Road & Bridge Design Publications

Monthly Update – March 2013

Revisions for the month of **March** are listed and displayed below. The special detail index for **February** will remain in effect. Please contact Wayne Pikka (pikkaw@michigan.gov) for questions regarding the road changes. Contact Vladimir Zokvic (zokvicv@michigan.gov) for questions related to the bridge changes.

Road Design Manual

6.03.09: HMA Mixture Selection Guidelines: Updated the CPM Binder Selection Guidelines by lowering the low end binder grade to address pre-mature cracking and eliminating the use of 5E50 for CPM jobs.

12.12: Bicycle Facilities: This section was re-written and restructured with updates for consistency with the 2012 AASHTO Guide for the Development of Bicycle Facilities and the MDOT Complete Streets Policy. Revisions include updated terminology, definitions, design values and an added requirement for design exceptions related to exclusive use bicycle lane widths.

Bridge Design Manual

7.02.13 C. (LFD & LRFD): Clarified that high strength bolts are hot-dip galvanized.

8.06.07 B. (LFD & LRFD): Designated sheet piling used in heavy chloride/sulfate area or critical location to be hot-dip galvanized.

8.07.04 W. (LFD & LRFD): Items cast into bridges shall all be hot-dip galvanized.

Updates to MDOT Cell Library, Bridge Auto Draw Program, etc., may be required in tandem with some of this month's updates. Until such updates to automated tools can be made, it is the designer's/detailer's responsibility to manually incorporate any necessary revisions to notes and plan details to reflect these revisions.

6.03.09 (revised 3-18-2013)

Hot Mix Asphalt (HMA) Mixture Selection Guidelines

This guide is to aid in the selection of Hot Mix Asphalt (HMA) mixtures, asphalt binders and Aggregate Wear Index values. It is the ultimate responsibility of the Region Soils/Materials Engineer to provide appropriate hot mix asphalt and thickness recommendations. Any questions regarding these guidelines should be addressed to either the HMA Unit or the Pavement Design Engineer in the Construction Field Services Division.

A. Rehabilitation, Reconstruction (R&R) and New Construction Projects

1. Mainline Paving

a) Mixture Selection

All mainline paving shall be composed of Superpave mixtures; exceptions do exist for the Capital Preventive Maintenance Program (CPM) (see Section 6.03.09B).

Computed Design BESAL's (HMA Equivalent Single Axle Load) will be used to identify the appropriate Superpave mixture type.

6.03.09A1a (continued)

Superpave Mix Type	Design BESAL (millions)
E03/LVSP	Less than 0.3
E1	Between 0.3 and 1.0
E3	Between 1.0 and 3.0
E10	Between 3.0 and 10.0
E30	Between 10.0 and 30.0
E50	Between 30.0 and 100.0
GGSP	Between 10.0 and 100.0

GGSP is to only be used as a top course mixture.

Design BESAL's are calculated using the following information:

- Commercial Traffic
- Traffic Growth Rate
- Lane Distribution of Commercial Traffic
- BESAL Axle Load Equivalency for Flexible Pavement
- Total accumulated BESAL's for 20 year design

The method for calculating ESAL's for flexible pavements (BESAL's) is explained in the ***AASHTO Guide for Design of Pavement Structures,*** 1993. Design BESAL's should be requested from the Project Planning Section of the Project Planning Division. The Pavement Design Engineer of the Pavement Management Section of the Construction Field Services Division can provide an approximate BESAL value (for estimating purposes only). Show the 20 year design BESAL's on the design plans.

b) Superpave Mixture Number Designation and Thickness Guidelines

After mixture selection has been determined, based on design BESAL's, the mixture number for use in the various pavement courses can be determined**.** The mixture number will be 2, 3, 4 or 5 depending on the nominal maximum size aggregate. Following are the mixture numbers, minimum/maximum application rates and course type application:

6.03.09 (continued)

Hot Mix Asphalt (HMA) Mixture Selection Guidelines

B. Capital Preventive Maintenance Projects (CPM)

Mainline and Non-Mainline Paving

- Selection is based on present day two-way commercial ADT. This table is to be used for CPM projects only.

Mixture Type and Binder Selection

Commercial ADT 0 - 300	Commercial ADT 301 – 700	Commercial ADT 701 – 1000	Commercial ADT 1001 – 3400	Commercial ADT ≥ 3401
LVSP/E03	5E1	5E3	5E10	GGSP or 5E30
PG 58-28*	PG 58-28*	PG 64-28*	PG 64-28*	PG 70-28P*

* Use PG 58-34 asphalt binder in the Superior Region for full depth flexible pavements.
Use PG 58-28 asphalt binder in the Superior Region for composite pavements.

NOTES:

- For shoulder paving, use a LVSP or E03 mixture.
- For mainline paving the application rate is 165 lbs/syd (1½" compacted thickness) for all mixes unless approved by the CPM Engineer. For shoulder paving the maximum application rate is 330 lbs/syd (3" compacted thickness).
- For hand patching, use the appropriate mainline mixture. Use a PG 58-28 binder for all regions.

