge Rail with 4in Joint Opening.



(a) Vertical (b) Single Slope

(c) F-Shape (d) NJ-Shape

Figure 2.6. Front Impact Side Tire at Maximum Snagging with Bridge Rail Joint (Transparency Added).

Table 2.1. Occupant Risk Results for Concrete Bridge Rails.

	Vertical	Single Slope	F-Shape	NJ-Shape
OIV, Longitudinal (ft/s)	25.2	20.7	16.7	18.1
OIV, Lateral (ft/s)	31.0	28.9	29.5	27.4
RDA, Longitudinal (g)	3.0	5.5	-11.4	-8.1
RDA, Lateral (g)	-11.4	-14.4	-13.4	-11.2
Roll (deg)	-4.6	35.6	17.2	-6.4
Pitch (deg)	-6.2	7.3	-9.1	9.9
Yaw (deg)	38.4	33.4	39.2	42.3

An additional simulation was conducted with a 54 inch tall vertical concrete bridge rail to determine the critical barrier height. Table 2.2 summarizes the occupant risk results for the two vertical concrete bridge rails. There was not a significant difference between the two bridge rail heights but the 54 inch vertical concrete bridge rail did result in a higher longitudinal OIV value. Thus, it was selected as the most critical barrier height.

Table 2.2. Occupant Risk Results for Concrete Bridge Rail Heights.

	Vertical – 32inch	Vertical – 54inch
OIV, Longitudinal (ft/s)	25.2	25.5
OIV, Lateral (ft/s)	31.0	30.4
RDA, Longitudinal (g)	3.0	4.2
RDA, Lateral (g)	-11.4	-11.6
Roll (deg)	-4.6	-5.2
Pitch (deg)	-6.2	-6.7
Yaw (deg)	38.4	36.6

A 54 inch tall vertical concrete bridge rail was determined to be the most critical bridge rail shape and height for vehicle snagging and occupant risk metrics. This system showed satisfactory performance with a 4 inch open joint. The next step was to evaluate other bridge rail joint openings.

2.2.2. Open Joints

Evaluation of a 4 inch open joint in concrete bridge rails showed satisfactory performance for MASH Test 3-10 evaluation criteria. Computer simulations were conducted to evaluate a 6 inch and 8 inch open joint with a 54 inch tall vertical concrete bridge rail.

6 inch Joint Width

MASH Test 3-10 was conducted on a 54 inch tall vertical concrete bridge rail with a 6 inch open joint width. Figure 2.7 shows sequential images of the impact event. MASH Test 3-11 was also conducted for this concrete bridge rail system. Figure 2.8 shows sequential images of the impact event. Table 2.3 shows the occupant risk results for both simulations runs.

During the MASH Test 3-10 simulation, there was observed occupant compartment deformation due to the wheel snagging on the joint opening and pushing back into vehicle. Figure 2.9 shows the wheel and vehicle damage after impact with the bridge rail. The deformation value was 4 inches in the toe pan region which is below the MASH limit of 9 inches.

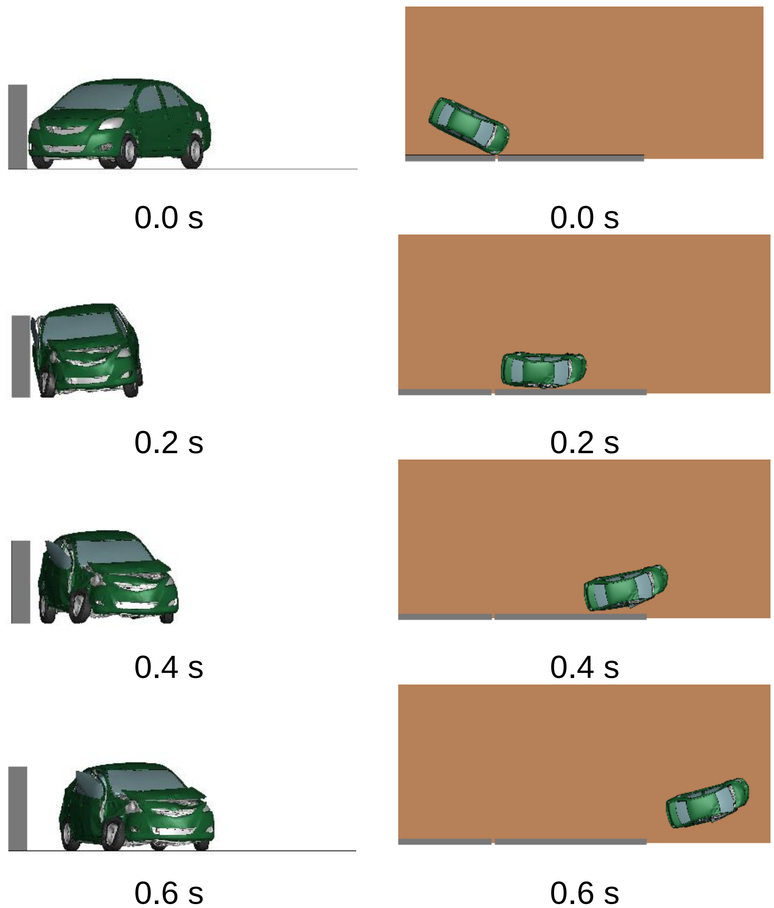


Figure 2.7. Sequential Images for MASH Test 3-10 Simulation – 54in Vertical Bridge Rail with 6in Joint Opening.

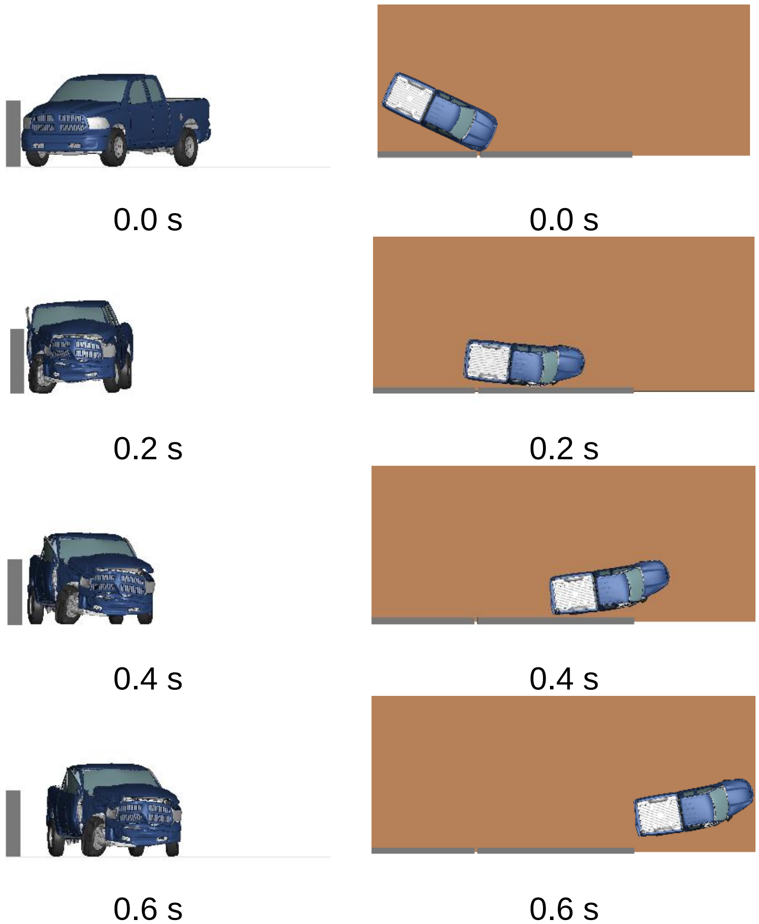


Figure 2.8. Sequential Images for MASH Test 3-11 Simulation – 54in Vertical Bridge Rail with 6in Joint Opening.

Table 2.3. Occupant Risk Values for 54in Vertical Bridge Rail with 6in Joint Opening.

	MASH Test 3-10	MASH Test 3-11
OIV, Longitudinal (ft/s)	26.5	25.3
OIV, Lateral (ft/s)	29.2	27.8
RDA, Longitudinal (g)	-3.8	-4.3
RDA, Lateral (g)	-7.9	-12.8
Roll (deg)	-6.1	-5.5
Pitch (deg)	-6.9	5.3
Yaw (deg)	39.6	35.0

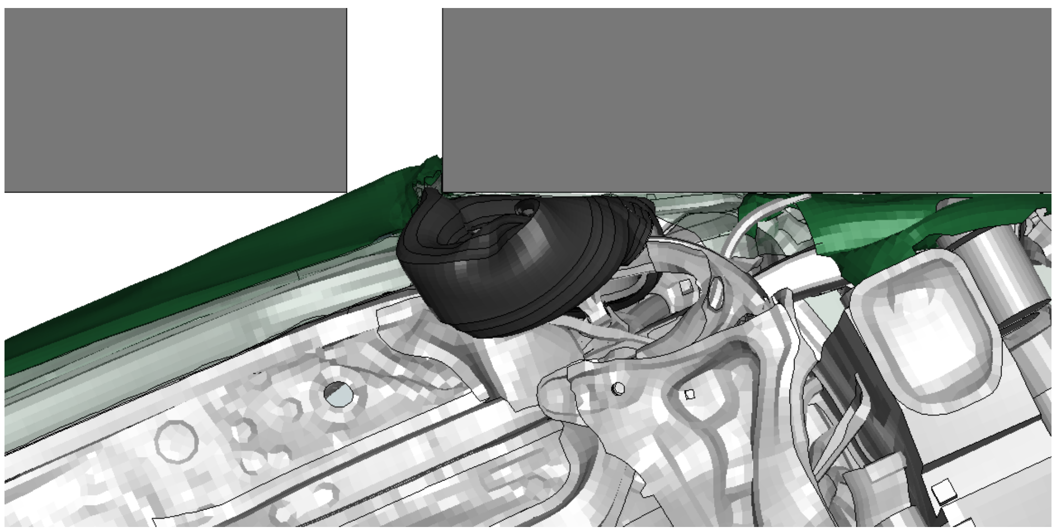


Figure 2.9. Wheel and Floor Pan Deformation after Snagging – 6in Joint.

Overall, the system showed satisfactory performance for MASH TL-3. Thus, a 6 inch joint opening in a concrete bridge rail would be considered acceptable for MASH TL-3 compliance.

8 inch Joint Width

MASH Test 3-10 was conducted on a 54 inch tall vertical concrete bridge rail with an 8 inch open joint width. Figure 2.10 shows sequential images of the impact event. Table 2.4 shows the occupant risk results for the simulations run. There was observed occupant compartment deformation due to the wheel snagging on the joint opening and pushing back into vehicle. Figure 2.11 shows the wheel and vehicle damage after impact with the bridge rail. The deformation value was 12.5 inches in the toe pan region which exceeded the MASH limit of 9 inches.

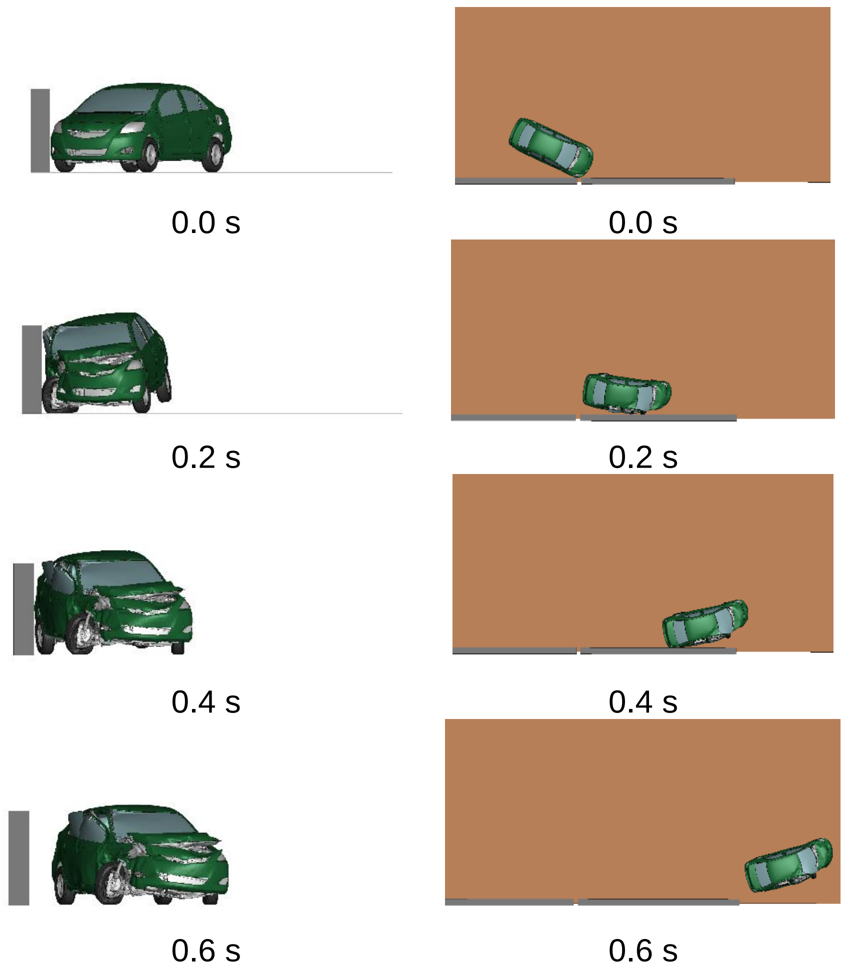


Figure 2.10. Sequential Images for MASH Test 3-10 Simulation – 54in Vertical Bridge Rail with 8in Joint Opening.

Table 2.4. Occupant Risk Values for 54in Vertical Bridge Rail with 8in Joint Opening.

	MASH Test 3-10
OIV, Longitudinal (ft/s)	32.7
OIV, Lateral (ft/s)	28.8
RDA, Longitudinal (g)	-4.7
RDA, Lateral (g)	-6.9
Roll (deg)	-11.0
Pitch (deg)	7.2
Yaw (deg)	37.5

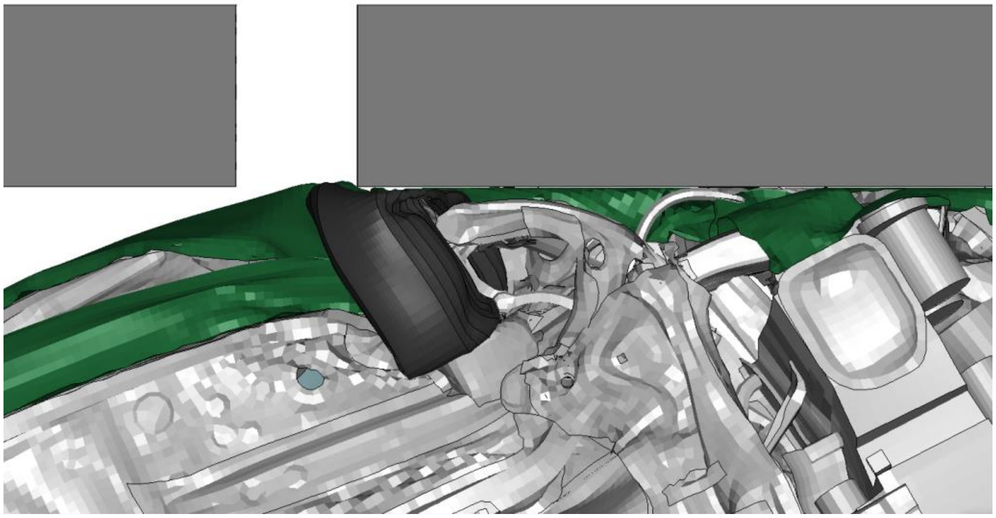


Figure 2.11. Wheel and Floor Pan Deformation after Snagging – 8in Joint.

Overall, the system showed unsatisfactory performance for MASH Test 3-10. Since the system showed unsatisfactory MASH Test 3-10 performance, MASH Test 3-11 was not conducted. Therefore, an 8-inch joint opening in a concrete bridge rail would not be considered acceptable for MASH TL-3 compliance. Alternative solutions are needed to protect joint openings 8 inches or greater. These are discussed in the next section.

2.2.3. Joint Protection Alternative Solutions

Joint Filler Material

Joints in bridge decks and bridge rails are often filled and sealed with a material. These materials can range in type, specification, and usage. These joint fill materials offer many advantages when used with bridges. One advantage is the protection of open joints during vehicle impacts.

A simulation was conducted to evaluate the effect of filler material with an open joint on MASH TL-3 compliance. As demonstrated previously, an 8-inch open joint leads to unsatisfactory MASH TL-3 compliance.

Figure 2.12 shows a 54 inch vertical concrete bridge rail with an 8 inch open joint and filler material. The filler material was modeled using MAT_057-LOW_DENSITY_FOAM. The properties were obtained using MatWeb material information (7) and were selected on the lower end of the spectrum.

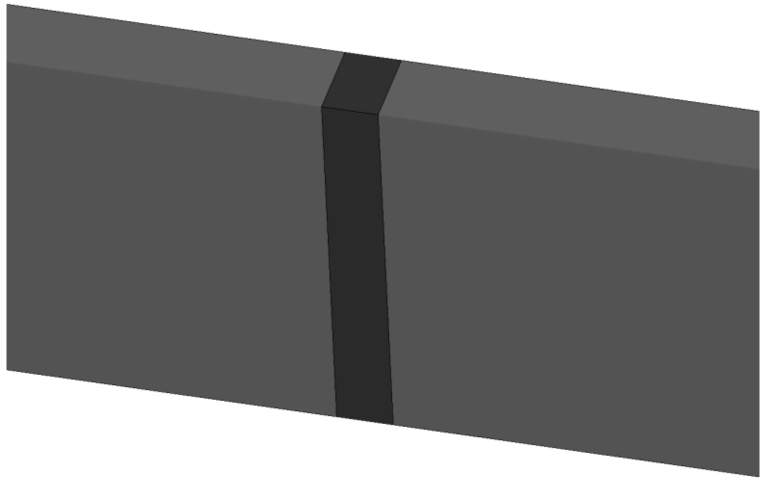


Figure 2.12. Joint Opening with Filler Material.

MASH Test 3-10 was conducted on a 54 inch tall vertical concrete bridge rail with an 8 inch open joint width and filler material. Figure 2.13 shows sequential images of the impact event. Table 2.5 shows the occupant risk results for the simulations run. There was no observed occupant compartment deformation with the filler material.

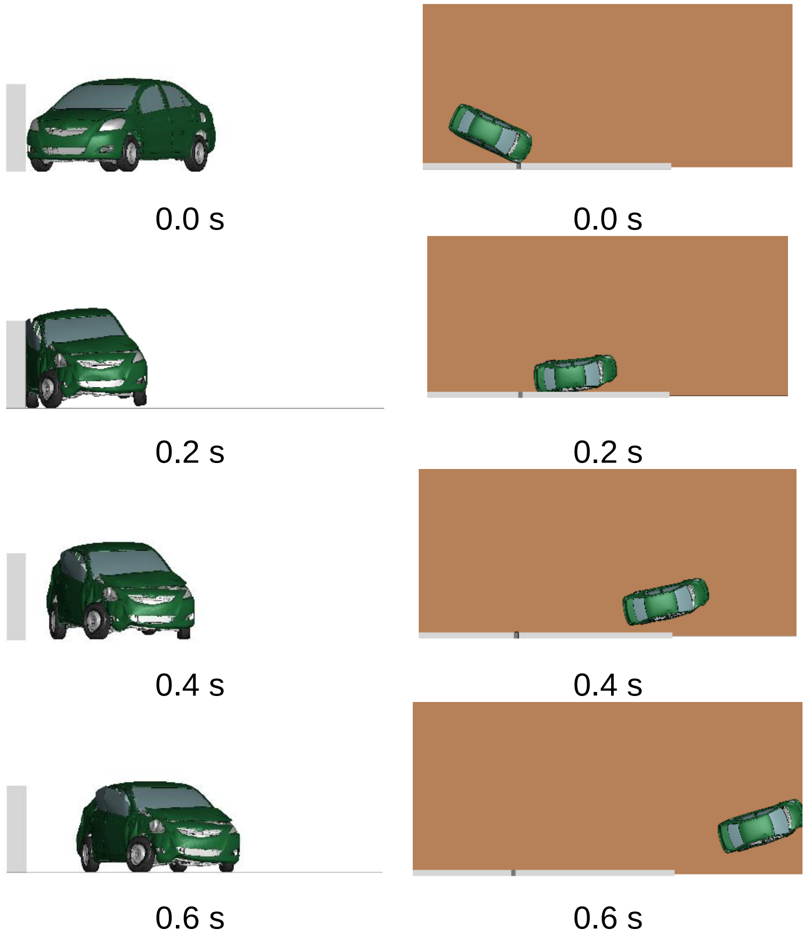


Figure 2.13. Sequential Images for MASH Test 3-10 Simulation – 54in Vertical Bridge Rail with 8in Joint Opening and Filler Material.

Table 2.5. Occupant Risk Values for 54in Vertical Bridge Rail with 8in Joint Opening and Filler Material.

	MASH Test 3-10
OIV, Longitudinal (ft/s)	19.8
OIV, Lateral (ft/s)	31.0
RDA, Longitudinal (g)	-3.2
RDA, Lateral (g)	-19.0
Roll (deg)	-5.9
Pitch (deg)	-5.2
Yaw (deg)	41.4

Overall, the system showed satisfactory performance for MASH Test 3-10. Thus, the use of joint filler material should be considered an acceptable solution to protect open joints during vehicle impacts. For reference, some examples of the use of filler materials and details being used by state DOTs are included in Appendix A. The use of any general filler material should be considered acceptable from a MASH crashworthiness material. A list of filler materials currently being used by some state DOTs can be found in Section 1.3 of this report.

Cover Plates

Another method in which bridge rail open joints are protected is the use of steel cover plates. There are different types of designs for the use of cover plates and can vary based on the site and project needs. Full-scale crash testing was previously conducted on a concrete bridge rail system with a steel cover plate (6). The crash was performed according to MASH 5-12. The cover plate provided adequate protection of the opening. While the small car and pickup truck crash tests were not conducted, the use of a cover plate should be considered an acceptable solution for protecting joints and maintaining MASH TL-3 compliance. For reference, some example cover plates details being used by state DOTs are included in Appendix B.

Chapter 3. CONCLUSIONS

3.1. SUMMARY

Bridges are often constructed with open joints in the deck and bridge rail. Guidance was needed to determine when these joints can be left open and still maintain MASH compliance.

To evaluate a variety of concrete bridge rails and open joints, finite element computer simulations were performed. The computer simulations performed represented MASH Test 3-10 and 3-11 impact conditions. The results were evaluated according to MASH TL-3 longitudinal barrier criteria.

The concrete bridge rail shapes considered in the evaluation were vertical, single slope, F-Shape, and NJ-Shape. The range of heights considered were 32 inches to 54 inches.

The simulations indicated satisfactory MASH TL-3 performance for concrete bridge rails with a 4 inch and 6 inch joint opening. Minimal wheel snagging was observed during the simulations with the 4 inch joint opening. Moderate wheel snagging (i.e., half of the wheel engaged the blunt end) was observed during the simulations with the 6 inch joint opening. However, the MASH TL-3 evaluation criteria was still met.

The simulations indicated unsatisfactory MASH TL-3 performance for concrete bridge rails with an 8 inch joint opening. The front impact-side tire experienced severe snagging on the blunt end of the bridge rail and the occupant compartment deformation exceeded the MASH limits.

Additional simulations were conducted to evaluate the effect of a filler material for the 8 inch joint opening. The use of filler material indicated satisfactory performance for MASH TL-3. Thus, it should be considered an acceptable alternative to maintain crashworthiness with large joint openings.

3.2. GUIDELINES

Recommendations were prepared for the implementation of the results found in this research study.

First, concrete bridge rails with a vertical, single slope, F-Shape, and NJ-Shape profile and an open joint up to 6 inches should be considered acceptable for MASH TL-3. The use of joint filler material or a cover plate would improve the crashworthiness of the system and reduce tire snagging.

Second, concrete bridge rails with a vertical, single slope, F-Shape, and NJ-Shape profile and an open joint greater than 6 inches require the use of filler material or a cover plate to maintain MASH TL-3 compliance. Based on current state DOT details and designs, the steel cover plate should meet the following recommendations:

1. Minimum thickness of $^{3}/_{8}$ inch

2. Bolts or screws which do not protrude beyond the traffic face of the barrier.
3. Recessed into concrete barrier

Other details of the cover plate may be designed based on site and project needs.

