BRIDGE RAILS

POLICY	COMMENTARY

2.1.1 BRIDGES CARRYING FEDERAL-AID ROUTES

For bridges which carry Federal-aid routes, the following shall apply:

2.1.1.A Any new and/or rehabilitated bridges financed with Federal-aid funds are expected to be provided with crash-tested bridge rails. An exception to this policy can only be made for bridges to be rehabilitated by formally requesting a variance for the site based on an analysis of the following criteria:

- Existing rail type
- Condition of structure (deterioration)
- Accident history
- Traffic information (ADT, speed)
- Alignment (straight, curved)
- Replacement scheduled within the Five Year Plan

2.1.1.B Bridge rails on any existing bridges located with the limits of any Federal-aid projects are expected to be evaluated considering, at a minimum, the factors identified in 2.1.1.A. Bridge rails that meet or can be modified to meet current AASHTO specifications, but which have not been crash-tested may remain in place.

2.1.1.C The decision to leave a bridge rail in place under the conditions of 2.1.1.B is a design decision and does not require a variance approval.

2.1.1.D Should the existing railing not meet current AASHTO for reasons of inadequate height, strength or geometrics and/or is included in the Five Year Plan, a

This Subsection, 2.1, is taken directly from the Staff Bridge Engineer’s 3/15/91 memorandum to the District Engineers and Branch Heads. The purpose of this 3/15/91 memorandum, which was approved by the Director of Central Engineering, was to replace the 4/18/88 memorandum from the Director of Central Engineering and to establish the Department’s policies with regard to replacement and/or upgrading of bridge rails.

On 6/13/89 FHWA by publication in the Federal Register implemented a final rule on the AASHTO Guide Specifications for Bridge Rails. That publication opened up a comment period on the Guide which apparently was still open as of 3/15/91. The Federal Register published notice that the Guide was placed in 23 CFR, specifically in subsection 23 CFR 625.5, as a guide and reference. This location in 23 CFR was specifically in contrast to 23 CFR 625.4 which subsection contains Standards, Policies and Standard Specifications.

FHWA has required crash-tested rails since August 1986, to be used on all Federal-aid bridge projects which require (1) new and/or (2) reconstructed bridge rails. FHWA has not, however, taken a similarly strong position on existing rails on bridges which fall within the limits of Federal-aid projects.

variance approval will be necessary to leave the rail in place.

2.1.2 BRIDGES OVER, WITHOUT DIRECT ACCESS BY, A FEDERAL-AID ROUTE

For bridges over the Federal-aid route that cannot be accessed by the traffic on the Federal-aid route; e.g., grade separations or frontage roads over the route, take either of the following actions:

2.1.2.A If no other work is being performed on the bridge with Federal funding, bridge rail upgrades are not required.

2.1.2.B If the District desires, railing may be upgraded provided the bridge carries a Federal-aid route.

2.1.3 BRIDGES OVER, WITH DIRECT ACCESS BY, A FEDERAL-AID ROUTE

For bridges over the Federal-aid route that can be accessed by the traffic on the Federal-aid route; e.g., interchanges, take one of the following actions:

2.1.3.A Upgrade the railing.

2.1.3.B Defer the upgrade to a later date if an upgrade of the route over is scheduled within the Five Year Plan.

2.1.3.C Evaluate a design decision for the site based on an analysis of the conditions noted in 2.1.1.B above.

REFERENCE

Geometric design criteria is derived from:

- *AASHTO Policy on Geometric Design of Highways and Streets*
- *AASHTO Guide for Development of New Bicycle Facilities*
- *FHWA-RD-75-114 Safety and Location for Bicycle Facilities*
- *ADA Accessibility Guidelines,* Architectural and Transportation Barriers Board, August 1991.
- Federal Register, *Proposed Rules,* December 21, 1992.

WIDTH AND CLEARANCE

Except for special situations, the minimum clear width for a pedestrian bridge shall be 8'-0". For an attached sidewalk on a vehicle bridge, the clear walkway shall be 4'-0" minimum, but in no case shall it be narrower than the approaching sidewalk. Additional width may be required in an urban area or for a shared pedestrian-bikeway facility.

For two-directional pedestrian traffic if the clear width is less than 5', then to meet ADA guidelines, passing spaces of at least 5' x 5' should be located at reasonable intervals, not to exceed 200'.

The minimum vertical clearance from an under-passing roadway surface to a pedestrian bridge shall be 17'-6".

The minimum vertical clearance from a pedestrian or bicycle path to an overhead obstruction shall be 8'-6", or 9'-0" for an equestrian path, measured at 1'-0" from the face of curb, parapet, or rail as shown in the sketches on page 3.

RAMPS

Pedestrian overpass structures, if practical, may be provided with both ramps and stairways, but under no condition should a structure be built with stairs only.

Maximum grades on pedestrian bridges and approach ramps shall be 8.33%.

Landings shall be provided to accommodate a maximum rise between landings of 30 inches. The maximum spacing of landings will be 30 ft. for a 8.33% grade or 40 ft. for a 6.25% grade.

Landings are not required when the grade is 5% or less. Landings shall be level, full width of the bridge, and a minimum of 5 ft. in length.

Landings shall be provided whenever the direction of the ramp changes.

The deck shall have a non-skid surface; i.e., transverse fiber broom finish for concrete.

LIGHTING

Lighting for pedestrian bridges shall be provided on poles independent of the bridge structure where possible.

PEDESTRIAN RAILINGS

Pedestrian railings shall be designed in accordance with AASHTO Specifications.

Handrails shall be provided for all stairs and for ramps with grades greater than 5%. The rail height shall be 34 to 38 inches (per ADA guidelines) as measured from the tread at the face of the riser for stairs and from the ramp surface for ramps.

CHAIN LINK FENCE

Portions of pedestrian bridges or walkways over traffic shall be provided with chain link fabric or other approved fencing. The maximum size opening for chain link fabric shall be 2”. Approved fencing includes the use of picket fences with a maximum clear opening of 2” between pickets. Fences shall have a minimum height of 7’-10” above the walkway surface. 7’-10” is used as the minimum instead of 8’-0” to allow use of a standard 5’ wide fabric chain link fence with a standard height Bridge Rail Type 7.

In general, vertical fences shall be used. However, where warranted due to pedestrian volume or where there are recorded incidents of objects thrown from overpasses, pedestrian bridges or walkways shall be fully or partially enclosed with chain link fabric or other approved material. The enclosure shall have a minimum vertical clearance of 8'-6" at 1'-0" from the face of curb, parapet or rail as shown in the sketches on page 3.

At highway crossings, chain link fencing shall extend a minimum of 30 feet beyond the outside shoulder line on the traveled way below the bridge. The ultimate roadway section shall be used to establish fencing limits when it is available. Previously 20 feet was used for this requirement. It was increased to 30’ to provide better protection from objects thrown from a vehicle, taking into consideration the forward velocity of the projectile.

BICYCLE RAILING

Bicycle railing shall be used on bridges specifically designed to carry bicycle traffic, and on bridges where specific protection of bicyclists is deemed necessary. The minimum height of railing used to protect a bicyclist shall be 54 inches, measured from the top of the surface on which the bicycle rides to the rail. Smooth rub rails shall be attached to the barriers at a handlebar height of 42 inches.

Chain link fence may be used in lieu of bicycle railing. However, smooth rub rails shall be attached to the fence posts at a handlebar height of 42 inches.

DEFLECTION AND LOADS

Design shall be in accordance with the *AASHTO Standard Specifications for Highway Bridges* except as modified by the *AASHTO Guide Specifications for Design of Pedestrian Bridges.*

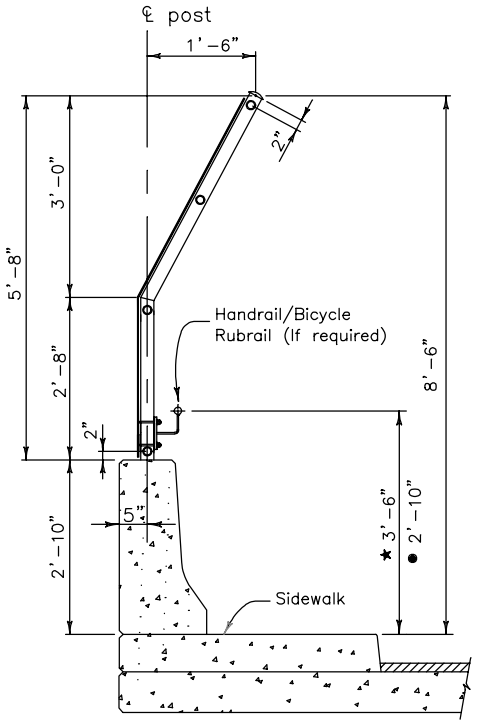
Girder deflection due to design live load shall be limited to L/600. Dynamic deflection response shall be controlled by applying the vibration criteria in the *AASHTO Guide Specifications for Design of Pedestrian Bridges.*

Pedestrian/bicycle bridges shall be designed for any planned or potential use by maintenance trucks, emergency vehicles, and construction live loads. The Colorado Legal Load Type 3 Vehicle should be used for this purpose and designed for at the operating level (AASHTO Load Group IB). This will provide structural adequacy for a broad range of legal load vehicles.

