PUMPING STRUCTURAL LIGHTWEIGHT CONCRETE PRODUCED WITH STALITE LIGHTWEIGHT AGGREGATE

STALITE expanded slate lightweight aggregate has the lowest absorption of any structural lightweight aggregate in the world allowing for relatively easy pumping with no segregation and excellent cohesiveness. The porous nature of the non-connected cells of the lightweight aggregates, however, may cause even STALITE to absorb mix water when subjected to pumping pressures. To avoid problems pumping lightweight concrete, conditioning the lightweight aggregate by pre-wetting is required. Uniform pre-wetting can be accomplished by using a sprinkler system as described in the section on “Recommendations for Moisture Conditioning (LINK TO THIS PAGE)”. This minimizes slump loss, increases pumpability and maintains consistency.

It should be noted that conditioning the lightweight aggregate increases the fresh density of the concrete, but this water does not affect the water-cementitious materials ratio of the mix. It is ultimately lost in the natural drying process as the concrete approaches equilibrium density, usually 28 to 90 days depending on ambient conditions. Also, it provides beneficial internal curing of the lightweight concrete.

The pumping system should use the largest size line available. A 5-inch line reduces line resistance and permits pumping at a lower pressure. Any reduction in diameter between the pump cylinder and line system is a potential trouble spot. If project conditions require a reduction in line size, use a reducer that is as long as possible. A reduction of 1 inch in 4 or 5 feet is best. The longer the reducing section, the less resistance will be created as concrete passes through the reducer. The number of elbows and the length of discharge hose should be held to a minimum. Addition of a reducer near the placement area should be avoided. All elbows, rubber hose and reducers on the deck increase line resistance and require higher line pressures that can increase water absorption in the aggregate and thus slump loss problems. Tight joints in the line system are essential to prevent grout loss. Pipe ends and couplings should be clean so that gaskets will fit properly and ensure a good seal.

The STALITE sample mix designs LINK SAMPLE MIX DESIGNS are designed to provide trouble free pumping as long as these suggestions are followed. Additional suggestions are found in the following ESCSI “Team Approach”.

Expanded Shale, Clay and Slate Institute
Rotary Kiln Structural Lightweight Aggregate

PUMPING STRUCTURAL LIGHTWEIGHT CONCRETE "The Team Approach"

Design Engineer

1. Mixes that are regularly used in a market area will be the most economical. Consult the lightweight aggregate suppliers for detailed mixture design information and material capabilities (i.e., density, strength, etc.)
2. Specify 4 to 7 percent air entrainment for pumpability, workability, finishability and durability.
3. Specify the maximum size aggregate rather than specifying individual sizes.
4. Allow higher slump into the pump to accommodate possible slump loss (slump control at discharge of pump).
5. Have the testing lab run design curves based on the maximum specified slump and air per ACI 301.
6. Specify a pre-pump meeting with the following present: engineer, architect, contractor, ready-mix supplier, lightweight aggregate supplier, testing agency, admixture supplier and pumping contractor.
7. On large jobs, these same people should be present at the first concrete pump placement.
8. Specify exactly where concrete should be tested, preferably at the end of the discharge line as per ACI 304.2R.
9. Realize that absorbed water does not affect the water-cementitious materials ratio, as defined in ASTM C 125.

General Contractor

1. Keep everyone communicating; this is a team effort!
2. Use an experienced pumping contractor.
3. Make arrangements so that two ready-mix trucks can unload simultaneously.
4. Designate a laborer to help the testing lab inspector.
5. Provide a washout area for ready-mix trucks.
6. Make use of the ready-mix truck radio when placement delays occur.
7. Specify to the ready-mix supplier the number of yards needed per hour, not how many truckloads.
8. Make an agreement with the ready-mix supplier as to how the quantity of concrete delivered will be determined.
9. It is necessary to properly lubricate the pump line before placing concrete.

Pumping Contractor

1. Know the concrete unit weight being pumped.
2. Order concrete to coincide with actual pumping time, not when the pump arrives at the job site.
3. Maintain continuous placement.
4. Operator should know the maximum slump allowed.
5. Use 5" minimum clean steel lines; minimize rubber at the end of the line; avoid reducers if possible.
6. Keep the same pump and operator throughout the duration of the job.
7. Use a pump whose piston size is as close as possible to the line size to maintain the best performance and least slump loss.

Ready-Mix Producers

1. The lightweight aggregate must be prewetted prior to batching using procedures recommended by the lightweight aggregate supplier.
2. Check with the lightweight aggregate supplier for the recommended pump mix design and field correction procedures.
3. The aggregate moisture content or density should be checked frequently. This is necessary for concrete yield control.
4. Make drivers aware of what admixtures are being used for slump control.
5. Maintain a minimum 3" slump before the addition of "superplasticizer".

Testing Labs

1. The field inspector shall be ACI Field Technician Grade 1 (or equivalent) per ASTM C 94.
2. Make sure the inspector has the proper tools including a roll-a-meter for volumetric air tests and a proper strike-off plate for density determination.
3. On large jobs use the same inspector for all concrete placements.
4. The inspector should know fresh density limitations (min and max).
5. Place test cylinders immediately upon casting in a curing box protected from the ambient temperature and vibration per ASTM C 31.