

2015 T.H.E. Conference

Illini Union
Champaign, IL

February 24, 2015

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**Temporary Concrete Barrier
Pinning
and
Drop-off Policy**

Code of Federal Regulations

- 23 CFR 630.1106 and 630.1108
 - The management of work zone impacts **shall include:**
 - the consideration and management of highway worker safety on Federal-aid highway projects, and
 - the use of positive protective devices

DRAFT Safety 4-15 Policy

“Work Zone Safety Supplemental Policy, Moving Ahead for Progress in the 21st Century Act (MAP-21) and Subpart K to Title 23 CFR Part 630: Positive Protection of Workers, Drop-offs and Temporary Concrete Barrier (TCB)”

DRAFT Safety 4-15 Policy

- Requirements and guidance addressing:

- Worker and motorist safety
- Positive protective devices to:
 - Limit exposure and risk from motorized traffic
 - Decrease likelihood of fatalities or injuries to workers, and
 - Prevent intrusion of motorized traffic into work zones

DRAFT Safety 4-15 Policy

- Supersedes Safety 4-08
- Revised to provide detailed guidance for:
 - Appropriate use and installation of TCB
 - Mitigating drop-offs

Use of Positive Protective Devices

- Must be considered in work zones:
 - That place workers at increased risk from motorized traffic, and
 - Where positive protective devices offer the highest potential for increased safety for workers and road users
- Mobile & Stationary Operations

Positive Protection for Stationary Operations

- Locations with no means of escape
 - Multilane highways - > 24 hours, or multiple days/nights setups > cumulative 24 hours
 - 2L2W highways - > 4 days/stage
- Requires temporary longitudinal traffic barriers (TLTBs)

Positive Protection for Stationary Operations (cont.)

- ◉ Long duration with high speed and workers near a traffic lane
 - Normal posted speed limit \geq 45 mph
 - Duration of the operation \geq 2 weeks, and
 - Workers present within 1 lane width of the open traffic lane

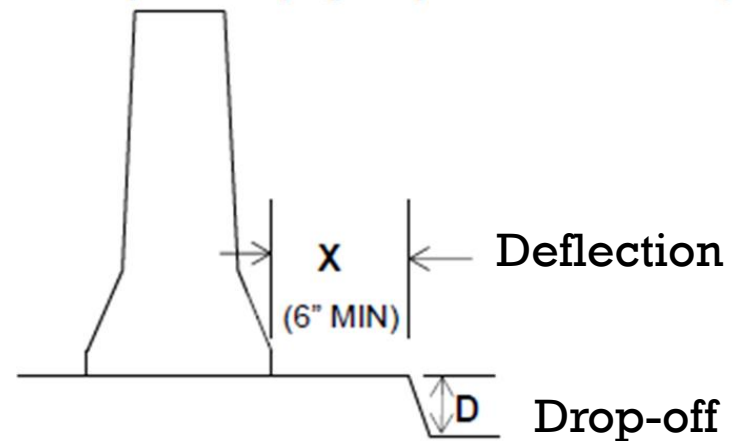
Drop-off Definition

- An elevation difference between:
 - Adjacent traveled lanes,
 - Traveled lane and an adjacent shoulder,
 - (Pavement patching not considered a drop-off condition, except when individual patching holes are left open > 24 hours)

Drop-off Definition (cont.)

- An elevation difference between:
 - Lane or shoulder and other lower surface (such as an excavation), or
 - Surface of a bridge deck and an exposed grid of rebars supported along its perimeter by structural concrete

“Illinois F-Shape” TCB (Highway Standard 704001)



Drop-off Between Traveled Lanes, Excluding Pavement Patching

- Table 1, Condition I - < 45 mph and ≥ 45 mph
- Quite similar to BDE Manual Figure 55-2.A