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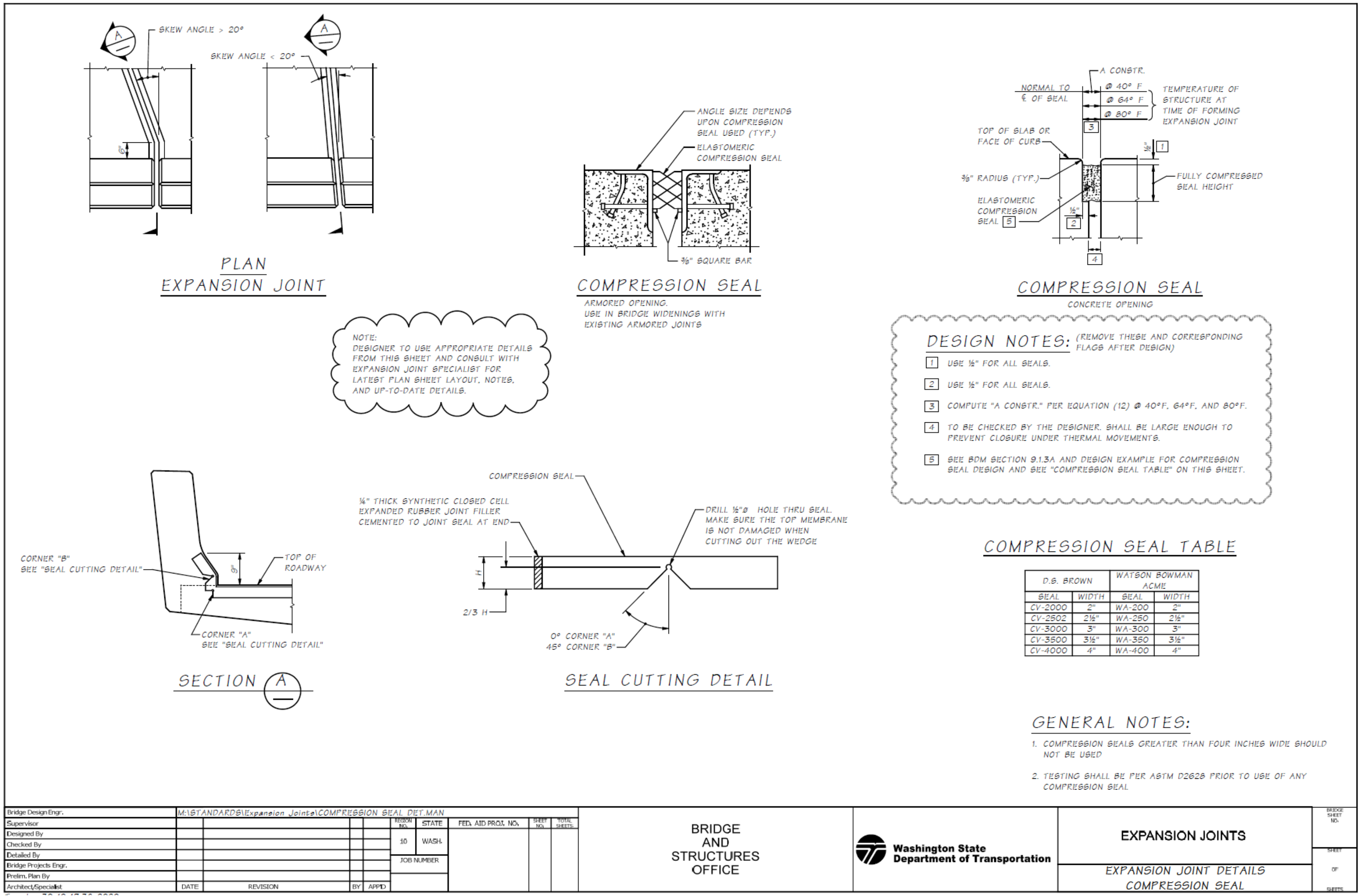
6. S.K. Rosenbaugh, J.D. Schmidt, E.M Regier, and R.K. Faller. *Development of the Manitoba Constrained-Width, Tall Wall Barrier*. Report No. TRP-03-356-16, Midwest Roadside Safety Facility, Lincoln, Nebraska, 2016.
7. MatWeb. https://www.matweb.com/search/DataSheet.aspx?MatGUID=cbe7a469897a47eda563816c86a73520&ckck=1. Accessed November 2023.

APPENDIX A. EXAMPLES OF STATE DOT JOINT FILLER MATERIAL AND DETAILS

A.1. WASHINGTON DOT



D.S. BROWN		WATSON BOWMAN ACME	
SEAL	WIDTH	SEAL	WIDTH
CV-2000	2"	WA-200	2"
CV-2502	2½"	WA-250	2½"
CV-3000	3"	WA-300	3"
CV-3500	3½"	WA-350	3½"
CV-4000	4"	WA-400	4"

STEEL SHAPE TYPES

MANUFACTURER	ITEM NAME	BRIDGE DECK TYPE	BRIDGE DECK S	BRIDGE DECK T	TRAFFIC BARRIERS TYPE	V	W	TRAFFIC BARRIERS TYPE	X	Y
D. S. BROWN	DSB STRIP SEAL	SSCM2	1¼"	3¾"	SSA2 ⟨4⟩	1¼"	2"	SSE2M ⟨4⟩	1"	1½"
WATSON BOWMAN ACME	WABO STRIP SEAL	R	1¼"	3¼"	A	1¼"	2"	E	1½"	1½"
R.J. WATSON, INC.	RJ STRIP SEAL	RJM	2¾"	3¼"	RJA	1¼"	2"	RJE	1¼"	1½"

2" MOTION RANGE

** GROUP	MANUFACTURER	ITEM NAME	OPENING "G" NORMAL TO JT. MIN.	OPENING "G" NORMAL TO JT. MAX.	MIN. INSTALLATION WIDTH NORMAL TO JOINT	OPENING "G" NORMAL TO JT. @40°F	@64°F	@80°F
1	D. S. BROWN	A2R-400 OR E2M-SEAL ⟨5⟩	½"	4½"	2"			
2	WATSON BOWMAN ACME	WABO STRIP SEAL SE-300	0"	3"	1½"			
2	R.J. WATSON, INC.	R.J. STRIP SEAL 200	0"	2"	1½"			

3" MOTION RANGE

** GROUP	MANUFACTURER	ITEM NAME	OPENING "G" NORMAL TO JT. MIN.	OPENING "G" NORMAL TO JT. MAX.	MIN. INSTALLATION WIDTH NORMAL TO JOINT	OPENING "G" NORMAL TO JT. @40°F	@64°F	@80°F
1	D. S. BROWN	A2R-400 OR E2M-SEAL ⟨5⟩	½"	4½"	2"			
2	WATSON BOWMAN ACME	WABO STRIP SEAL SE-300	0"	3"	1½"			
2	R.J. WATSON, INC.	R.J. STRIP SEAL 300	0"	3"	1½"			

4" MOTION RANGE

** GROUP	MANUFACTURER	ITEM NAME	OPENING "G" NORMAL TO JT. MIN.	OPENING "G" NORMAL TO JT. MAX.	MIN. INSTALLATION WIDTH NORMAL TO JOINT	OPENING "G" NORMAL TO JT. @40°F	@64°F	@80°F
1	D. S. BROWN	A2R-400 OR E2M-SEAL ⟨5⟩	½"	4½"	2"			
2	WATSON BOWMAN ACME	WABO STRIP SEAL SE-400	0"	4"	1½"			
2	R.J. WATSON, INC.	R.J. STRIP SEAL 400	0"	4"	1½"			

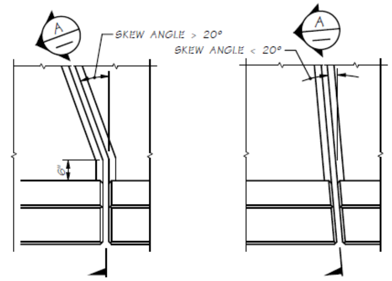
5" MOTION RANGE

** GROUP	MANUFACTURER	ITEM NAME	OPENING "G" NORMAL TO JT. MIN.	OPENING "G" NORMAL TO JT. MAX.	MIN. INSTALLATION WIDTH NORMAL TO JOINT	OPENING "G" NORMAL TO JT. @40°F	@64°F	@80°F
1	D. S. BROWN	DSB STRIP SEAL A2R-XTRA ⟨6⟩	½"	5½"	2"			
2	WATSON BOWMAN ACME	WABO STRIP SEAL SE-500	0"	5"	1½"			
1	R.J. WATSON, INC.	R.J. STRIP SEAL 500	½"	5"	1½"			

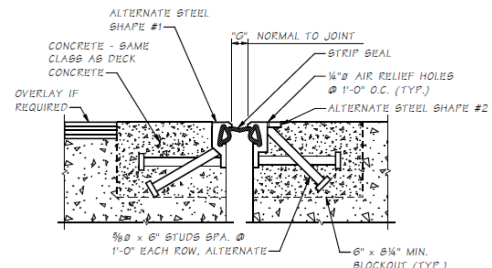
** GROUP COLUMN NOT TO BE SHOWN IN CONTRACT PLANS. FOR DESIGN PURPOSES ONLY.

NOTE:
DESIGNER TO USE APPROPRIATE DETAILS FROM THIS SHEET AND CONSULT WITH EXPANSION JOINT SPECIALIST FOR LATEST PLAN SHEET LAYOUT, NOTES, AND UP-TO-DATE DETAILS.

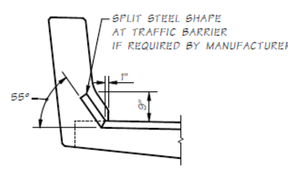
PAGE SHOULD BE REORGANIZED ACCORDINGLY AFTER ANY DETAILS OR TABLES ARE REMOVED. PAGE SHOULD BE FORMATTED AND VIEWS ALIGNED IN ACCORDANCE WITH CAD STANDARDS AND PRACTICES.



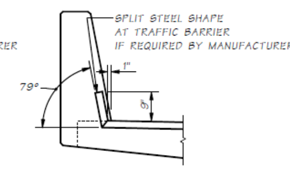
PLAN
EXPANSION JOINT



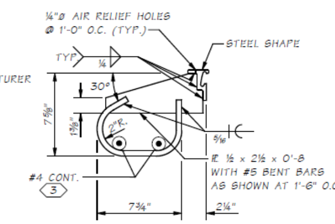
STRIP SEAL
STANDARD ANCHORAGE ⟨1⟩



SECTION A
FOR STRIP SEAL "F" SHAPE BARRIER



SECTION A
FOR STRIP SEAL SINGLE SLOPE BARRIER



STRIP SEAL
SPECIAL ANCHORAGE ⟨2⟩

STRIP SEAL DESIGN NOTES:

1. DESIGNER SHALL INCLUDE APPROPRIATE DETAILS AND TABLES IN THE PLANS.
2. SEE BDM SECTION 9.1.4B AND DESIGN EXAMPLE FOR STRIP SEAL DESIGN AND FOR DETERMINING OPENING "G" NORMAL TO THE JOINT. FILL IN AMOUNTS CALCULATED AND STEEL SHAPES SELECTED.
3. FOR SKEW ANGLE GREATER THAN 30° SEE JOINT SPECIALIST.
4. SEE JOINT SPECIALIST PRIOR TO SPECIFYING A 5" MOTION RANGE STRIP SEAL.
5. A GROUP 1 STRIP SEAL DOES NOT ALLOW FULL CLOSURE OF STEEL SHAPES. A GROUP 2 STRIP SEAL ALLOWS FULL CLOSURE OF STEEL SHAPES.
6. DO NOT USE STEEL SHAPES WITH HORIZONTAL LEGS IN CURB OR BARRIER REGION.

NOTES:

REMOVE NOTE ⟨6⟩ IF 5" MOTION RANGE TABLE IS NOT USED.

⟨1⟩ USE FOR NORMAL TRAFFIC VOLUME EXTEND SLAB STEEL INTO THE BLOCKOUT

⟨2⟩ USE FOR HIGH TRAFFIC VOLUME REQUIRES 9" x 1'-0" MIN. BLOCKOUT EXTEND SLAB STEEL INTO THE BLOCKOUT EXTEND BLOCKOUT TO EDGE OF DECK

⟨3⟩ PLACED AFTER EXPANSION JOINT IS IN POSITION. THREAD INTO PLACE FROM THE ENDS.

⟨4⟩ ALTERNATIVELY, TRIM VERTICAL LEG OF SSCM2 SHAPE FOR USE IN TRAFFIC BARRIER

⟨5⟩ USE E2M-SEAL WITH SSE2M SHAPE ONLY

⟨6⟩ NO SEAL AVAILABLE FOR SSE2M SHAPE

Bridge Design Engr.	M:\STANDARDS\Expansion Joints\STRIP SEAL DETAILS.MAN			
Supervisor		REGION NO. 10	STATE WASH.	FED. AID PROJ. NO. / SHEET NO. / TOTAL SHEETS
Designed By		JOB NUMBER		
Checked By				
Detailed By				
Bridge Projects Engr.				
Prelim. Plan By				
Architect/Specialist	DATE	REVISION	BY	APP'D

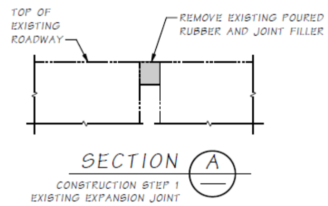
BRIDGE AND STRUCTURES OFFICE

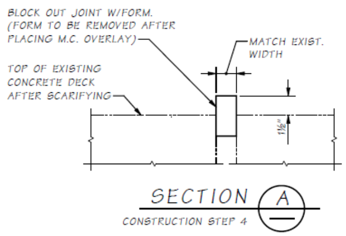
Washington State Department of Transportation

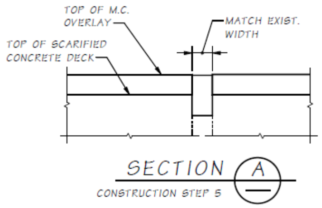
EXPANSION JOINTS

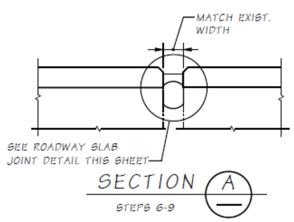
EXPANSION JOINT DETAILS
STRIP SEAL

BRIDGE SHEET NO.
SHEET OF SHEETS





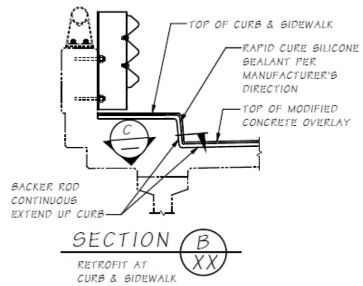


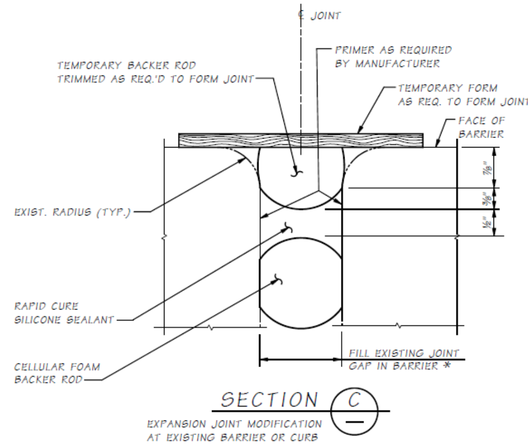


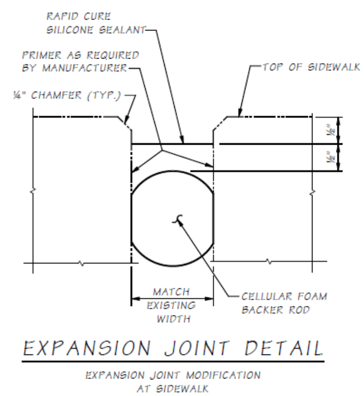
CONSTRUCTION STEPS:

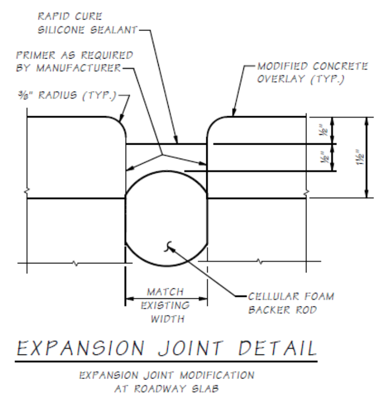
1. REMOVE EXISTING POURED RUBBER & JOINT FILLER MATERIAL FROM EXPANSION JOINT.
2. CLEAN SIDES AND BOTTOM OF JOINT OPENING TO CLEAN AND SOUND CONCRETE.
3. BLOW JOINT OPENING WITH OIL-FREE COMPRESSED AIR TO REMOVE LAITANCE AND DEBRIS FROM REMOVAL OPERATIONS.
4. PLACE FORM IN EXISTING JOINT OPENING TO A HEIGHT LEVEL WITH THE FINAL ROADWAY ELEVATION.
5. PLACE MODIFIED CONCRETE OVERLAY TO FINAL RDW'Y ELEVATION.
6. REMOVE FORM FROM JOINT OPENING AND LIGHTLY SANDBLAST TO REMOVE ALL RESIDUE.
7. PLACE AN APPROPRIATELY SIZED BACKER ROD TO THE CORRECT DEPTH IN JOINT OPENING IN ACCORDANCE WITH SEALANT MANUFACTURER'S DIRECTIONS.
8. PLACE RAPID CURE SILICON SEALANT IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS.

NOTE TO DESIGNER: CONSTRUCTION STEPS ARE FOR USE WHEN APPLYING A MODIFIED CONCRETE OVERLAY ONLY.









Bridge Design Engr.	M:\STANDARDS\Expansion Joints\SILICONE SEAL DETAILS.MAN
Supervisor	
Designed By	
Checked By	
Detailed By	
Bridge Projects Engr.	
Prelim. Plan By	
Architect/Specialist	DATE / REVISION / BY / APP'D

REGION NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
10	WASH.			
JOB NUMBER				

BRIDGE AND STRUCTURES OFFICE

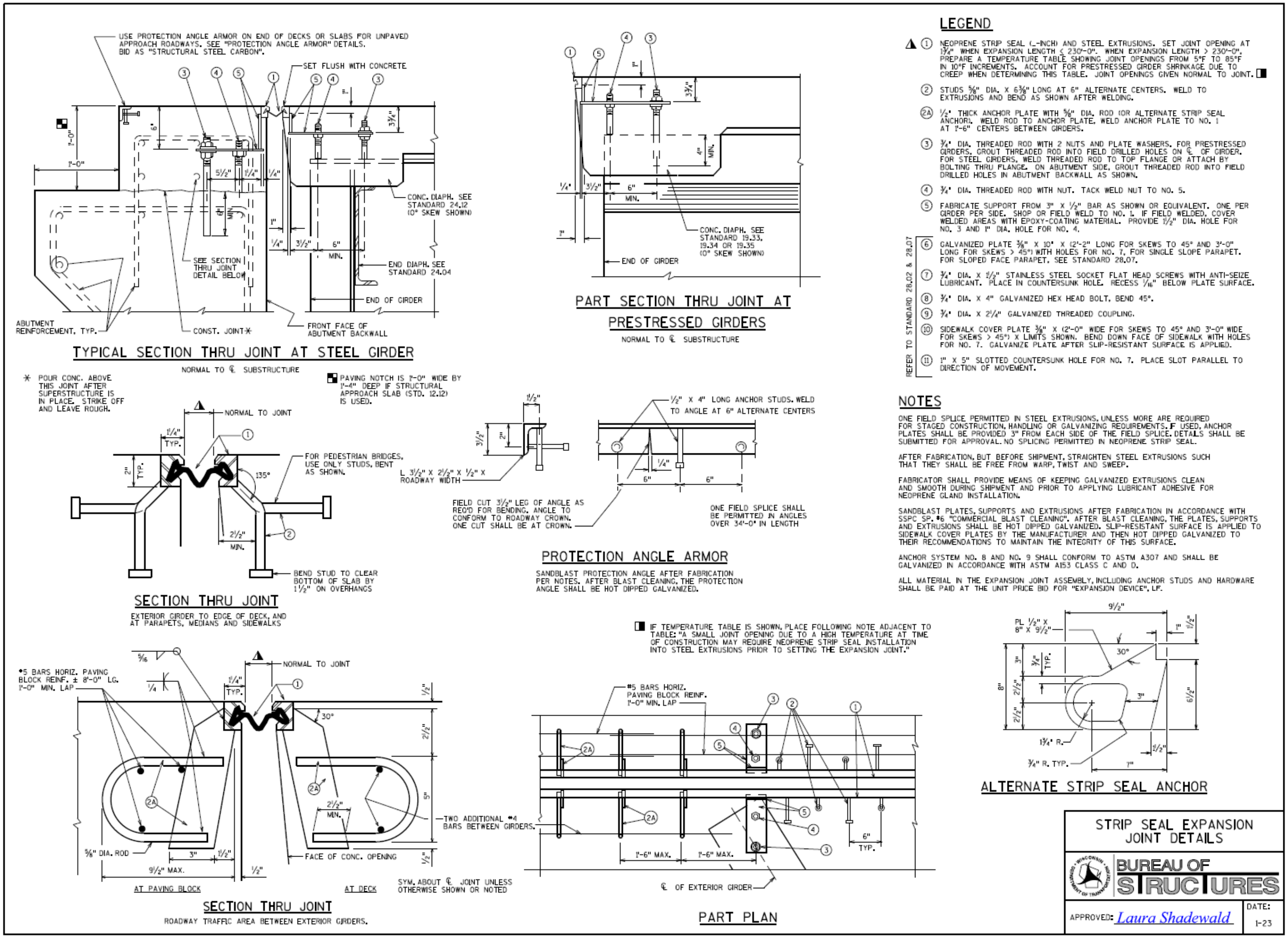
Washington State Department of Transportation

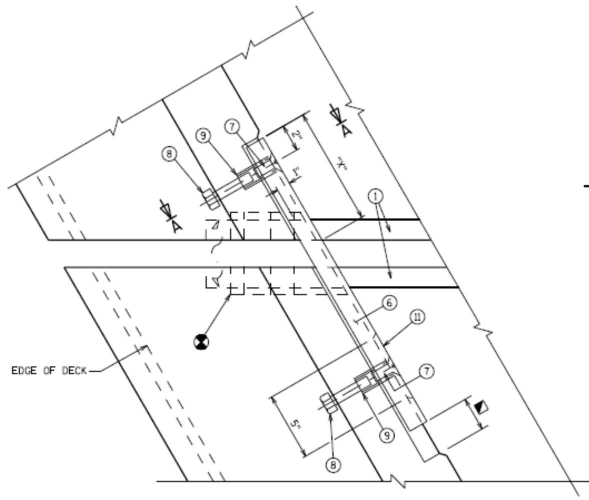
EXPANSION JOINTS

SILICONE SEAL EXPANSION JOINT DETAILS

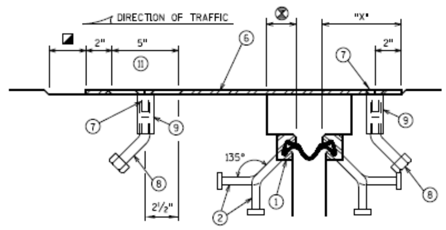
BRIDGE SHEET NO. / SHEET / OF / SHEETS

A.2. WISCONSIN DOT

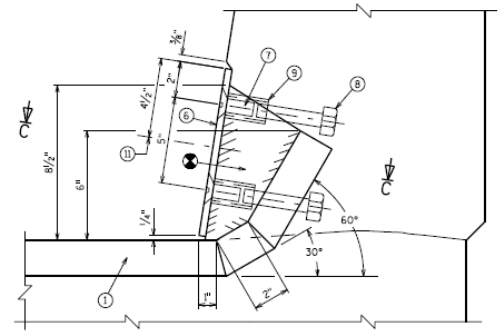




PLAN AT PARAPET
SINGLE SLOPE PARAPET

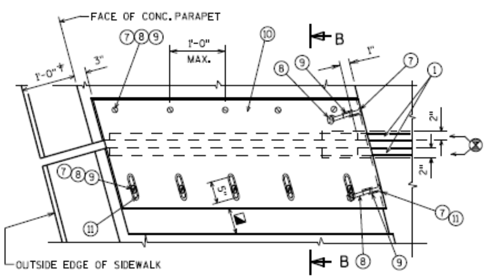


SECTION C-C



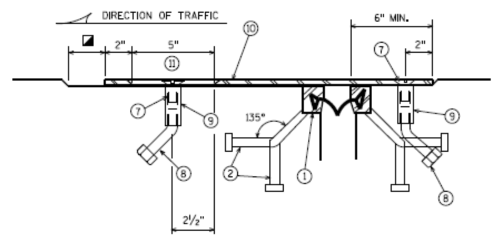
SECTION A-A
SINGLE SLOPE PARAPET

"X" - VALUES IN INCHES						USE "X" = 6½" FOR 0° SKEW							
SKEW	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°
RHF	6½	6½	6½	6½	6½	6½	6½	6½	6½	7	7	7½	8
LHF	7	7½	8	8½	9	9½	10½	11	11½	13	13½	14½	15½

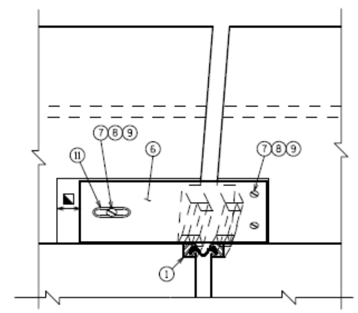


PLAN AT SIDEWALK

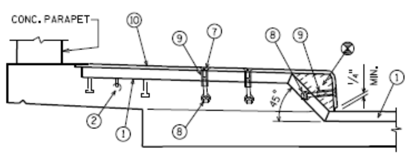
⚵ 1'-2" WHEN "VERTICAL FACE PARAPET TYPE 'TX' IS USED



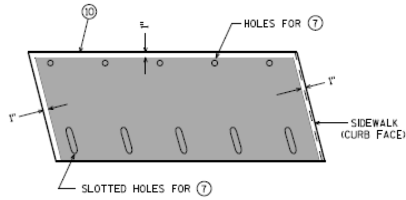
SECTION B-B



VIEW OF PARAPET PLATES
FROM ROADWAY
SINGLE SLOPE PARAPET



SECTION AT SIDEWALK



PLAN OF SIDEWALK COVER PLATE
WITH SLIP-RESISTANT SURFACE

PLACE SLIP-RESISTANT SURFACE ON TOP WALKING SURFACE IN SHADED AREA ONLY (NOT ON CURB FACE).

