

# MURK Part 1-B

## Construction Inspection Manual (CIM)

Unofficial Compilation

### DISCLAIMER

This file is substantially similar to the official MURK 1B, Construction Inspection Manual. It incorporates all official changes (as released by Engineering Bulletins) to the manual as of 02/25/2003.

However, **THIS IS NOT AN OFFICIAL COMPILATION**, and should not be distributed outside of the Department of Transportation. If any discrepancies exist between this electronic document and the printed version(s), the printed version(s) will take precedent.

**The exhibits are not included in this electronic document.** Also, as the official changes have been added, the page numbering has been affected, and thus may not match the official version of the CIM.

In particular, the layout of words, lines, tables, etc. on a page varies with printers. The printer selected may place different numbers of words on some lines, and different numbers of lines on many pages, and tables and graphics may shift their location. Thus any instructions regarding changes identified by page and line numbers apply only to the document printed and distributed by New York State Department of Transportation.

Please notify Brian DeWald of the MO Construction Division of any discrepancies found in this document.

## Unofficial Compilation

## **SECTION 200 EARTHWORK**

### **SECTION 201 - CLEARING AND GRUBBING**

#### **201-3.01 Limits of Work Areas**

This work, as stated in the Standard Specifications, consists of clearing, grubbing, removing and disposing of all trees, brush, stumps, fences, debris and miscellaneous structures not covered under other contract items, within the construction area and such other areas as specified or directed.

Safety and aesthetic interests relate to the proximity of trees to the traveled way. From a safety perspective:

1. collisions with trees are the leading cause of fatalities for run-off-the-road crashes,
2. the closer the trees are, the higher the crash rate is, and
3. the closer the trees are, the greater the accident severity is.

Roadside trees, shrubs and herbaceous plants provide seasonal aesthetic value to highway travelers, screen unsightly adjacent land uses for motorists and bicyclists, screen the highway from adjacent sensitive residential, recreational and commercial properties, and provide important wildlife habitat. Existing vegetation, including dead trees, provide food sources, nesting sites, refuge areas and travel corridors for many species of birds, mammals, amphibians and insects. Existing vegetation also serves to protect water quality and to stabilize the banks of streams, ponds and rivers.

There is no standard for clear zone area width that will provide a "safe condition". Instead we try to provide as much clear zone as we reasonably can without adverse socio-environmental impacts. To aid the EIC in making decisions about width, the HDM states "It is desirable for the designer to note on the plans locations where it may be possible to conveniently provide more clear area than the Design Clear Zone Width". Almost without exception, the wider a clear zone is, the safer the facility will be. At some point, of course, the safety benefits decline to less than the economic and aesthetic cost. The Engineer should coordinate the limits of vegetation to be saved with the Regional Landscape Architect.

For aesthetic and wildlife habitat reasons, avoid removing vegetation in even width bands for long stretches of roadway. This creates a monotonous appearance and degrades wildlife habitat. Trees and shrubs should be retained on uphill slopes, along stream corridors, at rock outcroppings, behind guide rail and in areas where there is no history of accidents. This will help to create a varying width clear zone that is more aesthetically pleasing. In no case should vegetation be cleared at a distance of greater than 50 feet, measured horizontally, from edge or pavement unless a documented accident history exists. The Engineer should coordinate the limits of vegetation to be saved with the Regional Landscape Architect and the Regional Environmental Contact.

The designer does not quantify clear zone widths. It would require a complex assessment involving traffic volumes, traffic speeds, vehicle types, embankment slopes, degrees of curvature, and environmental considerations. Obviously, there will be locations where special features limit the widths that can be cleared. There will be other locations where safe widths can be provided. In fact, there will be continuous variation in the widths that can be reasonably obtained over the length of the project. It has been viewed as impractical to describe and/or specify the construction of a continuously varying width of clear zone. The approach is to divide the roadside into stretches having similar roadside conditions and specify design clear zone widths for each segment on the plans. The design clear zone width, once established, represents our legal commitment to maintain that width in a cleared and safely transversable condition.

As a result of the permit work, ROW acquisition debates, discussions with environmental agencies and groups and public hearings, the Department should be in a good position to know where the efforts should be made to obtain more than the minimum width of clear area and where efforts should not be made.

The importance of designating carefully selected clear zone limits in wooded areas of the Adirondack and

Catskill Parks and along parkways, scenic byways, signed bike routes, river and stream corridors, designated scenic touring routes, and adjacent to public parks and wildlife management areas should be readily apparent. In these locations statewide, even greater consideration should be given to retaining existing woody vegetation. Doing a sensitive job under clearing and grubbing will be instrumental in improving the Department's environmental image and performance.

Often, formal and informal agreements on vegetation removal or retention have been made during planning and design with the regulatory and resource agencies, environmental groups and municipalities. The Engineer should ascertain from the Regional Design Engineer and the Regional Environmental Contact as to what commitments have been made. If these are not reflected in the contract documents, any conflicts between such commitments and the Department's safety standards should be resolved through the Construction Supervisor with direct involvement by the Regional Landscape/Environmental Unit.

## **SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

### **202-3.01 General and Safety Requirements**

#### **General**

Demolition of structures and buildings, and the replacement of structural elements on structures that are to remain in place, represent significant safety risks both to the works involved and to the traveling public. It is essential that these operations are carried out under the careful supervision of the contractor with adequate consideration of safety. The Engineer's attention is directed to Sections 202 and 589 of the Standard Specifications, which provide specific requirements that the contractor must address. Any demolition or removal of structural elements carried out under other sections of the specifications must address the same general requirements as listed in Section 202 and 589, based on the general health and safety provisions of Section 107-05A of the Standard Specifications, and on Subpart T of Title 29 Code of Federal Regulations Part 1926 (OSHA health and safety regulations for Construction).

Specific requirements include the following:

1. Prior to demolition operations, the contractor's competent person shall make an engineering survey of the building or structure.
2. The written findings and recommendations of this survey shall constitute a removal plan, which must be given to the Engineer and filed with the Project Safety and Health Plan. The removal plan must meet all the requirements of Title 29 Code of Federal Regulations Part 1926, Subpart T-Demolition, and also be consistent with the contractor's Project Safety and Health Plan. It should address the following areas of concern:
  - a. Existing condition of the building or structure.
  - b. Possibility of collapse of any portion during demolition operations.
  - c. Condition of adjacent buildings or structures within 300 meters (if directed by the Engineer). To make this determination, the Engineer should consider whether the stability of adjacent buildings or structures will be significantly affected by demolition operations.
  - d. Description of type, size and location of equipment to be used in the demolition operations.
  - e. Sequence and preliminary schedule of removal activities. The schedule should also identify any critical operations which will require on-site monitoring by the contractor's competent person.
  - f. Bracing or shoring required to secure or stabilize deteriorated buildings or structures so that workers can perform operations safely.
  - g. Walls, supports and bracing necessary to accomplish the demolition of party wall structures.
  - h. Details of the shoring and shoring foundations necessary to prevent damage to adjacent property.
  - i. Designation and identification of non-access areas (areas that could become unstable or subject to collapse).
  - j. The presence of potentially hazardous materials that were noted during the necessary structural survey. The competent person is not expected to perform hazardous materials survey and testing (this should have been done during the design phase), but suspect materials should be identified for testing by the State.

## **SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

- k. Plans for monitoring the building or structure during demolition operations. The contractor's competent person does not always have to be present, but should monitor the operations on a frequent and continuing basis, and be on-site to monitor any critical operations.
  - l. Plans for shutting off or maintaining utilities on the building or structure.
  - m. Maintenance and protection of traffic scheme.
3. For bridge structures longer than 6 meters, the competent person must be a registered Professional Engineer, unless this requirement is specifically waived in the contract documents. The decision to waive the requirement is made by the project designer, based on the type of structure, the condition of the structure and the type of feature crossed.
- For buildings, other than ordinary wood frame construction, the competent person must be a registered Professional Engineer or a registered Professional Architect.
4. Removal plans that must be prepared by a Professional Engineer or a Professional Architect shall be submitted to the Engineer 30 days prior to the commencement of demolition operations. Other removal plans shall be submitted 15 days prior to commencement.

### **Review of Contractor's Demolition Plan**

The Engineer should review the contractor's demolition plan to ensure that it addresses all appropriate specification requirements. If any obvious omissions are noted, the plan should be returned to the contractor with a request that the necessary information be provided. On particularly large and complicated jobs, the Engineer may also request the Regional Structures Engineer to review the demolition plan.

### **Inspection During Demolition**

During the course of demolition operations, the Engineer and the inspection staff must ensure that the contractor complies with all aspects of the demolition plan submitted. Inspectors must be knowledgeable about the specific aspects of the demolition operations for which they are responsible.

### **Changes to Demolition Plan**

Any changes to the demolition plan must be submitted to the Engineer for review as noted above. The Engineer is responsible for ensuring the inspection staff is kept informed of all such changes.

### **References:**

LOCAL BUILDING CODES

NYS FIRE PREVENTION & BUILDING CODE

NYC BUILDING CODE (FOR NYC PROJECTS)

TITLE 29 CODE OF FEDERAL REGULATIONS, PART 1926, SUBPART T-DEMOLITION

EI 92-020 "DEMOLITION SPECIFICATION"

EI 92-034 "ASBESTOS"

EI 93-034 "PROTECTING WORKERS FROM LEAD AND MATERIALS CONTAINING LEAD (PAINT)"

## **SECTION 203 - EXCAVATION AND EMBANKMENT**

### **203-2.01 Tests and Control Methods**

Included as Exhibit 203A is the Geotechnical Engineering Bureau's recommended frequency of sampling and testing of various earthwork items for quality control purposes. The number of samples and tests, as well as the distribution of locations from which they are taken, should be such as to adequately assure and verify that the materials incorporated in the work and resulting construction are acceptable and in accordance with the plans and specifications.

The sampling and testing should be augmented and coordinated by adequate visual inspection. It is important not only to assure that the methods and equipment used are in accordance with the specifications, but also to assure that the samples and tests are taken from material which is representative of the entire mass of materials. It is expected that inspection personnel on major earthwork projects will continuously observe all earthwork operations at all times and that the sampling and testing will be done by other personnel, to preclude the necessity for earthwork inspectors to leave the scene during operations to perform a test.

Earthwork compaction control tests may only be waived if, in the judgement of the Engineer-in-Charge, with the concurrence of the Regional Geotechnical Engineer (in writing) , the material being placed and compacted contains a sufficient proportion of gravel, stones and cobbles, as to make the performance of compaction control tests impractical.

However, compaction control tests shall not be waived on materials containing less than 30% by weight of particles retained on the 19 millimeter sieve. Waivers shall be properly noted in the project records, whenever compaction control tests are waived. The compaction control tests should reflect the in-place density of the entire lift thickness. The Contractor is required to provide adequate access to sources in order to perform these control tests.

All areas of failing tests should be retested after reworking the materials or applying additional compactive effort until a passing test is obtained. The Inspectors Daily Reports should cross-reference the failing test(s) and passing test(s).

### **203-3.01 General**

Soils and soil related items account for a significant proportion of the work involved in the construction of transportation facilities. Therefore, control of these items by the earthwork inspectors under the supervision of the Engineer-in-Charge (EIC) is essential. Although the EIC is wholly responsible for the enforcement of all the requirements of the specifications and the control of these items on the project, he/she may convene a preconstruction meeting on projects involving particular Geotechnical procedures or operations. Additionally, the EIC may request the advice and assistance of the Regional Geotechnical Engineer on soil engineering problems that develop as the job progresses.

The requirements for the earthwork items are found in the 200 section of the specification book. However, the plans and proposal should be examined closely for special notes and special specifications. The General Provisions, given in Section 100 of the specifications, also contain requirements which affect excavation items.

Section 107-01 requires that the Contractor abide by all applicable laws and regulations. Industrial Code Rule 53 (12NYCRR 53) applies to all excavation work by the Contractor. This rule establishes the legal responsibilities for the operators of public or private underground facilities and excavators. In essence, 12NYCRR 53 requires that prior to the start of excavation or demolition work the Contractor obtain a listing of the owners and operators of underground facilities in the area and notify them of the plan to perform this work. A listing can be obtained from the central registry maintained by each town or city outside the City of New York and each County within the City of New York. The operator is then required to stake out all of his underground facilities within the work area which the Contractor must verify as to the type, size, direction of run and depth and encasement before starting work. The work required to comply with Code

## **SECTION 203 - EXCAVATION AND EMBANKMENT**

Rule 53 is incidental to the contract and as such no separate contract payment is made for this work.

