

Structural Concrete

A. Forms and Reinforcement:

1. Forms shall be sufficiently tight to prevent the leakage of mortar (check forms for noticeable "openings"). Metal ties and anchorages shall be constructed such that the embedded portion can be removed to a depth of at least 50mm (2 inches) from the concrete surface. Spec ref.
2. The form interior shall be cleaned of all chips, dirt, sawdust and other extraneous material before placement. Spec ref.
3. Corrugated metal form supports, when used for structural deck slabs, shall not be welded to the girder flanges in tension zones (also, metal forms shall not rest directly on the flange). Screed and runway supports shall not be located on the form sheets, form supports or reinforcing steel. Spec ref.
4. All chairs, tie wires and other devices shall be made of or coated with a dielectric material. For uncoated reinforcing steel, stainless steel chairs meeting ASTM A493 (AISI Type 430) requirements without polyethylene tips may also be used. Spec ref.
5. Prior to installation all grease, dirt and other foreign substances shall be removed from the reinforcing steel. Damaged reinforcing steel coating (6mm x 6mm area or greater) shall be repaired with a material supplied by the coating applicator. Spec ref.
6. Reinforcing steel supports shall be placed no further than 1.2 meters (4 ft) apart and no closer than 150 mm (0.5 ft) from the edge of a concrete surface. Spec ref.
7. Bar reinforcement placement tolerances are +/- 6mm (0.25 inches) vertical and +/- 13mm (0.50 inches) horizontal from the plan spacing (see deck cross section and reinforcing layout plan sheets for details). Top and bottom mats shall be tied together 1.2 meters (4 ft) on centers. Spec ref.

B. Material Quality Assurance (Spec References):

1. Transit mixed concrete will be delivered to the site with a minimum 100 mixing revolutions. There can be two additions of water, with 30 mixing revolutions each, to achieve initial slump for the class of concrete. Class DP and HP Concrete can have a total of 100 to

200 mixing revolutions while all other classes can have 100 to 160 mixing revolutions (concrete properties are outlined in (Spec ref., Table XXX, "Concrete Mixtures").

2. For mixes containing water-reducer and set-retarding admixtures, the time from material batching to full discharge shall not exceed 90 minutes (typically structural decks). For mixes without these admixtures, the 90 minutes maximum applies to the batch to placement of subsequent lifts or strike off time frame (usually substructure elements).
3. Concrete having a discharge temperature exceeding 32C (90 F) will be subject to rejection. The concrete shall also have a slump and air content within the ranges specified for the concrete class and mix design (Table 501-3 is attached showing the ranges). The slump and air content tests will be performed initially and every 40 cubic meters (50 cubic yards) thereafter.
4. A set of concrete cylinders will be made for each structural component initially and every 150 cubic meters (200 cubic yards) thereafter. Twenty-eight day cylinder breaks should be reviewed to assure the compressive strength for the mix design has been met.

C. Concrete Placement:

1. Screed rail supports shall be placed 600mm (2 ft) on centers. Finishing machines are subject to approval by the RCE and are usually the power driven one-operation (strike-off auger, finisher roller) type. All one-operation machines shall also have a pan float. Spec ref.
2. Before concrete operations are started, the concrete machine shall be operated over the full length of the bridge segment to be constructed ("dry-run"). The screed shall be set to its finishing position for this test and the screed rails adjusted as needed and reinforcing 'cover' checked. Spec ref.
3. Existing concrete surfaces shall be free of loose or foreign material, scrubbed with wire brooms and kept wet before new concrete is placed. Immediately before placement, the old surface shall be thinly coated with a 1:1 portland cement mortar. Spec ref.
4. Concrete shall not be placed if the ambient air temperature is below 7C (45F) and/or the temperature will fall below 0C (32F) during the curing period

unless the Engineer gives approval per the Cold Weather Concreting Provisions (In this case, use Cold Weather Concreting IID for this review).

