PNEUMATICALLY APPLIED CONCRETE REPAIRS for URBAN RECONSTRUCTION

Objectives

- Establish when to apply concrete repairs pneumatically
- Discuss materials & procedures and the standards which apply
- Differentiate between application methods
  - Dry Process Shotcrete
  - Wet Process Shotcrete
  - Wet Spray Mortar
- Examine each application method through analysis of urban reconstruction projects

Robotic applied shotcrete: Supersized new construction
Not in the scope of our conversation

Why Apply Repairs Pneumatically?

Large continuous vertical and overhead repairs

Multiple repair areas
Irregular shapes that are difficult to form

The Challenge: Achieve a durable repair, that doesn’t crack while it’s still setting.

Possible Solution: Use an accelerated material that will gain strength during intervals between trains.

Drawback: Accelerated material can be difficult to use in formed applications.

Comprehensive specification that covers all aspects of applying shotcrete:

- Material standards for field mix and prepackaged products
- Equipment requirements for dry and wet process rigs, air, nozzles, hoses
- Proper execution from surface prep through curing and protection
- Crew composition and qualifications
- Sustainability including repair applications

Material specification for prepackaged shotcrete materials:

- Categorizes materials by Performance - flex, permeability Components – fibers, polymer, etc...
- Gives procedures for field sampling that are obtained using regular lab test methods. ACI 506 calls for field samples that are obtained by shooting.
- May be more applicable for wet spray mortar.

Manufactured to meet all pertinent specifications

Many enhancements available

- Fiber
- Silica Fume or other pozzolans
- Accelerator
- Polymer
- Specialty cements
- Specialty aggregates

Dry Shotcrete, Wet Shotcrete, Wet Spray

Yikes, you’ve got me so confused
Pneumatically applied concrete/mortar terminology made easy:

**Shotcrete (wet or dry)**
- The cement based product is applied using compressed air at high velocity so that it achieves compaction upon impact.
  - **Dry** – Dry solid materials are transported by one hose to a special nozzle, water through a second. A nozzleman controls the amount of water at the nozzle.
  - **Wet** – Material is mixed with water and pumped using a traditional concrete pump. No water is added at the nozzle. Consistency is that of a low slump concrete.

**Wet Spray Mortar**
- Premixed mortar sprayed at lower volume and lower velocity. Typically smaller equipment.

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### SUPERSTORM SANDY Rebuild – BREEZY POINT, NYC

**The Challenge:**
- Maintain the traditional frame home look of Breezy Point and The Rockaways, while providing structures that are much heartier and resistant to storms like Sandy.

**Solution:**
- Steel frames, concrete elements imprinted to resemble wood, or use faux wood architectural pieces.

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**Easiest way to get concrete to stay on a sloped roof?**
- Shotcrete – mixed to a low slump in a barrel mixer.
queens midtown tunnel air plenum repairs underneath roadway

Material is predampened to reduce dusting.
Equipment is staged on the tunnel roadway, but the plenum is underneath.
Dry Process Polymer Silica fume Fiber Accelerated

Casper the friendly shotcreter shoots the nightly test panels
Material is accelerated to increase production rate.

Lincoln tunnel NYC entrance ramp wall repairs

This piece right in the middle here is perfectly sound. We're going to save this one!

Wet Spray Mortar

Silica fume
Polymer
Fine Aggregate
Sprayed with rotor stator
Water proof coating
Even fine aggregate
Henry Hudson pkwy exit ramp columns from the George Washington Bridge
April 20, 1969 — The Brookpark Station opened as part of a four-mile extension of the heavy-rail Red Line to the Cleveland Hopkins International Airport. The historic extension to Hopkins — the first direct rail connection between a center city and an airport in the Western Hemisphere — actually opened on Nov. 15, 1968, with national TV coverage. Work on the Brookpark Station had not been completed, so the Cleveland Transit System (CTS) opened the station about six months after the Red Line was completed.
Leveling: Cover 1.5" corrugated steel with wet process shotcrete, 1" over the peak.

Waterproofing:
Waterproof membrane

Structural reinforcement: 8" shotcrete and steel
Pneumatically applied urban message:

Time to question everything