



Panama Canal uses Conjet to assist in major lock repairs



CONJET AB
P.O. Box 507
SE-136 25 HANINGE
SWEDEN

PHONE:
+46 (0)8 55 65 22 40
FAX:
+46 (0)8 55 65 22 60
E-MAIL:
conjet@conjet.com
WEBSITE:
www.conjet.com

Conjet hydrodemolition equipment is playing a key role in removing concrete and assisting with the replacement of the Panama Canal's special tow track rail system. The track is used by powerful electric rack and pinion drive locomotives to assist in towing and guiding ships through the canal's three sets of twin lane locks. The "Autoridad Del Canal De Panama" (ACP), Panama Canal Authority, which has the exclusive charge of the canal's administration, management, operation and maintenance, is responsible for removing the 16,188 m of worn out tow track, which runs along the tops of the lock walls, and replacing with a new stronger system to cater for the increase in canal traffic and high loadings from the locomotives.

Panama Canal Authority (ACP) using Conjet Jetframe 122

The ACP Locks Track & Structural Maintenance Unit is supervising the tow track modernisation program. The ACP is using a pair of Conjet Jetframe 122 hydrodemolition machines to accurately cut out the old concrete between the waterside rail and edge of the locks and between the twin rail's supporting steel crossties, prior to taking out sections of the worn out track.

The Panama Canal - A heavily trafficked shipping route of monumental proportions

The 80km long canal, joining the Atlantic and Pacific Oceans, was cut through the narrowest part of the isthmus joining North and South America between 1904 and 1914. It uses a system of three sets of dual lane locks to raise ships 26m from the level of the Pacific or the Atlantic to the level of Gatun Lake to navigate the channel through the Continental Divide. The Gatun lock, on the Atlantic side, has three separate chambers each 33.5m wide by 305m long, while the Pedro Miguel and Miraflores locks on the Pacific side, have respectively one and two chambers of the same size.

The 197,000m³ of fresh water, used to raise and lower vessels through each lock, flows by gravity from Gatun Lake through a system of tunnels and culverts under the lock chambers and



eventually into the sea. Up to eight 580hp(432kW) locomotives, each with a towing capacity of 311kN at 4.8km/h, assists in guiding and towing each vessel with steel wire ropes through a set of lock chambers. The canal has approximately 9,000 employees and operates round the clock, 365 days a year, handling between 13,000 and 14,000 vessels annually.

The unique tow track system has twin rails, which together with the central raised rack to engage with the locomotives' pinion drives, are supported on steel crossties and embedded in concrete. The original track was initially designed for loads of 41t on the waterside rail, which, being nearest the edge of the locks, has to accommodate the highest forces. But increase in canal traffic and weight of the ships, since it was opened in 1914, has need-

ed heavier and more powerful locomotives, which has increased the load on the waterside rail to 85t in 1965 and to 92t in 1996.

Previous modifications

Under a continual maintenance program the track system was modified three times during the 1960s, 1980s and again in the 1990s. This included complementing the original track's steel crossties with additional short intermediate supports under the waterside rail, replacing some of the original crossties, replacing some and improving the specification of the central rack, changing the rail section from 90lb to 105lb and replacing the fish plated bolted rail connections with thermally welded joints. But the increase in the forces and loadings has caused extensive cracking of the surrounding concrete along the entire tow track system. This has led the ACP into a complete redesign of the worn out tow track and an 8 year major reconstruction project costing an estimated US\$121M, which is part of a current US\$1 billion capital investment and modernization program to cater for a 20% increase in canal traffic.

