03 00 00 – Concrete

General
Construction documents shall show compressive strength of all grades and types of concrete, size, grade, type and location of reinforcement and anchors, rebar to be welded, and the size and location of structural elements. Construction documents shall show provisions for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature and moisture (per CBC, latest edition).

All shop drawings shall be reviewed and signed by a CA licensed Architect or PE prior to submittal.

Expansion and contraction/control joints shall be detailed on the design drawings. Control-joint spacing guidelines per ACI shall be followed. Provide expansion joint details with slip dowels allowing horizontal movement, but preventing differential vertical movement. Deep tooled contraction/control joints are preferred over saw-cut control joints so that crack control is initiated during plastic shrinkage of concrete. Cut alternate reinforcing bars running through contraction/control joints. Isolation joints shall be detailed around columns. “Diamond” block-outs are preferred. A joint plan for all concrete shall be submitted for structural, architectural and site work slabs.

Overhead anchorage into concrete ceilings or soffits with adhesive anchors is not allowed.

Products
Fly ash may be substituted for Portland cement. The following recommendations apply to concrete mix designs available in the area and consider the quality of locally available aggregate. 15% fly ash substitution may be made without impacting strength for concrete with up to $f'c = 5$ ksi. At this level of substitution, it improves the workability of the concrete and is less expensive than the Portland cement it replaces. Up to 25% substitution for $f'c$ less than or equal to 5 ksi may be used although concrete quality begins to degrade because it is harder to work and strength is impacted. 35% may be used in foundations or retaining walls where there is little need to work the concrete but strength is limited to $f'c = 4$ ksi and is determined based on 56 days rather than the traditional 28 days.

Reinforcing Steel
Use ASTM A615/A615M, Grade 60, deformed bars for #5 and larger sizes. Use STAM A706 rebar when welding is required. Traceable mill certificates shall be provided with all rebar delivered to the jobsite.

Cast-in-Place Concrete
Cast-in-place concrete will utilize cementitious and aggregate materials produced locally.
Contractor shall submit all concrete mixes for approval. Maximum specified shrinkage of concrete mixes based upon current laboratory testing shall be submitted by the contractor and supplier. Fly ash and/or pozzolan replacement of cement may be allowed. Concrete admixes shall not contain chloride.
Concrete mix designs with accelerating admixes for concrete placement in cold weather, shaded areas, etc. may be considered. Concrete mix designs with set retarding admixes for concrete placement in hot weather may be considered. Concrete mix designs with air entraining admixes for freeze-thaw resistance, resistance to chemical attack, water-tightness, workability, and pumpability may be considered. Shrinkage compensating admixes intended to counteract the effects of plastic shrinkage may be considered.

Corrosion inhibiting admixes and/or minimum water cement rations per ACI are required for concrete mixes exposed to the marine environment.

Spray-on evaporation retarding finishing aids (e.g. “Confilm, Eucobar, or equal) may be used for hot weather concreting. Contractor to confirm compatibility of finishing aids with floor covering adhesives and finishes.

Concrete aggregates shall be graded per ASTM C 33 so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor ¾ of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than ¾ inch in any dimension for slabs 4 inch thick or less.

Minimum concrete coverage for reinforcing steel shall conform to ACI structural concrete building code.

**Execution**

The slump of concrete delivered to the jobsite shall be adjusted to within one inch of the specified slump prior to delivery on-site. Final slump shall be adjusted to conform to approved plans and specifications by contractor/supplier at time of discharge. After addition of water in the field, each concrete batch shall receive a minimum 2 minutes of mixing to produce a uniform slump and W/C ratio. Concrete slump shall be fully adjusted prior to discharge; further adjustments of slump after discharge has started are discouraged. Concrete batches exceeding specified slump shall not be incorporated into the work.

All concrete placed, including sidewalks and flatwork, shall be vibrated to produce dense uniform concrete free of voids and honeycombs. Existing concrete shall be protected from damage during placement of new concrete. Cast in place dowels or adhesive bonded (2-part epoxy or equal) dowels inserted into drilled holes shall be installed where fresh concrete is placed against hardened concrete, typical.

Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Reinforcing steel and pre-stressing tendons shall be
placed and securely anchored against moving prior to concrete placement. “Web-setting” of embedded items is not allowed.

Contractor shall monitor ambient temperature, humidity and wind speed before, during, and after concrete placement. Concrete placement techniques per ACI shall accommodate ambient conditions. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

Sidewalks shall have a thickened edge with a depth that is twice the slab thickness, with a width that matches the slab thickness, and where the return slope is 1:1. All sidewalk, curb and gutter shall be constructed on a minimum 6 inch thick layer of compacted aggregate base.

Set forms and screeds to design grades in order to control strike-off of all concrete. Free hand strike-off is not allowed. Use bull floats or darbies after strike-off to eliminate high and low spots, embed large aggregate and to form a flat, uniform and open textured surface plane. Use wood floats for normal concrete mixes. Magnesium-aluminum alloy floats can be used on air entrained concrete.

Do not use steel finishing tools until bleed water has disappeared. Premature floating and troweling can cause scaling, crazing, or dusting, and will result in a surface with reduced wear resistance.

Concrete slabs shall be level, and flat to within no more than 1/8 inch in 10 feet; flatness shall be measured and confirmed by contractor during and after concrete placement, and check by the University. Concrete walls, columns, pilasters, beams, spandrels, girders and suspended slabs shall be cast plumb, line, plane, and square. ¾ x ¾ inch chamfer strips shall be used at concrete corners, typical, unless otherwise noted. Footing trenches shall be cut neat and square. ACI tolerances shall apply.

Protect concrete from construction traffic, weather or mechanical damage. Avoid use of hydraulic equipment on slabs; diaper equipment if needed. Do not use or locate pipe cutting equipment on exposed slabs. Do not place steel on exposed slabs.

**Accessories**

Exterior stair nosing shall be by Wooster Products Inc., Supergrit Safety Tread Type 321BF, or approved equal. Filler material shall be black in color. Where black is not contrasting to the stair color, a proposed color must be approved by the University.