If the Type 3 Legal Load has a strong effect on the bridge costs and it is clear that over the life of the bridge, the bridge will be accessed by only light maintenance and construction vehicles, then a different live load vehicle, appropriate for the situation, may be used. In no case shall the vehicle live load be less than H-5 for bridges with a clear deck width from 6' to 10', and H-10 for a clear deck width over 10'. These vehicles may be checked at the operating level. No vehicle live load is required for clear widths less than 6'.

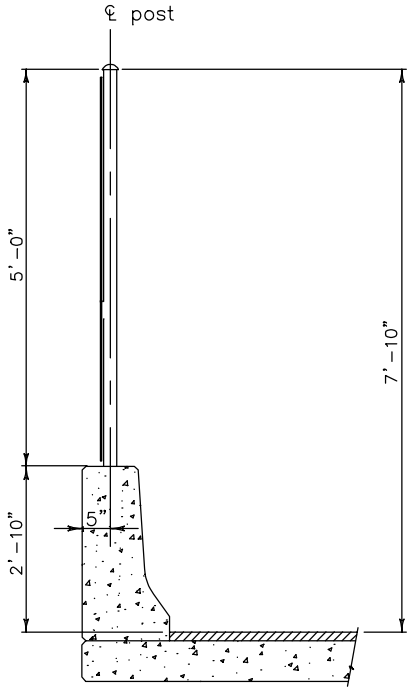
Over the life of the bridge, the bridge may be used for different purposes, or at different locations, than originally intended. This should be considered when selecting the appropriate vehicle live load. Whenever the vehicle live load selected is less than the Type 3 Legal Load, the vehicle load capacity shall be defined on signage permanently attached to each end of the bridge. The live load used in design shall be fully defined in the plans.

The Type 3 Legal Load is a 27-ton, 3-axle vehicle with 13.5' front axle spacing, and 4' rear. The axle loads are 7 tons on the front axle and 10 tons on each of the rear axles. The H-5 and H-10 live loads are 5 and 10 ton, 2 axle, vehicles with 14' axle spacing and 80% of the total load carried by the rear axle.



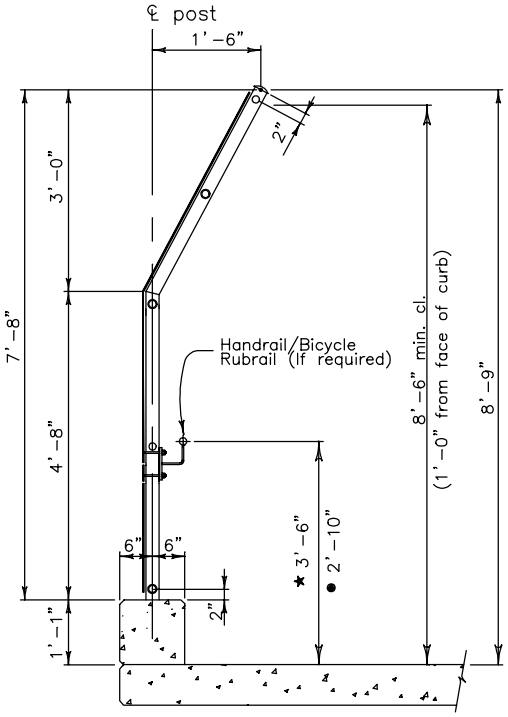
BRIDGE RAIL WITH PARTIAL ENCLOSURE

See B-607-6B for additional details.



BRIDGE RAIL WITH VERTICAL FENCE

See B-607-5 for additional details.



★ = (Bicycle Rubrail)
● = (Pedestrian Handrail)

PARTIAL ENCLOSURE

See B-607-8B for additional details

BRIDGE TYPICAL SECTIONS AND MINIMUM CLEARANCES

The following pages show typical bridge widths and minimum vertical and lateral clearances for various types of highways:

Page 2 -- Typical Bridge Cross Sections. Closing the median between bridges (i.e. extending the bridge deck across the median) shall be considered and discussed with the roadway designer when the median is less than or equal to 30 feet wide. Closing the median is desirable when it leads to greater uniformity between the median treatment on the bridge and the treatment off the bridge -- this is primarily with regard to the type and location of the median barrier. Bridge inspection access, maintenance access, constructability, and safety concerns shall be considered with cost when deciding whether or not to close the median between bridges.

Page 3 -- Standard Sidewalk Details

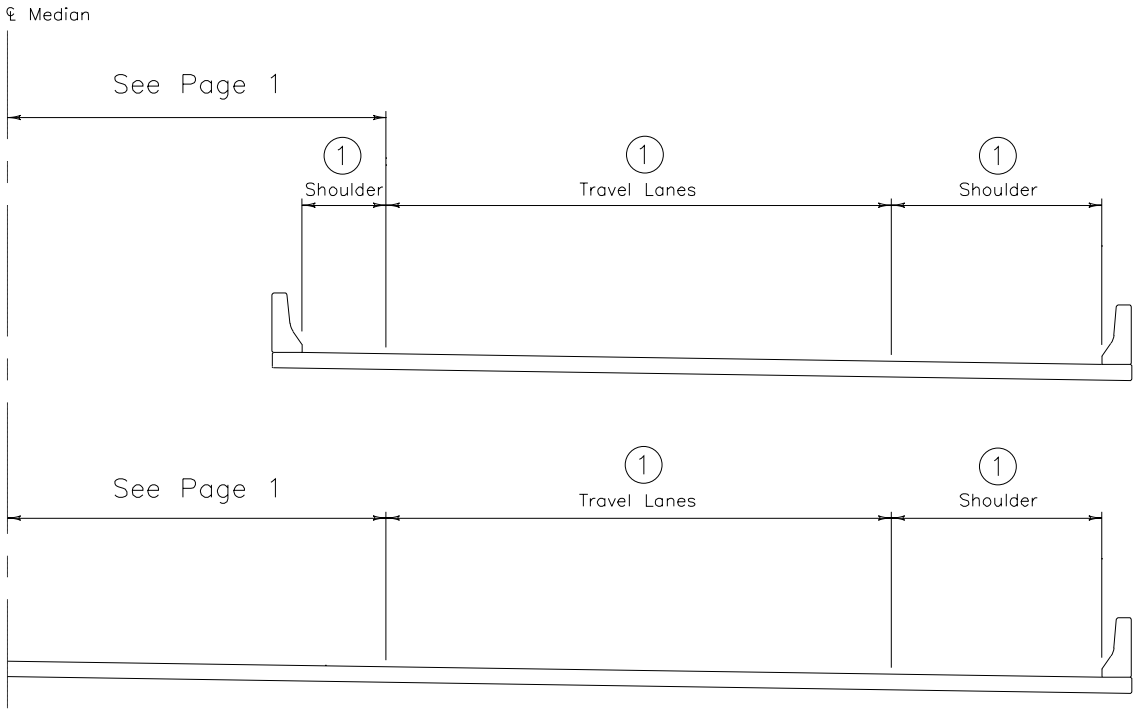
Page 4 -- Lateral Clearances, Single Span Bridge, High Speed & High Volume Undercrossing, Two Lane Roadways

Page 5 -- Lateral Clearances, Two Span Bridge, All Interstate Undercrossings, Urban & Rural, and All Other High Speed Divided Highways

