CONSTRUCTION OF THE TANTANGARA GATESHAFT
SNOWY 2.0 PROJECT

LOCATION: TANTANGARA, SNOWY MOUNTAINS NSW | CLIENT: FUTURE GENERATION JV

KEYWORDS

Construction, Tunnel, Civil, Shaft, Excavation, Drilling, Ground Support, Rock Bolts, Shotcrete

EXECUTIVE SUMMARY

Future Generation Joint Venture (FGJV) are the head contractor for the construction of the EPC Package for SHL on the Snowy 2.0 Project. FGJV awarded the Gateshaft construction to SU Tunnel and Civil Pty Ltd (SUTC)

The project involved the construction of the shaft for the gating structure at the Tantangara reservoir in a short timeframe. Excavation was in soft dacite material on the surface and very hard dacite with quartz at deeper depths requiring blasting, the use of innovative plant solutions minimised the blasting requirements where possible.

These plant innovations provided many advantages including safety benefits, reduced manhours on-site, reduction in program duration and greater certainty of cost.

INTRODUCTION

FGJV awarded the Gateshaft construction to SU Tunnel and Civil Pty Ltd (SUTC) in 2023. This project involved the construction of a Gateshaft which was 51m deep and elliptical in shape measuring 20m and 14m on the large and small diameter respectively. The construction consisted of excavation of 11220m3 of dacite material which ranged from soft free digging material to extremely hard dacite and limestone which required blasting along with mechanical excavation using hydraulic hammers where possible, installation of 675no rockbolts (4.0m and 6m long), hanging mesh (5500m2) and shotcreting (1000m3).

This document describes the plant and equipment innovations and their use in the construction of the Gateshaft at Tantangara on the Snowy 2.0 Project. It will also detail the advantages of using this equipment and the benefits associated with safety, time and cost.

CASE STUDY DETAIL

Working in an underground environment is challenging at the best of times. Excavation of shafts is also challenging typically working at depth with limited access and small machines.

Having experience and understanding this, SUTC developed an approach to reduce the FGJV target program and reduce costs with better plant utilisation.

SUTC provided the plant and equipment necessary to complete works. Using our own fleet of excavators with specialised attachments, drill rig and shotcrete rig, limiting different interfaces as opposed to using various different subcontractors.

TENDER PROGRAM:

As part of the FGJV project requirements, staging of the works were to be undertaken in 1.5-2m benches depending on the geology encountered during excavation.
During sections which required blasting 4m sections were blasted to minimise blast numbers. After blasting 2m sections were removed and the ground support installed before removing the final 2m of material.

Access constraints:
Access into the shaft was through use of scaffold stairs however they took up a large portion of space in the shaft and were eventually replaced with a small 35T crane dedicated to providing man cage access.

Dacite material:
The material to be excavated was determined to be Dacite material with widely varying strength (UCS between 12-200MPa). As the excavation progressed from freely diggable to mechanical hammering excavation and finally drill and blasting requirements. Additional geotechnical testing was undertaken, and results were found to be limestone with UCS >200MPa.

Vibration Limits
Strict vibration limits were imposed by designers for the ground support and the nearby dam wall. This limited the effectiveness of blasting as the powder factor would need to be kept to a minimum.

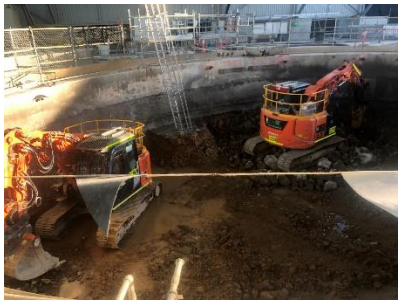
Plant and Equipment:
With these constraints the method selected was to use a specily modified 38T Excavator with ShortBoom that catered for a large upsized 5T rock breaker that would usally require a 50T carrier. This increased production and maximised the depth that could be reached into the harder rock through mechanical methods. Smaller 16T tunnel excavators would also be used to trim the walls while also having the capacity to run the drilling attachments for the bolts. This reduced the amount of blasts required which had design, safety and environemntal concerns attached to the blasting method. Mucking out activites were undertaken using a crane and muck bin.

