

## CHAPTER 1: PRECONSTRUCTION PLANNING

Preconstruction planning refers to the preliminary planning phases that precede actual construction and building. During preconstruction planning, project partners review the project parameters; assess resources, personnel, and construction methods; and ensure that all necessary details have been addressed.

Chapter 1 outlines key components, personnel, and procedures necessary for bridge deck construction. Following are a series of lists, guidelines, and questions to serve as frameworks for preconstruction planning:

- Section 1-1, *Concrete Mix and Materials*, draws from Chapters 2 and 3 of the *Concrete Technology Manual* to provide abbreviated lists of what to consider for deck concrete mix and materials—aggregates, cementitious materials, water cement ratio, admixtures, and strength requirements. Section 1 also addresses mix designs and trial batches as proposed by the Contractor and reviewed by the Structure Representative.
- Section 1-2, *Batch Plants*, covers the batch plant review, bringing together Contractor, district/region personnel, and structure personnel. Ideally, prior to batch plant review, bridge deck construction is discussed at the preconstruction conference, especially if there are unusual conditions.

Otherwise, the batch plant review should take place prior to and during trial batching the concrete for construction. Here, discuss the best management practices, grade control, access and operational considerations (traffic control, round trip times for concrete trucks, etc.), falsework requirements, sequence of concrete placement, scheduling, batch construction rate, backup plan, concrete quality control, and strength requirements.

- Section 1-3, *Deck Construction Conference*, emphasizes the importance of a deck construction conference for talking through project specifics. This section provides detailed lists for the Contractor and Engineer to discuss during the meeting: sequence and limit of placement; location of screeds and construction joints; concrete conveyance, placement method, and rate; finishing method; finishing crew and operators; special equipment required or advisable; curing equipment; construction details; and construction conditions and safety.

Preconstruction planning is akin to building a solid foundation: Taking the time at the start of a project to carefully plan and consider all facets of deck construction is vital to the success of a project.



## 1-1 Concrete Mix and Materials

The *Concrete Technology Manual*, Chapters 2 and 3, includes a complete discussion on concrete mixes and materials. The following is an abbreviated list of pertinent items to discuss prior to construction:

### 1-1.1 Aggregates<sup>1</sup>

Discuss the following items regarding aggregates:

1. Source.
2. Natural or manufactured.
3. Tests and gradation.
4. Moisture control.
5. Lightweight concrete.

### 1-1.2 Water Cement Ratio

Detail these considerations regarding the water cement ratio:

1. Aggregate particle size and configuration.
2. Admixtures.
3. Strength requirements (typically found in the contract plans in the *Structure Design Notes*).

### 1-1.3 Admixtures<sup>2</sup>

Specify type(s) of admixtures:

1. What type(s) are permitted?<sup>3</sup>
2. Are types compatible?<sup>4</sup>
3. How will admixtures affect strength, shrinkage, and workability?
4. What tests must be done? Obtain approval prior to incorporating in work.
5. Dispensing and calibration.

### 1-1.4 Mix Designs and Trial Batches<sup>5</sup>

1. The Contractor is responsible for mix designs, and the Structure Representative reviews them. As this is a review and not an approval, the Structure Representative must make a timely review to bring any issues to the Contractor's attention as soon as possible. Discuss the following:
2. Cementitious material content and strength requirements.<sup>6</sup>

<sup>1</sup> 2010 Standard Specifications (SS), 90-1.02C, *Aggregates*, 2010 SS 90-1.02F (2), *Storage of Aggregates*, 2010 SS 90-2, *Minor Concrete*, 2010 SS 90-3, *Rapid Strength Concrete*.

<sup>2</sup> 2010 SS 90-1.02E, *Admixtures*, or *Specials*.

<sup>3</sup> Bridge Construction Records and Procedures Manual (BCR&P) 100-4.0.

<sup>4</sup> 2010 SS 90-1.02E(1), *Admixtures, General*.

<sup>5</sup> 2010 SS 90-1.01C(6), *Mix Design*; *Concrete Technology Manual*, Chapter 3, *Review of Concrete Mix Designs*.



3. Admixture(s).<sup>7</sup>
4. Combined gradation of aggregates.<sup>8</sup>
5. Type of cement.<sup>9</sup>
6. Workability, placing, and finishing characteristics.
7. Schedule of trial batches.<sup>10</sup>
8. Uniformity (using the same concrete mixes as other projects supplied by the same plant).
9. Shrinkage.<sup>11</sup>

## 1-2 Batch Plants

Conduct a field review of the Contractor's proposed batch plant at an early stage in the contract for specification compliance. District/region personnel usually make this review, but it is good practice for Structure personnel to accompany them during the review.

