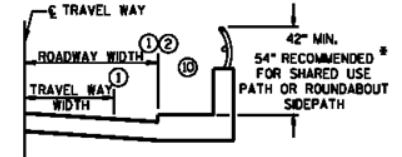
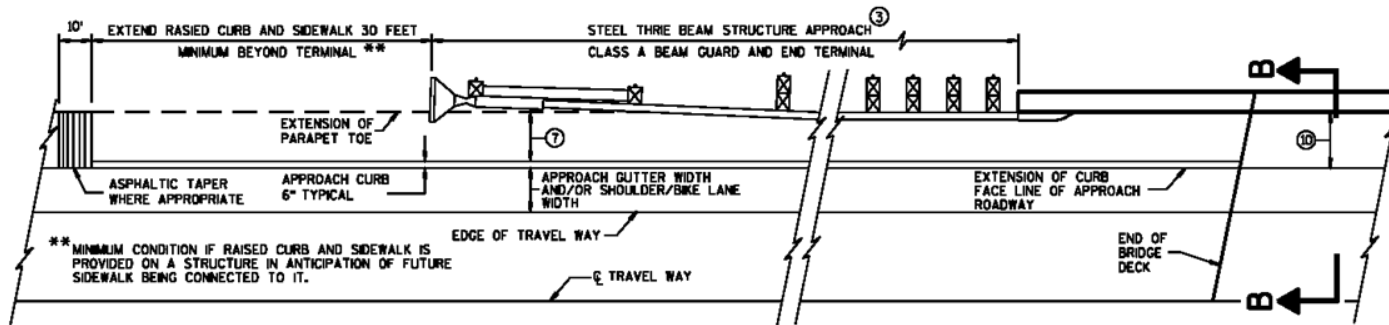


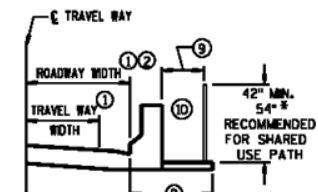
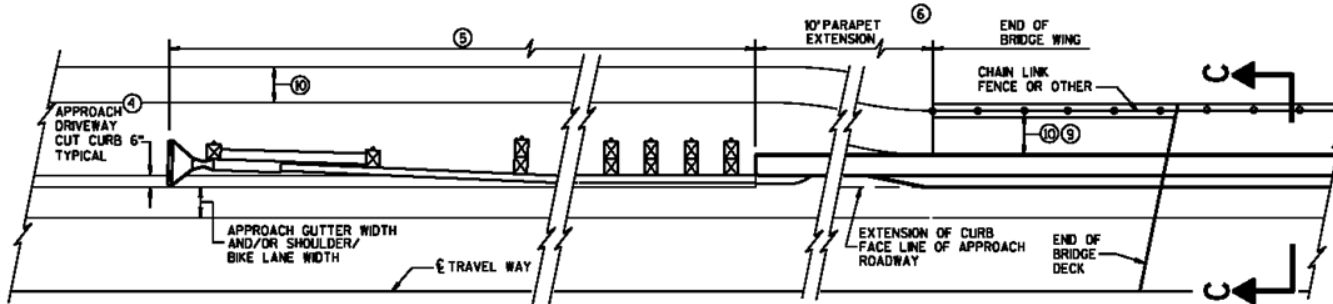
SECTION A-A

**PLAN VIEW**  
**BARRIER ON OUTSIDE EDGE OF ROADWAY**  
**(NO SIDEWALK, SHARED USE PATH, OR ROUNDABOUT SIDEPATH)**



SECTION B-B

**PLAN VIEW**  
**BARRIER ON OUTSIDE EDGE OF SIDEWALK, SHARED USE PATH, OR ROUNDABOUT SIDEPATH -**  
**CURB ON OUTSIDE EDGE OF ROADWAY**



SECTION C-C

\* FOR CHAIN LINK FENCE, USE 5-FOOT MIN.

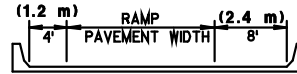
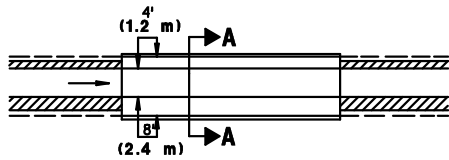
**PLAN VIEW**  
**BARRIER ON OUTSIDE EDGE OF ROADWAY WITH SEPARATED SIDEWALK,**  
**SHARED USE PATH, OR ROUNDABOUT SIDEPATH**

See notes on p. 2 of this Attachment

## Notes

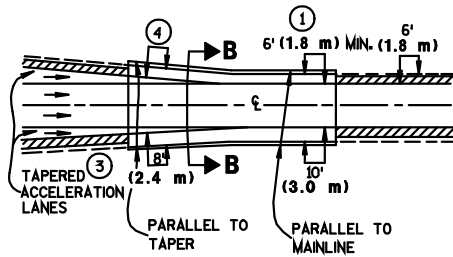
- ① Refer to FDM 11-35-1.2 for guidance on “Clear Roadway Width of Bridges”
- ② Total width of approach pavement. Roadway width includes gutter-pan, shoulder width or both.  
  
Use roadside barrier / end treatment if raised curb sidewalk is provided on a structure in anticipation of future sidewalk being connected to it. Extend the raised curb sidewalk at least 30 feet beyond the end of the barrier terminal. Terminate with a temporary asphaltic height transition ramp where appropriate. (See additional guidance in text in [FDM 11-35-1.6.1](#), "sidewalks").
- ③ Urbanized areas with curb and gutter shall have a flat driveway cut type Curb 100 feet in advance of the energy absorbing terminal and continue to the third post, (see [FDM 11-45-30.4.1.6](#), Curb and Gutter near EAT), transitional and rural areas may not have curb & gutter.
- ④ Barrier wall end protection is required. Use steel thrie beam structure Approach, Class A beam guard with end terminal or crash cushion.
- ⑤ If sidewalk/shared-use path/roundabout side path is behind the parapet
- ⑥ If a roadside barrier / end treatment is provided on the outside edge of a sidewalk/shared-use path/roundabout side path, then the sidewalk/shared-use path/roundabout side path may veer away from the back of the curb to create a terrace once it is past the terminal or crash cushion.
- ⑦ Distance from parapet toe to outside edge of sidewalk/shared-use path/roundabout side path  
  
Sidewalk = 6-foot lower minimum if distance ⑦  $\leq$  11 feet.  
⑧ Sidewalk/roundabout side path = 10-foot lower minimum if distance ⑦  $>$  11 feet (to allow bridge inspection Truck on sidewalk/roundabout side path.  
Shared use path = 12 foot typical (required width = width of shared-use path + 2 feet).
- ⑨ Sidewalk, shared-use path or roundabout side path

### 4-LANE DIVIDED HIGHWAY STRUCTURE WIDTHS

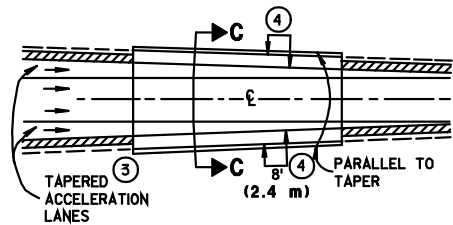


SECTION A-A

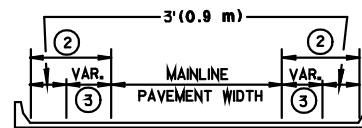
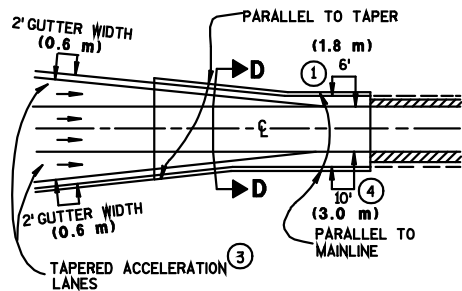
#### STANDARD RAMP STRUCTURE



SECTION B-B



SECTION C-C



SECTION D-D

NOTE: CONTINUOUS APPROACH CURB

#### STRUCTURES WITH ACCELERATION LANES

(LEFT OR RIGHT RAMP ENTRANCES)

#### NOTES:

TAPERS AND LANES ARE SHOWN OPPOSITE EACH OTHER FOR PICTORIAL PURPOSES.

