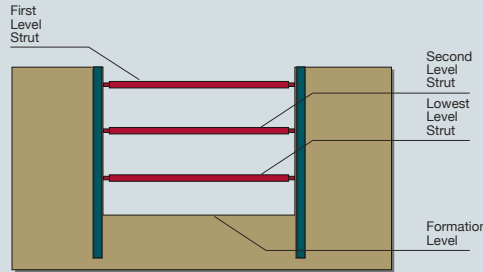
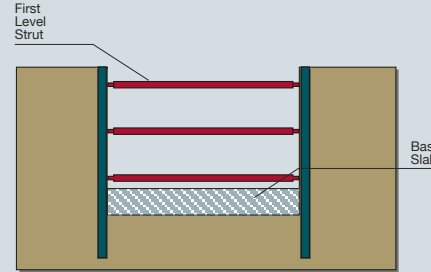


### 03. Excavation & Installation of Steel Strut



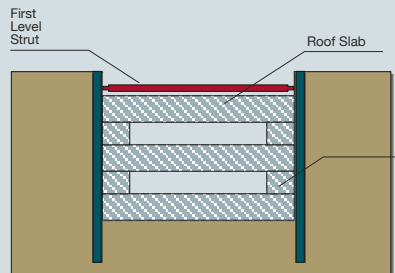
The soil is excavated to the next strut level and the second level strut is installed. It continues till the excavation reaches the final depth or formation level. The number of strut levels depends on the excavation depth.

### 04. Construction of Underground Structure



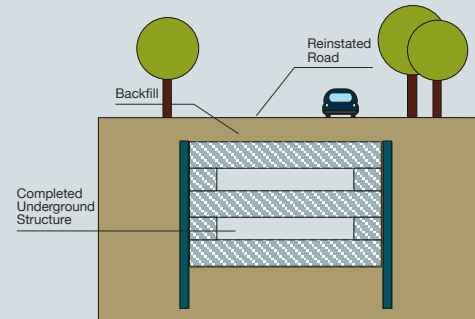
At formation level, the reinforced concrete slab or base slab is constructed, followed by the removal of the lowest level strut and the side walls are constructed.

### 05. Construction of Underground Structure



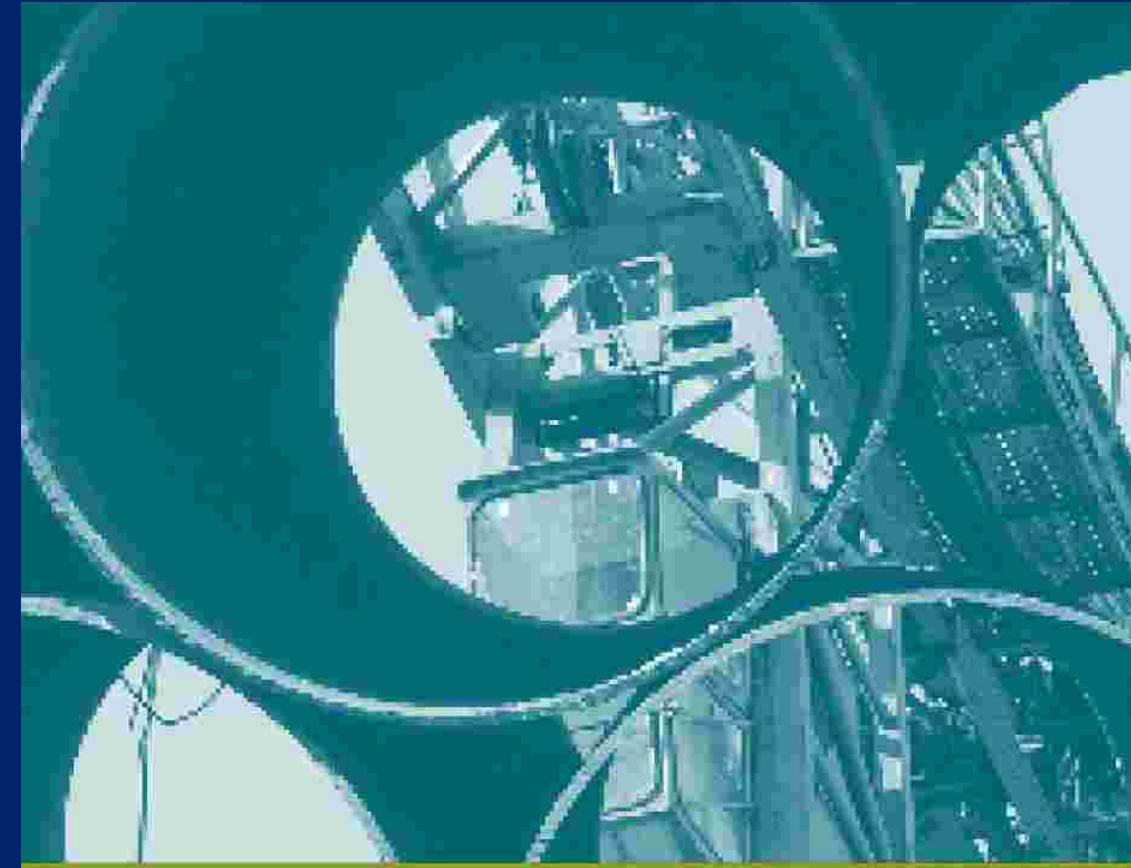
The next level of slab is constructed, followed by the removal of the strut near to that slab level. This process progresses upwards till the roof slab is constructed.