It is a good idea for Structure personnel to be aware of what the review involves and to check the following items:

1. Aggregate storage and handling (intermingling, contamination, moisture control, etc.).<sup>12</sup>
2. Storage of cementitious materials (protection, weighing, venting, sampling, quantity available, etc.).<sup>13</sup>
3. Admixture(s) (storage, introduction, and measurement). Mineral admixtures are treated as Supplemental Cementitious Materials (SCM) in the 2010 Standard Specifications.<sup>14</sup>
4. Water (adjustment for aggregate moisture content variation).<sup>15</sup>
5. Plant equipment and measuring devices (compliance with specifications, condition, and maintenance).<sup>16</sup>

<sup>6</sup> 2010 SS 51-1.02B, *Concrete*; 2010 SS 90-1.01D(5)(a), *Compressive Strength General*; 2010 SS 90-1.02B(1), *Cementitious Materials General*; and *Specials*.

<sup>7</sup> 2010 SS 90-1.02E, *Admixtures*.

<sup>8</sup> 2010 SS 90-1.02C(4)(d) *Combined Aggregate Grading*.

<sup>9</sup> 2010 SS 90-1.02B(2), *Cement*.

<sup>10</sup> 2010 SS 90-1.01D(5)(b), *Compressive Strength, Prequalification*.

<sup>11</sup> 2010 SS 90-1.01D(3) *Shrinkage*; and *Specials*.

<sup>12</sup> 2010 SS 90-1.02F(2), *Storage of Aggregates*; Concrete Technology Manual Chapter 4, *Proportioning, Mixing, and Transporting*.

<sup>13</sup> 2010 SS 90-1.02B(1), *Cementitious Materials, General*.

<sup>14</sup> 2010 SS 90-1.02E(1), *Admixtures, General*; 2010 SS 90-1.02F(4)(b), *Proportioning and Dispensing Liquid Admixtures*.

<sup>15</sup> 2010 SS 90-1.02D, *Water*; Concrete Technology Manual Chapter 4, *Proportioning, Mixing, and Transporting*.

<sup>16</sup> 2010 SS 5-1.33, *Equipment*; 2010 SS 9-1.02B, *Weighing Equipment and Procedures*; 2010 90-1.02F, *Proportioning Concrete*.



6. Transit-mix trucks (compliance with specifications, capacity, condition, and maintenance)<sup>17</sup> and volumetric mixer trucks.<sup>18</sup>
7. Hot and/or cold weather provisions.<sup>19</sup>
8. Inspection facilities provided.
9. Delivery ticket format and information.<sup>20</sup>

### 1-3 Deck Construction Conference

Prior to the stem and soffit pour, hold a meeting with the Contractor to discuss the particular features of the deck being constructed.

It is important that the Engineer understands the Contractor's proposed methods so that they can determine if these methods are compatible with the specifications and requirements of the contract. Resolve any previously unidentified differences at this time.

Below is a general outline of what this meeting might entail, but the Engineer is responsible for the particulars of each job and should determine and discuss the following:

#### 1-3.1 Sequence and Limit of Placement

Address the following questions as they pertain to the project:

1. Do the plans and specifications require certain concrete placement sequences?
2. How will the Contractor handle screed rail grades for varying width of deck, multiple pours, screed rail supports buried on girder stems, etc.?
3. Will the Contractor place any longitudinal or transverse joints other than those shown on the plans?<sup>21</sup>
4. Are longitudinal joints located on or close to a lane line?
5. Is stage construction required or proposed by the Contractor?
6. Are there any long-standing hinges?
7. What quantity of concrete is required for the various deck segments?
8. Will placement interfere with public traffic, existing power lines, or other obstructions?
9. In what direction is the pour?
10. Are there any closure pours?
11. How are closure pours formed, and how are they stripped?

<sup>17</sup> 2010 SS 90-1.01C(7), *Concrete Delivery*; 2010 SS 90-1.02G(3), *Transporting Mixed Concrete*; 2010 SS 90-1.02G(4), *Time or Quantity of Mixing*.

<sup>18</sup> 2010 SS 90-3, *Rapid Strength Concrete*.

<sup>19</sup> 2010 SS 90-1.03C, *Protecting Concrete*; Concrete Technology Manual Chapter 4, *Proportioning, Mixing, and Transporting*;

<sup>20</sup> 2010 SS 90-1-01C(7), *Concrete Delivery*.

<sup>21</sup> See SP BO-5.