In general all earthwork operations should cease between November 1st and March 31st. Temperatures below 0°C do not allow adequate compaction of most materials because frozen water inhibits consolidation of the individual soil particles. However, the Regional Director may grant exceptions which can contain additional requirements in order for the work to proceed. The construction of crushed rock embankments, are generally allowed under this exemption provision.

### **203-3.03 Soil Erosion and Water Pollution**

Section 203, Excavation and Embankment and Section 209 Temporary Soil Erosion and Water Pollution Control of the Standard Specifications both require schedules to be submitted. Work should not be permitted until these schedules have been received and approved. These schedules should be compared to and should be consistent with the contract documents erosion and sediment control plan to ensure that a logical sequence of excavation and control measures exist throughout the construction staging or until final site stabilization.

### **203-3.05 Rock Excavation & Scaling**

Prior to drilling of any holes and blasting operations on projects involving rock and/or structural removal, a project pre-blasting meeting is required. Those in attendance should include the Engineer, Contractor, Blaster, representatives of all affected agencies, utility companies and an Engineering Geologist from the Geotechnical Engineering Bureau.

The Earthwork Inspector should document all aspects of the drilling and blasting operations on Form GE-469 (Exhibit 203B), "BLASTING REPORT," and append it to the MURK-1, "INSPECTOR'S DAILY REPORT." Consult an Engineering Geologist for assistance in completing these forms.

Engineers on projects involving rock scaling where weighing of scaled materials is required shall complete FORM SM-428 (Exhibit 203C), "DAILY RECORD OF SCALE WEIGHTS."

On projects with contractor-supplied scales, the Contractor may use Certified Public Scales or may furnish certified scales. Inspect the contractor-supplied scales. Record the certification and presence of an unexpired seal of the appropriate Sealer of Weights and Measures on MURK-1, "INSPECTOR'S DAILY REPORT," documenting that only certified scales are used on the project. In the case of certified public scales, the Engineer shall provide the Contractor with written authorization to use specific scales.

As indicated in the specification, the tare weight of each truck shall be furnished to the Engineer prior to the start of work. After weighing and before reloading, a delivery ticket for each truck load shall be provided to the Engineer (or his representative) with at least the following information: scale identification, date, time and loaded truck weight.

### **203-3.06 Suitable Material**

Excavation items do not generally require testing of the excavated material. It is generally either suitable or unsuitable for embankment as defined in the specifications. In most cases, design investigations have determined whether suspect sites are contaminated and the proper disposal method. If soil is excavated that appears to be contaminated, work should immediately be stopped and the Regional Environmental Contact notified. The Regional Environmental Contact would then give direction to the EIC on how to properly proceed with the work.

### **203-3.08 Disposal of Surplus Excavated Materials**

Any surplus material generated in the course of a DOT construction project becomes the property of the Contractor to dispose of in accordance with all applicable laws and regulations. As per the specifications, the EIC must approve of the Contractor's proposed spoil/waste site regardless of whether it is on DOT ROW or on private land. Also these approved spoil sites must be restored in a manner consistent with

## SECTION 203 - EXCAVATION AND EMBANKMENT

sections 107-10 and 107-11. Disposal should not be approved in wetlands or flood plains, or adjacent to.

The Contractor may request to dispose of surplus material for the flattening of existing embankment slopes or filling of other areas within DOT's ROW. The EIC should verify that this fill will not infringe on a wetland or flood plain. A wetland, depending on its size and location, is regulated by DEC, APA, and/or the Army Corps of Engineers. All of these agencies have strict regulating processes to follow before an approval is granted to place fill in a wetland. Filling wetlands outside of the ROW may affect the type and conditions of the wetland permits obtained during design for work within the project limits. Even if the wetland spoil area were approved, the Contractor or the Department may be required to mitigate the loss of the wetland by creating an equal sized wetland in another location. In summary, the widespread availability of nonwetland spoil sites, time for approval, and associated costs, should preclude the consideration of wetlands for spoil sites.

Flood plains are regulated by DEC to ensure that construction activities do not increase the severity of flooding due to encroachment into the floodway or fringe areas. The floodway and fringe areas are the components of the flood plain. By definition, the flood plain is the land that is flooded by the 100 year flood. The elevation to which the flood will rise is termed the base of the flood elevation and is determined by the Federal Emergency Management Agency (FEMA). Because an outside agency has the responsibility to review and approve the disposal of material in these designated areas, the time for review and the decision itself are uncertain. Therefore, common sense would again dictate that flood plains should not be considered as a spoil area.

The only surplus demolition material that can be allowed in a waste site on or off DOT ROW is milled asphalt concrete or crushed portland cement concrete provided there is no exposed rebar. The EIC should refer to DEC's waste regulations , 6NYCRR, Part 360 to ensure proper disposal for all other demolition material. The Contractor must supply the EIC with all the appropriate paperwork which will be filed with the appropriate documentation.

### **203-3.10 Embankment Construction**

### **203-3.12 Compaction**

Embankment construction includes operations such as stripping, benching, and preparation of the embankment foundation, as well as the placement and compaction of suitable embankment materials. The major controls of embankment construction are the lift thickness, compactive effort, type of equipment and density requirements. Moisture content is controlled by the Contractor.

Lift thickness and compactive effort depend on the compaction equipment supplied by the Contractor. When a smooth drum is provided , a current list of the "Manufacturer's Data for the Rating of Smooth Drum Vibratory Compactors for Earthwork Construction" is available (see Exhibit 203D). The basic machine data for the various models required to determine loose lift thickness are unsprung drum weight, dynamic force, rated frequency, and drum width. Machines which do not meet the specifications are so noted. Machines which have had their specifications altered without changing the model number designations have been listed with the minimum acceptable parameters. The words low, medium, high, super, or the initials L, M, H, etc., appearing after the model number indicate a machine that has the capability of changing the dynamic force applied by varying the amplitude and/or rated frequency. The acceptable frequency range data provides limiting frequency values within which the compactor may operate (the acceptable frequency range is limited to 1100-1500 VPM by specification). The actual operating frequency must be verified by a tachometer supplied by the Contractor. For assistance in evaluating compaction equipment that is not on the current list, call the Regional Geotechnical Engineer. It is advisable to request assistance promptly to allow sufficient time to obtain the necessary data to rate the equipment.

Determination of loose lift thickness for the use of smooth wheel steel drum vibratory roller meeting the



## SECTION 203 - EXCAVATION AND EMBANKMENT

specifications and given in Exhibit 203D is as follows:

1. Given the manufacturer, model number, and anticipated operating frequency, enter the column headed "Frequency Range" to verify the operating frequency falls within the acceptable range.
2. Determine the operating dynamic force by converting the rated dynamic force to the planned operating frequency.
3. Using the operating dynamic force, unsprung drum weight, and drum width determine the minimum compactive force per unit length of drum.
4. Enter the graph (Figure 203-3) in the Standard Specifications, Section 203-3.12, Compaction, with the minimum compactive force and horizontally project to the intersection of the appropriate curve for soils and select granular material or blasted or broken rock then vertically down to determine the maximum loose lift thickness.
5. If the Contractor wishes to change the number of passes or operating speed of the roller, a new corresponding operating speed or number of passes would need to be established.

Example:

The Contractor wishes to use a Dynapac CA141D at an operating frequency of 1475/ V.P.M. and 4 passes to compact granular fill. What is the maximum loose lift thickness and operating speed?

1. The proposed operating frequency, 1475v.p.m. is within the listed frequency range of 1447-1500 v.p.m.
2. Conversion of manufacturer's published ratings, at a given frequency (see Exhibit 203-D), shall be made with the following equation:

$$\frac{F_2 = F_1(V_2)^2}{(V_1)^2} \quad 9,088 = \frac{15,883(1475)^2}{(1,950)^2}$$

3. Determine the minimum effective compactive force per unit length of drum.

$$P_{LI} = \frac{\text{Unsprung Drum Weight}(lbs) + \text{Dynamic Forced}(lbs)}{\text{Drum width}(inches)} \quad 210 = \frac{3500 + 9088}{60}$$

4. Determine maximum loose lift thickness.

From figure 203-3(B) 8 inches

5. Determine new operating speed for 4 passes of the roller.

## SECTION 203 - EXCAVATION AND EMBANKMENT

$$SpeedX = \frac{(SpecifiedSpeed) \times (Minimumpasses@X)}{(SpecifiedMinimumpasses))}$$
$$3ft/s = \frac{4.5(4)}{6}$$

Once determined, the compaction equipment, operating frequency, maximum and actual lift thickness, and number of passes shall be recorded on MURK-1, "INSPECTORS DAILY REPORT."

For items which have density requirements, minimum densities shall be verified with compaction control tests performed on the job by the project's earthwork inspection personnel. These tests shall be performed in conformance with the procedures contained in the appropriate Departmental publication in effect on the date of the advertisement for bids (References: STM-6, 9 or 10). The Regional Geotechnical Engineer can specify the appropriate test(s).

Test results shall be documented on MURK-1, "INSPECTOR'S DAILY REPORT," and Forms SM-384A, (Exhibit 203E) "COMPACTION CONTROL DATA SHEET," SM-417B, (Exhibit 203F) "FIELD COMPACTION DATA SHEET - SAND CONE OR VOLUMETER APPARATUS," AND/OR SM-418B, (Exhibit 203G) "FIELD COMPACTION DATA SHEET - NUCLEAR DIRECT TRANSMISSION." Retests of previously failing tests should be cross referenced to the original tests. A copy of the SM-417B shall be submitted to the Regional Geotechnical Engineer for their files.

### **203-3.15 Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cables**

Controlled Low Strength Material (CLSM) is often an acceptable alternative to compacted soil backfill. CLSM consists of cement, water and, at the contractor's option, fly ash, aggregate or chemical admixtures in any proportions such that the final product meets the strength and flow consistency requirements included in the specification. The mix is proportioned to be self leveling and does not require compaction. It is much lower in strength than concrete, making future excavation possible. CLSM should be thought of as "liquid dirt."

Guidelines for Placement and Inspection of Controlled Low Strength Material (CLSM):

- A - Narrower trench widths can be employed when using CLSM instead of soil backfill due to the self-compacting properties of the material. Therefore, construction personnel and equipment are not required to be in the trench for compaction operations. Some installations, however, may require that construction personnel temporarily occupy the trench to make adjustments to the alignment of the pipe. In this case, all OSHA requirements will be followed.
- B - In situations where CLSM is used as backfill around lightweight pipe, flotation of the pipe may occur. To counteract the buoyancy of the pipe as the CLSM is placed, partially fill the pipe with water as necessary for weight. Anchors, straps and gravel bags are also used to weight the pipe, but these methods are less desirable, as arching between the anchor points can occur.
- C - When placing CLSM, pour the material onto the top of the pipe at the center. This will help hold the pipe down and ensure even placement rates of CLSM on opposite sides of the pipe.
- D - Do not place CLSM in contact with aluminum pipe, including connections, fixtures, etc., unless the aluminum has been coated with an approved primer. Do not place CLSM containing fly ash in contact with cast iron pipes.

## SECTION 203 - EXCAVATION AND EMBANKMENT

- E - Once the depth of CLSM cover over the pipe is 150 mm and the remaining trench depth is less than 1.5 m, a 50 mm layer of crushed stone can be placed and tamped directly on the CLSM, allowing conventional backfill operations to continue during set-up of the material. If suitable, use the excavated soil as backfill material on top of the crushed stone to ensure uniform frost reaction.
- F - Where the distance between the top of pipe elevation and the top of subgrade elevation is less than 0.6 m, use CLSM for the backfill material to top of subgrade elevation.
- G - CLSM should be kept encapsulated with soil, as it is highly erodible and disintegrates when left exposed to the environment.
- H - Refer to Special Specification Item 17203.80 and Standard Sheet Nos. 203-6 and 203-7 for additional construction details of CLSM.