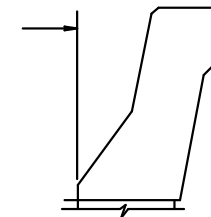
TOTAL STRUCTURE WIDTH IS A COMBINATION OF MAINLINE AND RAMP PAVEMENT WIDTHS PLUS MAINLINE OR RAMP SHOULDER WIDTHS. AN EXCEPTION IS THE WIDTH ASSOCIATED WITH AN APPROACHING CONTINUOUS CURB (SEE APPLICABLE DRAWING).

DASHED LINE INDICATES EDGE OF SHOULDER.

SHADOWED AREA BETWEEN EDGE OF APPROACH PAVEMENT AND EDGE OF SHOULDER REPRESENTS PAVED SHOULDER.

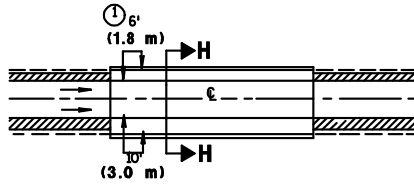
THE FACE OF THE STRUCTURE CURB SHALL BE A STRAIGHT LINE CONTINUATION OF THE SHOULDER LINE EXCEPT AS INDICATED.

- ① USE 10' (3.0 m) WHERE MAINLINE MEDIAN SHOULDER WIDTH IS 10' (3.0 m).
- ② EQUAL TO OR GREATER THAN APPROPRIATE MAINLINE ROAD SHOULDER WIDTH.
- ③ RAMP PAVEMENT TAPER WIDTH.
- ④ EQUAL TO THE APPROPRIATE DIRECTIONAL ROADWAY SHOULDER WIDTH.



POINT OF MEASUREMENT

## 4-LANE DIVIDED HIGHWAY STRUCTURE WIDTHS



**STANDARD "MAINLINE OVERPASS" STRUCTURE**  
 DIVIDED HIGHWAY (FOR DIVIDED HIGHWAYS WITH A MEDIAN WIDTH GREATER THAN 30'(9.0 m) PLUS MEDIAN SHOULDER WIDTHS)



**SECTION H-H**

**NOTES:**

TAPERS OR LANES ARE SHOWN OPPOSITE EACH OTHER FOR PICTORIAL PURPOSES.

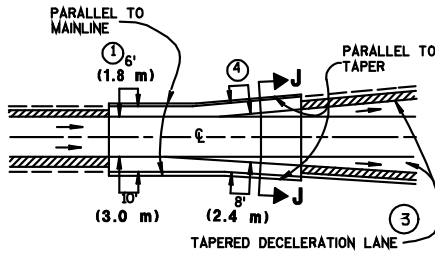
TOTAL STRUCTURE WIDTH IS A COMBINATION OF MAINLINE AND RAMP PAVEMENT WIDTHS PLUS FULL MAINLINE OR RAMP SHOULDER WIDTHS. AN EXCEPTION IS THE WIDTH ASSOCIATED WITH AN APPROACHING CONTINUOUS CURB (SEE APPLICABLE DRAWING).

DASHED LINE INDICATES EDGE OF SHOULDER.

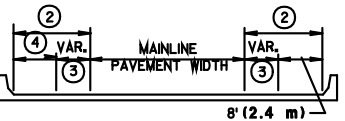
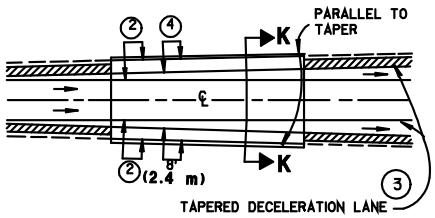
SHADOWED AREA BETWEEN EDGE OF APPROACH PAVEMENT AND EDGE OF SHOULDER REPRESENTS PAVED SHOULDER.

THE FACE OF THE STRUCTURE CURB SHALL BE A STRAIGHT LINE CONTINUATION OF THE SHOULDER LINE EXCEPT AS INDICATED.

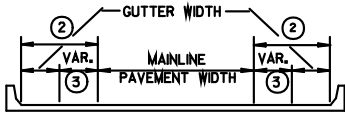
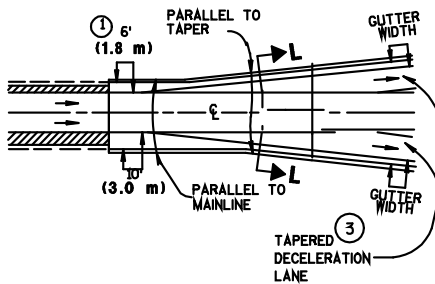
- ① USE 10'(3.0 m) WHERE MAINLINE MEDIAN SHOULDER WIDTH IS 10'(3.0 m)
- ② EQUAL TO OR GREATER THAN APPROPRIATE MAINLINE ROAD SHOULDER WIDTH.
- ③ RAMP PAVEMENT TAPER WIDTH.
- ④ EQUAL TO THE APPROPRIATE DIRECTIONAL ROADWAY SHOULDER WIDTH.



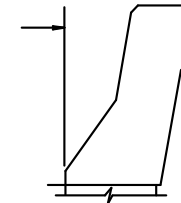
**SECTION J-J**



**SECTION K-K**



**SECTION L-L**



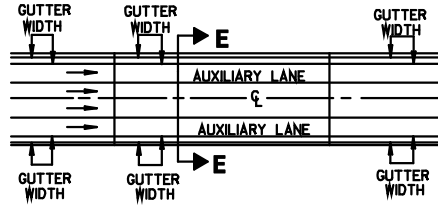
**POINT OF MEASUREMENT**

NOTE: CONTINUOUS APPROACH CURB

**STRUCTURES WITH DECELERATION LANES**

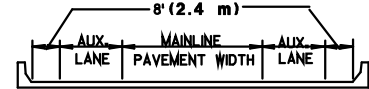
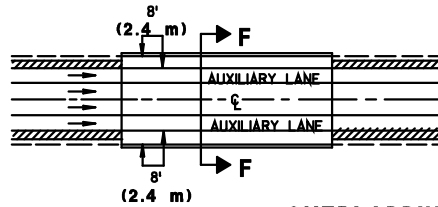
(LEFT OR RIGHT RAMP EXITS)

## 2, 4 AND 6 - LANE DIVIDED HIGHWAY STRUCTURE WIDTHS



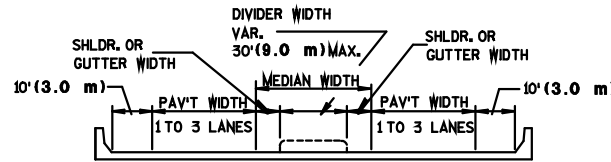
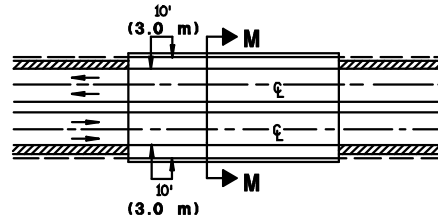
SECTION E-E

NOTE: CONTINUOUS APPROACH CURB



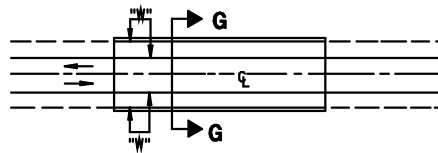
SECTION F-F

OVERLAPPING ACCELERATION-DECELERATION LANE (AUXILIARY LANE) STRUCTURE



SECTION M-M

COMBINED DUAL - LANE STRUCTURE



SECTION G-G

2 - LANE STRUCTURE WIDTHS

### NOTES:

TAPERS OR LANES ARE SHOWN OPPOSITE EACH OTHER FOR PICTORIAL PURPOSES.

