FDM 11-35-1 Widths, Clearances, Sidewalks and Protective Screening *November 15, 2022*

1.1 Structure Survey Reports

A structure survey report is required for all new, replacement, and rehabilitation bridge, retaining wall, box culvert extension and sign structure projects, or any other work performed on structures (refer to Chapter 6 of the WisDOT Bridge Manual Chapter 6 (https://wisconsindot.gov/dtsdManuals/strct/manuals/bridge/ch6.pdf). This report, including the appropriate soils information, must be received by Central Office Bureau of Structures according to the schedule. Variations to this schedule must be approved by the DTSD, Chief Structural Design Engineer. Reference should be made to the Bridge Design Manual for guidance in making this report and the selection of bridge types.

1.2 Clear Roadway Width of Bridges

Clear roadway width of bridges (aka “Bridge Width”, “structure width” and “clear roadway width of structures”) is a non-controlling criterion. Clear roadway width of bridges as defined in FDM 11-15-1 is “the most restrictive lower minimum distance between curbs or rails on a structure roadway. This measurement is exclusive of flared areas for ramps.

STH design criteria for clear roadway width of bridges are in FDM 11-15 Attachments 1.1 - 1.3.

CTH design criteria for clear roadway width of bridges are in FDM 11-15 Attachments 1.17 - 1.19.

Variances from these design criteria may be justified for long-span, high-cost structures and structures widened on the Corridors 2030 **(C2030)** Backbone system to accommodate traffic demand in work zones. See FDM 11-35-10 for warranting criteria and guidance on the appropriate use of 3-lane rural structures on the C2030 Backbone system. See FDM 4-1 Attachment 5.1 for a map showing the C2030 Backbone and Connector facilities. See FDM 11-45-30 for additional guidance if separated multi use paths are being considered as part of the structure.

1.2.1 Interstate[1]

On the Interstate System, the preferred design is full width shoulders across all bridges. However, the width of long bridges may be reduced to the width of the traveled way plus 4 feet offset on each side to the toe of the bridge parapets. Interstate long bridges are defined as those having an overall length in excess of 200 feet.

1.2.2 Town Roads

Town Road design criteria for clear roadway width of bridges are in FDM 11-15 Attachment 1.4 in the “Modernization Design Criteria for Town Roads (New Construction Only)”.

1.2.3 Urban Roadways

Urban Roadway design criteria for clear roadway width of bridges is the wider of:

- The full roadway width necessary to carry the design traffic* (see '*' note on next page), or
- The width needed to meet rating code 4 for item 68 as shown in FHWA’s Bridge Coding Guide[2], as shown in Table 1.1.

[1] A Policy on Design Standards Interstate System. Washington, DC: AASHTO, 2016

[2] *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.* FHWA-PD-96-001. Office of Engineering, Bridge Division, Bridge Management Branch, 1995. http://www.fhwa.dot.gov/bridge/mtguide.pdf, pp.48-50, Tables 2A, 2B, 2C, 2D

***Table 1.1** Clear Roadway Width of Bridges Needed to Meet Rating Code 4 for Item 68 as Shown in FHWA'S Bridge Coding Guide*

Roadway configuration	Coding Guide min. width*
2 lane divided	18' @ 2 sides
2 lane undivided	Depends on ADT & Length (L) 0-100 ADT = 18' 101-400 ADT = 20' 401-1000 ADT = 22 1001-2000 ADT = 24 2001-5000 ADT = 28' >5,000 ADT, L<200' = 32' >5,000 ADT, L >200' = 28'
4 lane divided	30' @ 2 sides
4 lane undivided	51'
6 lane divided	40' @ 2 sides

** Note: The full roadway width necessary to carry the design traffic includes:*

- *The traveled way (defined by AASHTO as the portion of roadway for the movement of vehicles, exclusive of shoulders),*
- *Shoulder or bike accommodation, and*
- *Gutter pan.*

Examples:

1. An urban 4-lane undivided roadway with 4 x 11-foot lanes and 2-foot gutters has a roadway width of 48-feet. The lower minimum clear roadway width of bridge needed to meet rating code 4 is 51-feet. Therefore, design the bridge clear roadway width = lower minimum width needed to meet rating coded 4 = 51-feet.
2. An urban 4-lane undivided roadway with 4 x 12-foot lanes and 2-foot gutters has a roadway width of 52-feet. The lower minimum clear roadway width of bridge needed to meet rating code 4 is 51-feet. Therefore, design the bridge clear roadway width = approach roadway = 52-feet.