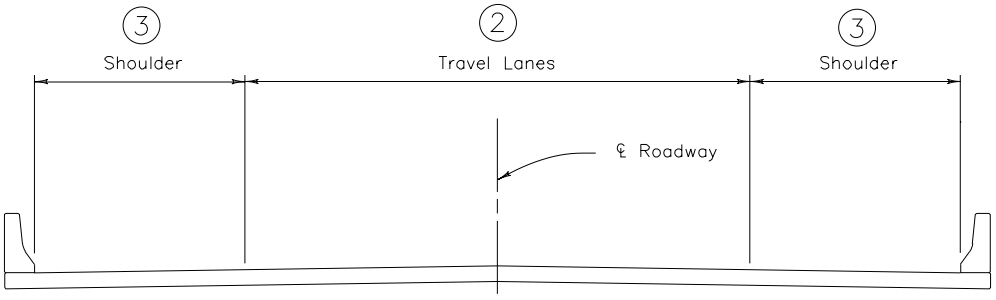
Page 6 -- Lateral Clearances, Three Span Bridge, High Speed & High Volume Undercrossings, Two Lane Roadways

Page 7 -- Lateral Clearances, Four or Five Span Bridge, All Interstate Undercrossings, Urban & Rural, and All Other High Speed Divided Highways

Page 8 -- Lateral Clearances, Low Speed & Low Volume Undercrossings, Two Lane Roadways



DIVIDED HIGHWAYS



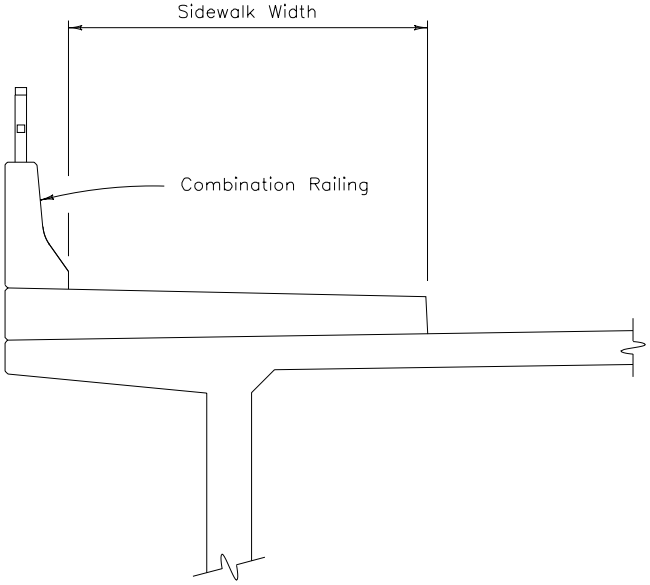
CROWNED SECTION

TYPICAL BRIDGE CROSS–SECTIONS

(1) Refer to Roadway Typical Sections.

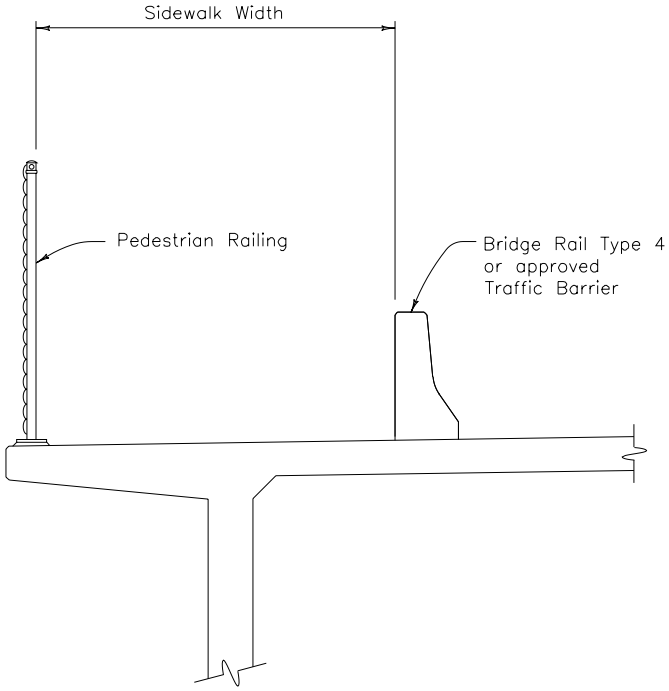
(2) Travel lane widths are based on ADT. Refer to Roadway Typical Sections.

(3) Full roadway shoulder plus 2 feet for shoulders less than 8 feet wide.
Full roadway shoulder only for shoulders 8 feet or wider.



LOCAL URBAN STREET CROSSING

with approaching curb and walk
(Speed less than 45 MPH)

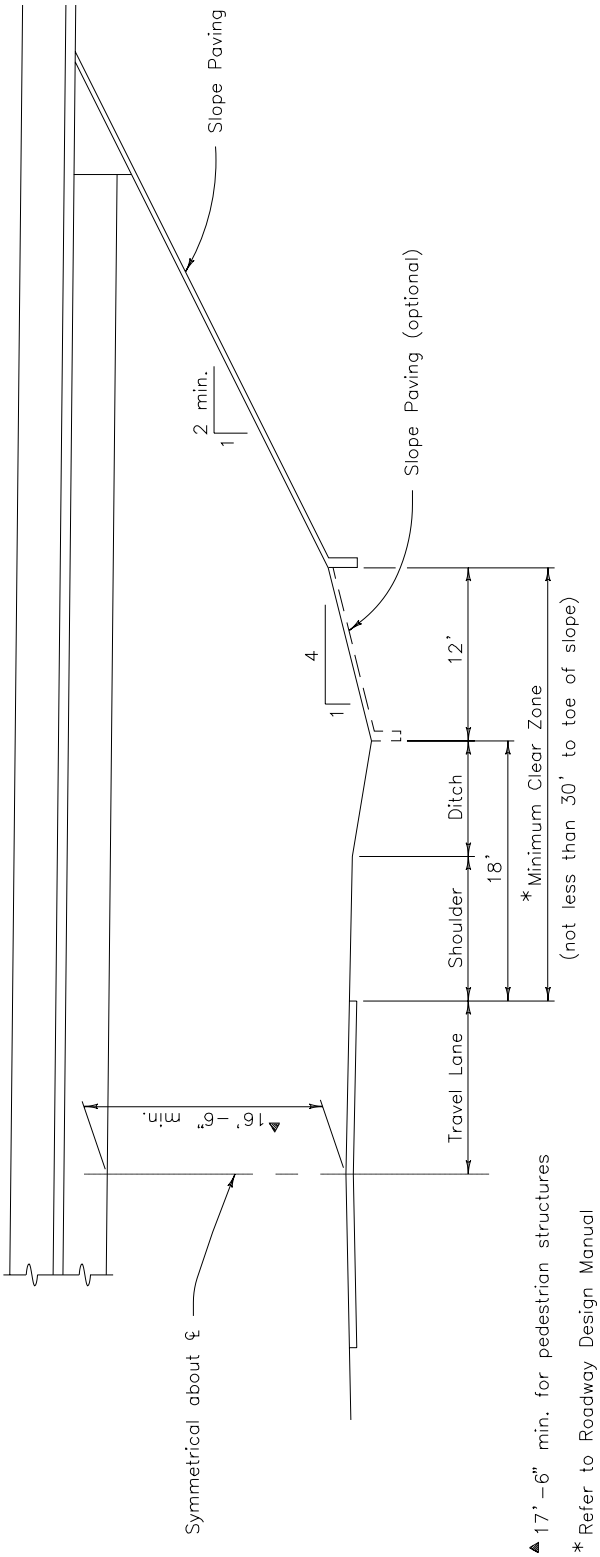


URBAN AND RURAL CROSSING

High speed, high volume roadways
or no approach curb
(Speed 45 MPH or greater)