### 06. Backfilling & Reinstatement



After the roof slab is completed, the soil is backfilled to the first strut level before the first level strut is removed. This is followed by completely backfilling the top of the underground structure. If the retaining wall is a diaphragm wall or a bored pile wall, the top 2 metres of the wall will be removed. If it is a sheet pile wall, the sheet piles will be extracted.

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



## CONSTRUCTION OF SECANT PILE WALL



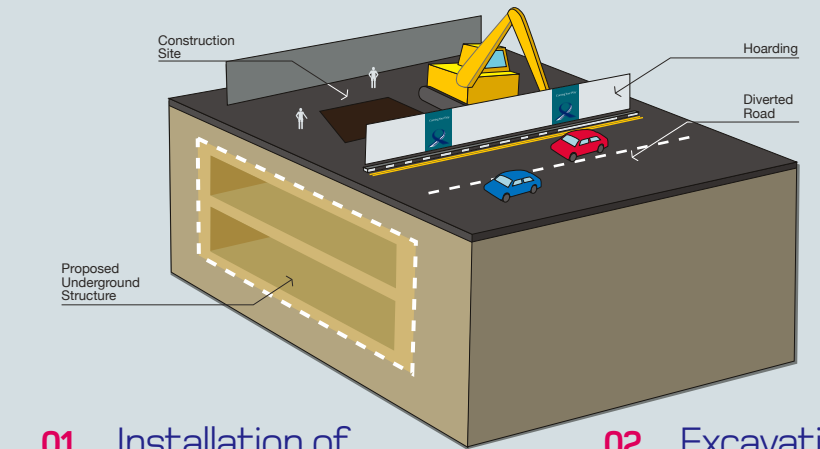
If you have any suggestions or feedback, please call our Customer Service Line: 1800 - CALL LTA 1800 - 2255 582

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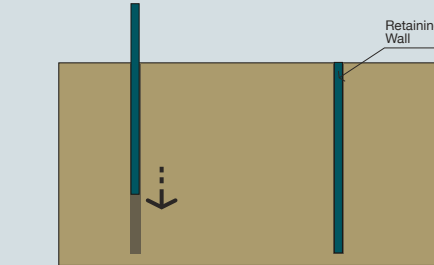


The underground Rapid Transit System (RTS) stations and cut-and-cover tunnels are typically constructed by the “open-cut and bottom-up” method. In this method, the earth is excavated to the required depth with retaining walls and struts supporting the soil at the sides. Upon the completion of excavation to the required depth, the base slab of the underground structure is cast at the bottom-most level, followed by the side walls. Casting of concrete progresses upwards, level by level till the roof of the structure is completed. Ground is then backfilled and reinstated.

