

1. Queen Street – Part 3 to 4 Connector Design and Construction Statement

1.1. Introduction

This additional methodology should be read in conjunction with the Part 3 construction methodology. It provides details of how an early section of the Part 4 works will be constructed to enable the Part 3 tunnelling works, referred to as the 'Part 3-Part 4' connector.

These works will consist of constructing a 43m length of the Part 4 tunnel and one manhole, which will in turn allow the Part 3 mTBM temporary services to be more easily routed between the Greys Ave Construction Support Area ('CSA') and the Part 3 launch shaft at the intersection of Mayoral Drive and Queen St. This service tunnel route will also cause less disruption to the local pedestrian / roading network.

Construction of this tunnel section and manhole will be used initially as temporary works for the Part 3 construction and will then revert to be used as permanent works for Part 4.

1.2. Shaft Construction for MH P4 MH4 in Greys Ave Carpark

The basic steps required to construct a temporary post and panel shaft is outlined below and in Figures 1, 2 and 3:

- An auger attachment on a 10 – 20t excavator or small piling rig (GEAX EK-40) will be used to drill 300 to 400mm dia holes and steel H beams will be set into each with sand or concrete backfill.
- The shaft will be excavated from the top using an excavator at surface level to a depth of approximately 1m below pipe invert (5.5m deep shaft). Six-wheeler trucks will be used to remove spoil off site. Approx shaft spoil volume will be 100m³ (20 return truck trips).
- Steel road plates or timber lagging will be installed between H beams as the excavation advances.
- The shaft base will be lined out with 500mm of aggregate or blinding concrete to provide a solid and level working platform.
- If dewatering is required, a 2 to 4 inch submersible pump will be used to remove water from excavation. The water will be pumped into clarifying tank for treatment before discharging. The pumps will run continuously while the trench is open and will be powered by a diesel generator or grid power from the CSA.
- Once the shaft has been used for tunnelling (refer Section 1.3 below), a manhole will be constructed, and the shaft reinstated. For manhole construction and shaft reinstatement please refer to the Part 3 methodology.

Plant List for Shaft Works

Activity	Plant List
Drilling and installing steel posts	10 – 20t excavator and / or GEAX EK-40
Excavating shaft	10 – 20t excavator
Spoil removal	6-wheeler or artic trucks
Concrete base	Concrete truck, pump truck