C. Aggregate Wear Index
(All R&R, CPM and New Construction Projects)

Aggregate Wear Index (AWI) is required for all aggregates used in bituminous top course mixtures. The following table identifies the required minimum AWI, based on the present average daily traffic (vehicular and commercial) per lane (ADT/Lane):

ADT/Lane	Minimum AWI
< 100	None
100 – 2000	220
> 2000	260

It is the responsibility of the designer to select the appropriate AWI for each top course mixture. When a bituminous top course mixture requires an AWI, the appropriate number corresponding to each top course mixture should be clearly identified in the HMA Application Estimate Table.

CHAPTER 12 MISCELLANEOUS ROADS INDEX (continued)

12.10.05 Curb Type in Rest Areas

12.10.06 Tar Emulsion Protective Seal Coat (Deleted pending review)

12.10.07 Barrier in Advance of Weigh Station Building

12.10.08 Portable Intermittent Truck Weigh Stations (PITWS) General Information

12.11 RAILROAD CROSSINGS

12.11.01 References

12.11.02 General

12.11.03 Railroad Contracts

12.11.04 Design of At-Grade Crossings
- A. Track Elevations on Plans
- B. Track Raises
- C. Establishing Grade
- D. Superelevation
- E. Types of Crossings
- F. Railroad Owned Materials
- G. Traffic Control Devices (Railroad Signals and Gates)

12.11.05 Railroad Grade Separations

12.12 BICYCLE FACILITIES

12.12.01 Legislation

12.12.02 References

12.12.03 Types of Bicycle Facilities

12.12.04 Non-motorized Transportation Project Review

12.12.05 Deleted

12.12.06 Deleted

12.12.07 Agreements – Shared-Use Paths

12.12.08 Deleted

CHAPTER 12 MISCELLANEOUS ROADS INDEX (continued)

12.12.09 Design Features of Shared-Use Paths
- A. Design Speed
- B. Grades
- C. Horizontal Alignment
- D. Crown and Superelevation
- E. Width
- F. Clearances
- G. Grading
- H. Surface Type
- I. Drainage and Structures
- J. Railings and Retaining Walls
- K. Shared-Use Facility Railroad Crossings
- L. Interchanges
- M. Curb Cuts and Bollards

12.12.10 Design Features of On-Road Bicycle Facilities
- A. Facility Type – Posted Speed
- B. Width
- C. Intersection
- D. Roundabouts

12.13 CARPOOL PARKING LOTS

12.13.01 General

12.13.02 Design Considerations
- A. R.O.W.
- B. Borings
- C. Survey
- D. Surfacing
- E. Cross-slope
- F. Pavement Markings
- G. Signing
- H. Landscaping
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12.14 TRUCK TRAPS

12.14.01 Purpose and Description

12.14.02 Design Details

12.12

BICYCLE FACILITIES

12.12.01 (revised 3-18-2013)

Legislation

Section l0k of Act 327, P.A. of 1972 amended the basic Act 51, by providing that ½ of 1% of the gas and weight tax returns made to the Department, counties, cities, and villages be spent for non-motorized transportation. Act 444, P.A. of 1978, further amended Act 51 by increasing the percentage to 1%. PA 135 of 2010 again amended Act 51, Section 10k and added Section 10p. The 2010 amendments define the concept of complete streets and outline coordination requirements on projects involving multiple agencies/jurisdictions.

Attorney General Opinions

Various Attorney General Opinions have stated the following:

A. The term "highway" includes facilities for non-motorized transportation; thus, the right of eminent domain applies. (November 1, 1973)

B. Participating cities must participate in the cost of a non-motorized path as if it were a highway. (April 29, 1974)

C. The Department must pay the entire cost of a railroad crossing required for a new bicycle path. (July 24, 1975)

D. A non-motorized facility must adjoin, be in close proximity to, or cross over roads, streets, or bridges in order to be considered a "reasonable appurtenance" to roads, streets, or bridges. (June 19. 1980)

E. A trail separated somewhat from its highway which demonstrably accommodates non-motorized traffic which would otherwise use the highway should satisfy the close proximity requirement. (Sept 3, 1992)

12.12.02 (revised 3-18-2013)

References

A. Act 51, P.A. of 1951 as amended, Section 247.660k

B. Act 51, P.A. of 1951 as amended, Section 247.660p

C. "Guide for Development of Bicycle Facilities, 2012 4th Edition," AASHTO

D. ***Standard Specifications for Construction*** – Current Edition

E. "Guide for the Planning, Design, and Maintenance of Pedestrian Facilities", 2004 AASHTO

F. State Transportation Commission Policy on Complete Streets; Policy number 10214, dated July 26, 2012

G. State Transportation Commission Policy on Context Sensitive Solutions; Policy number: 10138, dated May 26, 2005

H. 23 CFR 652.5

12.12.03 (revised 3-18-2013)

Types of Bicycle Facilities

Bicycle facilities can be classified as off-road or on-road facilities On-road facilities are the preferred design options in urban areas.