## OPEN-CUT & BOTTOM-UP CONSTRUCTION METHOD

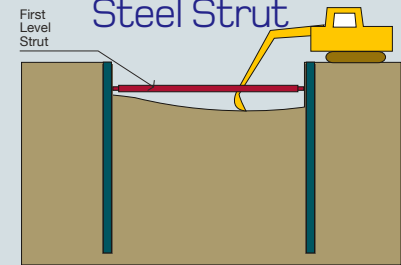


### 01. Installation of Retaining Wall



The underground retaining wall is installed before excavation commences. The retaining wall can be a concrete diaphragm wall, a concrete bored pile wall or a steel sheet pile wall; depending on the site condition, soil type and the excavation depth.

### 02. Excavation & Installation of Steel Strut

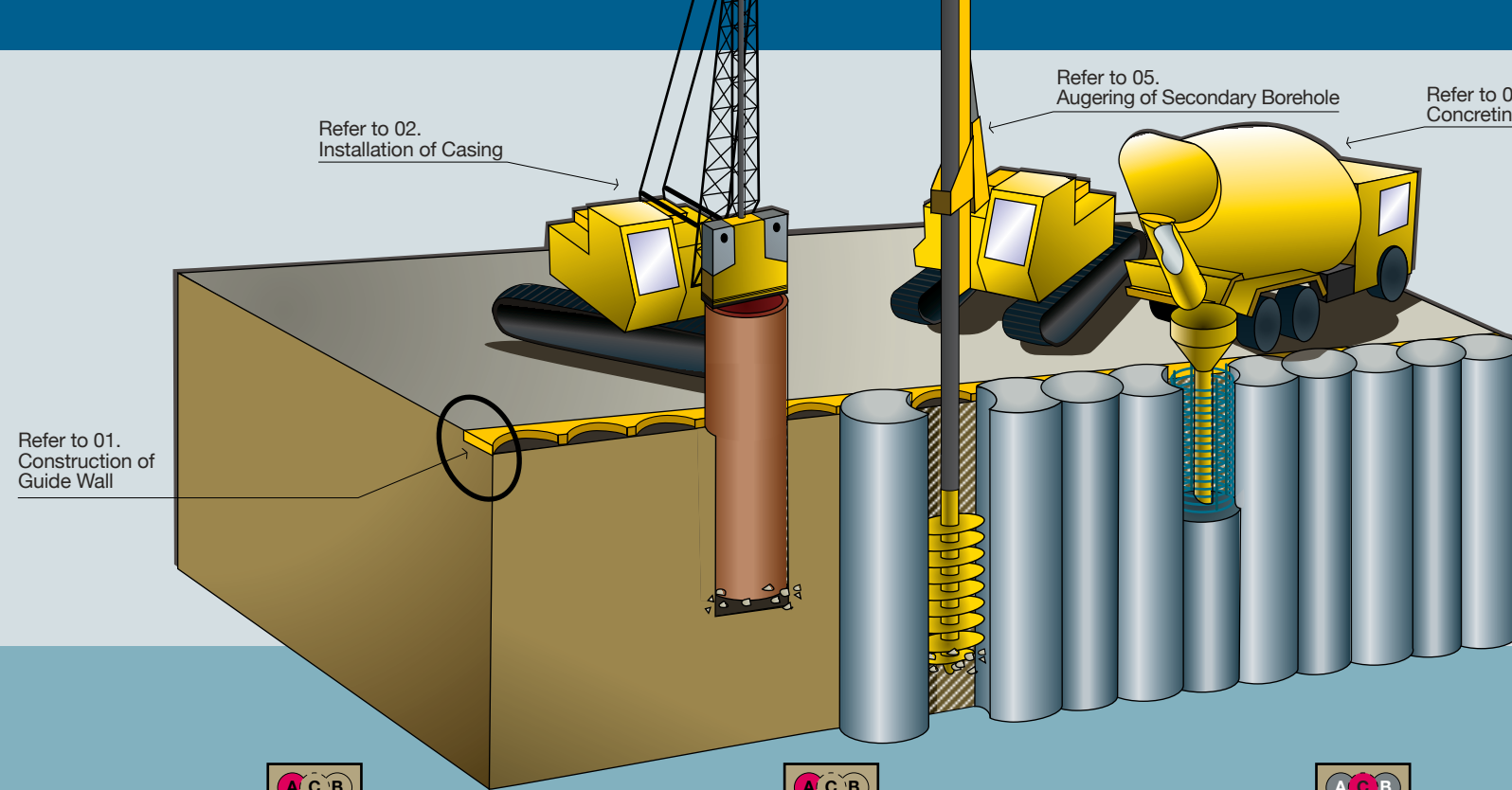


The soil is excavated to the first strut level. The first level strut is installed before the excavation proceeds further.