DESIGNER NOTES

FOR NEW BRIDGES, JOINT TO BE DETAILED STRAIGHT.

FOR JOINT REPLACEMENT PROJECTS, JOINT SHALL BE DETAILED TO MATCH ORIGINAL CONFIGURATION (STRAIGHT OR KINKED) IN ORDER TO REDUCE SUBSTRUCTURE MODIFICATIONS REQUIRED.

PLAN DETAILS SHALL REMOVE ENOUGH PARAPET LATERALLY, AND FULL HEIGHT, TO ENSURE DURABILITY OF THE JOINT REPLACEMENT.

⊗ BLOCK OUT CONCRETE 2" EACH SIDE OF JOINT OPENING

◪ JOINT OPENING DIM. ALONG SKEW PLUS ½"

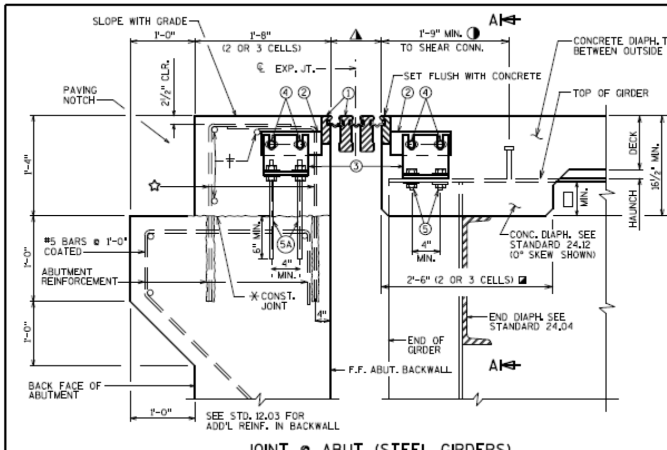
APPROVED SLIP-RESISTANT APPLIED SURFACES FOR STEEL PLATES		
PRODUCT	MANUFACTURER	CONTACT AT
SLIPNOT GRADE 2, STEEL	W. S. MOLNAR COMPANY	1-800-SLIPNOT
ALGRIP, STEEL	ROSS TECHNOLOGY CORP.	1-800-345-8170

STRIP SEAL COVER PLATES
SINGLE SLOPE PARA./SDWK.

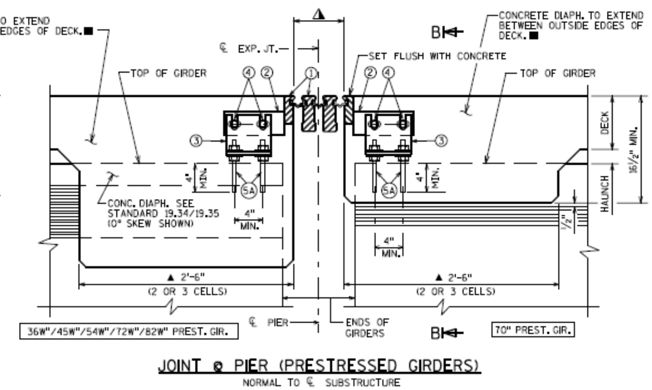
BUREAU OF STRUCTURES

APPROVED: Laura Shadewald

DATE: 7-19



JOINT @ ABUT. (STEEL GIRDERS)
NORMAL TO ℄ SUBSTRUCTURE



JOINT @ PIER (PRESTRESSED GIRDERS)
NORMAL TO ℄ SUBSTRUCTURE

LEGEND

① MODULAR EXPANSION JOINT DEVICE. ▭ CELLS.

② ½" PLATE, ONE PER GIRDER MIN. PROVIDE 2 - 1" X 2" MIN. SLOTTED HOLES PLACED HORIZONTALLY FOR NO. 4.

③ WT 6 X 29 (OR EQUIVALENT BUILT UP T-SECTION), ONE PER GIRDER. PROVIDE 2- 1" X 3" MIN. SLOTTED HOLES PLACED VERTICALLY IN WEB OF WT FOR BOLTS NO. 4.

④ ¾" DIA. HIGH STRENGTH BOLTS WITH NUTS & WASHERS. (A325 GALV.)

⑤ ¾" DIA. HIGH STRENGTH BOLTS WITH NUTS & WASHERS. FIELD DRILL HOLES IN GIRDER TOP FLANGE. (A325 GALV.)

(5A) ¾" DIA. THREADED ROD WITH 2 NUTS & WASHERS. GROUT THREADED ROD INTO FIELD DRILLED HOLES (GALV.).

⑥ SUPPORT BOX ASSEMBLY FOR SUPPORT BAR (SPA. PER MANUFACTURER). FABRICATE BOX FROM ½" PLATES.

⑦ ⅜" BULKHEAD PLATE. WELD TO NO. 1, NO. 8 AND NO. 14. WHEN CONDUIT IS PRESENT IN PARAPET OR SIDEWALK, ACCOMMODATE FOR BY PROVIDING OPENING IN NO. 7.

⑧ INSIDE PLATE. FABRICATE FROM ⅜" PLATE.

⑨ OUTSIDE PLATE. FABRICATE FROM ⅝" PLATE.

⑩ ⅞" SQUARE BAR. WELD TO NO. 8 AS SHOWN.

⑪ ¾" DIA. X 4" LONG STUDS. WELD TO NO. 7, 8, & 14 AS SHOWN.

⑫ ¾" DIA. X 2" STAINLESS STEEL FLAT CTSK. SLOTTED HEAD CAP SCREWS W/ ANTI-SEIZE LUBRICANT. RECESS 1/16" BELOW PL. SURFACE.

⑬ ½" PLATE WITH ⅝" DIA. LOOP ANCHOR FABRICATED AS SHOWN. SPACED AT MANUFACTURER'S SPEC.

⑭ INSIDE PLATE. FABRICATE FROM ⅝" PLATE

⑮ ADIPRENE BUTTON. SEE DETAIL. SET IN OUTSIDE PLATE.

■ AT LOCATION WHERE EXT. GIR. IS ADJACENT TO A RAISED SIDEWALK (STD.30.07), CONC. DIAPH. DOES NOT EXTEND OUT TO EDGE OF DECK, BUT IS TERMINATED AT INSIDE FACE OF EXT. GIR.

† #5 COATED BARS, ± 8'-0" LONG, 1'-0" MIN. LAP. CUT IN FIELD TO CLEAR JOINT SUPPORT SYSTEM AS REQ'D.

✳ POUR CONC. ABOVE THIS JOINT AFTER SUPERSTRUCTURE CONC. IS IN PLACE. STRIKE OFF & LEAVE ROUGH.

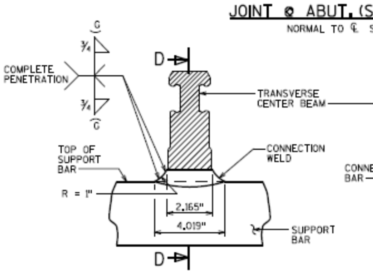
◑ DIMENSION IS PARALLEL TO ℄ GIRDER.

△ MANUFACTURER'S RECOMMENDED JOINT OPENING BASED ON THE TEMPERATURE ON THE DAY OF PLACEMENT PER TEMPERATURE TABLE. THE MODULAR EXPANSION DEVICE SHALL HAVE THE NUMBER OF CELLS AS INDICATED IN ①.

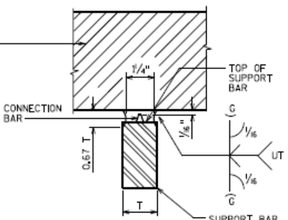
☆ (2) COATED L-SHAPED ADHESIVE ANCHORS NO. 5 BAR, EMBED 12" IN CONCRETE. SPACE AT 1'-0". PLACE ADHESIVE ANCHORS AFTER MODULAR JOINT IS IN POSITION.

◪ TOP FLANGE WIDTH WITHIN LIMITS OF CONC. DIAPH. SHALL BE ≤ 20" FOR SKEWS ≤ 30°

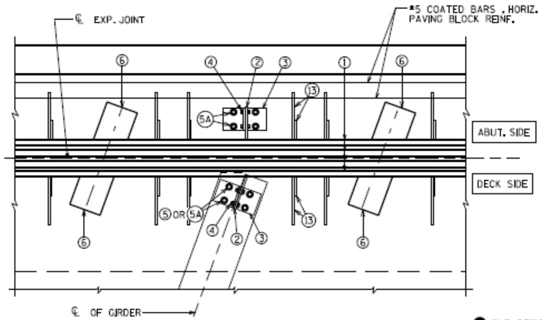
▲ FOR PRESTRESSED GIRDERS, PLACE THE FOLLOWING NOTE ON PLANS: "JOINT MANUFACTURER SHALL INFORM AND PROVIDE NECESSARY DETAILS TO THE PRESTRESSED GIRDER FABRICATOR, WHEN FORM-OUT OF THE TOP FLANGE IS REQ'D. TO ALLOW PLACEMENT OF SUPPORT BOX ASSEMBLY."



MODULAR EXPANSION JOINT CONNECTION DETAIL AND WELD SPECIFICATION



SECTION D-D



PART PLAN

NOTE:
MODULAR EXPANSION DEVICE DESIGN AND DETAILS ARE SPECIFIC TO THE MANUFACTURER SELECTED FROM THOSE LISTED IN THE SPECIAL PROVISIONS.

▲ SUPPORT BOXES ARE SHOWN FOR GENERAL INFORMATION AND LOCATION MAY VARY ACCORDING TO FABRICATOR DESIGN. SPACE SUPPORT BOXES TO MISS GIRDER TOP FLANGES WHEN POSSIBLE, BUT NOT TO EXCEED MAXIMUM SPACING PER SPECIAL PROVISIONS.

◓ SLIP-RESISTANT SURFACE IS APPLIED TO SIDEWALK COVER PLATES BY THE MANUFACTURER AND THEN HOT DIPPED GALVANIZED TO THEIR RECOMMENDATIONS TO MAINTAIN THE INTEGRITY OF THIS SURFACE.

NOTES

ONE FIELD SPLICE PERMITTED IN STEEL EXTRUSIONS. DETAILS SHALL BE SUBMITTED FOR APPROVAL. NO SPLICING PERMITTED IN NEOPRENE GLAND.

AFTER FABRICATION, BUT BEFORE SHIPMENT, STRAIGHTEN STEEL EXTRUSIONS SUCH THAT THEY SHALL BE FREE FROM WARP, TWIST & SWEEP.

NO EXPANSION JOINT PROTRUSIONS PERMITTED ABOVE ROADWAY SURFACE, ON PARAPET ROADWAY FACE OR ABOVE SIDEWALK SURFACE (FOR RAISED SIDEWALK).

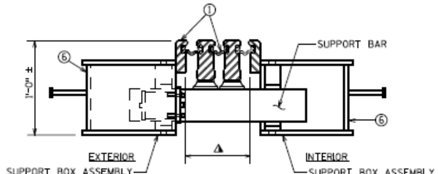
THE EXPANSION JOINT SEALS SHALL BE PLACED, BONDED & SEALED AS RECOMMENDED BY THE MANUFACTURER. FORM WORK SHALL BE PLACED BETWEEN THE SUPPORT BOXES TO PREVENT CONCRETE INTRUSION INTO THE SUPPORT BOX. A TECHNICAL REPRESENTATIVE OF THE MANUFACTURER SHALL BE PRESENT DURING INSTALLATION. PRIOR TO SETTING THE JOINT ASSEMBLY INTO POSITION, THE PROJECT ENGINEER SHALL DETERMINE THE PROPER JOINT OPENING.

EXPANSION JOINT EXTRUSIONS SHALL BE FABRICATED TO CONFORM TO ROADWAY CROWN & GRADE. FABRICATOR SHALL PROVIDE MEANS OF KEEPING GALVANIZED EXTRUSIONS CLEAN & SMOOTH DURING SHIPMENT AND PRIOR TO APPLYING LUBRICANT ADHESIVE FOR NEOPRENE GLAND INSTALLATION.

SANDBLAST BARS, PLATES, WT-SECTION, ANCHORAGE LOOP, & EXTRUSIONS AFTER FABRICATION IN ACCORDANCE WITH SSPC SP. #6 "COMMERCIAL BLAST CLEANING". AFTER BLAST CLEANING, THIS ASSEMBLY SHALL BE HOT DIPPED GALVANIZED. ◓

ALL MATERIAL IN THE EXPANSION JOINT ASSEMBLY, INCLUDING ANCHOR STUDS, PARAPET PLATES, SIDEWALK PLATES, AND HARDWARE SHALL BE PAID AT THE UNIT PRICE BID FOR STSP "EXPANSION DEVICE MODULAR", LF.

BAR STEEL REINF. IN DECK AND CONC. DIAPHRAGM SHALL BE RESPACED AS NECESSARY TO ALLOW PLACEMENT OF JOINT ASSEMBLY. TOP TRANSVERSE BARS, ADJACENT TO MOD. JT., TO BE CUT AND PLACED BETWEEN JT. SUPPORT SYSTEM.



JOINT DETAIL
AT SUPPORT BAR & SUPPORT BOX ASSEMBLY

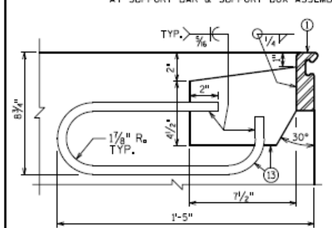
TEMP. TABLE

TEMPERATURE TABLE FOR SETTING JOINT OPENINGS TO BE DETERMINED BY JOINT MANUFACTURER WITH THE FOLLOWING DESIGN DATA:

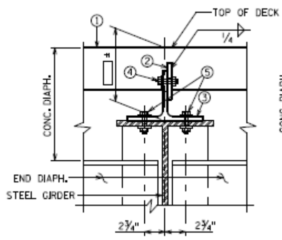
1. ▭ IN. OF MOVEMENT PER 10° F
2. MEDIAN TEMPERATURE OF 45° F
3. TEMP. RANGE IN TABLE FROM (5°F) TO (85°F) FOR PRESTRESSED CONCRETE GIRDERS AND FROM (-5°F) TO (+95°F) FOR STEEL GIRDERS.
4. ADJUST INITIAL JOINT OPENINGS BY A REDUCTION OF ▭ IN., WHICH ACCOUNTS FOR SHRINKAGE (CREEP) OF THE SUPERSTRUCTURE OVER TIME, TO PRODUCE FINAL JOINT OPENINGS FOR TABLE.

A TABLE OF JOINT OPENINGS BASED ON ABOVE DATA SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.

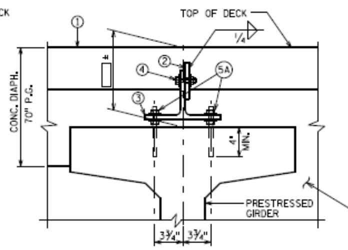
INCLUDE ITEM 4. FOR PRESTRESSED GIRDER STRUCTURES ONLY. SEE CHAPT. 28 IN BRIDGE DESIGN MANUAL FOR ADJUSTMENT FACTOR.



ANCHORAGE DETAIL
PLACE ADJACENT TO SUPPORT BOXES IN PAVING BLOCK @ ABUT. & IN DECK @ CONC. DIAPH.



SECTION A-A



SECTION B-B

STANDARD COVERS:
- SKEWS ≤ 30°
- 2 OR 3 CELL MODULAR EXPANSION JOINTS
- STEEL GIRDER BRIDGES
- PRESTRESSED GIRDER BRIDGES (70", 36W", 45W", 54W", 72W" AND 82W" SECTION)

MODULAR EXPANSION JOINT DETAILS

BUREAU OF STRUCTURES

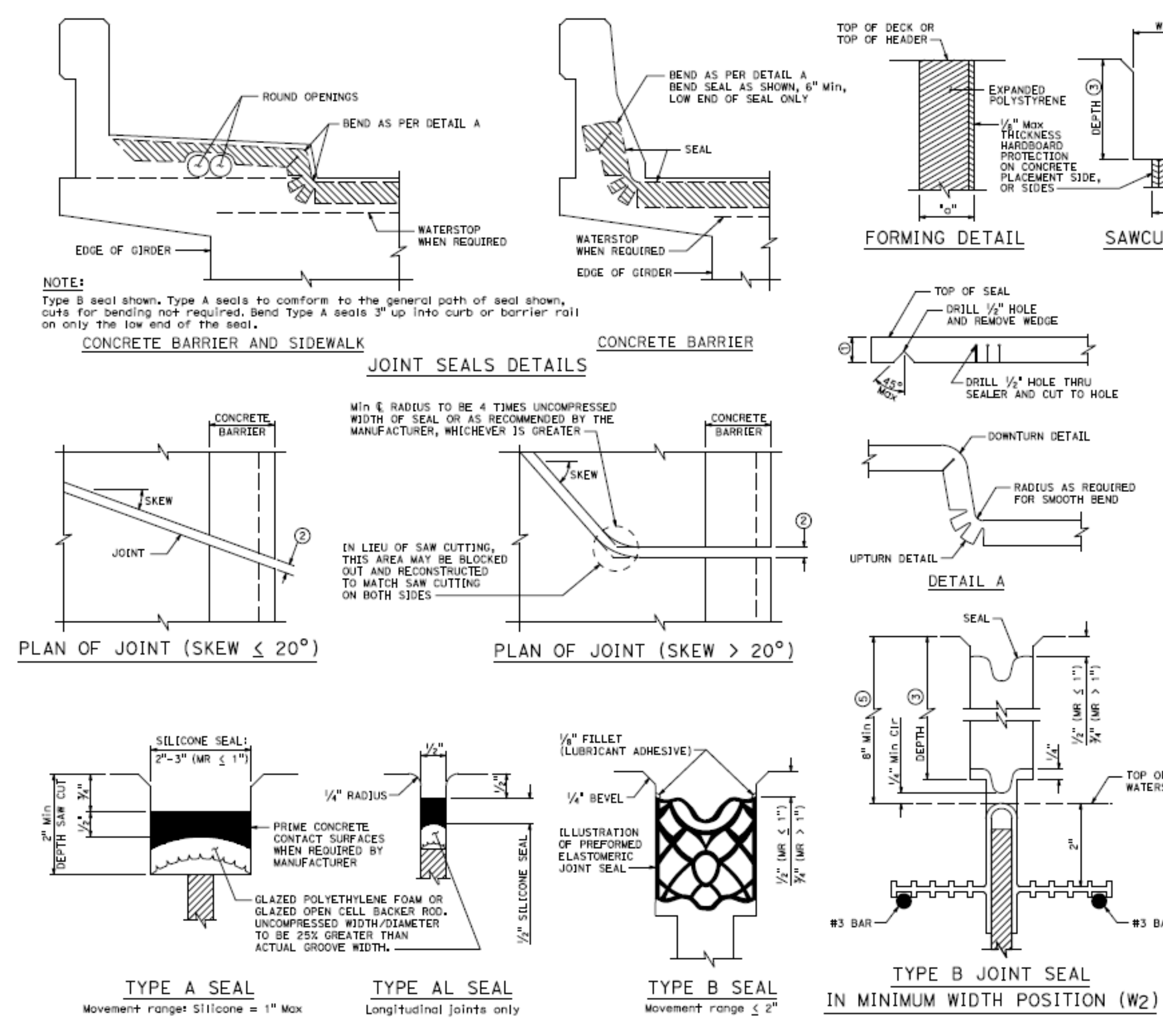
APPROVED: *Laura Shadewald*

DATE: 1-23

APPENDIX B. EXAMPLES OF STATE DOT JOINT COVER PLATE DETAILS

392

B.1. CALTRANS



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 1, 2023

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER — Don Nguyen-Tan — C57510 — Exp. 12-31-23 — CIVIL — STATE OF CALIFORNIA

NOTE:

Verify all controlling field dimensions before ordering or fabricatiing any material.

NOTES:

1. Make smooth cuts from the bottom of seal to 1½" clear of top leaving at least one complete cell between the top of the cut and top of the seal. When necessary cut back of seal to clear conduit and round openings.
2. Sawcut groove widths shall be as ordered by the Engineer.
3. Depth of sawcut:
   Type A - Depth to be 2" minimum.
   Type B - Depth to be equal to or greater than the depth of seal measured along the contact surface, when compressed to minimum width position (W_2) plus dimensions shown.
4. MR (movement range) as shown on other plan sheets.
5. Other depths must be approved by the Engineer.
6. Cover sidewalk joint with expansion joint armor. Expansion joint armor details shown on other plan sheets.

DIMENSIONS "a" OF JOINT REQUIRED

MOVEMENT RANGE (MR) ④	BRIDGE TYPE	"a" DIMENSION DECK CONCRETE PLACED WINTER	FALL-SPRING	SUMMER
2"	ALL EXCEPT CIP/PS	1½"	1¼"	¾"
	CIP/PS	1¼"	1"	½"
1½"	ALL EXCEPT CIP/PS	1¼"	1"	½"
	CIP/PS	1"	¾"	½"
1"	ALL EXCEPT CIP/PS	1"	¾"	½"
	CIP/PS	¾"	½"	½"
½"	ALL EXCEPT CIP/PS	¾"	¾"	½"
	CIP/PS	½"	½"	½"

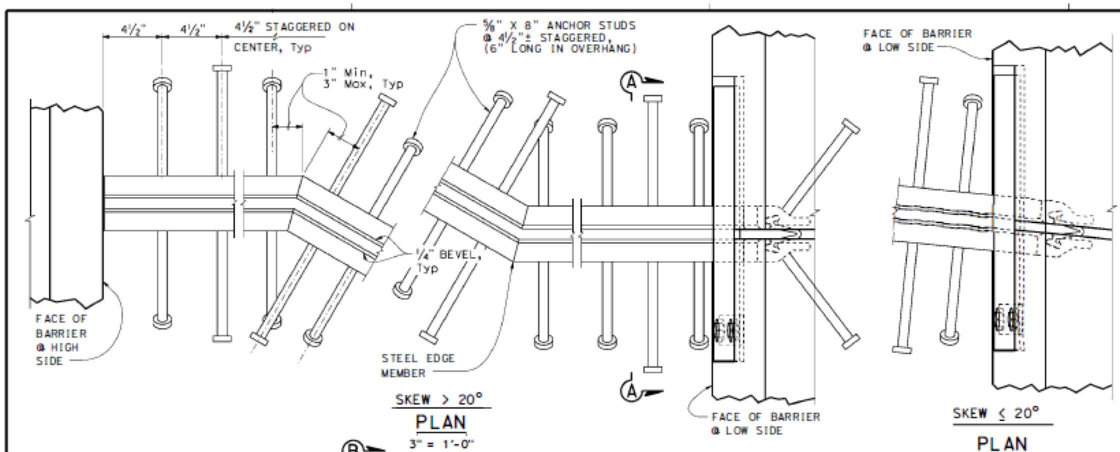
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

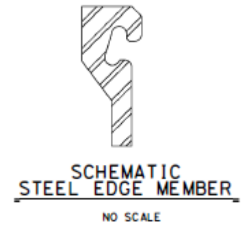
JOINT SEALS (MAXIMUM MOVEMENT RANGE = 2")

NO SCALE

B6-21

2023 STANDARD PLAN B6-21





DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE

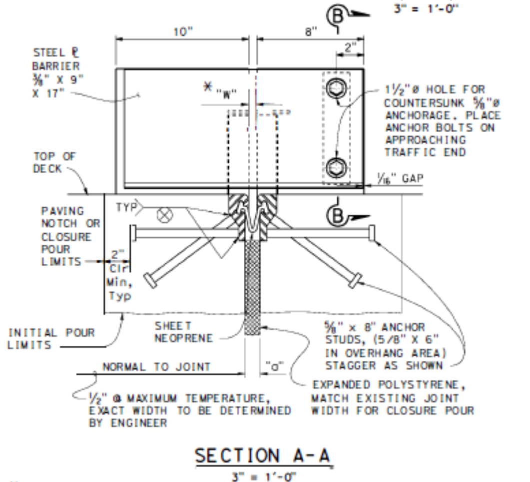
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

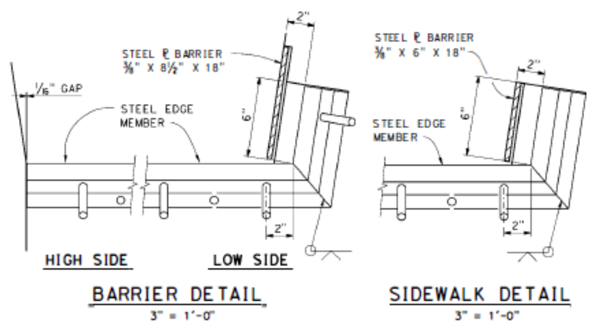
The Registered Civil Engineer for the project is responsible for the selection and proper application of the component design and any modifications shown.

