WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT: input State #

FEDERAL PROJECT: input Federal #

SECTION 601
STRUCTURAL CONCRETE
CLASS H BRIDGE DECKS

601.1 - DESCRIPTION:
ADD THE FOLLOWING PARAGRAPH TO THIS SUBSECTION:

Class H concrete shall be used for bridge decks and other bridge elements when designated in the plans.

601.2 – MATERIALS:
ADD THE FOLLOWING:

Class H Concrete Requirements: The total concrete constituents shall contribute less than 0.10% water soluble chloride ion by weight of cement. The Contractor shall use only one brand and/or source for any concrete constituent. The Contractor shall obtain a written statement from the manufacturer of the microsilica admixture that confirms the compatibility of the material combination and the sequence in which they are combined. The written statement, along with the results of all required tests, shall be furnished to the Engineer prior to the pre-pour meeting.

601.3 - PROPORTIONING:
ADD THE FOLLOWING TO THIS SUBSECTION:

Class H concrete shall consist of a homogeneous mixture of cement, fine aggregate, coarse aggregate, microsilica admixture, fly ash or ground granulated blast furnace slag, chemical admixtures and water.

Establishment of mixture proportions shall be coordinated with the manufacturer of the microsilica admixture.

Design mixture testing for Class H concrete shall include air content, slump, compressive strength results at 28 days, rapid chloride permeability tests, and dry shrinkage tests. For establishment of mixture proportions, rapid chloride permeability tests shall be made on representative samples cured for 28 days in accordance with ASTM C31, then prepared and tested in accordance with AASHTO T277 at an age of 35 to 42 days. The results of this test shall not exceed 750 coulombs. The Contractor shall be required to perform and report the results of dry shrinkage tests, per ASTM C157 at 4, 7, 14, 28, 56 and 90 days for the approved test mix. The 28-day compressive strength, of the test mix that satisfies the 750 coulomb threshold, shall be used as the basis for acceptance of Class H concrete per Section 601.4.5. The Contractor shall be required to utilize a source of aggregate that meets the above specified test mix acceptance criteria. The cost of all test mix requirements shall be considered incidental to the cost of Class H concrete.

DELETE TABLE 601.3.1A AND TABLE 601.3.1B AND REPLACE WITH THE FOLLOWING TABLES:

TABLE 601.3.1A
{ENGLISH}

Class of concrete	Design 28 Day Compressive Strength	Target Cement Factor	Maximum Water Content	Standard Size of Coarse Aggregate	Entrained Air
	Pounds per Square inch	Bags/c.y. *	Gal/bag Of cement **	Number	Percent
A	3500	7¼	5¾	7, 78, or 8	7½
K	4000	7	5	57, 67	7
B	3000	6	5½	57, 67	7
C	2500	5¼	6½	57, 67	6
D	2000	4¼	7	57, 67	5½
H	4000	7	4½	57,67	6½

{METRIC}

Class of concrete	Design 28 Day Compressive Strength	Target Cement Factor	Maximum Water Content	Standard Size of Coarse Aggregate	Entrained Air
	Mpa	Kg per cu. M. *	L/Kg Of cement **	Number	Percent
A	24	404	0.51	7, 78, or 8	7½
K	28	390	0.44	57, 67	7
B	21	335	0.48	57, 67	7
C	17	295	0.58	57, 67	6
D	14	235	0.62	57, 67	5½
H	28	390	0.40	57,67	6½

*An equal volume of a pozzolanic additive may be substituted for Portland cement up to the maximum amount in Table 601.3.1B. Only one pozzolanic additive is permitted in a mix design, except for Class H concrete. The target cement factor of Class H concrete shall consist of Option 1 or Option 2 from Table 601.3.1C. The Contractor may choose either option.

TABLE 601.3.1B

MATERIAL	CLASS OF CONCRETE	QUANTITY
Fly Ash	B, C, D	1 Bag (15%)
	A, K	1 ¼ Bags (19%)
Ground Granulated Furnace Slag	A, B, K	3 Bags (45%)
	C, D	2 Bags (30%)
Microsilica	All Classes	1/2 Bag (8%)

** When using a pozzolanic additive, volumes of these materials shall be considered as cement for purposes of establishing maximum water content.

TABLE 601.3.1C

OPTION	CEMENT	FLY ASH	GROUND GRANULATED FURNACE SLAG	MICROSILICA
1	5 Bags	1 ¾ Bags		30 lbs.
2	4 ½ Bags		2 ¼ Bags	30 lbs.