5. Structural slab and sidewalk placements shall not proceed if the evaporation rate is theoretically equal to, or greater than, 1.2 kg/sq. meter/hour. The evaporation rate shall be verified by the prime contractor. The test equipment shall be properly calibrated. The engineer can request re-tests as weather conditions change. Spec ref.
6. When concrete pumps are used, the lines shall have a minimum diameter of 125mm (5 inches). Chutes, troughs and pipes shall be kept clean and free of hardened concrete. Concrete material shall not be dropped a distance of 1.5 meters (5 ft) nor deposited in large quantities at any one point. Spec ref.
7. Concrete vibrators shall have a frequency of 3500 impulses-per-minute. For structural decks, one vibrator is required for every 30 cubic meters (39 cubic yards) placed per hour, with a minimum of two vibrators in use at all times. One additional vibrator shall be available as backup. Spec ref.
8. The vibrators shall be inserted into the plastic concrete in as near a vertical position as possible. The vibration time shall be sufficient to consolidate the concrete around reinforcement and at the form corners / edges. Vibrators shall not be used to push or distribute the concrete laterally. Over-vibrating, which creates pools of grout, shall be avoided. Spec ref.
9. If there was a bridge deck pour sequence specified in the plans, the reviewer should verify whether this sequence was followed.

D. Concrete Finishing:

1. As the concrete placement proceeds, the engineer shall verify at random the "cover" between top-of-slab and top-of-upper-mat [tolerances are +/- 13mm (0.5 inches)]. Spec ref.
2. Initial texturing will be done via an artificial turf drag. The turf type and brand shall appear on the State's "Approved List". The drag shall be cleaned periodically to remove hardened particles. Texturing shall stop 300mm (1 ft) from curbs or barriers. Spec ref.
3. Finished plastic concrete deck surfaces have a +/- 6mm (0.25 inch) tolerance when compared to the plan

elevation. Before texturing, the deck will be checked with a minimum 3-meter (10 ft) length straightedge. Irregularities greater than 5mm in 3 meters shall be corrected. Spec ref.

E. Curing Requirements (Spec ref.):

1. Five minutes after texturing (30 minutes after concrete placement), the deck surface shall be covered with wet burlap. Lapping shall be at least 300mm (1 ft). The burlap shall be continuously wet beginning ten minutes after placing and be protected from displacement.
2. Substructure elements shall be covered and cured for seven days using curing covers, wet burlap or both. Clear (fugitive dye) curing membrane can also be used for everything except structural slabs. Note: Curing covers are either Plastic Coated Fiber Blankets or Polyethylene (white opaque) Curing Covers.
3. Superstructure slabs shall be cured by either 14-days continuous burlap wetting or 7-days continuous burlap wetting, followed up with covering with curing covers.
4. Curing covers shall be lapped a minimum of 300mm (1 ft) and the lapped edges sealed with pressure sensitive tape. The covers shall be protected against displacement.
5. Structural approach slabs, curbs, sidewalks and safety walks on bridges shall be cured for 7-days by continuous wetting of the wet burlap. Forms may be stripped from approach slabs before the seven days have passed. However, curing must proceed using one of the methods discussed under E2 above.
6. Approach slabs and sidewalks and safety walks on bridges can be subjected to full legal loads after the 7-day curing period. Superstructure slabs can receive the full legal load after 28-days. However, full loading is allowed after the 14-day wet curing period provided the average compressive strength of two concrete cylinders breaks is 21 Megapascals (3000 psi) and no individual cylinder break is less than 19.5 Megapascals (2800 psi).
7. Typically, form stripping will not occur on superstructure elements until the curing periods described previously have ended. Regarding substructure elements.

F. Other Requirements:

1. For superstructure slabs having corrugated metal forms, a section of form shall be removed (after two curing days, and prior to the next placement) from the most recently completed placement of each span to check for soundness. After ten days but prior to the next placement, the engineer will hammer "sound" 50% percent of the area of 25% percent of the form panels. Panel removal and sounding can be moderated after a substantial amount of the deck has been placed and the results have been satisfactory. Spec ref.

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