
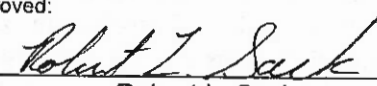


To: <b>MODIFIED</b> BY EB 05-006 <b>SUPERSEDED BY</b> <b>MODIFIED</b> EFFECTIVE <u>EB 06-057</u> EFFECTIVE BY EI 06-029 1/19/05 <b>EFFECTIVE</b> <u>5/3/07</u> 9/12/06		New York State Department of Transportation <b>ENGINEERING</b> <b>INSTRUCTION</b>	<b>EI</b> <b>04-021</b>
<b>Title: REVISIONS TO THE STANDARD SPECIFICATIONS FOR PORTLAND CEMENT CONCRETE (PCC) PRODUCTION AND PLACEMENT</b>			
Distribution: <input type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Agencies (32) <input checked="" type="checkbox"/> Contractors (39) <input type="checkbox"/> _____ ( )		Approved:  Robert L. Sack,      7. APR. 04 Deputy Chief Engineer, Research      Date	

**ADMINISTRATIVE INFORMATION:**

- This Engineering Instruction (EI) is effective beginning with projects scheduled for the letting of September 9, 2004.
- This EI does not supersede any previous issuances.
- The shelf notes transmitted by this EI will be incorporated into the next revision of the Standard Specifications.

**PURPOSE:** This Engineering Instruction transmits revisions to specifications related to portland cement concrete found in sections 500, 600, and 700 of the Standard Specifications.

**TECHNICAL INFORMATION:**

SUMMARY OF SPECIFICATION CHANGES		
SECTION	CHANGE TYPE	TOPICS COVERED
501	Shelf notes	Technical changes and friction requirements
555	Complete new specification	Reorganization and technical changes
557	Complete new specification	Reorganization, technical changes, and friction requirements
566	Shelf notes	Prewetting changes from EI 02-009
567	Shelf notes	Revised references to §555 and §557, Prewetting changes
569	Shelf notes	Revised references to §555 and §557, Prewetting changes
578	Shelf notes	References to §555 & §557, friction, and Prewetting changes
579	Shelf notes	Prewetting changes from EI 02-009
582	Shelf notes	Revised references to §555 and §557, Prewetting changes
583	Shelf notes	Revised references to §555 and §557, Prewetting changes
584	Shelf notes	Technical changes, friction, references, & Prewetting changes
603	Shelf notes	Revised references to §555 and §557
606	Shelf notes	Revised references to §555 and §557
703-07	Shelf notes	Friction requirements

**Section 501:**

- In Table 501-1, Class F concrete has been removed as an allowable substitution for Class C concrete for friction-related reasons. High-early-strength (HES) concrete, defined in §502-2.02, is listed as the only allowable substitution for Class C concrete.

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- New requirements have been added for friction requirements of coarse and fine aggregate. Four types of coarse aggregate friction requirements are given. The appropriate friction aggregate type will be designated by the designer via the corresponding pay item (see notes for subsections 557, 578, 584, and 601).
- The friction requirements for fine aggregate were moved from §703-07 to §501-2.02B. The friction requirement for concrete sand is changed to 25% acid-insoluble residue in both the plus 600  $\mu\text{m}$  and minus 600  $\mu\text{m}$  size fractions, from 40% noncarbonate particles in the primary sizes larger than 600  $\mu\text{m}$ .
- Specifications are changed to allow either (Class C or F) fly ash or ground granulated blast furnace slag (GGBFS) in combination with microsilica in high-performance mixtures to mitigate alkali silica reactivity (ASR) when high-alkali cements and reactive aggregates are used together.
- Repeating dials were deleted because digital displays have rendered them obsolete.
- The three changes to the inspection facility requirements include the following:
  1. Scales (large and small) provided after September 9, 2004, must meet the requirements of AASHTO M-231 and be digital.
  2. The sample drying appliance must now have a minimum total of four burners. These changes were made to reduce the time required for performing tests.
  3. A pH test kit must be supplied at plants supplying concrete with microsilica. Recent specification changes require the pH testing of microsilica samples.
- The Department has required for many years that electrical revolution counters on transit-mix trucks appear on the Approved List. A clarification of this requirement was included due to confusion over this requirement.
- The slump range for Class DP concrete is changed from 50 - 125 mm to 75 - 125 mm. This makes the slump range of Class DP concrete the same as Class HP. It changes the midpoint of the range from 88 to 100 mm. This will make it easier for field personnel to manage the slump of Class DP concrete because no water can be added once the slump is at or above the midpoint.
- While not a change, the batching tolerances for admixtures covered in §711-08 were added. Batching tolerances were also added for admixtures not covered in §711-08. This was prompted by the addition of §711-13 Calcium-Nitrite-Based Corrosion Inhibitors to the standard specifications. Calcium-nitrite is an admixture which is used in much larger quantities than standard admixtures so the batching tolerances and meter tolerances need to be addressed differently. An allowance was made for different types of admixtures that may have different dosage rates in the future.
- Current scale technology allows for a negative zero tolerance that was not possible in the past. There is reason to allow scales a negative (below) zero tolerance to keep pace with technology and allow faster production.

### Section 555:

- Cold-weather concrete operations have proven difficult at times, with specifications difficult to follow. This section has been rewritten and organized in a logical sequence of construction activities to make the specification easier to understand, and without excessive cross-references to other specifications.
- Form liner material properties are now included with the specification. As the use of form liners has increased to produce architectural finishes, the need to address form liner materials has developed to assure suitable quality of the textured surface.
- A new section related specifically to the conveyance of concrete has been established. This section addresses proper handling to control uniformity of the concrete from the point of acceptance to the point of discharge. Durability of concrete can be greatly affected by handling operations. The air void structure of concrete determines how resistant a concrete will be to freeze thaw and scaling. It is important that the air void structure not be significantly altered during concrete handling.
- The use of dropchutes has been added to clarify requirements for placing concrete between vertical forms greater than 1.5 m high.
- Prewetting and bonding grout technical changes developed under EI 02-009 for the 1995 specifications, have been inserted into the appropriate 2002 specifications.
- Tremie concrete applications have changed significantly since last updated in the specifications. An entire new section on depositing concrete underwater has been developed.
- Along with reorganization to more clearly define cold-weather concrete operations, technical changes have been included to improve the performance of concrete operations in cold weather.

1. Table 555-2 has been added to clearly define when conditions are considered cold weather. Within this section, cross-references to other sections have been minimized.
  2. The inclusion of alternate heating equipment has been made. Specifically, allowance to use hot-water boilers and heater hoses has now been included in the specification. When heating equipment is used, it is important to protect any exposed concrete from drying. Previously, only the use of wet curing was allowed.
  3. Combinations of curing regimes have now been included to provide alternative means of heating concrete while protecting exposed surfaces from drying.
  4. Table 555-4 has been updated to address those concretes which use pozzolans in cold-weather environments. A critical structural concern is the early loading of concrete elements to progress work or open concrete elements for use. The use of pozzolans slow the rate of concrete hydration and result in lower strength gains at earlier ages. When these materials are used in cold weather, especially temperatures less than 23° C, the strength gain rates are further reduced, potentially to a point where damage could occur to the concrete if loaded. Requirements for loading limitations and Table 555-4 have been modified to reflect improved oversight of concrete placed which include pozzolans.
- References to damaged and defective concrete have been updated, with prior reference to Section 502 - Portland Cement Concrete Pavement removed. This revised section provides a more accurate description of what constitutes damaged or defective concrete, and addresses repair for structural elements rather than pavements.

#### **Section 557 Technical Information:**

- Cold-weather concrete operations have proven difficult at times, with specifications difficult to follow. This section has been rewritten and organized in a logical sequence of construction activities to make the specification easier to understand, and without excessive cross-references to other specifications. Where cross-references are made, conscious effort has been made to be sure only a single cross-reference is needed to understand a given issue, and that the cross-referenced requirement does not make further cross-references within the specifications.
- The requirement that all reinforcing steel be positively anchored to the superstructure has been added. On occasion, reinforcing steel will uplift during placement operations. This is of special concern for multispan, continuously-placed structures.
- Numerous issues are required to be discussed in a preplacement meeting. For decks to be placed or cured after September 1<sup>st</sup> of each year, additional issues have been listed to ensure proper consideration of cold-weather concrete applications.
- A cross-reference to Section 555 for the conveyance of concrete has been added. This cross-reference establishes requirements for proper handling to control uniformity of the concrete from the point of acceptance to the point of discharge. Durability of concrete can be greatly affected by handling operations. The air void structure of concrete determines how resistant a concrete will be to freeze-thaw and scaling. It is important that the air void structure not be significantly altered during concrete handling.
- The section on finishing of integral wearing surfaces has been modified to better reflect the practices currently used.
  1. References to Section 502 Portland Cement Concrete Pavement have been eliminated.
  2. Equipment references have also been revised to reflect the current practice of using a one-operation finishing machine.
- Curing requirements have been revised for greater comprehension, eliminating many cross-references used in the previous specification. Cold-weather concrete provisions have been further defined. Two major changes to the specifications when the cold-weather concrete operation occurs are:
  1. The requirement to maintain uniform temperature within an enclosure, not to exceed 15° C. This reduces stresses placed on concrete from nonuniform temperature and will reduce the potential for cracking.
  2. Concrete that is placed late in the season is prone to scaling, if exposed to freezing temperature before drying. A new requirement establishes a drying period of 14 days. This will reduce the potential for scaling and freeze-thaw damage to "green" concrete.

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- Prewetting and bonding grout technical changes developed under EI 02-009 for the 1995 specifications, have been inserted into the appropriate 2002 specifications.
- References to damaged and defective concrete have been updated, with prior reference to Section 502 - Portland Cement Concrete Pavement removed. This revised section provides a more accurate description of what constitutes damaged or defective concrete, and addresses repair for structural elements rather than pavements.
- Pay items have been modified to allow designers to select the appropriate friction aggregate type. Design guidance for friction aggregate selection will be issued by Structures Division in the 2004 revisions to the Bridge Manual. The guidance is located in Section 5 of the Bridge Manual.
- Cost impacts due to the inclusion of friction aggregate requirements will vary greatly depending on the project's design traffic and location and the type of locally available aggregates.

**Sections 566, 567, 569, 579, 582, and 583:** Revisions to these sections have been made to correct cross-references with Section 555 and Section 557. Prewetting and bonding grout technical changes developed under EI 02-009 for the 1995 specifications, have been inserted into the appropriate 2002 specifications.

### **Sections 578 and 584:**

- Revisions to these sections have been made to correct cross-references with Section 555 and Section 557.
- Technical changes have been made to Section 584 to modify the "Handling, Measuring, and Batching" of Class DP and Microsilica Concrete to be consistent with the requirements in Section 501, Portland Cement Concrete-General.
- Pay items have been modified to allow designers to select the appropriate friction aggregate type. Design guidance for friction aggregate selection was issued by Structures Division in the 2004 revisions to the Bridge Manual. The guidance is located in Section 5 of the Bridge Manual.
- Cost impacts due to the inclusion of friction aggregate requirements will vary greatly depending on the project's design traffic and location and the type of locally available aggregates.

**Sections 603 and 606:** Revisions to these sections have been made to correct cross-references with Section 555 and Section 557.

**Section 703-07:** Requirements related to friction have been moved to §501-2.02 B. Aggregates.

### **IMPLEMENTATION:**

- The Design Quality Assurance Bureau will insert the transmitted shelf notes into contract proposals beginning with projects scheduled for the letting of September 9, 2004.

The following item numbers are disapproved by this EI:

- All Special Specifications which include cross-references to revised portions of Sections 555 or 557 are hereby disapproved and will have to be rewritten by those responsible for, or wanting to incorporate a specification into a project.
- The following specifications are disapproved:
  - 18502.070800 M Furnish and Placement of Rapid Setting Pavement Repairs
  - 04554.9610 M Permanent GRES Wall Facing With Simulated Stone Finish
  - 11555.010501 M Repair Subway Structure Column Base
  - 16555.049800 M Structural Slab Concrete, Class HP (Optional Forming Systems)
  - 01555.0498 M Accelerated Concrete With Corrosion Inhibitor for Structures
  - 11555.0498 M Cement Concrete With Non-Chloride Accelerator for Full Depth Slab Replacement
  - 08555.2100 M 35 MPa Concrete With Corrosion Inhibitor
  - 10555.7294 M Architectural Treatment to Vertical Stained Concrete Surfaces
  - 10555.7296 M Architectural Treatment to Construct Vertical Brick Finishes
  - 18555.8097 M Crack Repair (Keyway Method)
  - 11555.9001 M Cast-in-Place Substructure Concrete Designated by Compressive Strength

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557.01 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required
557.05 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required
557.20 M	Structural Approach Slab with Integral Wearing Surface
16557.4000 M	Exodermic Bridge Deck With Class DP Concrete
08557.4001 M	Exodermic Bridge Deck With Class DP Concrete
08557.4011 M	Exodermic Bridge Deck With Class DP Concrete (Precast)
06557.6000 M	Lightweight High-Performance Concrete Sidewalks
04558.0200 M	Diamond Grinding and Texturing of Structural Slab
16563.5000 M	48 MPa Structural Concrete
06569.3000 M	Lightweight High-Performance Concrete Bridge Barrier
578.02nnnn M	Overlay Concrete, Class E
578.03nnnn M	Reconstruction Concrete, Class D or E
11583.2001 M	Stabilize Rock Slope With Shotcrete (Square Meters)
11583.2002 M	Stabilize Rock Slope With Shotcrete (Cubic Meters)
11583.2003 M	Stabilize Rock Slope With Shotcrete (Bags)
11583.3001 M	Vertical and Overhead Repairs With Low Pressure Spray Mortar No Reinforcement Bar Encasement
11583.3002 M	Vertical and Overhead Repairs With Low Pressure Spray Mortar Reinforcement Bar Encasement
11584.070901 M	Furnish and Placement of Rapid Setting Concrete Bridge and Approach Slab Repairs
11584.0709 M	Surface Preparation for Rapid Setting Concrete Bridge and Approach Slab
584.20nnnn M	Overlay Concrete, Microsilica Concrete
584.21nnnn M	Overlay Concrete, Class DP
584.22nnnn M	Reconstruction Concrete, Class D, DP or Microsilica Concrete
09595.5000 M	Membrane Waterproofing System for Structural Slabs
11595.5001 M	Hot Applied Waterproofing Membrane
18603.0501 M	Lining Existing Culvert With Concrete Lined Corrugated Steel Pipe
18603.0511 M	Lining Existing Culvert With Corrugated Steel Pipe
18603.0521 M	Lining Existing Culvert With Corrugated Aluminum Pipe
09603.0523 M	Lining Existing Structural Plate Pipe Arch With Corrugated Aluminum...
25606.3042 M	Single Slope Traffic Barrier
10607.9968 M	Noise Barrier Footings
02615.8003 M	Galvanized Steel Pipe Handrail
11662.6000 M	New Empire Subway (ECS) Facilities

• The following new Item numbers are transmitted by this EI:

555.10 M	Concrete for Structures, Class D
555.11 M	Concrete for Structures, Class DP
557.0101 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 1 Friction
557.0102 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 2 Friction
557.0103 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 3 Friction
557.0109 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Required – Type 9 Friction
557.0501 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 1 Friction
557.0502 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 2 Friction
557.0503 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 3 Friction
557.0509 M	Superstructure Slab with Integral Wearing Surface – Bottom Formwork Not Required – Type 9 Friction
557.2001 M	Structural Approach Slab with Integral Wearing Surface – Type 1 Friction

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557.2002 M	Structural Approach Slab with Integral Wearing Surface – Type 2 Friction
557.2003 M	Structural Approach Slab with Integral Wearing Surface – Type 3 Friction
557.2009 M	Structural Approach Slab with Integral Wearing Surface – Type 9 Friction
578.1201nn M	Overlay Concrete, Class E – Type 1 Friction
578.1202nn M	Overlay Concrete, Class E – Type 2 Friction
578.1203nn M	Overlay Concrete, Class E – Type 3 Friction
578.1209nn M	Overlay Concrete, Class E – Type 9 Friction
578.1300nn M	Reconstruction Concrete, Class D or E
584.3001nn M	Overlay Concrete, Microsilica Concrete – Type 1 Friction
584.3002nn M	Overlay Concrete, Microsilica Concrete – Type 2 Friction
584.3003nn M	Overlay Concrete, Microsilica Concrete – Type 3 Friction
584.3009nn M	Overlay Concrete, Microsilica Concrete – Type 9 Friction
584.3101nn M	Overlay Concrete, Class DP – Type 1 Friction
584.3102nn M	Overlay Concrete, Class DP – Type 2 Friction
584.3103nn M	Overlay Concrete, Class DP – Type 3 Friction
584.3109nn M	Overlay Concrete, Class DP – Type 9 Friction
584.3200nn M	Reconstruction Concrete, Class D, DP or Microsilica Concrete

**TRANSMITTED MATERIALS:** This EI transmits shelf notes to the following sections and subsections: Section 501, Section 555, Section 557, Section 566, Section 567, Section 569, Section 578, Section 579, Section 582, Section 583, Section 584, §703-07.