MP 711.03.26 shall be used to control the cement factor in all classes of concrete.

601.3.2.1 – Consistency:

ADD THE FOLLOWING TO THE FIRST PARAGRAPH OF THIS SECTION:

Concrete for any "Slump Test" shall be deposited in a manner and location that excludes the effects of vibrations caused by traffic and concrete placement operations.

ADD THE FOLLOWING TO THE FOURTH PARAGRAPH OF THIS SECTION:

The slump of Class H concrete shall not exceed 7 inches (175 mm) under any circumstances.

ADD THE FOLLOWING TO TABLE 601.3.2:

TYPE	INCHES OF SLUMP
vi. For Class H concrete	4

601.3.2.2 – Air Content:

ADD THE FOLLOWING TO THE FIRST PARAGRAPH:

The target of the entrained air content of Class H concrete at the time of placement shall be as shown in Table 601.3.1A plus or minus 1.5 percentage points. If the entrained air content of Class H concrete does not conform to the target value plus or minus 2.0 percentage points, the concrete shall be rejected.

601.4-TESTING:

ADD THE FOLLOWING SUBSECTION:

601.4.5- Tests for Permeability Acceptance: The Contractor shall be required to compare the compressive strength test results obtained in Section 601.4.4 to the compressive strength of the approved test mix per Section 601.3. This comparison shall be used as the acceptance criteria for the Chloride Permeability requirements. Chloride Permeability of the in-place concrete shall be considered acceptable if the 28-day compressive strengths obtained in Section 601.4.4 are greater than eighty percent of the 28-day compressive strength of the approved test mix. Concrete represented by compressive strengths below eighty percent of the, 28-day compressive strength of the approved test mix may be removed and replaced by the Contractor. If the Contractor elects to leave the material in place, it will be evaluated as to adequacy for the use intended. All concrete evaluated as unsatisfactory for the use intended shall be removed and replaced or otherwise corrected by and at the expense of the Contractor as required in Section 105.3.

The Contractor shall also be required to perform rapid chloride permeability tests, per AASHTO T277, at 28, 56, and 90 days, and drying shrinkage tests, per ASTM C157, at 4, 7, 14, 28, 56, and 90 days. These tests shall be performed at the same frequency as the compressive strength tests and shall be correlated to the compressive tests. The rapid chloride permeability tests and dry shrinkage tests shall not be required for Class H concrete pours less than 25 cubic yards. The results of these tests shall be tabulated and forwarded to the Engineer. A copy of the tabulated results shall be forwarded to the following address no later than 10 days following completion of the tests. The cost of these tests shall be considered incidental to the cost of Class H concrete.

West Virginia Division of Highways
Engineering Division
1900 Kanawha Boulevard East
Building 5, Room A650
Charleston, West Virginia 25305

601.5-EQUIPMENT AND TOOLS:
ADD THE FOLLOWING SUBSECTION:

601.5.4-Recording Thermometer: The Contractor shall supply a continuous recording thermometer capable of recording temperatures in the 30 - 100° F range. It shall likewise provide a recording capability over a 24-hour continuous period, minimum. The Contractor shall provide any ancillary equipment, supplies and labor necessary for calibration of this equipment.

601.6-HANDLING, MEASURING, AND BATCHING OF MATERIALS:
ADD THE FOLLOWING TO THE END OF THIS SECTION:

When microsilica densified powder is used, the densified powder shall be weighed using an approved cement scale or standard 25 lb. or 50 lb. full bags may be substituted. If the microsilica densified powder is handled using standard 25lb. Or 50 lb. Full bags, the bag containing the powder shall not be placed in the mix. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus densified powder. Batching tolerance for the cement plus densified powder shall be 0.5%.

When microsilica slurry is used, the slurry shall be added prior to the initiation of the batching sequence using calibrated proportioning equipment approved by the Engineer. Batching tolerance of the slurry shall be 2%.

601.9.1– Cold Weather Concreting:

ADD THE FOLLOWING TO THIS SECTION:

Class H or Class K Concrete Cold Weather Provisions: No concrete shall be placed if the ambient air temperature is below 50° F, except as noted. Concrete may be placed at an ambient air temperature of 50° F if rising air temperatures are predicted, and then only if the prediction indicates a temperature of over 50° F for the eight hours immediately after placement. If air temperatures are such that the minimum temperature will not be met, the Contractor may place concrete if external heat is provided (refer to 601.12.2).