# CONSTRUCTION OF SECANT PILE WALL

This pictorial guide illustrates the construction sequence of a Secant Pile Wall. This type of retaining wall was used for the construction of Chinatown Station on the North East Line (NEL).



## Safety Measures

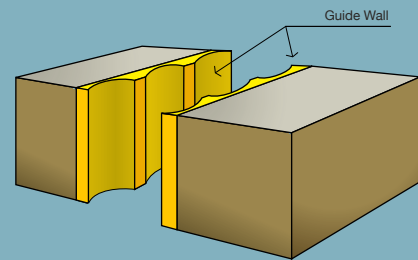
The Land Transport Authority (LTA) accords top priority to safety. Professional Engineers (PE) and Qualified Persons (QP) are engaged to carry out stringent checks on the temporary structures to ensure that they are installed correctly and safely before the excavation can proceed from one level to the 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.

## Inconveniences

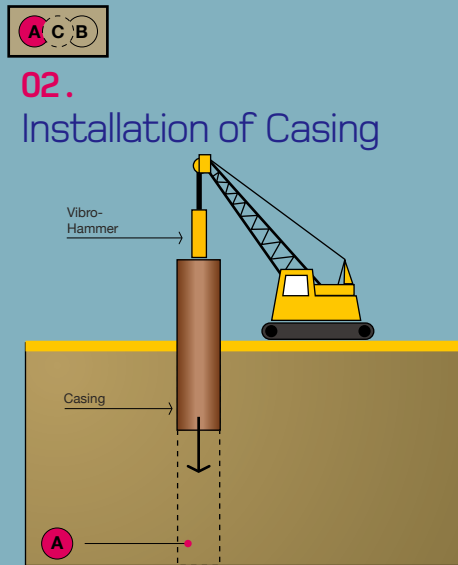
Noise and vibrations are generated when the casing is driven in and extracted from the ground by the vibro-hammer. Noise is also generated during the augering process. We will therefore try our best to schedule the work such that it creates minimal disruption to the public.



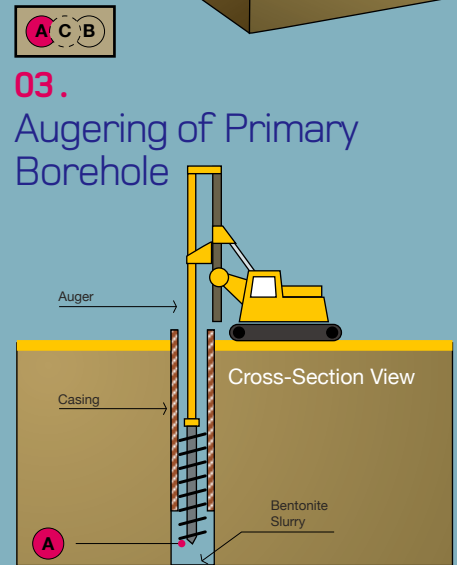
**01.** Construction of Guide Wall



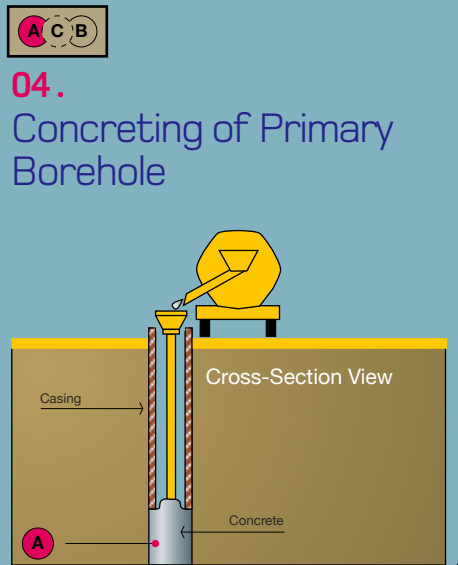
A guide wall is constructed to set out the position of the secant pile wall.