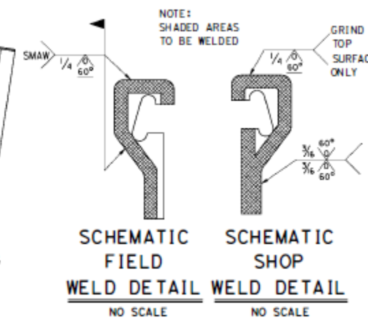
NOTES:

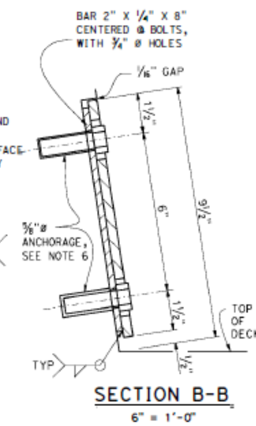
1. Alternatively, fillet or complete penetration welds may be used at anchor studs.
2. Alternate types of anchor studs may be permitted subject to the authorization by the Engineer.
3. Joint seal assembly to be used in conjunction with closure pour. (See other sheets for limits). Closure pour shall not be placed until final deck surface is within the tolerances specified.
4. Use joint at crown of roadway, at any change in transverse slope in deck and at changes in horizontal direction. Place other joints at or near lanes. All metal parts to be painted or galvanized after fabrication.
5. Sheet Neoprene shall be fabricated in one continuous piece and shall be fabricated to bend around corners. Field splices of the neoprene are not allowed.
6. Insert assembly or expansion anchorage for ⅝" x 1¾" bolts. Use installation bolts extended ½" minimum past nut and coat with bond breaker, after concrete has cured, remove installation bolts, install HS bolts and sheet neoprene.
7. Use sidewalk detail at all sidewalk joints. Use barrier detail low side at both sides if the roadway is crowned, or if the difference in elevation between the ends of the seal is 6 inches or less.
8. a_c, a_s, are the thermal expansion coefficients for concrete and steel respectively.
9. Anchor studs shall conform to ASTM A108.



JOINT INFORMATION			"a" DIMENSIONS		
LOCATION	MOVEMENT RANGE (MR)	SKEW	WINTER	SPRING & FALL	SUMMER







* TO SET MINIMUM JOINT OPENING "W"

"W" = ½"+[(Max Str temperature in °F)-(actual Str temperature in °F)]*(a_c or a_s)(12)(contributory L in feet)

½" Minimum

a_c = 0.0000060

a_s = 0.0000065

BRIDGE STANDARD DETAILS

xs8-010 FILE NO. | January 2021 APPROVAL DATE

The components of the Bridge Standard Details have been prepared under the responsible charge of the Technical Owner, a registered civil engineer in the State of California

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

BRIDGE NO. | POST MILE

STRIP JOINT SEAL ASSEMBLY

MAXIMUM MOVEMENT RANGE = 4"

UNIT:

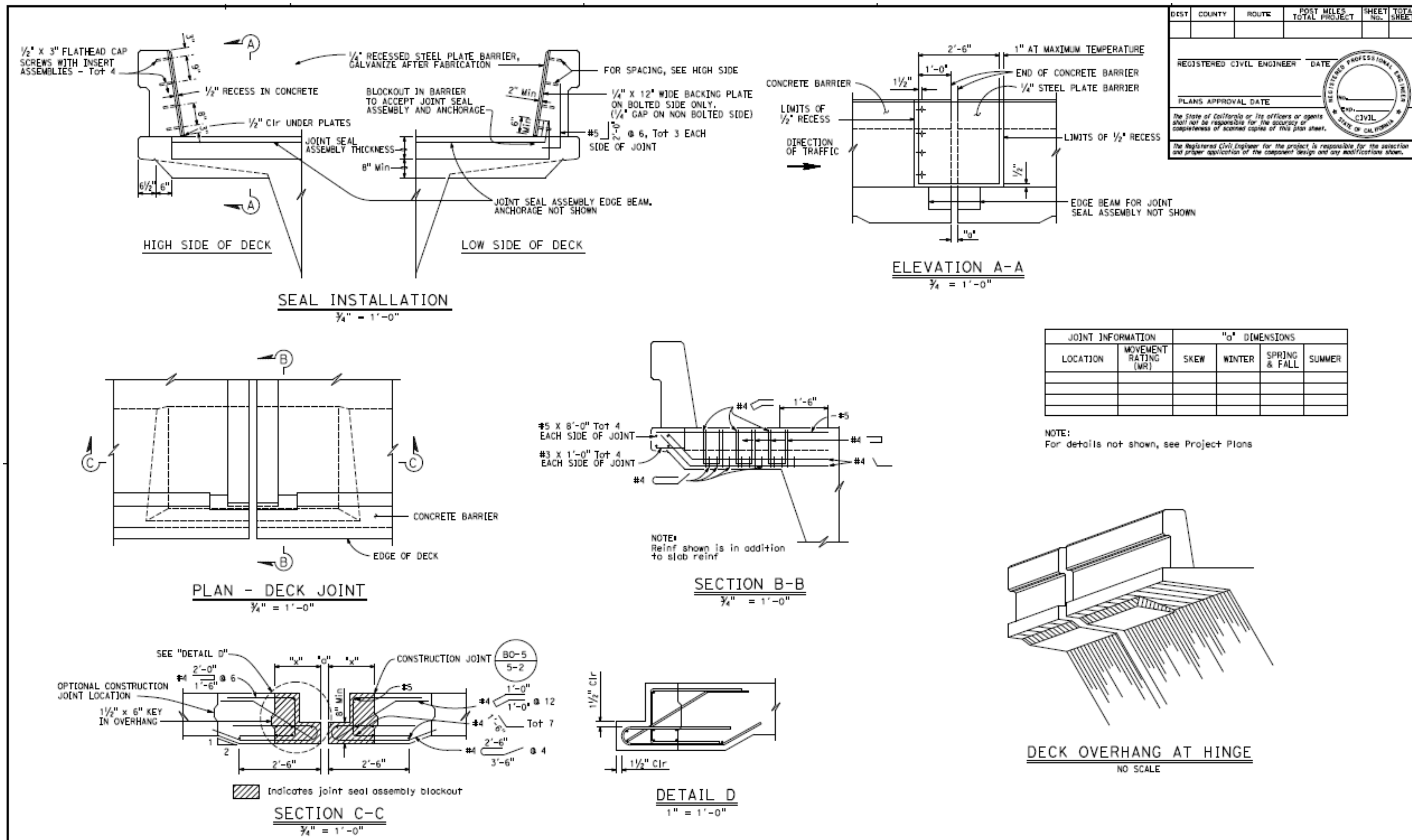
PROJECT NUMBER & PHASE: CONTRACT NO.:

DISREGARD PRINTS BEARING EARLIER REVISION DATES

TR No. 619651-01

32

2024-01-12



JOINT INFORMATION		"o" DIMENSIONS			
LOCATION	MOVEMENT RATING (MR)	SKEW	WINTER	SPRING & FALL	SUMMER

NOTE:
For details not shown, see Project Plans

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

The Registered Civil Engineer for the project is responsible for the selection and proper application of the component design and any modifications shown.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

BRIDGE STANDARD DETAILS

xs8-020 | FILE NO. | January 2021 | APPROVAL DATE

The components of the Bridge Standard Details have been prepared under the responsible charge of the technical owner, a registered civil engineer in the State of California

Refer to: http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/bridge-standard-detail-sheets/index.html

FILE => $REQUEST USERNAME => $USER TIME PLOTTED => $TIME DATE PLOTTED => $DATE

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

BRIDGE NO. | POST MILE

JOINT SEAL - HINGE DETAILS
MOVEMENT RANGE GREATER THAN 4"

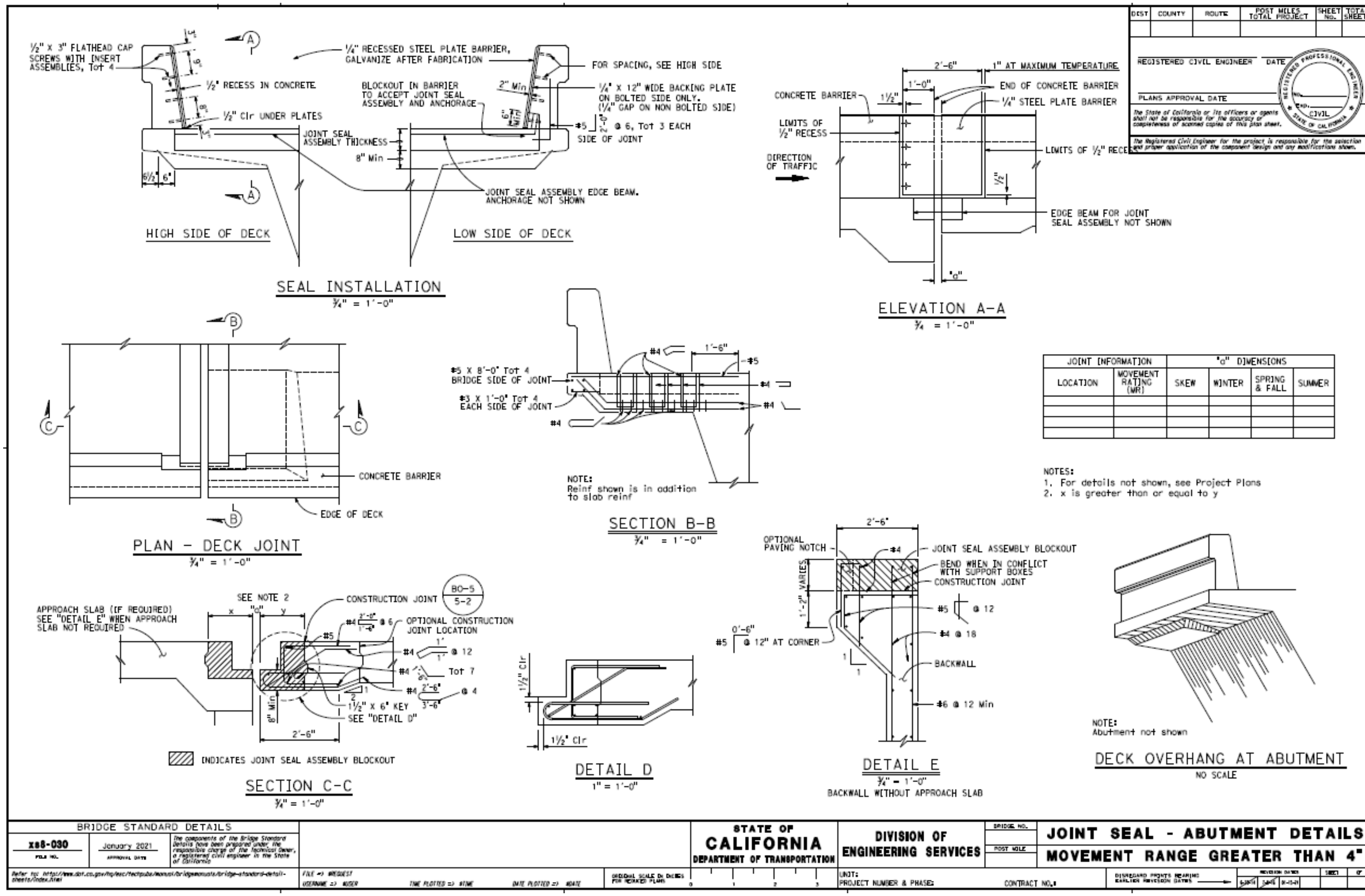
UNIT:
PROJECT NUMBER & PHASE:
CONTRACT NO.:

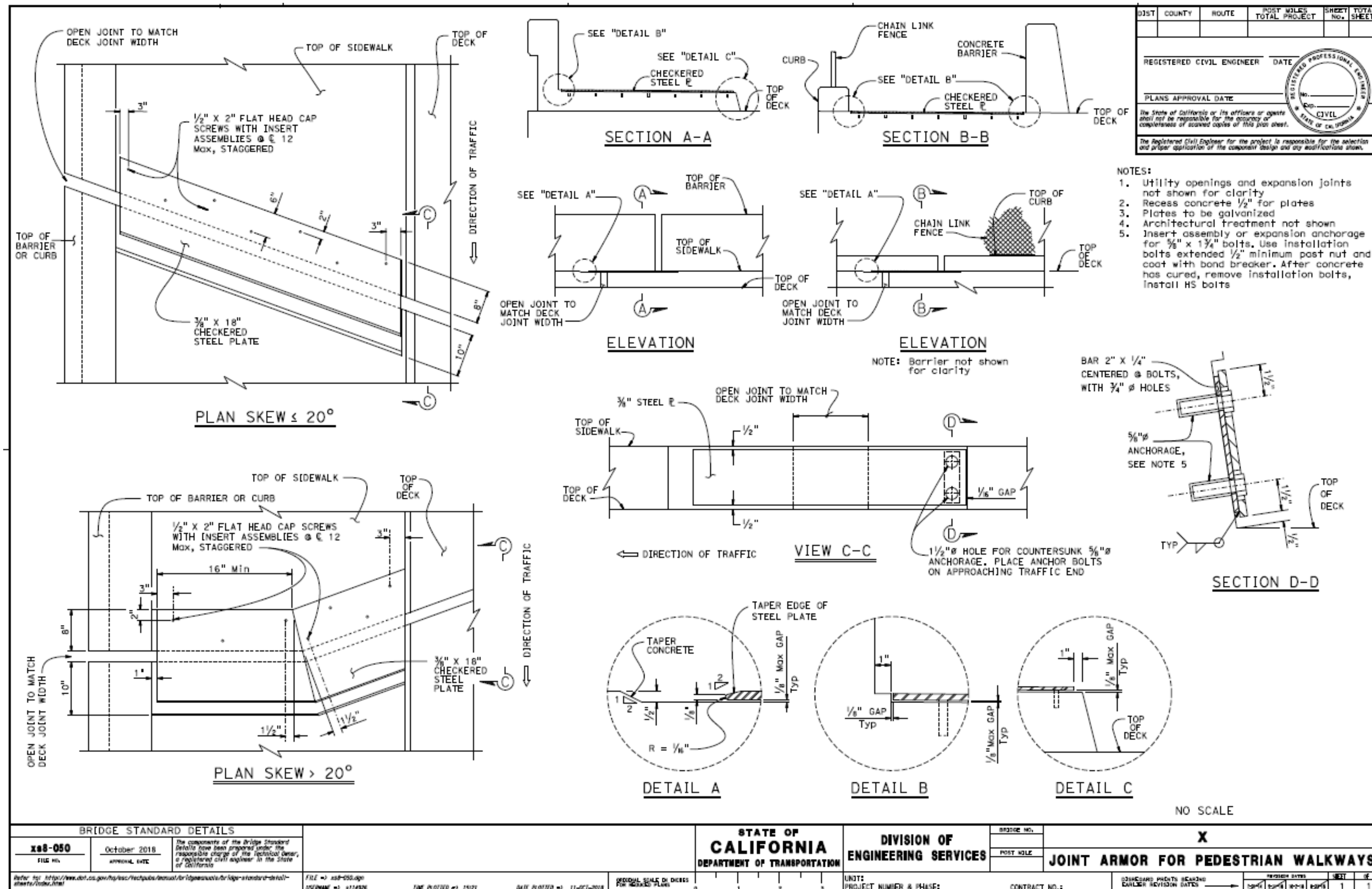
DISREGARD PRINTS BEARING EARLIER REVISION DATES | REVISION DATES | SHEET | OF

TR No. 619651-01

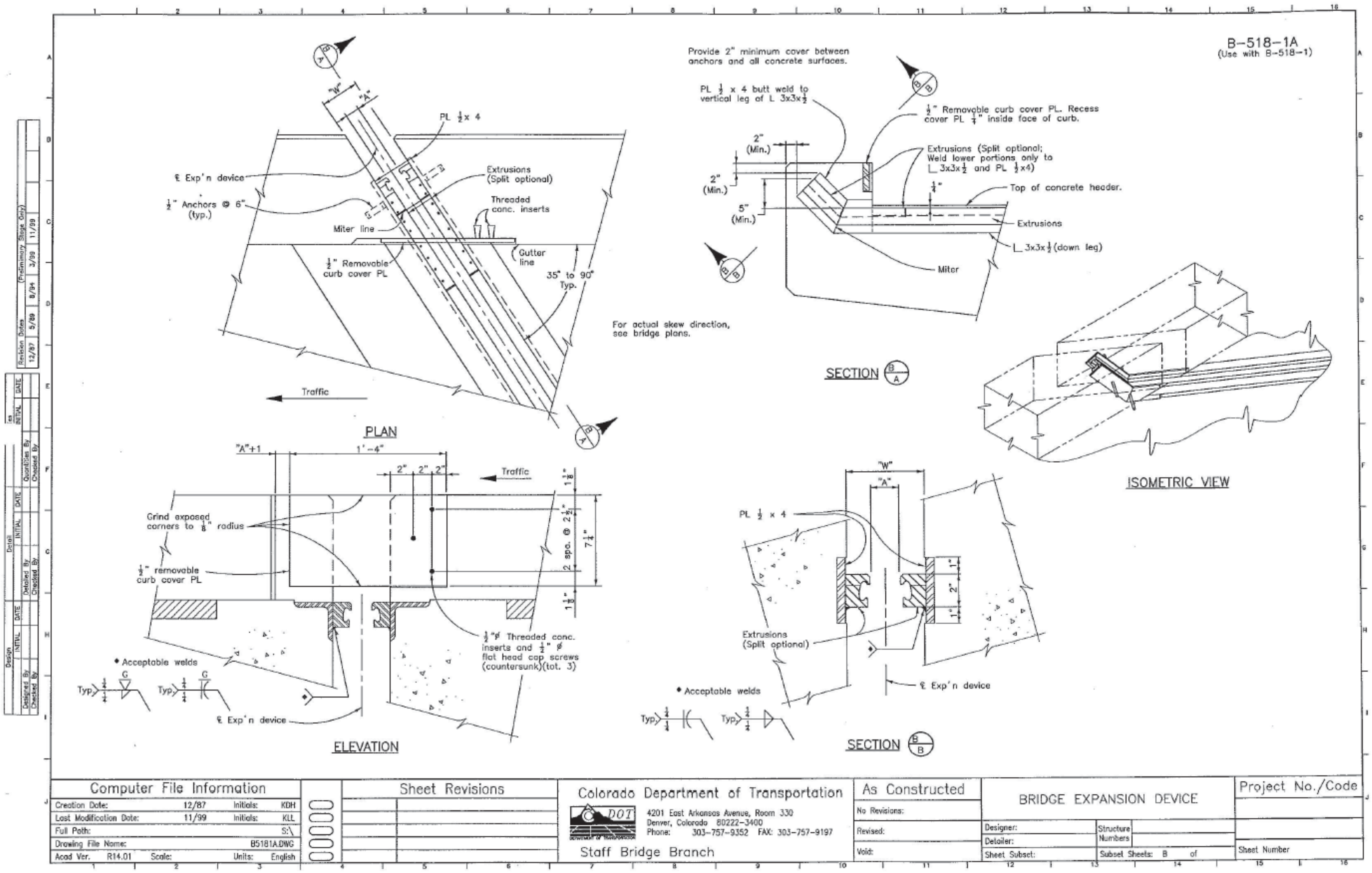
33

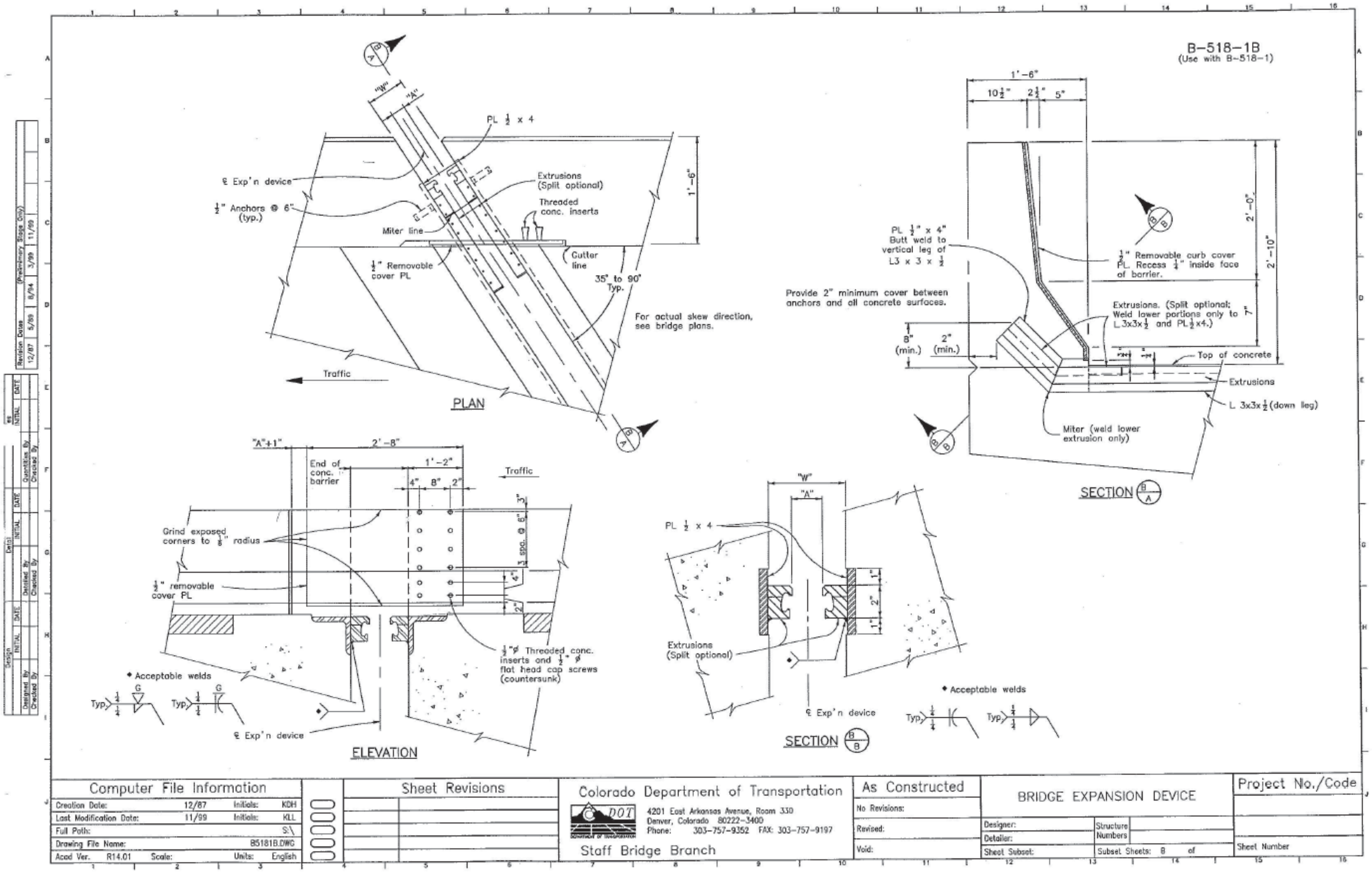
2024-01-12




OPEN JOINT TO MATCH DECK JOINT WIDTH
TOP OF SIDEWALK
TOP OF DECK
½" X 2" FLAT HEAD CAP SCREWS WITH INSERT ASSEMBLIES @ ℄ 12 Max, STAGGERED
TOP OF BARRIER OR CURB
⅜" X 18" CHECKERED STEEL PLATE
DIRECTION OF TRAFFIC
PLAN SKEW ≤ 20°
SEE "DETAIL B"
SEE "DETAIL C"
CHECKERED STEEL ℙ
SECTION A-A
CHAIN LINK FENCE
CONCRETE BARRIER
CURB
SECTION B-B
SEE "DETAIL A"
TOP OF BARRIER
TOP OF SIDEWALK
ELEVATION
TOP OF CURB
ELEVATION
NOTE: Barrier not shown for clarity
TOP OF BARRIER OR CURB
16" Min
PLAN SKEW > 20°
⅜" STEEL ℙ
⅛" GAP
1½"ø HOLE FOR COUNTERSUNK ⅝"ø ANCHORAGE. PLACE ANCHOR BOLTS ON APPROACHING TRAFFIC END
VIEW C-C
BAR 2" X ¼" CENTERED @ BOLTS, WITH ¾" ø HOLES
⅝"ø ANCHORAGE, SEE NOTE 5
SECTION D-D
NOTES:
1. Utility openings and expansion joints not shown for clarity
2. Recess concrete ½" for plates
3. Plates to be galvanized
4. Architectural treatment not shown
5. Insert assembly or expansion anchorage for ⅝" x 1¾" bolts. Use installation bolts extended ½" minimum past nut and coat with bond breaker. After concrete has cured, remove installation bolts, install HS bolts
TAPER CONCRETE
TAPER EDGE OF STEEL PLATE
⅛" Max GAP Typ
R = 1/16"
DETAIL A
DETAIL B
DETAIL C
NO SCALE
BRIDGE STANDARD DETAILS
xs8-050
October 2018
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
JOINT ARMOR FOR PEDESTRIAN WALKWAYS