601.10-PLACING CONCRETE:

601.10.1-General:

ADD THE FOLLOWING SUBSECTIONS:

601.10.1.1 - Pre-Pour Meeting: The Contractor shall schedule a meeting prior to the start of the concrete work. The Engineer, Construction Manager, Prime Contractor, Concrete Contractor, Concrete Finisher, and the Concrete Supplier shall attend. Topics of discussion shall include Class H concrete mixture proportions, batching, transporting, handling, placing, finishing and curing.

601.10.1.2 - Test Slab Requirements: After obtaining the Engineer's approval of mixture proportions and at least one week before any slab concrete is to be placed, the Contractor shall make one or more trial batches of the Class H concrete of the size to be hauled or mixed at the site. The trial shall simulate transportation and job site conditions, utilizing proposed material and methods of placing, finishing and curing. The test slab shall be constructed the same as the actual work (depth, reinforcing steel, etc.) and shall be at least one lane width wide and of a length (20 feet minimum) to allow the use of the contractor’s entire paving train from placement to finishing. The test slab location shall be as approved by the Engineer. The prime intent is to familiarize the concrete finishing crew with the handling, finishing and curing characteristics of the concrete. Batching, placement and texturing shall be in strict accordance with this specification. Additional reference test slabs may be constructed as necessary to provide an acceptable standard of reference. This standard of reference shall serve throughout the project construction period as the basis of acceptance of the actual as-built work. This Item may be deleted at the discretion of the Engineer.