12. Does the contract provide for falsework release alternatives?

### 1-3.2 Location of Screed Rails and Construction Joints

The location of screed rails and construction joints is critical. Discuss the following details:

1. Locations the Contractor plans on placing the rail supports for the finishing machine:
  - a. Edge of deck.
  - b. At longitudinal construction joints.
  - c. At exterior or intermediate girder location.
2. Type of structure may influence screed rail position and support.
3. Details for longitudinal joints referred to in the Standard Plans (SP). Locating screed rail supports at the girder is preferred.<sup>22</sup>
4. Evaluation of the support system of screed rails for deflection, rotation, and stability.
5. Screed rails should be adjustable within themselves.
6. Grade control at longitudinal and transverse construction joints.
7. Grade control for screed rails and method of establishing grade.
8. Stability of bulkheads for construction joints.

### 1-3.3 Concrete Conveyance, Placement Method, and Rate

Discuss the following with regards to the length and time of haul from batch plant to construction site:

1. Can the concrete be delivered at a uniform rate?
2. Will delivery, placement, and finishing of concrete cause a hazard to the public?
3. After delivery to the site, what placing method will be used to place the concrete in the deck (pump, tailgate method, bucket and crane, slick line, etc.)?
4. Will the placing method require additional support considerations in the formwork of reinforcing steel?
5. What is the anticipated rate of placement? Is this consistent with the rate of delivery, and how will this affect the surface finishing capabilities?
6. Will there be proper vibration of concrete after placement? What is the number of vibrator crew members required for accomplishing proper vibration?
7. What penetration depth is required? How will this affect method of placement (pumping) or the capability of the strike-off machine to properly work a given penetration in the concrete?<sup>23</sup>
8. Will conveyance and placement be interrupted for any reason such as moving the pump truck or crane and/or finishing equipment? What provisions are in place for keeping concrete fresh?
9. Will the placement method cause segregation or result in a non-uniform or uneven pour front?
10. Where are the Contractor's approved temporary concrete washouts?

<sup>22</sup> SP B0-5.

<sup>23</sup> 2010 SS 90-1.02A, *Materials, General*.

**1-3.4 Finishing Method**

Consider the following regarding the finishing method for concrete:

1. Finishing is the Contractor's responsibility.<sup>24</sup>
2. The Engineer's interest is in the end results of:
  - a. Rideability.
  - b. Durability.
  - c. Surface texture (for coefficient of friction and sound) surface crack intensity.
  - d. Physical properties of the concrete (plastic and final states) and cure details.
  - e. Longitudinal tining or grooving if applicable.
3. The Engineer's responsibility is to establish grade control points.
4. Special finishing considerations:
  - a. Lightweight concrete.
  - b. Adverse weather conditions (heat, wind, cold, rain, etc.).
  - c. Overlays.
  - d. A review of the project Rain Event Action Plan (REAP) as it applies to a deck pour.<sup>25</sup>

**1-3.5 Finishing Crew and Operators (for a typical 2-lane bridge)**

Because the specifications do not require specific methods in deck finishing, the Contractor decides on the size and classification of the crew. However, the staffing of a deck pour is an important area of discussion with the Contractor since the staffing affects the time required to complete the deck pour. This affects concrete delivery, which may be delayed by traffic, problems at the batch plant, etc. The site of pour must not be too far in distance from batch plant in order to ensure a timely pour.

The degree of mechanization and the individual abilities of laborers will vary from job to job, but a suggested average crew size is detailed in Table 1.1:

**Table 1.1. Finishing Crew and Operators**

Number of Positions	Duties
1	Foreman who is in charge of the pour
2	Laborers to rake ahead of the machine
1	Operator of the machine
2	Finishers for edging
1	Broom and cure laborer
2	Crew members operating vibrators
1	Bridge Carpenter or Pile Driver Carpenter to watch the falsework on slab bridge pours and overhang supports for large and heavy overhangs
1	Laborer tending concrete truck

<sup>24</sup> 2010 SS 51-1.01D(4), *Testing Roadway Surfaces*.

<sup>25</sup> 2010 SS 13-3.03B, *Rain Event Action Plan*.

