

INTRODUCTION TO HYDRODEMOLITION

Presented By
NLB CORPORATION

WHAT IS *HYDRODEMOLITION* AND HOW DOES IT WORK?

Concrete, as a construction material, is a relatively porous product. Hydrodemolition (Hydro-Blasting, Hydro-Jetting) uses the porous property of concrete to its advantage during removal operations. High pressure water-jets remove concrete by two separate mechanisms: direct impact on surface and pressurization of cracks.

The hydrodemolition process can provide selective removal of concrete by its flexibility to control the amount of released energy. The equipment is designed to remove concrete to a prescribed depth of solid concrete and complete removal of weakened, unsound concrete.

Deteriorated Concrete Removal

With deteriorated, delaminated, or spalled concrete, the high pressure water stream takes the path of least resistance. In other words, the water stream finds a greater resistance with sound concrete and a lesser resistance to unsound, or weakened concrete.

Sound Concrete Removal

In sound concrete, the high pressure water stream enters the concrete through pores and cracks. It starts breaking up any component in the concrete that has the least resistance to the water stream. Generally, the concrete components with the least resistance to the water-jet stream, are the cement and sand (mortar paste).

In the typical concrete deck surface that has been hydrodemolished, these characteristics are commonly found:

1. The rebar is intact and descaled. The high pressure water-jet cleans the exposed embedded rebar, removing the surrounding concrete and corrosion scale.
2. Aggregate is intact and washed due to the removal of concrete mortar paste. Exposed aggregate is ideal for bonding the new overlay.

It should be apparent that resistance, or the lack of resistance in concrete, is the key to the success of hydrodemolition. But, not all concrete offers the same degree of resistance. So how do we size and calibrate a hydrodemolition system for maximum productivity?

Based on thousands of hours of hydrodemolition experience, a ratio of 3.5 psi water pressure for every 1 psi compressive strength of concrete is used to calculate optimal operating pressure. If a concrete core test indicates nominal compressive strength of the concrete to be 5,000 psi, a minimum water pressure of 17,500 psi is indicated.

$$5,000 \text{ psi concrete strength} \times 3.5 \text{ psi ratio} = 17,500 \text{ psi cutting pressure}$$

Once water pressure is determined, other operating parameters which impact production should be adjusted. The traversing speed of the jet nozzle is set for a minimum duration of water stream impact, while still achieving the desired depth of concrete removal. Then, to maximize production, the duration time is reduced by increasing thrust. This is accomplished by increasing the water volume (gpm) of the hydrodemolition system.

ADVANTAGES OF HYDRODEMOLITION

- No dust
- Reduced noise
- Superior substrate bonding surface
- Elimination of additional structural damage
- Selectively removes inferior concrete
- Embedded reinforcement is cleaned, descaled, and free of mechanical damage
- Faster than mechanical methods of removal
- Minimizes sound concrete removal
- Dilutes the chloride ion concentration at the bonded surface interface due to water “washing” action

OTHER CONSTRUCTION APPLICATIONS

One of the greatest advantages in operating hydrodemolition equipment is the versatility of the NLB system. Numerous construction related applications exist which offer the contractor profit opportunities and additional avenues in which to utilize existing NLB high

pressure pumps. More applications mean a higher utilization factor, which in turn means lower operating costs and higher profits. The following is a short list of the most common construction related applications suitable for NLB high pressure pump systems.

- Membrane and coating removal
- Paint stripe removal
- Expansion joint removal
- Concrete removal on substructures
- Water-jet abrasive cutting
- Rubber removal
- Concrete laitance removal
- Bridge Widening

Membrane and Coating Removal

Parking structures, bridge decks, parking lots, water retention pits and other concrete surfaces are coated with materials to reduce moisture seepage and premature wear. These coatings - commonly called membranes or epoxy coatings - must periodically be removed so the concrete surface below can be inspected and repaired, or the coating re-applied.

NLB high pressure pumps - the same ones used in hydrodemolition applications - are capable of supplying the pressure and volume necessary to accomplish this coating removal. Using an NLB SPIN JET® Floor Cleaner to deliver the high pressure water to the surface increases production and improves cleaning effectiveness.

Paint Stripe Removal

NLB SPIN JETS® or hand lances with patented SPIN-NOZZLES® can be used for removing paint stripes and markings on roadways and airport runways. High pressure water is fast and effective in removing these markings. Unlike sandblasting, high pressure water does not create airborne dust or require fresh air equipment for operators.

Expansion Joint Removal

Contractors use high pressure water to remove expansion joint sealant from cracks and seams on roads and highways. The water-jet penetrates the joint quickly and blasts the material out of the crack leaving a clean bonding surface for the new sealant.

Concrete Removal on Substructures

While this is actually a form of hydrodemolition, it is accomplished with accessories other than the NLB Concrete Buster®. Concrete substructures - the vertical and overhead underside of bridges and overpasses - suffer from deterioration to the concrete. Moisture, freeze-thaw cycles and chlorides penetrating the concrete all contribute to the weakening of the structure. Waterblasting the deteriorated surfaces using NLB Model 4000 and 4500 X-Y Concrete Cutters saves time and costly steel repair often associated with jackhammers or chippers.

Water-jet Abrasive Cutting

High pressure water-jet abrasive cutting is a profitable alternative to diamond saw cutting on concrete and torch cutting on steel. Abrasive jet cutting uses a specially designed nozzle to mix the high pressure water with the abrasive media, which exits a tungsten carbide orifice at great velocity. Abrasive jet cutting is effective in cutting straight through concrete slabs - even rebar. Abrasive jets are also commonly used to cut steel, and are more desirable than torches in refineries and chemical plants where volatile gases are present.

Rubber Removal

Jet airplanes landing on runways leave a rubber build-up on the surface. This build-up collects and can create a hazard. NLB SPIN JETS® quickly blast away this rubber build-up exposing the concrete below without damage.

Concrete Laitance Removal

NLB SPIN JETS® are used to remove concrete laitance (loose slag) from a base pour to insure a good bonding surface for the next layer.

Bridge Widening

By pre-separating the concrete bridge deck using an NLB Concrete Buster®, the existing bridge wall can be removed without causing microfractures in the remaining concrete.



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