Off-Road Facilities

A shared-use path is a facility that is physically separated from motorized vehicular traffic by an open space or barrier - either within a highway right-of-way or within an independent right-of-way. Shared-use paths are also used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users.

On-Road Facilities

A bike lane is a portion of a roadway that has been designated for preferential or exclusive use by bicyclists by pavement markings and signs (optional). It is intended for one-way travel, usually in the same direction as the adjacent traffic lanes, unless designated as a contra-flow lane.

A shared lane is any roadway that is open to both bicycle and motor vehicle travel unless bicyclists are prohibited by statute or regulation. A shared lane can be widened, marked and/or signed to enhance the roadway to better accommodate bicycle mobility.

Paved shoulders accommodate stopped vehicles, emergency use, and provide lateral support of the roadway structure. Paved shoulders are often used by bicyclists. For bicycle use, paved shoulders are appropriate on rural highways that connect cities and other major attractors.

12.12.04 (revised 3-18-2013)

Non-motorized Transportation Project Review

In compliance with the State Transportation Commission Policy on Complete Streets, dated July 26, 2012 all projects regardless of scope, or length should be considered for the accommodation of bicyclists, pedestrians and all legal users of the roadway.

Factors such as location, connection to other facilities and use are considered when deciding to include a non-motorized facility in a project. The Bicycle/Pedestrian Coordinator and/or Pedestrian and Bicycle Safety Engineer can assist with recommending a type, location, or width.

The Bicycle/Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer may assist the Region or TSC staff in their efforts to review and discuss the project in detail, and solicitation of input from local governmental units and user groups. The Region or TSC should consider the availability of funds and the accumulated total of funds previously committed.

12.12.07 (revised 3-18-2013)

Agreements – Shared-Use Paths

Whenever it is proposed that an independent shared-use path be constructed, it will be necessary to obtain from the local unit of government, a commitment that it will not enact any ordinances prohibiting bicyclists from using shared-use paths constructed by the Department. In addition, the local unit of government must agree to repeal any such existing ordinances that might apply to the path in question.

The designer should provide the Governmental Coordination Unit with a description of the facility being constructed, including a print of the title sheet (if available) so that the necessary documents may be secured from the involved local unit of government. These documents should also include agreements with the municipalities relative to maintenance of shared-use paths. The Department will not construct, with State trunkline funds, independent shared-use paths (i.e., back of curb or beyond the shoulder) unless a local governmental agency accepts the responsibility for maintenance of the facility on completion of construction. This description of the facility should be forwarded early in the design stage to ensure that the local governmental agency will have sufficient time to act prior to our scheduled advertising date. Local rejection of such an agreement will have the effect of immediately terminating the shared-use path project.

In instances where agreements can't be reached or the need is not immediately evident, the designer should be cognizant of the potential to accommodate a facility in the future. This can be done by locating utilities, storm drains, signal controllers and other items outside of the area where a shared use path or sidewalk might be located in the future.

12.12.07 (continued)

See Section 12.03.06 for Department "policy" for constructing bicycle facilities on turnbacks.

To adhere to FHWA guidelines and Michigan law (MMVC 750.419), it is suggested that all state/local agreements for projects with shared-use paths contain a prohibition against use of the path by motorized vehicles, except maintenance vehicles.

Act 51 participation (cities over 25,000 population) is required for bicycle facilities, the same as for any other highway construction project. Separate agreements are used for funding, maintenance, and operations. The maintenance and operation agreement should be secured from the local unit prior to the design of the facility. Participation agreements are usually secured at a later date and are included with the major project.

If the shared-use path crosses a railroad, either by grade separation or at grade, the Railroad Coordination Unit – Office of Rail should be informed as soon as possible so that the proper arrangements and agreements can be made.

12.12.09 (revised 3-18-2013)

Design Features of Shared-Use Paths

The basis for the design of bicycle facilities is the AASHTO "Guide for the Development of Bicycle Facilities, 4th Edition 2012. Although formal design exceptions are not required for off road facilities, designers should document in the project file when minimum criteria for elements listed in A-F below cannot be met.

Generally, it is poor practice to attempt to utilize portions of existing sidewalk in front of homes for a shared-use path. If it is proposed to build a shared-use path in front of homes, the Region/TSC, and Design should coordinate the proposal with local officials. If favored locally, the local officials should contact affected property owners to discuss the shared use path and land requirements with them, and include those results in a response to MDOT. This information will be used to determine if an MDOT public hearing is required prior to initiating R.O.W. acquisition by MDOT.

A. Design Speed

The desirable design speed for bicycle paths should be 18 mph. Where descending grades are over 6%, the design speed should be increased to 30 mph. On paths where a high concentration of pedestrian users is anticipated, lower design speeds may be considered.

12.12.09 (continued)

B. Grades

Grades, in general, should follow the lay of the land or grade of the roadway. The grade of the path should not exceed 5%, but if the roadway exceeds 5% the path should be less than or equal to the adjacent roadway grades. Except for short distances, grades greater than 5%, either ascending or descending, are undesirable. Certain conditions such as physical constraints or regulatory constraints may prevent full compliance with 5% maximum grade and must be documented (Technical Infeasibility for ADA, Form 0370).

