Road & Bridge Design Publications

Monthly Update – July 2024

Revisions for the month of **July** are listed and displayed below and will be included in projects submitted for the **November** letting. The special detail index for **June** will remain in effect.

E-mail road related questions to MDOT-Road-Design-Standards@michigan.gov.
E-mail bridge related questions to MDOT-Bridge-Design-Standards@michigan.gov.

Road Design Manual

6.01.07: Alternate Pavement Bidding: Revised the life cycle cost differential between the two pavement design alternatives from 10% to 15% for Design-Bid-Build projects.

Bridge Design Manual

7.02.18 A.2: The 9th Edition of the AASHTO LRFD Bridge Design Specifications added restrictions and limitations to the use of debonded strands in prestressed concrete beams. This section has been updated to reference back to AASHTO LRFD and highlight MDOT requirements in addition to those outlined in AASHTO LRFD.

7.02.18 A. 4.: Added limit for vertical hold down force and maximum draped strand angle of inclination. Account for fabrication tolerances per AASHTO and other specifications when checking force and angle.

Updates to the MDOT Cell Library, Sample Plans, and other automated tools may be required in tandem with some of this month's updates. Until such updates 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.

6.01.06B (continued)

Pavement Design and Selection Policy

a. All new/reconstruction projects with pavement costs greater than $1.5 million

b. Major rehabilitation projects (unbonded concrete overlays, rubblized concrete with HMA surfacing, HMA over crush & shaped HMA, multi-course HMA overlays, thin concrete overlays, and multi-course HMA over an Asphalt Stabilized Crack Relief Layer) with pavement costs greater than $1.5 million.

Certain fixes known under a different name (e.g. 'inlay') may still require a life cycle cost analysis, regardless of whether it is a 3R or 4R project. Questions should be directed to Pavement Operations. Assistance will be given to the Regions for other projects on an as-needed basis

Life cycle cost analysis will include the cost of initial pavement construction costs as well as maintenance costs over the service life. It will also include calculation of user costs for both initial construction and all future maintenance shown in the maintenance schedules. User costs will be calculated using the software titled "Construction Congestion Cost."

Informational life cycle cost analyses may be conducted for a variety of reasons prior to processing of an official analysis. In addition, some circumstances will require re-analysis, such as scope changes or scheduling delays. Projects must be monitored during project development to ensure that a valid life cycle cost analysis is in place prior to advertisement, and that the correct pavement type has been specified in the plans. The ***Pavement Selection Manual*** contains details of these and many other aspects of the process.

6.01.07 (revised 7-29-2024)

Alternate Pavement Bidding

At times during pavement selection, the life-cycle cost between the two alternatives may be relatively close and all other design considerations relatively equal. Under these circumstances, bidding the project with alternate pavement options can allow market competition to determine best value.

On September 1, 2011 the Engineering Operations Committee approved a process for the identification and development of alternate pavement bid (APB) candidate projects.

Candidate selection criteria includes;

1. Only freeway projects will be eligible.

2. The project fix type must be either a complete reconstruction or a major rehabilitation (separated concrete overlay or HMA over rubblized concrete).

3. Estimated construction costs must exceed $10,000,000 dollars.

4. Each pavement alternate must be expected to have similar environmental, right of way, drainage, and utility impacts.

5. Maintaining traffic concepts must be similar for both pavement alternates.

6. Paving must be the controlling operation for the construction schedule.

7. If the project meets all the above criteria, the TSC will request an informational LCCA. The proposed pavement designs will be developed using the MDOT ***Pavement Selection Manual***. The life cycle costs of the two pavement design alternates must be within 15% to be considered for alternate bid on Design-Bid-Build projects. A Design-Build project will be identified as APB if the project meets the above Selection Criteria, regardless of the LCCA EUAC percentage differential.