Drop-off Near the Edge of Traveled Way, 2 Lane-2Way

Table 2, Condition II
Drop-off Near the Edge of Traveled Way

Existing Road Type	Normal Posted Speed Limit, NPSL (mph)	Drop-off Depth, D (in.)	TCB is Warranted(2)	Use of TCB may be warranted, based on traffic exposure.(2)	Maximum Allowable Total Traffic (Both Directions)Without TCB (3)
2L2W	Up to 35	$12 \leq D \leq 18$		Yes(1)	3.02
2L2W	Up to 35	$18 < D \leq 24$		Yes(1)	2.39
2L2W	Up to 35	$24 < D \leq 36$		Yes(1)	2.08
2L2W	Up to 35	$D > 36$	Yes(1)		
2L2W	$35 < \text{NPSL} \leq 45$	$12 \leq D \leq 18$		Yes(1)	1.42
2L2W	$35 < \text{NPSL} \leq 40$	$18 < D \leq 24$		Yes(1)	1.12
2L2W	> 45	$D > 12$	Yes(1)		

(1) For urban/suburban locations, the designer should consider access needs and sight distance in making a final decision to use TCB.

(2) However, see above sections for long duration stationary operations on high speed roads with workers, and for worker protection where there is no means of escape.

(3) The product of Average Daily Traffic and duration, in calendar days, divided by 1,000,000 (ADT x Calendar Days/1,000,000). This is per each time that the TCB is installed or relocated.

Drop-off Near the Edge of Traveled Way, 4 Lane-2Way

Table 2, Condition II
Drop-off Near the Edge of Traveled Way

Existing Road Type	Normal Posted Speed Limit, NPSL (mph)	Drop-off Depth, D (in.)	TCB is Warranted(2)	Use of TCB may be warranted, based on traffic exposure.(2)	Maximum Allowable Total Traffic (Both Directions) Without TCB (3)
4L2W	Up to 35	$12 \leq D \leq 18$		Yes(1)	9.31
4L2W	Up to 35	$18 < D \leq 24$		Yes(1)	7.30
4L2W	Up to 35	$24 < D \leq 36$		Yes(1)	6.25
4L2W	Up to 35	> 36	Yes(1)		
4L2W	$35 < \text{NPSL} \leq 45$	$12 \leq D \leq 18$		Yes(1)	3.43
4L2W	$35 < \text{NPSL} \leq 40$	$18 < D \leq 24$		Yes(1)	2.94
4L2W	> 45	$D \geq 12$	Yes(1)		
All	> 45	$D < 12$	No (2)		
All	> 45	$D \geq 12$	Yes		

(1) For urban/suburban locations, the designer should consider access needs and sight distance in making a final decision to use TCB.

(2) However, see above sections for long duration stationary operations on high speed roads with workers, and for worker protection where there is no means of escape.

(3) The product of Average Daily Traffic and duration, in calendar days, divided by 1,000,000 (ADT x Calendar Days/1,000,000). This is per each time that the TCB is installed or relocated.

Risk Assessment –

Projects Let Prior to July 1, 2015

- Unpinned TCB 0”-24” , inclusive, from a drop-off shall have a risk assessment performed
 - *Exception from risk assessment: bridge decks and approach slabs*

Risk Assessment –

Projects Let After July 1, 2015

- ◉ During TMP development and Traffic Control Plan (TCP) in Phase I or Phase II
- ◉ Policy and risk assessment apply:
 - When TCB is 12-24” (inclusive) from edge of a drop-off
 - *Exception from risk assessment: bridge decks and approach slabs*

Risk Assessment

● Takes into consideration:

- Safety performance of unpinned TCB,
- Duration and length of the project,
- Deflection distance, and
- Traffic exposure (ADT, percentage of single unit and multiple unit trucks, etc.)

