

**MELBOURNE METRO RAIL PROJECT ENVIRONMENT EFFECTS STATEMENT**  
**INQUIRY AND ADVISORY COMMITTEE**

**MMRA TECHNICAL NOTE**

**TECHNICAL NOTE NUMBER:** 024

**DATE:** 9 August 2016

**PRECINCT:** CBD North and CBD South Station Precincts

**EES/MAP BOOK REFERENCE:** Maps 7 and 8; EES Sections 6.6 and 18.1

**SUBJECT:** Revised station cavern construction methodology

**NOTE:**

1. Since the Melbourne Metro EES was placed on public exhibition, the geological profiles along the tunnel alignment have been updated by Golder Associates based on the information from 241 additional boreholes (erroneously referred to as 270 boreholes in Technical Note 008), including a horizontal directional bore at the site of the proposed CBD South station.
2. Technical Note 008 advised that in response to this new geological information, as a precaution it is proposed to drop the vertical alignment of the CBD South station by 4 metres. This Technical Note discusses other implications of this new geological information for the design and construction of the CBD stations.
3. While not expressly discussed in the EES, the assumption for construction involved the application of one of three means of primary support for the excavation of station caverns. Support class 1 is based on using rock bolts with shotcrete. Support class 2 is similar to class 1, but involves the use of a larger number of rockbolts and a thicker shotcrete layer (Figure 1-as per attachment). Support class 3 is based on using steel reinforcement in the form of a lattice girder or steel set, and a thick layer of shotcrete (Figure 2 – as per attachment).
4. Based on the enhanced understanding of CBD geology based on the 260 new boreholes, support class 3 in weakest ground condition requires a Universal Steel Column size 250 UC 73 instead of a lattice girder.

5. Based on the geological profiles provided by Golder Associates prior to July 2016 and documented in EES (Melbourne Metro Rail Project - Interpreted Geological Setting EES Summary Report - Report Number. 1525532-218-R-Rev2, dated 20 April 2016), the assumed support class distributions for the CBD North and South station caverns were based on support classes 1 and 2. Support class 3 was not specified (see Tables 1 and 2 below).
6. The excavation sequences for the cavern consisted of three headings, three benches and two inverters as per Figures 1 and 2. This applies to all the three support classes and has not changed as a result of the updated geological information.
7. The revised geological profile for CBD South station indicates that Class 3 support is required for 100% of the cavern.

**Table 1 Change to CBD South Primary Support class Distribution**

<b>CBD South</b>	<b>Type 1 (Rock bolts / Shotcrete)</b>	<b>Type 2 (Rock bolts / Shotcrete)</b>	<b>Type 3 – Steel set</b>	<b>Type 3 – Lattice Girder</b>
<b>Geological conditions</b>	Slightly weathered to fresh Melbourne Formation  Min Strength= Medium to High	Moderately weathered Melbourne Formation  Min Strength= Low to Medium	Highly weathered Melbourne Formation  Min Strength= Low	Highly weathered Melbourne Formation  Min Strength= Low
<b>Concept Design</b>	36%	64%	0%	0%
<b>Revised Design July 2016</b>	0%	0%	45%	55%

8. The revised geological profile for CBD North station indicates that Class 3 support is required for 100% of the cavern.

**Table 2 Change to CBD North Primary Support class Distribution**

<b>CBD North</b>	<b>Type 1 (Rock bolts / Shotcrete)</b>	<b>Type 2 (Rock bolts / Shotcrete)</b>	<b>Type 3 – Steel set</b>	<b>Type 3 – Lattice Girder</b>
<b>Geological conditions</b>	Slightly weathered to fresh Melbourne Formation  Min Strength= Medium to	Moderately weathered Melbourne Formation  Min Strength= Low to Medium	Highly weathered Melbourne Formation  Min Strength= Low	Highly weathered Melbourne Formation  Min Strength= Low

	High			
<b>Concept Design</b>	21%	79%	0%	0%
<b>Current Design July 2016</b>	0%	0%	72%	14%

