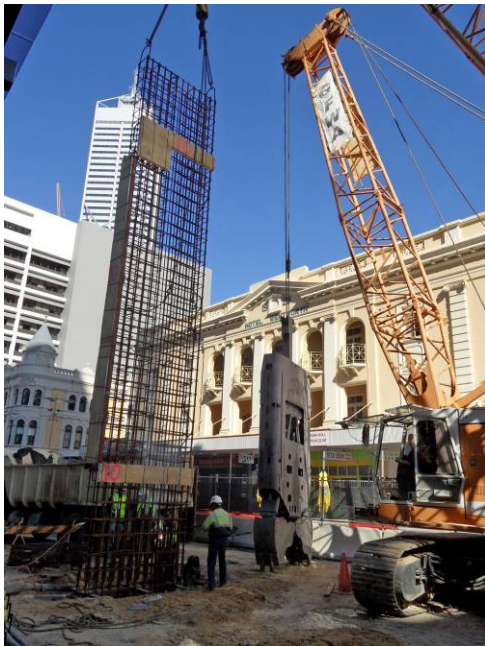


# RAINE SQUARE TUNNEL

## DIAPHRAGM WALLS & JET GROUTING



**Developer: Saracen Properties**  
**Main Contractor: Probuild**

**Specialist Contractor: GFWA**

### THE PROJECT

In recent years, the intersections of Wellington, William and Murray Streets in Perth's CBD have seen a vast amount of construction activity as the state's capital expanded during the resources boom. Since 2005, the area has seen the construction of William St Station, the second underground station on the Perth to Mandurah rail line. In addition to this significant subterranean structure, two very modern high rise developments, One40William and Raine Square, both with deep basements have been constructed on opposite sides of William Street using diaphragm wall technology.

As part of the Raine Square building, a pedestrian tunnel is to be constructed beneath William Street that will link all three of the above structures and accommodate several small retail outlets. The tunnel and retail facilities will be located within a 28 m long by 13 m wide box constructed top-down, with finished floor level approximately 10m below current carriageway level.

Ground conditions in the area consist of approximately 8 m of medium dense sands overlying interbedded sands and clays known locally as the Guilford formation.

### THE ROLE OF GFWA

GFWA's proposed construction method included the execution of diaphragm walls to three sides of the tunnel box and installation of 4 deep barrettes to support the tunnel's roof slab during top down construction. In total 11 diaphragm wall panels, 600 mm wide, were designed and constructed to depths between 18 and 25 m below ground level. The four 2.8 by 1.0 m barrettes extended to depths of 37 m, socketing 1.5m into the underlying bedrock, a medium strength siltstone.

Due to the presence of underground services beneath the adjacent footpath, building facades and other obstructions, the retaining structures in the break through sections between the Raine Square basement and William St Station Box have been constructed using jet grouting technology. In this method cementitious grout at pressures as high as 450 to 500 bars is injected into the ground and mixed with in-situ soil to create grout columns within the ground. Jet grouted gravity block walls were constructed to support the tunnel excavation side walls and overlapping columns were installed to create a grout roof over the excavation at the location of the underground utilities. The abundance of underground services within the jet grouting zone required a unique pattern of columns with numerous diameters.