Chapter 10
Quality Assurance

10-1. General

a. Training of inspectors. Any architectural concrete construction inspector must have had prior experience with similar construction, either under the supervision of a qualified inspector for this work or by having completed a similar project. Extensive experience in structural concrete is not sufficient without on-the-job training or a seminar type of instruction. Visual experience is needed to confidently judge when completion is satisfactory or what additional work is necessary and possible.

b. Responsibility limits. Prior to issuing a contract, the duties and responsibilities of the inspector should be outlined in detail. This should be spelled out in the specifications and reinforced at the pre-bid and preconstruction conferences. Definite instructions need to be given to the inspector by the design architect prior to the construction of the field mockup and after completion of the mockup so that the inspector understands what is acceptable. Whenever questions of acceptability arise on the project after construction begins, these questions should be resolved by the architect, owner, inspector, and construction personnel.

10-2. Quality Assurance Checklist

a. Job-site mockups.

(1) Is a mockup required by specifications?

(2) Is the size of the mockup specified in the specifications?

(3) If specified, request contractors to submit plans for the mockup as to size, materials, methods, concrete mixture, and personnel. Set date for first mockup early to allow repeats, if necessary, and aging of trial repairs. Do not let contractor delay. Advise contractor that no architectural forming is to be constructed for production concrete until mockup is accepted.

(4) Check mockup plan to ensure that contractor has included proposed materials, methods, and personnel to be used for architectural concrete. Is size sufficient to demonstrate all forming and treatments? Is mockup site adequate for construction period?

(5) Observe construction of mockup. Are the contractor's equipment, forming, and concrete materials the same as proposed for the architectural concrete?

(6) Inspect completed mockup with architect for approval. Does it meet architectural requirements and industry tolerances? If unsatisfactory, ask for repair or new mockup. If repair is elected by contractor, inspect again with the architect after repairs are completed and aged. Make decision for acceptance as repaired or request a new mockup if repair is unsatisfactory. Upon acceptance of mockup, request concrete placing schedule for architectural concrete.

b. Materials.

(1) Qualification.

(a) Check specifications for any special concrete materials such as special aggregate, cement, or color.

(b) Do materials proposed by concrete supplier match concrete in mockup? Design Reference Sample also? Have all admixtures, colors, or colored admixtures been approved and used in mockup? Do they meet project specifications? Do sources of special materials guarantee sufficient supply for construction period of the project? Has architectural designer reviewed submittals for final concurrence?

(2) Batching.

(a) If special cement or aggregate is specified, are there separate storage facilities? If regular cement is specified, is there more than one supplier? If so, what arrangements have been made to keep cements separated? If special aggregate is used, how is it batched to prevent contamination by other materials? If stored in stockpiles, are there means to prevent contamination from base soil and air?

(b) If color or colored admixture is specified, how is it stored and batched?

(c) How is concrete supplier guaranteeing that there will be sufficient special material (if any is specified) for the entire project? For each placement?

(d) Check mixture proportions. Are they the same as for mockup concrete? Is the proposed slump as specified?

(3) Mixing.

(a) Check mixers to be used for architectural concrete for cleanness, worn blades, and size. Are they to be used for architectural concrete only during placement? Are they clean for first load?

(b) Check mixing times for stationary mixer.

(c) Does plant have facilities for heating or cooling if required?

(4) Transporting.

(a) Check length of haul.

(b) Is the schedule of trucks sufficiently planned to guard against field problems?

(c) Will communications between plant and job site be adequate?

(d) Are drivers instructed as to how critical time is?

(e) If colored concrete, determine that contractor is ordering full loads only in accordance with the specifications.

c. Forming.

(1) Qualification.

(a) Does the forming meet the specifications? If it is not high density, and sandblasting is scheduled, recheck specs and coordinate with the architect.

(b) Is the plywood strong enough to resist pillowing?

(c) Job site mockup forming should be the same as proposed for use on production of architectural concrete. Any changes in forming will require new field mockup using change in forming.

(2) Construction.

(a) Do not allow contractor to construct forming for production of architectural concrete until mockup has been approved. This should be specified.

(b) Are the form joints being sealed properly during construction? How are the form ties sealed? Is the tape or caulking compound nonabsorbent?

