

<b>Title:</b>	Use of Premium Reinforcement in Bridges.
<b>Division:</b>	Transportation Infrastructure Management Division (TIM)
<b>Branch:</b>	Standards and Contracts Branch (SCB)
<b>Office:</b>	Structures Office
<b>Date:</b>	June 24, 2024
<b>Theme(s):</b>	Design
<b>Distribution:</b>	Open
<b>Memo #:</b>	SCB-SO-2024-02
<b>Approved by:</b>	
Walter Kenedi, Manager Structures Office	Bruce Cane, Director Standards & Contracts Branch

**Implementation**

This memorandum is effective as of the date of issue.

This memorandum replaces previous policies: Structural Manual, Table 12.2.1.

**Background**

Since the late 1970’s, MTO has addressed deterioration of concrete and reinforcement through several protection measures. Concrete cover to reinforcement was increased. Concrete quality was improved. Corrosion-resistant reinforcement was used, and all bridges decks were waterproofed as standard This has been referred to as a belt-and-suspenders approach.

The initial improvement to the durability of steel reinforcement was to use epoxy coating. With time, several problems were noticed, and it was recognized that the epoxy coated reinforcement would not lead to a service life of 75 years in most environments along provincial highways. In the early 2000’s MTO began specifying stainless steel reinforcement in severe exposure areas and normal black steel in more benign areas. In 2005, MTO began specifying Glass Fibre Reinforced Polymer (GFRP) reinforcement as an alternative premium reinforcement. Over the last two decades, adjustments were made to definition of “severe exposure” and several grades and types of stainless steel were considered.

With time, there have been additional types of approved premium reinforcements, and costs have changed. Construction costs and the effects of traffic disruption have increased significantly. Currently, MTO considers Type 316 LN or 2205 duplex stainless steel reinforcement and Grade III (60 GPa) Glass Fibre Reinforced Polymer (GFRP) reinforcement to be Premium Reinforcement.

MTO has reviewed the costs and benefits of premium reinforcement along with costs and risks of future rehabilitation construction and adjusted the warrants for the use of premium reinforcement in bridges.

**Policy**

1. MTO will begin implementing a transition policy to use Type 2304 duplex stainless steel reinforcement as an approved premium reinforcement for new construction. This will be reflected in the next updated of OPSS 905 and OPSS 1440.
2. Table 12.2.1 of the March 2024 version of the Structural Manual shall be replaced by the following table.

**Table Error! No text of specified style in document..1 – Reinforcing Requirements for Surfaces within Splash Zone**

Component Surface		Reinforcement <sup>6</sup>
<b>Deck Top</b>	Deck Slab Top Mat	Stainless or GFRP <sup>9</sup> on freeways <a href="#">and NHS Core and Feeder routes.</a> <sup>7</sup> with <a href="#">AADT &gt; 50,000</a>
	Closure pours between CIP deck stages	Stainless or GFRP on freeways <a href="#">and NHS Core and Feeder routes.</a> <sup>7</sup> with <a href="#">AADT &gt; 50,000</a>
	Deck Closure pours between Precast components.	Stainless or GFRP
	Deck Top within 1.5 m of expansion joint gap.	Stainless <a href="#">or GFRP</a>
	Topping Slab within 1.5 m of expansion joint.	Stainless <a href="#">or GFRP</a>

Component Surface		Reinforcement <sup>6</sup>
<b>Sidewalks and Barriers</b>	Barrier and parapet walls.	Stainless or GFRP <sup>4</sup>
	Sidewalks, medians, and curbs.	Stainless or GFRP
<b>Deck Soffit</b>	See Figure 12.2.1, Figure 12.2.2 and Figure 12.2.3.	Stainless or GFRP
	Deck soffit within 1.5 m of expansion joint gap.	Stainless <u>or GFRP</u>
	Soffit of Post-tensioned <u>underpass</u> Bridges <u>over freeways with AADT &gt; 50,000 under bridge</u> <sup>8</sup> .	Stainless or GFRP
	Precast deck.	Same as CIP deck.
<b>Girders</b>	Stirrups and perimeter bars from precast component (i.e., NU, CPCI, box) within 1.5 m of expansion joints.	Stainless <sup>2</sup>
<b>Abutment Areas</b>	Front surface of ballast wall and top surfaces of bearing seats and pedestals exposed to roadway drainage or possible dripping <sup>3</sup> .	Stainless <sup>2</sup>
	Surfaces of abutments, wingwalls, retaining and MSE(RSS) walls <sup>5</sup> that are exposed to roadway drainage or possible dripping <sup>3</sup> .	Stainless or GFRP
	Exposed faces of abutment walls, wingwalls, tunnels, retaining and MSE (RSS) walls <sup>5</sup> within 7 m horizontally and 5 m vertically of an existing or future roadway <sup>4</sup> .	Stainless or GFRP
<b>Piers<sup>7</sup></b>	Pier caps, bearing seats and sides of pier shafts and columns exposed to roadway drainage or possible dripping <sup>3</sup> .	Stainless
	Side and end surfaces of pier shafts and columns within 10 m horizontally and 5 m vertically above an existing or future roadway <sup>6</sup> . All reinforcement in the column should be considered, including dowels from the footing.	Stainless

Component Surface		Reinforcement <sup>6</sup>
	Pier shafts and columns exposed to roadway drainage or possible dripping.	Stainless
<b>Misc.</b>	Top surfaces of expansion joint end dams including those at sleeper slabs supporting the end of the approach slabs.	Stainless <sup>2</sup>
	Bars connecting approach slab to bridge and at approach slab end.	Stainless <sup>2</sup>
	For semi-integral abutment bridges: All surfaces at and within 750 mm of the joint between the deck and wingwall. (See Figure 12.2.4 for examples).	Stainless <u>or GFRP<sup>2</sup></u>
	Top and side surfaces of bases for lighting poles that are attached to bridges.	Stainless <u>or GFRP<sup>2</sup></u>

Notes:

- ~~Where specified by the Structural Section, stainless steel may be required for TL-5 barriers on bridges with AADT > 100,000 and where deck/shoulder width is narrow, precluding a safe work zone if repair to the barrier wall is required. For other situations, use either Stainless Steel or GFRP. Note no longer applicable.~~
- GFRP shall not be used due to the excessive bend requirements of bars in these locations.
- This includes surfaces below joints (sealed or unsealed), deck drain outlets, and overhanging features from which dripping may occur. “Below” should be taken to mean within a vertical cone of height 5m (measured from the bearing seat or drainage discharge) and having an apex angle of 45 degrees or likely to receive run-off from a surface within such a cone.
- Distance measured from the edge of the nearest travelled lane.
- The designer shall specify which MSE walls in the contract fall within these limits and require Premium Reinforcing in their facings. Premium reinforcing shall not be specified on contract drawings and shall be supplied according to approved DSM product drawings.

6. When AADT both on and under the bridge (if applicable) are between 400 and 2,000, Premium Reinforcement is only required in the barrier walls, curbs and sidewalks, with Black steel elsewhere. Where AADT < 400 both on and under the bridge (if applicable), Premium Reinforcement is not required, and Black steel shall be used throughout.
7. Although pier caps are within 5 meters vertically of the roadway surface, they are on the outer periphery of the splash zone and historically have performed well with black steel.
8. The requirement for Premium Reinforcing applies only to portions of the soffit within 6 m of top of the roadway surface. For the purpose of evaluation and design, post-tensioned bridges have a design service life of 100 years.
9. In slab-on-girder bridges and in topping slabs, GFRP shall be used unless approval to use stainless steel is obtained from the Head of Structural Section.