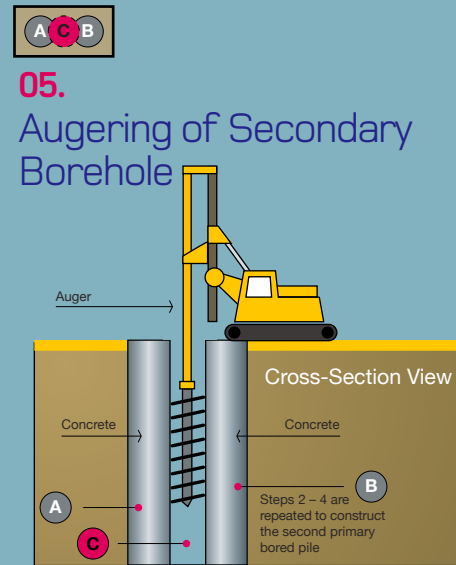
The vibro-hammer drives a casing into the ground, leaving about 1 metre length of the casing protruding from the ground.



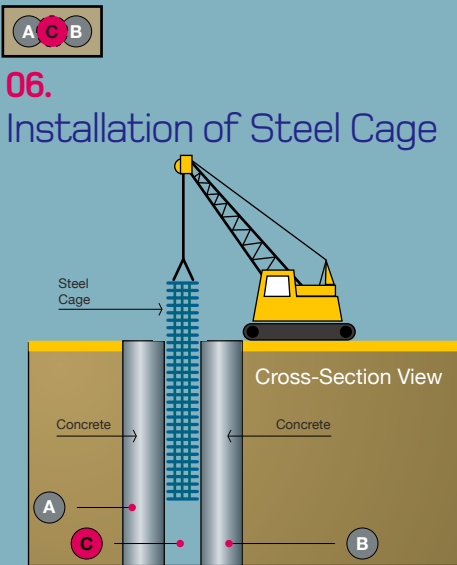
The auger, a drilling tool, cuts and removes the soil within the casing to form a primary borehole. The soil surrounding the borehole is supported by the casing. If the casing is not long enough to reach the required depth in the ground, bentonite slurry is used to support the soil below the casing.



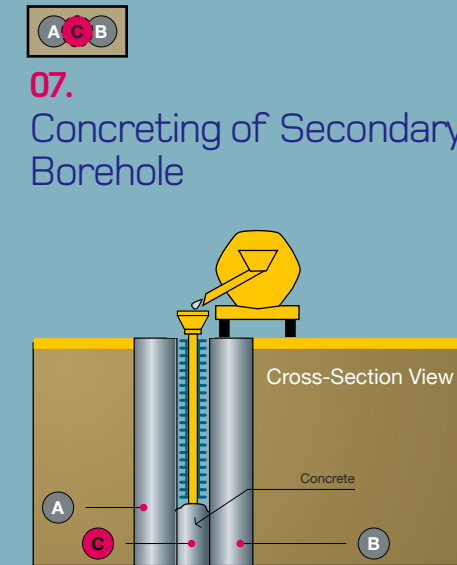
Concrete is poured into the borehole to form the primary bored pile.



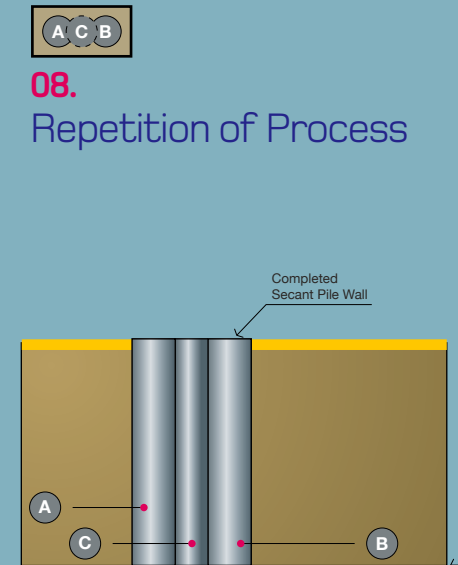
After the casings of the two primary bored piles are extracted by the vibro-hammer, the auger cuts and removes the soil in between the two primary bored piles to form a secondary borehole. The secondary borehole intersects with the adjacent primary bored piles.



The crane lifts up the steel cage and places it within the secondary borehole.



Concrete is poured into the borehole to form the secondary bored pile.



Steps 2 - 7 are repeated till the entire length of the secant pile wall construction is completed.