In situations where bridge approaches with curb and gutter adjoin structures with concrete parapets, the horizontal offset (shy distance) shall be aligned and maintained consistent throughout the transition between the curb face and the parapet toe. This offset in urban areas is generally the width of the gutter pan, or the combination of the gutter pan plus the shoulder or bike lane width. This offset in rural areas is generally the shoulder width. Refer to Attachment 1.1 through 1.4 for detail drawings.

1.2.4 Between Consecutive Roundabouts

The design criteria for clear roadway width of bridges between consecutive roundabouts are in FDM 11-26-30.5.13.3.

1.3 Lateral Underclearances to Structures[3] [4]

Lateral underclearance to Structure is non-controlling criteria. Requirements are shown in Attachment 1.5 and Attachment 1.6. An approved Design Justification (DJ) is required if the provided lateral underclearance to structure is < distance ①, as shown on Attachment 1.5 and Attachment 1.6. It is possible that approved DJs to other design criteria will also be needed.

Lateral Underclearance to Structure (also known as “Lateral Clearance under Structures”, or “Lateral Clearance at Bridge Underpass,” is defined as “the distance from the edge of the through roadway (excluding shoulders) to the nearest substructure unit (pier, abutment, etc.), to a rigid barrier (concrete bridge rail, etc.), to a retaining wall, or to a toe of slope steeper than 3:1.” There are different requirements for structures to the left and structures to the right. 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. Also, see FDM 11-15-1 for additional discussion of Horizontal Clearance.

Provide the full approach traveled way width(s) and shoulder widths through new and replacement structures and, if possible, through existing structures. For expressways, freeways and ramps it is recommended to carry the entire roadway section under the structure without change. Entire roadway section includes the median, traveled way and shoulders. For urban streets, it is also recommended that the entire roadway width of the approach be carried under the structure without change. However, the economic impacts should be analyzed in each individual case. In some cases, right of way restrictions may necessitate a reduction in the median width under the structure. This reduced width would not be as objectionable on urban streets as on freeways because of the lower speeds.

Another consideration is sight distance thru the structure. Make sure that the lines of sight needed for sight distance along the roadway are not obstructed. Also, make sure that the lines of sight needed for intersection sight distance for nearby intersections are not obstructed. See FDM 11-10-5 for sight distance requirements.

1.3.1 Barrier considerations

Roadside barrier under structures is provided for 2 purposes – either (1) to protect vehicles on the roadway from roadside hazards - such as substructure units or (2) to protect the structure from damage by vehicles impacting the structure. Roadside barrier used for vehicle protection may not be adequate for structure protection. Roadside barrier used for structure protection will be adequate for vehicle protection. If roadside barrier is used, then provide the appropriate type, height, length-of-need, transitions, and terminals in advance of and beyond the structure.

1.3.1.1 Vehicle Protection Barrier

Evaluate the need for vehicle protection barrier using the methods described in FDM 11-45. A vehicle protection barrier must have sufficient height and a sufficient offset between the barrier and the substructure unit (distance ③ on Attachment 1.5 and Attachment 1.6) to lessen the possibility of a vehicle impacting the structure, either because of barrier deflection or from leaning over the top of the barrier. Height and offset requirements are shown in Attachment 1.5 and Attachment 1.6.

1.3.1.2 Structure Protection Barrier

Confer and coordinate with the Bureau of Structures (BOS) on the need for structure protection barrier and document in the DSR. Structural design criteria specify the criteria for which structure protection barrier is required.

Confer and coordinate with the Bureau of Structures (BOS) and the Bureau of Project Development (BPD) on the design requirements for a structure protection barrier. A structure protection barrier must have sufficient strength, length, height and a sufficient offset between the barrier and the substructure unit (distance ③ on Attachment 1.5 and Attachment 1.6) to lessen the possibility of a vehicle impacting and damaging the structure, including impacts from leaning over the top of the barrier. Height and offset requirements are shown in Attachment 1.5 and Attachment 1.6. Provide suitable end treatment, such as transition to W-beam or a crash

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[3] A Policy on Geometric Design of Highways and Streets, 7th Edition, AASHTO, 2018

[4] FHWA. Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges. FHWA-PD-96-001, Office of Engineering, Bridge Division, Bridge Management Branch. Washington, DC, Dec. 1995. http://www.fhwa.dot.gov/bridge/mtguide.pdf. Accessed 12-5-2012.

cushion.