**BACKGROUND:** Background information is given below by section.

**Section 501 and §703-07:** The revisions to Section 501 are technical in nature.

In the 1970s the Department introduced requirements for fine aggregate used in PCC pavements and bridge decks, aimed at providing adequate friction in wet conditions. In 1999 the Department began its first significant review of these requirements since their adoption. The performance of both fine and coarse aggregates were reviewed in two separate studies. The Materials Bureau anticipates publishing the results of these studies in the near future.

Fine aggregate performance was reviewed because the Department's previous requirement was more stringent than the AASHTO recommended requirement. The Department's study found no justification for the Department's elevated threshold. The limit set in the attached shelf note to Section 501 is the limit recommended by AASHTO.

Prior to this EI, the Department had no standard for friction requirements for coarse aggregate in PCC wearing surfaces. The 1976 AASHTO Guidelines for Skid Resistant Highway Pavement Surfaces reads, "Coarse aggregate will not affect the skid resistance of concrete pavement, until it becomes exposed due to surface wear. The performance record of the coarse aggregate under consideration should be evaluated in terms of skid resistance."

Based on this recommendation the Department initiated an evaluation of coarse-aggregate friction performance in New York State. The study showed conclusively that once the coarse aggregate is exposed, the hardness of that coarse aggregate controls the pavement's ability to resist polishing under traffic, not the fine aggregate. Also, the performance of various types of coarse aggregates under various traffic conditions mirrored the performance of coarse aggregates in hot mix asphalt (HMA) pavement. Based on these findings the specification revisions follow similar requirements as exist for friction aggregate in HMA pavement, taking into account the differences in gradation and production process between HMA and PCC.

The revised friction aggregate requirements were developed in cooperation with: New York Construction Materials Association, American Concrete Pavement Association, New York City Concrete Promotional Council, and the Federal Highway Administration.

Concrete made with a combination of high-alkali cement and reactive aggregates is susceptible to deterioration from alkali-silica reactivity (ASR). ASR breaks concrete apart due to the force of expansion from alkali silicate gels coming in contact with water. The Department historically has prevented the potential for ASR by not allowing the use of high-alkali cement with reactive aggregates. In the mid-eighties, testing by the Department showed that by replacing 15 to 20% of the high-alkali cement with Class F fly ash, ASR could be mitigated. This is currently allowed by Department specifications for most standard Classes of concrete. In a high-performance concrete, when a high-

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alkali cement is used in combination with a reactive aggregate, currently only Class F fly ash and microsilica are allowed to mitigate ASR. Testing information reviewed by the Materials Bureau shows that the ASR can also be mitigated in high-performance mixtures by replacing 26% of the high-alkali cement with a combination of 20% GGBFS or Class C fly ash and 6% microsilica.

**Sections 555 and 557:** These specifications are reorganized to eliminate redundancies. The specifications did not follow a logical sequence of construction and were difficult to understand. The requirements for cold-weather concreting were particularly confusing and these changes are meant to make the specifications easier to understand. A number of technical changes have been made to further improve the performance of concrete elements constructed for the Department. Technical changes to prewetting and bonding grout were established by EI 02-009 to the 1995 specifications but these changes were never included in the 2002 specifications.

With the introduction of multiple types of friction aggregate requirements, based on friction demand, revisions were needed to pay item numbers for PCC wearing surfaces. The attached shelf notes contain modified pay item numbers for these items so that designers may easily identify to the Contractor the appropriate friction type. Design guidance for selecting the appropriate friction aggregate type will be issued separately by Structures Division in the next revision to the Bridge Manual.

**Sections 566, 567, 569, 579, 582, and 583:** Revisions to these specifications consist of correcting inconsistencies with and references to the revised Sections 501, 555, and 557. Technical changes to prewetting and bonding grout were established by EI 02-009 to the 1995 specifications but these changes were never included in the 2002 specifications.

**Sections 578 and 584:** Revisions have been made to these specifications to correct inconsistencies with and references to the revised Sections 501, 555, and 557.

Section 584 currently requires a maximum of 190 mixing revolutions for both Class DP and Microsilica concrete, and 100% of the mixing water to be added at the batching facility. This is being changed to concur with Section 501 which allows a maximum of 200 mixing revolutions of Class DP concrete and 90% of the total mixing water to be added at the batching facility. Also, two additions of water will be allowed at the discharge point to obtain initial slump. The term "initial slump" pertains to concrete that has reached the slump range as indicated in Table 501-3, Concrete Mixtures, for the class used. In general, no water additions are permitted once the mix has reached the midpoint of the slump range. After each addition of water, mix the concrete at least 30 mixing-speed revolutions before discharging. The initial loads may, with prior written approval by the Regional Materials Engineer, also be adjusted by using a water-reducing admixture (711-08, ASTM Type A). This adjustment will be limited to the first few trucks arriving for a particular placement before any adjustments have been made at the batching facility.

With the introduction of multiple types of friction aggregate requirements, based on friction demand, revisions to pay item numbers for PCC wearing surfaces were needed. The attached shelf notes contain modified pay item numbers for these items so that designers may easily identify to the Contractor the appropriate friction type. Design guidance for selecting the appropriate friction aggregate type will be issued separately by Structures Division in the next revision to the Bridge Manual.

**Sections 603 and 606:** Revisions to these specifications consist of correcting inconsistencies with and references to the revised Sections 501, 555, and 557.

**CONTACT:** Brad Allen of the Field Engineering 2 office of the Materials Bureau may be contacted for issues related to friction at [ballen@dot.state.ny.us](mailto:ballen@dot.state.ny.us) or (518) 457-3240. For all other issues, contact Donald Streeter of the Field Engineering 1 office of the Materials Bureau at [dstreeter@dot.state.ny.us](mailto:dstreeter@dot.state.ny.us) or (518) 457-3240.

Make the following changes to the Standard Specifications of January 2, 2002.

**Page 5-1**

Lines 14 – 29, Delete Table 501-1, Concrete Class Options in its entirety and replace it with the following. 5

“

<b>Concrete Class</b>	<b>Allowable Class Options</b>
A	C, E, F <sup>1</sup> , H or HP
C	HES <sup>2</sup>
D	DP
DP	None
E	H or HP
H	HP
F, G, GG, or HP	None
I	J
J	None

Notes:

1. Regional Director approval required for pavement applications, including approach slabs. D.C.E.S. approval required for structural or deck applications. May not be used in mass placements, or as a substitute for class A in Sign Structure, Signal Pole, and Luminary Foundations. 10
2. The requirements of §502-2.01 and §502-2.02 apply”

Line 33, under 501-2.02 Materials Requirements, **delete** “Coarse Aggregates 703-02.” 15

Line 34, under 501-2.02 Materials Requirements, **delete** “Concrete Sand 703-07.”

**Page 5-2**

Line 35 to page 5-3 line 19, under §501-2.02 **delete** paragraph “**B. Aggregates**” in its entirety and **replace** it with the following. 20

“**B. Aggregates.** Use aggregate from a source on the Approved List of Sources of Fine and Coarse Aggregates that also meets the following requirements for gradation and friction. 25

**1. Gradation.** Samples will be taken from stockpiles, barges, conveyor belts, or bins and tested for gradation at the plant site in accordance with NYSDOT Materials Method 9.1. Rejected aggregates may be reprocessed or reworked to meet the gradation requirements. 30

*a. Concrete Sand.* Use only sand meeting the requirements of §703-07, Concrete Sand.

*b. Coarse Aggregate.* Use only crushed stone, crushed gravel, or crushed slag meeting the requirements of §703-02, Coarse Aggregates in either one or a combination of size designations specified in Table 703-4, Sizes of Stone, Gravel, and Slag and graded according to Table 501-2, Coarse Aggregate Gradations.

Aggregates that are uniform in size, but do not meet the requirements in Table 703-4, may be approved by the Regional Director. When these sizes are combined to meet the mixture gradation requirements of Table 501-2, the gradation requirements of §703-02 shall not apply. Blending of aggregates during the batching process may be approved by the Regional Director. When blending aggregates prior to batching, the blending method requires approval by the Regional Director.

TABLE 501-2 COARSE AGGREGATE GRADATIONS		
Sieve Sizes	Type CA 1 General Limits	Type CA2 General Limits
	% Passing	% Passing
37.5 mm	-	100
25.0 mm	100	93-100
12.5 mm	90-100	27-58
6.3 mm	0-15	0-8

Notes: ASTM C33 Size Number 7 is an acceptable equivalent to the Type CA 1 gradation.  
 ASTM C33 Size Number 57 is an acceptable equivalent to the Type CA 2 gradation.  
 Material passing the 75 µm sieve (wet) is limited to a maximum 1.0 % by mass for ASTM sizes 7 and 57.

**2. Friction.** Sample and test aggregate for friction characteristics according to the procedures of Materials Method 28 “Friction Aggregate Control and Test Procedures.” The Engineer will identify pavement areas, if any, represented by failing samples according to the procedures of Materials Method 28 “Friction Aggregate Control and Test Procedures.”

*a. Concrete Sand.* For use in concrete pavements, bridge decks, precast pavers, or any other item used in concrete highway wearing surfaces, sand (natural or manufactured) must contain at least 25.0% acid-insoluble residue in the plus 600 µm size fraction and in the minus 600 µm size fraction. Sands may be blended to meet this requirement.

*b. Type 1 Coarse Aggregate.* Use coarse aggregate meeting one of the of the following requirements:

- Limestone, dolomite, or a blend of the two, having an acid-insoluble residue content not 30 less than 20.0%.
- Sandstone, granite, chert, traprock, ore tailings, slag, or other similar noncarbonate materials.
- For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types containing no less than 95.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction.

- For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types containing no less than 95.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions. 5

c. *Type 2 Coarse Aggregate.* Use coarse aggregate meeting one of the following requirements:

- Limestone, dolomite, or a blend of the two, having an acid-insoluble residue content not less than 20.0%. 10
- Sandstone, granite, chert, traprock, ore tailings, slag, or other similar noncarbonate materials.
- For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types 15 containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction.
- For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types 20 containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions.

d. *Type 3 Coarse Aggregate.* Use coarse aggregate meeting one of the following 25 requirements:

- Limestone or a blend of limestone and dolomite having an acid-insoluble residue content not less than 20.0%. 30
- Dolomite.
- Sandstone, granite, chert, traprock, ore tailings, slag or other similar noncarbonate materials. 35
- For concrete mixtures containing CA1 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 25.0 mm, plus 6.3 mm primary size fraction. 40
- For concrete mixtures containing CA2 coarse aggregate: gravel or a blend of rock types containing no less than 20.0% noncarbonate particles (by weight with adjustments to equivalent volumes for materials of different specific gravities) in the minus 37.5 mm, plus 12.5 mm and the minus 12.5, plus 6.3 mm primary size fractions. 45

e. *Type 9 Coarse Aggregate.* Use coarse aggregate meeting the requirements of §501-2.02 B.1.b. Coarse Aggregate.”

## Page 5-4

Lines 8 - 12, under §501-2.03 D. Scales, **delete** the third, fourth and fifth bullets beginning "Digital displays," "Minimum resolution" and "Digital displays," respectively and **replace** them with the following:

5

- Digital displays that match the primary scale within 1 division.
- Minimum resolution of digital displays equivalent to the minimum resolution on the primary scale.
- Digital displays located in direct sight of the operator's normal work station."

10

## Page 5-7

Lines 9 - 12, under §501-2.03 H. Inspection Facility, **delete** list items 13, 14, and 15 in their entirety and **replace** them with the following.

15

**13. Large Scale.** Minimum capacity of 14 kg, with a maximum gradation of 0.005 kg meeting AASHTO M-231 Class G20. Scales provided as new or replacement after September 1, 2004, must be digital."

20

**14. Small Scale.** Minimum capacity of 1500 g, with a maximum gradation of 0.1 g meeting AASHTO M-231 Class G2. Scales provided as new or replacement after September 1, 2004, must be digital.

**15. Sample Drying Appliance.** Stove or hot plates sized to rapidly dry aggregate samples with a minimum total of four burners."

25

Line 14, under §501-2.03 H. Inspection Facility., **insert** the following after list item 16.

**17. pH Test Kit.** pH test kit meeting the requirements of Materials Procedure NY 90-1 for all plants supplying concrete containing microsilica (711-11)."

30

Lines 36 and 37, under §501-2.04 B. 1. a. *Transit-Mixed Concrete.*, **delete** the first sentence beginning with, "Equip each truck mixer," and **replace** it with the following.

35

"Equip each truck mixer used for transit mixed concrete with an electrical revolution-counting device, appearing on the Approved List, mounted in a clearly visible position as follows:"

## Page 5-10

40

Lines 1 - 8, under §501-3.01 A. Aggregates and Cementitious Materials., **delete** the first two paragraphs on the page beginning with "Certain aggregates" and "Classes DP, G, GG, and HP," respectively, and **replace** them with the following.

"Certain aggregates appear in the Approved List of Sources of Fine & Coarse Aggregates that have use limitations if combined with a high-alkali portland cement. The Regional Materials Engineer may allow the use of these aggregates in combination with high-alkali cements provided that pozzolans are substituted for cement in the following way:

TABLE 501-3A POZZOLAN SUBSTITUTIONS		
Concrete Class Specified	Substitute Cement by Mass With	Class Substitution Allowed
A, C, E, H	15-20% Class F Fly Ash (§711-10)	HP <sup>1</sup>
I, J	15-20% Class F Fly Ash (§711-10)	-
D	15-20% Class F Fly Ash (§711-10)	DP <sup>1</sup>
G <sup>2</sup> and GG <sup>2</sup>	20% Class F Fly Ash (§711-10)	-
F	No Substitution Allowed	-

- Notes: 1. Class HP and DP concrete may be substituted to mitigate ASR as listed above. Classes HP and DP require the replacement of portland cement with 20% pozzolan and 6% microsilica. The pozzolan may be either Class C or F Fly Ash (§711-10) or Ground Granulated Blast Furnace Slag (§711-12). 5
2. Classes G and GG require the replacement of portland cement with 20% pozzolan. The mitigation of ASR in Classes G and GG must be accomplished using Class F Fly Ash (§711-10).