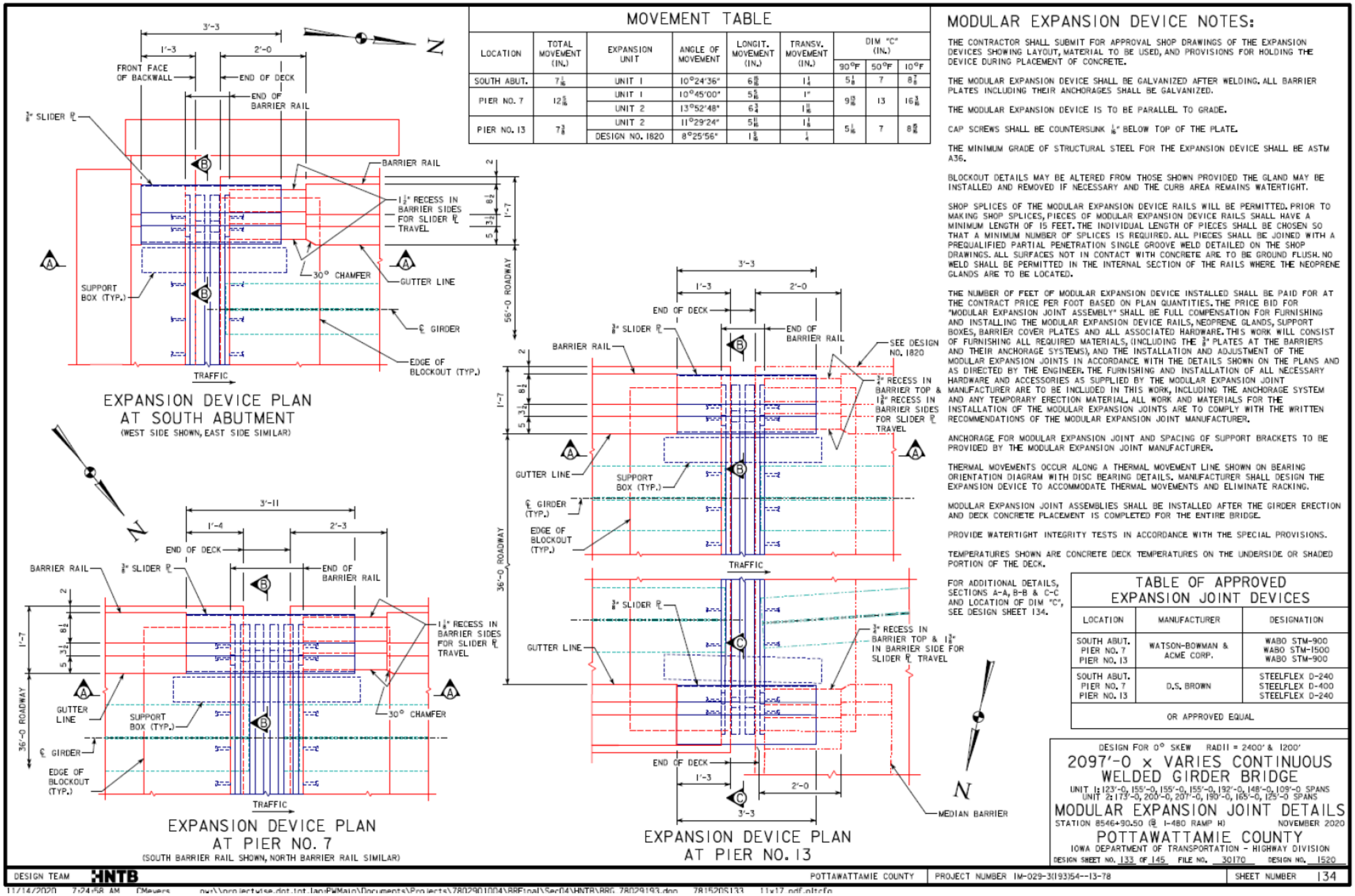
B.2. COLORADO DOT

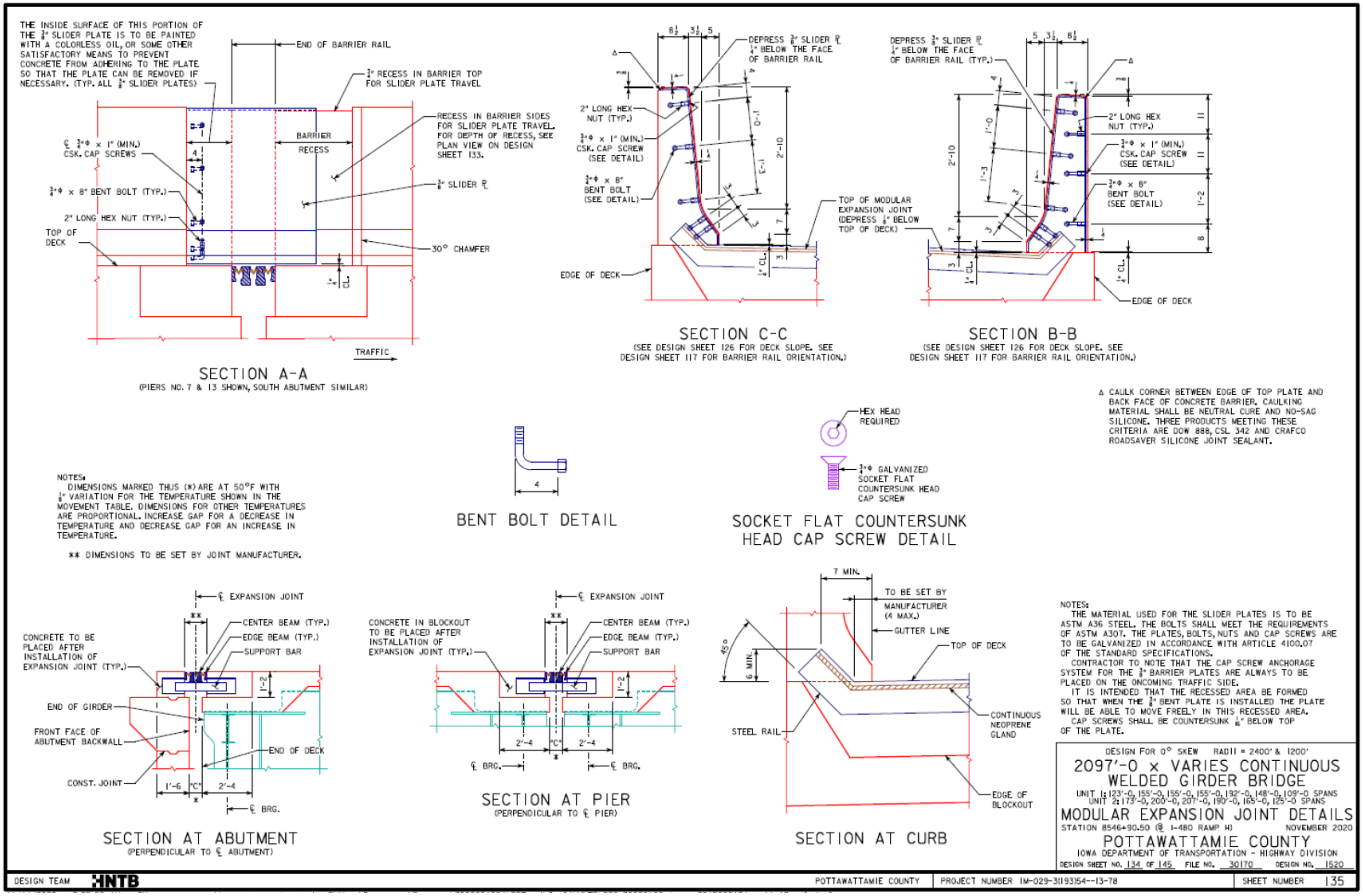




B-518-1B
(Use with B-518-1)
PL ½ x 4
℄ Exp'n device
½" Anchors @ 6" (typ.)
Extrusions (Split optional)
Threaded conc. inserts
Miter line
½" Removable cover PL
Gutter line
35° to 90° Typ.
For actual skew direction, see bridge plans.
1'-6"
Traffic
PLAN
"A"+1"
2'-8"
1'-2"
4" 8" 2"
End of conc. barrier
Grind exposed corners to ⅛" radius
½" removable cover PL
3 spa. @ 6"
½"ø Threaded conc. inserts and ½" ø flat head cap screws (countersunk)
Acceptable welds
℄ Exp'n device
ELEVATION
1'-6"
10½" 2½" 5"
PL ½" x 4" Butt weld to vertical leg of L3 x 3 x ½
½" Removable curb cover PL. Recess ¼" inside face of barrier.
Provide 2" minimum cover between anchors and all concrete surfaces.
Extrusions. (Split optional; Weld lower portions only to L3x3x½ and PL½x4.)
8" (min.) 2" (min.)
Top of concrete
Extrusions
L 3x3x½ (down leg)
Miter (weld lower extrusion only)
2'-0"
2'-10"
7"
SECTION A-A
"W"
"A"
PL ½ x 4
Extrusions (Split optional)
℄ Exp'n device
Acceptable welds
SECTION B-B
Computer File Information
Creation Date: 12/87 Initials: KDH
Last Modification Date: 11/99 Initials: KLL
Full Path: S:\
Drawing File Name: B5181B.DWG
Acad Ver. R14.01 Scale: Units: English
Sheet Revisions
Colorado Department of Transportation
4201 East Arkansas Avenue, Room 330
Denver, Colorado 80222-3400
Phone: 303-757-9352 FAX: 303-757-9197
Staff Bridge Branch
As Constructed
No Revisions:
Revised:
Void:
BRIDGE EXPANSION DEVICE
Designer:
Detailer:
Sheet Subset:
Structure Numbers
Subset Sheets: 8 of
Project No./Code
Sheet Number
Revision Dates: 12/87 5/89 8/94 3/99 11/99

B.3. IOWA DOT


MOVEMENT TABLE
LOCATION | TOTAL MOVEMENT (IN.) | EXPANSION UNIT | ANGLE OF MOVEMENT | LONGIT. MOVEMENT (IN.) | TRANSV. MOVEMENT (IN.) | DIM "C" (IN.) 90°F | 50°F | 10°F
SOUTH ABUT. | 7 1/16 | UNIT 1 | 10°24'36" | 6 15/16 | 1 1/4 | 5 1/8 | 7 | 8 7/8
PIER NO. 7 | 12 5/16 | UNIT 1 | 10°45'00" | 5 5/16 | 1" | 9 13/16 | 13 | 16 3/16
UNIT 2 | 13°52'48" | 6 3/4 | 1 11/16
PIER NO. 13 | 7 3/8 | UNIT 2 | 11°29'24" | 5 11/16 | 1 1/8 | 5 1/16 | 7 | 8 5/16
DESIGN NO. 1820 | 8°25'56" | 1 5/16 | 1/4
MODULAR EXPANSION DEVICE NOTES:
THE CONTRACTOR SHALL SUBMIT FOR APPROVAL SHOP DRAWINGS OF THE EXPANSION DEVICES SHOWING LAYOUT, MATERIAL TO BE USED, AND PROVISIONS FOR HOLDING THE DEVICE DURING PLACEMENT OF CONCRETE.
THE MODULAR EXPANSION DEVICE SHALL BE GALVANIZED AFTER WELDING. ALL BARRIER PLATES INCLUDING THEIR ANCHORAGES SHALL BE GALVANIZED.
THE MODULAR EXPANSION DEVICE IS TO BE PARALLEL TO GRADE.
CAP SCREWS SHALL BE COUNTERSUNK 1/16" BELOW TOP OF THE PLATE.
THE MINIMUM GRADE OF STRUCTURAL STEEL FOR THE EXPANSION DEVICE SHALL BE ASTM A36.
BLOCKOUT DETAILS MAY BE ALTERED FROM THOSE SHOWN PROVIDED THE GLAND MAY BE INSTALLED AND REMOVED IF NECESSARY AND THE CURB AREA REMAINS WATERTIGHT.
SHOP SPLICES OF THE MODULAR EXPANSION DEVICE RAILS WILL BE PERMITTED. PRIOR TO MAKING SHOP SPLICES, PIECES OF MODULAR EXPANSION DEVICE RAILS SHALL HAVE A MINIMUM LENGTH OF 15 FEET. THE INDIVIDUAL LENGTH OF PIECES SHALL BE CHOSEN SO THAT A MINIMUM NUMBER OF SPLICES IS REQUIRED. ALL PIECES SHALL BE JOINED WITH A PREQUALIFIED PARTIAL PENETRATION SINGLE GROOVE WELD DETAILED ON THE SHOP DRAWINGS. ALL SURFACES NOT IN CONTACT WITH CONCRETE ARE TO BE GROUND FLUSH. NO WELD SHALL BE PERMITTED IN THE INTERNAL SECTION OF THE RAILS WHERE THE NEOPRENE GLANDS ARE TO BE LOCATED.
THE NUMBER OF FEET OF MODULAR EXPANSION DEVICE INSTALLED SHALL BE PAID FOR AT THE CONTRACT PRICE PER FOOT BASED ON PLAN QUANTITIES. THE PRICE BID FOR "MODULAR EXPANSION JOINT ASSEMBLY" SHALL BE FULL COMPENSATION FOR FURNISHING AND INSTALLING THE MODULAR EXPANSION DEVICE RAILS, NEOPRENE GLANDS, SUPPORT BOXES, BARRIER COVER PLATES AND ALL ASSOCIATED HARDWARE. THIS WORK WILL CONSIST OF FURNISHING ALL REQUIRED MATERIALS, (INCLUDING THE 3/8" PLATES AT THE BARRIERS AND THEIR ANCHORAGE SYSTEMS), AND THE INSTALLATION AND ADJUSTMENT OF THE MODULAR EXPANSION JOINTS IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS AND AS DIRECTED BY THE ENGINEER. THE FURNISHING AND INSTALLATION OF ALL NECESSARY HARDWARE AND ACCESSORIES AS SUPPLIED BY THE MODULAR EXPANSION JOINT MANUFACTURER ARE TO BE INCLUDED IN THIS WORK, INCLUDING THE ANCHORAGE SYSTEM AND ANY TEMPORARY ERECTION MATERIAL. ALL WORK AND MATERIALS FOR THE INSTALLATION OF THE MODULAR EXPANSION JOINTS ARE TO COMPLY WITH THE WRITTEN RECOMMENDATIONS OF THE MODULAR EXPANSION JOINT MANUFACTURER.
ANCHORAGE FOR MODULAR EXPANSION JOINT AND SPACING OF SUPPORT BRACKETS TO BE PROVIDED BY THE MODULAR EXPANSION JOINT MANUFACTURER.
THERMAL MOVEMENTS OCCUR ALONG A THERMAL MOVEMENT LINE SHOWN ON BEARING ORIENTATION DIAGRAM WITH DISC BEARING DETAILS. MANUFACTURER SHALL DESIGN THE EXPANSION DEVICE TO ACCOMMODATE THERMAL MOVEMENTS AND ELIMINATE RACKING.
MODULAR EXPANSION JOINT ASSEMBLIES SHALL BE INSTALLED AFTER THE GIRDER ERECTION AND DECK CONCRETE PLACEMENT IS COMPLETED FOR THE ENTIRE BRIDGE.
PROVIDE WATERTIGHT INTEGRITY TESTS IN ACCORDANCE WITH THE SPECIAL PROVISIONS.
TEMPERATURES SHOWN ARE CONCRETE DECK TEMPERATURES ON THE UNDERSIDE OR SHADED PORTION OF THE DECK.
FOR ADDITIONAL DETAILS, SECTIONS A-A, B-B & C-C AND LOCATION OF DIM "C", SEE DESIGN SHEET 134.
TABLE OF APPROVED EXPANSION JOINT DEVICES
LOCATION | MANUFACTURER | DESIGNATION
SOUTH ABUT. PIER NO. 7 PIER NO. 13 | WATSON-BOWMAN & ACME CORP. | WABO STM-900 WABO STM-1500 WABO STM-900
SOUTH ABUT. PIER NO. 7 PIER NO. 13 | D.S. BROWN | STEELFLEX D-240 STEELFLEX D-400 STEELFLEX D-240
OR APPROVED EQUAL
EXPANSION DEVICE PLAN AT SOUTH ABUTMENT
(WEST SIDE SHOWN, EAST SIDE SIMILAR)
EXPANSION DEVICE PLAN AT PIER NO. 7
(SOUTH BARRIER RAIL SHOWN, NORTH BARRIER RAIL SIMILAR)
EXPANSION DEVICE PLAN AT PIER NO. 13
FRONT FACE OF BACKWALL
END OF DECK
END OF BARRIER RAIL
3/8" SLIDER ℄
BARRIER RAIL
1 1/2" RECESS IN BARRIER SIDES FOR SLIDER ℄ TRAVEL
30° CHAMFER
GUTTER LINE
SUPPORT BOX (TYP.)
℄ GIRDER
EDGE OF BLOCKOUT (TYP.)
TRAFFIC
56'-0 ROADWAY
36'-0 ROADWAY
SEE DESIGN NO. 1820
3/4" RECESS IN BARRIER TOP & 1 3/4" RECESS IN BARRIER SIDES FOR SLIDER ℄ TRAVEL
MEDIAN BARRIER
DESIGN FOR 0° SKEW RADII = 2400' & 1200'
2097'-0 x VARIES CONTINUOUS WELDED GIRDER BRIDGE
UNIT 1: 123'-0, 155'-0, 155'-0, 155'-0, 192'-0, 148'-0, 109'-0 SPANS
UNIT 2: 173'-0, 200'-0, 207'-0, 190'-0, 165'-0, 125'-0 SPANS
MODULAR EXPANSION JOINT DETAILS
STATION 8546+90.50 (℄ I-480 RAMP H) NOVEMBER 2020
POTTAWATTAMIE COUNTY
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION
DESIGN SHEET NO. 133 OF 145 FILE NO. 30170 DESIGN NO. 1520
DESIGN TEAM HNTB
POTTAWATTAMIE COUNTY
PROJECT NUMBER IM-029-3(193)54--13-78
SHEET NUMBER 134


THE INSIDE SURFACE OF THIS PORTION OF THE 3/4" SLIDER PLATE IS TO BE PAINTED WITH A COLORLESS OIL, OR SOME OTHER SATISFACTORY MEANS TO PREVENT CONCRETE FROM ADHERING TO THE PLATE SO THAT THE PLATE CAN BE REMOVED IF NECESSARY. (TYP. ALL 3/4" SLIDER PLATES)
END OF BARRIER RAIL
3/4" RECESS IN BARRIER TOP FOR SLIDER PLATE TRAVEL
RECESS IN BARRIER SIDES FOR SLIDER PLATE TRAVEL. FOR DEPTH OF RECESS, SEE PLAN VIEW ON DESIGN SHEET 133.
BARRIER RECESS
3/4" SLIDER PL
30° CHAMFER
3/4"Φ x 1" (MIN.) CSK. CAP SCREWS
3/4"Φ x 8" BENT BOLT (TYP.)
2" LONG HEX NUT (TYP.)
TOP OF DECK
TRAFFIC
SECTION A-A
(PIERS NO. 7 & 13 SHOWN, SOUTH ABUTMENT SIMILAR)
DEPRESS 3/4" SLIDER PL 1/4" BELOW THE FACE OF BARRIER RAIL
2" LONG HEX NUT (TYP.)
3/4"Φ x 1" (MIN.) CSK. CAP SCREW (SEE DETAIL)
3/4"Φ x 8" BENT BOLT (SEE DETAIL)
TOP OF MODULAR EXPANSION JOINT (DEPRESS 1/4" BELOW TOP OF DECK)
EDGE OF DECK
SECTION C-C
(SEE DESIGN SHEET 126 FOR DECK SLOPE. SEE DESIGN SHEET 117 FOR BARRIER RAIL ORIENTATION.)
DEPRESS 3/4" SLIDER PL 1/4" BELOW THE FACE OF BARRIER RAIL (TYP.)
2" LONG HEX NUT (TYP.)
3/4"Φ x 1" (MIN.) CSK. CAP SCREW (SEE DETAIL)
3/4"Φ x 8" BENT BOLT (SEE DETAIL)
EDGE OF DECK
SECTION B-B
(SEE DESIGN SHEET 126 FOR DECK SLOPE. SEE DESIGN SHEET 117 FOR BARRIER RAIL ORIENTATION.)
Δ CAULK CORNER BETWEEN EDGE OF TOP PLATE AND BACK FACE OF CONCRETE BARRIER. CAULKING MATERIAL SHALL BE NEUTRAL CURE AND NO-SAG SILICONE. THREE PRODUCTS MEETING THESE CRITERIA ARE DOW 888, CSL 342 AND CRAFCO ROADSAVER SILICONE JOINT SEALANT.
HEX HEAD REQUIRED
3/4"Φ GALVANIZED SOCKET FLAT COUNTERSUNK HEAD CAP SCREW
BENT BOLT DETAIL
SOCKET FLAT COUNTERSUNK HEAD CAP SCREW DETAIL
NOTES:
DIMENSIONS MARKED THUS (*) ARE AT 50°F WITH 1/8" VARIATION FOR THE TEMPERATURE SHOWN IN THE MOVEMENT TABLE. DIMENSIONS FOR OTHER TEMPERATURES ARE PROPORTIONAL. INCREASE GAP FOR A DECREASE IN TEMPERATURE AND DECREASE GAP FOR AN INCREASE IN TEMPERATURE.
** DIMENSIONS TO BE SET BY JOINT MANUFACTURER.
℄ EXPANSION JOINT
CENTER BEAM (TYP.)
EDGE BEAM (TYP.)
SUPPORT BAR
CONCRETE TO BE PLACED AFTER INSTALLATION OF EXPANSION JOINT (TYP.)
END OF GIRDER
FRONT FACE OF ABUTMENT BACKWALL
END OF DECK
CONST. JOINT
℄ BRG.
SECTION AT ABUTMENT
(PERPENDICULAR TO ℄ ABUTMENT)
CONCRETE IN BLOCKOUT TO BE PLACED AFTER INSTALLATION OF EXPANSION JOINT (TYP.)
SECTION AT PIER
(PERPENDICULAR TO ℄ PIER)
7 MIN.
TO BE SET BY MANUFACTURER (4 MAX.)
GUTTER LINE
TOP OF DECK
6 MIN.
45°
STEEL RAIL
CONTINUOUS NEOPRENE GLAND
EDGE OF BLOCKOUT
SECTION AT CURB
NOTES:
THE MATERIAL USED FOR THE SLIDER PLATES IS TO BE ASTM A36 STEEL. THE BOLTS SHALL MEET THE REQUIREMENTS OF ASTM A307. THE PLATES, BOLTS, NUTS AND CAP SCREWS ARE TO BE GALVANIZED IN ACCORDANCE WITH ARTICLE 4100.07 OF THE STANDARD SPECIFICATIONS.
CONTRACTOR TO NOTE THAT THE CAP SCREW ANCHORAGE SYSTEM FOR THE 3/4" BARRIER PLATES ARE ALWAYS TO BE PLACED ON THE ONCOMING TRAFFIC SIDE.
IT IS INTENDED THAT THE RECESSED AREA BE FORMED SO THAT WHEN THE 3/4" BENT PLATE IS INSTALLED THE PLATE WILL BE ABLE TO MOVE FREELY IN THIS RECESSED AREA.
CAP SCREWS SHALL BE COUNTERSUNK 1/16" BELOW TOP OF THE PLATE.
DESIGN FOR 0° SKEW RADII = 2400' & 1200'
2097'-0 x VARIES CONTINUOUS WELDED GIRDER BRIDGE
UNIT 1: 123'-0, 155'-0, 155'-0, 155'-0, 192'-0, 148'-0, 109'-0 SPANS
UNIT 2: 173'-0, 200'-0, 207'-0, 190'-0, 165'-0, 125'-0 SPANS
MODULAR EXPANSION JOINT DETAILS
STATION 8546+90.50 (℄ I-480 RAMP H) NOVEMBER 2020
POTTAWATTAMIE COUNTY
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION
DESIGN SHEET NO. 134 OF 145 FILE NO. 30170 DESIGN NO. 1520
DESIGN TEAM HNTB
POTTAWATTAMIE COUNTY
PROJECT NUMBER IM-029-3(193)54--13-78
SHEET NUMBER 135

