By taking three of the busiest train lines (Cranbourne, Pakenham and Sunbury) through a new tunnel under the city, the Metro Tunnel will untangle the City Loop so more trains can run more often across Melbourne.

As a result, room will be created on the network to enable more than half a million additional passengers per week to travel on the rail network during peak periods.

Cross passages
A cross passage is a short tunnel that connects two parallel tunnels. The Metro Tunnel will have 26 cross passages located approximately 230 metres apart along its tunnel alignment. These passages are an important safety feature that allow people (including emergency services) to move from one tunnel to the other in the event of an emergency.
Building the cross passages

The Metro Tunnel cross passages will be constructed from below ground within the tunnels after the tunnel boring machines (TBMs) have passed through.

The cross passages are generally constructed using traditional mining techniques to create a link between the two tunnels. These techniques typically include the use of ground treatment measures, excavators, rock breakers, rock bolting and shotcrete lining from within the tunnels.

Ground improvement works

In some cross passage locations, the ground conditions are not suitable for mining between the two tunnels without firstly increasing the strength of the ground and reducing groundwater permeability. This process is known as ground improvement and is achieved by utilising specialised drilling and grouting techniques as well as more conventional piling methods.

Depending on the ground conditions, ground improvement can often be done from inside the tunnel. However, in some instances the ground profile requires these works to be done from the surface level where a greater degree of ground treatment coverage can be achieved.

Where ground improvement works need to be done from surface level, they should be carried out prior to the tunnel boring machines passing through.

Managing noise, vibration and dust

The Metro Tunnel Project has stringent Environmental Performance Requirements (EPRs).

Environmental impacts – including noise, vibration and dust – will be managed in accordance with these requirements.

Prior to ground improvement works starting, a Construction Noise and Vibration Impact Assessment will be undertaken to ensure appropriate construction management is in place for the works to comply with the EPRs.

The use of ground improvement equipment will generate noise, dust and some vibration when in use.

The project team will contact residents and businesses in proximity to the ground improvement areas prior to works starting.

Environmental monitoring will continue throughout the works to inform the construction process and monitor compliance with the EPRs.

Cross passage construction

Surface level ground improvement works

1. Utility services investigation and relocation if required
2. Establishment of a works site and mobilisation of ground improvement equipment and machinery
3. Drilling underground to the desired ground improvement position
4. Pumping grout into the drilled hole
5. Repeating until the cross passage area has been treated
6. Testing the permeability and strength of the ground improvement, and continuing ground improvement until sufficiently complete
7. Demobilisation and reinstatement of the area

Below ground works

8. TBMs build tunnels through the area
9. Cross passages constructed below ground from within the constructed tunnels using conventional mining techniques.

Ground improvement works

1. Drilling underground to the desired ground improvement position
2. Pumping grout into the drilled hole
3. Repeating until the cross passage area has been treated
4. Testing the permeability and strength of the ground improvement, and continuing ground improvement until sufficiently complete
5. Demobilisation and reinstatement of the area

More information

To find out more about the Metro Tunnel Project and register for future email updates:

- 1800 105 105 (24 hours a day, 7 days a week)
- Press 2 and follow the prompts
- [facebook.com/metrotunnel](http://facebook.com/metrotunnel)

It should be noted that this information is current at the time of printing, however due to unforeseen circumstances, changes may occur. Please visit [metrotunnel.vic.gov.au](http://metrotunnel.vic.gov.au) for the latest updates.