<u>Drill attachments for Excavator</u>
Drill attachment selected which could drill 4m bolt holes in single pass to improve drilling times and machine mobilisation.

<u>Larger Hammer</u>
A large hammer (suitable for a 50T Exc) was used as an attachment on a 38T ShortBoom Excavator.

Additional Excavator

Two 16T Tunnel excavators with 20T attachment capabilities were in the shaft to increase production.



Shotecrete Rig

Jacon Midjet being self powered negated the requirement for electical installations.

Other Works:

Other works associated with the contract included:

Rockbolting: drilling, rockbolting, tensioning and grouting works were self performed using SUTC labour, HEM drill attachments, grout mixer/pump

Shotcreting: works were undertaken using SU Midjet and operators.

Cranage: was supplied by FGJV as requried to lift plant and equipment, as well as man cage access into shaft

Scaffold: FGJV Supplied a scaffolder to add stair panels as the benches were progressively excavated. However Scaffolding was abandoned due to space requirements

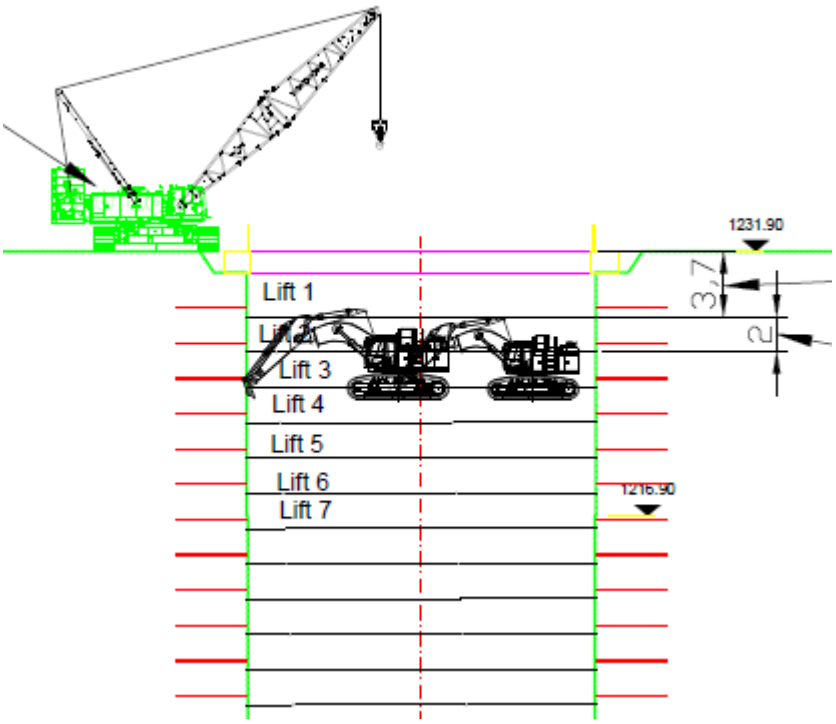


Figure 1: MDS10 Ventilation Shafts

ADVANCE 22	**9.02 days**	**Sun 3/03/24**	**Tue 12/03/24**
Drill and Blast RL1194.70-1192.70	**3.75 days**	**Sun 3/03/24**	**Thu 7/03/24**