Spreadsheet for Guidance on Pinning, Risk Assessment Tool

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	S
1	SPREADSHEET FOR GUIDANCE ON PINNING TCB											Data entry		Route				
2	LOCATIONS WITH NORMAL POSTED SPEED LIMIT OF 55 MPH OR 65 MPH											Calculated value		Contract				
3	OR OTHER FREEWAY LOCATIONS											Primary Consideration		Project Phase	Phase III			
4	<u>THIS IS NOT TO BE USED FOR BRIDGE DECKS OR SIMILAR LOCATIONS</u>											Supporting Consideration						
5												Data entry warning	MESSAGE					
6																		
7																		
8	Safety Performance to Date of Existing Unpinned TCB (PHASE III ONLY)											Input/Output		Recommendations and Remarks				
9																		
10	Has the TCB installation been hit, knocking any TCB unit into the drop off?											Yes						
11	If "Yes", how many times?											1	Integer		RECOMMEND RETROFIT PINNING			
12	Has the TCB installation been hit, knocking any TCB unit into the drop off and resulting in injury to anyone?											Yes						
13	If "Yes", how many times?											0	Integer					
14																		
15	Predicted Safety Performance																	
16																		
17	How long has the TCB installation been in place? (PHASE III ONLY.)											30	Weeks					
18	How much longer must the TCB installation be used?											30	Weeks					
19	How long is the TCB installation?											5	Miles (Nearest 0.1)					
20	What is the total 2 way AADT on the highway?											35000	(Nearest 5000)					
21	What percentage of the traffic is passenger vehicles, PV? (Cars, pickups, minivans, SUVs)											60	0 to 100					
22	What is the offset from the back of the TCB to the drop off?											1.5	Nearest 0.5 ft.					
23																		
24	Projected additional, excess TCB failures if not pinned.											0.47	Predicted excess TCB failures from present to completion.					
25																		
26	Actual TCB failures											1			THRESHOLD GREATER THAN PREDICTED IF PINNED			
27																		
28	Other Site Considerations																	
29																		
30	What is the percentage of Multiple Unit trucks in the AADT?											35	Nearest percent		LARGE TRUCK VOLUME SUPPORTS RETROFIT PINNING			
31	What is the percentage of Single Unit (SU) trucks in the AADT?											5	Nearest percent					
32	What is the general alignment along the TCB installation?											Some curves, up to 2 degrees.						
33	What is the terrain along the installation?											Flat						
34	Does the TCB installation length include any entrance ramps?											No						
35	Does the TCB installation length include any exit ramps?											No						
36																		
37																		
38																		
39																		
40	Dated: 3/13/2014																	
41	Updated: 5/2/2014 Corrected calculation bug. Corrected formulae and conditional formatting for some of the supporting considerations.																	
42	6/25/2014 Changed cell formatting for legibility in black and white printing.																	
43	8/7/2014 Account for application in Phase I, Phase II or Other.																	
44	1/9/2015 Corrected reference to project phases. Added checking for data appropriate to project phases.																	
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Risk Assessment Processing

- ◉ Submitted to and approved by BSE
- ◉ Exceptions to the policy requested through BSE

Deflection Distance Definition

- The distance that a barrier system moves laterally when impacted by a vehicle

Temporary Concrete Barrier (TCB)