9. Both station caverns will be tanked upon completion of construction, as described in the EES.
10. These revised reinforcement techniques mean that larger amounts of steel reinforcements would be required for both cavern stations than would be required for Type 1 and 2 supports. However, this does not have an impact on construction methodology or duration, nor does it affect the amounts of spoil that will need to be removed from the station caverns.
11. However, CBD South station requires re-charge facilities as well as pre-injection grouting to control groundwater drawdown and minimise impact on the aquifers. These measures are anticipated in the EES (see Section 18.1).
12. Construction of the CBD South station cavern, based on the current interpretation of the geological conditions and corresponding revised primary support described in this Technical Note, is estimated to be in the order of an additional 16 weeks longer to excavate and support. The EES currently assumes that cavern construction for the CBD South station will take approximately three years (see Section 6.6.5).
13. Construction duration for the CBD North station cavern, based on the current interpretation of the geological conditions and corresponding revised primary support described in this Technical Note, is estimated to be in the order of an additional 13 weeks longer to excavate and support. The EES currently assumes that cavern construction for the CBD North station will take approximately three years (see Section 6.6.5).
14. The construction of the CBD North and CBD South station caverns will not have any impact on the mined tunnel between them as these construction activities will be undertaken concurrently.

**CORRESPONDENCE:** No correspondence.

**ATTACHMENTS:** Figure 1 CD Support Class 2 (Class 1 similar less rock bolts (28 in total) and thinner shotcrete lining (150 mm))

Figure 2 CD Support Class 3 (lattice girder shown)

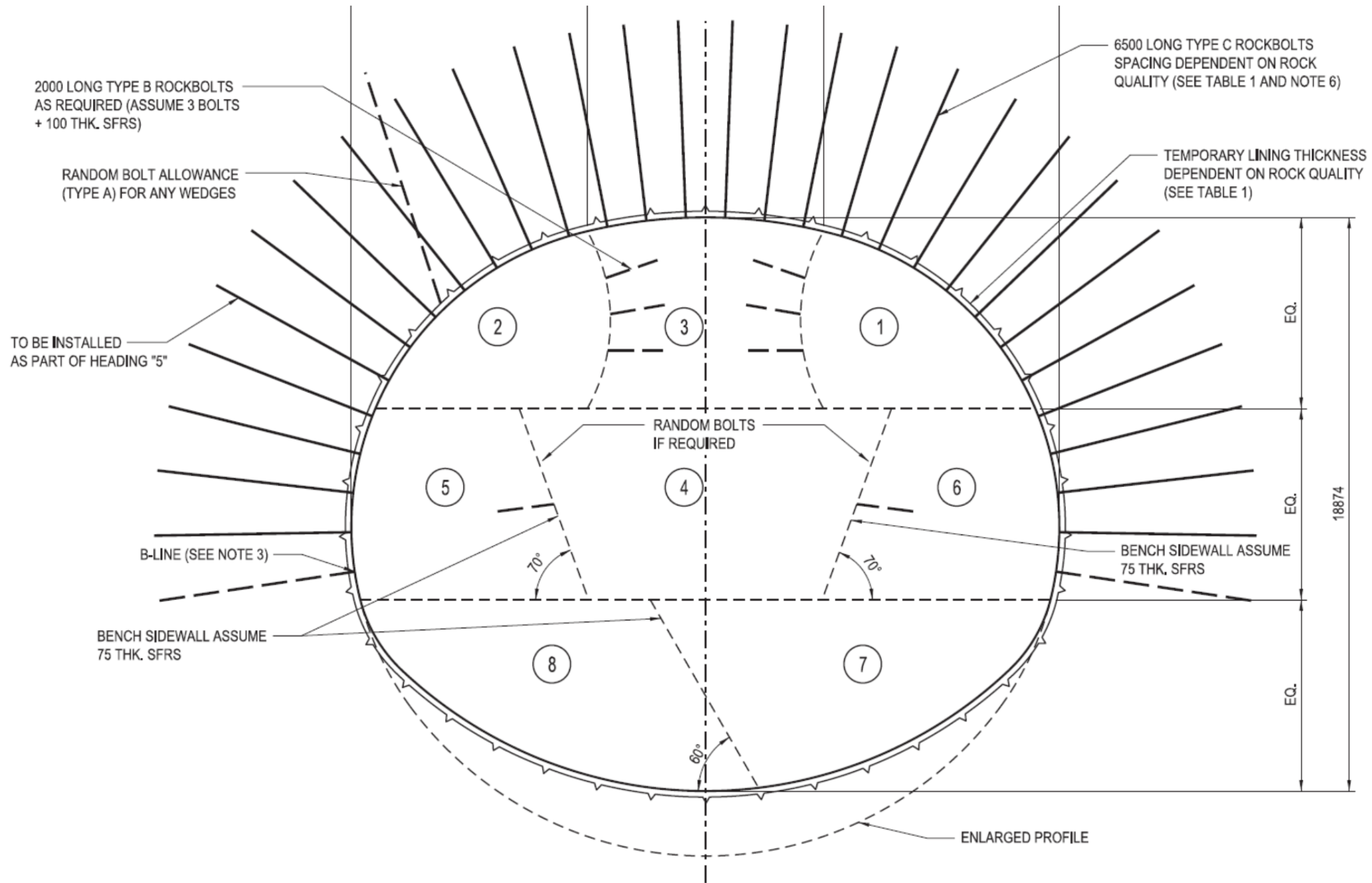


Figure 1 CD Support Class 2 (Class 1 similar less rock bolts (28 in total) and thinner shotcrete lining (150 mm))

