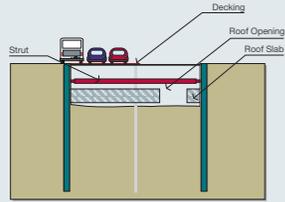
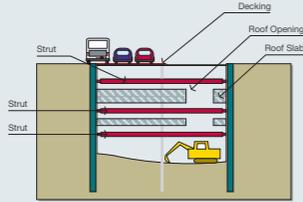


03. Construction of Underground Structure



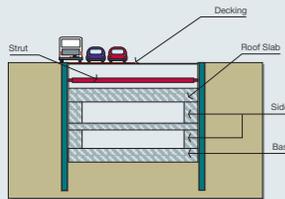
The roof slab is constructed, with access openings provided on the slab for works to proceed downwards. The roof slab not only provides a massive support across the excavation, it also acts as a noise barrier.

04. Construction of Underground Structure



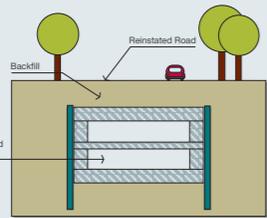
The next level of slab is constructed, and this process progresses downwards till the base slab is completed.

05. Construction of Underground Structure



The side walls are constructed upwards, followed by removal of the intermediate struts. The access openings on the roof slab are then sealed.

06. Backfilling & Reinstatement



After the underground structure is completed, the soil is backfilled to the top strut level before the strut is removed. This is followed by completely backfilling the top of the underground structure and finally reinstating the surface areas.

While noise, dust and other inconveniences are inevitable during construction, LTA will work closely with the contractor to keep them to a minimum.

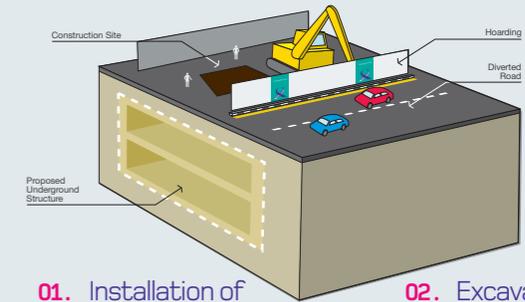


TOP-DOWN CONSTRUCTION

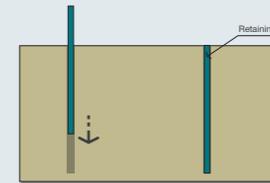
March 2005 Designed & produced by CE Design Studio Pte Ltd

Some of the underground Rapid Transit System (RTS) stations are constructed by the "top-down" method. In this method, the underground retaining walls are first installed. In most cases, these retaining walls are concrete diaphragm walls. This is followed by excavation to just below the roof slab level of the underground structure, with the retaining walls and struts supporting the soil at the sides. The roof slab is then constructed, providing a massive support across the excavation. Access openings on the roof slab are provided so that works thereafter could proceed downwards to the base slab level of the underground structure. Upon completion of the base slab, the side walls are constructed and the intermediate struts are progressively removed. The access openings on the roof slab are then sealed and the ground is subsequently backfilled and reinstated.

TOP-DOWN CONSTRUCTION METHOD

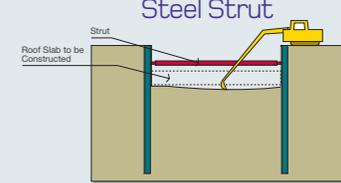


01. Installation of Retaining Wall



The underground retaining wall, which is usually a concrete diaphragm wall, is installed before excavation commences.