- ① Anchoring
- ① Deflection to Drop-off
- ① Pinning

TCB Anchoring

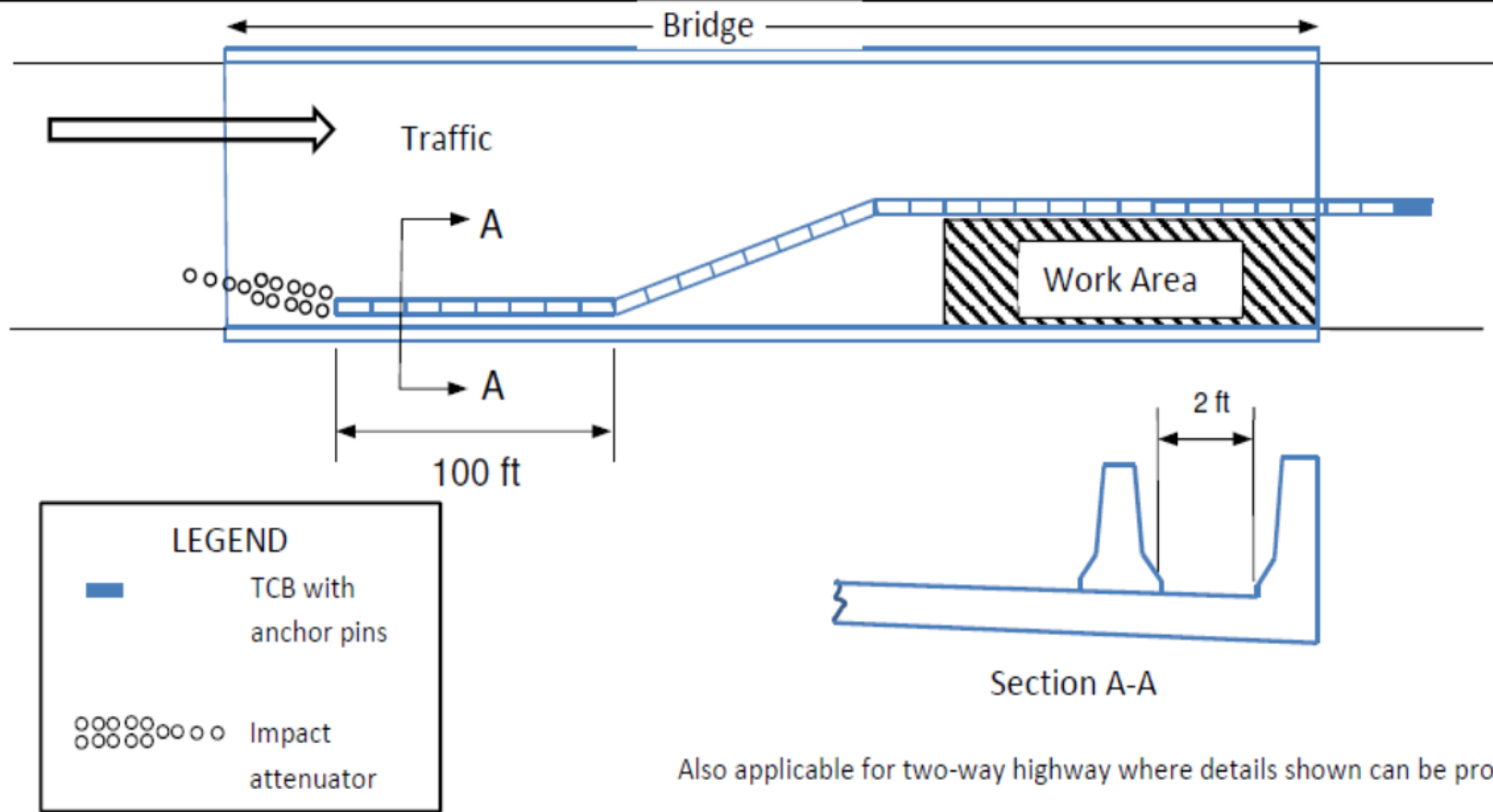
- A TCB is “anchored” if:
 - All six anchor pins are installed in both the first and last segments of a run, and
 - Connecting pins are installed joining adjacent TCB's

Alternative Anchoring of TCB

- When not feasible or desirable at one or both ends (e.g., new pavement, bridge approach slabs, or bridge decks)
 - Figure 2 or Figure 3 may be used in lieu of providing anchor pins
 - Site-specific structural details provided by the BBS and approved by the BSE may be applied
 - A water-filled, non-redirective impact attenuator may be used*