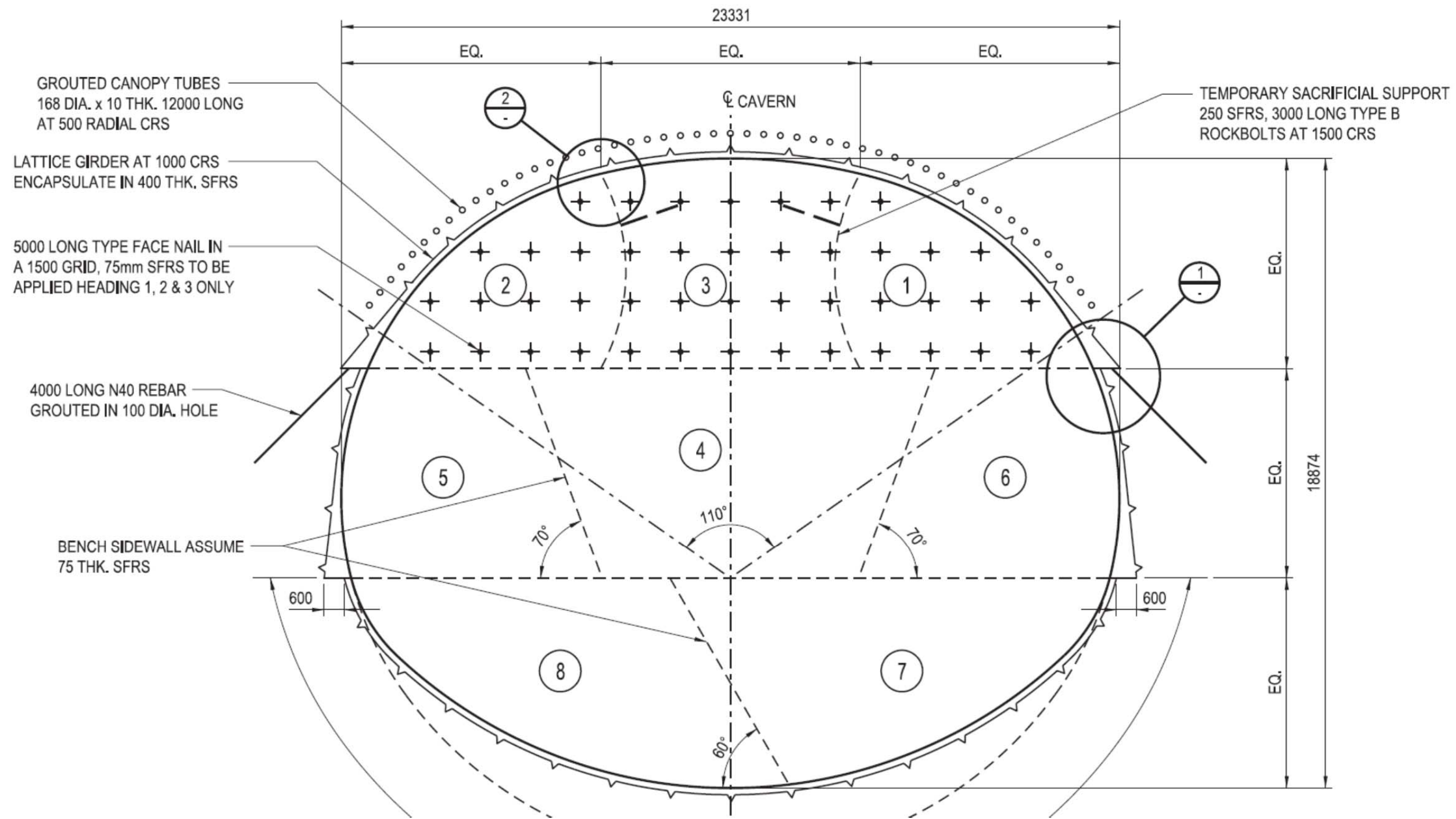


Figure 2 CD Support Class 3 (lattice girder shown)