For grades greater than 5%, consider level landing, rest areas or increased path width where feasible.

C. Horizontal Alignment

When curvature is required, compound or spiral curves are preferable to simple circular curves. Tight, short-radius curves should be avoided, if possible. For a design speed of 18 mph, a minimum radius on the order of 60' is recommended.

Design Speed (mph)	Minimum Radius (ft)
12	27
14	36
16	47
18	60
20	74
25	115
30	166

12.12.09 (continued)

Design Features of Shared-Use Paths

D. Crown and Superelevation

For drainage, a 1.5% to 2% cross-slope should be used. The crown point is located at one edge of the path (unidirectional crown) for ease of construction. Superelevation is not needed for horizontal curvature within the minimum radius. The direction of cross-slope should be switched as necessary to match the direction of curvature.

E. Width

The minimum paved width of a two-way path should be 10'. This width may be reduced to 8' for short distances to avoid inordinate cost, related to widening structures or other physical constraints. Where large numbers of bicyclists can be expected, e.g., adjacent to a college campus, or other significant traffic generators, 11' to 14' widths may be justified. Widths should be uniform for ease of construction.

F. Clearances

Lateral clearance from the edge of path to adjacent obstructions should be 2' minimum. If this clearance cannot be obtained at bridges or in tight R.O.W. that is fenced the side obstruction should be made as smooth as possible and marked with retroreflective markings.

Vertical ground clearance should be 8' minimum, with 10' desirable.

12.12.09 (continued)

G. Grading

If the subgrade contains vegetative cover or root mat, all such material should be removed to a depth of at least 6" and the subgrade smoothed and compacted and a soil sterilant applied. A minimum of 4" to 6" of "Coarse Aggregate 6A (LM)," should be used to provide an adequate base.

A minimum 2' width of graded area should be provided adjacent to the path. The paved surface should be close to the same elevation as the adjacent ground, consistent with good drainage.

H. Surface Type

A smooth path is considered paramount. To achieve the required smoothness of a HMA surfaced path, machine spreading should be specified. Most agencies opt for the HMA surfacing because it lacks joints.

If concrete is used, it is built much like sidewalk, except that sawing of joints should be specified to eliminate the depression that is characteristic of a jointing tool. A joint down the center of the path should be avoided unless saw cut.

I. Drainage and Structures

Drainage grates should not be located in the traveled portion of the shared use path. Any grates within the path must be ADA compliant. Horizontal openings should be ≤ 0.5 inches and elongated openings perpendicular to the path of travel.

Occasional temporary flooding of the path, is acceptable provided it is not frequent and that no objectionable deposits are left on the path. Drainage courses should be accommodated by culverts and bridges. These structures need not be elaborate; e.g., end treatments may often be omitted on culverts. For ease of maintenance, culverts should be used rather than bridges. Where small bridges are required, the Roadside Development Unit of Design Division should be consulted. Use of prefabricated structures should be considered.

12.12.09 (continued)

Design Features of Shared-Use Paths

When a typical timber structure for shared-use paths over small streams is called for, the designer should inform the Region/TSC Soils and Materials Engineer. The Soils and Materials Engineer will then conduct an investigation to determine if the assumed soil capacity is adequate. This investigation may range from a site inspection and review of previously made culvert borings to borings made with a continuous flight auger. In those rare cases where a complete foundation investigation is required, it will be requested by the Region/TSC Soils and Materials Engineer.

The minimum information for timber shared-use structures to be included in the plans consists of:

1. Complete alignment ties
2. Plan and profile
3. Design loading
4. Foundation design, including soil information and footing pressures.

Ditch crossings, if not via embankment and culvert, should be on a flat angle across the ditch.

J. Railings

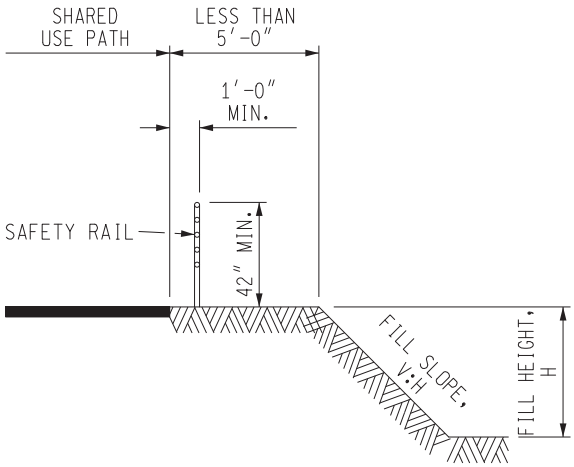
Railings or fencing are required on structures and should be considered to protect bicyclists from steep side slopes, water or other non-traversable features

Barriers or railings on structures should be a minimum height of 42" with 2' minimum offset from the edge of the path. Fence or rail openings should be such that a 6" sphere cannot pass through. For portions of a railing higher than 27", openings may be spaced such that an 8" sphere cannot pass through them.