*Must meet several conditions

“Anchoring” Adjacent to Concrete Bridge Parapet or Concrete Median Barrier

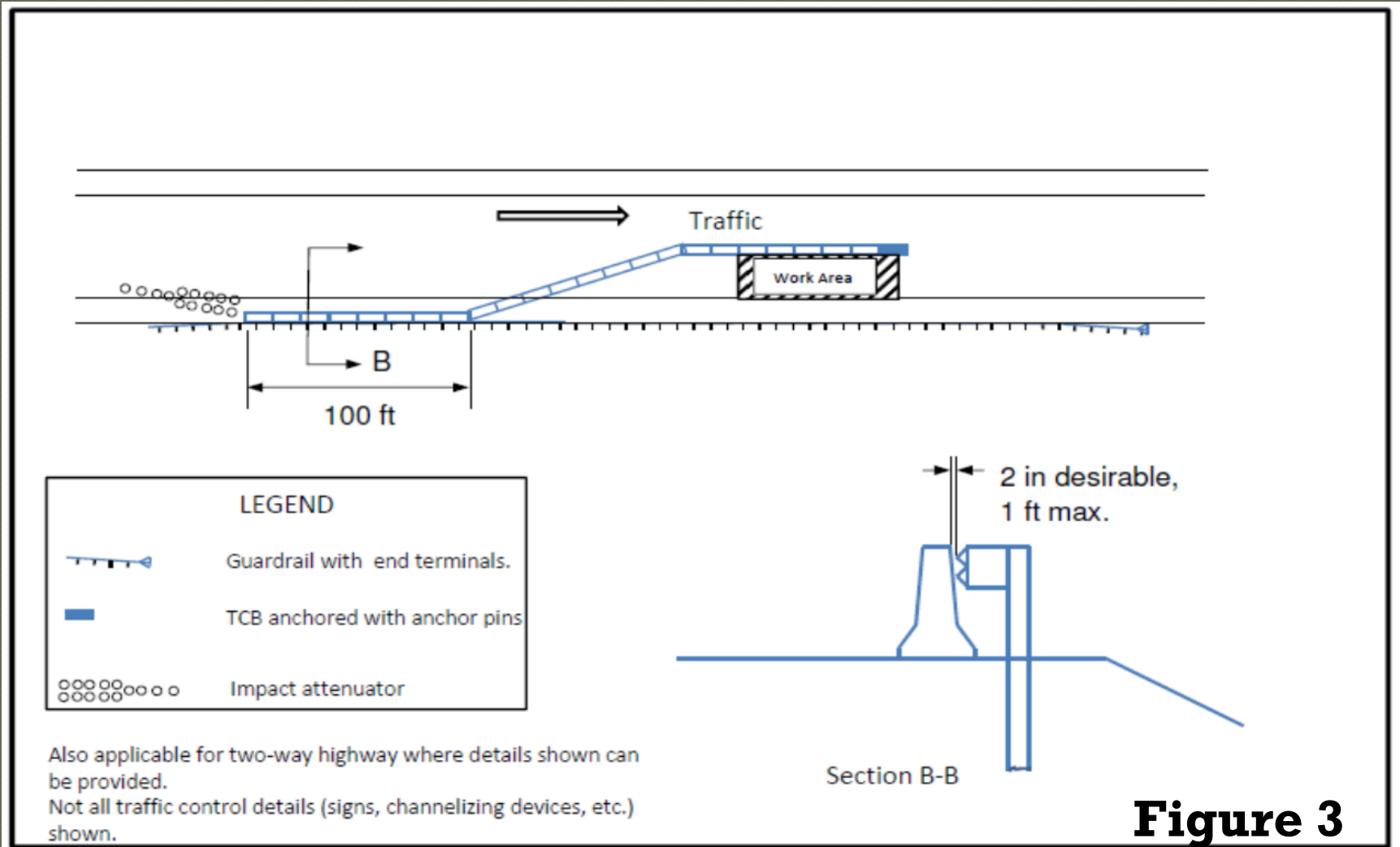


Also applicable for two-way highway where details shown can be provided.

Not all traffic control details (signs, channelizing devices, etc.) shown.

Figure 2

“Anchoring” Adjacent to Steel Plate Beam Guardrail



Bridge Deck Anchoring

- In no case shall holes for anchor pins be placed in bridge decks or approach slabs (without the concurrence of BSE and BBS).
- Order of preference for alternative options:
 1. Anchoring using Figure 2 or Figure 3
 2. Anchoring using special details by the BBS
 3. Installing a water-filled, non-redirective impact attenuator*

*Must meet several conditions

Pinned or Freestanding TCB

- When it has been determined that TCB is required and anchoring has been addressed
- Potential need for pinning must be determined

Pinning - Defined

- Each anchor pin is installed in the 1 ¼ in diameter hole of the barrier, along the traffic side only, and
- Connecting pins are installed in the connecting loops joining adjacent TCBs

Bridge Decks - Pinning

- On a bridge deck or approach slab, a TCB is “pinned” if:
 - Movement restrained by BBS detail:
 - Short pins into an existing deck, or
 - A retainer plate and wood block at the edge of a new deck