7.02.18

Prestressed Concrete Design

A. General

1. Strand Selection

The design and detail sheets shall specify only ASTM A416 (AASHTO M203) Grade 270 low relaxation strands. Strands shall be 0.6 inches in diameter with a release force of 44,000 pounds. (5-6-1999)

MDOT has begun using CFRP strands in some locations. If CFRP strands are desired, the provisions of MDOT guidance for Concrete Structures with CFRP Reinforcement shall be followed. CFRP strand use must be approved by the Chief Structure Design Engineer. (6-27-2022)

7.02.18 (continued)

2. Bond Breakers/Debonding (6-27-2022)

Draped strands shall be avoided where possible. Debonding is MDOT's preferred method of controlling stresses at the end of prestressed concrete Bulb Tee and I (PCI) beams. Strands should be debonded in pairs. A maximum of 44% (52% for continuous for live load structures) of the strands may be debonded. Amounts more than that require draped strands. Limits and restrictions on the debonding of stands are outlined in AASHTO LRFD 5.9.4.3.3. Additional MDOT specific requirements are included in the paragraphs below. (7-29-2024)

The debonding should be staggered by placing the debonded strands into groups similar to the table below.

Number Debonded	Shortest	2nd	3rd	Longest
4	2			2
6	4			2
8	4	2		2
10	6	2		2
12	6	2	2	2
14	6	4	2	2

The above table has been developed to meet the requirements outlined in AASHTO LRFD 5.9.4.3.3. The shortest point refers to the closest point to the beam end that any debonding can be terminated without overstressing the beam. The longest point refers to the point that all debonding can be terminated. Consultant debonding schemes shall follow a similar rational method. (7-29-2024)

From the end of the debonding to the point where the strands are no longer required to control stresses or provide ultimate capacity, a double development length (minimum) of bonding shall be provided. (7-29-2024)

Spans less than 30'-0" need not be debonded. It is realized that the continuity moments of continuous for live load structures may reduce the effectiveness of debonding & increase the number of draped strands. (7-29-2024)

If placing strands in the bottom row, they should be placed on every third strand with the corner strands being bonded.

7.02.18 (continued)

Prestressed Concrete Design

A. General

3. To aid in stabilizing transverse reinforcement in the beam, a bar or strand shall be located in the bottom corners of the beam. Second row up for box beams and certain PCI beams. (8-20-2009)

4. Draping of strands shall be the last option to reduce stresses at the end of beams. Location of draped strands at beam ends shall start 2" from the top of the beam downward. Draped strands at beam end shall correspond to the highest available strands at beam center. (8-20-2009)

If using draped strands limit the vertical force at the strand hold down point to 4,000 pounds per strand and the strand angle of inclination to less than 6 degrees. The calculation of the vertical force at the strand hold down point and the angle of inclination of the draped strands must take into account all applicable fabrication tolerances. (7-29-2024)

5. PCI beams under open joints are susceptible to corrosion from brine intrusion into the strands and mild reinforcement. This is the most prevalent distress to PCI beams. This can be mitigated by sealing the beam ends with an elastomeric sealer as described in Section 7.03.11A.

PCI beams and spread box beams under expansion joints should be coated per the special provision for Warranty on Concrete Surface Coating. Apply the coating from the beam end a length the greater of twice the beam depth, or five feet. In addition, where the coating operation will have a minimal effect on the maintaining traffic schedule, and the cost of the project, the entire outside face of the fascia beam and its bottom flange, should be coated. On new construction or superstructure replacement the fascia beam can be coated prior to erection. (6-27-2022)

6. Continuous for live load prestressed concrete beams shall be designed as simple span beams for all positive dead load and live load moments. (9-2-2003)

7.02.18 (continued)

7. Slab Ties (6-27-2022)

Ensure slab ties sufficiently penetrate haunches and slab to facilitate composite action of beams and slab. See Bridge Design Guide 6.42.03A for details and section 7.02.20 G. In some instances, the number of slab ties can be minimized due to the shear resistance resulting from the contact area of the top flange of some beams. See AASHTO LRFD 5.7.4.2. Avoid use of EK04 slab ties in Bulb Tee beams unless this provision cannot be met.