### 203-3.16 Borrow

As per the specification, any offsite borrow source must be approved by the Engineer-in-Charge prior to its use. Permission to use construction and demolition (C&D) materials from off-site locations must be critically reviewed as existing NYSDEC regulations severely restrict the type of C&D material that can be allowed for embankment construction. Also, it may be necessary for a mining permit to be acquired by the contractor. The recognized danger is that crushed or shredded, and therefore, unrecognizable C&D material is an ideal medium to conceal the disposal of hazardous or toxic materials. Accordingly, only recognizable uncontaminated concrete, asphalt concrete pavement, brick, soil or stone can be legally placed in our embankments. The presence of any other material even in minute amounts should be cause for rejection and requires the disposal by DEC, of all the material in a DEC approved C&D landfill. If this material is contaminated, it may not be acceptable for disposal in a DEC approved C&D landfill. In those instances the Engineer should defer to DEC so that the waste is properly disposed and does not create a problem.

### 203-3.17 Select Granular Materials

The control and test requirements of granular materials used on a project is covered in the appropriate Departmental publication in effect on the date of the bid advertisement (Reference: GCP-17).

Material for items in the 203 series do not require stockpiling. However, a Contractor may choose to stockpile these items, and if so, that material will be sampled, tested and evaluated as a stockpiled item. If the Contractor elects to stockpile 203 item materials, the EIC and Regional Geotechnical Engineer should inspect the construction of the stockpile(s) to assure that it is constructed according to Departmental requirements (Reference: GCP-17). Record the material source and stockpile construction features on MURK-1, "INSPECTOR'S DAILY REPORT." Final approval of the stockpile is requested and obtained from the Regional Geotechnical Engineer. The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of stockpiles. Test results will be reported on Form GE-454M (Exhibit 203H), "GRANULAR MATERIAL DOCUMENTATION FORM" and filed with project identification number and location of use with a copy to the Regional Geotechnical Engineer.

For items not stockpiled, which require soundness and plasticity index determinations, samples shall be taken by the Regional Geotechnical Engineer for testing in accordance with established Departmental procedures. Test results will be returned on Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM." A copy of this form shall be part of the project records. For projects that obtain material from sources which were tested under other projects, a copy of a letter approving transfer from the Regional Geotechnical Engineer, as well as a copy of the original GE-454M, shall be placed in the project file.

For items not stockpiled, which required conformance to a particular gradation, sieve tests shall be performed by earthwork inspection personnel in accordance with Departmental instructions (Reference: STM-20) and reported on Forms SM-15B (Exhibit 203I) , "SIEVE ANALYSIS DATA" and SM-198C (Exhibit

## SECTION 203 - EXCAVATION AND EMBANKMENT

203J), "FIELD SIEVE ANALYSIS SUMMARY SHEET - GRANULAR MATERIAL." For a guide to sampling frequency, refer to Exhibit 203-A.

### 203-3.18 Embankment Construction Control Devices

Facilities constructed on soft and compressible foundations sometimes require the installation of devices to determine settlement. The construction details and procedural requirements for these devices are given in a Departmental publication (Reference: GCP-15). Forms GE-435, "SETTLEMENT REPORT - MANOMETER GAGE (Exhibit 203K)," GE-436 (Exhibit 203L), "SETTLEMENT REPORT - ROD GAGE," and/or GE-437 (Exhibit 203M), "SETTLEMENT REPORT - PIPE GAGE," shall be completed.

Occasionally, piezometers are installed to monitor pore water pressures in embankments or slopes. Piezometer readings shall be recorded on Form GE-264 (Exhibit 203N), "PORE PRESSURE REPORT VIBRATING WIRE PIEZOMETER."

To monitor potential slope movements, slope indicator installations may be required. Form GE-422, (Exhibit 203O) "SLOPE INDICATOR DATA SHEET," shall be completed to record these readings.

### 203-4 Method of Measurement

- A. Payment lines for all items of work with payment units in cubic meters encompassed by Section 203 shall be computed from payment lines shown on the Plans or Standard Sheets, except where revised payment lines are established by the Engineer, in writing, prior to performing the work.
- B. Excavation of unsuitable material shall be permitted by the Engineer to the payment lines establishing the lateral and depth extent of the excavation as shown on the applicable cross sections. If such payment lines are not indicated on the cross sections, the Regional Geotechnical Engineer should be requested to acquire and furnish sufficient subsurface information that will permit the establishment of payment lines. Such payment lines shall be established and approved by the Regional Geotechnical Engineer before any excavation is done. The depth, extent and payment for unsuitable material excavation shall be based on predetermined payment lines and not on such criteria as the color of the water, the color of the muck in the bucket, or the color of the waste pile. Just prior to backfilling, the Engineer shall verify that the excavation has been completed to the payment lines. Also, payment shall not be made for excavation or backfill in excess of such predetermined payment lines.

#### 203-4.01 General

Interim earthwork quantities are almost always estimated. Back-up calculations must be kept on file for all estimated quantities. Steps shall be taken to assure that progress estimates of such estimated quantities as earthwork are reasonably close to the actual quantities at the time of an estimate.

A number of methods can be used to check earthwork quantities as the job progresses. Because of the large number of variables, such as type of contract, operating procedure of the contractor and size of the inspection force, the choice of method employed for checking estimated earthwork quantities is left to each Engineer-in-Charge. A few of these methods are:

- 1. Load count by our inspector. When using a load count method the vehicle volume should be documented. Volumes (both heaped and level) should be available from manufacturers' literature for most earthmoving equipment. If not, the vehicle should be measured. This theoretical volume can be factored to compensate for void space and, thereby, arrive at an adjusted compacted or in-place volume to use for loose measure truck counts. Continued periodic surveys of excavation or embankment should be made and truck volume factors adjusted as necessary.
- 2. Periodic surveys of cut areas at each estimate period. However, in most cases, time and personnel preclude the use of this method.
- 3. Computations of cut areas based on design cross sections and a sampling by survey of the

## SECTION 203 - EXCAVATION AND EMBANKMENT

elevations of excavations and/or embankment.

4. Proportioning of design earthwork workups utilizing a few actual interim survey elevations in cuts.

Periodic checks must be made and documented to substantiate earthwork quantities for which payment is made in progress estimates. The Engineer-in-Charge should select a method which best suits the particular job conditions, and, then, thoroughly document computations in the project records. Contractor's load counts may be used as checks on the accuracy of volumes obtained by means of the methods described above, but never as the sole basis for payment. Estimates should be representative of the actual work accomplished by the Contractor during the estimate period and, at the same time, be within a reasonable degree of accuracy.

All the aforementioned difficulties in keeping track of interim quantities have been magnified by the composite item adjustment clause of §109-16. This clause allows adjusting the price for "major" unclassified excavation and embankment or unclassified excavation and embankment items if the rock quantity part of the item varies by more than 25% from the expected quantity stated in the earthwork summary. The only way to know when this event occurs in order to keep cost records is to have accurate tracking of quantities. Given the strain placed on field personnel, it is strongly suggested that **each day** either estimated or measured rock quantities be agreed by both the inspector and Contractor. If a procedure is worked out between the two parties on quantity agreement, then cost adjustment if warranted will be subject to much less dispute.

### **Benching**

Benching is the construction procedure of tying a new slope into an existing embankment (embankment widening) or construction a new embankment on, or adjacent to an existing earth slope by cutting "steps" into the existing slope as the new material is placed. An interlock of the two materials is created, preventing the new fill from sliding down the existing embankment or slope.

### **Transition Foundation**

The longitudinal transition embankment foundation condition is encountered where the alignment places the embankment alongside a hillside or where an existing embankment is to be widened. The newly placed fill tends to slide down the slope of the hillside or the existing embankment. The standard sheet entitled "Earthwork Transitions and Benching Details" describes the preferred treatment for this condition. In effect, steps or benches are built into the existing slope to reduce the tendency of the new embankment to slide down the existing hillside or slope.

The same standard sheet ("Earthwork Transitions and Benching Details") describes the proper treatment of the transverse transitional embankment foundation at the interface where the roadway changes from embankment to cut. When an embankment is placed against existing ground, such as occurs in a fill-cut situation, a bump may occur in the pavement at the interface. This occurs because the existing hillside is inherently different than the constructed embankment. The standard treatment provides a more gradual transition between the fill and the cut.

### **Undercut**

Upon occasion unstable soil conditions are encountered at the subgrade surface. In this situation the soil is usually fine grained, inorganic and saturated. It is incapable of supporting normal construction operations and would result in poor pavement performance if the pavement could be constructed. Along with the ground water level that results in the saturate soil condition the instability may also be the result of liquefaction of the fine grained soils by the action of vibrating compaction equipment.

There are several methods of treating the unstable condition.

1. Drain the area by means of ditches or underdrains to reduce the degree of saturation of the soil.

## SECTION 203 - EXCAVATION AND EMBANKMENT

Unfortunately the terrain topography is frequently low and flat precluding this option which involves drainage by gravity.

2. Raise the profile to place the subgrade sufficiently above the unstable materials so that an adequate working platform can be constructed. Constraints such as design criteria and right of way may limit this option.
3. Horizontal realignment to avoid the site of the unstable soil is even more subject to the constraints of design criteria and right of way, and is rarely viable.
4. The most common treatment of an unstable subgrade is to undercut and replace some of the unstable material with granular material that will be stable in the wet environment. Undercuts of two feet are common. This depth of removal and replacement (determined by experience) may be reduced substantially by the use of geotextile.

The Engineer should request the opinion of the Regional Geotechnical Engineer concerning the need and depth of undercut.

### **Weaving**

The moisture content has a very important impact on compaction operations. At any compactive effort, the maximum density will be obtained at a particular degree of moisture called the Optimum Moisture Content. When the actual moisture content exceeds the optimum moisture content, the strength of the soil decreases rapidly. With increased moisture content the material becomes slop. This phenomenon may be observed on the grade. At moisture contents slightly over optimum, weaving of the embankment surface may occur.

That is, when a load such as a roller or heavy earthmoving equipment goes by, the embankment surfaces may depress. When the load has passed, the surface will spring back.

### **Rutting**

At a greater moisture content, the embankment surface will not return to its original level and will leave ruts. These ruts are caused when the soil is too weak to support the roller and soil shears or the surface is punctured. Significant rutting under the action of the compactor on the final passes on a lift is not acceptable by the Specification. The degree of rutting that is significant rutting is up to the discretion of the Engineer. The Regional Geotechnical Engineer is available to advise the Engineer on the significance of the rutting.

### **Proof Rolling**

Once the embankment is completed, and immediately prior to subbase placement, the subgrade surface must be proof rolled (See 203-3.13). The proof roller is a large box supported by four (4) pneumatic tires one axle. The weight of the roller is controlled by the load placed in the box and ranges from 30 to 50 tons. At 30 tons the box is empty, at 50 tons the box is filled to heaping. It is not the purpose of this proof rolling operation to cause rutting or failure of the embankment. If the roller is causing uniform excessive rutting, the stress level should be reduced as shown on Figure 203-4 of the Standard Specifications. If individual areas of distress are exposed by the proof rolling operation, the distressed area must be repaired or removed and replaced to the satisfaction of the Engineer at no additional cost to the State.

### **203-5 Basis of Payment**

Both Items 203.01 and 203.02 are covered by the composite item adjustment clause under §109-16. If the requirements of the major item definition, a 25% change in the rock quantity from what is shown in the earthwork summary sheet, and proper notification and recordkeeping are satisfied the unit price can be adjusted. The suggested method for formulating a new price is in section 109-16 of CAM.