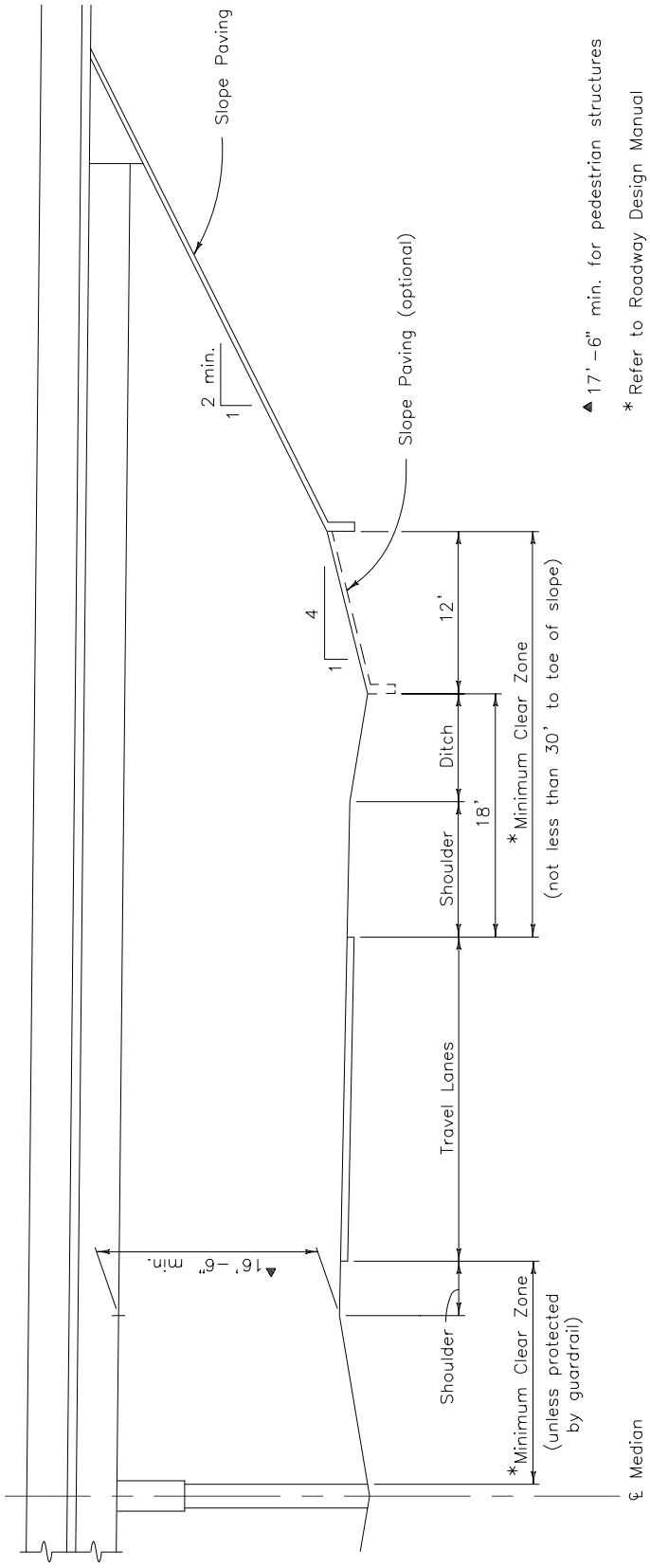
STANDARD SIDEWALK DETAILS

Reference: Staff Design Bulletin 84-1, July 1984



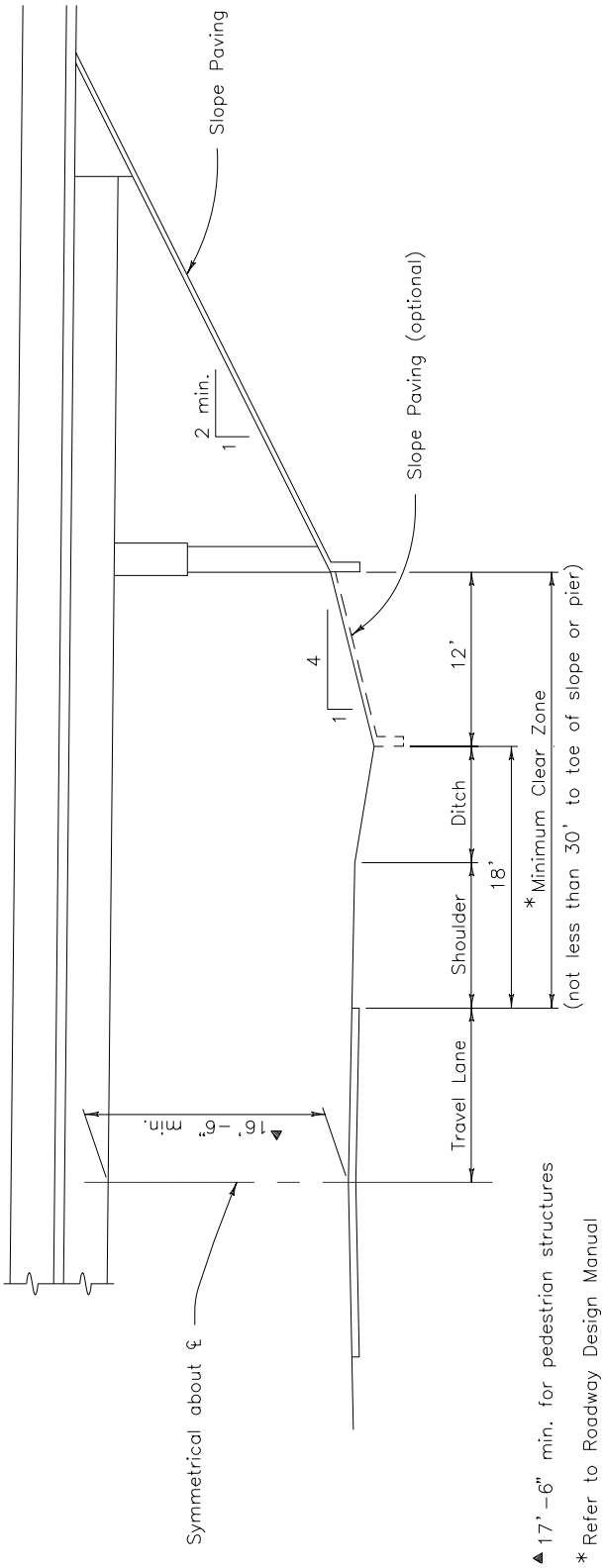
LATERAL CLEARANCES – SINGLE SPAN BRIDGE

High speed and high volume undercrossings
Two lane roadway (Design speed>50 MPH & ADT>750)



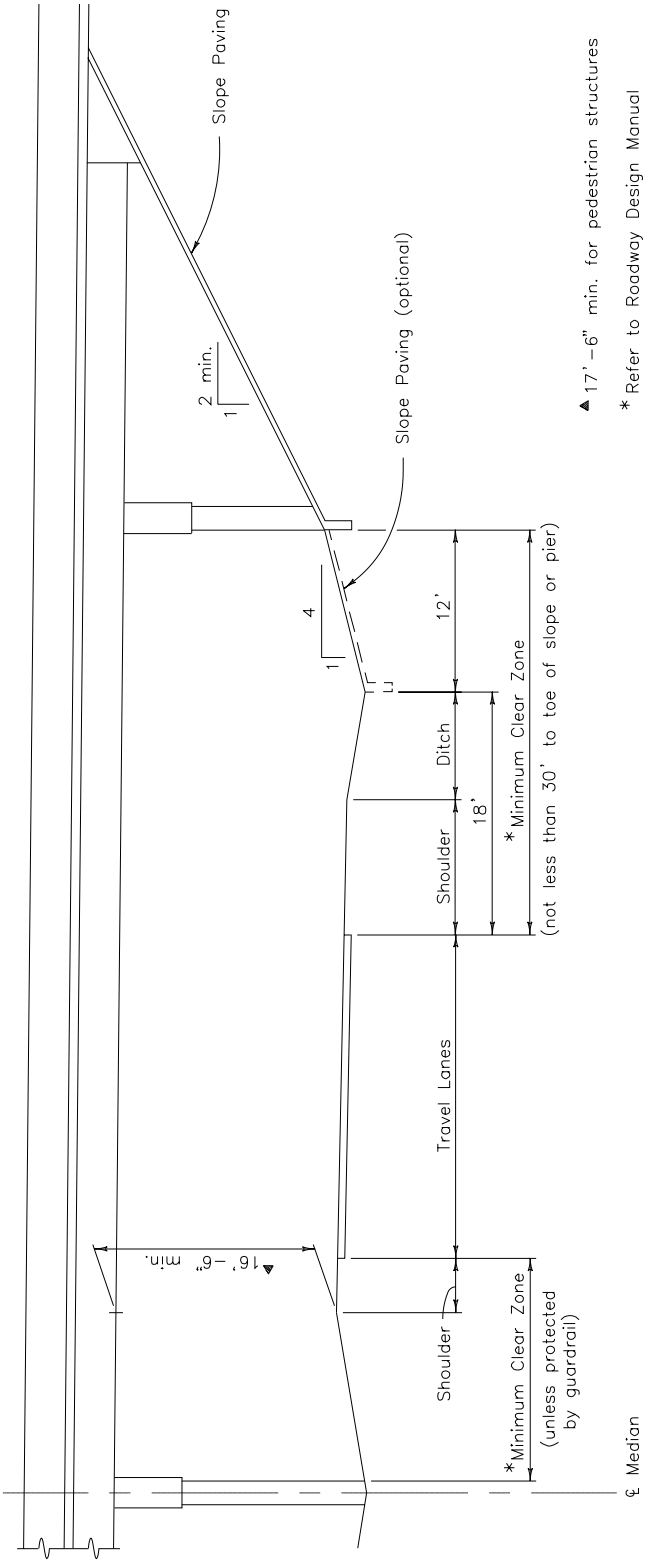
LATERAL CLEARANCES – 2 SPAN BRIDGE (PREFERRED)