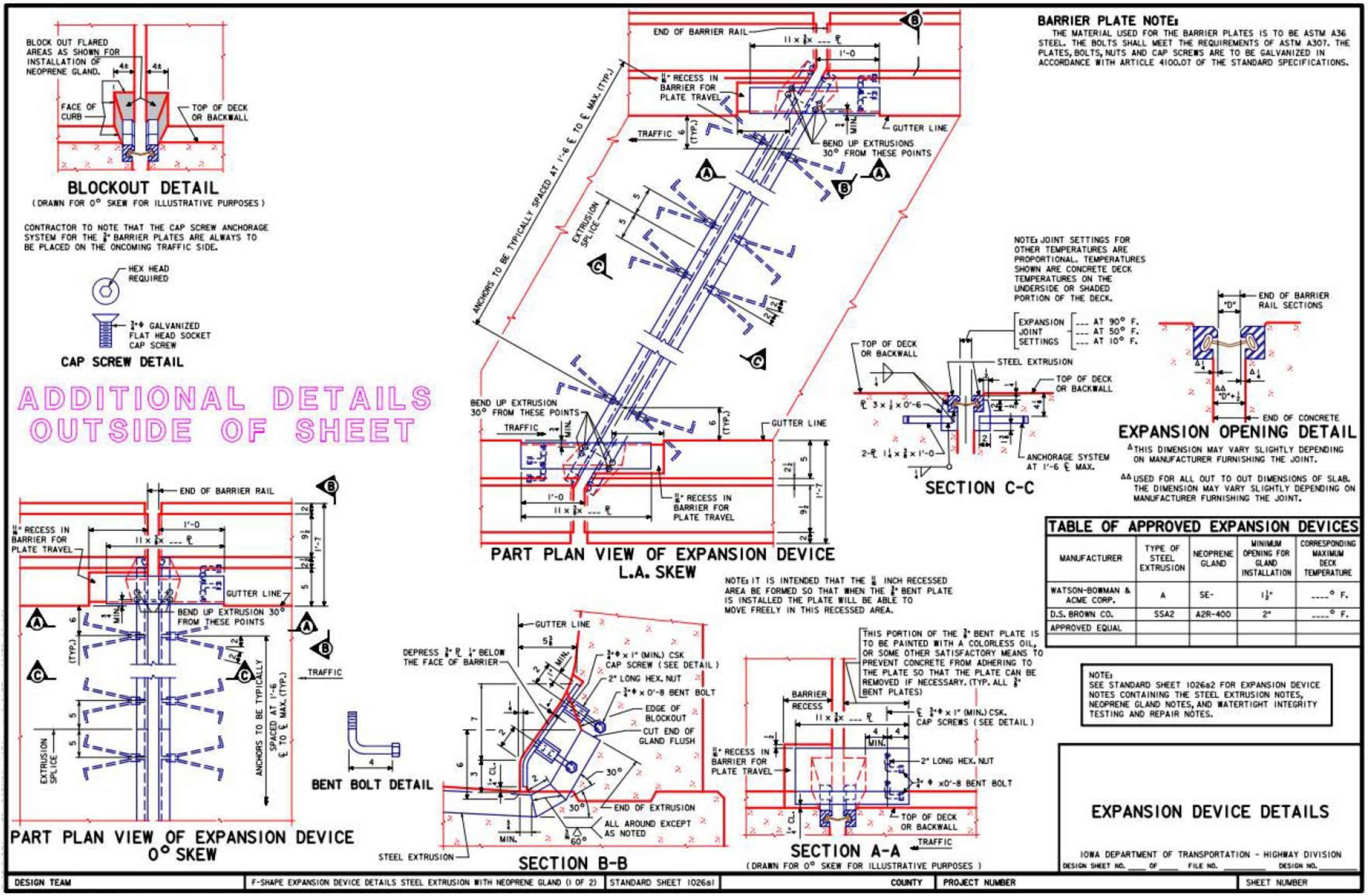
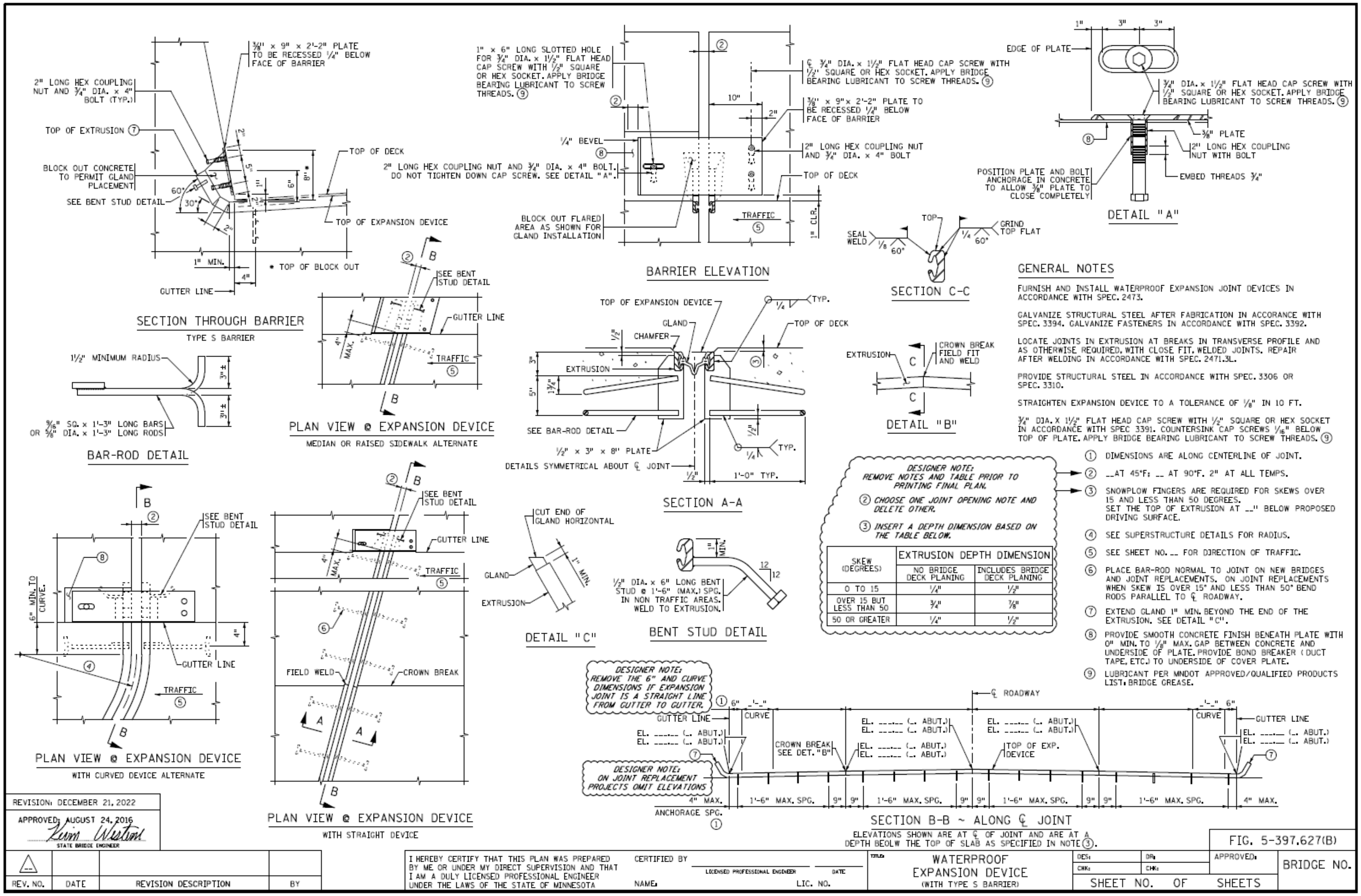
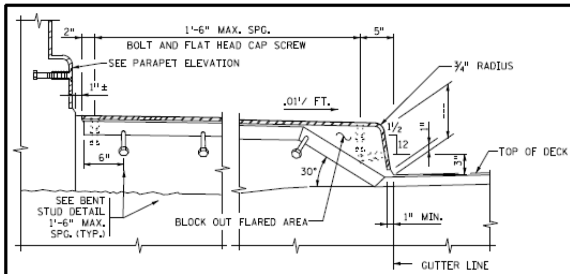


TABLE OF APPROVED EXPANSION DEVICES

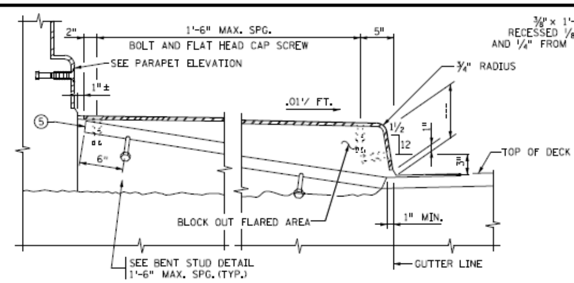
MANUFACTURER	TYPE OF STEEL EXTRUSION	NEOPRENE GLAND	MINIMUM OPENING FOR GLAND INSTALLATION	CORRESPONDING MAXIMUM DECK TEMPERATURE
WATSON-BOWMAN & ACME CORP.	A	SE-	1½"	----° F.
D.S. BROWN CO.	SSA2	A2R-400	2"	----° F.
APPROVED EQUAL				

B.4. MINNESOTA DOT

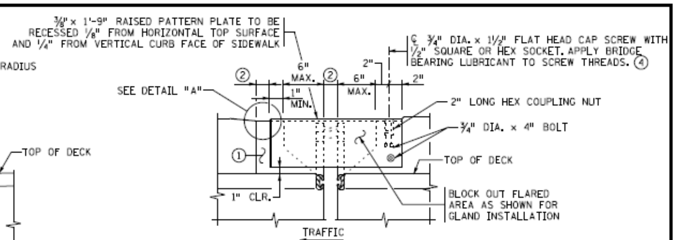




SECTION THROUGH RAISED SIDEWALK - OPTION 1

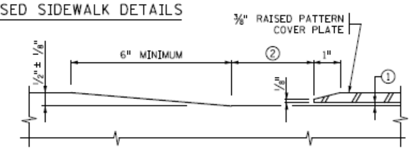


SECTION THROUGH RAISED SIDEWALK - OPTION 2

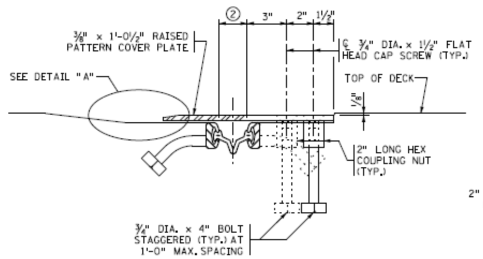


ELEVATION

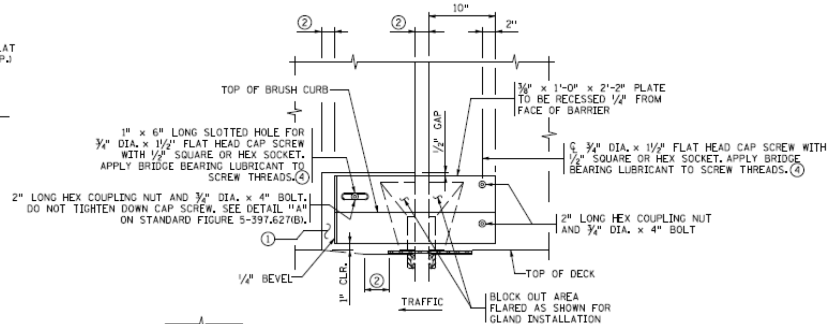
RAISED SIDEWALK DETAILS



DETAIL "A" ③



SECTION D-D ③
(INTEGRAL SIDEWALK)



PARAPET ELEVATION
(CONCRETE PARAPET AND BACK OF TYPE S BARRIER)

DESIGNER NOTE
(REMOVE PRIOR TO PRINTING FINAL PLAN):
ALWAYS INCLUDE STANDARD FIGURE 5-397.627(B) ALONG WITH THIS SHEET.

GENERAL NOTES

SEE OTHER WATERPROOF EXPANSION DEVICE SHEET FOR ADDITIONAL DETAILS AND NOTES.

PROVIDE RAISED PATTERN PLATE IN ACCORDANCE WITH SPEC. 3310, ASTM A709, GRADE 50, GALVANIZED IN ACCORDANCE WITH SPEC. 3394.

TRANSVERSE DECK REINFORCEMENT MAY BE SHIFTED THE MINIMUM DISTANCE REQUIRED FOR EXPANSION DEVICE PLACEMENT.

¾" DIA. × 1½" FLAT HEAD CAP SCREW WITH ½" SQUARE OR HEX SOCKET IN ACCORDANCE WITH SPEC 3391. COUNTERSINK CAP SCREWS $\frac{1}{16}$" FROM TOP OF PLATE. APPLY BRIDGE BEARING LUBRICANT TO SCREW THREADS. ④

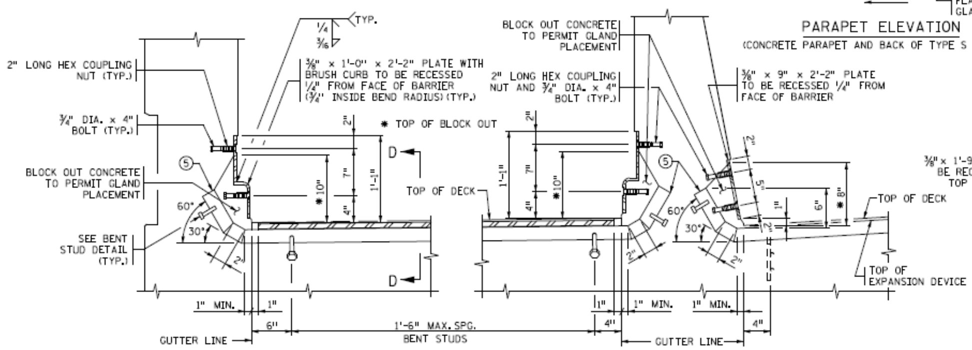
① PROVIDE SMOOTH CONCRETE FINISH BENEATH PLATE WITH 0" MIN. TO ⅛" MAX. GAP BETWEEN CONCRETE AND UNDERSIDE OF PLATE. PROVIDE BOND BREAKER (DUCT TAPE, ETC.) TO UNDERSIDE OF COVER PLATE.

② SEE NOTE ② ON OTHER WATERPROOFING EXPANSION DEVICE SHEET.

③ DIMENSIONS SHOWN ARE REQUIRED TO COMPLY WITH A.D.A. STANDARDS.

④ LUBRICANT PER MNDOT APPROVED/QUALIFIED PRODUCTS LIST: BRIDGE GREASE.

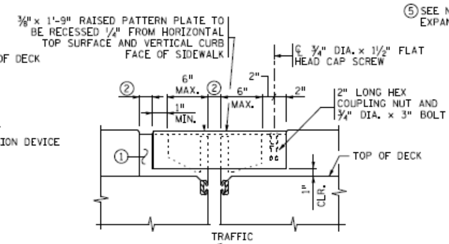
⑤ SEE NOTE ⑦ ON OTHER WATERPROOF EXPANSION DEVICE SHEET.



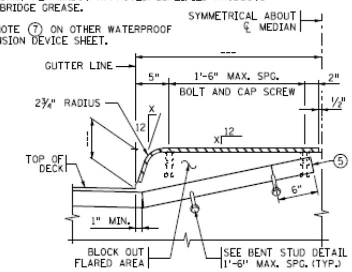
CONCRETE PARAPET

TYPE S BARRIER

SECTION THROUGH BARRIERS - INTEGRAL SIDEWALK



MEDIAN ELEVATION



MEDIAN SECTION

REVISION: DECEMBER 21, 2022			
APPROVED: AUGUST 24, 2016 Kim Wisttant STATE BRIDGE ENGINEER			
△			
REV. NO.	DATE	REVISION DESCRIPTION	BY

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

CERTIFIED BY ______ LICENSED PROFESSIONAL ENGINEER ______ DATE

NAME: ______ LIC. NO.

TITLE: WATERPROOF EXPANSION DEVICE
(RAISED MEDIAN OR SIDEWALK WITH S BARRIER AND PARAPET)

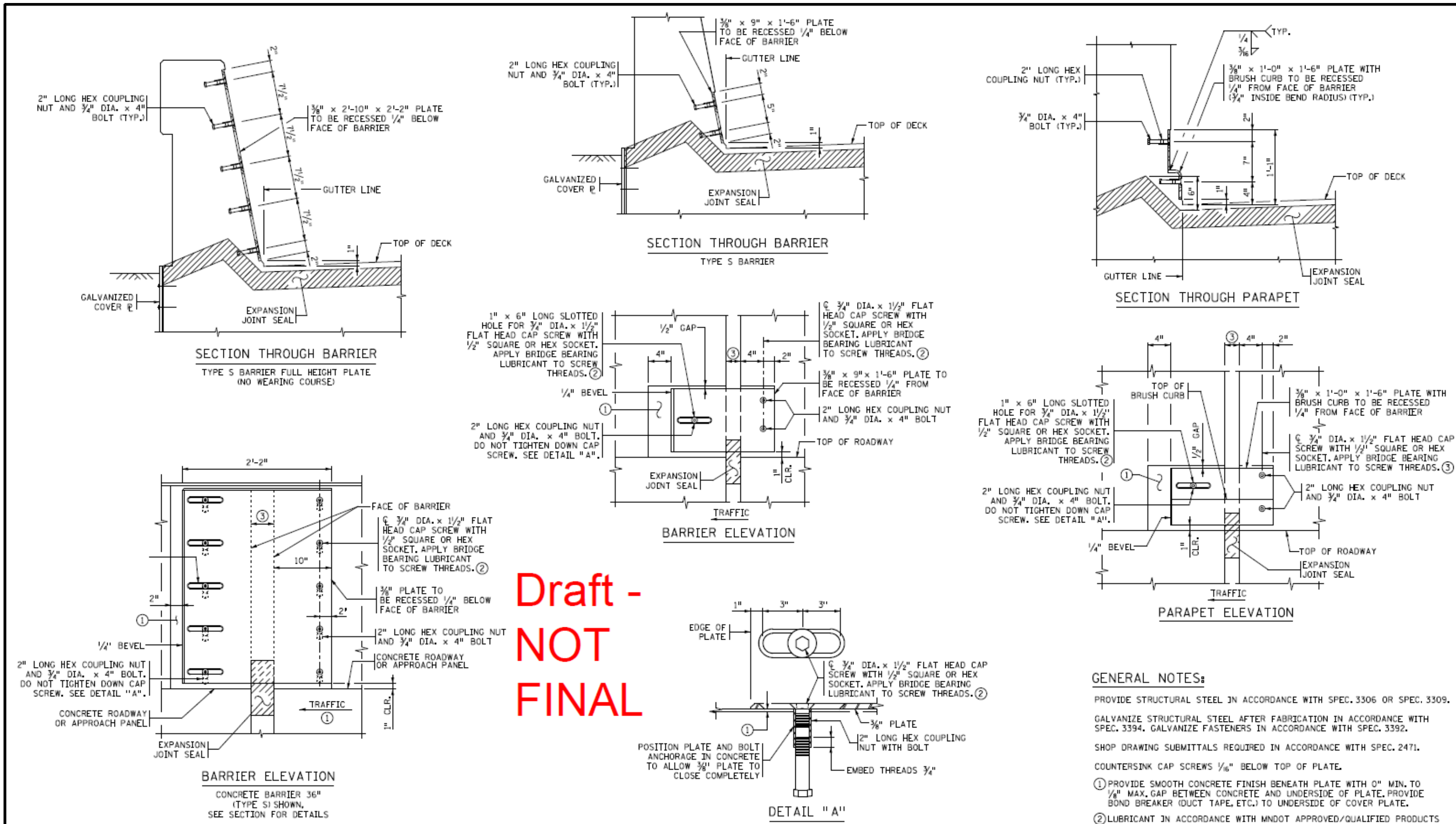
DES: | DR: | CHK: | CHK:

FIG. 5-397.630(B)

APPROVED:

BRIDGE NO.

SHEET NO. OF SHEETS



GENERAL NOTES:

PROVIDE STRUCTURAL STEEL IN ACCORDANCE WITH SPEC. 3306 OR SPEC. 3309.

GALVANIZE STRUCTURAL STEEL AFTER FABRICATION IN ACCORDANCE WITH SPEC. 3394. GALVANIZE FASTENERS IN ACCORDANCE WITH SPEC. 3392.

SHOP DRAWING SUBMITTALS REQUIRED IN ACCORDANCE WITH SPEC. 2471.

COUNTERSINK CAP SCREWS ¹⁄₁₆" BELOW TOP OF PLATE.

① PROVIDE SMOOTH CONCRETE FINISH BENEATH PLATE WITH 0" MIN. TO ⅛" MAX. GAP BETWEEN CONCRETE AND UNDERSIDE OF PLATE. PROVIDE BOND BREAKER (DUCT TAPE, ETC.) TO UNDERSIDE OF COVER PLATE.

② LUBRICANT IN ACCORDANCE WITH MNDOT APPROVED/QUALIFIED PRODUCTS LIST: BRIDGE GREASE.

③ REFER TO STANDARD FIGURE 5-297.223 FOR EXPANSION JOINT TYPE AND STANDARD FIGURE 5-297.225 AND 5-297.226 FOR SILL AND EXPANSION JOINT DETAILS.

REVISED:

REFERENCE DATE 07-20-2023

REV. NO.	DATE	REVISION DESCRIPTION	BY

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

CERTIFIED BY ______ LICENSED PROFESSIONAL ENGINEER ______ DATE

NAME: ______ LIC. NO. ______

TITLE: BRIDGE APPROACH PANEL COVER PLATE DETAILS

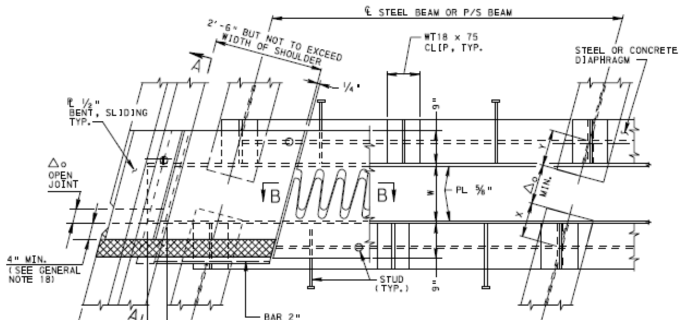
DES: DR: CHK: CHK: APPROVED:

FIG. 5-397.635(A)

SHEET NO. OF SHEETS

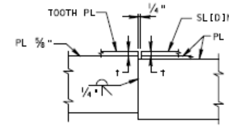
BRIDGE NO.

B.5. PENNSYLVANIA DOT

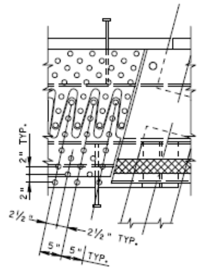


PLAN AT PIER

SKEW ANGLES ≥ 75°

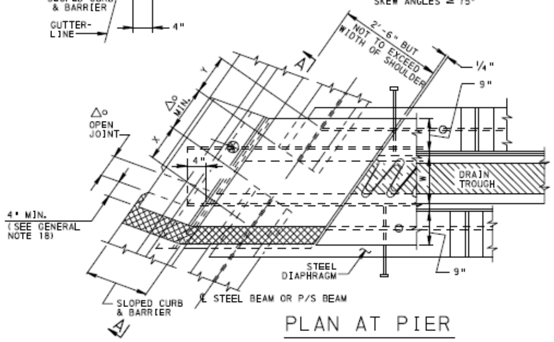


SECTION B-B



BALL STUD DETAIL

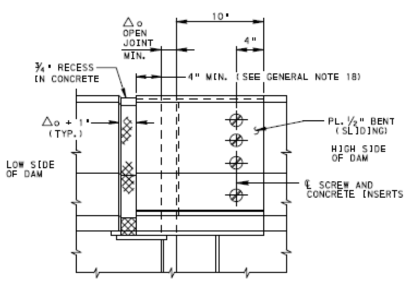
(SEE GENERAL NOTE 6)



PLAN AT PIER

SKEW ANGLES < 75°

PLAN AT ABUTMENT SIMILAR. FOR SECTION AT ABUTMENT, SEE SHEETS 3 AND 5.



SECTION A-A

SECTION A-A NOTE:

FORM CONCRETE RECESS AREA IN BARRIER AND GRIND TO PROVIDE SMOOTH SURFACE. APPLY ONE COAT OF ASPHALT CEMENT PAINT WA-1 OR PERFORMANCE GRADED ASPHALT CEMENT PG 64-22 TO ALLOW BENT SLIDING PLATE TO MOVE FREELY WITHOUT FRICTION.

DESIGN INFORMATION

NORMAL TEMPERATURE = 68°F.
TEMPERATURE RANGE = -10°F TO 110°F FOR STEEL & 10°F TO 100°F FOR P/S.
TEMPERATURE CHANGE = 42°F RISE, 78°F FALL FOR STEEL & 32°F RISE, 58°F FALL FOR P/S.
ξ = THERMAL COEFFICIENT = 0.0000065 PER °F FOR STEEL & 0.0000060 PER °F FOR P/S.
DESIGN LIVE LOAD = 100 PSI + 60% IMPACT = 160 PSI
DEFLECTION OF TOOTH SHALL NOT EXCEED $\ell/300$ WHERE ℓ = CANTILEVER LENGTH OF TOOTH.
EXPANSION: MIN. $\Delta o = \delta + \xi T_c L$ (L IN IN.) = 0.00672 L @ 68 °F (L IN FT.)
CONTRACTION: MIN. $\Delta = \delta + \xi T_c L$ (L IN IN.) = 0.00953 L @ 68 °F (L IN FT.)
SEE TABLE BELOW FOR VALUES @ 68° F
t = THICKNESS OF STEEL PLATE OR THICKNESS OF TOOTH..
L = EXPANDED LENGTH.
W = WIDTH OF TOOTH EXPANSION DAM.
δ = L/290, BUT NOT LESS THAN 1" (L IN FT.).
THE VALUE OF $\Delta o(T)$ FOR TEMPERATURE OF TIME OF DAM ERECTION OTHER THAN 68° F:

$\Delta o(T) = \Delta o(68°\ F) - (T - 68°\ F)L$

$\Delta o(68°F) = \Delta o$ FOR T 68°F NORMAL TEMPERATURE AS SHOWN ON PLAN.