12.12.09 (continued)

Where a bicyclist's handlebar may come in contact with a railing or barrier, a smooth rub rail should be provided beginning at 36" and ranging to a height of 42" to 44" to reduce the likelihood that a bicyclist's handlebar will be caught by the railing.

For treatment of side slopes, when the edge of the path is less than 5' from edge of slope, physical barriers or safety rail is recommended in the following situations.



Safety Rail Warrants – Steep Side Slopes with Hinge Line Offsets < 5 ft	
Fill Slope, (V:H)	**Fill Height, H**
1:3 or steeper	≥ 6 ft
1:2 or steeper	≥ 4 ft
1:1 or steeper	≥ 1 ft

For any application, the ends of the barrier or fence should be flared away from the path edge. Barrier or fence endings less than 2' from the path edge should be marked with object markers.

12.12.09 (continued)

Design Features of Shared-Use Paths

K. Shared-Use Facility Railroad Crossings

Shared-use paths should cross between 60°-90° angles to the tracks. ADA compliance is required according to Standard Plan R-28-Series. The Railroad Coordination Unit – Office of Rail should be contacted for design details of the crossing, including crossing material, flange filler, and appropriate signing and warning devices.

L. Interchanges

An important principle in designing interchanges that accommodate shared use paths is to reduce motor vehicle speeds at locations where pedestrians and bicyclists either cross the road, or merge with traffic. For this reason, urban interchange design with conventional 90 degree intersections (instead of free flow merge lanes) is preferable for pedestrian and bicycle safety. Interchange designs that enable motor vehicles to maintain speeds above 30 mph without stopping are not conducive to pedestrian and bicycle access and should be avoided. Shared use paths should cross interchange ramps at a 90° angle.

12.12.09 (continued)

M. Curb Cuts and Bollards

Curb cuts for shared-use paths are the same as for sidewalk ramps (See Standard Plan R-28-Series). Detectable warnings or truncated domes provide identification of the intersection of a pathway with a roadway or signalized or stop controlled driveway for persons with sight impairments.

Restricting access of motor vehicles through the use of bollards or similar barriers placed within the travel portion of the shared-use path is dangerous for the bicyclists and is discouraged. Efforts should be made to design the path-roadway intersection so that it does not look like a vehicle access point.

Directional strategies include signing or splitting the pathway entrance into two one-way pathways through the use of a median with natural landscaping at the roadway. The split entry way should consist of two 5’ cross sections with approximately 4’ of low landscaping in the middle. Emergency or maintenance vehicles can enter by straddling the landscape.

12.12.10 (added 3-18-2013)

Design Features of On-Road Bicycle Facilities

On-road facilities include bicycle lanes, paved shoulders or marked shared lanes.

Facilities should be designed with the context of the location in mind and in coordination with the Region, TSC, Pedestrian and Bicycle Coordinator and the Pedestrian and Bicycle Safety Engineer.

The basis for the design of bicycle facilities is the AASHTO "Guide for the Development of Bicycle Facilities, 4th Edition, 2012". Bicycle design standards for most critical criteria are met or exceeded by MDOT standards required for the roadway. Formal design exceptions for "lane width" are required when standard bicycle lane widths are not met. If a roadway width or bridge width is insufficient to accommodate minimum bicycle lane widths, the bicycle lane may be eliminated or alternatives may be investigated such as intermittent bike lane termination or transition to shared lanes. This situation should be considered in coordination with the Bicycle/Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer.

A. Facility Type – Posted Speed

If properly designed for motor vehicles, roadway design elements such as stopping sight distance, horizontal and vertical alignment grades, superelevation and cross slopes will meet or exceed the minimum design standards applicable to bicyclists.

Rather than being a basis for determining the design of the bicycle facility's geometric features, the roadway posted speed is a basis for selection of on-road facility type.

Bicycle lanes can be used on any road. For roads with higher posted speeds (greater than 35 mph) and/or volumes additional bike lane width or buffered bike lane should be considered.

Marked shared lanes can be used on roads with posted speeds 35 mph or less.

12.12.10 (continued)

B. Width

Bike Lanes

For roadways with no curb and gutter and no on street parking, the minimum width of a bicycle lane is 4'. Along sections of roadway with curb and gutter, a usable width of 4' measured from the edge of gutter pan to the center of the bike lane line is required. For roadways where the bicycle lane is adjacent to curb, guardrails or other vertical surface, the minimum bicycle lane width is 5'.

Where on-street parking is allowed, the bicycle lane should be placed between the parking lane and the vehicle travel lane. The minimum width of the bicycle lane next to a parking lane is 5' with 6' recommended.

Shared Lanes

All vehicle travel lanes where bicycles are permitted, whether they are marked or unmarked, are considered shared lanes.

Shared-lane markings can be used in situations where it is desirable to provide higher level of guidance to bicyclists and motorists, but the roadway lacks sufficient width to provide bicycle lanes. Shared lanes can be marked using the shared-lane marking ("sharrows"), regardless of width. See the MMUTCD or AASHTO Bicycle Guide for guidance on proper marking placement.