All Interstate undercrossings (urban and rural) and
All other high speed divided highways (urban and rural)



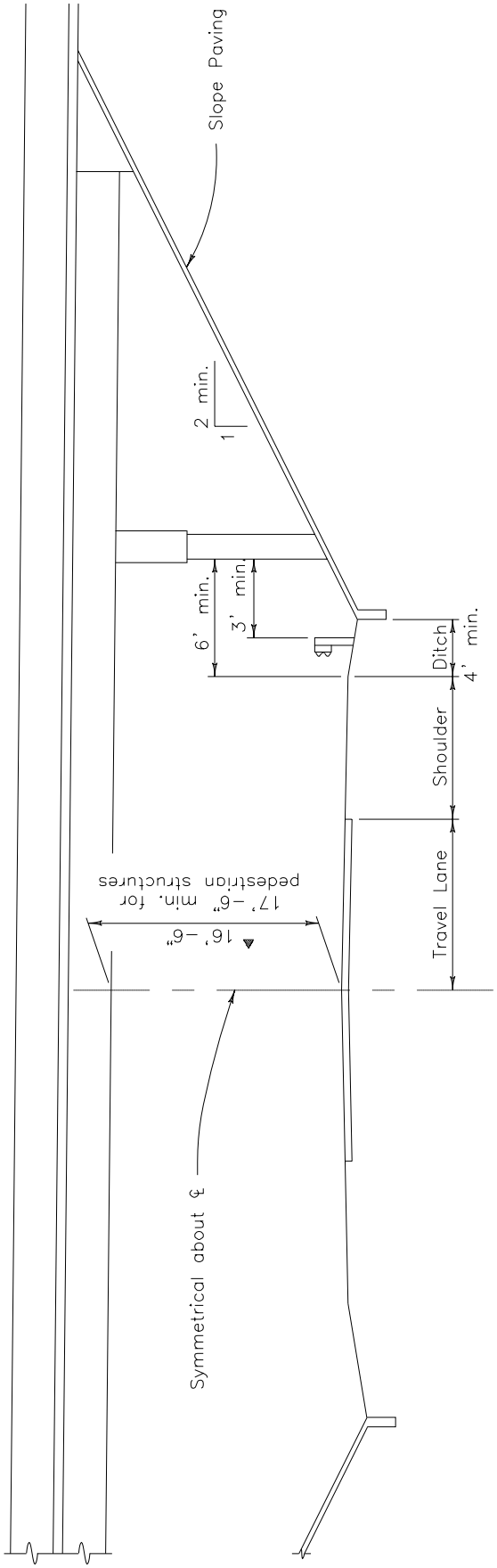
LATERAL CLEARANCES – 3 SPAN BRIDGE (PREFERRED)

High speed and high volume undercrossings
Two lane roadway (Design speed>50 MPH & ADT>750)



LATERAL CLEARANCES – 4 SPAN OR 5 SPAN BRIDGE

(For heavy skewed crossings and wide medians)
All Interstate undercrossings (urban and rural) and
All other high speed divided highways (urban and rural)



▲ This dimension may be reduced to 14'-6" for certain local road or private entrance crossings.

LATERAL CLEARANCES

Low speed and low volume undercrossings
Two lane roadway (Design speed<50 MPH & ADT<750)

2.4.1 REVISIONS

This revision allows the March 20, 1989 CDOT clearance requirements to lapse, and it synthesizes the clearance recommendations provided in the references that are cited in the next paragraph.

2.4.2 REFERENCES

- Reference is to the Federal-Aid Policy Guide, Title 23-Code of Federal Regulations (23-CFR), Part 646, Subparts A and B as revised and published December 9, 1991, in the Federal Register, Vol. 53, and as amended on August 27, 1997 (metric units).
- Statutes and Rules Governing Public Utilities and Rules of Practice and Procedure before the Public Utilities Commission of the State of Colorado.
- Federal-Aid Highway Program Manual Volume 6, Chapter 6, Section 2, Subsection 1 with Attachment 1.
- AREMA 2000 Manual for Railway Engineering.
- AASHTO LRFD Bridge Design Specifications, 2nd Edition 1998 with 2000 Interim Revisions.

2.4.3 GENERAL

All highway bridges over railroads shall meet the following requirements:

1. The minimum vertical clearance shall be 23'-0". This shall be defined by the C.L. of track at 90 degrees from the plane of top-of-rail (see figure 2) and be measured within the clearance envelope (see sheet 4 of 9). Clearances greater than 23'-0" may be approved on a project-by-project basis with special justification acceptable to both CDOT and the FHWA.

2. Attached at the end of subsection 2.4 is a six-page “For Information Only” table. In combination with this subsection, the For Information Only table replaces the (now lapsed) CDOT 1989 clearance requirements. The clearance minimums, which are typically required by railroad corporations are, listed alongside those recommended by railroad organizations, the Colorado Public Utilities Commission and the FHWA.

3. Greater clearances than those listed herein are required for tracks on a curve; see AREMA 2000, Chapter 28, subsection 1-1.

4. Bridge piers located within 25'-0" of the centerline of the outside track shall either meet the definition of being of heavy construction (see figure 1) or are to be protected by a reinforced concrete crash wall. See AREMA 2000 Chapter 8 subsection 2.1.5, the AREMA commentary C subsection 2.1.5 and AREMA figure C-2-1 for crash wall requirements.

   A. Note to Designers and Project Engineers: Contractors have at times, been reluctant to build the reinforcing details that connect crash walls to columns. This usually arises from preferring not to drill holes through rented forms. Nevertheless, crash wall details shall be as necessary to satisfy applicable AREMA and AASHTO design requirements.

B. Criteria regarding vehicle and railway collision loads on structures found in AASHTO LRFD Bridge Design Specifications, Subsection 3, Loads; are also applicable to the design of crash walls, as appropriate.

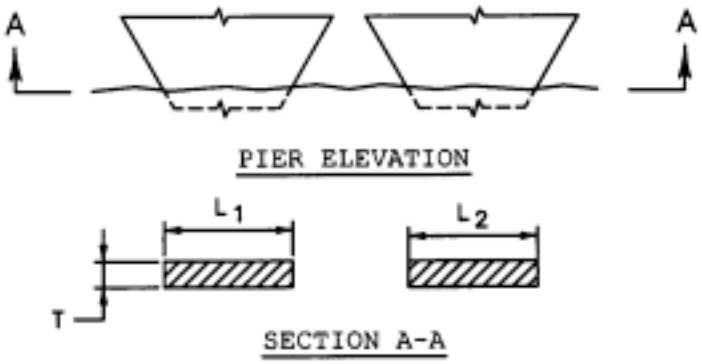
C. Any crash wall design is to appropriately limit climbing accessibility and attractiveness to children, with regards to the child's safety.

5. Increased clearances for electrification must be validated by a formal plan for a logical, independent segment of the rail system, which must be approved by the railroad's corporate headquarters.

Per 23 CFR 646.212, the FHWA will participate in the following vertical clearances where electrification is planned:

For 25 kv lines, vertical clearance = 7.4 meters (24' - 3")
For 50 kv lines, vertical clearance = 8.0 meters (26' – 3")

6. A need for clearances greater than those shown or referenced herein must be documented by the railroad or justified by special site conditions.