## **SECTION 203 - EXCAVATION AND EMBANKMENT**

### **References**

GCP-15, Settlement Gages and Settlement Rods  
GCP-17, Procedure for the Control of Granular Materials  
STM-6, Test Method for Rapid Earthwork Compaction Control  
STM-9, Test Method for Earthwork Compaction Control by Sand Cone or Volumeter Apparatus  
STM-10, Test Method for Earthwork Compaction Control by Nuclear Gauge  
STM-20, Test Method for the Grain- Size Analysis of Granular Materials  
Industrial Code Rule 53 (16 NYCRR PART 753)  
Guidelines for Embankment Construction SEM 12/87 - Official Issuance 7.14-6  
New York Standard Sheet 203-2  
Geotechnical Engineering Bureau Design Manual - Working Draft Section 19.3  
Contract Administration Manual (CAM)

### **Related Contract Provisions**

§102-05, Subsurface Information  
§105-13, Winter Earthwork Operations  
§106-01, Source of Supply and Quality Requirements  
§106-02, Samples, Tests and Cited Specifications  
§107-05B,C&D, Safety and Health Requirements  
§107-10, Restoration of Disturbed Areas outside the Right-of-Way  
§107-11, Restoration of Disturbed Areas within the Right-of-Way  
§107-12, Soil Erosion, Water and Air Pollution Abatement  
§109-16, Changed Condition and Delay Provisions  
§110-07, Construction, Excavation and Demolition Contracts at or near Underground Facilities  
§110-08, Construction and Demolition Debris  
§209-01, Temporary Soil Erosion and Water Pollution Control

## SECTION 203 - EXCAVATION AND EMBANKMENT

GUIDE TO FREQUENCY OF JOB CONTROL SAMPLING AND TESTING		
Material Description & Placement	FREQUENCY <u>COMPACTION</u>	FREQUENCY <u>GRADUATION</u>
Embankment Construction Material	One/day/fill or One/7,646 cm *	NR
Select Granular Items	“	One/day/source or One/3,823 cm *
Granular Pipe Backfill Items	One/day/culvert, pipe, abutment, wall, etc... or One/382 cm *	One/day/source or One/382 cm *
Slope Protection Material	NR	One/day/source or One/3,823 cm *
Underdrain Filter Material	NR	See GCP
Structure Backfill	One/day/abutment, pier, wall, etc. or One/382 cm *	One/day/source or One/765 cm *
Subbase Course (Non-Stockpiled)	NR	GCP or 2/day/source or One/1,147 cm *
Subbase Course (Stockpiled)	NR	See GCP
Trench & Culvert and Structure Excavation Backfill (Material backfilled under these items)	One/day/trench, abutment, pier or wall or One/382 cm *	NR

\* = Whichever results in the greater frequency

NR = Not required

GCP = Geotechnical Control Procedure

### Exhibit 203-A



## **SECTION 207 - GEOTEXTILE**

### **General Requirements**

The material supplied under this item shall be the type appropriate for the intended use as shown on the Approved List issued by the Department's Materials Bureau and visually approved by the Regional Geotechnical Engineer. Specific construction details are covered in the specifications.

### **Project Procedure**

Contact and/or send a sample of the geotextile to the Regional Geotechnical Engineer for visual approval. Inspect the placement of the geotextile. Record the quantity of material used and the brand name indicated on the geotextile or the geotextile container on MURK-1, "INSPECTORS DAILY REPORT," documenting that only approved material is used on the project.

### **Evidence of Acceptability**

1. Each roll of material should be properly identified either by a label on the geosynthetic or the container. The container may be either the cover wrapping or the core around which the geosynthetic is rolled. If the material is not labeled, it shall be rejected immediately. No attempt should be made to identify unlabeled material.
2. Properly labeled material must then be verified as appearing on the Materials Bureau Approved List. If the style does not appear on the approved list, the material shall be rejected.
3. Project staff shall cut a 76 millimeter by 127 millimeter sample of material from a representative roll and deliver it to the Regional Geotechnical Engineer.
4. The Regional Geotechnical Engineer shall visually inspect the material in accordance with Geotechnical Engineering Bureau guidelines and notify the project of acceptance.
5. Acceptance of the material shall be documented on the Inspector's Daily Report and on the MURK 14.

## **SECTION 209 - TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL**

Standard Specification Section 209-Temporary Soil Erosion and Sediment Control, contains the contract requirements for interim control of erosion and sedimentation during construction by minimizing unintended soil disturbance and the unwanted transportation and deposition of sediment.

### **General Requirements:**

#### **Mulching**

Hay/straw mulch should be applied at approximately 45kg (2-3 bales) per 100m<sup>2</sup> or 4.5 metric tons per hectare.

#### **Temporary Seeding**

If temporary seeding is not done within 24 hours of construction or disturbance, the soil must be scarified prior to seeding. Broadcasting, drilling with cultipack type seeder or hydroseeding are acceptable methods of seeding. Proper soil to seed contact is the key to successful seedings. Seed as soon as possible rather than waiting to do it efficiently, to reduce the need for "engineered" solutions. All seeded areas should also be mulched.

#### **Check Dams**

Periodic removal of sediment is required by the Contractor so that the check dams work properly. All water should be removed from the basins prior to the removal of the dams. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainage ways during structure removal. Replace stones, bales or fabric in check dams as needed to maintain the design cross section.

Check dams should be inspected at least once per week and after every measurable rainfall event. Repairs should immediately be made to any damaged sections and accumulated sediment should be removed if greater than or equal to ½ the diameter height.

#### **Strawbale/Haybale**

Bales have an estimated design life of three months, and need to be systematically monitored, evaluated and replaced. Bales should be replaced through the life of the contract, or until the slopes are stabilized. Bales shall be embedded in the soil a minimum of 100m, and be forced firmly together during placement.

#### **Sediment Traps**

Periodic inspection repair is required by the Contractor to correct damage. The Contractor is responsible for removal of excessive sediment deposits and must meet all requirements of §209-3.09 Sediment Trap.

#### **Turbidity Curtains**

A turbidity curtain is generally used when construction activities occur within a waterbody or along its shoreline and is of short duration, generally less than one month. A turbidity curtain should be inspected daily and repaired or replaced immediately. If the curtain is oriented in a manner that faces the prevailing winds frequent checks of the anchorage should be made. Turbidity curtains are not to be used across flowing watercourses.

#### **Silt Fence**

Geotextiles must be protected from exposure to sunlight during transport and storage. Geotextiles must meet all requirements of §207-2.

#### **Project Procedure**

Temporary erosion and sediment control measures shall be inspected by the contractor and maintained during the life of the project, including winter shutdown, etc., and such maintenance and inspection shall continue until permanent stabilization measures are in place and the temporary control measures are ordered to be removed by the Engineer.

## **SECTION 209 - TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL**

All temporary erosion and sediment control best management practices (BMP's) require frequent inspection to assure effective performance. All BMP's should be inspected at least once per week and after all measurable rainfall events. Any necessary repairs should be made and accumulated sediment removal as per Section 209.

The engineer has authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation and embankment operations, and to direct the Contractor to provide immediate permanent or temporary erosion and sediment control measures to minimize damage to adjacent property and to minimize contamination of adjacent streams or other watercourses, lakes, ponds or other areas of water impoundment, and wetlands.

When items require testing and/or other actions, those tests/actions and their results should be recorded/noted in the Inspector's Daily Report.

### **Evidence of Acceptability**

Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Department procedures in effect on the date of advertisements for bids.

### **References**

"New York Guidelines for Urban Erosion and Sediment Control"

"SPDES General Permit"

EPM 4.3

HDM Chapter 8; Drainage

Section 107-10, Restoration of Disturbed Areas Outside the Right-of-Way

Section 107-14, Furnishing Right-of-Way

Section 209, Temporary Erosion and Sediment Control

## **SECTION 300 BASES AND SUBBASES**

### **SECTION 302 - BITUMINOUS STABILIZED COURSE**

#### **General Requirements**

Granular material supplied under Option A shall be stockpiled in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17).

#### **Project Procedure**

Inspect the construction of stockpiles. Record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer, in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17).

The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpiles. Test results will be reported on Form GE-454 (See Exhibit 203H) , "GRANULAR MATERIAL DOCUMENTATION FORM."

In accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-16), the Geotechnical Engineering Bureau shall furnish a recommended application rate for Option A materials on Form GEB-344f, "BITUMINOUS STABILIZED COURSE - RECOMMENDED APPLICATION RATE." The Regional Geotechnical Engineer must submit an additional sample from each stockpile to the Geotechnical Engineering Bureau for lab testing to determine this application rate.

The Engineer is directed to Materials Method 8.2 for inspection and documentation of Bituminous Materials and to the Departmental publication (Reference: GCP-16) concerning calibration of pugmills. Form GEB 352b (Exhibit 302A) , "PROJECT INSPECTION REPORT - BITUMINOUS STABILIZED COURSE," should be completed by the Regional Geotechnical Engineer.

Regional Geotechnical and/or Geotechnical Engineering Bureau personnel are available to assist in the calibration of the plant. Form GEB-423b (Exhibit 302B), "BITUMINOUS PUGMILL CALIBRATION FORM," shall be used for the documentation.

The following shall be documented by the Inspector on MURK-1d, "INSPECTOR'S DAILY REPORT":

1. Approved material incorporated into the project including source and stockpile.
2. Weather and time of year conditions are within specification limits (no material shall be placed on a surface that is below 7° C., and from the last Saturday of September to May 15, except with written permission from the Deputy Chief Engineer, Technical Services Division.
3. Placement and compaction are within specification limits (maximum compacted thickness of any layer shall not exceed 100 mm.)

#### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. If variations to the stockpiling requirements are granted, a copy of the approval letter from the Director of the Geotechnical Engineering Bureau must be on file.
3. For granular materials furnished under Option A, copies of test results (Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM") and, when applicable, a copy of the letter approving stockpile transfer, as well as the original GE-454M.

Full payment shall be made after the bituminous stabilized course has been placed, properly cured, and compacted to the required tolerance, regardless of whether another item will be placed on top of the material.

**References**

GCP-16	Procedure for Determining Application Rates, Calibration and Inspection for Soil Stabilization Plants
GCP-17	Procedure for the Control of Granular Materials
GEB 344E	Bituminous Stabilized Course - Recommended Application Rate
Materials Method 8.2	

**Related Contract Provisions**

§401, Plant Mix Pavements - General

## SECTION 304 - SUBBASE COURSE

### General Requirements

Most material supplied for the subbase course must be stockpiled. See specifications for specific exceptions. Stockpile construction shall be in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17).

### Project Procedure

The Engineer inspects the construction of stockpiles. Record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer, in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17). Inspection of the construction of stockpiles may also be performed by the Regional Geotechnical Engineer.

The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpiles. Test results will be reported on Form GE-454M (See Exhibit 203H), "GRANULAR MATERIAL DOCUMENTATION FORM." The Inspector shall document on MURK-1d, "INSPECTOR'S DAILY REPORT," that only material from an approved source or stockpile is incorporated into the project.

Processing of non-stockpiled material shall be completed at the source. Project gradation tests shall be performed in accordance with Departmental instructions (Reference: GCP-17 and STM-20) and reported on Form SM-15B (See Exhibit 203I), "SIEVE ANALYSIS DATA." See Section 203 of this manual for the recommended frequency for gradation testing. Form SM-198C (See Exhibit 203J), "FIELD SIEVE ANALYSIS SUMMARY SHEET - GRANULAR MATERIAL," should be completed on a weekly basis.

The Inspector shall document on MURK-1d "INSPECTOR'S DAILY REPORT," the equipment used for the compaction, the number of passes applied and the thickness of the lift prior to compaction, and if the Contractor applied water to the lift. Thickness of the subbase material placed should be in accordance with the specifications for the type of material placed, Type 1,2,3 or 4. Care must be taken not to contaminate subbase with construction equipment. Cost of placing water to attain the proper compaction is included in the subbase item, unless there is a item for placing water in the contract.

### Placing

The upper course subbase material will be placed on the grade, in a manner to minimize segregation. Uncontrolled spreading from piles dumped on the grade resulting in segregation will not be permitted. The subbase course will not be placed in excess of 150 mm without being compacted.

### Compaction

When placing and compacting subbase material we are striving for the use of uniform material, having a moisture content of slightly less than optimum, and uniformly compacted. The compaction process artificially densifies the soil by expelling air and water from the soil to provide uniform high bearing capacity. The compacted soil is more resistant to shear deformation, develops full load-bearing capacity and prevents further densification due to traffic.

Due to the high percentage of plus 3/4 inch material, erroneous results can be obtained from density tests. Therefore, that portion of section 203-2.01 of this manual, waiving earthwork compaction tests, is also applicable to subbase material.

### Evidence of Acceptability

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. For granular material, copies of test results (GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM" or SM-15B, "SIEVE ANALYSIS DATA") and, when applicable, a copy of the letter approving stockpile transfer, as well as the original

GE-454M.

3. If variations to the stockpiling requirements are granted, a copy of the letter from the Director of the Geotechnical Engineering Bureau must be on file.
4. For granular material used in temporary work, a letter of approval from the Regional Geotechnical Engineer shall be on file.

