



Case Story

CONJET ROBOT 362 ASSISTS IN LISNAVE DRY-DOCK REPAIRS

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About 730m³ of weak, porous concrete has to be removed from about 5600m² of the dock's high vertical walls.

The Portuguese contractor Belbetões, a subsidiary of Portugal's leading civil engineering contractor Teixeira Duarte SA, has chosen one of the latest Swedish Conjet Robot 362 hydrodemolition machines to assist with extensive and major concrete repairs to Lisnave's vast Mitrena reinforced concrete dry dock, near Setubal, about 50km south east of the Portuguese capital Lisbon. The entire concrete surface on the dock walls and in the high level galleries has to be removed to below the steel reinforcement, which has been corroded by salty sea water seeping into the porous concrete.

Belbetões, working for the dock's main repair contractor Teixeira Duarte, is using the high pressure water jetting system with the Conjet Robot 362 to remove the weakened concrete and clean the reinforcement in the walls. This is done in a series of 1.5m high strips round the periphery of the dry-dock. Much of the concrete removal can be reached from the dock floor, but for the high level Belbetões has placed the Robot 362 on a temporary and easily moveable working platform. The Robot 362 is selectively removing the damaged concrete to a depth of about 120mm to 140mm and below the

reinforcement, which is also cleaned of rust. Approximately 730m³ of weak, porous concrete has to be removed from about 5600m² of the dock's high vertical walls. Belbetões is covering about 12.5m²/h, removing an average 1.5m³/h of the weak concrete.

"We didn't want to take any risks.."

"The job for Lisnave is the first we have used hydrodemolition," says Teixeira Duarte engineer Rui Camara. "We didn't want to take any risks and as



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APPLIED WATERJET TECHNOLOGY

Conjet is the leading manufacturer of hydrodemolition equipment we bought a complete Conjet system, including powerpack and Robot 362. It has proved to be a good, reliable machine and is doing a very good job. Hydrodemolition is a very good method as it takes off concrete to a pre-set depth either above or below reinforcement, which is also cleaned and left undamaged. It also provides a rough surface to give a good bond for the new replacement concrete.”

The dock has suffered an extensive chloride attack

The steel reinforcement in Lisnave's 350m long, 50m wide and 11m deep dry-dock has suffered from extensive chloride attack since it was built in 1973. Salt in the sea water has penetrated the concrete through surface cracks, porosity and capillary attraction. The ingress of salt has accelerated corrosion of the interior steel reinforcement, which has expanded as it corroded causing cracking and bursting of the surrounding concrete structure.

concrete which breaks away when this pressure rises above the tensile strength of the concrete.

60 MPa concrete as replacement

After removing the old concrete from the high vertical dock walls and exposing and cleaning the reinforcement Teixeira Duarte follows on to complete the restoration with a new cast in-situ in-fill layer of high strength concrete.



Strips of damaged concrete was removed from the dock walls.

This in-fill 60Mpa strength concrete contains silica powder to reduce porosity to prevent similar chloride corrosion of the rebar re-occurring. Teixeira Duarte started on the restoration to Lisnave's Mitrena dry-dock and other associated repairs just before Christmas 1998 and is one scheduled to complete the entire PTE500 million contract by August 1999.

The Conjet System

The Conjet System consists, in this case, of a Robot 362 and a Power Pack 345. The Power pack houses the diesel driven high pressure pump and water filter assembly. The Robot controls the movement of the waterjet over the surface in a manner that accomplish the specific task. The Power pack is capable of delivering 187 litres/minute at 1 000 bar.

The extension arm, fitted to the robot, allowed the robot to reach 4,5 metres vertically



Contractor Belbetões is using its Conjet Robot 362 to selectively remove damaged concrete to a depth of 120mm to 140mm and below the

Belbetões remotely operated, computer controlled Conjet Robot 362 relies on a jet of high pressure water, exiting from a special nozzle at supersonic speed and forcing its way into the concrete's porous surface. The water creates an hydraulic over pressure in the

- The following Conjet equipment was used during the repair:**
- 1x Conjet Robot 362, fitted with extension arm
 - 1x Conjet Power pack 345



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