Notify the Regional Materials Engineer prior to using pozzolan substitutions to mitigate ASR when using reactive aggregates in combination with a high alkali cement. 10  
Approval may be withdrawn when unsatisfactory results occur.”

**Page 5-11**

Line 6, under §501-3.01 Proportioning in Table 501-3 Concrete Mixtures., **delete** the 15 entire line and **replace** with “

C <sup>6</sup>	359	35.8	0.44	6.5 (5.0 – 8.0)	25 – 75	CA 2	Pavement: slipform paving, form paving
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Line 8, under §501-3.01 Proportioning in Table 501-3 Concrete Mixtures., **delete** the 20 slump range for Class DP concrete, “50-125” and **replace** with “75-125.”

Line 25, under §501-3.01 Proportioning in Table 501-3 Concrete Mixtures., Notes, after 25 line 25 add “6. Slump range for slipform paving is 25 – 65mm and for fixed form paving is 40 – 75 mm.”

**Page 5-14**

Lines 5 - 20, under §501-3.02 Handling, Measuring and Batching Materials., **delete** 25 table 501-4 “BATCHING TOLERANCES” in its entirety and **replace** it with the following.

**"TABLE 501-4  
BATCHING TOLERANCES**

Cement, Pozzolan, or Blended Cement	$\pm 1\%$ (by mass) of total cementitious materials, if no microsilica is weighed cumulatively on common scale. $\pm 0.5\%$ (by mass) of total cementitious materials, if microsilica powder is weighed cumulatively on a common scale.
Microsilica Powder	$\pm 0.5\%$ (by mass) of total cementitious materials, if weighed cumulatively with cement, Type IP or SM blend, or pozzolan.
	$\pm 1\%$ (by mass) if weighed on a separate scale.
Microsilica Slurry	$\pm 2\%$ (by volume)
Aggregate	$\pm 2\%$ (by mass)
Water (See Note 1)	$\pm 1\%$ (by mass or volume)
Admixtures 711-08	$\pm 3\%$ (by mass or volume) or $\pm 1$ meter pulse (see Note 3), whichever is greater.
Admixture (other)	contact Director, Materials Bureau
Zero - Aggregate (See Note 2)	$\pm 2\%$
Zero - Cementitious Mat'ls. (See Note 2)	$\pm 1\%$
Zero - Water (See Note 1, 2)	$\pm 1\%$

- Notes: 1: Tolerance applies to water added at central mix plants only.  
 2: Zero Tolerance is based on the minimum allowable batch size.  
 3. Based on the preprogrammed target quantity."

Make the following changes to the Standard Specifications of January 2, 2002.

Pages 5-59 to 5-73

Delete Section 555 in its entirety and **replace** it with the following.

5

### “SECTION 555 - STRUCTURAL CONCRETE

**555-1 DESCRIPTION.** This work shall consist of furnishing and placing portland cement concrete for structures as indicated in the contract documents and as directed by the Engineer.

#### 555-2 MATERIALS

**555-2.01 General.** The materials used for structural concrete shall comply with the material requirements of Section 501, *Portland Cement Concrete, General*.

Additional materials, listed below, required specifically for use in conjunction with structural concrete items shall meet the requirements of the following subsections:

Concrete Grout Material	701-05
Vertical and Overhead Patching Material	701-08
Rapid Hardening Concrete Repair Material	701-09
Preformed Cork Joint Filler	705-01
Preformed Rubber Joint Filler	705-03
Caulking Compound for Structures	705-06
Preformed Elastic Bridge Joint Sealer	705-09
Polyvinyl Chloride Extruded Shapes and Sheet Material	705-11
Lubricant for Preformed Elastic Joint Sealer	705-13
Bar Reinforcement, Grade 420	709-01
Wire Fabric for Concrete Reinforcement	709-02
Quilted Covers (for curing)	711-02
Plastic Coated Fiber Blankets (for curing)	711-03
Polyethylene Curing Cover (White Opaque)	711-04
Membrane Curing Compound	711-05
Burlap	711-06
Form Insulating Materials for Winter Concreting	711-07
Admixtures	711-08
Water	712-01
Asphalt Roofing Felt	712-12
Epoxy Resin System	721-01
Epoxy Polysulfide Grout	721-03
Copper Flashing	725-01
Sheet Gasket (treated both sides)	728-06
Concrete Cylinder Curing Box	735-01

**555-2.02 Concrete for Structures.** The class of concrete required for the various structural concrete items will be indicated in the contract documents. The same source of aggregates shall be used for all faces and surfaces of concrete exposed to view.

## 555-3 CONSTRUCTION DETAILS

**555-3.01 Concrete Manufacturing and Transportation.** Unless otherwise specified in the contract documents, the construction details for manufacturing and transporting concrete shall comply with §501-3, *Portland Cement Concrete - Construction Details*.

**555-3.02 Falsework.** Falsework plans shall be submitted by the Contractor and approved by the Engineer before falsework construction is started. Falsework or centering shall be designed for the dead load of the concrete forms, the dead load of the plastic concrete (based on 2400 kg per cubic meter) and a live load resulting from a mass of 245 kg per square meter applied to all horizontal surfaces.

Falsework which cannot be founded upon a solid footing, shall be supported by falsework piling.

Screw jacks or hardwood wedges may be required for falsework centering or to take up any slight settlement in the form work, either before or during the placing of concrete.

Falsework shall be set to give the finished structure the specified camber, plus allowance for shrinkage and settlement.

### 555-3.03 Forms.

**A. General.** All forms shall be well constructed, carefully aligned, substantial, and firm, securely braced, and fastened together in their final position. They shall be strong enough to prevent the fresh concrete from bulging the forms between supports and to withstand the action of mechanical vibrators. If required by the Engineer, form work plans shall be submitted by the Contractor and approved by the Engineer before forms can be used on the work.

Forms shall be designed to resist a dead load resulting from a mass of 2400 kg per cubic meter for the plastic concrete and a live load resulting from a mass of 245 kg per square meter on horizontal surfaces. The form and falsework design shall provide for the loads resulting from any conveyance system in addition to the live load.

When concrete is transported by buggies, conveyor belt, or other approved methods of conveyance, the forms shall be capable of supporting the distribution equipment and any concentrations of concrete which may occur during transportation and distribution. Buggy runways and other supporting platforms shall be supported directly by the forms.

Forms shall be adequately braced to resist concrete design loads. If the forms are inadequately braced concrete placement shall stop until adequate bracing has been provided.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the lumber. Forms shall be sufficiently tight to prevent leakage of mortar.

Forms may be constructed of wood, metal, or other approved materials, except when a particular material is specified in the contract documents. The use of fiber forms will be permitted for round columns only if the interior surface of the forms have been treated in such a manner as to prevent helical corrugation marks on the finished concrete surfaces. Forms shall be filleted 25 mm with forming material at all exposed corners to create a chamfer in the finished concrete unless otherwise shown in the contract documents.

When curved, patterned, or other special forms are required, the Contractor shall submit details of the form construction to the Engineer for approval prior to constructing the forms. Forms shall be so constructed that those surfaces on which finishing may be required may be stripped without disturbing the remaining forms. Premanufactured formliner panels, if used, shall be capable of imprinting the surface of the concrete with a uniform and aligned pattern and texture. The panels shall be composed of elastomeric urethane, polyvinyl chloride (PVC), ABS plastic, or other suitable material for their intended shape and number of reuses to achieve the desired effects. Formliners shall leave crisp, sharp definition of the architectural surface. Sufficient liners shall be used to minimize pattern repeat. Formliners shall not compress more than 6mm (¼ inch) when concrete is poured at a rate of 3 vertical meters per hour.

Any metal ties or anchorages within the forms shall be so constructed that the embedded portion of the ties can be removed to a depth of at least 50 mm from the surface of the concrete without damage to such surface. Wire ties shall not be used without written approval of the Engineer. In case wire ties are approved, all wires, upon removal of the forms, shall be cut back at least 6 mm from the face of the concrete with sharp chisels or nippers (nippers are necessary for green concrete). All cavities produced by the removal of metal ties shall be filled in conformance with requirements of §555-3.11, *Corrective Finishing*

For walls where access to the bottom of the forms is not practicable, the lower form boards or panels shall be left loose so that the inside of the forms can be readily cleaned of all chips, dirt, sawdust, or other extraneous material, immediately prior to the placing of concrete.

Forms to be reused shall be maintained in good condition as to accuracy of shape, strength, rigidity, watertightness, and smoothness of surface. Any warped or bulged forms must be carefully resized before being re-used. Forms that are unsatisfactory in any respect shall not be used. All form surfaces that will be in contact with the concrete shall be thoroughly treated with an approved form coating in the manner, and at the rate specified by the manufacturer. Only those coatings listed on the Approved List published by the Materials Bureau are acceptable. Forms so treated shall be protected against damage or dirt prior to placing concrete.

If metal forms are used, the material shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without damage to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Special care shall be exercised to keep metal forms free from rust, grease, or other foreign matter that would tend to discolor the concrete.

**B. Foundation Concrete.** The footings of structures shown in the contract documents shall be considered as approximate only, and when ordered in writing by the Deputy Chief Engineer (Structures), shall be changed to such dimensions as will give a satisfactory foundation. Concrete shall not be placed in any foundation form without the Engineer's approval.

#### **555-3.04 Handling and Placing Concrete.**

**A. Placement Limitations.** No concrete shall be placed when the ambient air temperature is below 7°C, unless the Engineer grants approval to a written proposal from the Contractor. No concrete shall be placed during rain.

When concrete is to be placed in contact with steel members, reinforcing steel, or previously placed concrete, the temperature of the steel and concrete shall be raised to approximately 7°C. The use of enclosures and heating equipment, including but not limited to the use of forced hot air, hot water boilers, and hoses, or other methods suitable to the Engineer, may be required before concreting begins.

When concrete is to be placed in contact with earth or rock, within piles, or for tremie placements, the temperature of the earth or rock shall be 2°C or higher. The earth or rock shall not have any snow, ice, frost, or standing water on its surface. The use of insulating materials and heating equipment may be required before concreting begins.

**B. Conveyance.** Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. All equipment used for conveying the concrete mix, from the point of delivery and material acceptance to the discharge point, shall be capable of meeting the permissible variations given in Table 555-1, Concrete Conveyance Uniformity. Prior to the actual placement of concrete, the Contractor shall demonstrate the capability of the equipment to convey the concrete mixture. Tests according to Department written instructions will be performed by, and at the discretion of the Engineer. No further verification of the equipment capability will be required unless evidence of nonuniform concrete is observed during placement.

When concrete pumps are used, the lines shall have a minimum diameter of 125 mm. The pumping operation shall be performed in such a manner as to discharge concrete horizontally a minimum distance of 1 m. Where horizontal discharge is not possible, the use of double 90-degree bends at the end of the pump hose, reducer hoses, or other equipment capable of maintaining a head of concrete in the pump line may be allowed, subject to the approval of the Director, Materials Bureau.

All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each use. Water used for flushing shall be discharged clear of the concrete already in place.

Concrete shall not come in contact with any aluminum during conveying and placing operations.

TABLE 555-1 CONCRETE CONVEYANCE UNIFORMITY		
Test		Permissible Variation (Concrete samples taken at two locations in the handling process)
Air Content, % by volume of Concrete		1.5%
Slump	Average slump 100 mm or less	25 mm
	Average slump greater than 100 mm	40 mm

**C. Acceptance/Testing.** The concrete mixture, prior to placement into the conveying equipment, shall meet the specified requirements for air content and slump given for the various classes and types of placement under Table 501-3, *Concrete Mixtures*.

**D. Placement.** All foreign matter of every kind shall be removed from the interior of the forms before placing concrete. Temporary studs or braces within the forms shall be removed when the concrete has reached an elevation rendering their further use unnecessary. Dropping concrete a distance of more than 1.5 m or depositing a large quantity at any point and running or working it along the forms shall not be permitted. Dropchutes shall be used between vertical forms unless conveyance equipment can be inserted between forms.

Special care shall be taken to fill each part of the form by depositing concrete directly into the form as near to its final position as possible, to work the coarser aggregates back from the face of the concrete and to force the concrete under and around the reinforcement without displacing the reinforcement. After the concrete has taken its initial set, care shall be exercised to avoid jarring the forms or placing any strain on the ends of the projecting reinforcement.

Concrete shall be placed in horizontal layers not more than 300 mm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and consolidated before the preceding layer has taken its initial set to prevent damage to the green concrete and avoid cold joints between batches. Each layer shall be consolidated using appropriate vibrating practices so as to avoid the formation of a joint with a preceding layer which has not taken initial set.

When concrete placement is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a depth sufficient to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smooth and level whenever concreting is discontinued. Where a "feather edge" would be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 150 mm in the succeeding layer. Work shall be continuous from the bottom to the top of any face.

When embedding structural shapes in concrete, the placement of concrete shall be progressed on one side of the shape only until it flushes up over the bottom flange of the shape on the opposite side, after which concrete shall be placed on both sides to completion.

**E. Vibration.** During and immediately after deposition, concrete shall be thoroughly consolidated by vibrating the concrete internally with mechanical vibrating equipment. The use of external vibrators will be permitted when satisfactory surfaces cannot be obtained by internal vibration alone or when it is impossible to use internal vibrators. The use of external vibrators shall be subject to the approval of the Engineer. External vibrators shall be attached to or held on the forms in such a manner as to effectively vibrate the concrete in a horizontal plane.

Internal mechanical vibrators shall be adequately powered, capable of transmitting vibration to the concrete in frequencies of not less than 5,000 vibrations per minute while inserted in concrete and shall produce a vibration of sufficient intensity to consolidate the concrete into place without separation of the ingredients. If any of the reinforcing steel has epoxy coating, an internal mechanical vibrator shall have a rubberized or elastomeric cover to prevent damage to the epoxy coating on the reinforcing bars. The vibrators and covers shall be inspected for defects prior to use.

A sufficient number of vibrators shall be employed, so that at the required rate of placement, thorough consolidation occurs throughout the entire volume of each layer of concrete. Extra vibrators shall be on hand for emergency use and when other vibrators are being serviced.

The vibrating element shall be vertically inserted in the concrete mass at a depth sufficient to vibrate the bottom of each layer effectively inserting the vibrator into the underlying lift. It shall be withdrawn completely from the concrete before being advanced to the next point of application.

Internal vibrators shall not be placed directly on the forms or the reinforcing steel. The vibratory element shall be inserted vertically into the concrete at the point of deposit and in areas of plastic concrete at evenly spaced intervals not farther apart than the radius over which the vibration is visibly effective and at a distance close enough to the forms to effectively vibrate the surface concrete. The time of vibration shall be of sufficient duration to accomplish thorough consolidation, complete embedment of the reinforcement, produce dense, smooth surfaces free from aggregate pockets, honeycombing, and air bubbles and to work the concrete into all angles and corners of the forms however, over-vibration shall be avoided. Vibration shall be continued in one place until the concrete has become uniformly plastic, but not to the extent that pools of grout are formed.