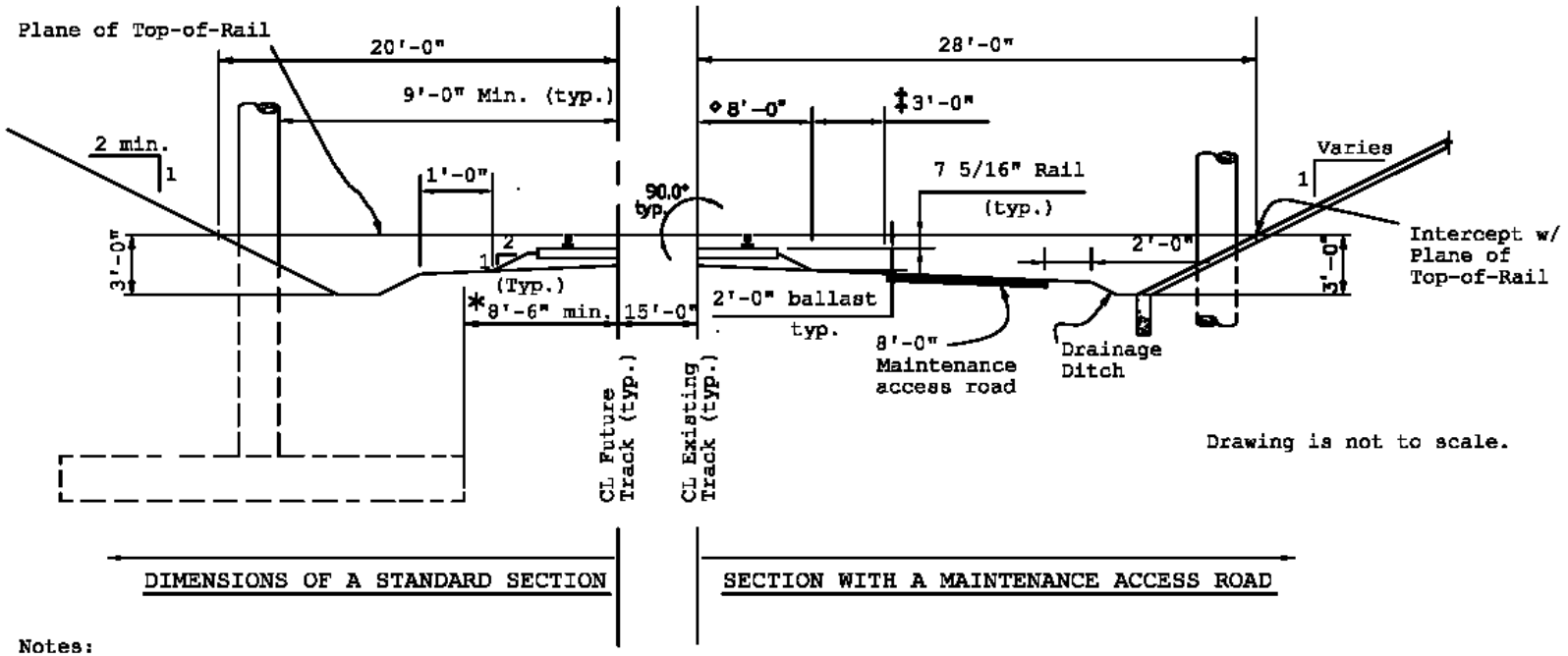


A pier is defined as being of heavy construction if:
$L_1 \geq$ 12'-0" and T ≥ 2'-6" and the larger of its dimensions is parallel to the track.

"HEAVY" CONSTRUCTION DETAIL
I.E. CRASH WALL NOT NECESSARY

FIGURE 1

FIGURE 2



Notes:

Minimum vertical clearance from top of rail is 23'-0".

Preferred that piers be kept beyond ditch and beyond toe of slope.

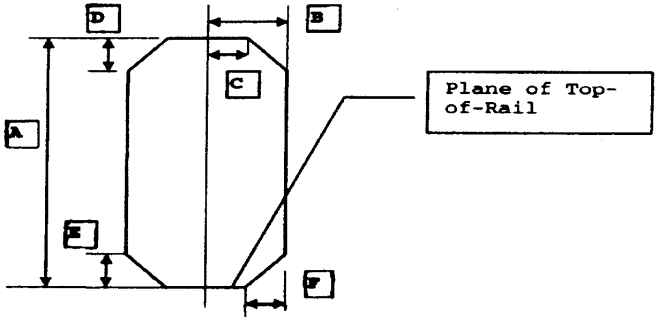
◇ Per the Colorado Legal Clearances Table 3-3 in article 28-3-30 of the AREMA 2000 Manual.

‡ Provides an 11' offset to the maintenance access road.

* Construction of the footing should not undermine the railway. It is preferred that there be no use of shoring. An absolute minimum offset to the edge of the footing is 8'-6". This requirement applies to both cut and fill sections.

Additional ditch width (horizontal clearance) may be provided, if established through a hydraulic analysis or through a verifiable "special needs" condition.

When in a cut section, additional ditch depth may be provided, if established through a hydraulic analysis or through a verifiable "special needs" condition.

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
	Vertical and Horizontal Clearance Envelope Dimensions of the following items, "A" through "F" are defined by the C.L. of track at 90 degrees from the plane of top-of-rail.								
Vertical Envelope "A"	[i]23'-6" (Greater if a future flood is probable) [ii]Or 24'-0"	23' (Greater if a future flood is probable)	23' (7010.4 mm) (Greater if electrified)	23' (7.0104 m)	23'	23' (Greater if electrified)	23' (7.1 m) (Greater if electrified)	22'-6" min. (22' w/ telltales) Can go below 22' w/tell-tales & Commission approval	22'-6" min. (22' w/ telltales) Can go below 22' w/tell-tales & Commission approval
Horizontal Envelope "B"		8' – 6'	9' (2743.2 mm)	9' (2.7432 m)				8' – 6'	8' – 6'
Horizontal Envelope "C"		8' – 6'	6' (1828.8 mm)	6' (1.8288 m)				4'	4'
Vertical Envelope "D"	0'	0'	3' (914.4 mm)	3' (0.9144 m)				6' – 9'	6' – 9'
Vertical Envelope "E"	0'	0'	4' (1219.2 mm)	4' (1.2192 m)				4'	4'
Horizontal Envelope "F"	0'	0'	3' (914.4 mm)	3' (0.9144 m)				2' – 6'	2' – 6'

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
Criteria to Include a Future Track	One or more future tracks as reqd. for operations	One or more future tracks as per long range planning, even along a low volume route		Adding future track where reasonably possible, depends on existing site			Fund a future track only after RR shows a demand and offers plans for its installation		It is reasonable to allow 1 future passing track at any mainline
Track CL to Future Track CL	25’	20’						15’	15’
Maintenance Access Road (MAR) Width		Offset to obstruction with MAR minus offset to obstruction w/out MAR is 7’		Add a MAR is reasonably possible, depending on existing site	Offset to ditch with MAR minus distance to ditch w/out MAR is 8’	8’	8’ (0’ if space for an 8” MAR is available in the adjacent span)		12’ MAR or a 4’ walkway on one side
Offset to Slope from CL of Tracks @ the Plane of Top-of-Rail		33’ - 10 ‘			20’ assuming 2:1 abutment slope (28’ if with MAR)	20’ (22’ if in cut)	20’ (to be increased as indicated by drainage hydraulics or snow drifts)		

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
Height of Crash Wall (CW)	6’ Above Top-of-Rails where Pier is w/in 12’ – 25’ (CW not required if Pier is 25’ or Greater from CL Track)	6’ Above Top-of-Rails where Pier is w/in 12’ – 25’ (CW not required if Pier is 25’ or Greater from CL Track	6’ Above Top-of-Rails where Pier is w/in 12’ – 25’ (CW not required if Pier is 25’ or Greater from CL Track	6’ Above Top-of-Rails where Pier is w/in 12’ – 25’ (CW not required if Pier is 25’ or Greater from CL Track	6’ Above Top-of-Rails where Pier is w/in 12’ – 25’ (CW not required if Pier is 25’ or Greater from CL Track				
Height of CW if Pier w/in 12’	12’ Above the Top-of -Rails	12’ Above the Top-of -Rails	12’ Above the Top-of -Rails	12’ Above the Top-of -Rails	6’ Above the Top-of -Rails				
CW Anchorage and Embedment in Ground	Anchored to footings and columns, min. 4’ below the (lowest) grade	Anchored to footings and columns, min. 4’ below the (lowest) grade	Anchored to footings and columns, min. 4’ below the (lowest) grade	Anchored to footings and columns, min. 4’ below the (lowest) grade					
Minimum CW Dimensions	2’ – 6” thick, 12’ long and 1’ past ends	2’ – 6” thick, 12’ long and 1’ past ends	2’ – 6” thick, 12’ long and 1’ past ends including a min. 6” cover over the track side of the column	2’ – 6” thick, 12’ long and 1’ past ends	2’ – 6” thick, for single column pier, 2’-0” thick for multi-columns, and 12’ long including a min. 6” cover over the track side of the column				