**References**

GCP-17, Procedure for the Control of Granular Materials

STM-20, Test Method for Grain-Size Analysis of Granular Soil Materials

**Related Contract Provisions**

§203-2.02, Select Materials and Subgrade Area Material Requirements

§203-3.01, Placing

§203-3.12, Compaction

## **SECTION 308 - SOIL CEMENT COURSE**

### **General Requirements**

Soil and granular material used for this item shall be stockpiled. Stockpile construction shall be in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17).

### **Project Procedure**

Inspect the construction of stockpiles. Record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer, in accordance with the appropriate Departmental publication current on the date of advertisement for bids (Reference: GCP-17) Inspection of the stockpile construction may be performed by the Regional Geotechnical Engineer.

The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpiles. Test results will be reported on GE-454M, (See Exhibit 203H) "GRANULAR MATERIAL DOCUMENTATION FORM."

The Geotechnical Engineering Bureau shall determine the suitability of the material. The required cement content shall be furnished in a letter from the Geotechnical Engineering Bureau.

The Engineer is directed to the Materials Inspection Manual, Part 2, Materials of Construction, Sub-part A, "Materials Under the Control of the Materials Bureau," and to the relevant sections of this CIM, for control of the portland cement, asphalt emulsion, crushed stone, water and calcium chloride.

Inspection personnel shall document on MURK-1d, "INSPECTOR'S DAILY REPORT," that the Soil Cement Course was mixed, placed, compacted and finished in accordance with the specifications. Compaction control tests shall be in accordance with the appropriate Departmental publication in effect on the date of the bid advertisement (References: STM-6, 9 or 10).

### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. For granular material, copies of test results (Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM") and, when applicable, a copy of the letter approving stockpile transfer, as well as the original GE-454M.
3. If variations to the stockpiling requirements are granted, a copy of the letter from the Director of the Geotechnical Engineering Bureau must be on file.
4. A copy of the letter from the Geotechnical Engineering Bureau on the recommended cement content shall be on file.

### **References**

GCP-17, Procedure for the Control of Granular Material  
STM-6, Test Method for Rapid Earthwork Compaction Control  
STM-9, Test Method for Earthwork Compaction Control by Sand Cone or Volumeter Apparatus  
STM-10, Test Method for Earthwork Compaction Control by Nuclear Gauge  
MURK 1C, Materials Inspection Manual, Part 2, Materials of Construction, Subpart A.

## **SECTION 400**



## SECTION 401 HOT MIX ASPHALT

### BITUMINOUS PAVEMENTS

<b>I. PRE-PAVE MEETING</b> .....	Page 1
A. PURPOSE .....	Page 1
B. ATTENDANCE .....	Page 1
C. PRE-PAVE MEETING ISSUES .....	Page 1
<b>M&amp;PT/SAFETY</b>	
<b>MATERIALS</b>	
<b>EQUIPMENT</b>	
<b>PAVING</b>	
D. TIMING .....	Page 6
<b>II. PAVING SAFETY ISSUES</b> .....	Page 8
A. GENERAL .....	Page 8
B. PERSONAL PROTECTION .....	Page 8
C. PROJECT SPECIFIC PAVING HAZARDS .....	Page 8
D. NUCLEAR DENSITY GAUGE SAFETY .....	Page 9
<b>III. MAINTENANCE &amp; PROTECTION OF TRAFFIC</b> .....	Page 12
A. GENERAL .....	Page 12
B. PUBLIC OUTREACH .....	Page 13
<b>IV. NIGHTTIME PAVING M&amp;PT AND SAFETY</b> .....	Page 13
A. GENERAL .....	Page 13
B. OUTLINE OF REQUIREMENTS .....	Page 13
<b>V. HMA PRODUCTION ISSUES</b> .....	Page 15
A. PROCESS AND PAPER .....	Page 15
1. Delivery tickets	
2. BR 343a - Daily Hot Mix Asphalt Authorized Shipments	
3. BR 307 - Quality Control Hot Mix Asphalt Certification	
B. Q/A ISSUES .....	Page 16
<b>VI. MURK 4d INSTRUCTIONS - MURK 4d Exhibit 401-E</b> .....	Page 16
<b>VII. PLACEMENT AND COMPACTION</b> .....	Page 27
A. SURFACE PREPARATION DETAILS .....	Page 27
1. Surface Defects	
2. Joint and Crack Filling	
3. Wheel Rut Shim	
4. Truing and Leveling	
5. Cold Milling	
6. Pavement Cleaning	
7. Pavement Termination	
8. Driveway Rebates	
B. TACK COAT .....	Page 30
C. MIX TEMPERATURE .....	Page 30
D. WEATHER AND SEASONAL LIMITS .....	Page 31
E. EQUIPMENT .....	Page 33
1. References	
2. Inspector's Tools/Equipment	
3. Paver	
4. Rollers	

## SECTION 401 HOT MIX ASPHALT

5.	Haul Trucks	
6.	Tack Distributor	
F.	RESPONSIBILITIES	Page 35
G.	COMPACTION ISSUES	Page 37
1.	Superpave 70 & 80 series specifications	
2.	Superpave 60 series specifications	
3.	Superpave 50 series specifications	
4.	Monitoring shoulders - all series	
5.	Monitoring nuclear gauge measurements	
H.	CONSTRUCTION JOINTS	Page 48
1.	Longitudinal Joints	
2.	Transverse Joints	
I.	CONTROL CHECKS OF ASPHALT QUANTITY	Page 53
1.	Mat thickness checks	
2.	Yield Checks	
J.	MAT PROBLEMS AND POSSIBLE SOLUTIONS	Page 55
K.	COMPLIANCE	Page 61
<b>VIII.</b>	<b>PAYMENT</b> .....	Page 63
A.	QUALITY UNITS	Page 63
B.	PLANT QUALITY ADJUSTMENT	Page 65
C.	DENSITY QUALITY ADJUSTMENTS	Page 66
D.	LONGITUDINAL JOINT ADJUSTMENT (trial use)	Page 67
E.	SMOOTHNESS ADJUSTMENT (trial use)	Page 67
<b>IX.</b>	<b>WARRANTY PAVING</b> .....	Page 67
A.	OVERVIEW	Page 67
B.	REQUIRED NOTIFICATION AND DOCUMENTATION.	Page 68
C.	BOND DOCUMENTATION	Page 69
D.	INSURANCE	Page 70
E.	FINAL INSPECTION	Page 71
F.	REPAIRS OF PAVEMENT	Page 71
G.	DISPUTES	Page 72

## SECTION 401 EXHIBITS

A	BR 340M HMA In-Place Density Data
B	HMA Mix Coding for Delivery Tickets
C	BR 343a Daily HMA Authorized Shipments
D	BR 307 Quality Control HMA Certification
E	MURK 4d Asphalt Concrete Daily Field Inspection Report
F	Compaction Analysis Report
G	Pavement Density Analysis Report
H	Plant Production Quality Adjustment
I	Instructions for Exhibit H
J	Pavement Density Quality Adjustment
K	Instructions for Exhibit J
L	HMA Pavement Warranty Report
M	HMA Warranty Inspection Form
N	Project Warranties-Hot Mix Asphalt Concrete Pavement
O	BR 309 Core Shipment Authorization

## **SECTION 401 HOT MIX ASPHALT**

### **PLANT MIX PAVEMENTS - GENERAL**

#### **I. PRE-PAVE MEETING**

##### **A. PURPOSE**

The purpose of the Pre-pave meeting is to have a “round table” discussion with all parties involved. This discussion will evolve into a job specific paving plan.

##### **B. ATTENDANCE**

The following people should be in attendance at the pre-pave:

1. Engineer-in-Charge and Resident Engineer (if applicable)
2. Superintendent
3. Paving Foreman
4. Chief Inspector and paving inspector(s)
5. Regional Materials Engineer or Designee
6. Plant representative
7. Nuclear Gauge Testing personnel.

The Engineer-in-Charge (EIC) or inspector will take written minutes of the meeting for the record and later distribution to all attendees. An attendance list is included at the end of this section.

##### **C. PRE-PAVE MEETING ISSUES**

###### **M&PT/SAFETY**

1. Who will be handling M&PT? Prime/Sub? Has Traffic Operations Center been notified?
2. Any night time paving planned? A separate meeting and additional submittals are required. Would night time paving be a noise concern?

Further information on night time paving considerations can be found in Section IV. Nighttime Paving M&PT and Safety.

3. Review Traffic Control Procedures
  - a) How will trucks enter and exit?
  - b) How will intersections be handled?
  - c) Hard hats and vests will be worn at all times. Flaggers must have orange hard hats. Reflectors are needed for night work on manpower and equipment.
  - d) There will be a flagger at the paver.
  - e) There will be a dedicated spotter for blind backing and overhead.
  - f) Will the trucks need to make U-Turns? Do you have/need permission? Flagman needed?
  - g) Do you need radios? Available? Spare batteries/radios?
  - h) Who will inform property owners in area of proposed paving?

Further information on M&PT considerations can be found in Section III. Maintenance & Protection of Traffic.

4. A supply of uneven lane and do not pass signs should be on hand in case they are

## SECTION 401 HOT MIX ASPHALT

needed for an overnight drop-off or other short term drop-off (i.e. 1 or 2 days maximum).

5. How and by whom will overhead hazards be marked out? They will be marked out prior to any paving work and preferably not painted on the road so that the marks don't get paved over. If they are marked out on the pavement, the marks must be transferred up immediately except for the final course.
6. Contractor will check with utility companies for shallow pipes, gas mains, or fibre optics that might be damaged due to vibratory rollers.
7. Check for buildings that might be damaged due to vibratory rollers. (Antique Shops, Historic Buildings, High Water Table, or Rock Foundations). Survey with pictures for documentation if needed.
8. There will be NO OPEN CONTAINERS OF FUEL ON THE PAVER!
9. Has the Radiation Safety plan been submitted? This must be done at least fourteen days in advance of any paving.

Further information on paving safety considerations can be found in Section II.C. Project Specific Paving Hazards.

### MATERIALS

1. Where will the tack come from? How will it be placed? Remember that tack coat shall be applied between all hot mix asphalt (HMA) lifts (excluding the surface of permeable base material) and the tack must break before paving can commence! Is Subcontractor approved? This is not a service item.
2. What plant will supply the asphalt? Will there be a backup plant? Who? What is the plant delivery rate? Are there any special arrangements for nighttime paving? Note the delivery temperature shall be a maximum of 165°C. or as recommended by the asphalt binder manufacturer.
3. Ask if incentive/disincentive issues have been formalized between the Contractor and the Producer. This agreement between the Contractor and Producer is not our responsibility but it may affect working relationships. [The Department's current viewpoint is that our contract is with the Contractor and we pay the Contractor. We have no contract with the plant or any suppliers. It is the Department's policy to avoid interfering in our prime contractors' business relationships with subcontractors and suppliers if at all possible. We can recommend the Contractor share his incentives/disincentives but we cannot make the Contractor do this. We have been encouraging the suppliers and producers to address this issue of payment (incentive/disincentive) in their agreement with the Contractor.]
4. Have the appropriate mix designs been submitted to and reviewed by the Regional Materials Engineer(RME)? Delivery ticket and mix code discussion.

Further information on delivery tickets can be found in Section V. A.1. Delivery Trucks.

5. Contractor is responsible for notifying Regional Materials through the plant notification process the business day before paving to ensure that the material will

## SECTION 401 HOT MIX ASPHALT

get quality assurance inspection or the material certified. Notification will be given by THREE O'CLOCK P.M.

6. The Regional Materials laboratory will test the State's cores. Who will deliver the cores and loose mix samples to the Materials Group? When? Exchange phone numbers. Inform Contractor of lab hours and location.