Drill (400Lm)	1 day	Sun 3/03/24	Mon 4/03/24
Inclement Weather	1 day	Mon 4/03/24	Tue 5/03/24
Lift Machines Out	0.25 days	Tue 5/03/24	Tue 5/03/24
Load Blasts, Install Blast Mats	1 day	Tue 5/03/24	Wed 6/03/24
Blast	0.25 days	Wed 6/03/24	Wed 6/03/24
Vent Shaft, Gas Check and Inspect for Misfires and Lift Machines In	0.25 days	Wed 6/03/24	Thu 7/03/24
Excavation RL1194.70-1192.70 (2m Lift 440BCM)	**2.67 days**	**Thu 7/03/24**	**Sun 10/03/24**
Dig out blast material	2 days	Thu 7/03/24	Sat 9/03/24
Trim	2 days	Thu 7/03/24	Sat 9/03/24
Spoil Disposal	1 day	Fri 8/03/24	Sat 9/03/24
Lift Machines Out	0.25 days	Sat 9/03/24	Sun 10/03/24
Geo Mapping and survey	0.25 days	Sun 10/03/24	Sun 10/03/24
Ground Support	**1.8 days**	**Sun 10/03/24**	**Tue 12/03/24**
Shotcrete (200mm thick + 100mm overbreak = 200mm total) 33m3	1 day	Sun 10/03/24	Mon 11/03/24
Sub Horizontal Drains	0 days	Mon 11/03/24	Mon 11/03/24
Rock Bolt RL1193.95-1191.95 (27 bolts 108LM)	0.8 days	Mon 11/03/24	Tue 12/03/24

Figure 2: Program sequence of works

Photo 1: Mesh Installation

Photo 2 Mucking bucket used to remove spoil from shaft

Photo 3: Blast Holes drilling with HEM

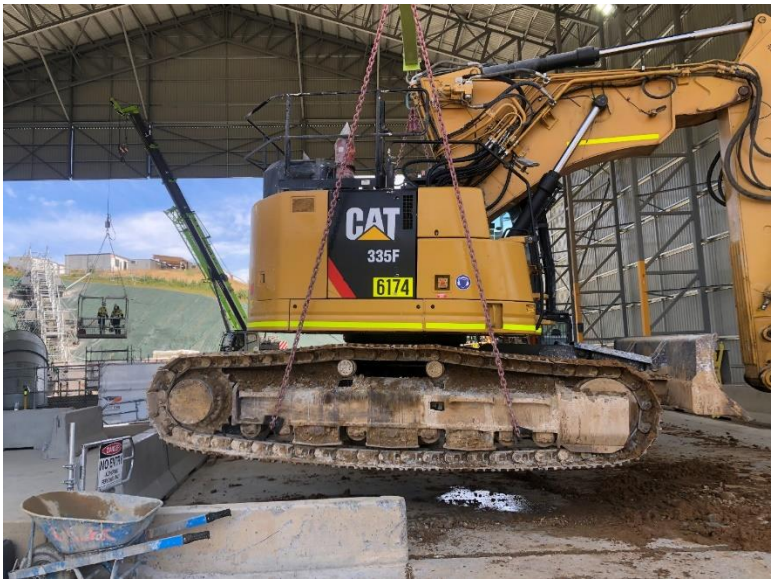


Photo 4: 35T Excavator lifted with slung tracks.

Photo 5 Shotcrete rig setup. Shotcrete supply by Truck until 23m.