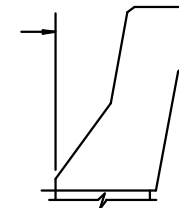
TOTAL STRUCTURE WIDTH IS A COMBINATION OF MAINLINE AND RAMP PAVEMENT WIDTHS PLUS FULL MAINLINE OR RAMP SHOULDER WIDTHS. AN EXCEPTION IS THE WIDTH ASSOCIATED WITH AN APPROACHING CONTINUOUS CURB (SEE APPLICABLE DRAWING).

DASHED LINE INDICATES EDGE OF SHOULDER.

SHADOWED AREA BETWEEN EDGE OF APPROACH PAVEMENT AND EDGE OF SHOULDER REPRESENTS PAVED SHOULDER.

THE FACE OF THE STRUCTURE CURB SHALL BE A STRAIGHT LINE CONTINUATION OF THE SHOULDER LINE EXCEPT AS INDICATED.

DESIGN CLASS	"W"
A 1	6' (1.8 m)
A 2	10' (3.0 m)
2-LANE INTERCHANGE STRUCTURES OVER-PASSING DESIGN CLASS A 2 HIGHWAYS	8' (2.4 m) MIN.

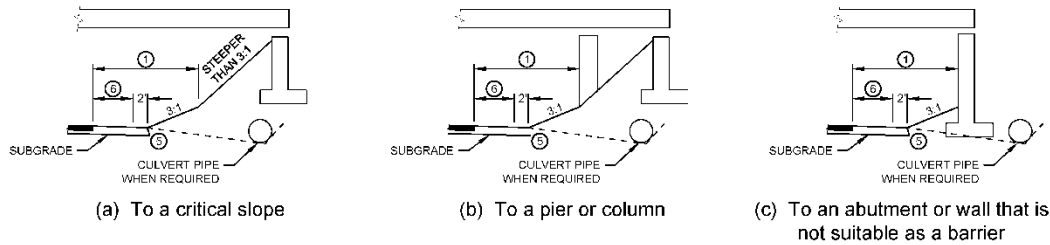


POINT OF MEASUREMENT

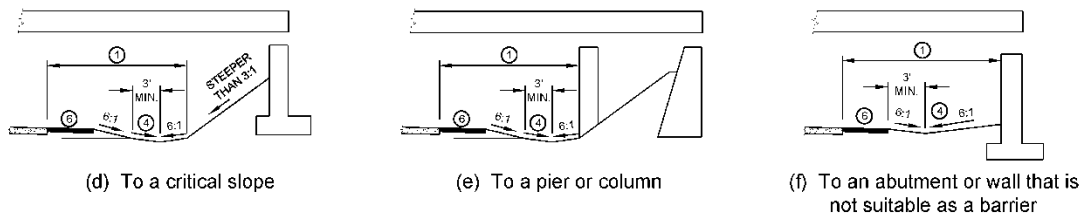
NOTE: FOR COUNTY TRUNK AND TOWN ROAD STRUCTURES SEE APPROPRIATE STANDARDS FOR STRUCTURE WIDTHS.

## LATERAL UNDERCLEARANCES TO STRUCTURE FOR BRIDGES ON RURAL HIGHWAYS, EXPRESSWAYS, AND FREEWAYS, INCLUDING URBAN ROADWAYS WITH RURAL CROSS-SECTIONS

### WITHOUT TRAFFIC BARRIER (DESIRABLE) PREFERRED SECTION \*

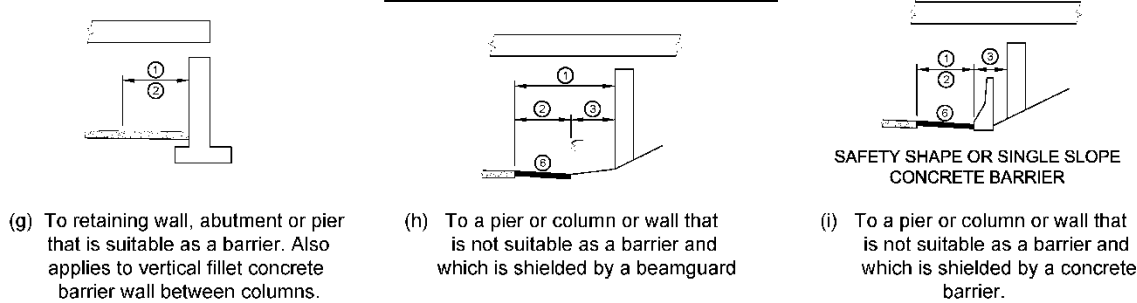


### WITHOUT TRAFFIC BARRIER (DESIRABLE) ALTERNATE SECTION \*

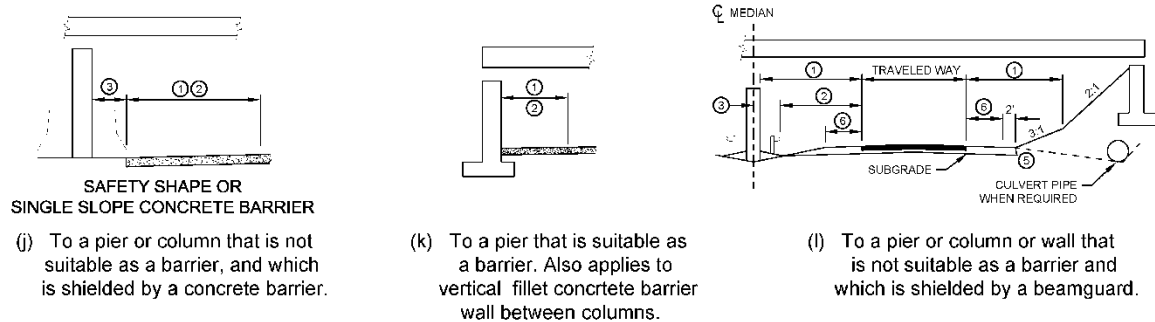


\* Consider using the "Alternate Section" on the high side of superelevated sections to help reduce the potential for snowmelt water to drain across the roadway.

### WITH TRAFFIC BARRIER (MINIMUM)



### MEDIAN SIDE EXAMPLE



### LEGEND

①	Lateral underclearance to structure as defined in text.
②	Lateral distance from edge of thru lane to beam guard face or to concrete barrier face at the toe.
③	Lateral distance from beamguard face or from concrete barrier face at the toe to face of fixed object (abutment, column, pier, or wall).
④	Ditch dimensions are determined by drainage requirements. Alternate traversable ditch cross-sections may be used. See FDM 11-15, Attachment 1.11
⑤	Perforated pipe underdrain may be required when free draining native soils are not present.
⑥	Shoulder width per FDM 11-15, Attachment 1.1 - 1.5 and 1.16 - 1.18

**<sup>A</sup> Lateral Underclearance to structure for RURAL HIGHWAYS, EXPRESSWAYS, and FREEWAYS, including URBAN ROADWAYS with rural cross-sections**

