

### Project Details

Sao Paulo is the largest city of Brazil and the largest city proper in the southern hemisphere. It's also one of the top 10 largest metropolitan areas in the world. The metro system in Sao Paulo is a crucial part of public transport infrastructure. Construction began in 1974 and as of 2010 there was 65.9 km of underground metro tracks over 5 lines connecting 58 stations. Expansion work is currently underway to expand the network to 137 km with an additional 68 stations.

Construction work is currently underway on an 11.8 km extension of Metro Line 5, taking the total length to 20 km and 17 stations by 2015. The extension will open the network to an additional 1 million residents and help meet the predicted demand of 6 million daily passengers by 2015.

### Design Details

The line 5 extension will be fully underground with both NATM and TBM construction. 4.6 km of single track running tunnels will be excavated by two 6.9 m diameter earth pressure balance TBM's and 5.7 km of double track running tunnels will also be excavated by a 10.6 m diameter TBM. There will be a total of 11 stations, 8 to be constructed with open excavation and 3 by NATM.

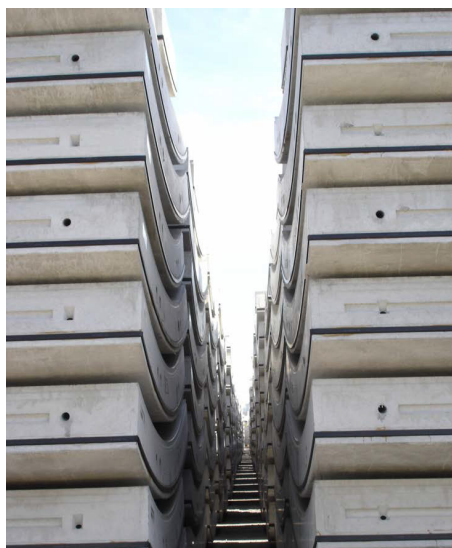
Ground condition consists mostly of soft and unconsolidated clay, sandy and silty clays and weathered and moderately weathered gneiss. Ground support in the TBM driven tunnel tracks consists of a precast segmental lining. The full lining consisted of seven segments and a key joint. The lining was made up of 7 segments and a key. Reinforcement is a combination of EPC's BarChip synthetic fibre and a single steel cage.

### Project Benefits

EPC's barchip synthetic fibres were specified in an direct effort to reduce segment cracking as a result of TBM impact. EPC's synthetic fibres provide reinforcement right to the very edge of the precast element, lowering the risk of impact damage. At the manufacturing plant EPC's synthetic fibres improve production output while lowering production costs. By using EPC's fibres steel does not need to be on site nor does it need to be manually placed in the mould. EPC's fibres also eliminate the risk of corrosion and improve the long term durability of the structure.



EPC BarChip synthetic fibre reinforced precast segmental tunnel lining



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