A safer and more cost-effective alternative to a structure protection barrier may be to retrofit or strengthen the existing substructure element(s) to resist the load requirement – for example, a suitably designed concrete beam (crash wall) between the columns[5]. This approach would be especially appropriate where the use of a structure protection barrier would adversely affect adjacent pedestrian facilities, utilities, sight distances on adjacent roadways, etc. Of course, these locations would still need to be evaluated for vehicle protection barriers.

1.3.2 Lower Minimum Lateral Underclearance to Structure for Railroads

Lower Minimum Lateral Underclearance to Structure for railroads is defined as the distance from the centerline (between rails) to the nearest substructure unit (pier, abutment, etc.), to a rigid barrier (concrete bridge rail, etc.), to a retaining wall, or to the toe of a slope steeper than 3:1. Requirements are shown in the Bridge Manual. Also, see FDM Chapter 17.

1.4 Parapets on Structures

Parapets on structures without approaching concrete barrier should generally be the 42-inch parapet with the Steel Thrie Beam Structure Approach and end treatment. There may be other bridge rails used as well, but typically end treatments will be applied. See FDM 11-45 for guidance on appropriate end treatments.

Parapets on structures should match the height and shape of the approaching barrier in the highway area. If the highway median approach concrete barrier is 51-inch, provide a 51-inch parapet on the structure as well.

1.5 Vertical Clearances[6] [7] [8]

See Attachment 1.8 and Attachment 1.9.

Additional under-clearance for pedestrian and sign bridge structures on roadways is provided because these types of structures are assumed to be non-redundant structures (i.e. trusses, two girder bridges) and have main structural members which are substantially lighter than the main structural members of vehicle overpass structures, and thus are more susceptible to collapsing from the impact of an over-height vehicle. This additional clearance is not required for railroads because railroads have exclusive control for heights moving down their lines, and therefore do not have the risks associated with highway traffic.

Vertical clearance over railroad tracks may sometimes be less than 23 feet -0 inches. See Note 7 on Page 1 of Attachment 1.8.

For interstate projects where vertical clearance over the interstate highway either exists or is proposed to be below 16 feet, complete design justification coordination with the Federal Highway Administration (FHWA) and

the Military Traffic Command Transportation Engineering Agency (MTMCTEA) of the Department of Defense using the guidance found at https://www.fhwa.dot.gov/design/090415.cfm.

1.5.1 OSOW High Clearance Routes

The Department has adopted OSOW High Clearance Routes with the objective of minimizing overhead constraints for OSOW vehicles along these routes. Refer to FDM 11-10-5.4.3 for further vertical clearance guidance along the high clearance routes.

Provide a lower minimum 20’-0” vertical clearance for new and replacement sign structures along the OSOW High Clearance Routes.

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 route for new bridges, replacement bridges and bridges with superstructure replacement. The Department’s goal is to provide a lower minimum vertical

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[5] Sicking DL. barrier requirements for pier and abutment protection to be included in FDM Procedure 11-35-1 - comment from Dean Sicking of MWRSF. Emerson E, editor. 6-18-2007.

[6] A Policy on Design Standards Interstate System. Washington, DC: AASHTO, 2016

[7] A Policy on Geometric Design of Highways and Streets, 7th Edition, AASHTO, 2018

[8] FHWA. Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges. FHWA-PD-96-001, Office of Engineering, Bridge Division, Bridge Management Branch. Washington, DC, Dec. 1995. http://www.fhwa.dot.gov/bridge/mtguide.pdf. Accessed 12-5-2012.

clearance of 20'-0" for bridges along these routes. Do not reduce existing vertical clearance less than or equal to 20'-0" along these routes. Consult the general notes of Attachment 1.8 and Attachment 1.9 for vertical clearance design criteria.

1.6 Sidewalks, Bicycle Accommodations, Shared Use Paths and Roundabout Sidepaths

Where a bridge is being replaced or receiving a major rehabilitation, such as re-decking, on a highway without full control of access, and bicycle operation is permitted at each approach, the bridge should be built to safely accommodate bicycle traffic. Likewise, provide sidewalk on or under a bridge within urban, suburban and transition areas where sidewalks exist or are very likely to be connected to the bridge once the bridge is in service. US DOT Policy on Accommodating Pedestrians and Bicycles states that bicycle and pedestrian ways shall be established in new construction and reconstruction projects in all urbanized areas unless the cost of establishing those facilities exceeds 20% of the cost of the larger project.