<sup>B</sup> Barrier type used	Distance	Mainline		Ramp	
		Left	Right	Left	Right
None (a-f)	①	Lower MIN. = The GREATEST of <sup>C</sup> Clear Zone Width OR <sup>D</sup> Lateral Clearance OR 4 feet	Lower MIN. = The GREATEST of <sup>C</sup> Clear Zone Width OR <sup>D</sup> Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi-lane divided	Lower MIN. = The GREATEST of <sup>C</sup> Clear Zone Width OR <sup>D</sup> Lateral Clearance OR 2 feet	Lower MIN. = The GREATEST of <sup>C</sup> Clear Zone Width OR <sup>D</sup> Lateral Clearance OR 4 feet
Beam guard (h, l)	①	= Dist. ② + Dist. ③	= Dist. ② + Dist. ③, Not < 6 feet for 2-lane highways Not < 10 feet for multi-lane divided	= Dist. ② + Dist. ③	= Dist. ② + Dist. ③
	②	Lower MIN. = <sup>D</sup> Lateral Clearance			
	③ Vehicle protection	Lower MIN. = 4'-6"			
<sup>E</sup> Safety shape concrete barrier; Single slope concrete barrier (i, j)	①	= Dist. ②	= Dist. ②	= Dist. ②	= Dist. ②
	②	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi-lane divided	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 2 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet
	③ Vehicle protection	{Safety-shape concrete barrier with height >=32-inch } Lower MIN. = 2'-6" {Single-slope concrete barrier with height >=32-inch } Lower MIN. = Working width (see FDM 11-45-30)			
	③ Structure protection	{Either safety-shape or single-slope concrete barrier with height >=42-inch and <54-inch } Lower MIN. = 10'-0" {Either safety-shape or single-slope concrete barrier with height >=54-inch } Lower MIN. = 2'-6"			
<sup>E</sup> Vertical wall concrete barrier (g, k)	①	= Dist. ②	= Dist. ②	= Dist. ②	= Dist. ②
	②	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi-lane divided	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 2 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet
	③ Vehicle protection	Existing structures: {vertical fillet concrete barrier wall between columns with height >=51-inch} MIN. = MAX. = 0"			
<sup>E</sup> solid shaft style piers; full retaining abutments (g, k)	①	= Dist. ②	= Dist. ②	= Dist. ②	= Dist. ②
	②	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi-lane divided	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 2 feet	Lower MIN. = The GREATER of <sup>D</sup> Lateral Clearance OR 4 feet

Letters in parentheses (a) thru (l) refer to examples shown on page 1 of this attachment; distance numbers ① thru ③ refer to the legend on page 1.

**Notes:**

A Lateral Underclearance to Structure is non-controlling criteria.

Lateral Underclearance to Structures requirements to the right applies to both sides of undivided bi-directional roadways, the right side of 1-way streets and ramps, and the outside lanes of divided highways. Lateral Underclearance to Structures requirements to the left applies to the left side of 1-way streets and ramps, and the median side of divided highways.

B See text under section "Barrier Considerations" for discussion of and criteria for Vehicle Protection Barriers and Structure Protection Barriers.

**For new and replacement structures,** it is desirable to construct new and replacement structures so that a barrier is not needed on the **right (outside)**. Explain in the DSR if barrier is required on the **right (outside)**.

If barrier is used, then provide appropriate length of need, transitions and terminals in advance of and beyond the structure.

For new and replacement structures it may be necessary to provide solid shaft style piers or full retaining abutments at locations where it is not possible to provide a lower minimum distance ③. These need to meet structural load requirements, and to be geometrically, structurally, and texturally suitable as a barrier wall.

**For existing structures,** it is most important to provide the full approach traveled way and shoulder width through the structure. Provide the maximum distance ③ possible without encroaching onto the required shoulder width and lateral clearance.

C Clear Zone Width per Table "Clear Zone Distance Table (In Feet from Edge of Traveled Way)" on [FDM 11-15 Attachment 1.9](#).

For the "PREFERRED SECTION", use the maximum distances shown in the "BACKSLOPES" columns for a 1V:3H slope (for example, with a design speed of 60 mph, ADT = 6500, and slope = 3H: 1V, the required distance would be 22-feet).

For the "ALTERNATE SECTION", use 30-feet or the maximum distances shown in the 1V:6H "FORESLOPES" column, whichever is less (for example, with a design speed of 60 mph, ADT = 6500, the required distance would be 30-feet even though the table distance is 32-feet).

If there is an auxiliary lane check the clear zone requirements for the auxiliary lane based on its traffic volume and speed conditions. Use the greater of the through traffic lane or auxiliary lane requirement.

D Lateral Clearance requirements per [FDM 11-15 Table 1.2](#) "Required Lateral Clearance from Edge of Driving Lane for Rural Highways".

E Use concrete barrier of the same height as on the approach roadway, unless the above table requires a greater height.

For one-way traffic, vehicle protection concrete barrier of the required height and shape is to begin 25 feet in advance of the upstream substructure unit and to extend 30 feet, or to the end of the downstream substructure unit, whichever is longer.

For two-way traffic, vehicle protection concrete barrier of the required height and shape is to begin 25 feet in advance of the upstream substructure unit and to extend 25 feet beyond the end of the downstream substructure unit.

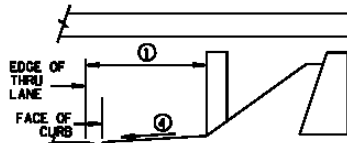
Confer and coordinate with the Bureau of Structures (BOS) and the Bureau of Project Development (BPD) on the required length of structure protection concrete barrier.

Connect other appropriate barrier types to the ends of the concrete barrier and provide appropriate lengths of need, transitions and terminals.

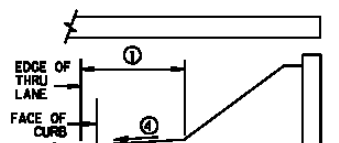
Use a lower minimum transition length of 15 feet to go from/to safety-shape (or single-slope) concrete barrier to/from vertical face concrete barrier. Use an 8:1 taper ratio for vertical height transitions.

## LATERAL UNDERCLEARANCES TO STRUCTURES FOR URBAN STREETS

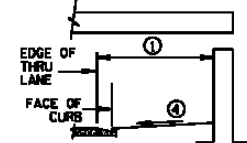
### OUTSIDE CLEARANCES



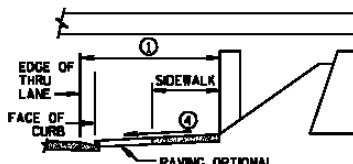
(a) To column



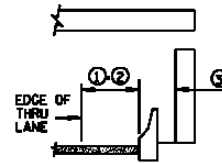
(b) To slope steeper than 3:1



(d) To retaining wall, abutment, or pier that is not suitable as barrier



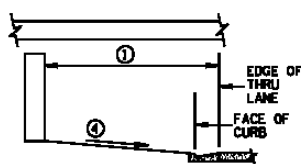
(c) With sidewalk  
PLACE SIDEWALK AS FAR TO THE OUTSIDE AS POSSIBLE



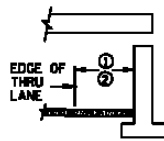
SAFETY SHAPE OR SINGLE SLOPE

(e) To a pier or column or wall that is not suitable as a barrier and which is shielded by a concrete barrier

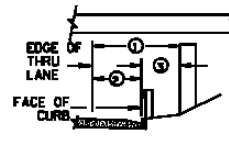
### MEDIAN CLEARANCES



(h) To column

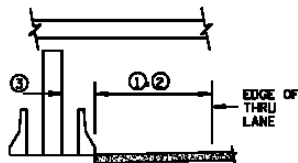


(f) To retaining wall, abutment, or pier that is suitable as barrier. Also applies to vertical fillet concrete barrier wall between columns



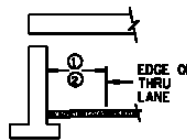
(g) To a pier or column or wall that is not suitable as a barrier and which is shielded by a beamguard

### MEDIAN CLEARANCES

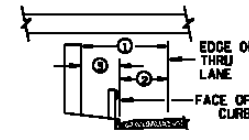


SAFETY SHAPE OR SINGLE SLOPE

(i) To a pier or column that is not suitable as a barrier and which is shielded by a concrete barrier



(j) To a pier that is suitable as a barrier. Also applies to vertical fillet concrete barrier wall between columns



