



The Old Convent
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St Helier Surface Water Link & Storage Cavern, Jersey

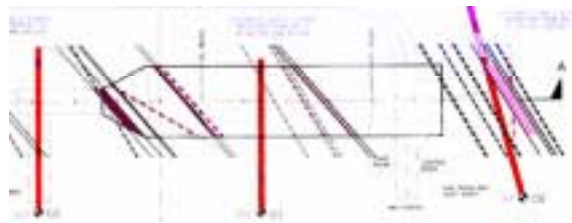
SubTerra Engineering were appointed by the main Contractor Balfour Beatty Civil Engineering to review the site investigation data, rock support requirements, and trial blast data and advise on excavation methods for the two tunnels, the cavern, and associated shafts and adits which formed the scheme.

The cavern is located in the Fort Regent Granite which forms a prominent outcrop in the centre of St Helier. The scheme was required to reduce the risk of flooding in St Helier and prevent the discharge of untreated sewage into the sea during periods of high flow. During high flows, waste water is stored in the 28,000 cubic metre cavern for later treatment and discharge.

Engineering Geology

A comprehensive review of the geology, structure and geotechnical parameters using the site investigation data, published information and field mapping was carried out by SubTerra Engineering post tender.

The regional structure is dominated by an abundance of sub-vertical dykes between 1m and 10m thick, trending ENE-WSW. Most dykes occupy minor faults or fissures and there is evidence of post dyke reactivation. No evidence of major faulting was found at the site, however minor faulting was indicated by zones of no recovery in the three cavern boreholes, one of which was orientated enabling structural data to be correlated with the surface outcrops.



As the surface outcrops were some 80m from the cavern location probabilistic analysis methods were used to project the structure into the cavern and predict the likely zones of influence. This was particularly important as a minor fault was predicted to intersect the corner of the cavern where the end wall was at its maximum height of 25m. Construction mapping data was analysed and fed back into the geological model to

revise the projected locations of planes of weakness on the sidewalls so that the contractor could adjust the excavation sequence and plan support design changes with minimum disruption.

A comprehensive analysis of the site investigation geotechnical data was carried out and compared with the results from contract testing. This analysis demonstrated that the granite was considerably stronger and more abrasive than anticipated. SubTerra Engineering developed a probabilistic model for drill and blast excavation to demonstrate the effect of increased rock strength on the drilling time and overall cycle time. This model enabled the contractor to demonstrate the effect of rock strength on his program duration.



Construction

The cavern was constructed by drill and blast with a central top heading excavated as a continuation of the main access tunnel, followed by two side slashes to the full 20m span. The 70m long cavern was then excavated in a series of 3.5m deep benches to its full height of 15 to 25m. Rock support comprising 5m long resin grouted rock-bolts and fibre reinforced shotcrete was installed in line with excavation on a 1.5m or 1.0m grid depending on the ground conditions. The final lining of the cavern crown was also shotcrete with a reinforced concrete lining for the walls and floor.

Blast vibration was an important aspect of the construction with sensitive properties within 50m of the cavern. Blast vibration monitoring data was analysed and the MIC constantly reviewed to ensure the maximum allowable instantaneous charge to keep the vibrations within specified limits.