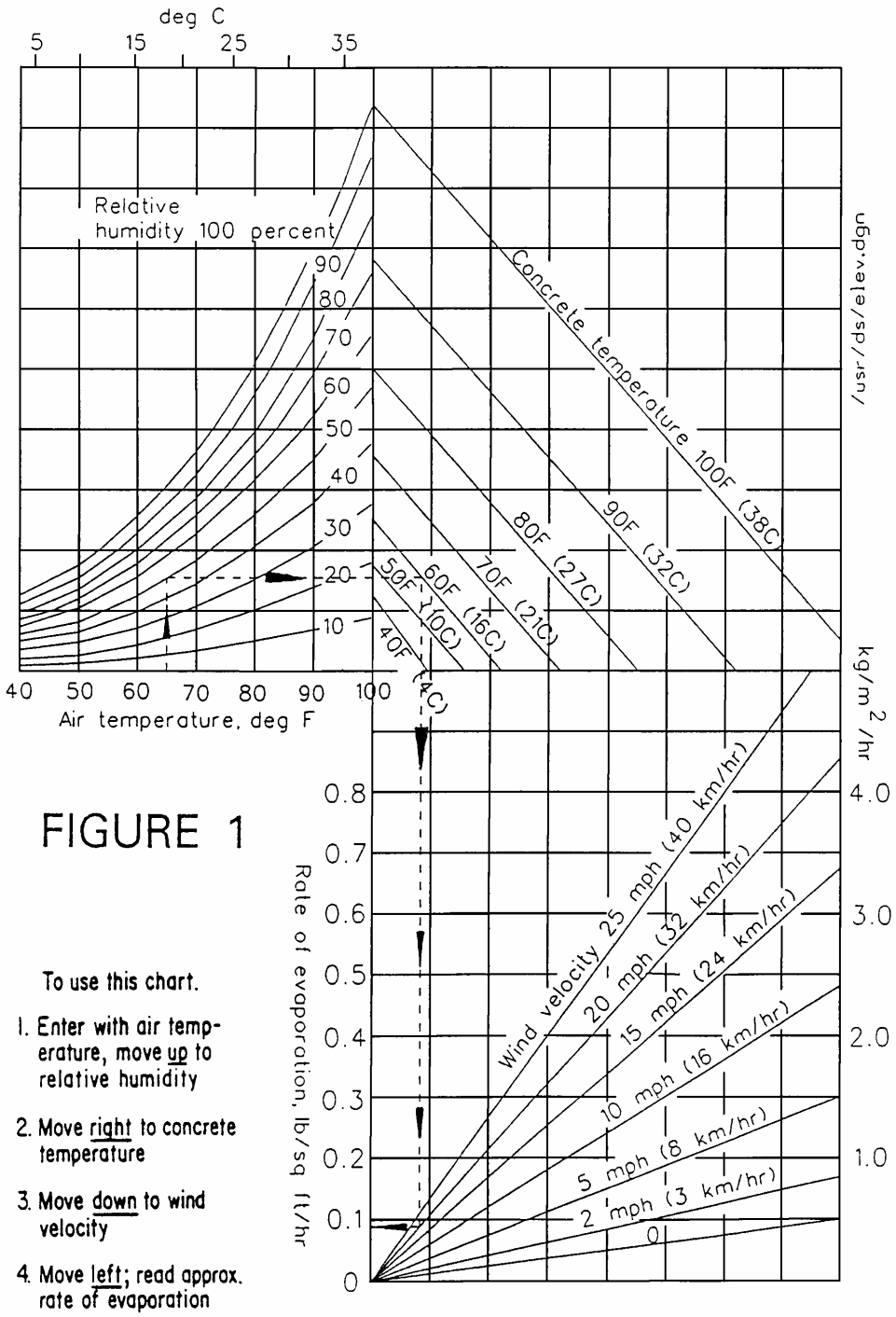

FIGURE 1

To use this chart.

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

601.10.1.3 – Concrete Placement Limitations: If the evaporation rate exceeds 0.10 lb./sq. ft. per hour (see Figure 1), the Contractor shall make provisions (i.e. wind breaks, fogging, etc.) to reduce the rate prior to placing concrete.

601.10.1.4 – Concrete Placement at Night: If placement of any concrete is to be made at night, a plan which provides adequate lighting for the work area shall be submitted at least 14 days before concrete is placed for the Engineer's approval.

601.10.4 - Placing Concrete Bridge Decks:
ADD THE FOLLOWING SUBSECTIONS:

601.10.4.1 - Fogging Equipment: When Class H concrete is used, fogging equipment shall be available for use in accordance with these specifications. The fogging nozzles shall produce an atomized mist. Fogging nozzles shall incorporate compressed air to create the mist. Hand held or hand operated equipment shall be permitted when the Contractor has demonstrated that his operator has been trained in its use.

601.10.4.2 - Placement: The following requirements shall apply during placement of the Bridge Deck concrete:

a) So that the use of hand tools will be kept to a minimum, concrete shall be deposited as nearly as possible to its final position. Internal vibrators shall not be used for moving concrete into position.

b) A pencil type vibrator shall be used along all construction joints to further consolidate the concrete to prevent voids.

c) The new concrete shall be placed slightly above final grade. It shall then be struck-off, screeded, and finished to final grade.

d) The finished surface, before texturing, shall be uniformly smooth, dense and even. Variations in pavement surface in excess of ⅛ inch above, or below, the proper finished elevation, or surface irregularities of more than ⅛ inch in 10 feet, will not be accepted.

e) A construction dam, or bulkhead, shall be installed in case of a delay in the placement operations exceeding 30 minutes duration. During any delays of 30 minutes or less, the placement shall be protected from drying with several layers of wet burlap. If the concrete placement is stopped, or delayed, for 90 minutes or more, further placement shall be discontinued and may be resumed only after the concrete has cured. This restriction does not prohibit continuation of the placement provided a gap is left in the placement. This gap shall be sufficient in

length to allow the finishing machine to clear the previously placed concrete.

f) Adequate precautions shall be taken to protect freshly placed concrete from rainfall. All placement operations shall stop when it starts to rain. The Engineer may order removal and replacement of material damaged by rainfall.

g) The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

601.11.4-Finishing Concrete Bridge Decks:

ADD TO THE FOLLOWING SUBSECTION:

601.11.4.1 – Class H Bridge Decks

Surface Texturing: The surface of the Class H concrete shall be uniformly smooth, dense and even. The surface shall then be given a suitable texture with an approved burlap drag.

The Contractor shall texture in a transverse or longitudinal direction. Once begun, the direction of texturing shall not change. All texturing shall be performed prior to the beginning of curing operations. Only one pass of the drag over the finished area will be permitted. Texturing shall be in strict accordance with the time requirements of 601.12.4 for applying wet burlap.

If texturing is done in the transverse direction, the Contractor shall texture by hand methods as soon as practicable after finishing machine passage.

If texturing is done in the longitudinal direction, the burlap drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured as soon as practicable after finishing machine passage. Small areas, inaccessible to the attached drag, may be textured by hand methods.

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

Texture resulting from the drag shall stop within one foot of curbs or parapets.