(k) To a pier or column that is not suitable as a barrier and which is shielded by a beamguard

### Legend:

①	Lateral Underclearance to structure as defined in text
②	Lateral distance from edge of thru lane to beam guard face or to concrete barrier face at the toe
③	Lateral distance from beam guard face or from concrete barrier face at the toe to face of fixed object (abutment, column, pier, or wall)
④	Cross-slopes: see <a href="#">FDM 11-20-1</a> and <a href="#">FDM 11-46-5</a>



**A Lateral Underclearance to Structure for URBAN STREETS**

B Barrier type used	Distance		Arterial		Non-Arterial
			Left	Right	Left & Right
None (a-d, h)	①	C If Clear Zone is provided	Lower MIN. = The GREATEST of C Clear Zone OR 4 feet OR offset from edge of thru lane to face of curb +2 feet	Lower MIN. = The GREATEST of C Clear Zone OR 6 feet OR offset from edge of thru lane to face of curb +4 feet	Lower MIN. = The GREATEST of C Clear Zone OR 4 feet OR offset from edge of thru lane to face of curb +2 feet
			Upper MIN. = The GREATEST of C Clear Zone OR 10 feet OR offset from edge of thru lane to face of curb +4 feet	Upper MIN. = The GREATEST of C Clear Zone OR 12 feet OR offset from edge of thru lane to face of curb +4 feet	Upper MIN. = The GREATEST of C Clear Zone OR 10 feet OR offset from edge of thru lane to face of curb +4 feet
		C If Clear Zone isn't provided	Lower MIN. = the GREATER of 4 feet OR offset from edge of thru lane to face of curb +2 feet	Lower MIN. = the GREATER of 6 feet OR offset from edge of thru lane to face of curb +4 feet	Lower MIN. = the GREATER of 4 feet OR offset from edge of thru lane to face of curb +2 feet
			Upper MIN. = The GREATER of 10 feet OR offset from edge of thru lane to face of curb +4 feet	Upper MIN. = The GREATER of 12 feet OR offset from edge of thru lane to face of curb +4 feet	Upper MIN. = The GREATER of 10 feet OR offset from edge of thru lane to face of curb +4 feet
Beam guard (g, k)	①		= Dist. ② + Dist. ③	= Dist. ② + Dist. ③, but not < 6 feet	= Dist. ② + Dist. ③
	②		Lower MIN. = D Lateral Clearance		
	③	Vehicle protection	MIN. = 4'-6"		
E Safety shape concrete barrier; Single slope concrete barrier (e, i)	①		= Dist. ②	= Dist. ②	= Dist. ②
	②		Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 6 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet
	③	Vehicle protection	{Safety-shape concrete barrier with height >=32-inch } Lower MIN. = 2'-6" {Single-slope concrete barrier with height >=32-inch } Lower MIN. = Working width (see FDM 11-45-30)		
		Structure protection	{Either safety-shape or single-slope concrete barrier with height >=42-inch and <54-inch } Lower MIN. = 10'-0" {Either safety-shape or single-slope concrete barrier with height >=54-inch} Lower MIN. = 2'6"		
E Vertical wall concrete barrier (f, j)	①		=Dist. ②	=Dist. ②	=Dist. ②
	②		Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 6 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet
	③	Vehicle protection	Existing structures: {vertical fillet concrete barrier wall between columns with height >=51-inch} MIN. = MAX. = 0"		
E Solid shaft style piers; full retaining abutments (f, j)	①		=Dist. ②	=Dist. ②	=Dist. ②
	②		Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 6 feet	Lower MIN. = The GREATER of D Lateral Clearance OR 4 feet

Letters in parentheses (a) thru (k) refer to examples shown on page 1 of this attachment; distance numbers ① thru ③ refer to the legend on page 1.

**Notes:**

A Lateral underclearance to Structure is non-controlling criteria.

Lateral underclearance to structures requirements to the right applies to both sides of undivided bi-directional roadways, the right side of 1-way streets and ramps, and the outside lanes of divided highways. Lateral underclearance to structures requirements to the left applies to the left side of 1-way streets and ramps, and the median side of divided highways.

B See text under section "Barrier Considerations" for discussion of and criteria for Vehicle Protection Barriers and Structure Protection Barriers.

**For new and replacement structures,** it is preferred to provide sufficient lateral underclearance so that a barrier is not needed. If barrier is used, then provide appropriate length of need, transitions, and terminals in advance of and beyond the structure.

It may be necessary to provide solid shaft style piers or full retaining abutments at locations where it is not possible to provide a lower minimum distance ③. These need to meet structural load requirements, and to be geometrically, structurally, and texturally suitable as a barrier wall.

**For existing structures,** it is most important to provide the full approach traveled way and shoulder width (or gutter width) through the structure. Provide the maximum distance ③ possible without encroaching onto the required shoulder width (or gutter width) and Lateral clearance.

C Clear Zone Width per FDM 11-15 Attachment 1.9. This clear distance may not be practical in urban areas where right-of-way costs are higher and traffic conditions are different than in rural areas. If there is an auxiliary lane check the clear zone requirements for the auxiliary lane based on its traffic volume and speed conditions. Use the greater of the through traffic lane or auxiliary lane requirement.

See FDM 11-20 Table 1.6 for clear zone requirements on urban roadways.

D See FDM 11-20 Table 1.5 for Lateral Clearance requirements

E Use concrete barrier of the same height as on the approach roadway, unless the above table requires a greater height.

For one-way traffic, vehicle protection concrete barrier of the required height and shape is to begin 25 feet in advance of the upstream substructure unit and to extend 30 feet, or to the end of the downstream substructure unit, whichever is longer.

For two-way traffic, vehicle protection concrete barrier of the required height and shape is to begin 25 feet in advance of the upstream substructure unit and to extend 25 feet beyond the end of the downstream substructure unit.

Confer and coordinate with the Bureau of Structures (BOS) and the Bureau of Project Development (BPD) on the required length of structure protection concrete barrier.

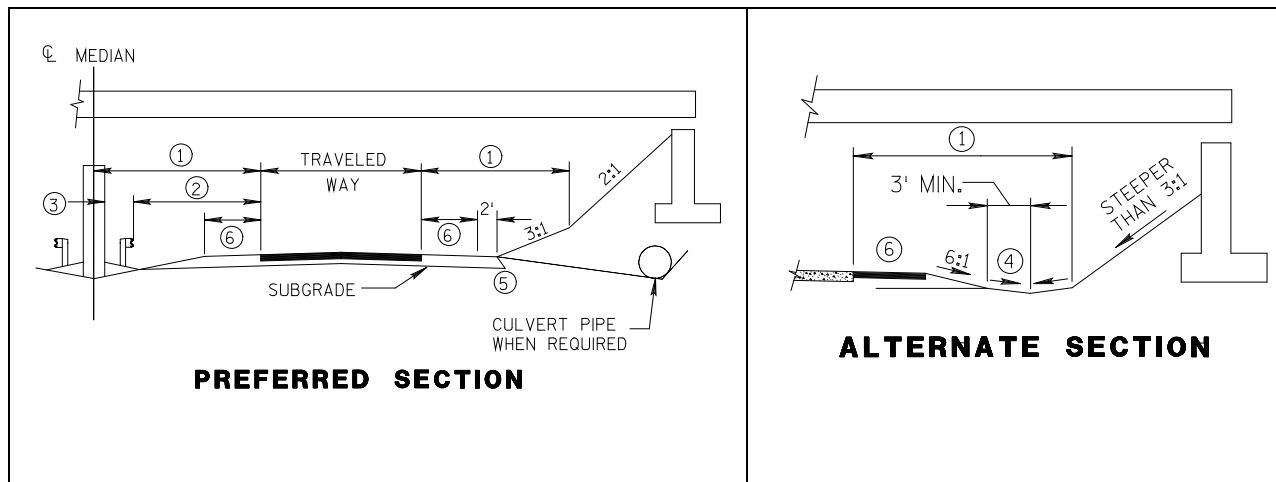
Connect other appropriate barrier types to the ends of the concrete barrier and provide appropriate lengths of need, transitions and terminals.