FILLET WELD SIZE SHALL BE THE 'MINIMUM FILLET WELD SIZE' AS SPECIFIED IN AWS D1.5 UNLESS OTHERWISE NOTED.

FOR STEEL BEAMS *																
L (FT.)	251	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
Δo (IN.)	1⅝	2	2⅜	2⅝	3	3⅜	3¾	4	4⅜	4¾	5	5⅜	5¾	6	6⅜	6¾
Δ (IN.)	2⅜	2⅞	3⅜	3¾	4¼	4¾	5¼	5¾	6¼	6⅝	7⅛	7⅝	8	8⅝	9	9½
t (IN.)	1	1	1	1	1	1	1	1½	1½	1½	1½	1½	1½	2	2	2

* FOR P/S BRIDGES, USE ¾ OF Δo & Δ VALUES IN THIS TABLE.

GENERAL NOTES:

1. DO NOT WELD GRADE 60 STEEL REINFORCEMENT BARS UNLESS SPECIFIED.
2. PROVIDE MATERIALS AND WORKMANSHIP IN ACCORDANCE WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION PUBLICATION 408 AND AASHTO/AWS WELDING SPECIFICATIONS.
3. GALVANIZE STEEL IN ACCORDANCE WITH SECTION 1105.02 (s) OF PUBLICATION 408. IF SPECIFIED, PAINT ALL GALVANIZED STEEL SURFACES IN THE SHOP IN ACCORDANCE WITH PUBLICATION 408, SECTION 1060.2 (b).
4. PROVIDE AASHTO M 270, GRADE 36 (ASTM A 709, GRADE 36), GALVANIZED, UNLESS OTHERWISE SPECIFIED ON DESIGN DRAWINGS. ANCHOR STUDS TO BE IN ACCORDANCE WITH SECTION 1105.02 (e) OF PUB. 408. STUDSMAY BE PIGGY BACKED TO ACHIEVE REQUIRED LENGTH.
5. USE FLATHEAD STAINLESS STEEL ASTM F 738 OR F 593 (TYPE 304) FOR COUNTERSUNK SCREWS WITH INSERTS. ALL CONCRETE INSERTS AND COUNTERSUNK MACHINE SCREWS ARE ¾" DIAMETER UNLESS OTHERWISE NOTED.
6. BALL TYPE OR MILD STEEL KNOCK-OFF STUDS SHOULD BE PROVIDED UNLESS OTHERWISE SPECIFIED. BALL STUDS ARE TO BE ⅜" DIAMETER BY ¼" HEIGHT. KNOCK-OFF STUDS WILL BE ANTI-SKID TYPE. KNOCK-OFF STUDS ARE TO BE 5⁄16" NOMINAL DIAMETER BY ¼" HEIGHT. ALTERNATE PATTERNS OTHER THAN SHOWN ON BALL OR KNOCK-OFF STUD DETAIL MUST BE APPROVED BY THE DEPARTMENT.
7. ALL BOLTS TO CONFORM TO ASTM A 325.
8. USE THIS DRAWING AS A GUIDE IN THE PREPARATION OF SHOP DRAWINGS.
9. CONSTRUCT EXPANSION DAM TO MATCH ROADWAY GRADE AND CROSS SLOPE.
10. PLACE CONCRETE UNDER THE DAM AND VIBRATE UNTIL THE CONCRETE IS FORCED THROUGH THE ⅞" DIAMETER AIR HOLES. STRIKE OFF EXCESS CONCRETE. AFTER CONCRETE HAS CURED, INSPECT THE HOLES AND REMOVE UNSOUND CONCRETE. CLEAN THE HOLES WITH AN AIR JET AND FILL WITH APPROVED SEALER.
11. CONTROL THE MAXIMUM DEPTH OF THE TROUGH SUCH THAT IT DOES NOT COME INTO CONTACT WITH THE SUBSTRUCTURE OF THE BRIDGE.
12. SET DAM AFTER ADJACENT DECKS HAVE BEEN PLACED. DO NOT PLACE CONCRETE IN TOP OF ABUTMENT BACKWALLS UNTIL THE BEAMS, DAMS AND DECK SLAB HAVE BEEN PLACED.
13. FABRICATOR TO PROVIDE A CHART SHOWING JOINT OPENING FOR TEMPERATURES BETWEEN -10°F TO 110°F FOR STEEL STRUCTURES AND 10°F TO 100°F FOR P/S CONCRETE STRUCTURES, IN 10°F INTERVALS ON SHOP DRAWINGS.
14. PERFORM NON-DESTRUCTIVE TESTING OF WELDS AS REQUIRED IN ACCORDANCE WITH AASHTO/AWS SPECIFICATIONS.
15. BEFORE PLACING BLOCKOUT CONCRETE APPLY APPROVED EPOXY BONDING AGENT TO TRANSVERSE DECK CONSTRUCTION JOINTS.
16. FABRICATOR TO SHOW DETAIL OF ALL SHIPPING AND ERECTION TEMPORARY ATTACHMENTS ON SHOP DRAWINGS. AFTER ERECTION, AND AFTER OPENING IS ADJUSTED FOR ERECTION TEMPERATURE, TEMPORARY ATTACHMENTS ARE TO BE REMOVED BY CHIPPING CONNECTION WELDS AND GRINDING SURFACE SMOOTH.
17. PLACE CLASS AAAP CEMENT CONCRETE IN THE BLOCKOUT AREA EXCEPT AS SPECIFIED OR INDICATED. THIS WORK IS INCIDENTAL TO DECK CONCRETE EXCEPT AS SPECIFIED OR INDICATED.
18. MAINTAIN 4" MIN. BETWEEN EDGE OF STEEL TO THE EDGE OF CONCRETE AT TEMPERATURE OF -10°F FOR STEEL AND 10°F FOR P/S CONCRETE. GRIND ALL EDGES EXPOSED TO TRAFFIC OR PEDESTRIANS TO 3⁄16" MIN. RADIUS.

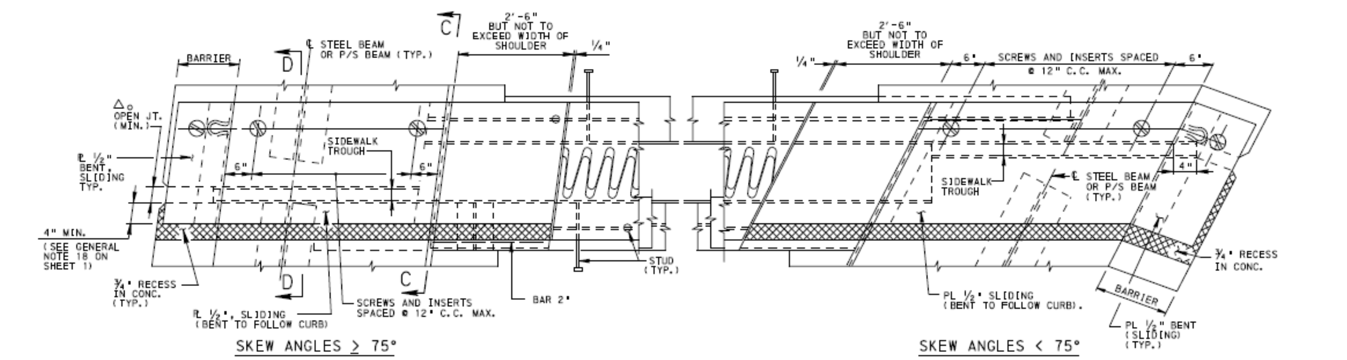
BC-734M	STANDARD ANCHOR SYSTEMS
BC-735M	WALL CONSTR. & EXPANSION JT. DETAILS
BC-751M	BRIDGE DRAINAGE
BC-788M	TYPICAL WATERPROOFING AND EXPANSION DETAILS

REFERENCE DRAWINGS

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

STANDARD
TOOTH EXPANSION DAM
FOR PRESTRESSED CONCRETE &
STEEL I-BEAM BRIDGES

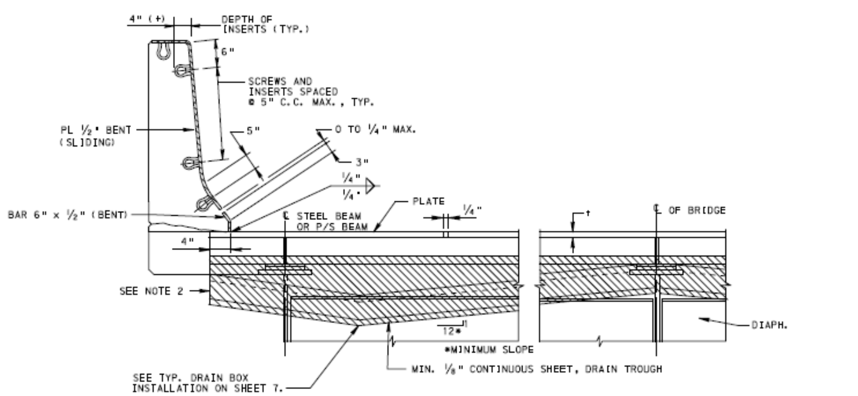
RECOMMENDED JAN. 31, 2019 — CHIEF BRIDGE ENGINEER
RECOMMENDED JAN. 31, 2019 — ACTING DIR. BUR. OF PROJECT DELIVERY
SHEET 1 OF 7
BC-762M



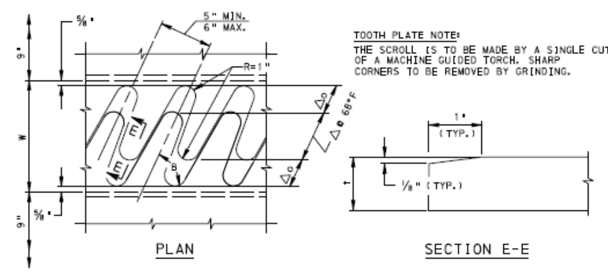
PLAN AT SIDEWALK

NOTES:

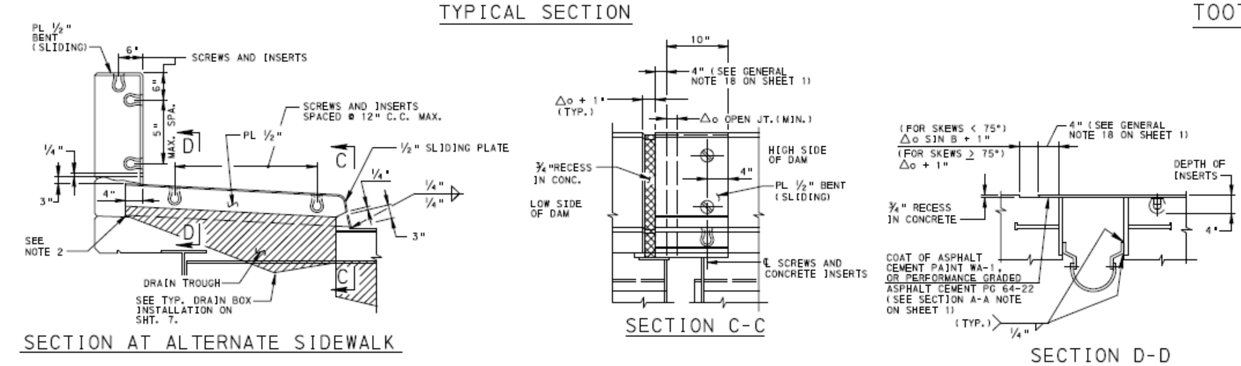
1. TO INSURE THAT INSERTS & SCREWS ARE ALIGNED PROPERLY, PLACE CURB & SIDEWALKS WITH ½" SLIDING PLATES IN PLACE. APPLY BOND BREAKER TO SLIDING PLATES PRIOR TO INSTALLATION.
2. ENDS OF DRAIN TROUGH TO BE CLOSED AND MADE WATER TIGHT IN A MANNER ACCEPTABLE TO THE DEPARTMENT.
3. TYPE OF DRAINAGE DISCHARGE IS DEPENDENT UPON THE LOCATION OF THE STRUCTURE.
4. CONTRACT DRAWINGS TO SHOW DETAILS OF TIE-IN TO EXISTING DRAINAGE SYSTEM.
5. TROUGH SYSTEM AS SHOWN MAY BE SUBSTITUTED BY APPROVED EQUAL.
6. ALL DETAILS ARE SHOWN WITH A SEPARATE SIDEWALK TROUGH. DETAILS MAY BE MODIFIED TO SHOW A SINGLE TROUGH TO REDUCE DECK DRAINS. SEE SHEET 7 FOR EXAMPLE. ALL DRAIN LOCATIONS MUST BE SHOWN ON THE DESIGN DRAWINGS.



TYPICAL SECTION



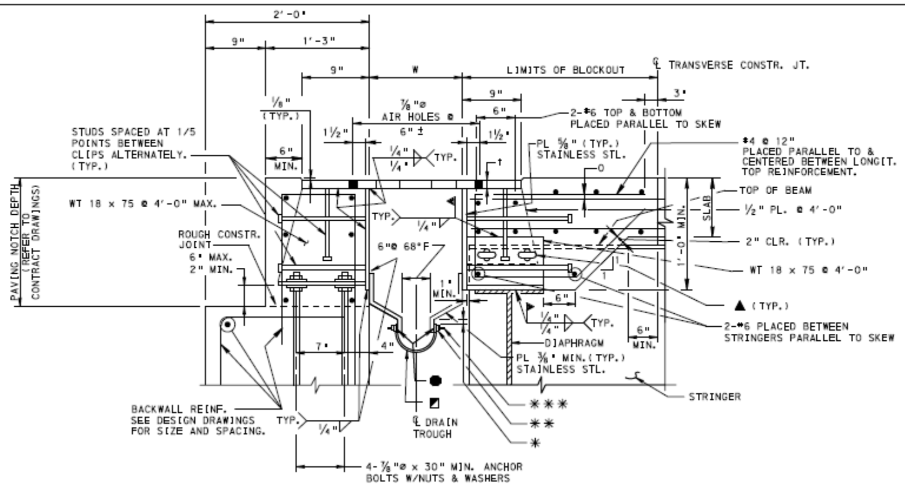
TOOTH PLATE DETAIL



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

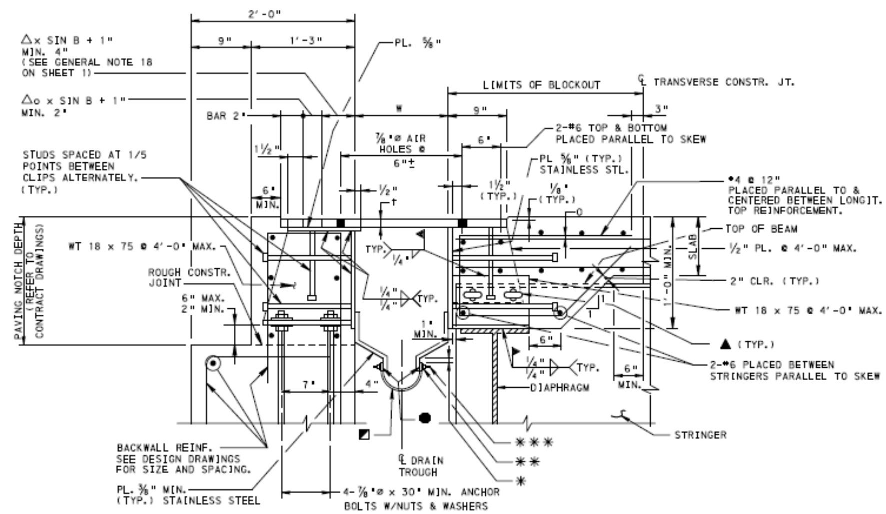
STANDARD
TOOTH EXPANSION DAM
FOR PRESTRESSED CONCRETE &
STEEL I-BEAM BRIDGES

RECOMMENDED JAN. 31, 2019	RECOMMENDED JAN. 31, 2019	SHEET 2 OF 7
CHIEF BRIDGE ENGINEER	ACTING DIR. BUR. OF PROJECT DELIVERY	BC-762M



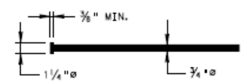
SECTION AT ABUTMENT
FOR STEEL BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



SECTION AT ABUTMENT (@ SHOULDER)
FOR STEEL BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



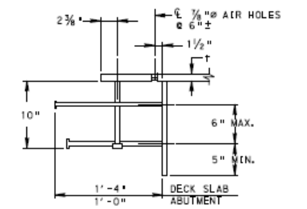
TYPICAL STUD

LEGEND:

- ✱ VARY TO PROVIDE MINIMUM 1V:12H. SLOPE TO DRAIN. SEE DESIGN DWG. FOR ACTUAL DESIGN SLOPE.
- ✱✱ 1½" x ¼" PL. STAINLESS STEEL (TYPE 304), FULL LENGTH OF DRAIN TROUGH.
- ✱✱✱ ⅝"⌀ STAINLESS STEEL STUDS WITH SELF LOCKING NUT & WASHER @ 12" C.C.
- ▲ 1" x 1¾" SLOTTED HOLES FOR ⅞"⌀ H.S. BOLTS.
- ● APPLY ¼" BEAD OF AN EXTERIOR RATED SILICONE CAULK SEALANT PRIOR TO ASSEMBLY.
- ◩ SEE PUBLICATION 408 SECTION 1020.3 FOR MATERIAL SPECIFICATION.

SECTION NOTES:

1. ALL VERTICAL STUDS ARE ¾"⌀ x 10" LONG.
2. HORIZONTAL STUDS IN ABUTMENT ARE ¾"⌀ x 12" LONG.
3. HORIZONTAL STUDS IN SLAB ARE ¾"⌀ x 16" LONG.
4. MINIMUM DEPTH OF CONCRETE OVER DIAPHRAGMS IS 12".
5. BEFORE PLACING BLOCKOUT APPLY APPROVED EPOXY BONDING AGENT TO TRANSVERSE CONSTRUCTION JOINTS.



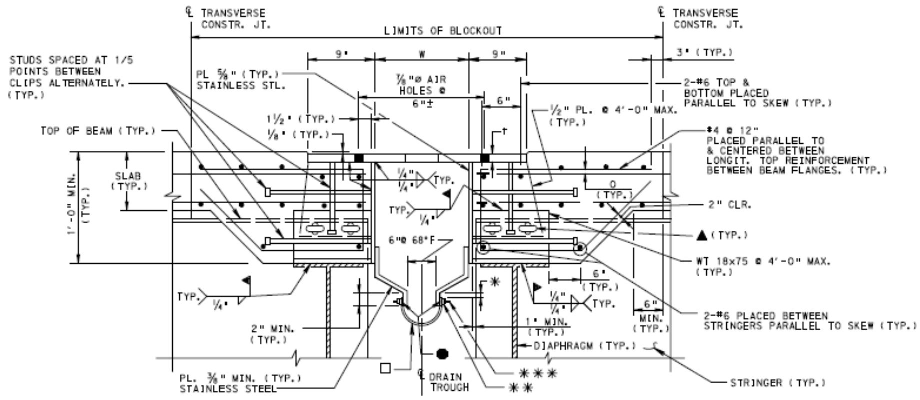
INDIVIDUAL STUDS MAY BE BENT OR SHORTER STUDS MAY BE USED (WHERE CLEARANCE IS LIMITED), IF PERMITTED BY THE STRUCTURE CONTROL ENGINEER OR DISTRICT BRIDGE ENGINEER.

STUD DETAIL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF PROJECT DELIVERY

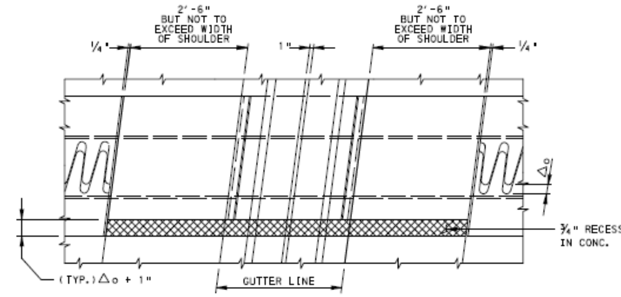
STANDARD
TOOTH EXPANSION DAM
FOR PRESTRESSED CONCRETE &
STEEL I-BEAM BRIDGES

RECOMMENDED JAN. 31, 2019 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED JAN. 31, 2019 ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 3 OF 7 BC-762M



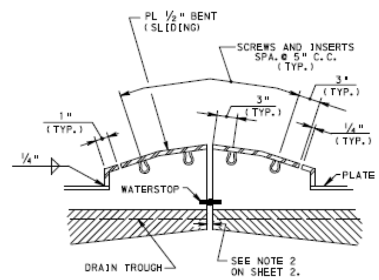
SECTION AT PIER
FOR STEEL BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



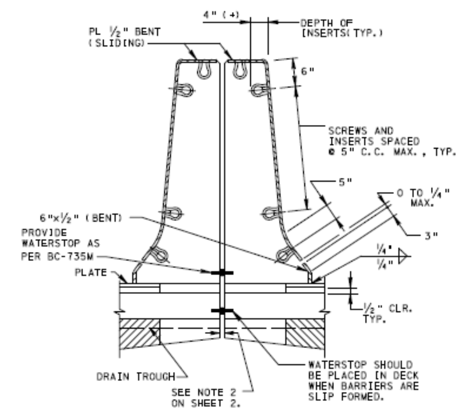
PLAN AT SPLIT MEDIAN BARRIER

NOTE: PLAN AT SPLIT CONCRETE DIVISOR SIMILAR



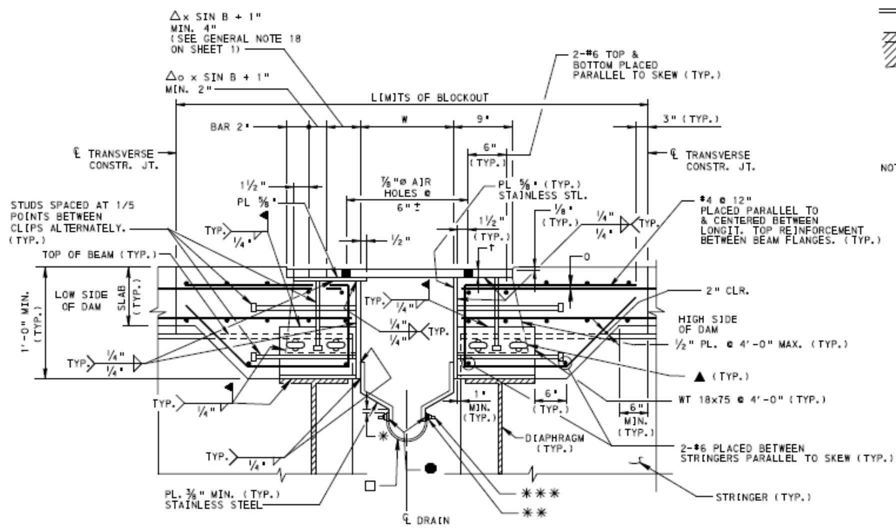
SECTION AT SPLIT
CONCRETE DIVISOR

NOTE: FOR CONCRETE DIVISOR NOT SPLIT, USE ONE PIECE ½" BENT SLIDING PLATE. DRAIN TROUGH MAY BE CONTINUOUS THROUGH DIVISOR.



SECTION AT SPLIT
MEDIAN BARRIER

NOTE: FOR MEDIAN BARRIER NOT SPLIT, USE ONE PIECE ½" BENT SLIDING PLATE. DRAIN TROUGH MAY BE CONTINUOUS THROUGH DIVISOR.