Vibration shall be supplemented by working or spading by hand in the corners and angles of forms and along form surfaces while the concrete is plastic. Vibrators shall not be used to push or distribute the concrete laterally.

### **555-3.05 Depositing Structural Concrete Under Water.**

**A. General.** Use a tremie tube, pipeline, or similar method to place concrete under 0°- 32°C water in one continuous operation. Since the tremie tube and the pipeline are both tubes, the word "tube" in this specification refers to either type, except where specific reference is made to either the tremie tube or the pipeline.

Unless noted differently on the plans, use Class G concrete as described in Table 501-3, Concrete Mixtures. Substitute Class GG Concrete when clear openings between closely spaced objects such as reinforcement bars are less than 75 mm. Pozzolan replacement may be omitted for small placements in a fresh water environment when approved by the D.C.E.S.

In addition to §555-3.03 Forms, place concrete on prepared areas cleaned of all debris, mud, or other unsuitable material.

Submit a list of equipment, including back-up, and a schedule for transporting and placing concrete, to the Engineer for review at least 20 working days prior to concrete placement. The Contractor shall be responsible to design a tremie placement, with appropriate forming, that maintains a minimum vertical rise of 0.3 meters per hour for the overall area and a minimum

placement rate of 30 cubic meters per hour, unless fluid concrete pressure requires a reduced placement rate.

Place fresh concrete before stiffening and initial set of the adjacent concrete to ensure a good bond and avoid cold joints. If a delay occurs, determine stiffening and initial set by probes or other methods approved by the Engineer. Stop the operation if the placement cannot be continued before initial set of the adjacent concrete. The Engineer will then immediately contact the D.C.E.S.

**B. Methods of Placement.** The tremie tube and pump and pipeline are the most common methods. Obtain approval of the D.C.E.S. for any other method.

**1. Tremie Tube Method (Open System).** – This method uses a vertical tube open at the top, where concrete is delivered to the top and falls down the tube.

a. Tremie tube size shall be based on the delivery system used by the Contractor.

<u>Delivery System</u>	<u>Inside Diameter</u>
Large volume, such as crane and bucket	250 mm minimum
Small volume, such as pump line or conveyor	125 mm minimum

b. Use a sturdy hopper or funnel with a bottom opening smaller than the tremie tube diameter to transfer concrete into the tremie tube. The capacity and shape of the hopper or funnel depends on the volume and type of concrete delivery system. A device with the same size bottom opening may be used if a 40 to 50 mm diameter breather tube is installed to reach 0.3 meters or more down into the tremie tube.

c. Install a safe work platform at the top of the tremie tube.

**2. Pump and Pipeline Method (Closed System)** – This method uses a vertical tube, attached to a closed tube system, where concrete is pumped to the top and falls down the tube.

a. Use pipe with a minimum inside diameter of 125 mm.

b. Install a minimum 50 mm diameter air vent or valve connection, or leave the pipe joint loose without a gasket, near the high point of the downgrade, 0.3 - 1.3 meters below the point where concrete starts falling down the pipe, to allow air displaced by concrete to escape, and admit air to prevent a siphoning effect.

c. Class G concrete, the mix noted on the plans, or a "cement-water" grout may be used for pipeline lubrication and placed in the forms. Waste any other concrete mix used to lubricate pipeline.

**C. Placement Tubes for Tremie Tube or Pump and Pipeline Method.** Clearly mark each tube in at least 0.5 meter increments (numbered every 2 meters) to show depth to the outlet. Use watertight joints. Place tubes no more than 5 meters from the forms and no more than 10 meters on center.

**1. Open end tubes** - Install a separate tube at each placement point, as loss of seal occurs when the embedded end of this tube type is removed from fresh concrete under water. Once started, do not relocate or remove open end tubes until completion of the concrete placement at that location. If loss of seal occurs, remove and seal the tube with a watertight plate or plug for restarting. Restart tremie placement only if a seal can be reestablished using a dewatered tube where the outlet can be surrounded by fresh concrete.

**2. End-valve sealed tubes** - Install the number of tubes based on the minimum placement rate defined in A. General, as the seal is maintained when the embedded end of this type is removed from fresh concrete under water. Raise the end of the tube to about 1 meter below the fresh concrete surface. Then, close the valve with the tube ½ full of concrete (½ the water depth), and slowly remove the tube. Reverse this procedure upon relocation in fresh concrete.

**D. Dewatering.** When necessary, proceed with dewatering at least 4 days after completion of concrete placement, unless noted differently on the Contract Plans or as ordered by the Engineer. After dewatering, continue curing and excavate one or more sumps to provide for pumping of accumulated water. Excavate sumps outside of areas which will receive new concrete, or as approved by the Engineer.

**E. Concrete Evaluation.**

**1. Nondestructive Testing.** Use as directed by the Contract, or as approved by the D.C.E.S.

**2. Cores.** Obtain cores in the presence of the Engineer at locations and to depths shown on the contract plans. Take NX size (nominal 54 mm) cores, no earlier than 7 days after concrete placement, according to §648-3.04, Rock Core Samples, B. Sampling, the 1<sup>st</sup> sentence. Use drill bits meeting the requirements of Section 732-06, Coring Bits.

Obtain 100% recovery from each core hole, as less is presumed to indicate defective concrete. Use a 1.5 meter nominal length of core drill run. Record core boring log data in accordance with §648-3.01B, Driller's Logs.

Label and pack all cores according to §648-3.04 C, Marking, Packaging and Transporting Samples. Deliver and store the core boxes at a site approved by the Engineer, where they become the property of the Department. Provide assistance in moving and arranging core boxes at the site to facilitate evaluation by the Department.

**F. Defects.** Obtain additional cores for further investigation from areas which contain voids, honeycombing, seams, or other defects. The D.C.E.S. will determine the number and location of additional core holes. Repair defects with grout when approved by the D.C.E.S. Placements with defects determined to be unrepairable by grouting will be rejected. Alternate repair techniques require D.C.E.S. approval.

**G. Grout Repairs and Grout Placements.** This section only applies for underwater grout placements limited to quickly filled areas, such as core drill holes, small piles up to 0.3 meters in diameter, and other small voids. Use materials meeting §701-05, Concrete Grout Material, for the grout proportioned as specified or as approved by the D.C.E.S.

When the D.C.E.S. grants approval for repairs, the proposed grouting method shall be performed by cleaning out and filling all defects and core drill holes with grout. Position a grout tube (50 mm or less in diameter) about 25 mm off the bottom of the prepared hole until the grouting operation is complete. Start pumping (closed system) or filling a tremie tube (open system) faster than the grout can fall through water. Continue placing grout until the grout coming back out the hole is the same consistency as that going in. Then withdraw the tube.

Additional cores may be required to verify acceptable repairs.

**H. Tremie Construction Joints.** Prepare the top area of the placement receiving new concrete to within 75 mm of the elevation shown on the plans. When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface, and all porous surfaces to be in contact with new concrete shall be thoroughly wet using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc. to maintain moisture. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces

from drying, so the existing concrete remains in a clean, saturated, surface-dry condition until placement of the new concrete.

Fill any low areas with a leveling course of Class A concrete (or Class D for 35 to 125 mm thick placements).

Fill sumps with concrete or stone, as ordered by the Engineer.

### 555-3.06 Concrete Joints.

**A. Construction Joints.** Construction joints for the purpose of these specifications are joints used to provide for interruptions in the placement of concrete. Construction joints shall be placed only where shown in the contract documents or where approved by the Deputy Chief Engineer (Structures). Bulkheads required during placement shall be constructed at the direction of the EIC.

Unless otherwise shown in the contract documents, a shear key shall be provided at each construction joint by embedding water-saturated wooden blocks in the plastic concrete. The shear key thus provided shall be approximately  $\frac{1}{3}$  of the width of the parts joined. The key depth shall equal the thickness of standard form lumber, approximately  $\frac{1}{2}$  the key width. Shear keys need not exceed 140 mm in depth regardless of the key width.

On steel truss or open-spandrel, concrete arch spans, unless otherwise noted in the contract documents, the concrete in the floor system shall be placed about the center line of the span, beginning at the center and working simultaneously toward each end; or beginning at the ends, and working simultaneously toward the center. Care shall be taken to prevent the displacement of reinforcement during the placing of concrete. If, for any reason, it becomes necessary to introduce a construction joint, this shall be formed by means of a vertical bulkhead so constructed as to produce a key joint, placed as shown in the contract documents or as permitted by the Deputy Chief Engineer (Structures).

When joining fresh concrete to concrete that has already set, the concrete in place shall have its surface scoured or abraded with a suitable tool to remove all loose and foreign materials. After the surface preparation, the concrete surface and all porous surfaces to be in contact with new concrete shall be thoroughly wetted, to achieve a saturated surface dry condition, using potable water for 12 hours with soaker hoses or the use of burlap/burlene/etc., to maintain moisture. If conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. The Contractor shall remove any puddles of free-standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface-dry condition until placement of the new concrete. Immediately before placing the new concrete, the forms shall be drawn tightly against the concrete already in place.

Forms for female shear keys shall be beveled on four sides to facilitate their removal and shall be securely fastened to the forms to prevent displacement before the concrete has set. Key forms shall be removed in such a manner as to avoid damage to the concrete.

**B. Contraction Joints.** Contraction joints shall be placed at locations shown in the contract documents and unless otherwise specified, shall be formed the same as construction joints, except that reinforcement shall not extend through the joint.

**C. Expansion Joints.** Expansion joints shall be placed as shown in the contract documents. Expansion joints shall provide for expansion, contraction, and the transfer of shear at the joint, unless otherwise specified. When expansion joints are formed by the insertion and subsequent removal of joint templates, this work shall be done in such a manner that joint edges are not chipped or broken down in the process.

When concrete is to be placed against a joint filler, holes or joints in the filler shall be suitably filled with mastic to prevent mortar or concrete from entering the joint and restricting its movement. The face edges of all joints shall be carefully finished or formed true to line and elevation for a minimum distance of 50 mm back from all exposed surfaces.

When caulking compound is used to seal a joint containing premolded bituminous joint filler, a layer of an approved type of pressure-sensitive release tape shall be placed between these materials due to their incompatibility.

**D. Waterstops.** Waterstops shall be installed in joints to provide for expansion and contraction movements at joints. Place waterstop at all joints exposed to view, as shown in the contract documents, or as ordered by the Engineer. Waterstop shall be a polyvinyl chloride or other approved flexible material, copper strip, zinc strip or lead sheet. The waterstop shall extend at least 75 mm into the concrete on each side of the joint, shall be joined to be continuous and watertight, and shall be carefully protected from damage until covered by concrete or backfill.

### 555-3.07 Finishing.

**A. General.** All exposed unformed surfaces, whether permanent or at construction joints, shall be finished by placing an excess of material in the forms and striking off the excess with a suitable float, forcing the coarse aggregate below the level of the finished surface, and troweled to a suitable finish. The use of mortar topping for surfaces shall not be permitted.

Following the discontinuance of placing concrete, all accumulation of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the plastic concrete.

**B. Bearing Surfaces.** The entire surface area of bridge seats or pedestals shall be floated and troweled to true grade or, at the option of the Contractor, left approximately 6 mm high and bush hammered or otherwise finished to the exact elevations indicated in the contract documents.

### 555-3.08 Curing.

**A. General.** All structural concrete shall be cured for a minimum of seven curing days unless otherwise stated. The curing period shall begin only after all curing procedures and practices for a given placement are established. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C.

An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

**1. Continuously Recording Thermometer.** The thermometer shall be capable of continuously recording temperatures within a range of -20°C to 50°C for a minimum of 24 hours.

**2. Maximum - Minimum Recording Thermometer.** For all placements, the thermometer shall be capable of recording maximum and minimum temperatures within a range of -20°C to 50°C.

Provide all equipment, supplies, and labor necessary for calibration.

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between 7°C and 30°C inclusive.

All structural concrete surfaces must be cured by any one, or a combination of, the following methods unless otherwise noted:

- Polyethylene curing covers - white opaque.
- Plastic coated fiber blankets.
- Clear (fugitive dye) membrane curing compound.
- Continuous burlap wetting.
- Wet burlap and curing covers.
- Forms left in place

Curing shall commence on all exposed surfaces no later than 30 minutes after completion of finishing. Finishing and curing operations shall progress with concrete placement.

Curing covers shall be placed as soon after concrete finishing as the Engineer determines will not cause damage to the concrete surface. However, under no circumstances shall the curing be delayed beyond 30 minutes of the completion of finishing. Care shall be taken so as not to damage the finished surface or texturing. Curing covers shall be lapped a minimum of 300 mm. All lapped edges shall be sealed with pressure sensitive tape. Covers shall be protected from displacement.

Clear (fugitive dye) membrane curing compound shall be sprayed on the concrete surface immediately following the finishing operation, or form removal, whichever is applicable. The compound shall be applied by means of a pressure spraying system, or by distributing equipment, at a minimum rate of 0.285 L per m<sup>2</sup> of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide for adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the application method produce a nonuniform film, or should the spraying equipment fail and back-up equipment is not immediately available, the application shall cease. Curing shall then be continued by another acceptable method. The Contractor shall provide sufficient approved covers for protection of the concrete surface in the event of rain or equipment breakdown.

If forms are removed during the curing period (refer to §555-3.09), the concrete curing shall be continued using a clear (fugitive dye) membrane curing compound applied immediately after form removal.

**B. Provisions for Curing in Hot Weather.** When forms are left in place in extremely hot weather the forms shall require wetting to reduce surface heat.

If the ambient air temperature exceeds 30°C, continuous, uniform wetting for curing shall be required until the seven (7) day curing period is complete and forms are removed. Use of plastic sheeting over the established curing is not allowed in hot weather conditions.

**C. Provisions for Curing in Cold Weather.** If the ambient air temperature falls, or is expected to fall, below 7°C, the requirements of Table 555-2 shall apply.

TABLE 555-2 COLD WEATHER CURING REQUIREMENTS	
Ambient Temperature (AT) at time of concrete placement and as anticipated during curing duration	Curing requirements
0°C < AT < 7°C for less than 24 consecutive hours	Contractor proposed/Engineer approved method for maintaining temperatures used
0°C < AT < 7°C for more than 24 consecutive hours	Heated enclosure required
AT ≤ 0°C	Heated enclosure required

Prior to use, all proposed methods must meet the approval of the Engineer. If the curing temperature falls below 0°C at any time during the curing period, the concrete will be rejected.

To provide assurance of the curing temperatures, the Contractor shall supply maximum-minimum thermometers. Temperature measurements will be taken by the Engineer and a record will be maintained for the curing period. As a minimum, thermometers shall be placed adjacent to forms at the bottom, middle, and top of a placement. Additional thermometers may be placed in areas where extreme cold or heat, from external sources, can be expected.

If the existing method employed by the Contractor to maintain the curing temperature fails, the Contractor shall modify the existing method immediately to reestablish an acceptable curing temperature. The length of the curing period will be extended until the required number of curing days are accumulated.

**1. General.** When approval is granted in writing by the Engineer for cold-weather concreting, the curing temperature shall be maintained between 7°C and 30°C for the curing durations stated by provision of external heat or utilization of heat of hydration retained by insulated forms.