Use a lower minimum transition length of 15 feet to go from/to safety-shape (or single-slope) concrete barrier to/from vertical face concrete barrier. Use an 8:1 taper ratio for vertical height transitions.

**Example 1 – Replacement Bridge over 4-lane rural freeway**

**Given**

- 4-lane rural freeway
- Design year AADT = 25,000
- Design speed = 70 MPH;
- Tangent alignment;
- Lane width = 12 feet;
- Shoulder width = 10-ft RT; 6-ft LT
- Median width = 60 feet
- Structure protection barrier is not needed according to BOS.



**Find**

A. Required lower minimum lateral underclearance to structure (distance ①) to the right if barrier is not used

**Solution**

**A. Required lower minimum lateral underclearance to structure to the right if barrier is not used:**

1. Go to [FDM 11-35 Attachment 1.5](#)
2. Start in the 1st column of the table [Barrier type used]
3. Go to the row for “None”
4. Go across this row to the column for “Mainline – Right”, which shows the distance ① requirement as:
 

*“The GREATEST of <sup>C</sup>Clear Zone Width OR <sup>D</sup>Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi - lane divided.”*
5. Compute clear zone distances for both the PREFERRED and ALTERNATE sections per note C under the table: “Clear Zone Width per Table “Clear Zone Distance Table (In Feet From Edge of Traveled Way)” on [FDM 11-15 Attachment 1.9](#). / For the “PREFERRED SECTION”, use the maximum distances shown in the “BACKSLOPES” columns for a 1V:3H slope / For the “ALTERNATE SECTION”, use 30-feet or the maximum distances shown in the 1V:6H “FORESLOPES” column, whichever is less”
  - The Clear Zone requirement for the PREFERRED section = the maximum distance shown in the “BACKSLOPES” columns for a 1V:3H slope in the above-mentioned table = 24 feet for a design speed of 70 mph and AADT of 25,000. Therefore, the Clear Zone requirement for the PREFERRED section is 24 feet.
  - The Clear Zone requirement for the ALTERNATE section = 30 feet or the maximum distances shown in the 1V:6H “FORESLOPES” column, whichever is less. The Clear Zone requirement from the table is 34 feet for a design speed of 70 mph and AADT of 25,000. Therefore, the Clear Zone requirement for the ALTERNATE section is 30 feet because it is less than 34 feet.

6. Compute lateral clearance per note D under the table: Lateral Clearance requirements per [FDM 11-15 Table 1.2](#) "Required Lateral Clearance from Edge of Driving Lane for Rural Highways".
- Go to the above-mentioned Table 1 for ROAD TYPE = "All STH's / Arterials / non-STH Collector and Local Roads (i.e., non-arterials) with Design Year AADT  $\geq$  1500";
  - Use the column for "WITHOUT roadside barrier". The lateral clearance requirement is shown as: "Upper and Lower Minimum = The GREATER of 6 ft OR finished shoulder width + 2 ft"
  - Lateral clearance is the greater of either 6 feet or (shoulder width + 2 feet) = (10-feet + 2 feet) = 12 feet. Therefore, Lateral Clearance = 12-feet because it is greater than 6-feet.

The lateral underclearance to structure requirement distance ① is based on the clear zone distances because the clear zone distances are greater than both the lateral clearance requirement and the 10-foot lower minimum requirement for multi-lane divided highways. Therefore:

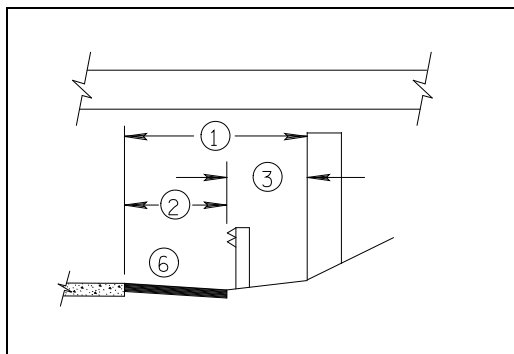
Distance ① = 24-feet, if the PREFERRED section is used.

Distance ① = 30-feet if the ALTERNATE section is used.

## Example 2 – existing bridge over 2-lane rural highway

### Given

- 2-lane rural STH
- Design year AADT = 2500
- Design speed = 60 MPH;
- Tangent alignment;
- Lane width = 12 feet;
- Shoulder width = 6-ft
- 3-span bridge with face of piers at 12-feet from edge of travel lane
- Structure protection barrier is not needed according to BOS.



### Find

- A. Determine if vehicle protection barrier is needed to shield the piers.
- B. If vehicle protection barrier is needed, determine if beamguard is an option.

### Solution

#### A. Determine if vehicle protection barrier is needed to shield the piers:

1. Go to Attachment 5, page 2
2. Start in the 1st column of the table [Barrier type used]
3. Go to the row for “None”
4. Go across this row to the column for “Mainline – Right”, which shows the distance ① requirement as:
 

*“The GREATEST of <sup>C</sup> Clear Zone Width OR <sup>D</sup> Lateral Clearance OR 6 feet for 2-lane highway OR 10 feet for multi -lane divided.”*
5. Compute clear zone distances for only the PREFERRED section per note C under the table: “Clear Zone Width per Table “Clear Zone Distance Table (In Feet from Edge of Traveled Way)” on [FDM 11-15 Attachment 1.9](#). / For the “PREFERRED SECTION”, use the maximum distances shown in the “BACKSLOPES” columns for a 1V:3H slope / For the “ALTERNATE SECTION”, use 30-feet or the maximum distances shown in the 1V:6H “FORESLOPES” column, whichever is less”
  - The Clear Zone requirement for the PREFERRED section = the maximum distance shown in the “BACKSLOPES” columns for a 1V:3H slope in the above-mentioned table = 18 feet for a design speed of 60 mph and AADT of 2500. Therefore, the Clear Zone requirement for the PREFERRED section is 18 feet.
6. Compute lateral clearance per note D under the table: Lateral Clearance requirements per [FDM 11-15 Table 1.2](#) “Required Lateral Clearance from Edge of Driving Lane for Rural Highways”.
  - Go to the above-mentioned Table 1 for ROAD TYPE = “All STH's / Arterials / non-STH Collector and Local Roads (i.e., nonarterials) with Design Year AADT ≥ 1500”;
  - Use the column for “WITHOUT roadside barrier”. The lateral clearance requirement is shown as: “Upper and Lower Minimum = The GREATER of 6 ft OR finished shoulder width + 2 ft”
  - Lateral clearance is the greater of either 6 feet or (shoulder width + 2 feet) = (6-feet + 2 feet) = 8 feet. Therefore, Lateral Clearance = 8-feet because it is greater than 6-feet.