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
Piers that are of "Heavy Constructio n" i.e. CW not necessary	Are parallel to track w/cross section greater than that of crash wall	Are parallel to track w/cross section greater than that of crash wall	Are parallel to track w/cross section greater than that of crash wall	Are parallel to track w/cross section greater than that of crash wall					
Minimum Offset to Obstruction (e.g. a pier) from CL of Tracks	25' unless accompanied by a crashwall. The absolute minimum is indefinite (Piers are not to be located w/in drainage ditches)	Seemingly, 18' (25' where there is an access road between the track and an obstruction)		9' to nearest "obstruction"	9' to nearest "obstruction" (preferred that pier(s) be kept beyond toe of slope)	8' to nearest "obstruction"	9' to nearest "obstruction" (preferred that pier(s) be kept beyond ditch)	8' – 6" min. & 10' is recommended to the nearest "obstruction"	8' – 6" min. & 10' is recommended to the nearest "obstruction"
Offset from CL of tracks to the Spread Footing	Shoring must be a minimum of 15' from CL of nearest track. If excavation for shoring is intersected by a 1:1 line from the end of the tie; then a RR live load is applicable	No excavation allowed w/in 12' of the CL of track. Footing to be a min. 6'-0" below base of rail. Shoring and RR live loads per C.E. 106613			Determined by ½:1 slope but not less than 8' – 6"				

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
Drainage Ditch Depth; Below Plane of Top-of-Rail		5.6' (6.4' if a v-shaped ditch)	3' to 4' The ditch profile may have to be steeper than the grade profile		3'	3'			
Ditch Side Slopes		2 H: 1 v (seemingly 1.57 H: 1 V)	Trapezoida1 w/3' minimum bottom width; or V-shaped						
Minimum CL Track to CL Ditch		21'							

Topic	*Railroad Corporation*		*Railroad Associations*		*CDOT*	*FHWA*	*FHWA*	*PUC*	*PUC*
	BNRR 2000	*UPRR 1998*	*AREMA 2000*	*AREA 1990*	*1989 Lapsed*	*1976*	*1991*	*1961*	*1988*
List of all pertinent regulations, decision, cases, standards, and recommended guidelines, i.e. of all pertinent railroad documents	Burlington Northern Railroad Clearances for Highway and Pedestrian Overpasses (standard drawing) revised November 2000. Also, Guidelines for Design and Construction of Grade Separation Structures 2000.	Union Pacific Railroad Design Clearances (Standard Drawing 0035); General Shoring Requirements (C.E. 106613); Barriers, Fences and Splashboards (drawing UP-OH1); and Typical Sections at Abutment Slopes (Drawing UP-OH2); all dated 3/31/98. Also, a 7/10/97 conversation with UPRR's Kurt Anderson (concerning the horizontal envelope dimensions E and F); telephone (402) 271-5891	Recommended standards and practices as developed by the American Railway Engineering and Maintenance of Way Association's technical committees in order to assist railroad corporation(s) AREMA is a 1997 merger of the American Railway Engineering Association the American Railway Bridge and Building Association and the Roadmasters and Maintenance of Way	Recom-mended standards and practices as developed by the American Railway Engineer-ing Associa-tion's technical committees in order to assist railroad corpora-tion(s)	Bridge Design Manual Section 2.4 Standard Railroad Clearances	Federal Aid Highway Program Manual Transmittal 194; Volume 6 Chapter 6 Section 2 Subsection 1 Attachment 1	Reference is to the 23 Code of Federal Regulations (CFR) 646B	Reference is to Colorado P.U.C. Decision Nos. 38476 and 55621, Case No. 5032. Are minimum values of practice in the public interest? The P.U.C. has the authority to approve or disapprove individual projects and may determine sharing expense, up to 50% participation, by the railroad corporation, the state, county, municipality, local authority or etc.	Additional '88 references are to Colorado P.U.C. Case No. 6329-re-opened (1987) and Decision No. C88-374, April 6, 1988. The P.U.C. retains authority to approve or disapprove individual projects and may determine sharing expenses, up to 50% participation, by the railroad corporation, the state, county, municipality, local authority or etc.

i Per BNRR Clearances for Highway and Pedestrian overpasses (standard drawing) dated 11/00
ii Per BNRR Guidelines for Design and Construction of Grade Separation Structures, (2000).

PROTECTIVE SCREENING, SPLASHBOARDS, AND DRAINS OVER RAILROADS

All highway bridges over any railroad shall include the following:

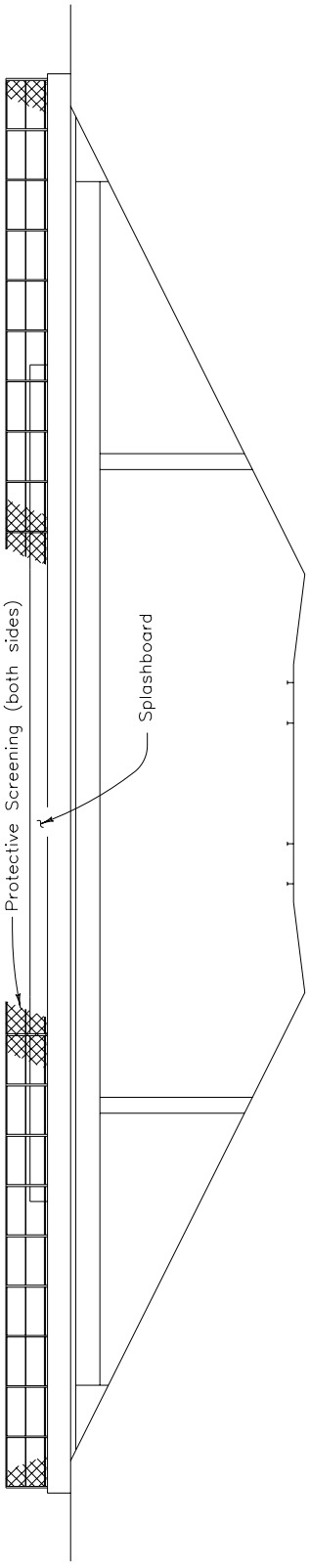
Protective screening may be provided on both sides, full length of the bridge or 100 feet minimum from the centerline of the outside tracks.

Splashboards may be provided on both sides for the span over the tracks or for a minimum distance of 50’-0" from the centerline of the outside tracks. Splashboards shall be included in the cost of Fence Chain Link Special.

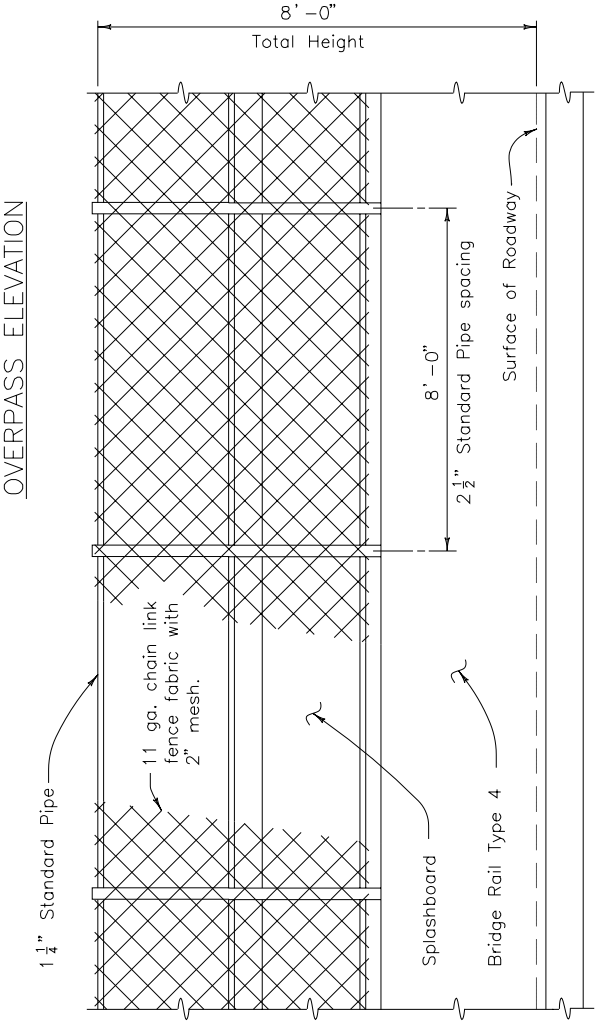
Bridge drains shall not be located within the length of the splashboard limits.

Bridge Rail Type 4 will be used for all bridges over railroads, unless the District requests the use of Bridge Rail Type 10.