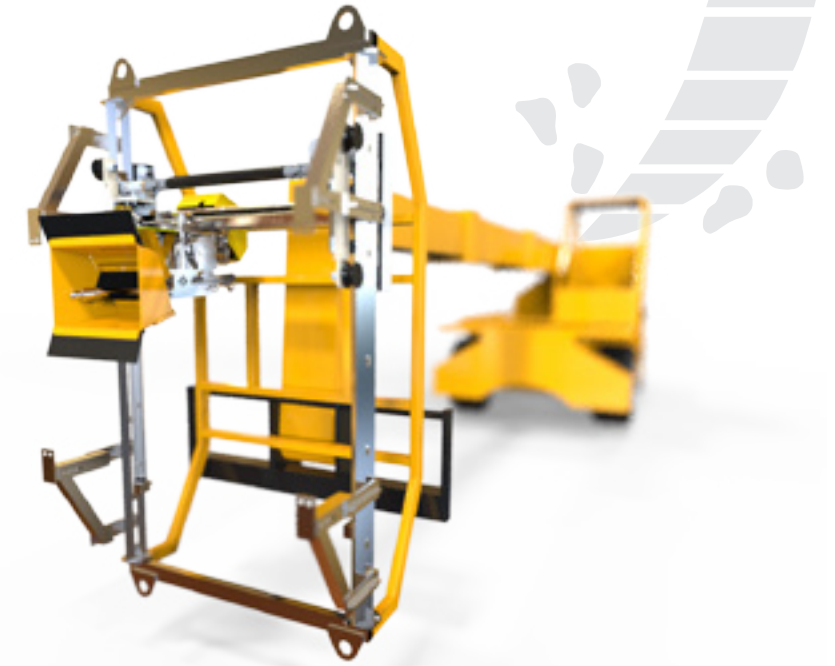
Time is of the essence

The loss of revenue from the reduction of canal traffic, during repairs, has dictated the reconstruction sequence and speed of construction, with the ACP focusing on reducing the partial closures of the locks to a minimum. Some of the very largest vessels have to pay toll fees of up US\$200,000 to navigate the canal.

"Everything is geared to reducing disruption of the canal traffic for our customers," says ACP Locks Track & Structural Maintenance Unit manager Wilfredo Yau. "When we first started in 1999 we took about one and three quarter days to replace a 30m section of track, during a 10 day to 12 day outage or occupation, but we have improved our technique and system and with the help of the Conjet equipment we can now replace the same amount of track in about half a day."

Working with the Jetframe

The Conjet Jetframe, which supports the shrouded oscillating jetting nozzle and travelling feedbeam assembly, is controlled by a remotely operated Conjet CCU197 computer control unit. High-pressure water is supplied to the



nozzle through a flexible hose from a Conjet 345-400 power pack housing a 400kW Caterpillar engine driving a high-pressure pump providing 195litres/min at a pressure of 1100bar. The Jetframe equipment cuts out a 300mm wide by 350mm deep trench alongside the edge of the waterside rail and also blasts away concrete between the twin track's supporting steel crossties.

"We have two sets of Conjet Jetframe hydrodemolition equipment, which have proved to be very good," adds Wilfredo Yau. "We elected Conjet from open bids and bought the first unit in 1999 and a second one last year. They are proving ideal for the work we are using them on selectively removing concrete from the tow track, lock gate sills and the culverts, which channel the fresh water from the lake in and out of the individual lock chambers. I expect we will remove about 800m³ of concrete by hydrodemolition. Conjet has also supported us with excellent service and technical backup and provided operator and service training at their headquarters in Sweden and on site here on the canal."