The lateral underclearance to structure requirement distance ① is based on the clear zone distance because the clear zone distance is greater than both the lateral clearance requirement and the 6-foot lower minimum requirement for 2-lane highways. Therefore, the lower minimum required Distance ①, if barrier is not used, is 18-feet. The existing distance ① of 12-feet is less than this. Therefore:

Vehicle protection barrier is required

**B. If vehicle protection barrier is needed, determine if beam guard is an option:**

1. Go to Attachment 5, page 2
2. Start in the 1st column of the table [Barrier type used]
3. Go to the row for "Beam Guard"
4. Go across this row to the column for "Mainline – Right", (NOTE: "lateral underclearance to the right" applies to both sides of the road because this is an undivided bidirectional highway.) which shows the distance ① requirement as:

*"Dist. ② + Dist. ③, Not < 6 feet for 2-lane highways; Not <10 feet for multi-lane divided."*

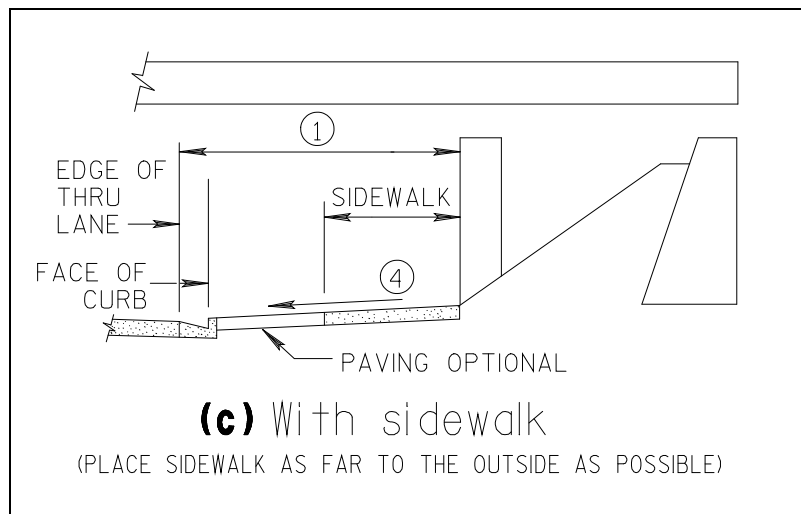
5. Compute lateral clearance per note D under the table: Lateral Clearance requirements per [FDM 11-15 Table 1.2](#) "Required Lateral Clearance from Edge of Driving Lane for Rural Highways".
  - Go to the above-mentioned Table 1 for ROAD TYPE = "All STH's / Arterials / non-STH Collector and Local Roads (i.e., nonarterials) with Design Year AADT  $\geq$  1500";
  - Use the column for "WITH roadside barrier". The lateral clearance requirement is shown as: "Upper Minimum = The GREATER of 6 ft OR finished shoulder width; Lower minimum = The GREATER of 4 ft OR finished shoulder width"
  - Lateral clearance is the greater of either (6-feet upper minimum / 4-feet lower minimum) or (shoulder width=6-feet).  
Therefore, Dist. ② = Lateral Clearance = 6-feet because the shoulder width meets the upper minimum requirement and exceeds the lower minimum requirement.
6. Lower minimum required Dist. ③ for beam guard as vehicle protection barrier = 4'6" (From the table on p.2 of Attachment 5). Distance ③ provided = 6-feet
7. Lower minimum required Distance ① = Dist. ② + Dist. ③ = 6' + 4'6" = 10'6". Distance ① provided = 6' + 6' = 12'

Beam guard may be used to shield the piers because the distance ③ provided of 6-feet is greater than the minimum required distance of 4'-6", and the existing distance ① of 12-feet is greater than the minimum required distance ① of 10'6" and is also greater than the 6-foot minimum requirement for 2-lane highways.

### Example 3 – existing bridge over 4-lane urban arterial

#### Given

- 4-lane un-divided urban arterial in developed area
- Design year AADT = 12,000
- Posted speed = 45 MPH;
- Tangent alignment;
- Lane width = 12 feet;
- Clear zone has not been provided for the roadway based on [FDM 11-20 Table 1.6](#) “Recommended Clear Zone for Urban Roadways—New Construction and Reconstruction”
- Offset from thru lane to curb face = 6-ft
- There is no barrier
- Sidewalk is 5-feet wide and abuts back of curb
- The offset from curb face to outside edge of sidewalk = 5.5 feet
- 3-span bridge with face of piers at 11.5 feet from edge of thru lane – no work is proposed to be done on the structure
- Structure protection barrier is not needed according to BOS.



#### Find

- A. Determine if design criteria for lateral underclearance to structure are met.
- B. Determine if the sidewalk meets lower minimum requirements
- C. Determine if a barrier is required between the roadway and the sidewalk

#### Solution

##### A. Determine if design criteria for lateral underclearance to structure are met:

1. Go to Attachment 6, page 2
2. Start in the 1st column of the table [Barrier type used]
3. Go to the row for “None - Clear Zone isn’t provided”
4. Go across this row to the column for “Arterial – Right”, (**NOTE:** The lateral underclearance to the right applies to both sides of the roadway because this is an undivided bi-directional roadway.) which shows the distance ① requirement as:

**“Lower MIN.** = the **GREATER** of 6 feet OR offset from edge of thru lane to face of curb +4-feet  
**Upper MIN.** = The **GREATER** of 12 feet OR offset from edge of thru lane to face of curb +4 feet”

5. Test for the Lower minimum condition:
  - (Offset from travel lane to pier) = 11.5 feet > 6 feet **[MET]**
  - (Offset from curb face to pier) = (Offset from travel lane to pier) – (Offset from travel lane to curb

face) = 11.5-ft - 6-ft = 5.5 ft > 4-ft **[MET]**  
**[The MINIMUM condition is met]**

6. Test for the **Upper MINIMUM** condition:

- 11.5 feet (offset from travel lane to pier) < 12 feet **[NOT MET]**  
**[The DESIRABLE condition is NOT met]**

The Design Justification (DJ) isn't required because the lower minimum requirement has been met or exceeded. However, justification is required in the DSR for not meeting upper minimum design criteria.

**B. Determine if the sidewalk meets lower minimum requirements:**

1. Go to the 2<sup>nd</sup> and 3<sup>rd</sup> paragraphs in the subsection for "Sidewalks" in the text: "Sidewalks under new, replacement and existing structures with a terrace between the back of curb and sidewalk shall have a lower minimum width of 5 feet. Sidewalks under new, replacement and existing structures where the sidewalk is adjacent to the back of curb shall have a lower minimum width of 6 feet from face of curb to the back of sidewalk. If a parapet or barrier separation device is used between the roadway and the sidewalk then the lower minimum width of sidewalk under new, replacement and existing structures shall be 6 feet. A wider sidewalk may be justified where high pedestrian usage is anticipated.

If conditions require that a sidewalk under an existing structure remain in place with less than the lower minimum width then provide justification in the DSR based on an evaluation of current use, width, safety, and ADA requirements."

Justification in the DSR is required because the offset from curb face to outside edge of sidewalk of 5.5 feet is < 6-foot lower minimum requirement for a sidewalk abutting the back of curb.

**C. Determine if a barrier is required between the roadway and the sidewalk:**

1. In the subsection for "Sidewalks", go to the paragraph just above Table 1 "Barrier Wall Separation Required Between Roadway and Sidewalk":

*"A structure shall include a parapet or barrier wall to separate the roadway from a sidewalk based on Table 1 for the proposed posted speed...."*

2. The above-mentioned Table 1 shows that barrier wall separation is required between roadway and sidewalk for a "*new, reconstructed, or rehabilitated structure*" if the posted speed is  $\geq 45$  mph. It is not required for structures not meeting these criteria but could be provided if "*requested by community and agreed to by designer*".

A barrier isn't required between the roadway and sidewalk because work is not being done on the structure. However, a barrier could be included if requested by the community and agreed to by the designer.