See FDM 11-46 for guidance on accommodating pedestrians and bicyclists.

1.6.1 Sidewalks

Sidewalks on bridges shall be designed a lower minimum of 6 feet wide. The typical sidewalk approach to the bridge will be 5 feet wide. Just prior to the bridge it is important to transition the sidewalk width to 6 feet. The transition area will include the sidewalk plus a nominal width for the curb head (1 foot is typical) to provide a lower minimum 6-foot wide sidewalk across the bridge, curb face to the parapet toe, or vertical face. In situations where high pedestrian usage across the bridge is anticipated, a wider sidewalk may be justified. This may occur in urban areas that are fully developed or developing with retail stores or office buildings. Apply the same sidewalk width principals described above. The approach sidewalk width plus a nominal width for the curb head (1 foot is typical) will yield a final width of sidewalk for the bridge crossing. The 1-foot of typical additional width will provide for the curb head and will serve as a 1 foot recommended shy distance from the curb face to the pedestrian.

Sidewalks under new, replacement and existing structures with at least a 3-foot terrace between the face of curb and the sidewalk shall have a lower minimum width of 5 feet. Sidewalks under new, replacement and existing structures where terrace is less than 3-feet between the face of the curb and 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.

Raised curb and sidewalk are sometimes provided on a structure in anticipation of future sidewalk being connected to it. If the barrier is located on the outside edge of the sidewalk, then the sidewalk and curb must be extended beyond the barrier terminal for a distance of at least 30-feet - see Attachment 1.1. The purpose is to maintain the functionality of the barrier and barrier terminal. Terminate the sidewalk and raised curb by installing a temporary asphaltic height transition, or ramp, on the roadway approach from the top surface of the sidewalk down to the level of the adjacent ground surface to eliminate the blunt end effect of the sidewalk. This transition height is typically 6 to 8 inches and shall extend approximately 10 feet in advance of the end of the sidewalk. This guidance applies to all posted speeds and all project locations. Consider using white, 4-inch, cross hatch pavement marking to delineate the ramp area.

Existing conditions on Perpetuation and Rehabilitation projects may require that a raised sidewalk remain in place with less than the lower minimum width. The current use, width, safety and ADA requirements shall be evaluated on a project specific basis. Provide justification in the DSR for sidewalks left in place with less than the lower minimum width.

Note: sidewalks on or under bridges need an agreement with local governments to establish maintenance responsibility.

A structure shall include a parapet or barrier wall to separate the roadway from a sidewalk based on Table 1.2 for the proposed posted speed. Barrier requirements for shared use paths are discussed below in the Shared Use Paths section.

Table 1.2 Barrier Wall Separation Required Between Roadway and Sidewalk [9]

For new, reconstructed, or rehabilitated structures with a posted speed >= 45 mph	For other existing structures with a posted speed >= 45 mph	For any structure with a posted speed <= 40 mph
Yes	No, unless requested by community and agreed to by the Department. [1]	No, unless requested by community and agreed to by the Department [1]

[1] The designer and community may decide that a parapet/barrier wall separation is a desirable safety solution, especially for posted speeds of 35 mph and greater. Bear in mind that installing a parapet or barrier on a structure is considered structure rehabilitation. Consider the adjacent roadway character, shy distance between traveled way and raised curb sidewalk, pedestrian volume, length of structure

1. *Part of reasonable justification to provide separation is if the adjacent roadway character is rural.*
2. *Another reasonable justification to provide separation is if there is a narrow shoulder or gutter (< 1.8-ft) located between the travel lane and the sidewalk.*
3. *High, seasonal or year around, pedestrian volume may suggest that separation is desirable.*
4. *A long structure may be more likely to include separation than a short structure.*

Justification to include parapet/barrier wall separation in the Design Study Report is not required, but is encouraged.

The lower minimum height for a barrier wall/parapet separating the sidewalk from the roadway is 32-inches for posted speeds of 40 mph or greater (see Attachment 1.1, Section C-C). A lower barrier meeting NCHRP 350 TL2 may be considered for posted speeds of 35 mph or less.