### EQUIPMENT

1. All trucks will be covered by solid tarps that will hang over the sides and back of the body and be securely fastened. Who will monitor this? If a truck arrives uncovered, it will be rejected.
2. All haul units will obey the New York State Vehicle and Traffic Laws and carry only the loads permitted for their vehicle and axle configurations.
3. All haul units will be cleaned prior to loading. Any haul unit found to have foreign material in the body will not be allowed back on the project until the body has been cleaned to the satisfaction of a DOT representative. The inside surface of the truck body may be lightly coated with an approved asphalt release agent. Approved asphalt release agents can be found in the Department's Approved List. Fuel oil is not an approved release agent.
4. Where will trucks and paver clean out?
5. What make and model paver will be used? When will paver be on site? What will be used for grade and depth control? Stringline? Ski? Marked fills on pavement? Is there a straight edge with the paver.
6. What rollers will be used? Are they on the approved list?
7. Who will be operating the rollers? If Trainee; how much experience do they have? Who will be training them? Remember that if we are not achieving the desired results, it will be the EIC's decision to have them kept in an observatory mode. Has training report been filed?
8. Will there be a spare roller on site? What will it be? How far away is it?
9. Arrange time for inspection staff to view and approve equipment.

The equipment checklist can be found in Section VII. E. Equipment.

### PAVING

1. Discuss chain of command, lines of communication, giving and receiving instructions.
2. What are the anticipated paving hours? Do these times conflict with any time or lane restrictions in the plans or proposal?
3. O.T. dispensation - generally what time should last load come to get equipment off road to be in compliance?

## SECTION 401 HOT MIX ASPHALT

4. What about the weather? Temperature? Rain? When and by whom will the decision be made to go or stop?  
  
Further information on weather and warranty considerations can be found in Sections VII. D. Weather and Seasonal Limits and IX. Warranty Paving.
5. Where is test section planned? Refer to Section VII. G. Compaction Issues.
6. Review sequences and widths (paving vs. lane) on plans, problem areas should be walked through in the field. Does planned paving and lane width impact striping?
7. If paving over 5 meters wide, will a second reference line/point be required? Encourage the Contractor to add auger extension for this width paving.
8. Where will rebates be required? What will be used to cut them and who will do it? How long will rebates be? (Remember typically twenty meters per 40 mm of depth on mainline). Remember that the bid price for driveways includes the cost of rebates. Standard Sheet M403-1. Note, the HMA item required for driveways may be different than the HMA item required for mainline paving.
9. How many crews will be paving?
10. How and when will joint filler be removed, replaced, and pavement cleaning done?
11. What is the anticipated paving speed? Can the plant keep up? Can the rollers keep up? We want the paving to be as consistent as possible to produce a quality paving product. (We do not want the paver to speed up to get rid of trucks and stop to rest while you wait for more).  
  
Further information on mix specific routine paving issues can be found in Section VII. G. Compaction Issues.
12. Discuss compaction patterns and equipment to be used to determine patterns. Who will be in control of compaction, paving foreman or nuclear gauge operator? Compaction should always progress from the low side to the high side. A discussion of the tender zone and its associated problems should be conducted. Once a rolling pattern is established, it is important that it be maintained and monitored to ensure consistent density. (Superpave payments are based on consistent density) How will compaction be addressed around catch basins, valve boxes, and along curbs? In areas where vibratory rollers can't be utilized, a Pneumatic Roller may be required?  
  
Further information on mix specific compaction issues can be found in Section VII. G. Compaction Issues.
13. How will longitudinal joints be constructed? How will they be compacted? Unless the contract documents include a special note that allows the longitudinal joint to be left open to traffic overnight, the longitudinal joint must be caught up at the end of each paving day. How will transverse joints be constructed? What will be used to cut the tapers back? Remember that at the end of each paving day, we want a smooth transition from our paving course to the existing pavement (typically one meter per 30 mm of pavement thickness). If the wedge joint is used, a written request must be made to leave it overnight. Discuss signing requirements.

## SECTION 401 HOT MIX ASPHALT

Further information on joint construction issues can be found in Section VII. H. Construction Joints.

14. What pavement markings are required to be replaced daily? How and by whom will they be replaced?
15. Discuss short term markings. When placing removable short term pavement markings on top course, be sure to offset them from the permanent locations. One application of short term paint can be overlaid by permanent marking.
16. When will drainage structures and utility boxes be raised? Who will do this? How will the basins be raised? i.e., lifting rings or bricked up."

### D. TIMING

The Pre-pave meeting should be held one to two weeks in advance of scheduled paving to leave enough time to make changes if necessary.

## SECTION 401 HOT MIX ASPHALT

## PRE-PAVE MEETING

DATE : \_\_\_\_\_

CONTRACT : \_\_\_\_\_

EIC : \_\_\_\_\_

PRIME CONTRACTOR : \_\_\_\_\_

PAVING CONTRACTOR: \_\_\_\_\_

## ATTENDANCE

[illegible]



## **SECTION 401 HOT MIX ASPHALT**

### **II. PAVING SAFETY ISSUES**

#### **A. GENERAL**

The Department is committed to a construction program that promotes a safe work environment. This would include all parties involved with the construction of Department projects. As with all work, the Contractor and Department Staff must keep the safety of all employees and the traveling public paramount. Consistent with achieving this end, the Engineer should perform a review of the following contract resources to ensure that safety issues as they relate to HMA paving have been addressed by the contractor prior to commencing with paving operations:

OSHA Regulations  
Contractor Site Specific Health and Safety Plan  
Safety and Health Program Manual (MURK 1C)  
M.U.T.C.D.  
Material Safety Data Sheets  
Contract Plans, Proposal, Special Notes & Project Specification  
Discussion as necessary with the Regional Construction Safety Coordinator  
Engineering Directives & Bulletins  
Construction Division Health & Safety Handbook (C.D.H.S.H)

More specifically, several areas of concern should be constantly monitored for conformance with general safety concerns. These areas include but are not limited to:

#### **B. PERSONAL PROTECTION**

All the contractor's employees, State Inspectors and Consultant Inspectors should be provided with all necessary personal protective equipment while performing duties related to HMA paving operations. These personal protective devices may include the following: Hard Hats, Reflective Vests, Appropriate Foot & Hand Wear Protection and Eye & Ear Protection when necessary.

Further information can be found in MURK 1C, I.A.3. Hard Hats and High Visibility Apparel and C.D.H.S.H. Section II. Personal Hazards and Protective Equipment.

#### **C. PROJECT SPECIFIC PAVING HAZARDS**

As part of HMA paving safety, one should consider the importance of emphasizing the benefits of a paving safety meeting. This meeting would be an appropriate time to discuss the specific hazards that relate to HMA paving. The following general safety issues apply to most paving operations and could be included in a pre-paving safety meeting:

- ! Care should be taken to ensure that all required personal protection equipment is available.
- ! Check equipment and delivery trucks for backup alarms.
- ! Avoid pinch points and blind spots during paving operations. Use proper backing procedures at all times. Also see special contract proposal notes on dedicated spotter requirements and MURK 1C, III.H.1. Backup Alarms and Backing Procedures.
- ! Identify and clearly mark all overhead electrical hazards.
- ! Discuss the requirement for Spotters and that delivery trucks must not pull away from the paving operation until the boxes are fully lowered. Also see MURK 1C, III.H.5. Motorized Construction Vehicles and Equipment.
- ! Remind inexperienced workers and inspectors of the mix temperatures & burn hazard that exists. Also see C.D.H.S.H. Section III.10. Paving Operations.
- ! Ensure that the contractor identifies a competent person and they are available throughout the

## SECTION 401 HOT MIX ASPHALT

HMA paving.

! Review & inform everyone of the M&PT plan and paving scheme that has been approved.

! Remind everyone of the traffic hazard and the proximity of traffic to the paving operation.

! Impact of dust from pavement cleaning on traffic.

! Discuss the operating procedures for equipment and ensure that all equipment is operated as intended.

! Time of tack coat application and impacts to traffic.

### D. NUCLEAR DENSITY GAUGE SAFETY

Regulations from the US Nuclear Reg. Commission, USDOT and NYSDOL have established the safe procedures for the transportation, operation, and storage of low level radiation sources and have established acceptable radiation exposure levels for workers exposed to the equipment.

All Gauge owners, both contractors and NYSDOT, are required to adhere to the regulations, which include a NYSDOL license. All operators must also be trained and safety certified by a gauge manufacturer. In addition, all gauge operators must be provided with personnel monitoring devices to measure their radiation exposure. See EI 99-011 "Guidelines for Inspection and Record Keeping of Nuclear Gauge Readings" for further information regarding Nuclear Gauges.

Murk 1C requires a Radiation Safety Plan if nuclear density gauges are to be employed on a project. Please refer to MURK 1C, Chapter II, A.8. Radiation Safety Plan, Chapter III, N. Radiation Safety, Chapter IV, L. Radiation Safety, and Appendix H. Nuclear Density Gauge - Health and Safety Information for detailed information regarding the issue of Nuclear Density Gauges. Safety checklists for the paving inspector have been developed and can be found on the next page.

## SECTION 401 HOT MIX ASPHALT

### Checklist for Nuclear Gauge Safety

- 1) Make sure the Contractor has given a written Radiation Safety Plan to the Engineer. This plan will contain all the names and phone numbers that must be called in case of an emergency.
- 2) Make sure the gauge operator is certified to use the gauge.
  - review a copy of their certificate
  - check name against some form of picture ID (Driver's License)
  - make sure they are wearing a thermoluminescent dosimeter (TLD)
  - verify name on TLD.
- 3) Observe gauge operator for safe operation practices.
  - Gauge is in his immediate presence at all times or locked in a vehicle.
  - Gauge is kept a reasonable distance from traffic.
  - Gauge is not lifted off pavement when the radioactive source is in the backscatter position (the gauge handle is down).
- 4) Stay 5m (16.5 ft) away from gauge when the source rod is down. Only stand near gauge when the source rod is in the "safe position" (The gauge's handle is all the way up.) to confirm measurement values on the gauge's display against values recorded on BR 340M, **Exhibit 401-A**.
- 5) Check gauge operator enough to confirm the numbers are properly recorded (4 locations per day minimum, more if you suspect there may be problems.)

### **Checklist in the Event of a Damaged Gauge**

- 1) The immediate area (5 meters or 16.5 ft) is cordoned off with tape and warning signs.
- 2) Appropriate phone calls are made. Paperwork is required to be kept with the gauge at all times and shall include all required phone numbers. The names and phone numbers should also be available in the Radiation Safety Plan on file with the Engineer. (Task 1 and 2 should be completed by the gauge operator unless he is not present or unable.)
- 3) Complete a NYSDOT Construction Division Initial Notification of Work Zone Accident - Form A and submit it to your supervisor and the Regional Construction Safety Coordinator (RCSC).

## SECTION 401 HOT MIX ASPHALT

### III. MAINTENANCE & PROTECTION OF TRAFFIC

#### A. GENERAL

The issue of maintenance & protection of traffic during HMA paving operations is important not only to ensure that a sound plan for maintaining traffic is in place but also for providing a logical approach to accomplish the paving work. It remains a challenge to balance the traffic issues and concerns against the overwhelming desire to just pave the job as quickly as possible with minimal regard to traffic. In order to develop an M&PT plan that is sensitive to both the traveling public and the paving operation, considerations must be given to the following:

! Can the technical paving related issues that would enhance the pavement quality be addressed while minimizing the impacts to traffic?

! What delays and or traffic movement closures should be considered as reasonable in an effort to provide the technical paving advantages?

The above issues cannot be properly addressed without giving due consideration to the requirements contained in the following resources and these other factors:

! M.U.T.C.D.

! Engineering Directives (Work Zone Counter Measures)

! General requirements of the 619 Standard Specifications

! Inclement weather conditions that may impact traffic safety (i.e. rain/steam = visibility issues)

! Increases in traffic running speeds as a result of paving (will rumble strips become warranted)

! Standard Contract Paving Details

! Longitudinal Joint Requirements

! Pavement Marking Requirements

! Placement of traffic onto a tack coated area

This discussion would not be complete without the specific mention of VPP & PM paving contracts. A review of the contractual obligations is necessary to identify the differences that exist in these contracts versus a typical capital program project. One such difference worth noting is that VPP contracts require the submission of an M&PT plan, by the contractor, for approval and that the contracts require the minimum use of three flaggers at the paving operation (or an approved alternative such as the use of pilot vehicles).

#### B. PUBLIC OUTREACH

On projects where disruption to the traveling public will occur as a result of HMA paving operations or when direct benefits may result by keeping the traveling public informed of planned paving operations, public outreach should be considered. This outreach may include many levels. First and foremost the Regional Public Information Officer should be kept informed of scheduled paving operations. The Regions could then inform the local media of the planned work and the delays and impacts that can be anticipated resulting from the HMA paving operations. Outreach may include the following: Local Press, Radio & Television, and Businesses & Residences impacted.

