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Spall Repairs Using Preplaced Aggregate Concrete RAP 9

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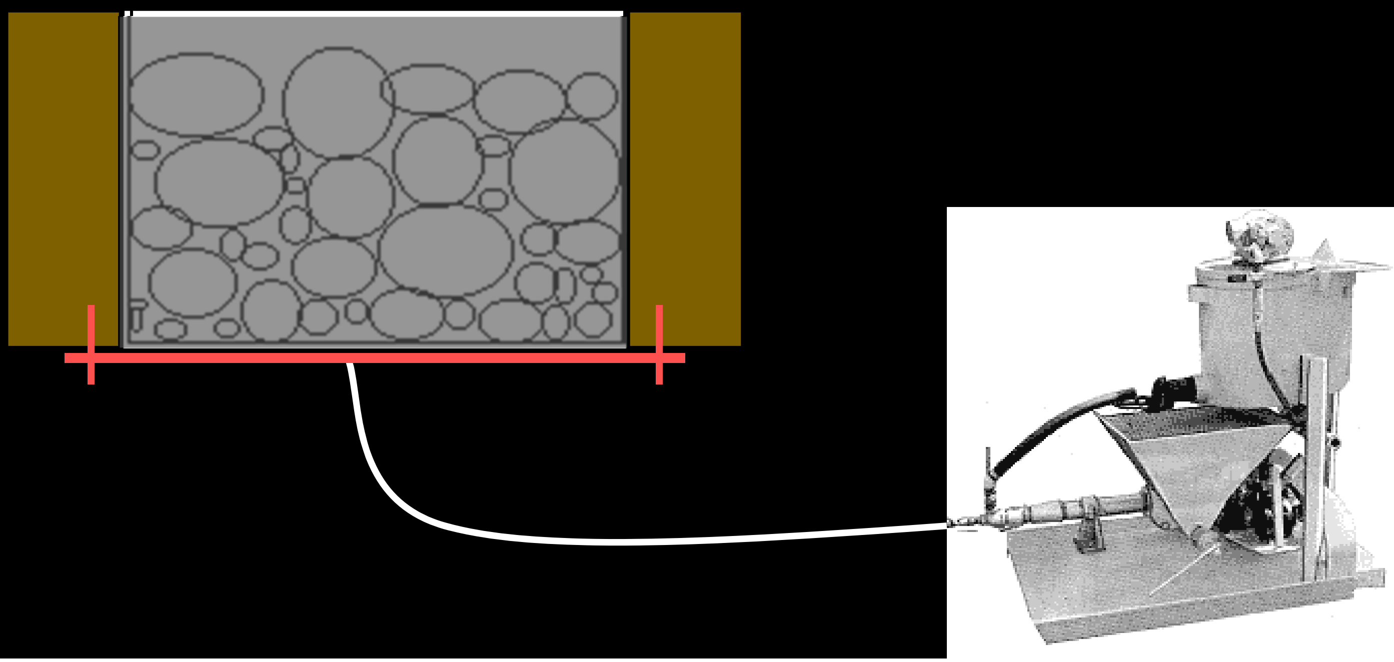
What is Preplaced Aggregate Concrete?

Preplaced Aggregate Concrete is "concrete that is produced by placing coarse aggregate in a form and later injecting a Portland cement-sand grout, usually with admixtures, to fill the voids."

(ACI 116R)

Preplaced Aggregate Construction



Applications for Preplaced Aggregate Concrete in Repair

- Where low volume change repair concrete is required
- Where the repair concrete is to participate in stress distribution
- Where high-density concrete is required (Nuclear)
- Placement in areas with closely-spaced reinforcement
- Placement in areas where overhead contact is required
- High-lift monolithic placements
- Underwater concrete placements (ACI 546.2R)
  - Preplaced Aggregate repairs are particularly applicable for underwater applications as the grout (with anti-washout admixtures) will displace the water as it is being pumped

Installation Procedures

Check surface of repair for contamination. Often the surface of the repair is saturated with water to prevent excess absorption of water from the grout. Surfaces should be allowed to dry prior to pumping grout.

The goal is to achieve a saturated, surface dry condition.

Installation Procedures

Aggregate is often saturated with water prior to placing in forms. Aggregate must be gap-graded per ACI 304.1R

For most common applications, no more than 10% should pass a 3/4-inch sieve and no more than 2% should pass a 1/2-inch sieve

Installation Procedures

Forms must be grout-tight. Grout is usually pumped at about 10psi pressure. Seal against existing concrete with thick mortar, caulking rope, or strong compressible material.

Do not use caulk. Caulk can yield under the head pressure from the grout.

Installation Procedures

Typical mixing equipment is a two-tub mixer with a water meter. Keep at least one backup pump on hand.

Test the consistency of the grout. Flow of 10 to 30 seconds is typical for site mixed grout using a standard flow cone test.

Installation Procedures

Start pumping at bottom of placement. Grout inlets can be placed vertically on the sides of the forms, or grout tubes may be used to distribute the grout to different elevations.

Finish the repair as needed on any exposed surfaces (top of repair). Curing is same as conventional concrete.

Other Considerations When Using Preplaced Aggregate Concrete

- Strength of Preplaced Aggregate concrete is easily comparable to, or can exceed that of conventional concrete.
  - Strengths of 13,000psi at 1 year have been reported
- Preplaced Aggregate Concrete has demonstrated excellent durability
  - This is likely due to the placement method and the air entrainment that naturally occurs due to the admixures used
- Heat of Hydration can be readily controlled using Preplaced Aggregate techniques
  - Forms, aggregate and grout can be cooled prior to placement.
  - Initial temperatures of 40 to 45 degrees F are easily obtained

Other Considerations When Using Preplaced Aggregate Concrete

- Grout Fluidifiers are commonly used
  - Contains a water-reducing admixture, a suspending agent, and aluminum powder
  - Offsets the effect of bleed water
  - Reduces the w/cm ratio
  - Retards set time
  - Aluminum powder generates hydrogen gas, which causes slight expansion of the grout and adds small bubbles to the hardened grout – increasing freeze-thaw durability
- Epoxy can be used in place of the cementious grout
  - Provides high early strength
  - Improves bond strength
  - Epoxy does produce a large amount of heat, so it is best used in thinner applications (about 2” or so)
  - Aggregate must be completely dry to prevent steam formation

Installation Procedures

West 6th Street Viaduct in Erie, Pennsylvania prior to repair

and 26 years later…

Installation Procedures

Hand-Placing High Density Aggregate (Barite) for Biological Containment Structure at Materials Testing Reactor in Arco, Idaho

Equipment Hatch in Nuclear Containment Structure

How do I know if Preplaced Aggregate Repairs are Right for my Project?

- Cost is definitely higher than conventional repairs because formwork must be tighter and the operation is more labor-intensive
- Advantages outweigh the cost in some situations, particularly when low shrinkage is desired and/or rebar or embedded items make vibrating conventional concrete impossible.

Questions?

Thank you!

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