The lower minimum height for a barrier wall/parapet on the outside of the sidewalk is 42-inches (see Attachment 1.1, Section B-B to visualize the raised curb sidewalk option). Keep in mind that certain areas require Protective Screening, to discourage people from dropping or throwing objects onto vehicles passing under the structure. See FDM 11-35-1.8 for guidance on Protective Screening.

Also, see FDM 11-45-30.3.5, “Transitions to Rigid Barriers.”

1.6.2 Bicycle Accommodations

The majority of bicycle accommodations in rural areas will be provided through paved shoulders and in urban areas through bike lanes. If a bridge or approaching highway has either pavement-marked bike lanes, or is signed as a bicycle route, and the bicycle accommodation is immediately adjacent to the bridge railing, the railing height should be a lower minimum of 42-inches. If the bridge/highway is not marked or signed as a bicycle facility, then use the typical 32-inch barrier height on the bridge (i.e. even if the bridge/highway has a paved shoulder wider than typical paved width shoulder and is not marked or signed as a bicycle facility use the typical barrier height). Refer to FDM 11-46-15 for additional information on bicycle accommodations.

1.6.3 Shared Use Path

In some situations, a two-way shared use path will be provided. Two-way shared use paths, like sidewalks, need agreement for maintenance and right-of-way considerations from the local unit of government and the DTSD, Chief Structural Design Engineer. Two-way shared use paths should only be used when they connect to, or are planned to connect to, two-way shared use paths on both ends of the bridge for a significant distance beyond the approaches.

Two-way shared use paths are required to be separated from the traveled way for all posted speeds with a 42-inch barrier wall, except that a 32-inch barrier wall may be considered if:

- There is 5 feet or more separation (i.e. shoulder or bike accommodation) between the outside edge of the traveled lane and the face of barrier, or
- There is a shared use path on a short bridge (less than 75 feet).

There is another unique option for a shared use path that allows the elimination of the barrier wall if the posted speed is 40 mph or less. That option is to provide a 16- foot wide raised curb shared use path across the structure. This option provides the 5- foot space separation and the shared use path as a combined raised curb section (see Attachment 1.1, Section B-B to visualize the raised curb option).

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[9] TRB, Plaxico CA, Ray MH, Weir JA, Orengo F, Tiso P et al. Recommended Guidelines for Curb and Curb-Barrier Installations. NCHRP Report [537], C1-C2; i-vi, 1-96; A-I; C3 (106 total). 2005.

If a parapet/barrier separation device is used, then a shared use path on or under a structure is required to be 2 feet wider than the width of the path approaching the structure (this is commonly 12 feet wide). For paths on the structure this width is measured from the barrier wall back face to the face of the outer protection, be it fencing, railing or parapet (see Attachment 1.1, Section C-C to visualize the separated path option). For paths under a structure, this width is measured from the barrier wall back face to the face of the nearest substructure unit.

The outside protection is recommended to be a 54-inch height when adjacent to a shared use path. The lower minimum height of the outside protection is 42 inches. The higher height protection should be provided on any curved sections of paths leading up to or away from a bridge or underpass. Providing higher protection on long and high bridges will also provide an additional level of comfort for users. The consequences of going over the outside protection can be considered in determining the height. For example, a short drop-off or a grassy sideslope with a modest grade of incline on the other side of the protection would support the lower minimum height, as would a short bridge crossing or an extra wide path where users can shy away from the railing or fence.

Chain link fence is available in nominal heights of 4-feet, 5-feet, 6-feet etc. Therefore, if using chain link fence use 5-foot height or higher. Keep in mind that certain areas require Protective Screening, to discourage people from dropping or throwing objects onto vehicles passing under the structure. See FDM 11-35-1.8 for guidance on Protective Screening.

When a height transition between different height barrier walls or between beam guard and a higher wall is needed, the transition ratio is 20:1. When transitioning from Steel Thrie Beam Structure Approach, 31-inch height, to a 42-inch barrier wall height approximately 18 feet of wall length is needed for the height transition. As a result of this transition up to full barrier wall height and back down on the other end of the barrier wall to the beam guard height, the overall/total barrier wall length should be 75 feet or longer to justify a 42-inch barrier wall separation device. See FDM 11-46-15 for additional guidance on bicycle facilities.

Also, see FDM 11-45-30.3.5, “Transitions to Rigid Barriers”.

