

Design and Construction Transportation Infrastructure

Bridges, Structures and Expressways

This design standard supplements standards and provisions set forth in the 2016 edition of the Structural Manual developed by the Ministry of Transportation of Ontario. Designers must use this document in conjunction with the Structural Manual in order to prepare contract plans and specifications for structural elements and/or systems on City of Toronto infrastructure.

Implementation

This design standard is effective as of June 10, 2021.

Background

The city of Toronto is located in a region prone to freeze thaw cycles during cold weather. Extensive use of de-icing salt on the bridges in Toronto, has resulted in accelerated deterioration of concrete bridge components due to the corrosion of reinforcement steel. The use of premium reinforcement for the entire top surfaces of bridge decks is formally implemented to mitigate premature deck deterioration resulting in achieving more durable and sustainable bridges.

Exception to the Structural Manual (September, 2016)

12.1.3 PREMIUM REINFORCING - WHERE REQUIRED

All paragraphs under Subsection 12.1.3, and table 12.1.3 are deleted and replaced with the following:

Premium Reinforcing materials are as defined in section 2.8.2. Premium Reinforcing shall be used in the entire top mat reinforcement of the deck; and in locations vulnerable to salt-induced corrosion (e.g. piers and abutments). In the pier and abutment locations, bars within 100 mm (e.g. cover specified as 125 ± 25 mm) below the specified cover shall be of Premium Reinforcing unless the surface is permanently covered with at least 500 mm of soil or water. Table 12.1.3 provides a summary of Premium Reinforcing requirements for surfaces of structures.

Other than in proximity to expansion joints, in the locations shown on structural standard (SS) drawings, stirrups from standard precast beams that project into deckslabs that are 200 mm or more in thickness need not be of Premium Reinforcing material.

Fig. 12.1.3(a) to (d) illustrates the extent of Premium Reinforcing for selected locations described in Table 12.1.3.

Premium Reinforcing is not required for selected components or structures that are covered by specific standards and that have a design life less than 50 years; such as footings of sign support structures and footings of high mast pole structures.

For replacement of concrete traffic barrier, Premium Reinforcing materials are not required if the remaining life of the deck is less than 35 years.

TABLE 12.1.3: Premium Reinforcing Requirements for Component Surfaces within Splash Zone

STRUCTURAL MANUAL			
2016 09 01	REINFORCING		PAGE 12 - 4
Component Surface		Stainless Steel	GFRP
<ul style="list-style-type: none"> • Entire top surfaces of bridge decks and top slab of culverts; where soil cover is less than 500mm; ballast walls and approach slabs on structures: <ul style="list-style-type: none"> i. Carrying a road classification of Expressway, Major Arterial, Minor Arterial as defined in City's Road Classification System; ii. Crossing electrified rail, or carrying a combination of road and electrified rail (LRT, Street Car, or other). 		Yes	Yes
<ul style="list-style-type: none"> • All surfaces of curbs, sidewalks, stairs, ramps, medians, parapets and barrier walls. 		Yes	Yes
<ul style="list-style-type: none"> • Surfaces of abutments, piers and retaining walls that are exposed to roadway drainage or dripping. This includes surfaces below sealed or unsealed joints, below deck drain outlets, below storm drain outlets intercepting retaining walls and culvert barrels, and below overhanging features from which dripping may occur. "Below" should be taken to mean within a vertical cone having an apex angle of 45 degrees or likely to receive run-off from a surface within such a cone 		Yes	Yes
<ul style="list-style-type: none"> • Exposed faces of abutment walls, tunnels/retaining walls* within 7 m horizontally and 5 m vertically of an existing or future roadway measured from the edge of the nearest travelled lane. 		Yes	Yes
<ul style="list-style-type: none"> • Side and end surfaces of pier shafts, retaining walls, and earth retaining systems within 10 m horizontally and 5 m vertically of an existing or future roadway measured from the edge of the nearest travelled lane 		Yes	Yes
<ul style="list-style-type: none"> • Top surfaces of expansion jointend dams including those at sleeper slabs supporting the end of the approach slabs 		Yes	No*

<ul style="list-style-type: none"> Surfaces of columns within 10 m horizontally and 5 m vertically of an existing or future roadway measured from the edge of the nearest travelled lane. All reinforcement in the column should be considered, including dowels from the footing. 	Yes	No*
<ul style="list-style-type: none"> Pier caps are exempt from this requirement except at location below expansion joints as stated below 	Yes	No*
<ul style="list-style-type: none"> Bearing seats and sides of piershafts and columns, including pier caps, below expansion joints within 5 m measured vertically from the bearing seat 	Yes	No*
<ul style="list-style-type: none"> Top and side surfaces of bases for pole and sign structures that are attached to bridges 	Yes	No*
<ul style="list-style-type: none"> Front surface of ballast wall and top surfaces of bearing seats and pedestals for bridges with expansion joints 	Yes	No*
<ul style="list-style-type: none"> For semi-integral abutment bridges: All surfaces at and within 750 mm of the joint between the deck and wingwall. (see Figure 12.1.3(d) for examples) 	Yes	No*
<ul style="list-style-type: none"> The entire pedestrian bridge and ramp slabs of must use premium reinforcement unless it is confirmed by the divisional asset owner that structure will not be exposed to de-icing salt 	Yes	No*

* GFRP is not specified for these elements due to extensive amount of bent bars or spirals required.

** Includes RSS walls with concrete facings. The designer shall specify which RSS walls in the contract require Premium Reinforcing.