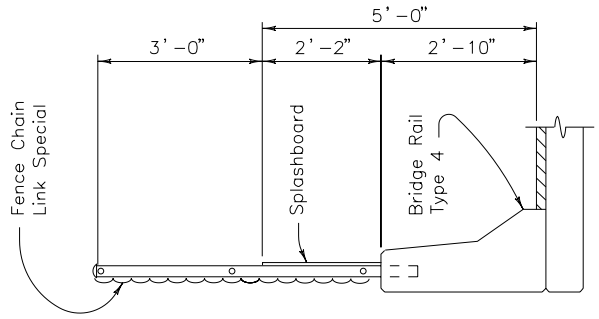
See page 2 for more details.



OVERPASS ELEVATION



ELEVATION



SECTION

SCREENED BARRIER FOR HIGHWAY OVERPASS

Drainage is to be diverted away from tracks and not discharged onto tracks and roadbed.

WIDTH OF ABUTMENT BERM

The width of the abutment berm, measured perpendicular to and in front of the front face of the abutment, shall be as indicated for the type of slope protection used:

For Concrete Slope Paving, the minimum berm width shall be two feet.

For Riprap, the minimum berm width shall be two feet plus the width of the riprap.

For 2:1 slopes, the riprap width shall be the square root of five multiplied times the riprap thickness.

See Subsection 7.2, Use of Integral Abutments, for additional information.

ACCESS FOR INSPECTION

POLICY	COMMENTARY

GENERAL

All bridge girders shall be made accessible either from the ground, from walkways installed within the girder bays, or by means of the "snooper" truck, as appropriate. All fracture critical details on bridges shall be made fully and readily accessible for inspection. The method of access used shall be both practical as well as the optimum method with all considerations taken into account. (C1)

C1: Parameters to determine which method should be used in a specific case are not available at this time. As a minimum, allowable ladder and snooper reaches should be provided by this memo in the future. At this time, designers must use their judgment in determining the optimum method of access to provide for.

STEEL AND CONCRETE BOX GIRDERS

Box girders with an inside depth of 5 feet or greater shall be made accessible for interior inspection. The bridge plans for these girders shall contain a note that all formwork (except steel stay-in-place deck forms and precast panel deck forms), concrete waste, and debris shall be removed from the inside of the boxes. (C2)

C2: An inside depth limitation of 4′, as well as 5′, was initially considered. The 5′ limitation was selected in order to insure that the access opening dimensions herein could be readily accommodated, and to provide the most reasonable space where entry by bridge inspectors would be required.

Steel box girders with an inside depth of less than 5 feet are discouraged. If used, they shall not be fracture critical members.

Access doors shall be aluminum, providing a 2′ by 3′ minimum opening, and shall open to the inside of the box girders. The doors shall be locked by a single padlock. Neither bolts nor screws may be substituted for the padlock. An example access door for steel box girders is shown on page 3 of this Subsection, and on Staff Bridge Worksheet B-618-2 for concrete box girders. (C3)

C3: There has been concern about corrosion between the aluminum door and the adjacent steel. With bare surfaces, this corrosion should be slow with aluminum as the sacrificial material. Therefore, problems are not anticipated within the probable life span of the structure. However, the plans should call for shop coating, as a minimum, of the aluminum to steel surfaces on painted girders. The designer may call for rubber shims at the interfaces with unpainted ASTM A588 steel if desired.

For payment, the aluminum plate should be included in the work for the girder. It should not receive a separate pay item. The plans should call for ASTM B209 aluminum plate, alloy number 6061-T6. Additional Material specifications are not needed.

Traffic, required ladder heights or "snooper" reaches, and other obstacles shall be taken into account when locating access

doors. Where possible, access doors near abutments should be placed 3 feet minimum to 5 feet maximum clear from top of ground to allow entry without a ladder. Where a ladder must be used above slope paving, support cleats or level areas for the ladder shall be provided in the slope paving.

Access through diaphragms within boxes shall be provided by openings 2’-6" or greater in diameter. At pier diaphragms, when special considerations may be necessary, the designer may submit to the Staff Bridge Engineer a request to use an opening between 2’-0" and 2’-6" in diameter.

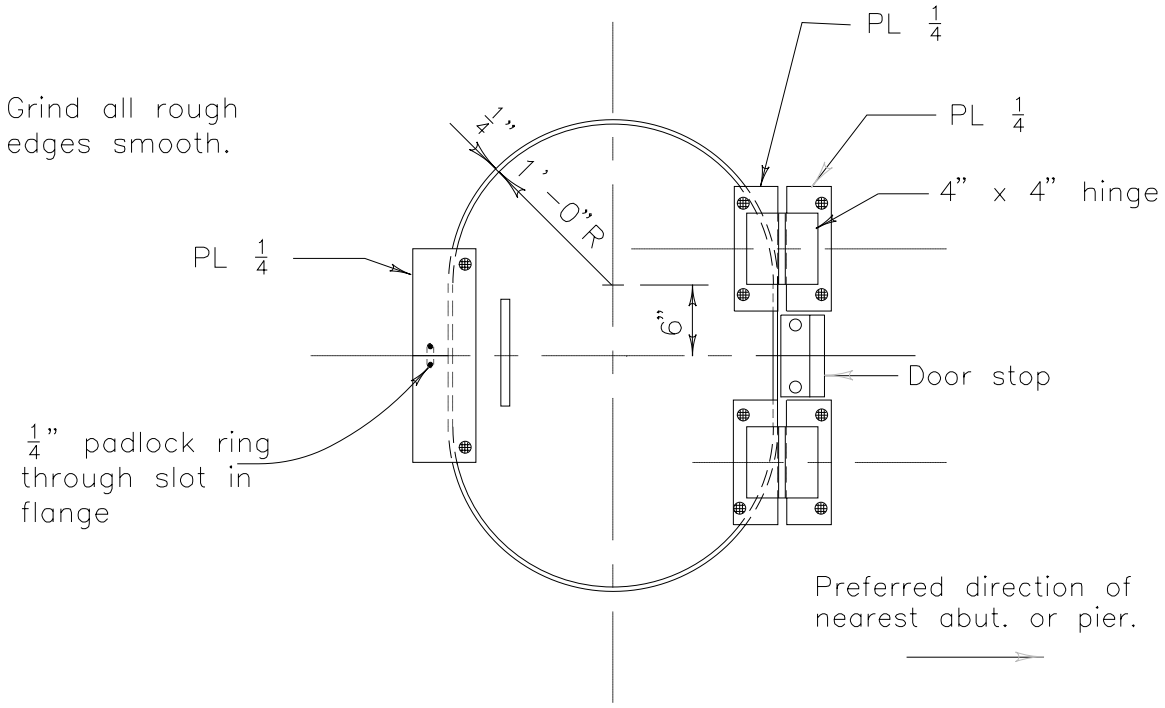
The bottom of the opening through diaphragms within boxes shall not exceed 2’-6" from the bottom of the girder unless details for passing through higher openings are provided; for example, step platforms, or climbing handles up the side of the diaphragm and, if necessary, along the bottom of the deck. (C4)

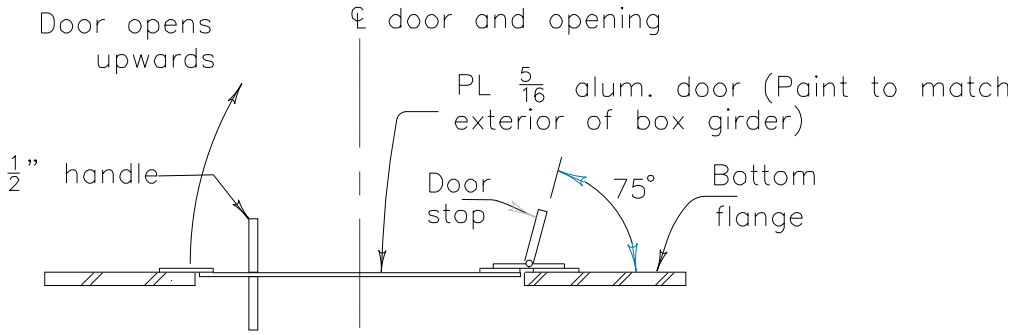
Attachments to diaphragms (e.g. bearing stiffeners) and other possible projections shall be detailed so they will not present a hazard to someone passing through the box.

The 2’-6" minimum diameter opening shall be provided through steel box girder intermediate diaphragms by using k-type bracing, as shown to the right.

C4: Comprehensive standard details are not available at this time. Standard practice in providing access to box girders has not evolved to where specific details, other than the requirements given by this memo, are being mandated.

MISSING FIGURE





ACCESS DOOR DETAIL

Door shall be aluminium ASTM B209 alloy no. 6061–T6. Other hardware and plates are ASTM A36 steel. Door and associated hardware to be included in Item 509 Structural Steel.