(See BBS Base Sheet R-27, “Temporary Concrete Barrier for Stage Construction”)

Pinning Required (other than bridge deck and approach slab)

- Where any fixed object within a rectangle 24" behind base of TCB and within 78" above the bottom of TCB
- Where drop-off > 2 inches located 6-12" (inclusive) from the back of the TCB

TCB Pinned on Traffic Side by Force Account



Pinning May Be Required

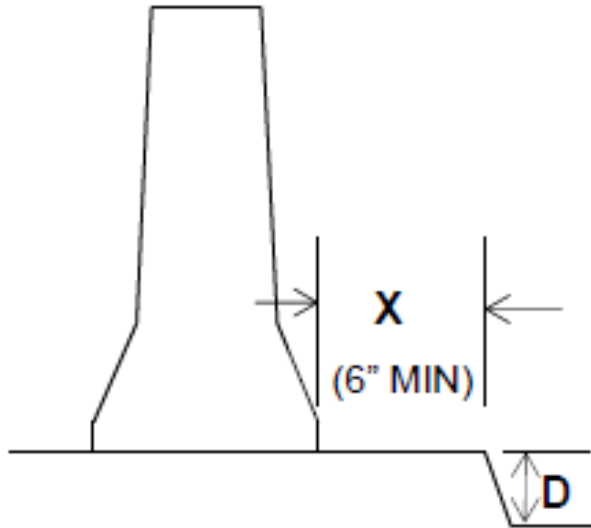
- Back of the TCB to edge of drop-off < 37”
- Locations where engineering judgment identifies risks similar to the edge of bridge decks

TCB Not Pinned



Pinning Guide

“Illinois F-Shape” TCB (Highway Standard 704001)



D (Drop-off)	X (Distance Behind TCB)				
	$X < 6$ in.	$6 \text{ in.} \leq X \leq 12$ in.	$12 \text{ in.} \leq X \leq 24$ in.	$24 \text{ in.} \leq X < 37$ in.	$37 \text{ in.} \leq X$
> 2 in, except as below	Not Allowed	Pinned	Subject to Results of Risk Assessment	Not Pinned	Not Pinned
Edge of Bridge Deck or similar	Not Allowed	Pinned	Pinned	Pinned	Not Pinned

Transitions

- ◉ Where pinned TCB connects to freestanding TCB:
 - First TCB segment beyond the pinned unit - anchor pins in the first and last hole of the traffic side;
 - Next TCB unit - anchor pin in the middle hole of the traffic side, and;
 - Next TCB segment(s) - freestanding

Minimum Pavement for Pinning TCB

- Two inch (2") thickness of compacted Hot Mix Asphalt (HMA) provides a suitable bearing surface for the TCB
(Existing sound HMA pavements, shoulders, or bases ≥ 2 " thick adequate for pinning TCB)

TCB Used for Separating Opposing Traffic

- ◉ Design deflection is 24''
- ◉ If roadway width in one direction $< 12'$, deflection may not be accommodated, and an engineering study should determine whether to provide:
 - additional paved width,
 - pinning of TCB,
 - use of other TLTB, or
 - use of channelizing devices

Tapers and Median Crossovers

- TCB alignment tapers toward the traveled way
- TCB used to separate and shift traffic at a median crossover
- Not desirable to use TCB in a pinned configuration
- Provide at least 37", desirably more, clear paved area behind TCB for deflection

Exceptions from Pinning Due to Field Conditions

- If, due to field conditions, pinning is not fully compliant with the contract requirements
 - Reasons and locations where pinning is not fully achieved shall be documented by the Resident Engineer in the project diary
(Partially embedded pins should not be used and short pins should not be installed.)

Measurement & Payment

- **Anchor pins (except for the six (6) anchor pins at each end of an installation):**
 - Measured for payment as each, per anchor pin installed
 - Paid for at the contract unit price per each for **PINNING TEMPORARY CONCRETE BARRIER**





Questions ?!?



Thank you!

For Additional Information contact:

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