Under structures, provide at least the median shoulder width, travel lane width(s), outside shoulder width and shared-path width. If there will be road signs, power poles, light poles or other fixtures installed along the roadside then provide at least a 5-foot-wide terrace between the face of curb at the outside of the shoulder and the front of the path.

Note: Increasing bridge width to facilitate snow removal can rarely be economically justified.

1.6.3.1 Roundabout Sidepath

A “roundabout sidepath” is a sidepath around the perimeter of an isolated roundabout or a sidepath between two closely spaced roundabouts and around their perimeters. See FDM 11-26-30.5.13 and FDM 11-46-15.6 for additional guidance on closely spaced roundabouts and roundabout sidepaths.

Typically, the barrier wall/parapet is on the outside of a roundabout sidepath and not between the roadway and a roundabout sidepath (see Attachment 1.1, Section B-B). However, at locations with high, seasonal or year around, pedestrian or bicycle use, the barrier wall/parapet may be between the roundabout sidepath and the roadway if the Department and the community jointly agree that this is a desirable safety solution. For this case, place a fence on the outside of the roundabout sidepath - see Attachment 1.1, Section C-C. For locations where a barrier wall/parapet is between the roadway and the roundabout sidepath, the lower minimum height of barrier wall/parapet is 42-inches, except that a 32-inch barrier may be considered if:

- There is 5 feet or more separation between the outside edge of travel lane and the face of barrier, or
- There is a roundabout sidepath on a short bridge (less than 75 feet).

A roundabout sidepath on a structure is required to be 2 feet wider than the width of the roundabout sidepath approaching the structure. This width is from the face of curb to the face of the barrier wall/parapet (or, if the parapet/barrier is between the roundabout sidepath and the roadway, from the back face of the barrier wall/parapet to the fence).

As with shared-use paths, the recommended height of the outside protection is 54-inch when adjacent to a roundabout sidepath. The lower minimum height of the outside protection is 42 inches. Provide the taller protection on any curved sections of a roundabout sidepath leading up to or away from a bridge or underpass. Providing taller protection on long and high bridges also provides an additional level of comfort for users. Consider the consequences of going over the outside protection in determining the height. For example, a short drop-off or a grassy sideslope with a modest grade of incline on the other side of the protection would support the lower minimum height, as would a short bridge crossing or an extra wide roundabout sidepath where users can shy away from the railing or fence.

Keep in mind that certain areas require Protective Screening to discourage people from dropping or throwing

objects onto vehicles passing under the structure. See FDM 11-35-1.8 for guidance on Protective Screening.

Also, see FDM 11-45-30.3.5, "Transitions to Rigid Barriers."

Under structures, provide at least the median shoulder width, travel lane width(s), outside shoulder width and roundabout sidepath width. If there will be road signs, power poles, light poles or other fixtures installed along the roadside then provide at least a 5-foot-wide terrace between the face of curb at the outside of the shoulder and the front of the path.

1.7 Touchdown Points on Local Program Bridge Projects

Refer to FDM 3-20-1 for a discussion of the process for determining local program bridge approach length eligible for federal funding.

1.8 Protective Screening

Protective screening is a special type of fence built on the sides of an overpass to discourage people from dropping or throwing objects onto vehicles passing under the structure. Protective screening shall be provided on overpasses based on the following chart.

Table 1.3 Protective Screening Requirements

Structure Type	With Sidewalk, Shared-Use, or Roundabout Sidepath	Without Sidewalk, Shared-Use Path, or Roundabout Sidepath
New	Yes	When Warranted
Existing	When Warranted	When Warranted

Example situations that warrant consideration of protective screening are:

1. If there have been instances of objects being dropped or thrown from an existing overpass.
2. For new overpasses, if there have been such instances at other existing overpasses in the area.
3. On overpasses near a school, playground, residential area or any other location where the overpass may be used by children who are not accompanied by adults.
4. On railroad bridges over highways in urban areas. If screening is used then use one -inch chain link mesh screening at these locations.

In addition, all pedestrian overpasses should have protective screening on both sides.

Protective screening is not always warranted. An example of when it may not be warranted is on an overpass without sidewalks where pedestrians do not have safe or convenient access to either side because of high traffic volumes or the number of traffic lanes that must be crossed.

If protective screening is warranted, the lower minimum design should require screening on the side of the structure with sidewalk. Designers may call for protective screening on sides without sidewalk if those sides are readily accessible to pedestrians.