Wide (13' or greater) lanes, marked or unmarked, can better accommodate the passing of bicycles and decrease or eliminate vehicle encroachment into the adjacent lane. Bike lanes are recommended when shared lane widths are 15' or greater, whether they are marked or unmarked. Wider shared lanes may encourage increased motorist driving speeds and may increase the level of bicyclist discomfort.

12.12.10 (continued)

Design Features of On-Road Bicycle Facilities

Paved Shoulders
Paved shoulder width minimum is 4', or 5' wide on curbed roadways or were vertical obstructions such as guardrail, signs or bridge abutments are adjacent to the roadway. Shoulders should be 6' where rumble strips are used (see Standard Plan R-112-Series). Paved shoulders in rural locations are generally not designated as a bicycle lane.

C. Intersection

Special attention should be given to on-road bicycle travel when designing intersections whether traditional or a roundabout. At a traditional signalized intersection, when the signal is actuated it is essential to consider the ability of a bicycle in the roadway or bicycle lane to activate the signal. Consult the MMUTCD and 2012 AASHTO Guide for the Development of Bicycle Facilities for guidance on intersection design and signals.

At signalized intersections with a designated right turn lane, the bicycle lane should be transitioned to the left of the designated right turn lane. If ROW is not sufficient to allow for a designated bicycle lane and a right turn lane, the bicycle lane can be terminated prior to the right turn lane and started again on the far side of the intersection. This situation should be carefully consider and designed in coordination with the Bicycle and Pedestrian Coordinator and/or the Pedestrian and Bicycle Safety Engineer.

12.12.10 (continued)

D. Roundabouts

Bicycle lanes should not be located within the circulatory roadway of roundabouts. Bicycle lanes should be terminated 100' in advance of the circulatory roadway. At roundabout exits, an appropriate taper should begin after the crosswalk and the bicycle lane resume as soon as the normal bike lane width is available.

Some bicyclists may not feel comfortable riding through the roundabout. Bicycle ramps can be constructed to allow access to the sidewalk or shared use path at the roundabout. Bicycle ramps should be placed at least 50' prior to the crosswalk and at the end of the full width taper at a 35° and 45° degree angle to the roadway. Bicycle ramps at the roundabout exits should be built with similar geometry and ramp placement as entries. Bicycle ramps should be placed at least 50' beyond the crosswalk at the roundabout exit.

7.02.12

Welding

All welding details are to be according to AWS specifications, except for minimum fillet weld sizes, which should be as shown in the Standard Specifications. Any intended deviations are to be called to the attention of the Design Supervising Engineer. (5-6-99)

Plans should show welding details but should not show the size unless a deviation from AWS specifications is intended.

Plans should also show beam or girder flange tension and stress reversal zones where lifting lugs will not be permitted.

7.02.13

Field Splices in Plate Girders

A. General

Girder Length	Field Splice
0' to 125'	None provided.
Over 125' to 160'	Field splice is shown on plans as optional; it is designed and detailed, but not paid for.
Over 160'	Field splice is designed, detailed, and paid for. *

Fabricators that wish to field splice other than as called for on the plans will need prior Design approval.

* Additional steel weight from splices will be added to quantity for "Structural Steel, Plate, Furn and Fab". (12-22-2011)

7.02.13 (continued)

B. Location

Field splices are to be located at low-stress areas at or near the point of contraflexure for continuous spans.

C. Bolts

All high strength bolts are to be hot-dip galvanized. (3-18-2013)

7.02.14

Diaphragms and Crossframes

A. Orientation (8-20-2009)

Diaphragms or cross-frames shall be provided at abutments, piers and hinge joints. Intermediate diaphragms may be used between beams in curved systems or where necessary to provide torsional resistance and support the deck at points of discontinuity or at angle in girders.

The need for diaphragms or cross-frames shall be investigated for all stages of assumed construction procedures and the final condition. Diaphragms or cross-frames required for conditions other than the final condition may be specified to be temporary bracing.

B. End Diaphragms

End diaphragms or crossframes are required at ends of beams to support the end of slab unless it is supported by other means. Curved girders shall have diaphragms or crossframes placed at the centerline of support. To provide access for painting, these diaphragms or crossframes shall be no closer than 2'-0" from the beam end at independent backwalls and shall have no less than 2'-0" of clearance at simple supports. (5-6-99)

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Over 160'	Field splice is designed, detailed, and paid for. *

Fabricators that wish to field splice other than as called for on the plans will need prior Design approval.

* Additional steel weight from splices will be added to quantity for “Structural Steel, Plate, Furn and Fab”. (12-22-2011)

7.02.13 (continued)

B. Location

Field splices are to be located at low-stress areas at or near the point of contraflexure for continuous spans.

C. Bolts

All high strength bolts are to be hot-dip galvanized. (3-18-2013)

7.02.14

Diaphragms and Crossframes

A. Orientation

When bridges are on grades, the diaphragm or crossframe connection plates are to be set normal to the flange.