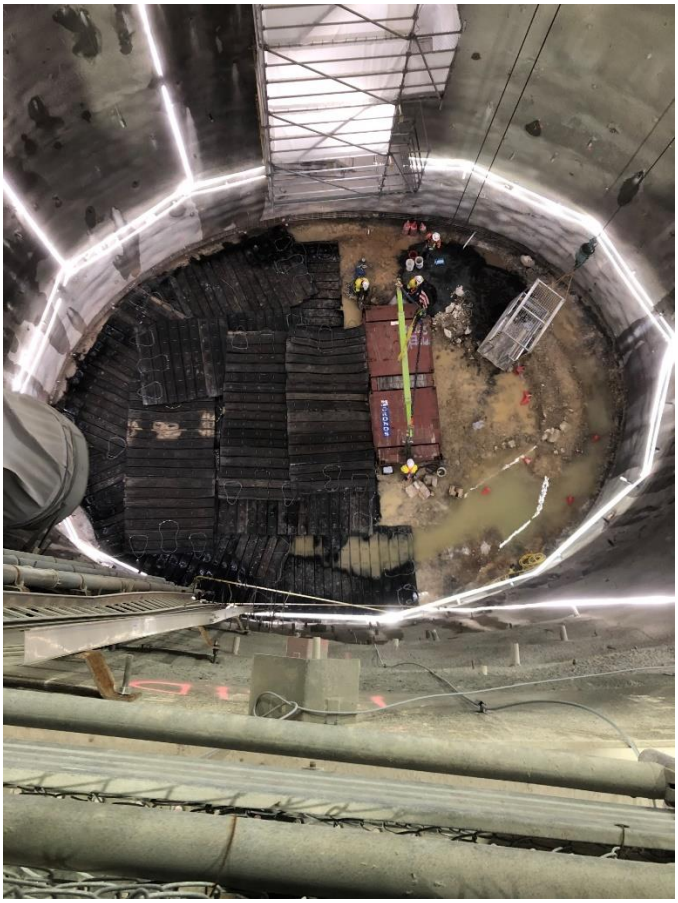


Photo 6: Blast Mat Installation

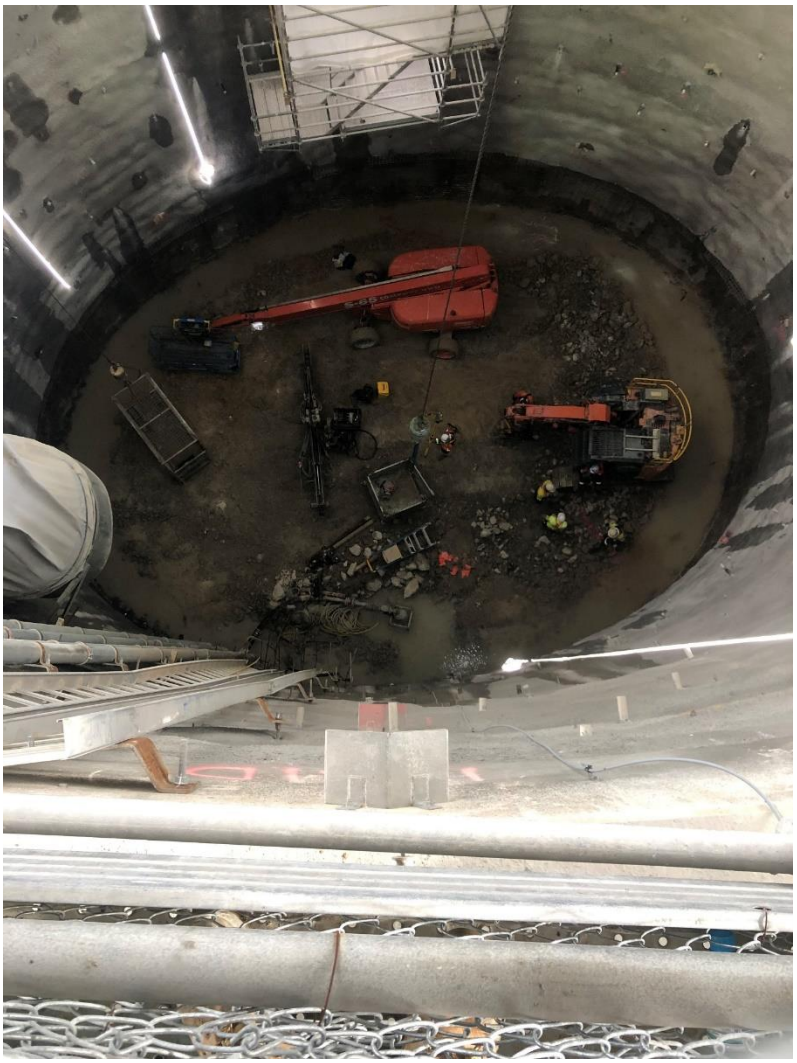


Photo 7: Drilling in Shaft and installing rockbolts

Photo 8: Shotcrete rig spraying with kibble used for supply

Photo 9: T35 lifting in to drill probe holes

Photo 10: Spot bolts and mesh installed on walls.

Photo 11: Muck out from top with excavator in bottom.