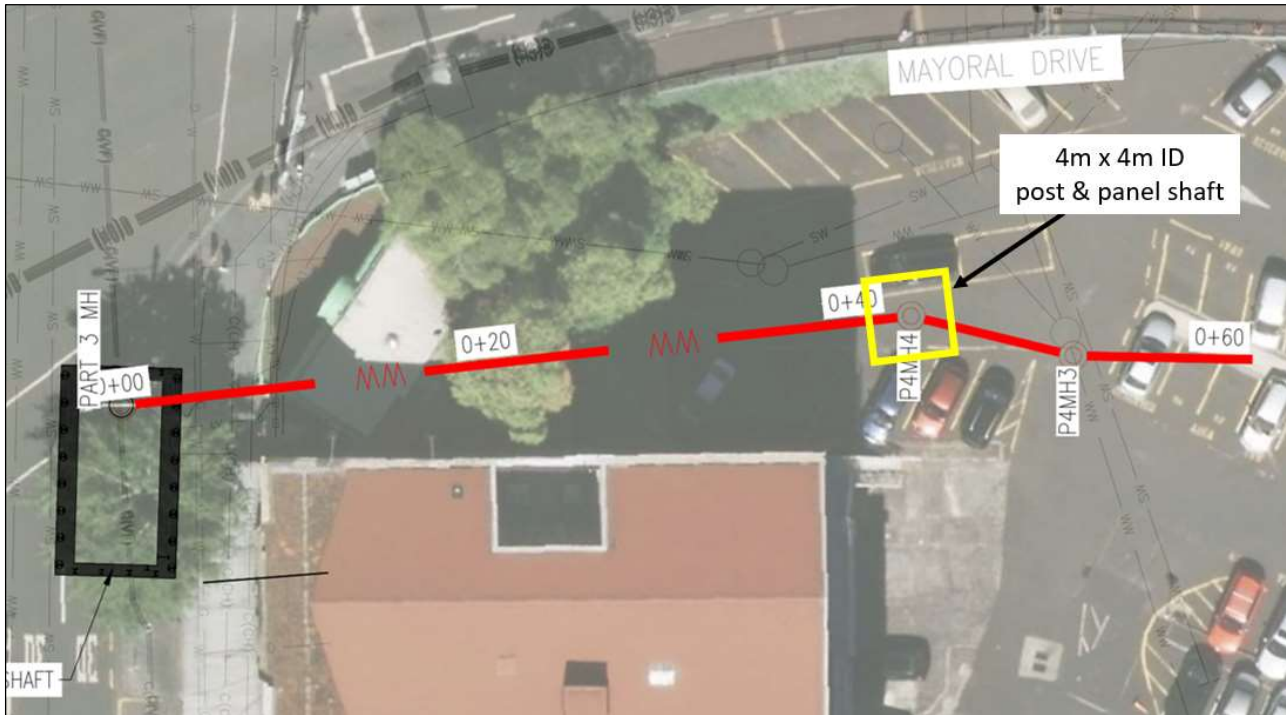


Figure 1 – Temporary shaft location shown on WSP plan drawing

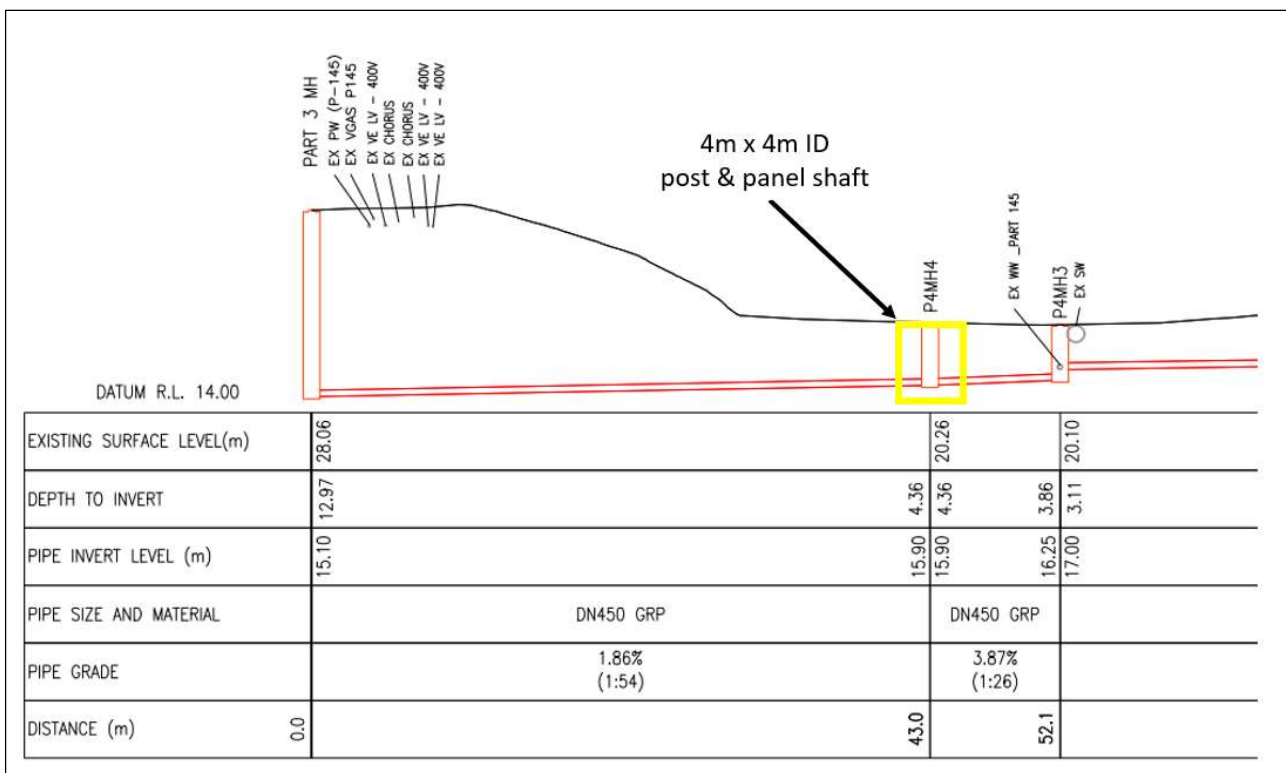


Figure 2 – Temporary shaft location shown on WSP long-section

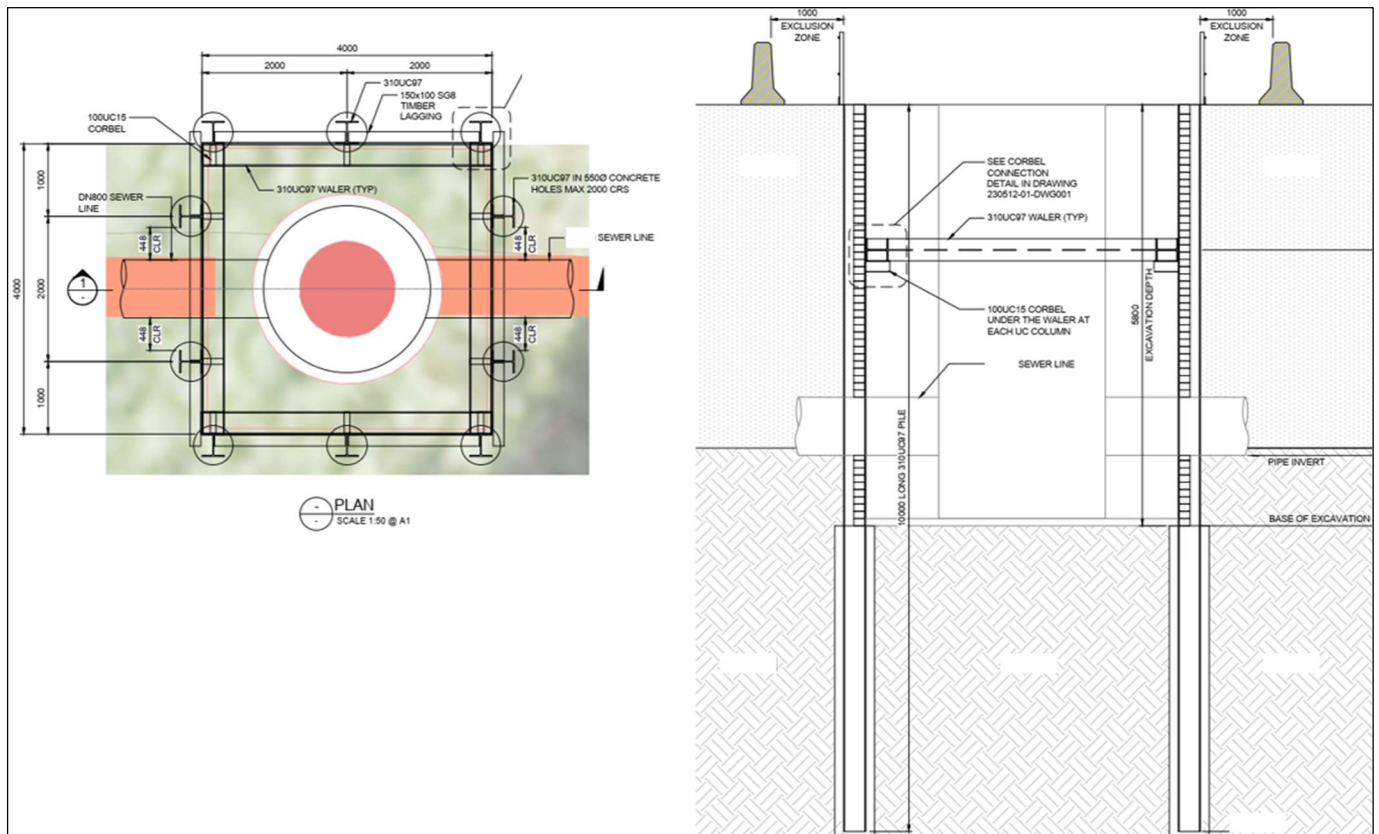


Figure 3 – Temporary shaft typical temporary works details (detail by A. O'Sullivan & Associates)

1.3. Trenchless Pilot Bore Construction

The basic construction steps required to tunnel between P4MH4 shaft and the Part 3 Mayoral Dr / Queen St shaft are outlined below.

Trenchless laser guided pilot bore construction will be used:

- Setup power pack, pump and water tank on surface adjacent to launch pit
- Lift pilot bore rig into pit and survey into position
- Drill pilot hole to reception pit using laser guided steering head
- Install cutting reamer and pull back to launch pit
- An auger or vacuum with sucker truck will be used to remove spoil from drive and it will be disposed offsite using 6 wheelers or sucker trucks. Approx wet tunnel spoil volume will be 20m³ (8 return truck trips).
- Simultaneously jack GRP pipes between pits
- Clean up and flush drill slurry out of pipe by jetting and vacuum truck
- CCTV inspect and low pressure air test on completion

Plant List for Tunnelling Works

Activity	Plant List
Tunnelling – Launch Shaft (Greys Ave)	Crane truck
	Power pack container
	Pipe jack
	Sucker truck or 6 wheeler

	Tool truck
Tunnelling – Reception Shaft (Queen St)	Crane truck
	Power pack container
	Pipe jack
	Tool truck

Figure 4, 5 and 6 below of pilot bore operation (note that exact methods vary between different machines).