SECTION AT PIER (@ SHOULDER)
FOR STEEL BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

NOTES:

1. FOR LEGEND AND SECTION NOTES, SEE SHEET 3.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
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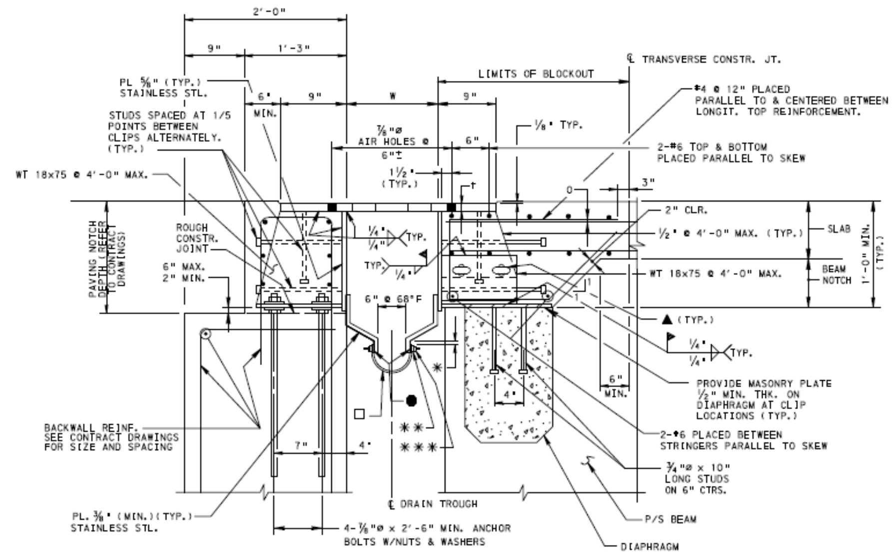
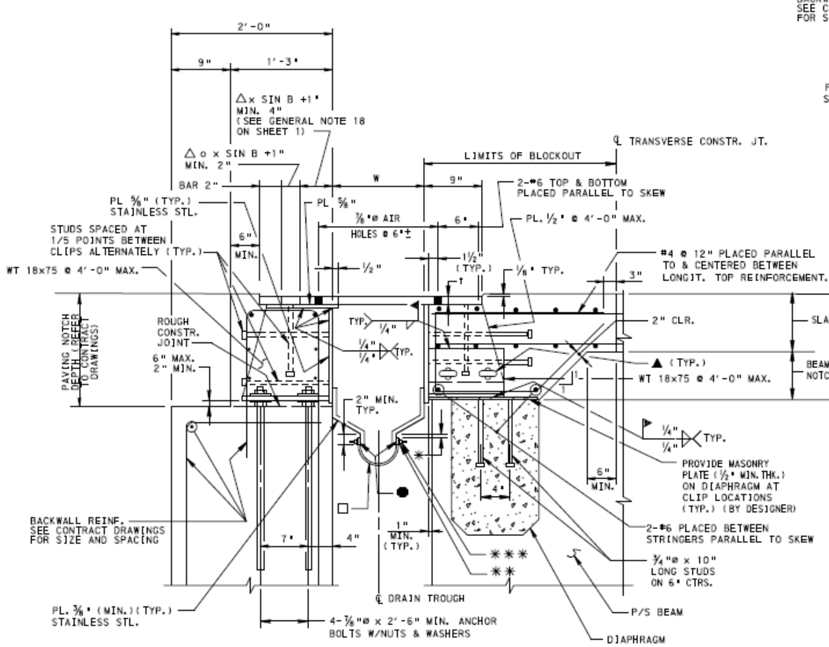
STEEL I-BEAM BRIDGES

RECOMMENDED JAN. 31, 2019 Thomas P. Macioce CHIEF BRIDGE ENGINEER	RECOMMENDED JAN. 31, 2019 ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 4 OF 7 BC-762M



SECTION AT ABUTMENT
FOR P/S BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



SECTION AT ABUTMENT (@ SHOULDER)
FOR P/S BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

NOTES:

1. FOR LEGEND AND SECTION NOTES, SEE SHEET 3.
2. TOOTH EXPANSION DAMS ARE NOT PERMITTED TO BE USED WITH PRESTRESSED CONCRETE ADJACENT BOX BEAM BRIDGES.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
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FOR PRESTRESSED CONCRETE &
STEEL I-BEAM BRIDGES

RECOMMENDED JAN. 31, 2019	RECOMMENDED JAN. 31, 2019	SHEET 5 OF 7
Thomas P. Macioce — CHIEF BRIDGE ENGINEER	ACTING DIR. BUR. OF PROJECT DELIVERY	BC-762M

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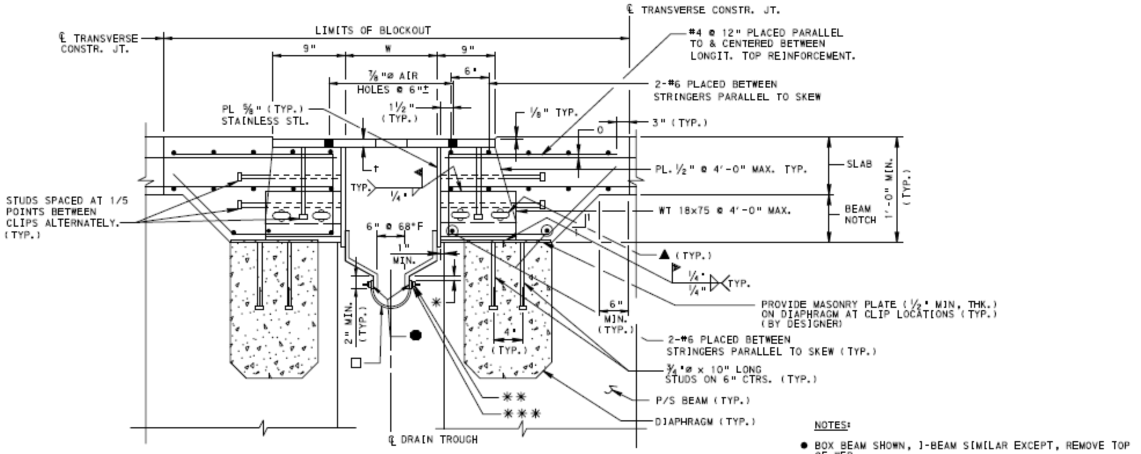
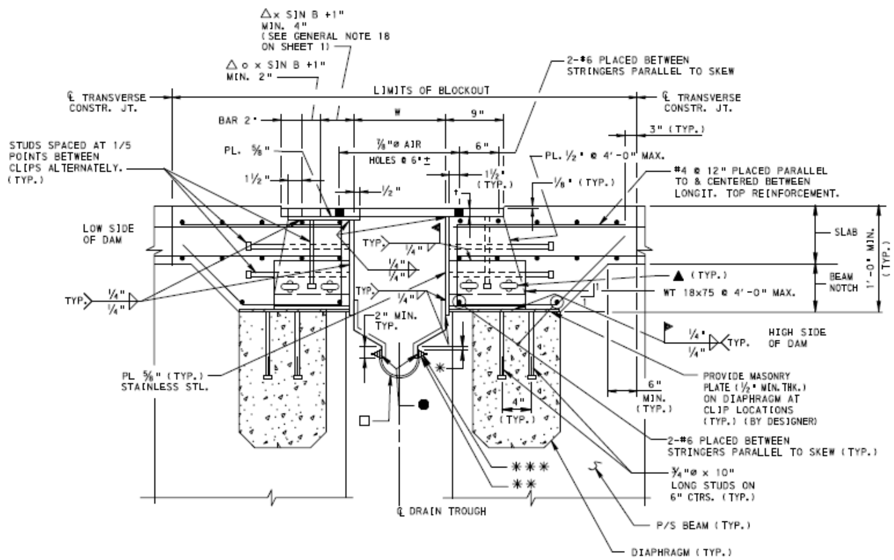


SECTION AT PIER

FOR P/S BEAMS

NOTES:

- ● BOX BEAM SHOWN, I-BEAM SIMILAR EXCEPT, REMOVE TOP OF WEB.
- ● FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.



SECTION AT PIER (@ SHOULDER)

FOR P/S BEAMS

FOR DECK TOP REINFORCEMENT MAT: TRANSVERSE BARS SHOWN ON TOP, SIMILAR WHEN LONGITUDINAL BARS ON TOP.

NOTES:

1. FOR LEGEND AND SECTION NOTES, SEE SHEET 3.
2. TOOTH EXPANSION DAMS ARE NOT PERMITTED TO BE USED WITH PRESTRESSED CONCRETE ADJACENT BOX BEAM BRIDGES.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
TOOTH EXPANSION DAM
FOR PRESTRESSED CONCRETE &
STEEL I-BEAM BRIDGES

RECOMMENDED JAN. 31, 2019 — Thomas P. Macioce — CHIEF BRIDGE ENGINEER	RECOMMENDED JAN. 31, 2019 — ACTING DIR. BUR. OF PROJECT DELIVERY	SHEET 6 OF 7 — BC-762M

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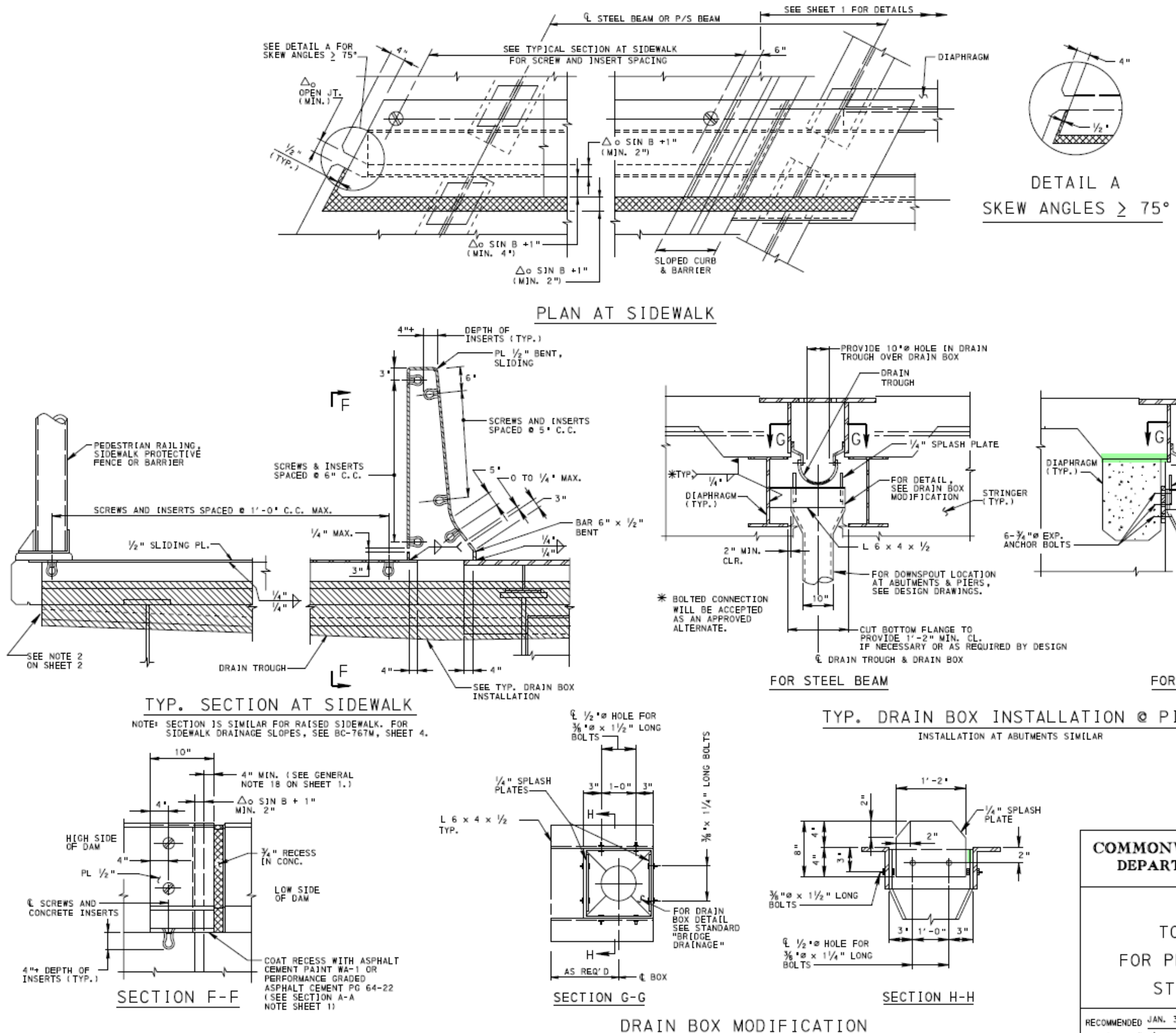
2024-01-12



NOTE:

1. ALL DETAILS ARE SHOWN WITH A SINGLE TROUGH TO REDUCE DECK DRAINS. DETAILS MAY BE MODIFIED TO SHOW A SEPARATE TROUGH. SEE SHEET 2 FOR EXAMPLE. ALL DRAIN LOCATIONS MUST BE SHOWN ON THE DESIGN DRAWINGS.

COMMONWEALTH OF PENNSYLVANIA
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STANDARD
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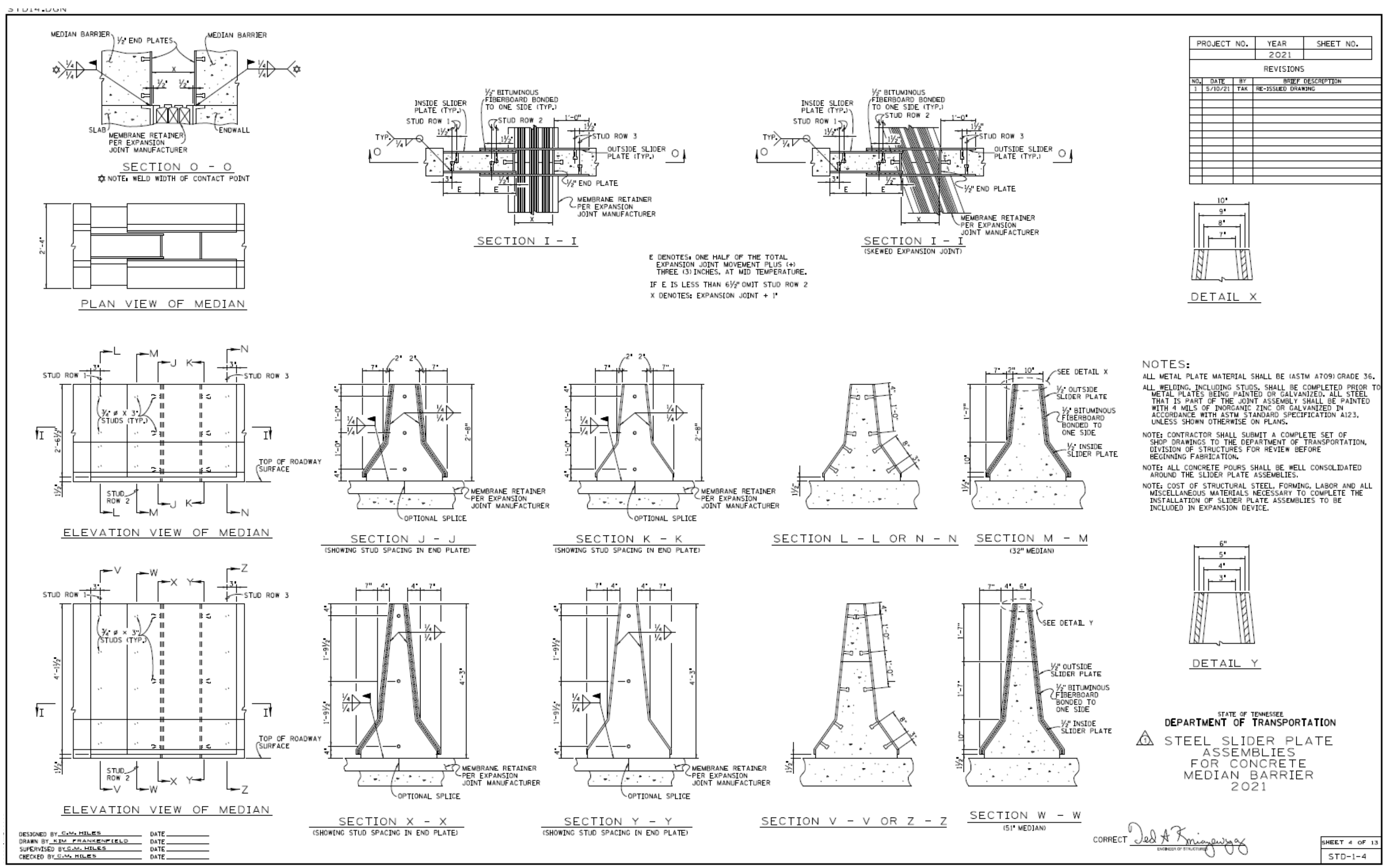
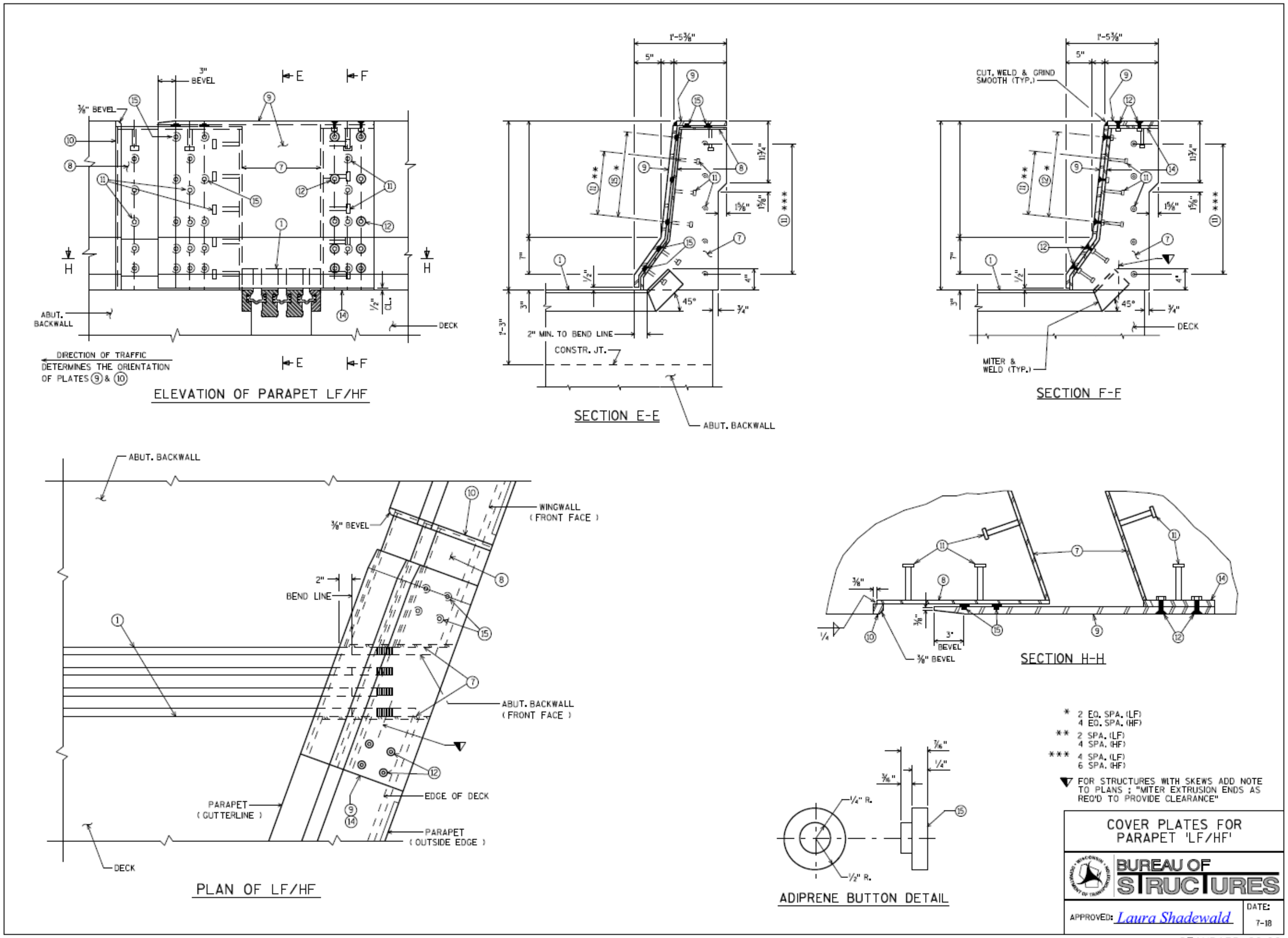
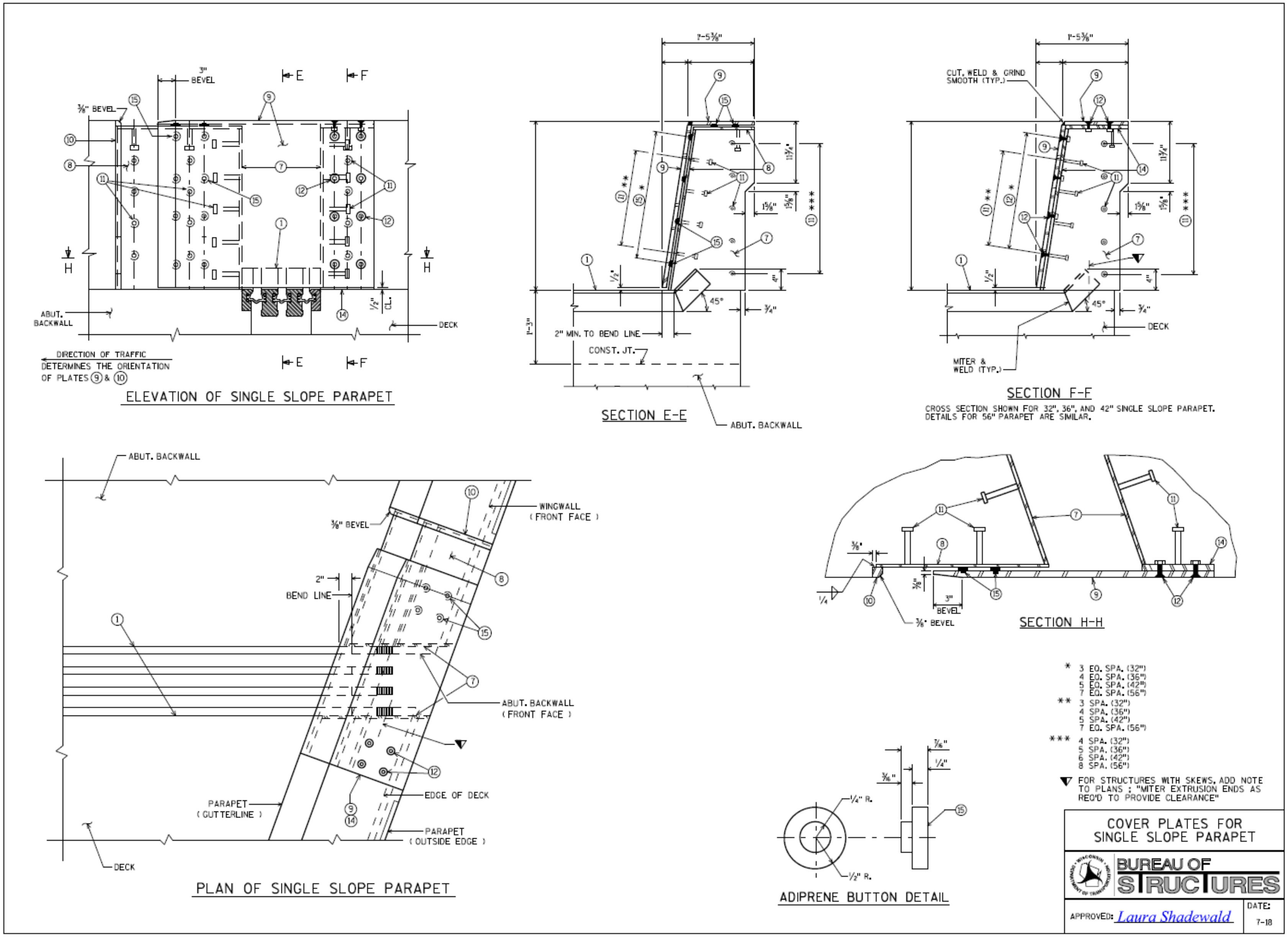
RECOMMENDED JAN. 31, 2019	RECOMMENDED JAN. 31, 2019	SHEET 7 OF 7
CHIEF BRIDGE ENGINEER	ACTING DIR. BUR. OF PROJECT DELIVERY	BC-762M

B.6. TENNESSEE DOT



B.7. WISCONSIN DOT




ELEVATION OF SINGLE SLOPE PARAPET
DIRECTION OF TRAFFIC DETERMINES THE ORIENTATION OF PLATES ⑨ & ⑩
SECTION E-E
SECTION F-F
CROSS SECTION SHOWN FOR 32", 36", AND 42" SINGLE SLOPE PARAPET. DETAILS FOR 56" PARAPET ARE SIMILAR.
CUT, WELD & GRIND SMOOTH (TYP.)
MITER & WELD (TYP.)
2" MIN. TO BEND LINE
CONST. JT.
ABUT. BACKWALL
DECK
PLAN OF SINGLE SLOPE PARAPET
WINGWALL (FRONT FACE)
ABUT. BACKWALL (FRONT FACE)
BEND LINE
PARAPET (GUTTERLINE)
PARAPET (OUTSIDE EDGE)
EDGE OF DECK
SECTION H-H
ADIPRENE BUTTON DETAIL
* 3 EQ. SPA. (32") 4 EQ. SPA. (36") 5 EQ. SPA. (42") 7 EQ. SPA. (56")
** 3 SPA. (32") 4 SPA. (36") 5 SPA. (42") 7 EQ. SPA. (56")
*** 4 SPA. (32") 5 SPA. (36") 6 SPA. (42") 8 SPA. (56")
FOR STRUCTURES WITH SKEWS, ADD NOTE TO PLANS : "MITER EXTRUSION ENDS AS REQ'D TO PROVIDE CLEARANCE"
COVER PLATES FOR SINGLE SLOPE PARAPET
BUREAU OF STRUCTURES
APPROVED: Laura Shadewald
DATE: 7-18