



Concrete Surface Preparation Using Hydrodemolition

By Bob Nittinger

Over the last several years, concrete restoration projects have become very demanding. Whether the repair is to a parking structure, bridge deck, dam, spillway, pier, industrial facility or a waste-water treatment plant, owners expect rapid and safe completion of a project while increasing the quality of the finished product. Engineers are forced to explore new innovations and technologies to accomplish the aggressive goals set forth by owners. One technology that is increasingly being deployed on concrete restoration projects is hydrodemolition.

Hydrodemolition is the method of concrete removal using high-pressure water. This technology was first developed in Europe in the 1970s and has since become a widely accepted method for concrete repair throughout Europe and North America. A typical hydrodemolition unit consists of one or more high pressure pumps transferring water via high pressure hoses to a programmable, mechanized cutting robot.

Hydrodemolition has appealing advantages to engineers over conventional demolition methods. These advantages include the speed at which the concrete is removed, since one hydrodemolition unit can replace up to twenty concrete breakers. Hydrodemolition does not damage the reinforcing steel, induce micro-fractures, or cause structural vibration during the removal procedure.

Another very important aspect of hydrodemolition is that this method of concrete removal does not cause silica dust, which makes it ultimately much safer than removing concrete with concrete breakers. OSHA

has become increasingly concerned about employee exposure to silica dust when performing concrete removal by conventional demolition methods. A study on a project in 1996 showed that employees were exposed to 400 times the OSHA-allowed limit of silica dust during concrete removal with conventional concrete breakers. Once the contractor switched to hydrodemolition on the project, there was no silica dust detected.

One of the most important aspects of a successful concrete repair project is the quality of the surface preparation. Hydrodemolition has proven to be a valuable tool in providing a rough, irregular profile that is free of micro-fractures. This surface typically leads to bond strengths that are greater than concrete surfaces prepared with breakers.

During hydrodemolition concrete removal, the cement matrix is removed from the aggregate, leaving bulk debris of sand and aggregate to be collected and properly disposed of. Traditional cleanup methods on hydrodemolition projects have consisted of a combination of different tools that could include any or all of the following: firehoses, pressure washers, compressed air, sweepers, skid steer loaders, vacuum trucks, and manual labor. Once the bulk debris has been removed from the hydrodemolished surface, some detail chipping will usually be necessary. The detail chipping is needed to remove any concrete remaining directly below the rebar, and since the cutting robot will usually leave a few inches of concrete along obstructions, it will be necessary to chip around columns, walls, curbs, sidewalks, etc.



Once the detail work is complete, it is necessary to perform a final cleaning of the surface to remove any bulk debris or slurry that could inhibit a good bond with the new concrete. The final cleaning is performed with a high-pressure washer (5,000 – 10,000 psi) or a low-pressure, high-volume water tool such as a firehose. Once the final wash of the surface has been completed, compressed air is used to remove any standing water. At this point the concrete surface will be ready to accept a new overlay or patch material. It is important to note that sandblasting of the rebar is not required since the hydrodemolition process completely cleans all exposed reinforcing steel.

Hydrodemolition has also been used extensively in recent years for the removal of epoxy and urethane coatings. This method has many of the same advantages stated above; however, the concrete remaining after the coating has been removed is much smoother than with other hydrodemolition. When performing coating removal with hydrodemolition, a single jet nozzle is used. It is possible to remove membranes without damaging the underlying concrete through the use of multi-jet nozzles. Cleanup of membrane debris typically involves the use of a pressure washer and a skid-steer loader with a bucket and broom attachment. Once the cleanup is complete the surface is usually shotblasted prior to the application of a new membrane to remove any laitance that may remain.

Although the advantages of hydrodemolition far outweigh the disadvantages, it must be noted that there are some unique factors to be taken into consideration when using this high-volume process of concrete removal. The acquisition and disposal of hundreds of thousands of gallons of water can pose some challenges, especially in enclosed structures such as parking garages. Since much of the cement in the concrete matrix becomes suspended in the slurry as

concrete is removed, the pH of the waste water is elevated to levels that are sometimes subject to regulation prior to disposal. Settling and neutralization of the waste water in these instances involves installation of temporary tanks and chemical treatment equipment, the cost of which must be factored into the overall cost of the project.

Also somewhat unique to hydrodemolition is the sheer size of the equipment used. Both from a space and time standpoint, this limits the use of hydrodemolition mostly to projects where the quantity of concrete removal is significant. As a rough rule of thumb, a single unit can be expected to remove from 12 to 18 yd³ (9 to 14 m³) per day, and it is probably safe to conjecture that a minimum of three days of removal would be necessary in order to become cost competitive with other removal methods. When the other advantages of hydrodemolition are taken into consideration, however, a quality-minded engineer or owner may still wish to specify this method on smaller jobs.

As is the case with any concrete restoration project, proper planning and execution of a hydrodemolition project is the key to a successful outcome. The quality of a hydrodemolished surface can be far better for accepting a new overlay or patch material than a surface prepared using concrete breakers. The same benefits of hydrodemolition for surface preparation are achieved whether the concrete removal is on a horizontal, vertical or overhead surface.



Bob Nittinger is the President of American Hydro, based in Baltimore, Md. Bob is a member of ICRI and chairman of the task group preparing the guideline for hydrodemolition.