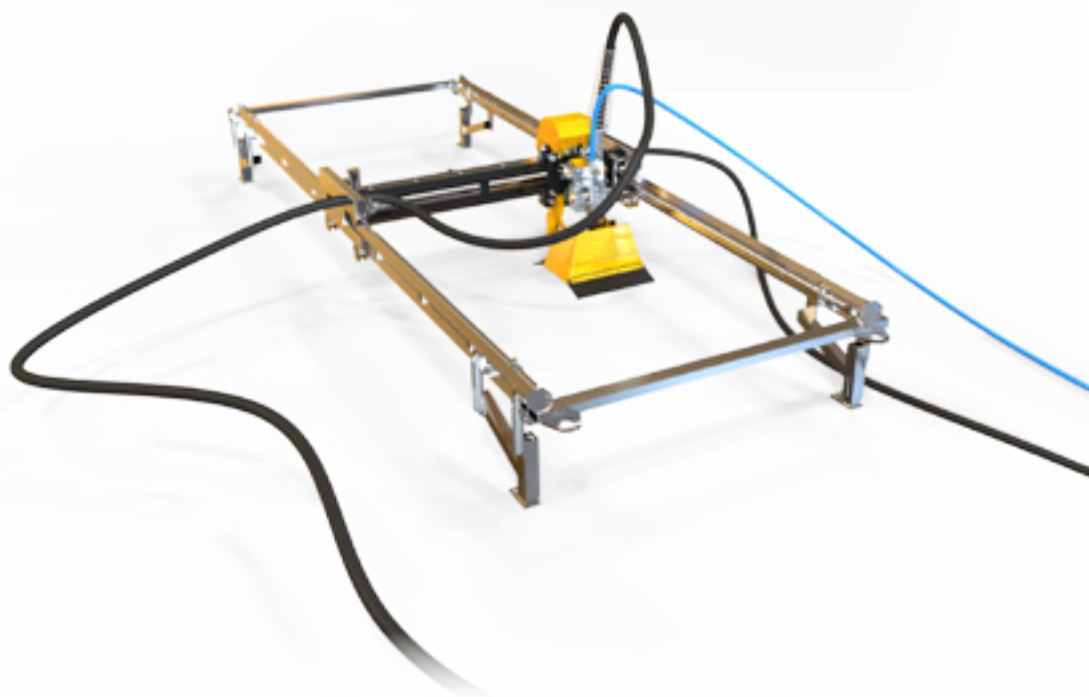
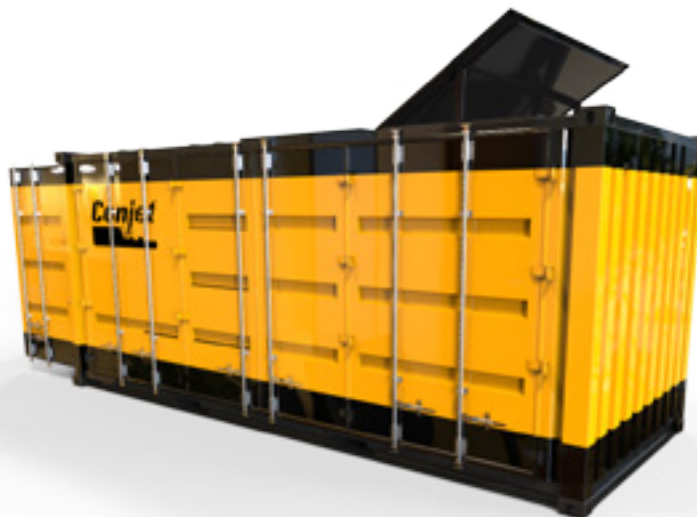
Keeping a tight schedule and mechanical tolerances

The tow track repair and maintenance work is always programmed during lane

closures, when the lock's mitre gates, culverts and valves also receive maintenance and repair.

The ACP spend several weeks using the Conjet and other demolition equipment in advance preparation to replace between 300m and 750m of track, depending on location, during an approximate 11 day occupation of one of the lock's two lanes. The process is geared for a combination of speed, quality and safety with the ACP prefabricating 9m long sections of track. These pre-assembled sections can then be quickly positioned and concreted in place after final cutting and lifting out approximate 15t blocks of concrete about 3m wide and 0.5m deep complete with the old track sections. Unusually the ACP civil engineering team has, for them, to work to a very tight mechanical tolerance of ±2mm in 450m of track.

ACP's two sets of Conjet Jetframe 122 hydrodemolition equipment have proved ideal for removing the concrete from the tow track and are making a major contribution towards the ACP completing the extensive track rehabilitation project on schedule next year.



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PHONE:
+46 (0)8 55 65 22 40

FAX:
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E-MAIL:
conjet@conjet.com

WEBSITE:
www.conjet.com

Equipment used

2 Conjet Powerpack 345-400kW

2 Conjet Jetframe 122

CE, EMC certified

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