WAGSTAFF PILING

PROJECT PROFILE

Yarra River Crossing

The challenge of the Yarra Crossing was to build a road tunnel under the Yarra River in a busy area of inner Melbourne Australia.

The vertical and horizontal alignment constraints meant that the tunnel needed to be relatively shallow and only just under the river bed in soft alluvial sediments. The 1200 mm diameter secant piles were installed to form the permanent walls for the majority of the river crossing. The overall scheme involved a two stage crossing of the river, with the first stage involving the most challenging and complex deep foundation works.

CONSTRUCTION SEQUENCE

The general sequence of the first stage was as follows:

- Install a sheet pile cofferdam 75 metres into the river (3000 m^2 of sheets)
- Tie, brace and backfill the cofferdam to create a working platform in the river
- Install reinforced concrete secant guide walls
- Install 212 secant piles, 1200 mm diameter upto 28 metres depth at 1000 mm centres using the hard/hard method
- Excavate down to cut off level upto 10 metres below the river level
- The tunnel roof was built in the dry, within the sheet piled cofferdam
- Tunnel construction occurred under the roof beneath the river

WORKING PLATFORM

Wagstaff Piling was responsible for the deep foundation component of the works. To create a working platform for the drilling rigs a steel sheet pile cofferdam was installed. The wall was braced and tied with walers and stress bars.

The sheet piles were up to 18 metres long. They were installed through temporary steel templates in the river using an ICE 44-50 vibrator and a 6 tonne hydraulic hammer. The cofferdam was backfilled with an engineered fill of crushed basalt.

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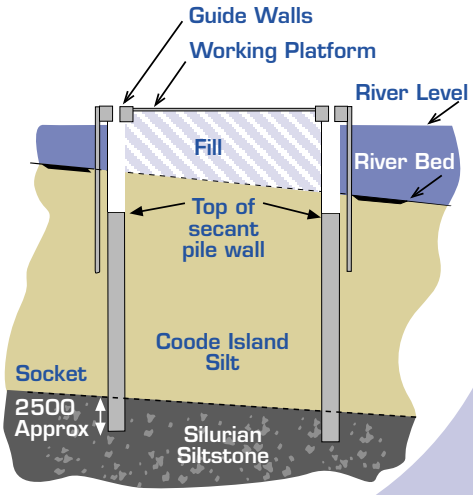
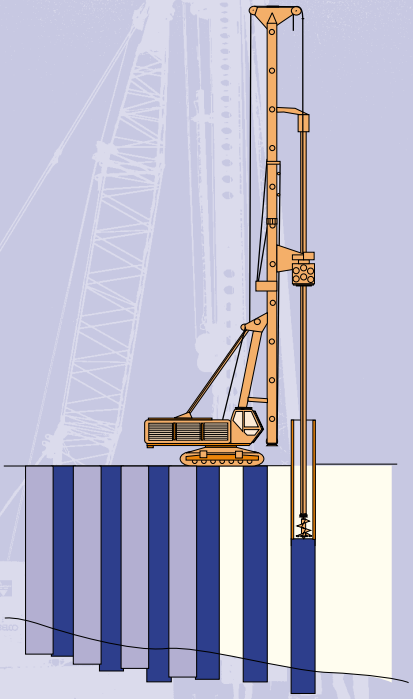
Reinforced concrete guide walls were formed against the sheet piling at the top of the platform.

The outer guide walls were later used as waler beams to support the sheet piling together with steel struts for the tunnel roof construction. The secant piles were installed using double walled segmental casing, in a primary / secondary sequence. The design required high strength 55 MPa concrete and reinforcement in both the primary and secondary piles of 250 kg per cubic metre. In order to accommodate such a heavy reinforcement ratio, 50 mm diameter reinforcing was needed.

The piles were installed around the clock using powerful Casagrande C600 and TRD100 drilling machines equipped with casing drivers with upto 50 tonne metre of torque. All piles were drilled under a head of water to prevent collapse or "blow in" of sandy layers and were then concreted under water using tremie techniques. A Casagrande casing oscillator GCL1500 was used to extract the segmental casings.





GEOTECHNICAL PROFILE

The geotechnical profile was extremely variable and consisted of engineered fill of crushed basalt, very soft to soft silts, interbedded silt and clay layers to Silurian siltstone/sandstone.

The piles were required to be socketed 2500 mm into the bedrock and were required to be fully cut out to 1200 mm diameter even at the base of the sockets. Therefore the temporary casing had to be rotary driven the full depth of the pile.

MAJOR CHALLENGES

Many important lessons of a technical and practical nature were learnt during the course of the construction.

The deep foundation component of the project was carried out in 1997 and the tunnel was opened to traffic in 2000. The challenging aspects of this project included the complex geotechnical profile, the difficult access, the vertical and horizontal alignment constraints and the tight programme.

We believe it was a project that challenged the limits of accepted practice and capability, certainly within Australia, but also anywhere in the world.