### 1-3.6 Special Equipment Required or Advisable

Discuss the following precautions as they pertain to the project:

1. Cooling of concrete in hot weather requires:<sup>26</sup>
  - a. Ice machine at the plant or refrigerated water.
  - b. Fogging or sprinklers over the coarse aggregate stockpiles.
  - c. Shade cover over the aggregate stockpiles.
  - d. Cool water supply at deck pour.
  - e. Fogging rebar and forms with cool water ahead of placement (be cautious of over-watering to avoid runoff, which may pond at falsework supports or cause erosion and storm water discharges).
2. Critical back-up equipment for machinery (pumps, light plants, generators, spare parts etc.).
3. Heating and protecting concrete in cold weather requires:
  - a. Heating for water.
  - b. Heating for coarse aggregate.
  - c. Covering stockpiles with black polyethylene sheeting (visqueen).
  - d. Protecting completed deck as necessary to maintain temperature requirements. (Possible use of an external heat source. In freezing weather, deck curing temperatures have been kept in the mid 60°F by using burlene or carpets on the deck, followed by black polyethylene sheeting (visqueen), followed by additional carpets.)
4. Possibility of rain.

If there is impending inclement weather, do not schedule concrete deck placements. However, if there is a chance of rain, take precautionary measures and make appropriate materials available at the site at all times, such as:

  1. Black polyethylene sheeting (visqueen).
  2. Method of placing and removing black polyethylene sheeting (visqueen).
  3. A plan for getting rid of excess water on the low side of deck.
  4. Building an emergency bulkhead.

### 1-3.7 Curing Equipment

Discuss the following considerations regarding curing:

1. Water supply at the site.
2. Sufficient supply and pressure to produce a fog mist.
3. Fog nozzle.
4. Adequate means of applying curing compound.<sup>27</sup>
  - a. Contractor should demonstrate (prior to concrete placement) the adequacy of the system for applying curing compound to the deck surface (e.g. power atomizing spray).
  - b. The conventional hand pump garden sprayer is not permitted for deck curing

<sup>26</sup> 2006 SS 90-6.02, *Machine Mixing*.

<sup>27</sup> 2010 SS 90-1.03B(3)(c & d), *Mixing and Application (Curing Compound Method)*.

- compound. This includes Hudson type spray cans.
5. Ensure that there are no leaks in the curing compound hose lines. The hoses or other components must not drag and damage the fresh texture on the deck surface.
  6. Water for cure and for use in deck construction is to conform to the requirements of the *Standard Specifications*.<sup>28</sup>
  7. Adequate supply of burlene or other cure blankets for the deck square footage.
  8. Means of keeping the different types of curing compound separate and identifiable.
  9. Method to prevent cure blankets from blowing off or moving in the event of strong wind. This would be in addition to the weight of any cure water (for example, 2 x 6s laid on the cure blankets at edges and elsewhere as necessary).
  10. Will cure water run continuously or will the blankets or carpets be watered on a regular schedule?

### 1-3.8 Construction Details

Make a complete review of plans and specifications, including:

1. Skew versus camber versus strike-off device and screed rail grade.
2. Is the bridge on a radius, or are the edges of decks flared?
3. Super-elevation and transitions.
4. Bent cap steel related to deck steel (cap steel is tight up into cap stirrups and deck steel is on top of the bent cap steel).
5. Openings through bent caps, deck, and bent cap steel clearance.
6. Hinges and prestressing hardware versus deck grades.
7. Steel girder structures versus deck grades.
8. P/S P/C girders: deck grades and thickness for uneven cambers and cross slopes.
9. Variable span lengths: non parallel abutments or bents.
10. Stem and diaphragm stirrup hook location and resulting effect on deck steel placement.
11. Specified openings and the effect on screed rail control for deck grades.
12. Longitudinal and transverse construction joints.
13. Details of paving notch.
14. Sidewalk and railing steel layout and height.
15. Lane lines.
16. Utilities, drains, manholes, etc.
17. Block-outs in the deck for prestress duct vents.

### 1-3.9 Construction Conditions and Safety

Discuss the following construction conditions and safety precautions:

1. Will appropriate installation of rails and kickboards at the edge of the deck, finishing and cure bridges, and other locations be performed?<sup>29</sup>
2. Is the Contractor ensuring the placement of equipment so that they will not

<sup>28</sup> 2010 SS 90-102D, *Water*.

<sup>29</sup> Construction Safety Orders-CSO 1620 & 1621.



- operate over the public or railway? Lane closures must be utilized to prevent pumps, cranes, or other equipment from being placed over the traveling public.
3. Will equipment interfere with overhead power or utility lines?
  4. Will the public be adversely affected by delivery of concrete? Is there a possibility that placement will be interrupted?
  5. Will strike-off location and finishing machine length interfere with hand railing? Handrails should be kept in place.
  6. Runways for foot traffic should not be less than 20" wide. <sup>30</sup>
  7. Are eye-wash stations placed and spaced properly per Cal/OSHA GISO 5162?

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<sup>30</sup> CSO 1624.