

Project:
Jurong Rock Cavern Phase 1

Location:
Singapore

Project completed:
2014

Owner/s:
JTC Corporation

Applicator/Contractor:
Hyundai Engineering &
Construction Co., Ltd

Concrete Producer:
Pan-United Concrete Pte Ltd

Architect/Specifier:
SINTEF-TRITECH-
MULTICONCONSULT Consortium /
GK-JCPL Consortium

Products used & amounts:
MasterGlenium® SKY 8403 –
290,000 litres
MasterRoc® HCA 10 –
120,000 litres
MasterRoc® SA 160 –
1,260,000 litres

Contact:
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Robust Shotcrete reinforcements for Jurong Rock Cavern



Our reference of Jurong Rock Cavern Phase 1 (Singapore). Photo courtesy of JTC Corporation.

The background

Jurong Rock Cavern (JRC), an initiative launched by the Jurong Town Council to increase underground oil storage capacity on Jurong Island in Singapore, was built at subterranean depths beneath the seabed of Banyan Basin.

After completion, the project will feature potential storage capacity of close to 3,000,000m³ (Phase 1 and 2) catering specifically to liquid hydrocarbons like crude oil, condensates, naphtha and diesel oil.

Development works for Phase 1 of JRC, with a storage capacity of about 1,500,000m³, commenced at the end of 2009. Upon completion, it would be filled with about nine million barrels of crude oil and other petrol products, making it the first oil storage cavern in Southeast Asia. Storage of petrochemical products beneath the seabed through the JRC will further enhance safety and security on Jurong Island.

In addition, the underground storage facility will free up land for higher value manufacturing operations. The size and storage capacity of the JRC translates to a saving of approximately 60 hectares of surface land space.

The challenge

The caverns were built using a technique that drills and blasts sedimentary rock, followed by removal of blasted rock and support of newly exposed rock.

However, at a depth of 130m below ground level, it is critical to support the excavated opening and prevent potential collapse of the cavern, with robust and effective shotcrete reinforcements.

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Our solution

Master Builders Solutions partnered with ready-mixed concrete supplier Pan-United Concrete Pte Ltd and contractor Hyundai Engineering & Construction Co.Ltd to develop an optimized mix design incorporating MasterGlenium® SKY 8403, MasterRoc® HCA 10 and an alkali-free accelerator MasterRoc® SA 160 for the proposed shotcrete lining.

MasterGlenium® SKY 8403 was recommended as it could impart superior workability and consistency to the shotcrete mix while MasterRoc® HCA 10 helped extend the time for application. With the introduction of MasterRoc® SA 160, the shotcrete was able to adhere securely to the rock face, achieving the early strength required for the contractor to proceed with their scheduled excavation work.

In addition, a large storage tank with special agitating pumps was installed on site to provide an uninterrupted supply of MasterRoc® SA 160 round the clock. Shotcrete was then sprayed onto the walls with high-pressure hoses. Huge FRP bolts are driven into the walls every meter or so to minimize the chance of collapse.

The customer's benefit

- Concrete workability enhanced by MasterRoc® HCA 10 extending the open time of concrete for completion of shotcreting works, hence reducing wastage and downtime.
- Shotcrete adhered well to the rock surface with less rebound, resulting in less wastage, reduced cost, shortened working time and lower resources input.
- Safer working environment for workers and equipment.
- Good reinforcement results which contributed to the project's efficiency and its completion on schedule.
- MasterRoc® SA 160 creates initial set within minutes and bring the "slept" concrete to provide sufficient support to the cavern.
- MasterGlenium® SKY 8403 enhances the shotcrete's flowability, allowing it to be conveyed safely over a distance from the batching plant to the place of application without compromising its performance.

Projects facts at a glance (max. 800 characters)

- Total storage capacity of JRC is approximately 3,000,000m³ catering to liquid hydrocarbons like crude oil, condensates, naphtha and diesel oil.
- Phase 1 of JRC project consists of 18km of tunnels and 5 caverns housing a total of 9 storage galleries.
- More than 80,000m³ of shotcrete is expected to be used in Phase 1.
- Phase 1 completed in Q2 2014
- Contract value for Phase 1: S\$ 890 million

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Master Builders Solutions is built on the experience gained from more than a century in the construction industry. At the core of the Master Builders Solutions brand is the combined know-how and experience of a global community of MBCC construction experts, who connect with you to solve all of your construction challenges.

Further information is available at:

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