



Metrolinx General Guidelines for Design of Railway Bridges and Structures Bulletin #02 Guidelines for Shoring Wall Design and Monitoring outside the Rail Corridor

01 March 2023

Bulletin No. 002

Introduction

The use of this Bulletin is limited to temporary shoring wall construction adjacent to Metrolinx-owned Rail Corridors that meets the following conditions:

- 1) All temporary structures shall be designed and constructed to provide safe support and adequate rigidity for the loads imposed;
- 2) All temporary structures shall be constructed with minimal interference to the operating tracks;
- 3) Temporary structures are defined as structures in service for not more than an 18-month period;
- 4) The shoring wall is located outside the railway right-of-way (not including the tie-back anchors) and has a minimum distance of 10 meters from the nearest rail; and,
- 5) Review and approval by Metrolinx Bridges and Structures for the following considerations:
 - i. Soil and groundwater conditions
 - ii. Depth of excavation
 - iii. Types of shoring wall
 - iv. The presence of sensitive track works, utilities, buildings, and other structures/assets
 - v. Other project-specific factors and conditions

If, at the discretion of Metrolinx Bridges and Structures, any of the above conditions are not satisfied, this Bulletin shall not be used, and Part 6 GUIDELINES FOR SHORING WALL DESIGN AND MONITORING in Metrolinx General Guidelines for Design of Railway Bridges and Structures shall be followed.

This Bulletin shall always be read jointly with General Guidelines for Design of Railway Bridges and Structures.

*****REVISED*****

Refer to Part 6 Section 2.4, and revise to read:

For estimation of soil lateral pressure, the triangular soil pressure method may be used. Alternate soil pressure distribution models may be used if the Design Engineer determines that such models will provide a more accurate approximation of the actual soil load distribution, according to the recommendations of Canadian Foundation Engineering Manual (latest edition). The Design Engineer shall also consider any load redistribution that may occur as the tiebacks are stressed.

Refer to Part 6, and delete Section 2.5

Refer to Part 6 Section 4.1, and revise to read:

For any tiebacks in the 1st row that are subject to track loading, the distance between the tiebacks and the bottom of the rail and/or elevation of the top of excavation (whichever is closer) shall be maximum 1.5 m (5 ft).

Refer to Part 6 Section 4.12, and revise to read:

Performance bond test(s) (2.0 times the tieback design load) shall be performed to validate the assumed allowable bond stress between the soil/rock and tieback.

- The duration of the portion of the test - as part of the creep test - while holding the load equal to 2.0 times the tieback design load, shall not be less than 10 hours.
- Special attention shall be taken for the testing of the top anchors in order to avoid track heave for passive wedge failure.
- The loading of the anchor shall be less than the passive resistance behind the wall (toward the tracks).

Refer to Part 6 Section 4.13, and revise to read:

Proof test(s) (1.33 times of the tieback design load) shall be performed to validate the proof of actual overall bond capacity between the soil/rock and tieback.

- The duration of the portion of the test - as part of creep test - while holding the load equal to 1.33 times the tieback design load, shall not be less than 10 minutes.

Refer to Part 6 Section 5.1.2, and revise to read:

Each increment shall be held for a minimum of 2 minutes except the maximum load (133% of design load) shall be held for a minimum of 10 minutes. Total movement at the maximum load shall be recorded at 1, 2, 3, 4, 5, 6, and 10 minutes. If the difference between the total movements at 1 and 10 minutes exceeds 1 mm, the maximum load shall be maintained for an additional 50 minutes and the movement readings shall be recorded at 20, 30, 40, 50, and 60 minutes.

Refer to Part 6, and delete Section 5.1.4

Refer to Part 6 Section 5.2, and revise to read:

PERFORMANCE TEST

Performance/Pre-production testing of ground anchors/tiebacks shall be in accordance with OPSS.PROV 942, except as modified in this section.

5.2.1 The maximum load (200% of design load) shall be held for a minimum of 10 hours.

5.2.2 The minimum number of anchors required for performance/pre-production testing of 200% of the design load shall be the first two or three anchors as determined by the Engineer and thereafter a minimum of 2% of the remaining anchors. However, additional performance/pre-production testing of anchors may be required by Metrolinx due to site conditions.

Refer to Part 6 Section 6.2, and revise to read:

The creep movement between 1 and 10 minutes of loading shall not exceed 1 mm (0.04 in) per log cycle of time or the creep movement within 60 minutes at the creep test load shall not exceed 2 mm (0.08 in) per log cycle of time.