**2. Provision of External Heat.** If the Contractor is required, or elects, to maintain curing temperatures by this method, the Contractor shall furnish sufficient canvas and framework, or other type of housing, to enclose and protect the structure in such a way that the air surrounding the fresh concrete on all sides be kept at a temperature between 7°C and 30°C for the specified curing period. At the end of the curing period, the heat shall be gradually reduced at a rate not to exceed 0.5 degree C per hour until the temperature within the enclosure equals the temperature outside the enclosure. Materials and equipment necessary to erect the enclosure and provide external heat shall be present on the job site and approved by the Engineer before any concrete is placed.

External heat shall be provided by means of stoves, salamanders, heated hoses, steam equipment, warmed curing water, or other equipment supplied by, operated by the Contractor. Heating appliances shall not be placed in such a manner as to endanger formwork, centering, or expose any area of concrete to drying out or damage due to excessive temperatures. Sufficient equipment shall be supplied to continuously maintain the specified temperature with a reasonable degree of uniformity in all parts of the enclosure. The enclosures shall be properly vented to prevent surface disintegration of fresh concrete due to an accumulation of carbon dioxide gas. All exposed concrete surfaces within the heated area shall be protected from drying by one of the following methods:

- Use of live steam.

- Continuous wet burlap or wet burlap used with curing covers.
- Curing compounds used with curing covers.

**3. Heat Retention by Insulated Forms.** Insulated forms may be used to maintain acceptable curing temperatures in accordance with the provisions of Table 555-2, when ambient temperatures will not drop below 0°C. If the Contractor elects to maintain curing temperatures by this method, sufficient insulation shall be furnished to protect and maintain the temperature between the insulation and formwork within the range of 7°C to 30°C for the specified curing period. Discontinuance of protection shall be accomplished in such a manner that the drop in temperature of any portion of the concrete shall be gradual. The surface temperature of concrete sections more than 600 mm in thickness shall not drop faster than 10°C in a 24-hour period. The surface temperature of concrete sections less than 600 mm in thickness shall not drop faster than 20°C in a 24 hour period.

Forms may be removed without restriction, providing the temperature difference between the air and the surface of the concrete is not more than 15°C. If possible, forms shall be removed about the middle of the day to take advantage of the generally higher afternoon temperatures.

Form insulating material shall be installed on the forms in such a manner so as to achieve the full benefit of its insulating properties and at the same time provide against the infiltration of wind and water. All portions of steel forms shall be covered by insulating material so that no steel is exposed to the air. Any tears or damaged areas in the insulating material shall be repaired. Special attention shall be given to ensure that all corners and angles are properly insulated and protected against wind damage.

Where tie rods extend through the form insulating material, a plywood washer (20 mm x 150 mm x 150 mm approx.) shall be placed over the tie rod and secured against the insulating material.

After placement of the concrete, the exposed concrete surfaces shall be covered with insulating blankets, except for areas where protruding reinforcing bars make the use of blankets impracticable. These areas may be covered with hay or other approved insulating material. Tarpaulins shall be used to protect the insulating material.

The insulating material shall be insulating blankets, bat insulation, solid foam, or sprayed foam meeting the requirements of §711-07, *Form Insulating Materials for Winter Concreting*. The thickness of standard blankets, or bat insulation, required for varying air temperatures, concrete thicknesses, and cement contents of the mix are listed in Table 555-3. The thickness of the insulating material used shall be determined by multiplying the equivalency factor for the insulating material by the thickness shown on Table 555-3. The equivalency factors for all approved insulating materials are given in the Department's Approved List, *Insulating Materials for Winter Concrete* (§711-07).

**TABLE 555-3 INSULATION REQUIREMENTS FOR CONCRETE WALLS,  
PIERS AND ABUTMENTS ABOVE GROUND**

Minimum air temperature allowable - Concrete Placed at 10°C				
Wall Thickness mm	Thicknesses of Commercial blanket or bat insulation - Deg. C.			
	13 mm	25 mm	40 mm	50mm
<u>Portland Cement Content - 300 kg/m<sup>3</sup></u>				
150	7	2	-5	-10
300	2	-9	-27	-32
450	-3	-19	-36	-54
600	-5	-23	-45	
900	-8	-29		
1200	-8	-30		
1500	-9	-32		
<u>Portland Cement Content - 360 kg/m<sup>3</sup></u>				
150	7	0	9	-14
300	0	-13	-27	-40
450	-6	-26	-46	-67
600	-8	-30		
900	-11	-37		
1200	-12	-39		
1500	-12	-40		
<u>Portland Cement Content - 415 kg/m<sup>3</sup></u>				
150	6	-2	-12	-18
300	-2	-17	-33	-49
450	-9	-32	-56	
600	-11	-36		
900	-14	-44		
1200	-15			
1500	-16			

Notes: This table is based upon the stated thickness of blanket, or bat-type insulation, having a thermal conductivity (K value) of 0.036 [W/m-K].

When using concrete containing pozzolans, do not consider the pozzolans as part of the cement content. Use the values given for a portland cement content that are equal to or less than the actual cement content of the mix, due to a lower heat of hydration when using pozzolans.

**555-3.09 Form Removal.** Forms shall be removed in such a way as to permit the concrete to take the stresses uniformly and gradually. Any method of form removal likely to cause overstressing of the concrete shall not be used.

The forms for any portion of a structure shall not be removed until the concrete is strong enough to resist damage. The earliest time of form removal shall be as specified in Table 555-4, *Minimum Time for Form Removal - Substructures*. If the form removal causes damage, the operation must stop immediately until such time that sufficient concrete strength is achieved. All damage shall be repaired in conformance with §555-3.13, *Damaged or Defective Concrete*.

**555-3.10 Loading Limitations.** Forms used for substructure concrete placements shall be removed in accordance with the requirements of Table 555-4, *Minimum Time for Form Removal - Substructures*. The minimum times for loading in this table are **NOT** applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.

<b>TABLE 555-4</b>			
<b>MINIMUM TIME FOR FORM REMOVAL/FORMING/LOADING LIMITATIONS –</b>			
<b>SUBSTRUCTURES (note <sup>1</sup>)</b>			
<b>SUBSTRUCTURE PIECE</b>	<b>STRIPPING (note <sup>2</sup>)</b>	<b>FORMING NEXT PLACEMENT</b>	<b>LOADING</b>
All Footings	2 days	2 days	4 days before next placement
Abutment stems, backwalls	2 days if less than 3.0 m (avg.). Add 1 day for each additional 1.5 m to 5 days, maximum.	2 days	5 days before placing backwall on stem. 7 days before backfilling, 14 days before placing superstructure loads. (note <sup>3</sup> )
Pier Columns, Pier Plinths	2 days if less than 3.0 m high (avg.). Add 1 day for each additional 1.5 m.	4 days - columns  2 days if forming pedestal	Columns - 7 days before placing cap beam. Plinth- 2 days before pedestal placement. 21 days before placing superstructure loads. (note <sup>3</sup> )
Pier cap beams	8 days (bottom) 3 days (sides)	2 days	5 days before pedestal placement. 21 days before placing superstructure loads. (note <sup>3</sup> )
All pedestals	2 days	—	7 days (class A) 3 days (class F) (note <sup>4</sup> )
Wingwalls or Retaining walls	Same as abutment stems.	—	14 days before backfilling (note <sup>3</sup> )
Arch centers Centering under beams	8 days	—	14 day (see note <sup>3</sup> )

**NOTES:**

1 The minimum times for loading in this table are **NOT** applicable when using concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when ambient temperatures are 16°C or less. The provisions in Note 3 are required for casting, curing, and testing of compressive strength cylinders for concrete that contains fly ash or ground, granulated blast furnace slag that is placed and/or cured when the ambient temperature is 16°C or less. The compressive strength results will be the basis of determining when loading can occur.

2 All concrete shall be cured for a minimum of seven curing days. A “Day” is a curing day as defined in Section 555-3.08A. Concrete surfaces being cured using forms, covers, or blankets from which the covers are removed for any purpose prior to the full cure period shall be sprayed with an approved clear (fugitive dye) curing compound within ten minutes of cover removal.

3 When early loading is requested, the minimum time requirements for loading may be reduced (or extended) based on test cylinder compressive strength results. The D.C.E.S. will establish requirements for early loading upon request. The Contractor shall notify the Engineer, in writing, at least 10 days prior to placement, that early loading is being requested, so that arrangements for test cylinders can be made. Test cylinders shall be prepared in accordance with Materials Method 9.2 - Field Inspection of Portland Cement Concrete. Two test cylinders shall be prepared for each anticipated testing period. These cylinders shall be cured in the same manner as the substructure element which they represent. After the first compression test, the Engineer shall determine subsequent testing periods based on the results of the first test. No more than three tests for each substructure element shall be allowed.

4 Minimum time for loading pedestals shall not compromise minimum loading times specified for other placements.

**555-3.11 Corrective Finishing.** Immediately after forms have been removed, surfaces exposed to view shall have all projections and irregularities carefully removed and all cavities greater than 25 mm in diameter and/or 6 mm in depth neatly filled with mortar of the proportion used in the concrete. The same brand of cement and the same kind of aggregate shall be used for filling cavities as was used in the original concrete mix. Plastering of surfaces shall not be allowed. The surface film (drying cement paste) of all such repaired surfaces shall be carefully removed before setting occurs.

All rust and other stains shall be removed from concrete exposed to view. Removal shall be accomplished using methods and materials approved by the Engineer. Materials used for rust stain removal shall be as listed on the Approved List published by the Department's Materials Bureau.

**555-3.12 Weep Holes.** The Contractor shall construct weep holes in all retaining walls and abutments as indicated in the contract documents.

**555-3.13 Damaged or Defective Concrete.** All defects or damaged to concrete which occurs prior to the final acceptance of the work shall be repaired or replaced at no additional expense to the State. The defects shall include but are not limited to spalling and irregular cracking at joints, edge spalls, honeycombing, and damage or other imperfections caused by traffic and/or construction operations. Any concrete requiring complete replacement shall be replaced in kind as concrete originally called for in the contract documents. Any repairs shall be performed to the methods described in these specifications unless otherwise approved by the Engineer. When a repair is made, the defective or damaged concrete shall be removed by saw cutting the perimeter to a depth of 40 mm, chipping the unsuitable material to sound concrete with light, hand held, pneumatic tools at a 45 degree angle into the patch area, and cleaning all exposed reinforcing and concrete surfaces. All surfaces to be repaired shall be thoroughly blast cleaned. Prior to placing repair concrete, all surfaces shall be wetted to a saturated surface dry condition.

Small spalls of  $0.1 \text{ m}^3$  or less, and areas of  $0.25 \text{ m}^2$  or less where concrete removal is required may be repaired using approved Concrete repair materials. Vertical or overhead surfaces may be patched with Vertical and Overhead Patching Material. Surface preparation for small repairs shall be according to the material manufacturer's recommendations. After repair is complete, and curing time has elapsed, the Engineer will hammer sound all repair areas to assure proper bond has been achieved.

Concrete with surfaces misshapen by bulges or deformations caused by inadequate forms, or resulting in insufficient cover of reinforcing, shall be removed or corrected.

#### **555-4 METHOD OF MEASUREMENT**

**555-4.01 Concrete for Structures.** The work will be measured for payment as the number of cubic meters of concrete for structures satisfactorily placed, measured to the nearest 0.1 cubic meters within the lines of the structure as shown in the contract documents. No deductions shall be made for the volume of joint material, embedded metal reinforcement, structural shapes, chamfers, tops of piles, or pipe with an end area of less than  $0.1 \text{ m}^2$ .

## 555-5 BASIS OF PAYMENT

**555-5.01 General.** When the Contractor elects to substitute an optional concrete class as permitted by Table 501-1, Concrete Class Options, payment will be made for the originally specified class of concrete using the originally specified method of measurement.

**555-5.02 Concrete for Structures.** The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except reinforcement will be paid for separately under its appropriate item. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing flashing or other metal strips, flexible water stops, sheet packing, pipe drains, bituminous material, water for wetting, joint materials, felt, tar paper, joint sealing compounds, joint fillers, and concrete curing materials.

No extra compensation for falsework or falsework piling will be paid. This work is included as part of the formwork.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Bridge bearings, expansion joints, and anchor bolts will be paid for under their appropriate items.

Progress payments will be made, after the concrete and curing applications have been properly placed, to the extent that payment will be made at 90% of the computed quantity of each concrete placement, with the balance to be paid after completion of all curing and corrective work thereon.

### ***Payment will be made under:***

<b>Item No</b>	<b>Item</b>	<b>Pay Unit</b>
555.0104 M	Footing Concrete, Class A (No Concrete Class Substitutions Permitted, Except Class H Where Footing is 1 m Thick or Less)	Cubic Meter
555.0105 M	Concrete for Structures, Class A	Cubic Meter
555.05 M	Concrete for Structures, Class F	Cubic Meter
555.06 M	Concrete for Structures, Class G (Deposited Under Water)	Cubic Meter
555.07 M	Concrete for Structures, Class GG (Deposited Under Water)	Cubic Meter
555.08 M	Footing Concrete, Class HP	Cubic Meter
555.09 M	Concrete for Structures, Class HP	Cubic Meter
555.10 M	Concrete for Structures, Class D	Cubic Meter
555.11 M	Concrete for Structures, Class DP	Cubic Meter

Make the following changes to the Standard Specifications of January 2, 2002.

Pages 5-78 to 5-87

Delete Section 557 in its entirety and *replace* it with the following:

**“SECTION 557 - SUPERSTRUCTURE SLABS, SIDEWALKS ON BRIDGES,  
AND STRUCTURAL APPROACH SLABS**

**557-1 DESCRIPTION.** The work shall consist of placing high performance (Class HP) concrete to construct superstructure slabs, sidewalks, safety walks, and structural approach slabs, as required by the contract documents.

**557-2 MATERIALS**

**557-2.01 General.** The materials used for superstructure slabs, sidewalks on bridges, and structural approach slabs shall meet the material requirements of the following subsections:

Structural concrete materials	555-2.01
Reinforcing steel	556-2
Prestressed concrete form units	718-05
Permanent Corrugated Metal Forms for Bridge Slabs	736-01

**557-2.02 Concrete.** This shall meet the material requirements for Class HP in accordance with §501. Unless otherwise directed by the Engineer, all concrete shall contain a water-reducing and retarding admixture, meeting the requirements of §711-08. The quantity of the admixture shall be sufficient to achieve the minimum retardation consistent with placing conditions to keep the entire placement plastic (either one continuous placement or all sections of a sequence placement). The dosage rate used shall be determined by the Contractor in accordance with the manufacturer’s recommendation and in concurrence with the Regional Materials Engineer. The dosage shall remain consistent for the duration of the concrete placement except for minor adjustments to meet changing environmental conditions.

**557-3 CONSTRUCTION DETAILS**

**557-3.01 Concrete Manufacturing and Transportation.** The requirements of §501-3 shall apply.

**557-3.02 Falsework.** The requirements of §555-3.02 shall apply.

**557-3.03 Forms.** Unless otherwise noted the contractor may use any of the following forming systems to form the underside of the superstructure slabs:

**A. Removable Forms.** The requirements of §555-3.03A shall apply.

**B. Permanent Corrugated Metal Forms for Superstructure Slabs.** Where permanent metal forms are employed, the following construction procedures shall apply.

Care and protection shall be given the metal form sheets, supports, and accessory items during handling, shipping, and storage. During loading, hoisting, and unloading operations, extra precaution and care shall be taken to prevent damage to ends, corners, and edges of the form sheets, supports, and accessory items. If the form units and accessories are to be stored prior to installation, they shall

not be placed in contact with the ground and the material shall be adequately covered or protected to keep it dry.

