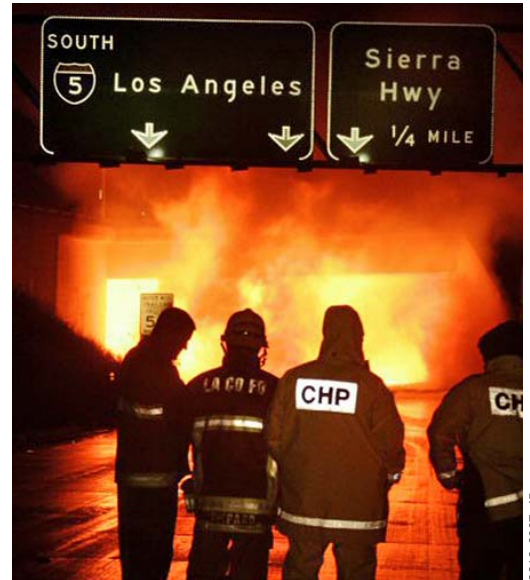




Conjet to Rescue in California Tunnel Fire Repairs

The fast response from the US specialist hydrodemolition contractor and rental company Hydro Pressure Cleaning Inc (HPC) contributed to the rapid repairs to a strategic road tunnel in the Newhall Pass on the major I-5 Interstate near Santa Clarita, California about 30 miles (48km) north west of Los Angeles. The California Department of Transportation instigated the approximate \$19M restoration, which included the removal of the entire concrete skin from both walls of the fire damaged tunnel by HPC with its two Conjet hydrodemolition Robots, followed by reskinning with a new sprayed concrete lining.

The approximate 600ft (183m) long, two lane rectangular box shaped reinforced concrete tunnel, known locally as the truck by pass tunnel, takes south bound traffic only. It runs under a portion of the south bound sections of the highway and is near the main intersection of the I-5 Golden State Freeway, and Antelope Valley Freeway. A massive fire erupted in the 40ft (12.2m) wide tunnel after a collision of several trucks and cars. Wind whipped up the flames from one end to the other, and the searing heat from the raging inferno, with temperatures up to 1,400°C (2550°F), caused concrete to split. The accident involved around 31 vehicles and entry to the tunnel was impossible as the fire raged. It was allowed to burn itself out before



Massive fire in the Tunnel on the I-5 golden State Freeway in California

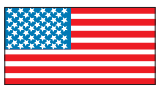
emergency services were provided, and engineers from Caltrans could start inspecting the damage.

HPC saw the accident on the local TV news and immediately contacted Caltrans and its initial emergency repair and clean up contractor Chumo Construction Inc. HPC, based in Camarillo, about 50 miles (80km) from the tunnel, explained the benefits of using the hydrodemolition technique of high pressure water jetting to selectively remove only damaged or unsound concrete. "We went to site a week after the accident and removal of the debris from the tunnel and had a meeting and were given the go ahead to start with concrete removal tests with our Conjet 322 hydrodemolition robot," says HPC general manager Paul Phelps. "We initially used different water pressures of 20,000, 15,000 and 12,000psi (1,360, 1,020 and 816bar) with the Conjet 322 Robot and our 500hp (373kW) high pressure pump and removed concrete in 2ft (610mm) wide 5ft (1524mm) high patches every 50ft (15.24m) from the walls. This enabled Caltrans engineers to see the difference in concrete condition, and together with core samples, allowed them to assess and verify the damage and develop the scope of work for the overall repair. We also did a test at 19,000psi (1,290bar) using a



Damage inspections

Case Stories



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Conjet Robot 363 MPA removing concrete from the Tunnel wall

nozzle with a narrow fan jet pattern instead of the normal straight jetting nozzle. This was great, especially in those areas where they just wanted to roughen up the existing concrete surface to get a bond for the new overlay.”

HPC also performed some tests on the tunnel ceiling using only hydrodemolition hand lances. From the results Caltrans decided just to clean the soot off the tunnel soffit, except in one severely damaged area over the main fire, which had to be completely removed by a breaker mounted on an excavator and replaced with a new precast concrete beam section.

“I have used hand lances before but this was my first experience with hydrodemolition robots which have worked well for the situation as we didn’t know exactly how much concrete was damaged and needed to be removed,” says Caltrans senior bridge engineer Henry Kirzhner. “As we could initially use different pressures we were able to determine how deep we should go just to remove the damaged concrete and quickly evaluate the extent of the damage which was not consistent. This then allowed us to determine the right pressure to use throughout the entire tunnel and just selectively remove the damaged and weak concrete. The biggest advantage for us was that it just took away the bad concrete and didn’t damage any of the rebar or the good concrete left behind. It also created a very rough surface for a better bond for the new sprayed concrete overlay. Any conventional removal methods, like jackhammers, could always damage reinforcement and it was vitally important for us to do removal without any damage to the portion of the structure remaining in place. I would definitely recommend using hydrodemolition robots again on other projects like bridge deck rehabilitation. Our goal on the tunnel walls, which vary in height from about 16ft to 24ft, (4.88m to 7.3m) was to cut out damaged concrete to expose to the face side of the reinforcement, but in some areas we selectively removed concrete from behind the rebar as a means of inspection. This was done to evaluate the strength of the concrete and to take samples of the rebar to

check if it had been damaged by the intense heat from the fire.”

From the initial tests Caltrans opted to remove concrete from the entire area of both walls, equivalent to about 30,180ft² (2,803m²) on the walls of the tunnel and an additional 2,600ft² (242m²) on the wing walls. In the undamaged areas removal depth varied from about 0.5in to 1.25in (25mm to 31.25mm) and in the damaged areas the removal was from 2in to 4in. (50mm to 100mm) and in some isolated spots it was up to a maximum of 6in (150mm). “The day after testing we started on the main removal, which overlapped and extended from the initial emergency repair cleanup contract under Chumo Construction with the main repair contract under prime contractor Security Paving,” adds Paul Phelps. “To complement our Conjet 322 for the project we brought in a larger Conjet 363 Robot and 500hp (373kW) Hammelmann HDP-353 pump capable of 32 gpm



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Conjet Robot 363 MPA and Conjet Robot 322 on a scaffold in the background removing concrete from the tunnel wall.

(121litres/min) at 21,000psi (1,428bar) from Conjet’s US agent National Hydro, based in Fowlerville, Michigan. Using the fan jet nozzle on the Conjet 363 Robot we were able to prepare 730ft²/h, (68m²/h) equivalent to concrete removal of 1.7yd³/hphour (1.3m³/hphour). In the initial emergency repair contract with Chumo we removed about 6,400ft² (595m²). But in our contract with Security Paving we had about 26,400ft² (2,452m²) of surface preparation and concrete removal on the tunnel walls, which we did amazingly fast. Working two 12 hour shifts we were finished in just four days and there is no way we could have done that in that time without the Conjet 322 and 363 Robots.”

Security Paving’s specialist subcontractor Superior Gunite followed on behind drilling and dowelling and placing wire mesh in some areas prior to reskinning the walls with a sprayed concrete overlay and final hand float finish. Caltrans allowed 33 days for the repair, but the tunnel reopened for traffic more than two weeks ahead of schedule.

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