Designers should ensure that where protective screening is called for, it does not interfere with sight distances between the overpass and any ramps connecting it with the road below. This is especially important on cloverleaf and partial cloverleaf type interchanges.

Protective screening is considered part of the design of the overpass structure. Designers should refer to the Bridge Manual for further guidance on protective screening.

LIST OF ATTACHMENTS

Attachment 1.1	Structure Roadway Widths and Approach Details
Attachment 1.2	4 - Lane Divided Highway Structure Widths (w/Acceleration Lanes)
Attachment 1.3	4 - Lane Divided Highway Structure Widths (w/Deceleration Lanes)
Attachment 1.4	2, 4, and 6 - Lane Structure Widths (Special Situations)
Attachment 1.5	Lateral Underclearance to Structure for Rural Highways, Expressways, and Freeways
Attachment 1.6	Lateral Underclearance to Structure for Urban Streets
Attachment 1.7	Examples of Lateral Underclearance to Structure

Attachment 1.8 Lower Minimum Vertical Clearance for New Bridges and Replacement Bridges

Attachment 1.9 Lower Minimum Vertical Clearance for Bridges to Remain

FDM 11-35-5 Temporary Bridges

May 15, 2019

Temporary bridges may be warranted to minimize user delays. Early in the design process, confer and coordinate with the Bureau of Structures (BOS) and the Bureau of Project Development (BPD) on the need for temporary bridges and for design requirements. See Chapter 8 of the WisDOT Bridge Manual for hydraulic design criteria for temporary structures (http://wisconsindot.gov/dtsdManuals/strct/manuals/bridge/ch8.pdf). Typically, temporary bridges are either designed by the department or the contractor. For contractor-designed bridges, the contractor is responsible for the design, construction, inspection, maintenance, and removal, while the department provides clearance requirements. For department-designed bridges, the contractor is typically responsible for the construction, inspection, maintenance, and removal, while the department provides the design.

Lower minimum clearance requirements shall be considered when using temporary bridges. This is especially important for vertical clearance checks with contractor-designed bridges. During the design process, the designer will need to assume a superstructure depth to check vertical clearances. Keep in mind that contractor-designed temporary bridges are the responsibility of the contractor and assuming a less than practical superstructure depth may result in high costs or construction issues.

Note: The region and structural engineer should verify estimated superstructure depths are reasonable. Contact BOS early in the design process for questions regarding estimated superstructure depths.

FDM 11-35-10 Three Lane Bridge Criteria

August 15, 2019

10.1 General

This guidance is limited to 4-lane divided Corridors 2030 (C2030) Backbone rural facilities. See FDM 4-1-5. It is not intended to address structure widening on C2030 Backbone facilities in urban areas, or rural facilities wider than 4-lanes. However, information contained in this procedure may assist in the thought process of potential solutions for urban, high capacity, high volume roadways.

For guidance on determining the work zone capacity and user delay reference FDM 11-50.

This guidance is intended to assist in the evaluation of:

1. When to provide a wider bridge, with overall clear width of 56-feet.[10]
2. Methods to widen an existing bridge from 2-lanes to 3-lanes, while maintaining 2-lanes of traffic on the bridge as it is being widened.

View these guidelines as warrants to consider a wider bridge, not as absolute “must build” design criteria.

10.2 Bridge Widening Warrants

The widening decision depends on the following factors.

- Projected traffic volumes for the year when the adjoining highway will be reconstructed or rehabilitated (not when the bridge will be overlaid or re-decked)
- The proposed project improvement type for the adjoining highway
- The hours during which highway construction will cause lane restrictions.

Bridge widening is warranted if the projected AADT reached 25,000. This AADT on a highway with average peaking characteristics would produce a DHV of approximately 1,700 vph.

[10] The 56-foot clear width bridge is based on three 12-foot lanes with 10-foot shoulders on each side. The final bridge width may vary from the typical 56-feet in some situations. This variation may be necessary to accommodate construction staging and other project specific requirements. The 56-foot clear width will allow for a work zone to have four 11-foot lanes, a barrier wall separating the 2 lanes of traffic in each direction, and approximately 2.5-foot shy distance on each side of the center barrier wall and 2.5-foot shy distance from the outside parapet walls. The shy distance may vary as well depending on construction staging.

Bridge widening may be warranted under the following conditions.