B. End Diaphragms

End diaphragms or crossframes are required at ends of beams to support the end of slab unless it is supported by other means. Curved girders shall have diaphragms or crossframes placed at the centerline of support. To provide access for painting, these diaphragms or crossframes shall be no closer than 2'-0" from the beam end at independent backwalls and shall have no less than 2'-0" of clearance at simple supports. (5-6-99)

8.06.06

Retaining Wall Notes

A. The exposed faces of the retaining walls (and abutment) shall have special architectural treatment according to Subsection 706.03 of the Standard Specifications. [Use on retaining walls and abutments connected to retaining walls where special architectural treatment is desired.] (9-18-98)

8.06.07

Steel Sheet Pile Notes

A. The substructure excavation and concrete quantities take into consideration the additional concrete and excavation necessary to excavate and pour to the Permanent Steel Sheet Piling. [Use on all projects where concrete is to be poured against Permanent Steel Sheet Piling.]

B. All sheet piling used at _____ shall be hot-dip galvanized. [Specify location and use when sheet piling will be subjected to heavy chlorides or sulfates. Include Special Provision.] (9-18-98) (3-18-2013)

C. All Permanent Steel Sheet Piling shall be _____. Where allowed by the Engineer, select alternate hot rolled sheet piling with a nominal section modulus of at least _____ in^3/ft or cold rolled sheet piling with a nominal section modulus of at least _____ in^3/ft. [Specify designation and appropriate section modulus. Refer to Section 7.03.08 D. for design criteria.] (12-5-2005)

8.06.05

Pile Notes

A. All piles shall be driven to a minimum bearing capacity of ____ tons.

B. Pile shells shall be a minimum of 0.312" nominal wall thickness, ____ " O.D. [Use with C.I.P. concrete piles.] (8-20-2012)

C. The estimated pile length is based on the static formula. (9-2-2003)

D. Batter piles for Abutment(s) ____ shall be driven to a 3V:1H (2.5V :1H) batter angle. (9-18-98)

E. Steel piles shall be (HP 14x73) (HP 12x53) (HP 10x42).

F. Piles are to be driven to such accuracy that the ends of the piles to be embedded in the concrete are within 3" of the location shown on the plans. [Use for pile bents.]

G. The pile driving formulas in the Standard Specifications are not to be used to determine battered pile capacity. Battered piles are to be driven to the elevation established for vertical piles. [Use when piles are driven to a 2.5V:1H batter or flatter.]

H. The desired pile driving sequence shall be from the center of the pile group outward in both directions or from one side of the pile group to the other side. The contractor may request Engineer approval to sequence the pile driving from the center of the pile group outward in a clockwise or counterclockwise pattern if four or more rows of piles exist. [Use for pipe piles to alleviate soil pressure from driven piles. A pile driving sequence will minimize detrimental effects of heave and lateral displacement of the ground as well as the influence the new construction has on adjacent structures.] (11-28-2011)

8.06.05 (continued)

I. Steel piles used for pile bents are considered primary members and all welding must be in accordance with AASHTO/AWS D1.5:2010, Bridge Welding Code, as modified by the current Special Provision for Structural Steel and Aluminum Construction. (7-30-2012)

8.06.06

Retaining Wall Notes

A. The exposed faces of the retaining walls (and abutment) shall have special architectural treatment according to Subsection 706.03 of the Standard Specifications. [Use on retaining walls and abutments connected to retaining walls where special architectural treatment is desired.] (9-18-98)

8.06.07

Steel Sheet Pile Notes

A. The substructure excavation and concrete quantities take into consideration the additional concrete and excavation necessary to excavate and pour to the Permanent Steel Sheet Piling. [Use on all projects where concrete is to be poured against Permanent Steel Sheet Piling.]

B. All sheet piling used at _____ shall be hot-dip galvanized. [Specify location and use when sheet piling will be subjected to heavy chlorides or sulfates. Include Special Provision.] (9-18-98) (3-18-2013)

C. All Permanent Steel Sheet Piling shall be _____. Where allowed by the Engineer, select alternate hot rolled sheet piling with a nominal section modulus of at least _____ in^3/ft or cold rolled sheet piling with a nominal section modulus of at least _____ in^3/ft. [Specify designation and appropriate section modulus. Refer to Section 7.03.08 D. for design criteria.] (12-5-2005)

8.07.04 (continued)

Prestressed Concrete I-Beam & Box Beam Notes

P. Any holes cast or formed in the beam shall be filled with non-shrinking grout. Included in the bid item "Prest Conc 1800 Beam, Erect." [Use for Michigan 1800 Prestressed I-Beam.] (12-5-2005)

Q. The outer 6" of the top surface of the beam shall be fabricated to a smooth trowel finish, and then coated with a bond breaker as specified in section 708 of the Standard Specifications. [Use for Michigan 1800 Prestressed I-Beam.] (12-5-2005)

