**WHAT is Structural Lightweight Concrete?**

Structural lightweight concrete has an in-place density (unit weight) on the order of 90 to 115 lb/ft³ (1440 to 1840 kg/m³) compared to normalweight concrete with a density in the range of 140 to 150 lb/ft³ (2240 to 2400 kg/m³). For structural applications the concrete strength should be greater than 2500 psi (17.0 MPa). The concrete mixture is made with a lightweight coarse aggregate. In some cases a portion or the entire fine aggregate may be a lightweight product. Lightweight aggregates used in structural lightweight concrete are typically expanded shale, clay or slate materials that have been fired in a rotary kiln to develop a porous structure. Other products such as air-cooled blast furnace slag are also used. There are other classes of non-structural lightweight concretes with lower density made with other aggregate materials and higher air voids in the cement paste matrix, such as in cellular concrete. These are typically used for their insulation properties. This CIP focuses on structural lightweight concrete.

**HOW is Structural Lightweight Concrete Used?**

Lightweight concrete can be manufactured with a combination of fine and coarse lightweight aggregate or coarse lightweight aggregate and normalweight fine aggregate. Complete replacement of normalweight fine aggregate with a lightweight aggregate will decrease the concrete density by approximately 10 lb/ft³ (160 kg/m³).

Designers recognize that structural lightweight concrete will not typically serve in an oven-dry environment. Therefore, structural design generally relies on an equilibrium density (sometimes referred to as air-dry density); the condition in which some moisture is retained within the lightweight concrete. Equilibrium density is a standardized value intended to represent the approximate density of the in-place concrete when it is in service. Project specifications should indicate the required equilibrium density of the lightweight concrete. Equilibrium density is defined in ASTM C 567, and can be calculated from the concrete mixture proportions. Field acceptance is based on measured density of fresh concrete in accordance with ASTM C 138. Equilibrium density will be approximately 3 to 8 lb/ft³ (50 to 130 kg/m³) less than the fresh density and a correlation should be agreed upon prior to delivery of concrete. The tolerance for acceptance on fresh density is typically ±3 lb/ft³ (±50 kg/m³) from the target value.

Structural lightweight concrete has been used for bridge decks, piers and beams, slabs and wall elements in steel and concrete frame buildings, parking structures, tilt-up walls, topping slabs and composite slabs on metal deck.

Sprinkling Aggregate in a Stockpile
Guidelines For Pumping

Lightweight concrete placements frequently employ pumps and this can be done successfully when a few precautions are considered prior to the actual placement.

1. Aggregate should be adequately pre-soaked as pressure during pumping will drive water into the aggregate pores and cause slump loss that may result in plugging of the pump line and difficulties in placement and finishing.
2. Pump lines should be as large as possible, preferably 5-inch (125-mm) diameter, with a minimum number of elbows, reducers or rubber hose sections.
3. The lowest practical pressure should be used.
4. Pump location should be such that vertical fall of the concrete is minimized.
5. Adjustments to mixture characteristics, such as slump, aggregate content and air content may be necessary to ensure adequate pumpability for the job conditions.
6. Decide on where concrete samples for acceptance tests will be taken and what implications this would have on the concrete mixture proportions and properties as delivered to the jobsite.