In addition to the groups mentioned above, it is beneficial to inform emergency services such as 911, police, fire departments and ambulance companies. Where operations will have significant impacts to school busses or local transit vehicles it is also necessary to inform these groups. Finally, the notification of impacted agencies or groups will further help to build a relationship between the Department and the Public and for this reason it should not be overlooked.

## SECTION 401 HOT MIX ASPHALT

### IV. NIGHTTIME PAVING M&PT AND SAFETY

#### A. GENERAL

Standard Specifications §619-1.15 and §619.3.13 Maintenance and Protection of Traffic During Nighttime Operations describes the requirements for scheduled nighttime work. Special Specification 15619.6730 describes the lighting requirements for nighttime work.

#### B. OUTLINE OF REQUIREMENTS

The following steps must be followed to prepare for nighttime work:

1. Preparation of nighttime work plan by the contractor.
2. Review of nighttime work plan in accordance with regional policy.
  - a. Approval.
  - b. Modifications, if necessary.
3. Meeting to plan for nighttime work.
  - a. Attendees
    1. Engineer-in-Charge
    2. Traffic Engineering
    3. Inspector(s)
    4. Contractor Superintendent
    5. Subcontractor Superintendent
    6. Nighttime Traffic Control Supervisor
    7. Regional Construction Safety Coordinator
    8. Nuclear Gauge Operator
  - b. Topics for Discussion
    1. Workdays and Work hours
    2. Plans for Nighttime Operations (Written)
      - i. Detailed traffic control plan
      - ii. Lighting plans
      - iii. Contingency plan identifying and addressing foreseeable problems.
      - iv. Emergency contact telephone numbers
    3. Project Site Patrol
    4. Trained flaggers
    5. Emergency flares
    6. Worker protection (paving, inspection, & testing crews)
    7. Vehicle protection
    8. Material delivery
    9. Staging and clean up areas
4. Preparation for nighttime work.
  - a. On site night work safety meeting prior to start.
  - b. Recommend mock run to insure all devices and measures are in place and adequate. This should be done at night with no other operations to allow for correction without impeding production.
5. Review of site on the first night of work.
  - a. Modifications, if necessary.

Further information on the "Requirements for Maintenance and Protection of Traffic During Nighttime Construction" can be found in EI 95-003.

## SECTION 401 HOT MIX ASPHALT

### V. HMA PRODUCTION ISSUES

#### A. PROCESS AND PAPER

Prior to the first paving of the season, the RME should be contacted to determine if the plant and control plan have been approved for the season. Department procedures for acceptance of HMA pavements are dependent upon on-site inspection and testing performed by the Quality Assurance Technician (QAT) at the HMA plant. These quality assurance operations are conducted through the Regional Materials Office. Field inspection staff should be familiar with the following three documents which are prepared at the plant and provided to the project staff:

- Delivery Tickets
- BR 343a - Daily Hot Mix Asphalt Authorized Shipments
- BR 307 - Quality Control Hot Mix Asphalt Certification

#### 1. Delivery tickets

All HMA delivered to the project site must be accompanied by a delivery ticket prepared by the HMA manufacturer. As a minimum, the delivery ticket is required to contain the following information:

- a. Delivery Ticket Number
- b. Plant Identification
- c. Contract Number
- d. Material Description, (including the PG-Binder Grade)
- e. Quantity of Material in Vehicle
- f. Date and Time

All delivery vehicle tickets must contain the material description coding as shown in (**Exhibit 401-B**).

One legible copy of the delivery ticket shall be made available to the state paving inspector. The delivery ticket quantities must be in metric tons and reported to the nearest 0.01 metric ton. These quantities are determined as outlined in §401-4, Method of Measurement of the Standard Specifications.

#### 2. BR 343a - Daily Hot Mix Asphalt Authorized Shipments

The QAT is responsible for the issuance of Form BR 343a - Daily Hot Mix Asphalt Authorized Shipments (**Exhibit 401-C**) to each project served by the HMA plant. This form has the quantity of each mix type of HMA produced and shipped to each project. This quantity is determined from the plant automation system or the delivery vehicle weigh system. Also included on the BR 343a is the Quality Adjustment Factor (QAF) for each mix type produced and shipped to each project.

#### 3. BR 307 - Quality Control Hot Mix Asphalt Certification

The HMA manufacturer is allowed to certify, without testing, HMA plant lot production quantities of 150 metric tons or less. These certified quantities have a QAF of 1.00. The conditions under which the HMA manufacturer is allowed to certify HMA production is determined by the RME. It is the responsibility of the HMA manufacturer to fill out and submit Form BR 307 - "QUALITY CONTROL HOT MIX ASPHALT CERTIFICATION" (**Exhibit 401-D**) to the project. In addition, production records are maintained at the production facility site unless otherwise directed by the RME.

#### B. Q/A ISSUES

## SECTION 401 HOT MIX ASPHALT

Quality Adjustment Factors are determined daily for plant production, pavement density, longitudinal joint density (future) and smoothness (future). The daily QAF is used to determine each day's quality payment adjustment. The plant production daily QAF is included on form BR 343a (**Exhibit 401-C**). The pavement density daily QAF is provided by the RME. (Longitudinal joint and pavement smoothness adjustment factors are not in general use at this time.)

### VI. MURK 4d INSTRUCTIONS - MURK 4d Exhibit 401-E

JOB STAMP

Each project has a rubber stamp which has information which identifies the project. All project documents are stamped with this rubber stamp so that if a document is misplaced the project to which it belongs can be easily identified. The inspector generally affixes the stamp to the report.

Date:

Day of the week	S	M	T	W	T	F	S
-----------------	---	---	---	---	---	---	---

Enter the date and circle the day of the week on which the work is done.

I.R. No.: \_\_\_\_\_

This is the Inspector Report Number. This number is entered by the EIC or the person assigned to maintain the records. The inspector does not enter the number. Refer to Contract Administration Manual (CAM) Section 90 under Record Keeping Procedures II. Project Records C. Daily Inspector's Report 3 for more information on the I.R. No.

Sheet No. \_\_\_\_\_ of \_\_\_\_\_ Sheets

Refer to Contract Administration Manual (CAM) Section 90 under Record Keeping Procedures II Project Records C. Daily Inspector's Report 4 for information on this field.

Surface Temperature				
Start		Finish		
	Time	Temp	Time	Temp
A.M.	11:00	18°C		

P.M.			2:00	32°C
------	--	--	------	------

## SECTION 401 HOT MIX ASPHALT

Generally the Start time and temperature will be entered in the A.M. row and Finish time and temperature in the P.M. row. However, weather conditions or break- downs could result in all the work being done either in the A.M. or the P.M. Night time paving may require a P.M. start and A.M. finish.

Name of Paving

Subcontractor (if any): \_\_\_\_\_

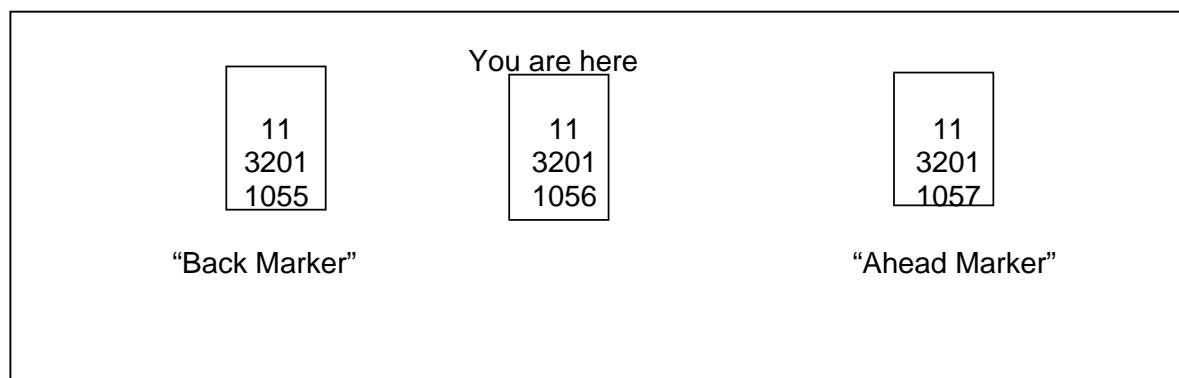
In some cases the contractor that bid the job (Prime Contractor) may hire a subcontractor to do the paving. In that case the name of the subcontractor is entered here. If the prime contractor is doing the work leave this blank.

Item No.	Station to Station	Lane	Length	Width	Course	Design Depth	Area	Weight
18403.12620 2	RM 1056 + 76 to RM 1062 - 45.5	Rt	844	3.1	Top	40 mm	261 6	231

Item No. - All materials used by NYSDOT have an Item Number. The item numbers for the materials used on your project can be found on the typical section drawing in the current plans of the "Project Proposal."

Stations - Stations are reference points marked on the pavement generally at intervals of 25 meters. When stations are marked out by the Contractor, metric measurements should always be used. However, your project may not have stations marked on the pavement. You may have to use Reference Markers as reference points.

When you stand by a reference marker (say 1056) and look at the next higher reference marker (say 1057) you are looking at the "ahead marker". If you turn around and look back at the lower reference marker (say 1055) you are looking at the "back marker".

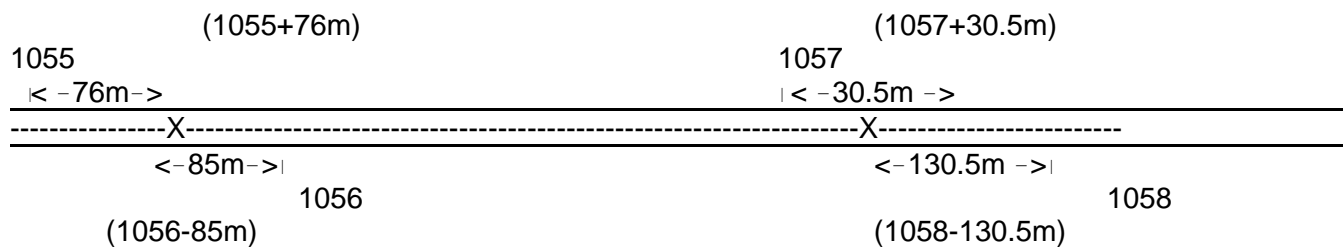


In the case above the 1056 represents a distance. So as you move toward the "Ahead Marker" the distance increases. As you move toward the "Back Marker" the distance decreases.

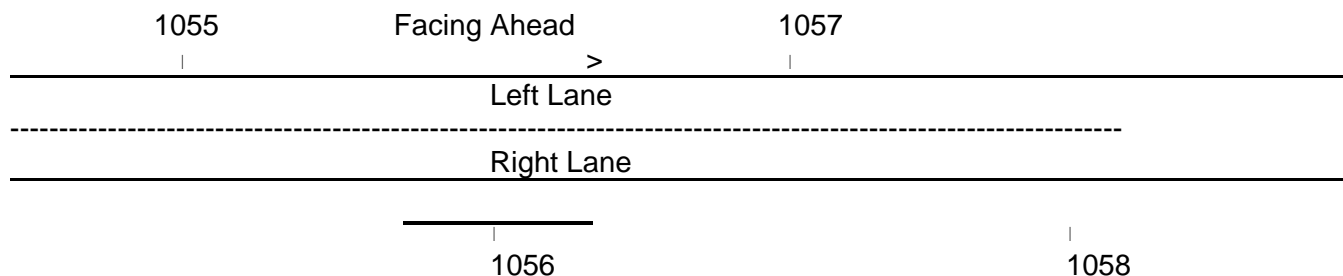
A measurement taken from a reference marker toward the "Ahead Marker" is a plus (+) measurement, and measurement taken toward the "Back Marker" is a minus (-) measurement.