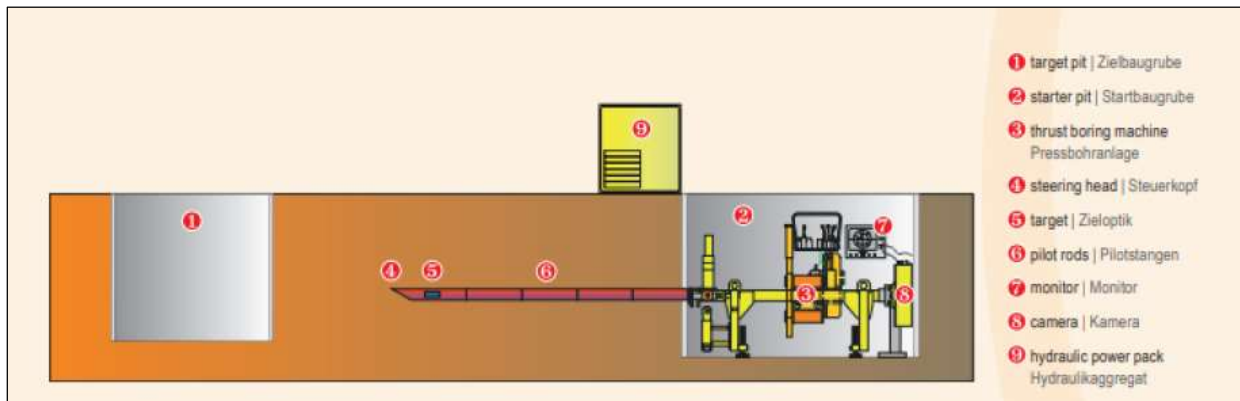


Figure 4 – Typical pilot bore – pilot process

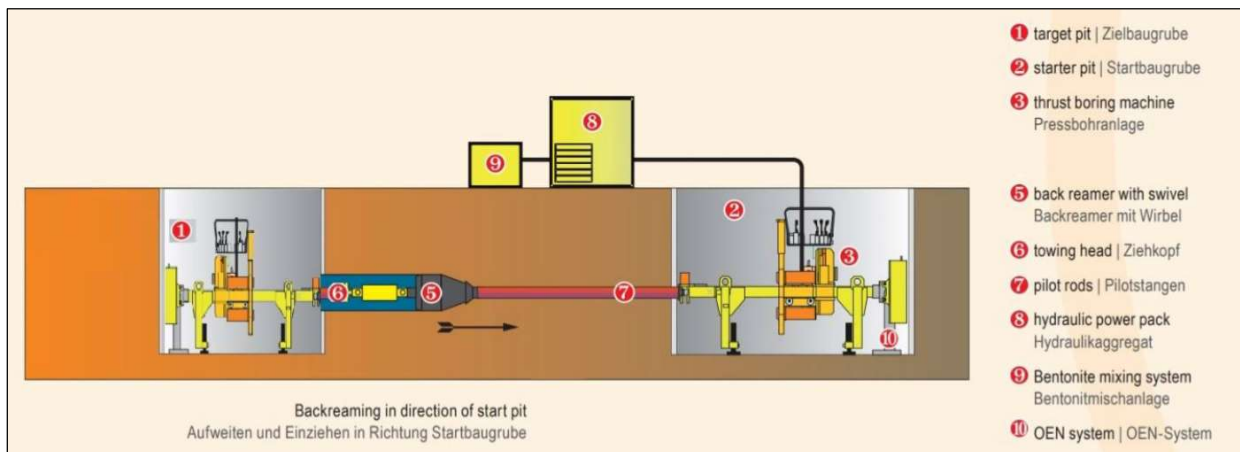


Figure 5 – Typical pilot bore – cutting back

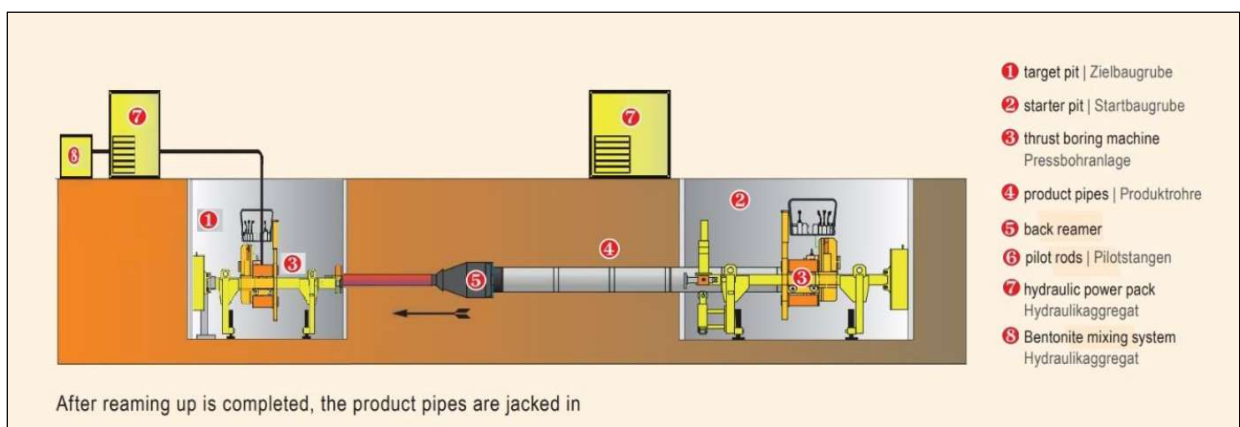


Figure 6 – Typical pilot bore – jacking pipes in

2. Sequence of work & Programme Durations

- Shaft construction – 15 days
- Tunnel construction – 20 days
- Manhole construction – 10 days

3. Revision History

Rev.	Date	Author	Description
0	03/08/2023	Jeremy Gordon	Issued for WSL & WSP review
1	04/08/2023	Jeremy Gordon	Issued for specialist review (WSP Planning Team)
2	07/09/2023	Jeremy Gordon	Final