**Vertical Clearance for Construction of New Bridges, Replacement Bridges, and Bridges on which the Superstructure is being replaced <sup>1</sup>**

Overpass Facility →	Freeway, Expressway, STH, or Interstate Highway		Railroad <sup>4</sup> , CTH, Town Road, Local Road, or Street	Pedestrian or Shared-use Structures	Sign Structures <sup>2</sup>
	Interchange	Grade Separation			
<b>Non-arterial</b> either STH, CTH, Town Road, Local Road, or Street	15'-9" Upper Min.	15'-3" Upper Minimum		16'- 9" Upper Minimum	18'-3" Lower Minimum
	15'-3" Lower min.	14'-9" Minimum		16'-3" Minimum	
<b>Arterial</b> either CTH, Town Road, Local Road, or Street ( <b>excludes</b> freeway and expressway; also excludes arterial STH)	16'-9" Upper Min.	15'-3" Upper Minimum		17'- 9" Upper Minimum	
	16'-3" Lower min.	14'-9" Lower Minimum		17'-3" Lower Minimum	
Freeway <sup>3</sup> , Expressway, arterial STH, or Interstate Highway	16'-9" Upper Minimum		17'- 9" Upper Minimum		
	16'-4" Lower Minimum		17'-4" Lower Minimum		
Railroad <sup>4,5,6,7</sup>	23'-0" Lower Minimum to 23'-3½" Maximum				

**General notes:**

- 1 Vertical clearance is needed for the entire roadway width (critical point; to include traveled way, auxiliary lanes, turn lanes, and shoulders), according to the above table. Vertical clearance for railroads is measured from the top of rail and is required over an area 8 feet 6 inches from the track centerline on each side of a railroad track. Do not exceed the desirable vertical clearance shown unless justified. Depending on topography and other specific situations vertical clearance for any structure may be greater than that shown when justified. Some things to consider are: over height loads traveling on the roadway; the level of development in the area, the projected growth in traffic volume and importance of the roadway, and the possibility of reclassification. Coordinate early in the design process with the Bureau of Highway Maintenance and Bureau of Structures in determining the appropriate vertical clearance along an OSOW High Clearance Route. Consider future underpass facility overlay improvements in establishing this vertical clearance.
- 2 See Bridge Manual Chapter 39 (<http://wisconsin.gov/dtsdManuals/strct/manuals/bridge/ch39.pdf>) and bridge Standard Details 39.02 and 39.10 for design considerations and requirements for vertical clearance on new and replacement Sign Structures. A lower minimum vertical clearance of 20'-0" is required on the OSOW High Clearance Route. See the OSOW maps for routes designated as high clearance routes (<https://wisconsin.gov/Pages/doing-bus/eng-consultants/cnsit-rsrcs/tools/planning-maps.aspx>).
- 3 See [FDM 11-35-1.5](#) for additional vertical clearance guidance specific to interstate freeways.
- 4 Consult with the Region Railroad Coordinator if the over-passing or under-passing facility is either a railroad or a "rails-to-trails" trail; or if a structure is owned by a railroad company.
- 5 A vertical clearance <23'-0" requires both an approved Design Justification (DJ) (see [FDM 11-1-20](#)) and early coordination with BTLR R&H, Railroads and Harbors Section (RHS) through the Region Railroad Coordinator. The Design Justification (DJ) shall contain documentation that the Office of the Commissioner of Railroads (OCR) has been petitioned. See [FDM Chapter 17](#) for additional information.
- 6 Provide justification for a vertical clearance >23'-3 ½" to the RHS.
- 7 Vertical clearance less than 23'-0" may be acceptable or desirable in certain situations, such as for spur tracks, lead tracks, some branch lines and even mainline tracks when other impediments to 23'-0" exist. Review such situations with the Railroad Project Coordination Engineer in RHS. Early coordination with RHS is required.



**Lower Minimum Vertical Clearance for Existing Bridges which are not Being Replaced and for Existing Bridges on which the Superstructure is not Being Replaced**<sup>1, 2</sup>

Overpass Facility →	Freeway, Expressway, STH, or Interstate Highway		Railroad <sup>5</sup> , CTH, Town Road, Local Road, or Street	Pedestrian or Shared-use Structures	Sign Structures <sup>6</sup>
Underpass Facility ↓	Interchange	Grade Separation			
Non-arterial either STH, CTH, Town Road, Local Road, or Street	15'-3" min. or DJ <sup>3</sup>	If existing is < 14'-0" then increase to 14'-0" min. or DJ <sup>3</sup>	16'-3" min. or DJ <sup>3</sup>		
		If existing is ≥ 14'-0", but < 14'-6" then maintain existing min. or DJ <sup>3</sup>			
		If existing is ≥ 14'-6" then 14'-6" min. or DJ <sup>3</sup>			
Arterial either CTH, Town Road, Local Road, or Street (excludes freeway and expressway; also excludes arterial STH)	If existing is < 15'-3" then increase to 15'-3" min. or DJ <sup>3</sup> If existing is ≥ 15'-3", but < 16'-0" then maintain existing min. or DJ <sup>3</sup> If existing is ≥ 16' 0" then 16' 0" min. or DJ <sup>3</sup>	If existing is < 14'-0" then increase to 14'-0" min. or DJ <sup>3</sup>	17'-0" min. or DJ <sup>3</sup>		18'-0" min. or DJ <sup>3</sup> for existing sign structures on Modernization projects;  17'-0" or DJ <sup>3</sup> for existing sign structures on Perpetuation and Rehabilitation projects
		If existing is ≥ 14'-0", but < 14'-6" then maintain existing min. or DJ <sup>3</sup>			
		If existing is ≥ 14'-6" then 14'-6" min. or DJ <sup>3</sup>			
Arterial STH (excludes freeway and expressway)	If existing is < 15'-3" then increase to 15'-3" min. or DJ <sup>3</sup> If existing is ≥ 15'-3", but < 16'-0" then maintain existing min. or DJ <sup>3</sup> If existing is ≥ 16' 0" then 16' 0" min. or DJ <sup>3</sup>	If existing is < 14'-0" then increase to 14'-0" min. or DJ <sup>3</sup>	17'-0" min. or DJ <sup>3</sup>		
		If existing is ≥ 14'-0", but < 16'-0" then maintain existing min. or DJ <sup>3</sup>			
		If existing is ≥ 16' 0" then 16' 0" min. or DJ <sup>3</sup>			
Freeway <sup>4</sup> , Expressway, or Interstate Highway	16'-0" min. or DJ <sup>3</sup>				
Railroad <sup>5</sup>	Maintain existing vertical clearance - if existing clearance is < 23'-0" then confer with BTLR Railroads and Harbors Section to determine the adequacy of the existing clearance.				

**General notes:**

- 1 Vertical clearance is needed for the entire roadway width (critical point; to include traveled way, auxiliary lanes, turn lanes, and shoulders), according to the above table. Provide greater than lower minimum clearance if evaluation shows that greater clearance is needed because bridge superstructure is susceptible to being hit by under-passing vehicles. Vertical clearance for railroads is measured from the top of rail and is required over an area 8 feet 6 inches from the track centerline on each side of a railroad track.
- 2 Include a low clearance sign (W12-2), on structures if its use is in accordance with WisDOT MUTCD 2C.22.
- 3 DJ = approved Design Justification (DJ) required (see [FDM 11-1-20](#)).
- 4 See [FDM 11-35-1.5](#) for additional vertical clearance guidance specific to interstate freeways.
- 5 Consult with the Region Railroad Coordinator if the over-passing or under-passing facility is either a railroad or a "rails-to-trails" trail; or if a structure is owned by a railroad company.
- 6 See Bridge Manual Chapter 39 for design considerations for vertical clearance on Sign Structures: <http://wisconsin.gov/dtsdManuals/strct/manuals/bridge/ch39.pdf>  
Do not reduce vertical clearance that is less than or equal to 20'-0" on the OSOW High Clearance Route. Refer to the OSOW maps for routes designated as high clearance routes (<https://wisconsin.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/planning-maps.aspx>).
- 7 Do not reduce vertical clearance that is less than or equal to 20'-0" on the OSOW High Clearance Route. Refer to the OSOW maps for routes designated as high clearance routes (<https://wisconsin.gov/Pages/doing-bus/eng-consultants/cnslt-rsrcs/tools/planning-maps.aspx>). Coordinate early in the design process with the Bureau of Highway Maintenance and Bureau of Structures in determining the appropriate vertical clearance along an OSOW High Clearance Route.