

## Design and Construction Standards

### Division 03 – Concrete

#### **General**

In general, follow the guidelines below when designing, specifying and installing concrete. Unless specifically indicated otherwise, these guidelines are not intended to restrict or replace professional judgment.

1. Design and specifications for concrete shall be generally based on the recommendations of the American Concrete Institute and ASTM tests.
2. A copy of all concrete test reports shall be furnished to the University.
3. Concrete Mix Design and associated manufacture of concrete shall be appropriate for the application and constructability (workability) of the concrete. Mixes and manufacture shall be appropriate to minimize the water added after leaving the plant or on-site. Only in special conditions or extreme weather shall water be added to concrete at jobsite.
4. Installation of poured concrete shall be continuous. Cold joints shall be allowed only at the locations identified in the design. Unplanned cold joints are prohibited.
5. Exterior concrete paving and flatwork shall have positive slope away from building.
6. Supported or platform slabs shall be used at all building entrances to avoid heaving/binding. When possible, simple spans are to be avoided. Design of these supported or platform slabs shall be per the project but is generally expected to have foundations.

#### **Section 03 30 00 Cast-in-Place Concrete**

1. Take concrete tests at the following intervals:
  - a. Slump Tests: Minimum once per pour / Required once every 60 yd<sup>3</sup>.
  - b. Cylinders: Minimum three cylinders per pour / Required at least once every 60 yd<sup>3</sup>. Compressive strength to be testes at 7 days, 28 days, and reserve test if required.
  - c. Air Entrainment: Minimum once per pour / Required at least once every 60 yd<sup>3</sup>.
2. Concrete compressive strength, at 28 days, shall be determined based on structural loading and conditions of the design, however shall in general be as follows:
  - a. Foundations: 3,500 psi (minimum)
  - b. Interior Slabs on Grade: 4,000 psi (minimum)
  - c. Exterior Slabs on Grade: 4,000 psi (minimum)
  - d. Slabs on Deck: per the structural design
3. All exterior concrete slabs, or concrete exposed to weather, shall be appropriately air entrained. Entrained air to be 6.5% ± 1.5%.
4. Concrete Flatwork shall have the following minimum characteristics:
  - a. Thickness shall be minimum as follows:

- i. Minimum of 4" in all locations
    - ii. Interior Floor Slabs on Grade: 4" minimum, actual per loading required
    - iii. Interior Supported Slabs: 2 ½" minimum, actual per loading and reinforcing designed
    - iv. Exterior Slabs on Grade (Sidewalks):
      1. Non-vehicular Traffic: 5"
      2. Vehicular Traffic: 8"
  - b. Flatwork Reinforcing shall be minimum as follows:
    - i. Interior Slabs on Grade: Minimum of fiber mesh inclusion. Preference is for welded wire fabric of appropriate sizing and gauge for design load.
    - ii. Interior Supported Slabs: Per the structural design
    - iii. Exterior Slabs on Grade: Fiber mesh. Welded wire fabric discouraged in exterior applications, however will be considered when appropriate.
  - c. Subsurface Preparation shall be minimum as follows:
    - i. Remove all organics or poor quality materials below concrete poured over grade.
    - ii. Interior Slabs on Grade: Minimum 4" compacted sand with vapor barrier of appropriate thickness (6 mil or greater).
    - iii. Exterior Slabs on Grade: Minimum 4" 21AA or compacted sand.
  - d. Surface Finish:
    - i. When possible, all patterns and coloring shall be integral to the concrete and applied prior to setting.
    - ii. Interior Slabs: Surface finish shall be as appropriate for finish flooring surface to be applied.
      1. Stains shall be integral and not surface applied.
      2. Hardening agent shall be used when appropriate, however compatibility with finish flooring shall be verified prior to use.
    - iii. Exterior Slabs:
      1. Broom or equivalent non-slip finish as appropriate for the location of walk.
      2. Surface shall be ½" to 1" above the adjacent grade to facilitate walk clearing/plowing during winter weather.
  - e. Jointing:
    - i. Provide concrete with appropriate control joints. When possible, align joints with structural columns, masonry wall corners, or other significant structural items.
    - ii. At exterior locations, provide expansion joints and sealants at all subsurface structures, or integral/adjacent elements such as bollards, light poles, signs, etc.
5. Formed Concrete: Concrete poured into forms shall be installed per the structural design including all reinforcing, thickness, strengths, etc.

- a. Beam pockets shall have integral bearing plates when possible.
  - b. Provide appropriate studs, clip angles, or kerfs in concrete where necessary to appropriate structural attachment.
  - c. Concrete at bearing points shall be finished and leveled according to the design finish elevation. Excessive use of shims for steel due to improper concrete elevation is prohibited.
  - d. All forms, steel, reinforcing, decks, etc. shall be free from oils, rust, scale or debris prior to application of concrete.
6. Concrete Stairs, Ramps, and Platforms:
- a. Concrete steps shall have nosing protection provided by rounded cast nosing with non-slip surface.
  - b. Coordinate all railing systems with Section 05 – Metals prior to installing concrete systems.
  - c. Ramps, treads, and platform of stairs shall have non-slip surface when not covered with finish flooring materials.
  - d. Where retaining walls or similar structures are present, provide edge drains or similar to facilitate removal of ground water to prevent slab heaves, salt intrusion, or other freeze-thaw actions which could damage concrete.

### **Section 03 33 00 Architectural Concrete**

1. Where concrete is intended to be a finish surface, exposed to view, whether pre-cast or poured-in-place, provide a sample panel for review. Panel to be constructed in manner to match actual construction, complete with finishes. Panel shall be 4' x 8' and posted on the job-site for review.
2. Flooring toppings and light weight concrete: When possible, designs should avoid flooring caps or lightweight concrete (gycrete) applications. EMU Experience has shown these floors to crumble over time resulting in unlevel floors which are difficult to maintain, replace, or improve. Use shall only be allowed when specifically agreed to in writing by the Physical Plant.
  - a. Appropriate jointing locations shall be planned as part of the design for any concrete floor toppings or lightweight concrete.

### **Section 03 40 00 Precast Concrete**

1. All Precast Concrete shall conform to the design standards from the ACI, ASTM tests, and the Precast/Prestressed Concrete Institute.
2. See Division 33 – Utilities, for additional applicable requirements and standards.

## **End of Division 03 – Concrete**