Class H Concrete Finished Deck Grooving: After corrective grinding and before opening to traffic, grooves shall be cut into the concrete using a mechanical saw. These grooves shall be 0.10 inch wide and 0.25 inch deep. Groove spacing shall be 1.5 inches center to center. No later than one week prior to grooving operations, the Contractor shall provide the Engineer with two accurate, easily readable gauges with which to verify groove dimensions. Groove depth and spacing tolerances are limited to ±1/16 inch. Groove width tolerances are +0.02 inch and -0.0 inch. The

grooves shall be cut in a direction that is transverse to the centerline of the roadway or parallel to the skew. On any one bridge the direction of the grooves shall be consistent. Grooves shall be cut continuously across the deck to within one foot of gutter lines or drainage structures. Grooves shall also be continuous across the full width of the deck surface including construction joints. Grooves shall terminate within 1 inch of any exposed metal component or elastomeric concrete of an expansion joint. When the deck is skewed and the contractor is using gang blades to saw the grooves, the maximum distance (measured perpendicular to the centerline of the expansion joint) from the last groove termination in the pass to the expansion joint shall be 1 foot - 8 inches. Radial grooving shall be performed in increments limited to 12 feet of bridge length.

Saw Cutting Equipment: Only multi-bladed saw cutting equipment, using circular saw blades, will be permitted for final deck finish operations. The Engineer may allow the use of single blade circular saw equipment only where such equipment is necessary to complete the work as required.

601.12 – CURING AND PROTECTING CONCRETE:

601.12.1-Curing Under Normal Conditions:

DELETE THE SECOND PARAGRAPH AND REPLACE WITH THE FOLLOWING:

Concrete surfaces shall be kept completely and continuously moist. Curing shall be continued for a period of at least 7 days. This curing period may be reduced if the contractor presents evidence that the in place concrete has attained 70% of the specified strength for the class of concrete under cure. Under no circumstances, shall the period of cure be less than 3 days. The reduced curing period option is not applicable to Class H or Class K concrete. Surfaces may have coverings temporally removed for finishing, but the covering shall be restored as soon as possible.

ADD THE FOLLOWING PARAGRAPH:

Curing Temperature is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering.

601.12.2-Curing Under Cold Weather Conditions:

ADD THE FOLLOWING TO THIS SECTION:

Class H or Class K Concrete External Heat Provisions: The provisions of ACI 306, Cold Weather Concreting, and the following modifications shall apply:

a) Temperature limits shall be maintained for 168 continuous curing hours.

b) Enclosures for heat retention shall be properly vented to prevent surface disintegration from carbon dioxide gas.

If the curing temperature drops below 45° F during the curing period, then the surface shall be enclosed and external heat shall be provided in accordance with the provisions of this section. The time required for tenting will not be counted as curing time. Once external heat provisions are required, they shall remain on the surface until curing is complete, regardless of the ambient air temperature.

If curing temperature falls below 32° F, at any time during the curing period, the concrete will be rejected.

Continuous wetting shall be replaced by wetting at regular intervals if, in the opinion of the Engineer, expected air temperatures could result in freezing of run-off water.

ADD THE FOLLOWING SUBSECTIONS:

601.12.4 – Curing Class H Concrete: It is the nature of Class H concrete material to quickly form a plastic film at the surface upon drying. This film is to be protected from drying and cracking by prompt covering with wet burlap. Regardless of the type of concrete placed, the use of membrane curing compounds will not be allowed. Floor drains shall be immediately unplugged to permit the deck to drain.

The concrete surface shall be completely covered with clean, wet burlap. The burlap shall be thoroughly saturated over its entire area, but shall be drained of excess water before application. Burlap shall be lapped a minimum of one foot and shall lay flat. Failure to apply wet burlap within 10 minutes after the concrete has been placed will be cause for rejection of the work as determined by the Engineer. The Engineer may extend time if the plastic film has not formed or the Contractor's fogging operation adequately protects the film. Care shall be exercised to ensure that the burlap is well drained. Burlap shall be continuously wet for a period of seven days by means of automatic intermittent sprinkling or a continuous wetting system.

601.14 - METHOD OF MEASUREMENT:
DELETE THE FIRST PARAGRAPH AND CHANGE TO THE FOLLOWING:

The quantity of work done for Class A, Class K, Class H, Class B, Class C and Class D concrete will be measured in cubic yards, complete in place and accepted, as determined by the dimensions on the Plans or contract documents, and will be the number of cubic yards established in the Proposal, subject to adjustments provided for in 104.2 and 109.2.

ADD THE FOLLOWING PARAGRAPH:

Test Slab will be measured on a lump sum basis complete in place. This shall include the complete execution of work required herein, regardless of the number of test slabs constructed. This item may be deleted at the discretion of the Engineer.

601.15 - PAY ITEMS:

ADD THE FOLLOWING PAY ITEMS:

ITEM	DESCRIPTION	UNIT
601009-*	CLASS H CONCRETE	CUBIC YARD
601014-*	TEST SLAB	LUMP SUM

* Sequence Number