- If the projected AADT is between 20,000 and 25,000 and high seasonal peaking characteristics are present. This AADT on a highway with average peaking characteristics would produce a DHV of 1,400 vph and 1,700 vph respectively.
- If the projected AADT is less than 20,000 and high summer weekend traffic is present. In this situation, an hourly traffic demand and capacity analysis in the project areas is required to justify the need for a 3-lane bridge.

Also, consider whether the proposed construction would allow lanes to be re-opened during peak traffic hours.

Within the 75-year life cycle of a bridge on a Corridors 2030 Backbone route, there is typically a deck overlay that takes place 25-30 years after the original construction. The bridge is re-decked about 20-25 years after the overlay. After the bridge is re-decked, it is anticipated to last another 25-30 years, or the remainder of the structure's useful life. The decision whether to widen in conjunction with the bridge rehabilitation or wait until the next highway rehabilitation project depends on the type of bridge work needed (i.e., replacement, re-decking, or overlay) and the timing of the next anticipated pavement reconstruction project.

10.2.1 Bridge Replacement or Re-Decking.

Bridge widening is warranted if reconstruction of the adjoining highway is anticipated within 20 years, and if the projected traffic volumes meet the warrants described above.

10.2.2 Bridge Deck Overlay

Typically, bridge widening isn't done when a bridge is programmed for an overlay. However, bridge widening is warranted at the time of the overlay if highway reconstruction or rehabilitation is scheduled within 10 years and the work will require lane closures and will cause the traffic demand to exceed the capacity of the existing facility.

10.3 Bridge Rehabilitation and Widening Practices

After the decision to widen has been made, there are 3 other decisions to make. The first is whether to widen both bridges at a location. Although widening both bridges is preferable because it allows future work zones to be separated from traffic by the median, it may be uneconomical or undesirable for other reasons. However, even if only one bridge is widened, construction traffic control can still be staged to maintain 2 lanes of traffic in each direction.

The second decision is whether to replace the entire existing deck, or to attach the widening to it. Refer to the Bridge Manual Chapter 40, Bridge Rehabilitation, particularly Section 40.8, "Widenings". This section, in part, states that:

> *"Deck widenings, except on the Interstate, are attached to the existing decks if they are structurally sound and the remaining width is more than 50 percent of the total new width. If the existing deck is over 20 percent surface delaminated or spalled, the existing deck shall be replaced. For all deck widenings on Interstate Highway bridges, consideration shall be given to replacing the entire deck in order that total deck life is equal and costs are likely to be less when considering future traffic control. Evaluate the cost of traffic control for deck widenings on other highway bridges. The total deck should be replaced in these cases where the lifecycle cost difference is minimal if future maintenance costs are substantially reduced."*

The third decision is whether to widen to the inside (median side), to the outside, or to both sides. This is decided on a case-by-case basis, but factors which may affect this decision include:

- Whether the widening construction is to be done under traffic,
- Environmental impacts,
- Right-of-way acquisition,
- Whether there are plans for capacity expansion on the approach roadway,
- Cross section geometry, including: clear roadway width of the bridge, median width, crown line, ditch depth, fill height, maximum side slopes, and clear zone,
- Vertical clearance (particularly if there is superelevation), usually below the bridge, but possibly above the bridge for multi-level sites,
- Drainage.

If the widened portion of the bridge isn't to be used, other than for construction traffic handling, provide edgeline pavement marking similar to the adjoining highway. Shield the parapet wall with either an acceptable crash cushion, or with thrie beam and an energy-absorbing terminal.

10.4 Other Factors to Consider

When planning a bridge or a highway rehabilitation project, consider using a public awareness campaign to reduce the anticipated traffic and provide alternative detour routes where possible. In certain situations, this may eliminate the need for a wider bridge.

For bridges that are to be widened adjacent to live traffic lanes, consider requiring deck pours to be done during period of low traffic volume. This will reduce the vibrations that can cause an insufficient bond between the concrete and the reinforcing steel. Although important, this concern is generally considered to be less significant than the major user delay that will result if traffic is restricted and long queues develop.

Consider funding availability and impacts on other projects in the program. This is especially true when making decisions on deck overly projects and basing the decision on the timing of projected highway reconstruction projects that fall beyond the current 6-year program. Given the limited Backbone Program budget and the history of project cost increases and critical additions to the Backbone Program, it is possible that projects anticipated in 8-10 years may be delayed beyond this period. In these cases, consider waiting to do the widening until just before the reconstruction occurs.