Form supports shall be placed in direct contact with the flange of a stringer or floor beam. All attachments shall be made by permissible welds, bolts, clips, or other approved means. The welding of form supports to steel not considered weldable or to portions of flanges subject to tensile stresses shall not be permitted. Welding shall be in accordance with the provisions of the New York State Steel Construction Manual (SCM) except that 3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the SCM.

Form sheets shall not be permitted to rest directly on the flanges. They shall be securely fastened to form supports by self-tapping screws and shall have a minimum bearing length of 25 mm at each end. Transverse construction joints shall be located at the bottom of a flute and 6 mm weep holes shall be field drilled at not less than 300 mm on centers along the line of the joint.

Screed rail and pouring runway supports shall not be located directly on the form sheets, form supports, or reinforcing steel. No loose sheets or miscellaneous hardware shall be left on the structural slab at the end of the work day. Metal forms shall not be used where longitudinal slab construction joints are located between stringers, nor shall they be used on the fascia overhang.

The corrugated metal sheets shall be fabricated for the placement sequence used with the joints between sections of sheet overlapped or securely fastened to eliminate differential deflections between sections. Any exposed form metal where galvanizing has been damaged, shall be cleaned and repaired as provided for in §719-01, *Galvanized Coatings and Repair Methods*.

**C. Prestressed Concrete Form Units.** The applicable requirements of §555-3.03A and the Prestressed Concrete Construction Manual shall apply.

Form supports shall be placed in direct contact with the flange of the stringer. All attachments shall be made by permissible welds, bolts, or other means approved by the Engineer. The welding of form supports to steel not considered weldable, or to portions of flanges subject to tensile stresses will not be permitted. Welds and welding shall be in accordance with those portions of the SCM concerned with fillet weld design, fillet weld details, general workmanship and technique, except that 3 mm fillet welds will be permitted. All welding shall be performed by a welder certified under the SCM.

**D. Restrictions.** The following restrictions shall apply to all forms.

1. Fascia overhangs shall be formed with removable forms to provide a flat concrete surface.
2. A bay, constructed in stages such that a longitudinal joint is required, shall only be formed with removable forms.
3. A haunch which rests upon an end diaphragm shall only be formed with removable or permanent corrugated metal forms.
4. Prestressed concrete form units shall not be used where the design span is less than 1.5 meters nor greater than 3.3 meters. The design span is equal to the beam spacing minus one-half the top flange width.
5. Prestressed concrete form units may be restricted at the ends of some skewed spans. Refer to the contract documents for details.

6. Prestressed concrete form units shall not be used on prestressed concrete box beam superstructures unless specifically allowed by the contract documents.

**557-3.04 Placing and Fastening Reinforcing Steel.** Immediately prior to placement of concrete, the Engineer will verify that the reinforcing steel is positioned within required tolerances. If the allowable tolerances are exceeded, the Contractor shall correct the position of the reinforcing steel before placing concrete. All reinforcing steel and chairs shall be anchored to prevent uplift.

**A. Permanent Corrugated Metal Forms or Removable Forms.** Except for prestressed concrete form units the requirements of §556-3.01 and §556-3.03 shall apply.

**B. Prestressed Concrete Form Units.** The requirements of §556-3.01 and §556-3.03 shall apply. The top reinforcing steel mat shall be securely connected to the forms and the stud shear connectors. Connections shall be placed no farther apart than 1.2 meters on center. Connections to the forms may be made to the form-lifting devices, reinforcing steel projecting from the forms, or devices in the form supplied for this purpose. Hold-down devices shot into the form will not be permitted. Connections shall neither deflect the reinforcing steel nor interfere with the smooth flow of concrete.

**557-3.05 Handling and Placing Concrete.** The requirements of §555- 3.04 *Handling and Placing Concrete* shall apply. A Preplacement Meeting is required to be held at least one week prior to the start of any concrete placement for superstructure slabs. Meeting participants besides the Contractor and Engineer should include materials suppliers, subcontractors, Regional Materials Engineer, Regional Safety Officer, and others as deemed appropriate. Participants will review all aspects of the proposed placement including, but not limited to, the following:

- Equipment proposed for use and for backup.
- Planned workforce, assigned tasks of each designated position, and experience and expertise.
- Proposed construction techniques and crew experience.
- Safety considerations.
- Concrete mix design.
- Admixtures and technical data; dosage rates will be approved by the Regional Materials Engineer.
- Proposed placement rate, curing and loading schedules.
- Curing practices to be employed as well as the workforce designated to the curing process.
- Delivery/conveyance equipment, including deck finishing machine setup and operation.
- Traffic control.

For placements between September 15<sup>th</sup> and April 1<sup>st</sup> :

- Expected environmental conditions at time of placement and during curing
- Proposed curing methods to maintain acceptable curing temperature
- Engineers permission to progress cold-weather concreting

No concrete shall be placed until all aspects of the proposed placement are approved by the Engineer. A written report of the preplacement meeting will be established by the Engineer. Modifications shall be submitted in writing to the Engineer for approval. Further, for placements between September 15<sup>th</sup> and April 1<sup>st</sup>, no concrete shall be placed until all aspects of the proposed placement are approved by the Regional Construction Engineer.

Before concrete slabs are placed on steel spans, all permanent field connections shall be completed unless otherwise noted on the contract plans, and all temporary supports and mechanisms used in steel erection shall be removed.

No concrete shall be placed until all the provisions of §555-3.04A. *Placement Limitations* are met, environmental conditions are deemed favorable, and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration, the evaporation rate not to exceed 1.2 kg/m<sup>2</sup>/hr, and acceptable curing temperatures expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place.

The Contractor shall take the necessary measurements and calculate the theoretical evaporation rate. The measurements for air temperature, relative humidity, and wind speed shall be taken as near as possible to the final placement location of the concrete.

Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor shall supply all instruments necessary to make the required calculations. All instruments shall be approved by the Engineer, as being in good working order. The Contractor's measurements and calculations will be subject to the Engineer's approval. To determine the evaporation rate, apply the values taken for relative humidity, plastic concrete temperature, air temperature, and wind velocity to Figure 557-1 *Structural Concrete Evaporation Rate*.

The placing of concrete for any bridge slab shall be continuous between joints. Conveyance of concrete shall meet the requirements of §555-3.04B.

Vibrating of concrete shall be in accordance with §555-3.04E except the number of vibrators required shall be one for every 30 cubic meters of concrete placed per hour, with a minimum of two vibrators in use at all times, and equally spaced across the placement front. One additional vibrator shall be available for use as a backup.

**557-3.06 Cold Joints.** "Cold Jointing," the bonding of fresh concrete to set concrete, shall be done where indicated in the contract documents, or where approved by the D.C.E.S.

**A. Horizontal Joints.** Within 24 hours of the start of the placement, the hardened concrete shall have laitance and dirt removed by a high-pressure water wash. The high-pressure water wash shall be sufficiently strong to remove any laitance and dirt, but not damage the reinforcement or reinforcement coating. The pressure wash equipment shall be capable of providing pressure of 21 MPa to 35 MPa.

After pressure washing, the concrete shall be continuously wetted for a minimum of 12 hours immediately prior to deck placement. Before placing fresh concrete, all standing water shall be removed with oil-free compressed air. The surface shall be protected from drying to maintain a clean, saturated surface dry condition when placing the new concrete.

If the tops of precast/prestressed elements have been sealed with a penetrating sealer, pressure wash the tops a maximum of 2 hours prior to concrete placement. The requirement for prewetting is waived.

**B. Construction Joints.** The requirements of § 555-3.06 A. shall apply. Construction joints shall be placed only where shown in the contract documents or where permitted by the D.C.E.S.

In the event an ongoing placement is delayed excessively, the establishment of a bulkhead shall be required.

**557-3.07 Finishing Integral Wearing Surfaces on Superstructure Slabs.** Machine finishing shall be used throughout all superstructure concrete placement operations with the exception of areas which are inaccessible to finishing machines.

Machine finishing shall be accomplished with an approved power-driven, one-operation (strike-off and finishing) machine. The finishing machine shall have a strike-off auger set 6 mm to 13 mm above the finished surface, a power-driven roller or oscillating type screed, and a pan float.

Finishing machines shall be equipped with adjustable strike-off and finishing screeds, the bottom surfaces of which shall be adjusted to produce the required contour of the finished surface. Machines shall be kept in true adjustment. Machines out of adjustment shall not be used until proper adjustments have been made and the adjustments have been approved by the Engineer.

The specific method and equipment that the Contractor proposes to use for finishing will be supplied during the Preplacement Meeting and will be subject to approval by the Engineer based on the above listed requirements.

Finishing machine rail supports shall be accurately set and of substantial construction so that the finished deck surface will conform to the profile and transverse sections shown in the contract documents. Finishing machine rail supports shall be placed and adjusted to properly provide for the deflection of forms, falsework, and structural supporting members which will occur during the placement of the concrete. Finishing machine rail supports shall not be attached by welding to portions of flanges subject to tensile stresses. The finishing machine rail supports shall be spaced at a maximum of 600 mm on center. During stage construction, the support system shall be on the stage being placed.

Where the deck surface falls outside the fascia stringer flange, the finishing machine rail supports shall be placed on the forms. The forms shall be designed to take these loads through the use of outriggers or some other approved means.

Prior to commencing concreting operations, the finishing machine shall be given a test run over the full length of the superstructure segment to be paved, with the finishing machine adjusted to its finishing position. While operating the finishing machine during this test, the finishing machine rails shall be checked for deflection and proper adjustment, the cover on slab reinforcement measured, and the controlling dimensions of slab reinforcement and forms checked. All necessary corrections shall be made and verified by the Engineer before concreting is begun.

A sufficient amount of concrete equal to the finishing machine capacity shall be supplied at all times.

After the concrete has been placed, spread, and consolidated to provide a uniformly dense structural slab, the surface shall be struck off immediately by a single passage of the transverse finishing machine. The finishing machine shall carry sufficient concrete in front of the screed to fill low and porous places. This operation shall be done only once and shall produce a uniformly consolidated dense smooth surface of the required contour. The passage of the strike-off auger shall provide a concrete surface slightly above grade so that after settlement, if any, and the disappearance of excess water from the surface, the passage of the finishing screed will result in a uniform surface at the required grade and contour over its entire area, and provide the required cover over reinforcing.

In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the D.C. E. S.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be performed in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width.

Care shall be taken not to overwork the concrete surface during any finishing operation.

In the event the placement is delayed as a result of equipment breakdowns or delivery problems, all concrete in place shall be protected from evaporation by covering the surface with wet burlap, curing blankets, or plastic sheets. Excessive delays shall require the establishment of a bulkhead and the ceasing of the placement.

Prior to texturing, the finished concrete surface shall be examined by the Contractor and the Engineer using a straightedge. The straight-edge shall not be less than 3 m long. It shall be furnished by the Contractor and maintained in good, usable condition at the placement site at all times. While the concrete is still plastic, surface depressions shall be filled with concrete of the same class as the placement in progress. Surface irregularities greater than 5 mm in 3 m in either the longitudinal or the transverse direction shall be corrected in a manner acceptable to the Engineer. Thin mortar or laitance, which may have accumulated ahead of the finishing machine screed, shall be removed from the work site. They shall not be used to fill depressions.

After finishing, the surface shall be given a suitable texture with an artificial turf drag made of molded polyethylene with approximately 64,000 synthetic turf blades per square meter, each approximately 13 mm long. The artificial turf drag shall be of a type and brand appearing on the Department's Approved List.

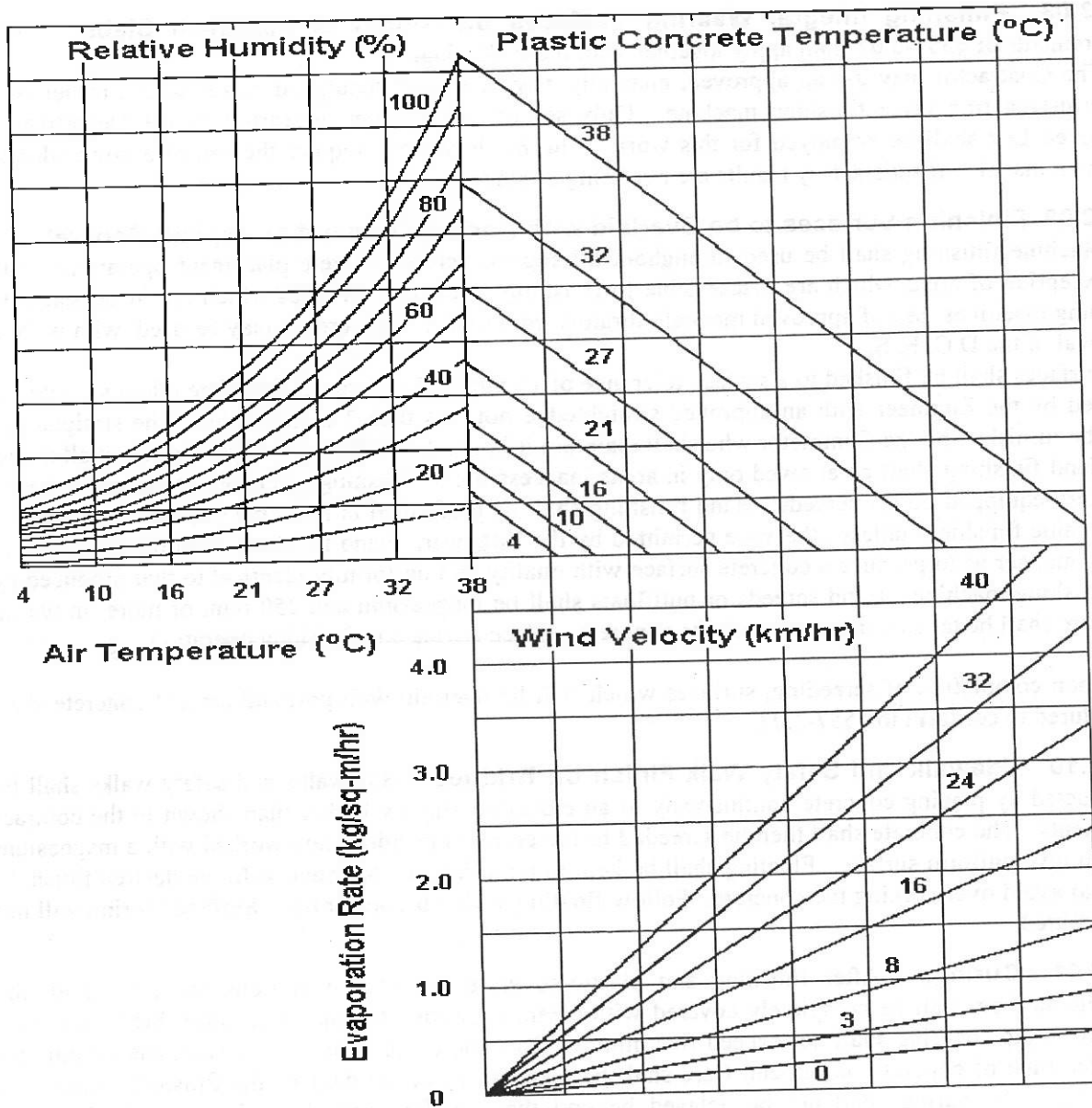
The Contractor may apply texture in a transverse direction, longitudinal direction, or parallel to the finishing machine. Once begun, the direction of texturing shall not change. All texturing shall be done from a work bridge immediately following the finishing operation. Texturing shall be done prior to the beginning of curing operations. Only one pass of the turf drag over the finished area will be permitted.