Refer to Part 6 Section 7.1, and revise to read:

The timber lagging shall be species (S-P-F), beams and stringers, grade No. 1 or better, in accordance with AREMA chapter 7, or alternate species with proven superior strengths and modulus of elasticity, as approved by the Design Engineer.

Refer to Part 6 Section 7.2, and revise to read:

The allowable bending stresses shall be in accordance with AREMA chapter 7 for the species and grade selected.

Refer to Part 6 Section 7.3, and revise to read:

The thickness of lagging for shoring walls shall be as follows, unless the Design Engineer can demonstrate through analysis and calculation that a reduced thickness is acceptable:

- For the upper 2 m (6.5 ft) – 150 mm (6 in) minimum
- Below 2 m (6.5 ft) to a depth of 4.5 m (14.8 ft) – 200 mm (8 in) minimum

Refer to Part 6 Section 8.3, and revise to read:

For calculation of the passive earth pressure, the coefficient of passive resistance K_p shall be multiplied by 0.66 to provide a factor of safety of 1.5 per AREMA Chapter 8 - Article 28.5.1.2.

Refer to Part 6 Section 10.1, and revise to read:

The concrete used in filler caissons shall have the minimum compressive strength of 4 MPa, prior to the commencement of excavation.

Refer to Part 6 Section 10.2, and revise to read:

Removal (shaving off) of concrete from the filler caissons will not be allowed, unless the following conditions are satisfied:

- The reduced concrete section is verified by the Design Engineer of the shoring wall; and,
- The contractor can demonstrate the technique used will not damage the secant wall.

Refer to Part 6 Section 10.5, and revise to read:

The maximum spacing between the centerline of king piles shall be limited to 1.6 times the king pile diameter to a maximum of 2.4 m (8.0 ft), unless the Design Engineer can demonstrate through analysis and calculation that an increased spacing is acceptable.

Refer to Part 6, and delete Section 10.6

Refer to Part 6 Section 12.6, and revise to read:

The monitoring instrumentation reading interval shall be daily from the first day of shoring wall installation until such time the excavated area is backfilled, or the shoring wall is removed. This duration includes:

- during shoring wall installation,
- during excavation,
- at all times when the excavation is in an open condition, and the shoring wall is under load,
- during all stages of the work and,
- until all the shoring wall is removed or excavated area is backfilled

Provided that a continuous monitoring system is used and access to live data log readings is available to the Engineer, the daily surveying of the monitoring points may be reduced to weekly after the excavation is completed. The detailed GIMP is subject to review and approval by Metrolinx Bridges and Structures.

Refer to Part 6 Section 12.10, and revise to read:

Track and ground monitoring shall be carried out in accordance with Section 13.11 and Section 13.12 (including revision provided in this Bulletin). If any upward, downward or lateral movement of track is/are observed, the following shall be immediately reported to the Metrolinx Project Manager:

- a) site information, location,
- b) location of track(s) movement, and
- c) length of track(s) movement

Refer to Part 6 Section 12.11, and revise to read:

Targets shall be placed on a minimum of one-third of the piles. For secant pile wall construction, targets shall be placed on a minimum of one-third of the king piles.

Refer to Part 6 Section 12.12, and revise to read:

It is required that monitoring targets shall be placed:

- a) At the top of the selected pile(s),
- b) At the level of all tiebacks on each selected pile(s),
- c) At a mid-point between two consecutive levels of tie backs

If the GIMP specifies continuous monitoring of the piles using inclinometers, the monitoring targets at c) the mid-point between two consecutive levels of tie backs of these piles may be omitted.

Refer to Part 6 Section 12.19, and revise to read:

The only acceptable location of inclinometer is in the filler caisson, along the centreline of the filler-pile at the back face of shoring wall furthest from the open excavation, unless approved otherwise by Metrolinx Bridges and Structures.

Refer to Part 6 Section 13.11, and revise to read:

Ground Movement Visual Monitoring shall be performed a minimum of twice daily (i.e. before morning rush hour trains and prior to afternoon rush hour trains) during construction/ boring/ tunneling activities and when excavation is in an open condition. If requested by the Design Engineer and after completion of a risk assessment, reduction of reading intervals may be reviewed and approved by the Director, Engineering – Track or delegate.

Refer to Part 6 Section 13.12, and revise to read:

Track movement monitoring, via surveying of in-ground monitoring points and rail surface monitoring points, shall be performed once a day during construction/boring/tunneling activities and when excavation is in an open condition. If requested by the Design Engineer and after completion of a risk assessment, reduction of reading intervals may be reviewed and approved by the Director, Engineering – Track or delegate.

These changes are effective immediately.

*****END*****

Signed:

Craig Harper
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