(c) Are the form ties being sealed against leakage?

(d) Is the form release agent the same as that used on the mockup?

(e) Is the form release agent being applied on each use?

(f) Are the forms being braced sufficiently to prevent bulging?

(g) Are nails used to secure the reinforcing in the architectural face against recommendations?

(h) Are the chamfer and rustication strips sealed against absorption and voids between them and the form face-caulked?

(i) Are plastic liners being attached during the hottest part of day? Is fastening in accordance with recommendations?

(3) Repair and reuse.

(a) Is forming being cleaned and release agent being applied properly?

(b) Are damaged portions being discarded?

(c) Is forming being stored properly? (Plywood and metal flat, plastic and plastic-coated forming protected from direct sun.)

(d) Are old tie holes being plugged properly?

(e) Are any surfaces too worn to be used again for architectural concrete?

d. Construction procedures.

(1) Placing.

(a) Is the color of the first load of concrete satisfactory when checked with wet check test?

(b) Is the color uniform from truck to truck?

(c) Is the slump within specification and uniform from load to load?

(d) Are the concrete trucks adhering to schedule?

(e) Is conveying equipment (pump and hose, bucket, chute or buggies)clean for first delivery?

(f) Are forms protected against splatter?

(g) Are forms complete for placement?

(h) Is the construction joint clean for placement? If the architectural appearance is to be exposed aggregate, do not allow grout to be placed on construction joint.

(i) Is the crew large enough for placement?

(2) Consolidation.

(a) Are two vibrators available in case one malfunctions?

(b) Is contractor keeping within the maximum height of layer specified?

(c) Is the vibrator being inserted often enough so that vibration effect overlaps?

(d) Is the vibration in one place lasting for 10-15 sec per insertion, and the vibrator being withdrawn at 75 mm (3 in.) per second?

(e) Is the vibrator being kept at least 50 mm (2 in.) away from the form?

(f) Is the previous lift being penetrated by the vibrator at least 75 mm (3 in.)?

(g) Is the concrete being revibrated, at least the top lift?

(3) Curing and final flushing.

(a) Check specifications as to form removal time.

(b) Is top of placement being cured to prevent shrinkage cracking?

(c) Is the contractor applying curing after form removal which is compatible with subsequent procedures?

(d) If forms are eased for gradual temperature drop of 4.4 ° C (40° F) in 24 hr, is protection provided to prevent drying of edges of concrete?

(e) Is curing meeting the requirements of the specifications?

(f) If exposed aggregate is the appearance required, does contractor have proper equipment and schedule for process?

(g) Is contractor following same procedures and timing used on field mockup?

(h) Is exposure process being accomplished on concrete at same age?

(i) Is needle gun available on project?

(j) Is the repair mixture identical to that used on field mockup?

(k) For exposed aggregate concrete, are repairs being delayed until exposure is completed?

(1) If sealer is required by specifications, does proposed sealer meet specifications and is it being applied properly?

(4) Concrete protection.

(a) Is completed concrete being protected from staining and damage from construction operations?

(b) Is completed concrete being protected from weather?

10-3. Final Acceptance

a. Mockup.

(1) Does mockup represent all materials and methods proposed by contractor for architectural concrete?

(2) Has precast plant fabricated first production sample for approval to produce?

(3) Do the architect, contractor, and owner agree that the mockup represents the satisfactory product?

(4) Have photographs been taken of the mockup?

(5) Are plant-cast precast units being inspected at plant for ACI casting tolerances?

(6) Are plant-cast precast units being inspected at job site for erection tolerances and damage?

(7) Is present location permanent and safe for mockup until completion of architectural concrete?

b. In-place architectural concrete.

(1) If there are large contrasts, request that contractor do remedial work.

(2) Do not allow contractor to prolong aggregate exposure by sandblasting until completion of placement of all architectural concrete. Request trial exposure on first production placement to see if changes are required for remaining concrete. Has contractor been asked to do trial wall for training of personnel? First completed production section should be approved by design architect before proceeding further.

(3) Have design architect and contractor been asked to walk job for final approval?

(4) Is contractor protecting accepted concrete from construction work and weather?