If texturing is done in a transverse or skewed direction, the Contractor shall texture by hand methods immediately after finishing machine passage.

If texturing is done in the longitudinal direction the turf drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured immediately after finishing machine passage. Small areas, otherwise inaccessible to the attached drag, may be textured by hand methods. Texture resulting from the drag shall stop within 300 mm of curbs.

The finishing movement and resulting progress of the turf drag shall be done in a manner so as to prevent ridges or gouges forming in the concrete surface. The drag shall be weighted and the contact area changed as required to produce an acceptable texture. The drag shall be cleaned periodically to remove all hardened concrete particles.

FIGURE 557 - 1 STRUCTURAL CONCRETE EVAPORATION RATE



**To use this chart:**

1. Enter with air temperature, move up to relative humidity.
2. Move right to plastic concrete temperature.
3. Move down to wind velocity.
4. Move left to read approximate rate of evaporation.

**557-3.08 Finishing Integral Wearing Surfaces on Structural Approach Slabs.** The requirements of §557-3.07 shall apply together with the following:

The Contractor may use an approved, manually driven, vibrator-equipped power screed in lieu of a power-driven transverse finishing machine. Only screed model types appearing on the Department's Approved List shall be employed for this work. The Engineer may require the use of a power-driven finishing machine if satisfactory results are not being attained.

**557-3.09 Finishing Surfaces to be Overlaid with Portland Cement or Asphalt Concrete.**

Machine finishing shall be used throughout all superstructure concrete placement operations, with the exception of areas which are inaccessible to finishing machines. In areas which are inaccessible to finishing machines, use of approved manual vibratory equipped power screeds may be used, with written approval of the D.C. E. S.

Surfaces shall be finished to a surface tolerance of 10 mm in 3 meters. The surface tolerance shall be verified by the Engineer with an approved straightedge not less than 3 meters long. The straightedge shall be furnished by the Contractor who shall maintain it in good condition at the paving site at all times.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand finishing shall be performed in the same sequence and manner as machine finishing, unless otherwise permitted by the Engineer. Hand finishing shall be performed in such a manner as to produce a concrete surface with quality and uniformity identical to that produced by the finishing machine. Hand screeds or bullfloats shall be magnesium and 250 mm, or more, in width.

Care shall be taken not to overwork the concrete surface during any finishing operation.

Upon completion of screeding, surfaces which will be overlaid with portland cement concrete shall be textured to conform to §557-3.07.

**557-3.10 Sidewalk and Safety Walk Finish on Bridges.** Sidewalks and safety walks shall be constructed by placing concrete continuously to an elevation slightly higher than shown in the contract documents. The concrete shall then be screeded to the correct elevations and worked with a magnesium float to give uniform surface. Floating shall be kept to a minimum, consistent with the desired finish, in order to avoid overworking the concrete. Follow floating with a broom finish. Surface scoring will not be permitted.

**557-3.11 Curing.** After finishing and plastic-concrete texturing operations are completed, the concrete surface shall be completely covered with clean, prewetted burlap. The allowable time period for wet burlap covering shall not exceed five minutes from the completion of texturing, and 30 minutes from the time of concrete placement. Care shall be taken so as not to damage the finished surface and texturing. The curing shall not be delayed beyond the specified period. Burlap shall be lapped a minimum of 300 mm. Lapped edges are not required to be sealed. Burlap shall be thoroughly saturated over its entire surface area and shall be drained of excess water prior to its application. Burlap shall be kept continuously wet, commencing 10 minutes from the time the wet burlap is placed, and protected from displacement. The Contractor may cover the wet burlap and soaker hoses only if it is necessary to maintain curing temperature.

The curing period shall begin only after all concrete for a given placement is complete. A curing day is defined as any day during which the ambient air temperature at the concrete surface is 7°C or higher for the entire day.

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching temperatures that qualify as curing temperatures. If these conditions occur and with the Engineer's approval, the Contractor may aggregate curing hours. A curing hour is defined as any hour during which the curing temperature remains at, or above 7°C.

An aggregation of 24 curing hours will be credited as one curing day. Aggregations of less than 24 curing hours will not be credited.

Curing hours will be determined with continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer. Thermometers used to monitor curing temperatures shall consist of the following types:

1. **Continuously Recording Thermometer.** The thermometer shall be capable of continuously recording temperatures within a range of  $-20^{\circ}\text{C}$  to  $50^{\circ}\text{C}$  for a minimum of 24 hours.
2. **Maximum - Minimum Recording Thermometer.** For all placements the thermometer shall be capable of recording maximum and minimum temperatures in a range of  $-20^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ .

The curing temperature of concrete is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering. Temperatures at these locations are critical for proper concrete curing. For the purposes of this section the temperatures at the foregoing locations shall be maintained between  $7^{\circ}\text{C}$  and  $30^{\circ}\text{C}$  inclusive.

**A. Superstructure Slabs.** After the burlap placement has been fully completed, the concrete surface shall be cured for 14 curing days. The Contractor may use either option listed below. After seven curing days, the Contractor may be permitted to perform incidental work on the structure under the loading limitations of §557-3.14 *Loading Limitations for Superstructure Slabs*. The burlap may be displaced in limited areas, for short durations, to perform items such as sawcut grooving, placement of sidewalks, safety walks, curbing, bridge rail, and fencing. The amount of burlap displaced to perform these operations shall be limited to the immediate area affected by the Contractor's operations. All concrete surfaces exposed during these operations shall be kept in a saturated condition. Immediately after the work is completed in the affected area, all burlap shall be replaced for the duration of the curing period. Removable forms shall remain in place until the minimum curing period is complete.

1. **Fourteen-Day Continuous Wetting.** Leave all burlap in place for 14 curing days. Provide continuous, uniform wetting for the entire curing period.
2. **Wet Burlap and Curing Covers.** Provide continuous uniform wetting for seven curing days. After seven curing days, either of the following methods may be used:
  - a. Remove all burlap after seven curing days. Apply curing covers immediately upon burlap removal. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A *General*. Concrete cured in this manner shall not be exposed to the atmosphere for more than 10 minutes between burlap removal and curing cover placement.
  - b. Apply curing covers directly over the wet burlap. Plastic-coated fiber blankets are not required to be laid dry. Application and maintenance of covers shall be in accordance with §555-3.08A *General*. The concrete surface shall be inspected periodically to ensure that its condition remains saturated.

The Contractor shall inform the Engineer of the intended curing procedure at the Preplacement Meeting.

**B. Structural Approach Slabs, Curbs, Sidewalks and Safety Walks on Bridges.** After the burlap placement has been fully completed, leave all burlap in place for 7 curing days. Provide continuous, uniform wetting for the entire curing period. Forms for curbs, sidewalks, and safety walks shall remain in place until the minimum curing period is complete. Forms for structural approach slabs shall remain in place until sufficient strength is achieved to avoid damage to the concrete. After removal of approach slab forms, the formed surfaces shall be cured as per the requirements of §555-3.08A.

**557-3.12 Provisions for Concreting in Cold Weather.** When permission is granted in writing by the Regional Construction Engineer for cold-weather concreting between September 15<sup>th</sup> and April 1<sup>st</sup>, curing temperatures shall be maintained in accordance with §555-3.08C *Provisions for Curing in Cold Weather*, except as modified here:

- The curing duration shall be 14 days.
- The use of external heat to maintain curing temperatures is required. All concrete surfaces within the heated areas shall be protected from drying by the use of live steam or use of burlap that is continuously wetted.
- Continuously recording thermometers shall be placed on both the top and underside of the deck to monitor areas where extreme cold or heat can be expected.
- The temperature differential between any two locations within the heated enclosure shall not be more than 15°C.
- Upon completion of curing, concrete shall be air dried for 14 days before being exposed to freezing temperatures. Once the drying period is complete, temperatures shall be gradually reduced at a rate not to exceed 0.5°C/hr until the temperature within the enclosure equals the temperature outside the enclosure.

After seven (7) drying days, the Contractor may be permitted to perform incidental work on the structure, within the enclosure, to progress sawcut grooving and sealing. All concrete surfaces shall be kept reasonably dry during these operations, with use of any water kept to a minimum.

Failure to maintain acceptable curing conditions, as indicated above, shall result in all concrete of the placement being considered damaged or defective and shall be cause for rejection of all concrete of the represented placement. Acceptance may be established based on contractor evaluation and testing as directed by the Department, at no additional cost to the State.

**557-3.13 Removal of Forms.** Removal of forms for superstructure slabs shall meet the requirements of §555-3.09 *Form Removal* and as modified herein. The minimum curing period prior to form removal is 10 curing days, except that for cold weather concreting a minimum of 14 curing days is required unless minimum compressive strengths are achieved as determined by the D.C. E. S. A curing day is defined in §555-3.08A. Permanent field connections, if required, shall be made on the same day prior to removal of forms and falsework.

The following inspection procedures will be used as a check to insure the soundness of the concrete structural slab adjacent to the steel forms. Not less than two days after completion of a concrete structural slab pour, but prior to the next slab pour, the Contractor shall remove a section of the steel form from the most recently completed pour of each span, at a location selected by the Engineer, in order to provide visual evidence that the concrete mix or the construction procedures are obtaining the desired results. If either the concrete mix or the construction procedures are varied significantly within a pour, such as a change in the extent of vibration or change in the workability of the mix, the Contractor shall remove another section of form to verify that the new procedures yielded desirable results.

After the concrete has been placed in a span for a minimum of ten days but prior to any further work performed on the superstructure in that span, the Engineer will spot-check the underside areas of the steel forms by sounding with a suitable-weight hammer at least 50% of the area of at least 25% of the individual form panels on a random basis to determine whether any honeycomb or void areas exist. If such areas are detected, the Contractor shall remove the forms from these areas for a visual inspection of the slab.

The amount of sounding and form removal may be reduced after a substantial amount of slab has been constructed and inspected, if the Contractor's methods of construction and the results of the inspections as outlined above indicate that sound concrete is present throughout the slabs.

If, after removing a section of form, the concrete is found to be defective, additional panels shall be removed. All defective concrete shall be repaired to match the adjacent concrete in section and color.

The form sections shall be removed by a metal saw or air-carbon-arc gouging with minimum damage to the concrete. Cuts shall only be sufficiently deep to sever the form. Any other method of removal shall be submitted to the Deputy Chief Engineer (Structures) for approval. Cuts that are parallel to the corrugations in the forms shall be located on the sloping surface midway between a crest and a valley. Cuts parallel to the supporting beams shall be made through the supporting angles taking care not to damage the structural steel beams. The Contractor will not be required to replace the removed forms.

The Contractor shall provide all the facilities required for safe, suitable and convenient means of access to the forms for the Engineer's inspection.

**557-3.14 Loading Limitations for Superstructure Slabs.** Superstructure slabs, during the curing period, may be subjected to a vehicle load not to exceed nine metric tons, or a wheel load not to exceed three metric tons no sooner than seven curing days after placement. Full legal loading may commence using either of the following options:

**A.** Superstructure slabs may be subjected to full legal loads no sooner than 14 calendar days after completion of the curing period.

**B.** The Contractor may subject a superstructure slab to its full legal load upon completion of the curing period, or any day thereafter provided that the procedure below is followed:

**1.** The Contractor shall notify the Engineer at the Preplacement Meeting of the intention to subject the slab to full legal load prior to the 14th day after completion of curing.

**2.** During the slab concrete placement, the Engineer will cast two sets (pairs) of test cylinders in addition to each set cast for record and cure the cylinders on site in the same manner as the superstructure slab.

**3.** The Engineer will forward cylinders to the Materials Bureau or Regional Testing Facility. One set will be tested fourteen calendar days after placement and, if necessary, the second set will be tested twenty-one calendar days after concrete placement. Under no circumstances will cylinders be tested sooner than fourteen calendar days after the concrete placement they represent.

**4.** Concrete cylinder sets (pairs) designated for advance testing shall achieve an average compressive strength of 21 MPa, or greater, with individual cylinders having a compressive strength of 19.5 MPa, or greater.

5. Results of compression tests will be transmitted to the Engineer as soon as possible. The Engineer will inform the Contractor of the cylinder testing results and allow early loading if appropriate. If the required compressive strengths are not achieved, the requirements of §557-3.14A shall apply.

**557-3.15 Loading Limitations for Structural Approach Slabs, Sidewalks, and Safety Walks on Bridges.** The Contractor may subject structural approach slabs, sidewalks, and safety walks to their full legal load upon completion of the 7-day curing period.

**557-3.16 Damaged or Defective Concrete.** Damaged or defective concrete shall be defined by, and repaired in accordance with, the requirements of §555-3.13, *Defective or Damaged Concrete*.

Subsequent to placement of concrete, either before or after setting, the Engineer will verify at random that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown on the contract plans, is correct within a tolerance of plus or minus 13 mm. If the allowable tolerance is exceeded, the Engineer shall reject the work so advise the Contractor and the Deputy Chief Engineer (Structures), in writing, stating the deficiencies upon which the rejection is based. The Deputy Chief Engineer (Structures) shall review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

- The affected placement shall be removed and replaced in whole or in part.
- The Contractor shall provide special corrective measures as directed by the Deputy Chief Engineer (Structures).
- The concrete placement shall be accepted without corrective action.

After the concrete has hardened, the Engineer will examine it using the Contractor's straightedge. Surface irregularities greater than 5 mm in 3 meters shall be corrected. Unless otherwise directed by the Regional Materials Engineer, the concrete used for repairs shall be of the same materials as that used for the original placement.

**557-3.17 No Bar list provided.** When no bar lists are provided in the contract documents the following shall apply:

1. At least thirty (30) days prior to fabrication of the reinforcement the Contractor shall submit a minimum of two copies of the bar lists and placement drawings showing the bar locations to the Engineer. The details of the bar list and placement drawings shall meet the requirements of the current edition of the Concrete Reinforcing Steel Institute's publication Reinforcing Bar Detailing. Placement drawings shall be size "B". Drawings and bar lists shall be clear and legible.
2. Requests for information or changes along with reasons shall be documented in a separate list.
3. The Engineer will transmit the documents to the designer for review for conformance with the design requirements and in accordance with §105-16. The designer will not be checking lengths, number of bars, weights or bar marks. Corrections will be returned to the Contractor. When the documents are satisfactory they will be returned to the Contractor stamped "Approved In Conformance With Design Requirements". The Contractor shall supply the Engineer with five (5) copies of the approved documents. No reinforcement shall be placed until copies of the approved documents are received by the Engineer.
4. Partial submissions that require coordination with other drawings will not be accepted.

**557-4 METHOD OF MEASUREMENT.** The work will be measured for payment as the number of square meters of slab, sidewalk, or safety walk satisfactorily installed, measured to the nearest 0.1 square meters.

**557-5 BASIS OF PAYMENT.** The unit price bid per square meter shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work. Unless otherwise provided, the unit price bid shall include the cost of furnishing and placing bar reinforcement, wire fabric for concrete reinforcement, copper flashing, flexible water stops, mechanical connectors where specified, sheet packing, water for wetting, joint sealing compounds, joint fillers, concrete curing materials, and the cost of screed rail supports and other brackets or braces necessary to support finishing machines.