R. At the locations shown on these plans, coat the beams using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating in the manner specified in the Special provision for a distance of _____ feet, starting from the beam end at the joint, coating both sides and bottom of beam. [Use on Prestressed I beam and Spread box beam projects with expansion joints on the bridge. Show the locations to be coated on the erection diagram (new) or on existing General Plan of Structure sheet for existing beams.] (8-20-2009)

S. Coat the entire outside and bottom of the fascia beam using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating according to the Special Provision. [Use on Prestressed I beam and spread box beam projects where the beam ends are being coated and where coating fascia beams will not significantly effect the maintaining traffic scheme of the project.] (8-20-2009)

T. Steel for sole plates and other bearing components shall meet the requirements of AASHTO M 270 Grade 36. (12-5-2005)

8.07.04 (continued)

U. Beam steel reinforcement, including stirrups, shall be Grade 60 (ksi). [Use for all I-Beams and all box beams except 17" & 21" box beams.] (12-5-2005) (11-28-2011)

V. Field drilling shall be allowed for sign support anchors only. Location of anchors shall be as detailed on Traffic & Safety Sign Support Special Details. Any damage to the beams shall be repaired at the contractor's expense and approved by the Engineer. (8-20-2009)

W. Items cast into the beams to facilitate bridge construction (forming, finishing, etc.) shall be hot dip galvanized or epoxy coated. (8-20-2009) (3-18-2013)

X. Concrete inserts shall be 1" diameter; Dayton Superior, Type B-1 Standard or Type B-18; Williams Form, Type C 12; Meadow Burke, Type CT-2; or equal. Inserts shall be cast with the beams. Field installation of inserts is not allowed. [Use for I-Beams and spread box beams.] (8-20-2009)

Y. Adhesive anchors shall use a non-shrink grout (which is cementitious) listed in MDOT's Qualified Products List. [Use for adhesive anchors in sustained, tensile-load-only overhead applications such as traffic signals/sign supports.] (8-20-2009)

Z. Longitudinal beam steel reinforcement (A bars) shall be Grade 60 (ksi). Transverse beam steel reinforcement, stirrups and slab ties (ED & D bars), shall be Grade 40 (ksi). [Use for 17" & 21" box beams.] (11-28-2011)

8.07.04 (continued)

Prestressed Concrete I-Beam & Box Beam Notes

P. Any holes cast or formed in the beam shall be filled with non-shrinking grout. Included in the bid item "Prest Conc 1800 Beam, Erect." [Use for Michigan 1800 Prestressed I-Beam.] (12-5-2005)

Q. The outer 6" of the top surface of the beam shall be fabricated to a smooth trowel finish, and then coated with a bond breaker as specified in section 708 of the Standard Specifications. [Use for Michigan 1800 Prestressed I-Beam.] (12-5-2005)

R. At the locations shown on these plans, coat the beams using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating in the manner specified in the Special provision for a distance of _____ feet, starting from the beam end at the joint, coating both sides and bottom of beam. [Use on Prestressed I beam and Spread box beam projects with expansion joints on the bridge. Show the locations to be coated on the erection diagram (new) or on existing General Plan of Structure sheet for existing beams.] (10-24-2001) (11-28-2011)

S. Coat the entire outside and bottom of the fascia beam using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating according to the Special Provision. [Use on Prestressed I beam and spread box beam projects where the beam ends are being coated and where coating fascia beams will not significantly effect the maintaining traffic scheme of the project.] (10-24-2001) (11-28-2011)

T. Steel for sole plates and other bearing components shall meet the requirements of AASHTO M 270 Grade 36. (12-5-2005)

8.07.04 (continued)

U. Beam steel reinforcement, including stirrups, shall be Grade 60 (ksi). [Use for all I-Beams and all box beams except 17" & 21" box beams.] (12-5-2005) (11-28-2011)

V. Field drilling shall be allowed for sign support anchors only. Location of anchors shall be as detailed on Traffic & Safety Sign Support Special Details. Any damage to the beams shall be repaired at the contractor's expense and approved by the Engineer. (11-28-2011)

W. Items cast into the beams to facilitate bridge construction (forming, finishing, etc.) shall be hot-dip galvanized or epoxy coated. (11-28-2011) (3-18-2013)

X. Concrete inserts shall be 1" diameter; Dayton Superior, Type B-1 Standard or Type B-18; Williams Form, Type C 12; Meadow Burke, Type CT-2; or equal. Inserts shall be cast with the beams. Field installation of inserts is not allowed. [Use for I-Beams and spread box beams.] (11-28-2011)

Y. Adhesive anchors shall use a non-shrink grout (which is cementitious) listed in MDOT's Qualified Products List. [Use for adhesive anchors in sustained, tensile-load-only overhead applications such as traffic signals/sign supports.] (11-28-2011)

Z. Longitudinal beam steel reinforcement (A bars) shall be Grade 60 (ksi). Transverse beam steel reinforcement, stirrups and slab ties (ED & D bars), shall be Grade 40 (ksi). [Use for 17" & 21" box beams.] (11-28-2011)