

Hydrodemolition vs Jackhammers - Head to Head in Toronto

Although founded in 1999 as a concrete restoration specialist in underground car parking garages – using conventional jackhammer techniques – Toronto-based CanMar Contracting Ltd. is today taking on its competitors “head to head” utilizing Aquajet hydrodemolition robots.

In a current garage contract, CanMar is meeting its target of treating up to 90 m²/d of concrete slab using one of its three Aquajet robots.

This can be directly compared with a contractor using jackhammers on an identical project in the adjacent apartment block.

According to CanMar’s Hydrodemolition manager, David Porciello, a single jackhammer can achieve, at best, up to 4,6 m²/d. “This means at least 20 operators are required to match the production of the Hydrodemolition robot,” he says. “Not only are jackhammers labor intensive, hydrodemolition provides a cleaner finish and does not damage the rebar.”

Both adjacent projects are located in Toronto’s Davisville Village, each featuring identical 2787 m² basement levels.

Built some 40 years ago, the slabs underwent patchwork repairs some years ago as remedial treatment against deterioration caused by deicing chemicals on the roads during Canada’s harsh winters.

Starting its contract in May this year, and to ensure that the garage could remain operational during the concrete removal, CanMar divided the floors into two phases; each covering half of the two levels.

The contract also calls for the removal of the 25 mm thick layer of protective asphaltic mastic so as to identify the deteriorated areas.

CanMar is then responsible for the selective removal and replacement of concrete over at least 65% of each floor down to a depth of 10 cm in the 25 cm thick slab.

The key element of hydrodemolition is to pressurise and widen existing pores and micro cracks in the weakened concrete structure using high pressure water penetration.

Material is easily removed as the build up pressure exceeds the tensile strength of the damaged or weakened concrete.

In addition to the water pressure, the volume of water is also a contributing factor to the systems efficiency. The rate

of removal, for example, is dependent on the amount of water directed towards the concrete surface in order to rapidly and continuously pressurise the areas being treated.

This combination of water pressure and flow together with the controlled kinetic and geometric movements of the robotic equipment creates the necessary ‘effect’ criteria for the hydrodemolition process; leaving sound concrete undamaged.

Research into water jet erosion has shown that the concrete resistance against water jet removal is dependent on concrete strength, method of finishing the

concrete, aggregate size and the content of steel reinforcement bars.

The lower the concrete strength, the larger the material removal rate that can be achieved due to larger penetration and pressurisation of the material. Additionally, the higher the cement matrix strength the higher the concrete resistance.

This is due to the increased difference in the compressive strength of the construction and the penetration effect of the water jets pressure, water volume and jet movement.

It is proven that hydrodemolition produces an excellent clean surface quality. The pull-off strength, which is an important indicator of the surface structure conditions, exceeds the required 1.5 MPa (N/mm²) value with a 95% reliability.

If the surface is prepared with water jets, the interfaced zone between the remaining concrete and the new cast overlay very seldom constitutes a plane of weakness. This compares favorably with a surface prepared with hand-held tools which results in a higher probability on interface failures at pull-off testing.

With water jet hydrodemolition, once programmed, the jet moves rapidly and continuously over the selected area for removal. There is no percussive effect on the surface with the water jet penetrating the deteriorated concrete. Extensive

investigations have proved that there is no modification of the concrete microstructure during the water jet treatment. Similarly the concrete pore structure is not affected by the water jet.

The surface geometry achieved after hydrodemolition depends on the type and



size of the aggregate. With limestone, for example, the surface is comparatively smooth and characterised by a high degree of fractured aggregate gains.

In contrast, quartzite containing concrete exhibits an uneven surface and a high amount of undamaged aggregates.

Compared with other removal methods, hydrodemolition generates a very large contact surface between the concrete and applied coating system.

With more than 10 years hydrodemolition experience in both Canada and the U.S. using a variety of U.S. and European marquee robots, CanMar operator Tim Best, considers the Aquajet aquacutter robot to be the clear market leader. “Its highly manoeuvrable and a very compact machine which is able to cut closer to the edges.”

Over the past 24 months CanMar has successfully completed more than 55 000 m² garage slab restoration using its Aquajet Hydrodemolition robots; achieving approximately 14 000 m² per robot per year – highlighting the success of its new found direction.

Issued on behalf of Aquajet Systems AB by Joem Promotions