If permanent metal forms are used, the cost of furnishing all facilities required for access, removing the permanent forms for inspection or repair purposes, painting the cut edges of the forms and repairing the concrete as required herein shall be included in the price bid for this work.

No extra compensation for corrective finishing or repairs to damaged or defective concrete will be paid.

Progress payments will be made on a per-span basis as follows:

Forty (40) percent of the area will be paid for after all reinforcing is properly placed. Forty (40) percent of the area will be paid for after the concrete has been properly placed and proper curing applications have been instituted. The remainder will be paid for after completion of all curing, and necessary corrective work.

**Payment will be made under:**

Item No.	Item	Pay Unit
557.0101	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Required - Type 1 Friction	Square Meter
557.0102	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Required - Type 2 Friction	Square Meter
557.0103	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Required - Type 3 Friction	Square Meter
557.0109	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Required - Type 9 Friction	Square Meter
557.0501	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Not Required - Type 1 Friction	Square Meter
557.0502	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Not Required - Type 2 Friction	Square Meter
557.0503	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Not Required - Type 3 Friction	Square Meter
557.0509	M Superstructure Slab with Integral Wearing Surface - Bottom Formwork Not Required - Type 9 Friction	Square Meter
557.07	M Superstructure Slab with Separate Wearing Surface - Bottom Formwork Required	Square Meter
557.09	M Superstructure Slab with Separate Wearing Surface - Bottom Formwork Not Required	Square Meter
557.13	M Class D Concrete	Square Meter
557.2001	M Structural Approach Slab with Integral Wearing Surface - Type 1 Friction	Square Meter
557.2002	M Structural Approach Slab with Integral Wearing Surface - Type 2 Friction	Square Meter

557.2003 M

Structural Approach Slab with Integral Wearing Surface -  
Type 3 Friction

Square Meter

557.2009 M

Structural Approach Slab with Integral Wearing Surface -  
Type 9 Friction

Square Meter

557.22 M

Structural Approach Slab with Separate Wearing Surface

Square Meter

557.30 M

Sidewalks and Safety Walks

Square Meter"

Make the following changes to the Standard Specifications of January 2, 2002

#### Page 5-111

Lines 30-32, under §566-3 Construction Details, §566-3.03 Installation, C., **delete** "At such times that the necessary concrete is placed (after joint system plate installation), existing surfaces shall receive a coating of Portland Cement Bonding Grout (705-22) immediately prior to concrete placement. The cost of the grout shall be included in the unit price bid for the concrete." and **replace** with the following:

"This surface shall be scrubbed with wire brooms. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete."

Lines 40-41, under §566-3 Construction Details, 566-3.03 Installation, E., **delete** "Prior to concrete placement, all existing concrete surfaces shall be coated with Portland Cement Bonding Grout (705-22)." and **replace** with the following:

"This surface shall be scrubbed with wire brooms. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Construction joints must be wetted by continuous spraying with hoses using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete."

Line 43, **delete**: ", including grout placement,"

#### Page 5-115

Line 35, under §567-2.03, **delete** "Bonding Grout 705-22"

#### Page 5-117

Line 41, under §567-3.01 G. Concrete Placement and Finishing., **delete** the reference to "557-3.09" and **replace** it with "557-3.07"

#### Page 5-118

Line 37 to 38, under §567-3.03 F.1., **delete** "Prior to concrete placement, all existing concrete surfaces shall be coated with Portland Cement Bonding Grout."

Line 39; under §567-3.03 F. 1. Concrete., **delete** the reference to "557-3.09" and **replace** it with "557-3.07"

#### Page 5-123

Lines 12 to 13, §569-2.01 Fabrication., **delete** " Portland cement bonding grout (air entrained with an 8.0% +/- 2.0% air content ) 705-22"

#### Page 5-124

Line 31, **add** as the first sentences of the paragraph "Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until placement of the new concrete."

#### Page 5-125

Line 4, **add** after "... shall not apply."

"Thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surfaces from drying, so the concrete remains in a saturated surface dry condition until placement of the new concrete."

#### Page 5-126

Lines 4 to 5, under §569-3 Construction Details, §569-3.05 Cast-In-Place Concrete - Slipformed., H., **delete** "Immediately prior to placing fresh concrete, the set surface shall be completely coated with portland cement bonding grout, §705-22, thoroughly brushed in."

Lines 28 to 29, under §569-3 Construction Details, §569-3.06 Precast Concrete B., **delete** "All precast barrier shall be installed on grout beds conforming to the requirements of §705-22 as modified herein." and **replace** with

"After the cleaned surface has been accepted, thoroughly wet the surface over which the precast barrier will be placed for at least 12 hours immediately prior to placing the grout bed. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the surface remains in a saturated surface dry condition when placing the grout bed. All precast barrier shall be installed on grout beds conforming to the requirements of §701-05 as modified herein."

#### Page 5-129

Line 8, under §569-3.08 C. 2<sup>nd</sup> bullet, **delete** the references to "§555-3.06A, and §555-3.06B." and **replace** them with "§555-3.08."

Line 11; under §569-3.08 C. 3<sup>rd</sup> bullet, **delete** the reference to “§555-3.09” and **replace** it with “§555-3.08A.”

### Page 5-144

Lines 19 to 20, under §578-2 MATERIALS., **delete** “...and Bonding Grout, §705-22. Do not add water to the bonding grout once an acceptable consistency is achieved.”

Lines 24 to 25, under §578-3 CONSTRUCTION DETAILS., §578-3.03 Bonding Grout Placement., **delete** “578-3.03 Bonding Grout Placement. Mix bonding grout in a mixer that meets §584-2.04D and place in accordance with §584-3.04.” and **replace** with “578-3.03 Vacant.”

Line 30, under §578-3.07 Finishing Bonded Concrete Overlay, **delete** the reference to “§557-3.09” and **replace** it with “§557-3.07”

Line 31, under §578-3.08 Curing Bonded Concrete Overlay, **delete** the reference to “§557-3.12” and **replace** it with “§557-3.11.”

### Page 5-145

Lines 14 to 18, §578-5 **delete** the entire list of Payment Items and the Errata **Issued with Prop Makeup for 1/16/03** and **replace** them with the following.

*“Payment will be made under:*

Item No.	Item	Pay Unit	
578.1201nn M	Overlay Concrete, Class E – Type 1 Friction		Square Meter
578.1202nn M	Overlay Concrete, Class E – Type 2 Friction		Square Meter
578.1203nn M	Overlay Concrete, Class E – Type 3 Friction		Square Meter
578.1209nn M	Overlay Concrete, Class E – Type 9 Friction		Square Meter
578.1300nn M	Slab Reconstruction Concrete, Class D or E		Square Meter

nn denotes a serialized pay item. Refer to §101-02 Definitions of Terms under “Specifications”.

### Page 5-147

Lines 24 to 26, under §579-3 Construction Details., 579-3.03 Full Depth Patches., **delete** “Existing concrete surfaces, which will come in contact with new concrete, shall be thoroughly coated with portland cement bonding mortar meeting the requirements of subsection 705-22. The mortar shall be thoroughly worked into the surface by means of stiff nylon brushes.” and **replace** with

“After blastcleaning has been accepted, thoroughly wet the structural slab surface and all porous surfaces to be in contact with new concrete for at least 12 hours immediately prior to placement. Remove all standing water with oil-free compressed air, and protect the surface from drying, so the concrete remains in a saturated surface dry condition when placing bonding grout.”

## Page 5-154

Lines 1 to 4, under §582-3 Construction Details, §582-3.04 Placement, **delete** "Immediately prior to the placement of new material, receiving surfaces shall be air cleaned and thoroughly wetted. Surfaces receiving patching material shall also be prepared in accordance with the manufacturer's instructions. All air cleaning work shall be done by means of oil-free air. No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7° C." and **replace** with the following:

"Air clean the surface with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface, and all porous surfaces to be in contact with new concrete, for 12 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If, in the opinion of the Engineer, conditions or the situation prohibits this, then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete. No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7° C."

Line 7; under §582-3.04 A. Concrete Placement., **delete** the reference to "§555-3.09."

Line 43; under §582-3.05 Form Removal., **delete** the reference to "§555-3.03B" and **replace** it with "§555-3.09."

## Page 5-155

Line 5, under §582-3.06 A. Concrete., **delete** the reference to "§555-3.09" and **replace** it with "§555-3.08."

## Page 5-157

Lines 18 to 19, under §583-3 Construction Details, §583-3.01 Preparation of Surfaces, **delete** "Just prior to shotcreting, the sound surface shall be thoroughly cleaned, wetted and air blown." and **replace** with the following:

"Air clean the surface with oil-free compressed air. After the surface preparation has been accepted, every effort should be made to thoroughly wet the concrete surface and all porous surfaces to be in contact with new concrete for 12 hours. This may be accomplished by continuous wetting with soaker hoses or the use of burlap/burlene/etc. where moisture can be maintained. If in the opinion of the Engineer conditions or the situation prohibits this then the surfaces should be wetted for as long as possible. Surfaces must be wetted by a means acceptable to the Engineer using potable water. The Contractor shall remove any puddles of free standing water with oil-free compressed air, and protect the surfaces from drying, so the existing concrete remains in a clean, saturated surface dry condition until placement of the new concrete. No material shall be placed if the ambient air, or concrete surface temperature is at, or below 7° C."

### Page 5-158

Line 41, under §583-3.03 A. Weather., **delete** the reference to "555-3.06B" and **replace** it with "555-3.08 C. 2."

### Page 5-160

Line 17, under §583-3.03 E. Curing., **delete** the reference to "555-3.09" and **replace** it with "555-3.08."

Line 22; under §583-3.03 E., 2<sup>nd</sup> bullet **delete** the reference to "555-3.09A" and **replace** it with "555-3.08A."

### Page 5-162

Lines 2-8, under 584-2.01 B. Microsilica Admixture, **delete** paragraphs 1, 2 and 3 in their entirety, and **replace** them with the following.

- “1. Follow the requirements of §501-2 and §501-3.01.
2. Samples will be taken in accordance with Materials Method 9.1M and Materials Procedure 90.1.
3. Blended Portland Cement, §701-03 (Type SF) may also be used for the Portland cement/microsilica portion of the Class DP and the Microsilica Concrete designed mix.”

Lines 9 to 10, under §584-2 Materials., 584-2.01 General., **delete** “C. Bonding Grout. §705-22, with the following: Do not add water once an acceptable consistency is achieved.” and **replace** with “C. Vacant.”

Lines 15- 28, under 584-2.02 B. Handling Measuring and Batching., **delete** “501 with the following”, and subparagraphs 1-4 in their entirety, and **replace** them with:

“Follow the requirements of §501-3.02 and §501-3.03, except that water reduction must be accomplished using only a water-reducing and retarding admixture (§711-08, ASTM Type D). If a microsilica slurry is used, include the slurry water as mix water.”

### Page 5-163

Lines 14-19, under 584-2.03 B. Handling, Measuring and Batching., **delete** the entire paragraph, and **replace** it with:

“**B. Handling, Measuring and Batching.** Follow the requirements of Section 501-3.02 and -3.03, except that water reduction must be accomplished using only a High-Range Water-Reducing Admixture (§711-08, ASTM Type F). Add the High-Range Water Reducer at the batching facility. The Regional Materials Engineer may allow a maximum of two additions of water and/or admixture at the work site. Provide an additional 30 mixing revolutions for each addition of water and/or admixture.

However, once the concrete has reached the desired slump, only the High-Range Water Reducer may be used to adjust the concrete slump. The maximum total mixing revolutions is 200. Observe the Manufacturer's maximum dosage rate for the admixture, regardless of where the admixture is added. If a microsilica slurry is used, include the slurry water as mix water."

Lines 21-35; under 584-2.04 A. Microsilica Admixture Slurry Delivery System., **delete** the entire subsection, and it **replace** with "**A. Microsilica Admixture.** Follow Section 584-2.01B."

### **Pages 164 to 165**

Lines 33 of Page 164 to line 3 of Page 165, under §584-3 Construction Details., §584-3.04 Bonding Grout Placement **delete** the following:

#### **"584-3.04 Bonding Grout Placement**

- A. After structural slab wetting and immediately before placing concrete, use stiff, nylon-bristle brooms to brush a thin (approximately 3 mm) coating of grout into the prepared surfaces, including any slabs, curbs, longitudinal and transverse joints and reinforcing steel. Do not allow the grout to puddle.
- B. Apply the grout with straight handled stiff, nylon-bristle brooms around reinforcing steel, and at joints.
- C. Limit the application of grout, according to atmospheric conditions, to that area which will be covered with new concrete before the grout begins to dry. Dry bonding grout appears light grey in color and has a chalky texture. Do not place concrete on dry bonding grout. Concrete placement operations must be interrupted if dry bonding grout is encountered. Install construction dams, wait at least 48 hours, remove dry grout by blast cleaning and place new grout and concrete, all in accordance with this specification."

and **replace** with "**584-3.04 Vacant.**"

### **Page 5-165**

Line 4, under §584-3.05 Handling and Placing Concrete., **delete** the references to "557-3.06 and 557-3.07" and **replace** them with "557-3.05 and 557-3.12."

Line 19, under §584-3.06 A. Slab Reconstruction Concrete - Separate Placement., **delete** the references to "557-3.11 and 557-3.12" and **replace** them with "557-3.09 and 557-3.11."

Line 33, under §584-3.06 B. Overlay Concrete., **delete** the references to "557-3.09 and 557-3.12" and **replace** them with "557-3.08, 557-3.11, and 557-3.12."

**Page 5-166**

Line 19; under §584-3.08 Defective or Damaged Concrete., **delete** the reference to "557-3.13" and **replace** it with "557-3.16."

**Page 5-166**

Under §584-5 **delete** the entire list of Payment Items and the Errata *Issued with Prop Makeup for 1/16/03* and **replace** them with the following.

*"Payment will be made under:*

<b>Item No.</b>		<b>Item</b>
584.3001nn M	Overlay Concrete, Microsilica Concrete – Type 1 Friction	Square Meter
584.3002nn M	Overlay Concrete, Microsilica Concrete – Type 2 Friction	Square Meter
584.3003nn M	Overlay Concrete, Microsilica Concrete – Type 3 Friction	Square Meter
584.3009nn M	Overlay Concrete, Microsilica Concrete – Type 9 Friction	Square Meter
584.3101nn M	Overlay Concrete, Class DP – Type 1 Friction	Square Meter
584.3102nn M	Overlay Concrete, Class DP – Type 2 Friction	Square Meter
584.3103nn M	Overlay Concrete, Class DP – Type 3 Friction	Square Meter
584.3109nn M	Overlay Concrete, Class DP – Type 9 Friction	Square Meter
584.3200nn M	Slab Reconstruction Concrete, Class D, DP or Microsilica Concrete	Square Meter

nn denotes a serialized pay item. Refer to §101-02 Definitions of Terms under "Specifications".

**Page 6-10**

Line 16; under §603-3.07 Concrete Paving for Corrugated Structural Plate Pipe, **delete** the reference to "555-3.06" and **replace** it with "555-3.08C."

**Page 6-28**

Line 38; under §606-3.05 B. 6. Concrete Curing, **delete** the reference to "555-3.09" and **replace** it with "555-3.08."

**Page 7-23**

lines 26 to 30, under §703-07 **delete** the last paragraph under "MATERIAL REQUIREMENTS," which begins with "Sand manufactured from," in its entirety.