02. Excavation & Installation of Steel Strut

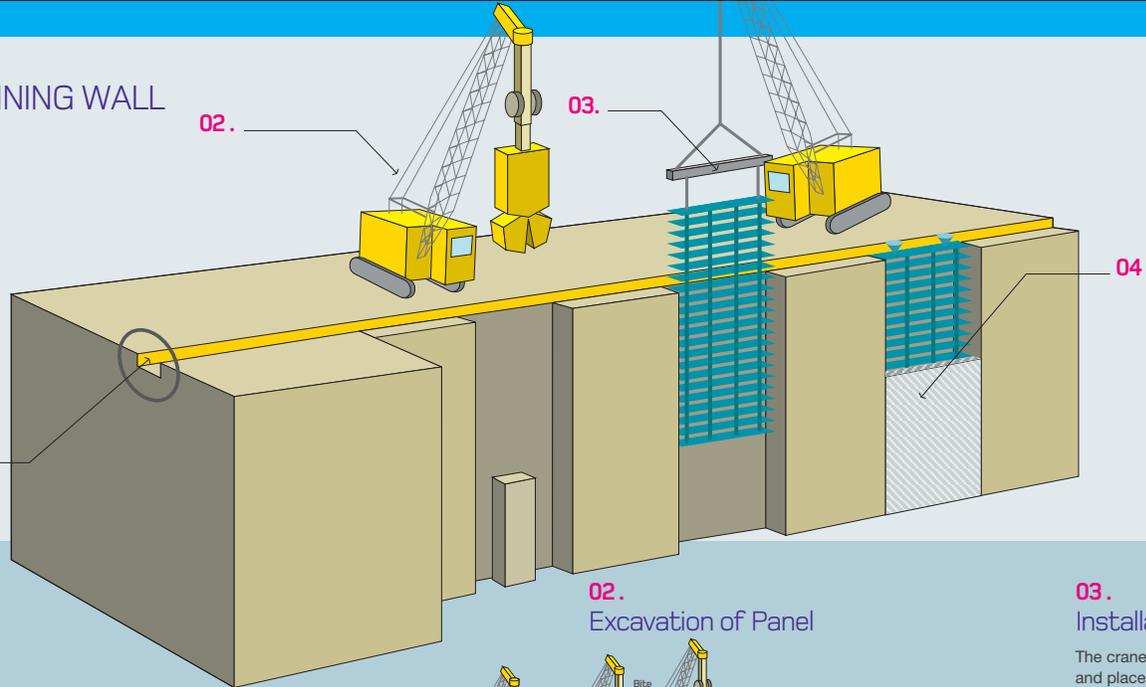


The soil is excavated to just below the roof slab level of the underground structure. Struts are installed to support the retaining walls, which in turn support the soil at the sides.

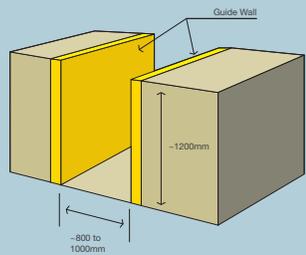


INSTALLATION OF RETAINING WALL - DIAPHRAGM WALL

The following pictorial guide illustrates the construction sequence of a typical diaphragm wall. This type of retaining wall was used for the construction of Kovan Station on the North East Line (NEL).



01. Construction of Guide Wall

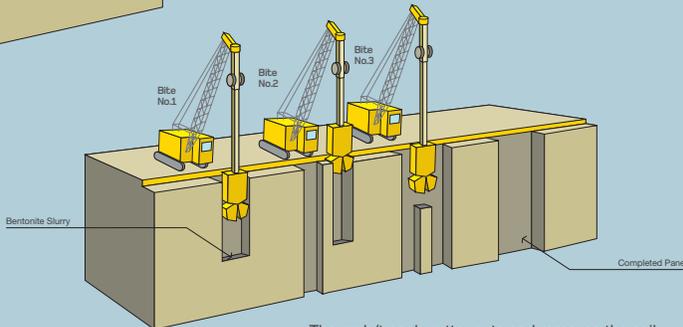


A guide wall is constructed to set out the position of the diaphragm wall.

02.

03.

04.



02. Excavation of Panel

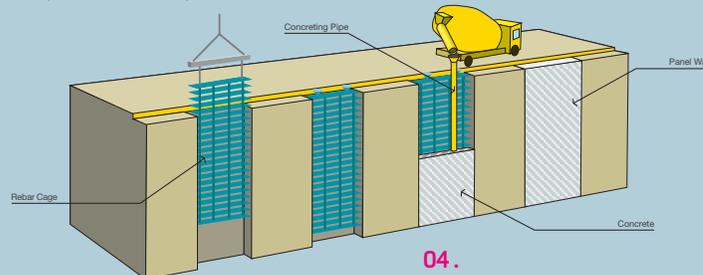
The grab/trench cutter cuts and removes the soil to form the panel. The excavation is stabilised by filling it with bentonite slurry to support the wall of the excavation.

Safety Measures

The Land Transport Authority (LTA) accords top priority to safety. Professional Engineers (PE) and Qualified Persons (QP) are engaged to carry out stringent checks on the temporary structures to ensure that they are installed correctly and safely before the excavation can proceed from one level to the next level. In addition, our engineers monitor the various stress and strain gauges installed on the temporary structures on a regular basis so as to be sure that the stresses fall within acceptable limits set by the design engineers. Likewise, instruments are extensively installed in the vicinity of the construction site to monitor vibrations, ground movements etc. This is so that the engineers are always in the know of the impact of the construction on the surrounding buildings and structures, thereby ensuring that they are safe.

03. Installation of Rebar Cage

The crane lifts up the reinforcement-bar cage and places it within the panel.



04. Concreting of Panel

Concrete is poured into the panel to form the panel wall.

Inconveniences

Noise is generated when the grab/trench cutter excavates the soil as well as during the panel concreting process. As it is vital that concrete is poured continuously into the panel till the whole panel is completely and homogeneously filled with the concrete, it is inevitable that work runs into the night when the panel is concreted so as not to affect its structural integrity.

05. Repetition of Process

Process 2 - 4 repeats for the remaining soil in between the panels till the entire length of the diaphragm wall construction is completed.