## SECTION 401 HOT MIX ASPHALT

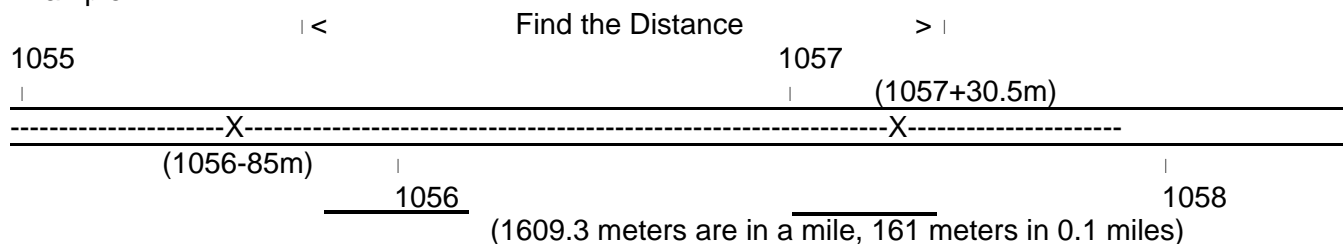


Lane - The lane is generally Left (Lt) or Right (Rt). However, in some instances, EB, WB, SB or NB are used for east bound, west bound, etc. For roads with 3 or more lanes, the lanes can be further distinguished by driving, passing, turning, middle etc. To determine which is the left or right lane use the reference markers. You face toward the Ahead Marker and the left is on your left and the right lane is on your right.



Length --- There are a number of different ways to calculate the length. If you used reference markers to locate the start and finish of paving each location point will be made up of two parts. The first part is the reference marker number and the second part is the measurement relative to the reference marker.

Example:



Subtract the back reference marker number used in the measurement from the ahead reference marker number. Keeping in mind that the last number is a tenth (1057 = 105.7). Then multiply 1609 by the result of the subtraction. This will give you the distance in feet between the two reference markers.

$$\begin{array}{r}
 105.7 \\
 -105.6 \\
 \hline
 0.1 \text{ miles}
 \end{array}
 \qquad
 \begin{array}{r}
 1609.3 \\
 \times 0.1 \\
 \hline
 160.9\text{m}
 \end{array}$$

This result needs to be adjusted by the measurements you took relative to the reference markers.

If the distance measured at the "Back Marker" is minus (-) then add the number, if it is plus (+) then subtract it.

If the distance measured at the "Ahead Marker" is minus (-) then subtract the number, if it is plus add it.

## SECTION 401 HOT MIX ASPHALT

$$\text{Distance} = 161 + 85 + 30.5 = 276.5$$

< (1078+46)	Find the distance	>   (1092+68.5)
-----X-----		-----X-----

$$\begin{array}{r} 109.2 \\ -107.8 \\ \hline 1.4 \text{ miles} \end{array}$$

$$\begin{array}{r} 1609.3 \text{ meters/mile} \\ \times 1.4 \\ \hline 2253 \text{ meters} \end{array}$$

$$\text{Distance} = 2253 - 46 + 68.5 = 2275.5 \text{ meters}$$

- Width - This will be the width of the mat being paved. On top course it should be the same as required by the contract. On underlying courses, the staggered longitudinal joint offset must be considered.
- Course - This will generally be T&L (Truing and Leveling), permeable base, base, binder or top.
- Design Depth - This is the depth, in mm, as required by the Project Plans or Proposal. This is not the actual depth measured in the field.
- Area (S.M.) - Multiply the length by the width. Length X Width = Area
- Weight (M) - This is the actual quantity placed, for this run as determined by the delivery tickets. There is no deduction made for waste at this point. If a load is split between two runs, make a rough estimate of how much of the load went to this run.

T O T A L S	Item No.	18403.126202	5162	456
	Item No.			
	Item No.			

The total amount placed and the total square meters for each item are entered here. If you have more than one item then total each item separately.

Mix Type/Code	12 F3 2YB			
Plant Dispatched Q'ty				
Quantity Received	503.26			
Quantity Used	501.84			
Quantity Wasted*/ Quantity Rejected**	1.42			

\*Show basis of estimate on reverse side.

## SECTION 401 HOT MIX ASPHALT

**\*\*Show reason for rejection & quantity on reverse of delivery ticket**

Mix Type - Refer to **Exhibit 401-E**. The mix type or code can be taken off the delivery ticket.

Plant Dispatched Q'ty - This is the actual amount of HMA that was sent from the HMA plant to the project as indicated in the records at the plant. The inspector does not fill this in. A BR 343 or BR 307 will be sent to the EIC or office engineer who will then use it to fill this in on the report.

Quantity Received - This is the amount of HMA which arrived at the project. Loads which are rejected and waste are included in this amount.

Quantity Used - This is the actual amount that was placed as asphalt pavement. This does not include material which is rejected or wasted.

Q'ty Wasted/Rejected - Waste is the amount of acceptable material that was not actually placed as pavement. It could be the total amount that remained in the trucks after they had dumped and was later cleaned out. It could also be material not used as a result of a break down. This material should be measured and the quantity estimated. The inspector should seek concurrence from the foreman on the wasted quantity and document the concurrence to hopefully avoid potential dispute.

Rejected material is material that was not used because it did not meet the Specifications.

No. of Tickets	33
First Ticket No.	580
Last Ticket No.	710

No. of Tickets - This is the total number of delivery tickets received for the truck loads of material actually used for paving. Do not accept or include tickets for rejected loads.

First/Last Ticket No. - This will be the ticket number of the first and the last load dispatched from the plant for the project that day. The ticket numbers are generally not consecutive because some of the loads dispatched from the plant go to other projects.

**NOTE:** All delivery tickets received, for acceptable material, will be initialed or signed by the inspector. A minimum of five times a day the inspector shall note the temperature of the material on the delivery ticket.

ITEM NO.	FS	E S	INTERIM QUANT.	FINAL QUANT.	QUANT. CHK.	DESCRIPTION OF WORK	COMPUTER ENT.	CHK
18403.12620 2	01			501		RT 5 EB Lane RM 1056 to RM 1062		

This section on the bottom of the front side of the Murk 4d is the Computer Engineer's Estimate System (CEES) Data Entry Fields. For more information on these fields, refer to the Contract Administration Manual (CAM) Section 90, II.C.7. CEES Data Entry Fields.

ITEM NO. - All materials used by NYSDOT have an item number. The item numbers for the  
CIM 2003

## SECTION 401 HOT MIX ASPHALT

materials used on your project can be found in the "Project Proposal" which should be provided to you by the EIC.

- FS - Fiscal Share. The money for a project may sometimes come from more than one source. In that case the different sources are given numbers called fiscal shares. Fiscal Share 01, 02, 03, etc. As an example, a project may have a bridge and some highway work. The funds for the bridge may come from one source and funds for the highway may come from a different source. Payment for work done on the bridge might be fiscal share 01 while work done on the highway is fiscal share 02. Check with your EIC regarding fiscal shares.
- 
- ES - Engineering Share. It's generally not necessary to record the Engineering Share. Check with your EIC.
- INTERIM QUANT.- An interim quantity is an estimate of the work done. It is used when it is not possible or practical to determine the exact final quantity. This entry is temporary. A final quantity must be determined at some point. Generally, with HMA items, you will not enter a quantity here. The exact amount of HMA used can be determined at the end of the day and no estimating is required.
- FINAL QUANT. - This is where you would enter the quantity of HMA actually placed and accepted for the particular item.
- QUANT. CHK. - When you have completed your report, it should be checked for accuracy regarding the quantity paid. The person who does the checking would place their initials here.
- DESCRIPTION OF WORK - A very brief description of the paving location. Example: "Rt.5 EB Driving lane RM 1048 to RM 1076."
- COMPUTER ENT./CHK. - These entries are used by the people who enter the data into the computer. ENT. (Enter) is initialed by the person who enters the data into the computer. CHK. (Check) is initialed by the person who checks the computer entries.
- 

The above described work was incorporated into this project and was inspected by:

Inspector's Signature

Reviewed by

Date

Engineer-in-Charge  
Resident Engineer

Inspector's Signature: This is further explained in CAM Section 90, II. C. 9. Inspector's Signature.

Reviewed by: Engineer-in-Charge or Resident Engineer signature. This Section is further explained in CAM Section 90, II. C.10. Reviewed by/Date:.

## SECTION 401 HOT MIX ASPHALT

DEPTH CHECKS					DEPTH CHECKS				
Station	Lane	Uncomp Depth	Course		Station	Lane	Uncomp Depth	Course	
1056+300	Rt	50mm	Top		1056+300	Lt	47mm	Top	
10057	Rt	50mm	Top		10057	Lt	47mm	Top	

Station / Lane/ Course - The definition of these terms are explained in the previous material.

Uncomp Depth - Uncompacted Depth. This is the depth of the material, as measured in the field, directly behind the paver. The measurement is taken prior to rolling. These measurements should be spread out over the length of the paving run, and be representative of the depth placed.

- Started Paving at 8:10 AM

- J. Fink wanted to continue paving the right lane today and come back tomorrow and do the Left lane. He said that is the way he paved on the last project. I told him that he has to notify the EIC of his intent in writing and have the necessary M&PT and signing devices ready to put up. He said he would write the letter today and the necessary M&PT and signing devices would be on the project tomorrow.

- J. Fink paved an apron for the field office driveway with the waste material. We agreed that the apron was 3 meters long by 4.2m wide on average and was 50mm thick or 4.2x3x 0.50x2.25 Mg/Cm=1.42Mg

**This part of the report is used for comments. Enter only facts. Do not enter opinions!**

MANPOWER						EQUIPMENT					
Type	Prime	Sub	Sub	Sub	Sub	Type	Prime	Sub	Sub	Sub	Sub
Foreman	1					Blaw Knox PF 180 Paver	1				
Operators -	3										
Laborers -	3					Tampo RS 166A Vib.Roller	1				
Teamsters -	9										
Iron Workers						Buffalo Spring KT 19B8 Tandem	1				

## SECTION 401 HOT MIX ASPHALT

Carpenters -											
						Ten Wheelers	9				

This part of the report is used to record the men and equipment used on your particular operation. Under MANPOWER, near the bottom, are some blank entries for work categories not covered above.

When listing equipment enter the type, make, and model. Make sure vibratory rollers are on the approved list.

CAM Section 90 has more information about completing these tables under II. C. 8. Labor and Equipment used.

The "Prime" refers to the contractor who was awarded the contract. The "Sub" refers to subcontractor. Sometimes the "Prime" contractor may hire a subcontractor to do the paving. In that case, you would use the column "Sub". There are a number of "Sub" columns on the report form because there may be a number of subcontractor's associated with your operation. Example: Paving sub, Striping sub, Trucking sub, etc.

### YIELD

Yield is the unit weight of compacted HMA or the number of megagrams in one cubic meter which is one inch thick. For each mix type there is an approximate theoretical unit weight. The theoretical unit weight can be based on core density for cores taken from the project or 94% of the maximum theoretical density. The RME or Plant Quality Control Technician (QCT) can provide this number.

		Area	Weight
T O T A L	Item No.		

- 1) Find the number of Mg of material per square meters.

Total square meters = 5162

Total Mg = 456 Mg

$456 \text{ Mg} / 5162 \text{ m}^2 = .0883 \text{ Mg/m}^2$

- 2) Find the number of Megagrams of material per cubic meter.

$0.0883 \text{ mg/m}^2 / 0.040\text{m} = 2.21 \text{ Mg/m}^3$

## VII. PLACEMENT AND COMPACTION

### A. SURFACE PREPARATION DETAILS

The performance of HMA pavement is affected by the condition of the underlying surface. Care should be taken to prepare the surface so the pavement's service life can be achieved.

#### 1. Surface Defects

The first step in surface preparation is to address the failed areas of the pavement. Localized distress (potholes) in concrete or HMA pavement should be cut back to sound pavement. The repair area should be cleaned, tack coated, patched with HMA and compacted. Fatigue or subbase related distress should be repaired by isolated

## SECTION 401 HOT MIX ASPHALT

reconstruction. This is accomplished by undercutting the area and replacing with suitable subbase material and HMA.

Further information can be found in §401-3.07 of the Standard Specifications.

2. **Joint and Crack Filling**  
Concrete pavement joints and cracks in HMA pavement require a great deal of preparation. Joints and cracks are cleaned and filled to prevent water and non-compressible material from entering the pavement structure. Unfilled and inadequately filled joints and cracks should be repaired by first cleaning the joint/crack with a compressed air stream of at least 550 kPa. Any sealant remaining can be left in place. Joints/cracks that are between 6 mm to 25 mm wide are filled with a hot applied asphalt filler (Material Designation 702-0700). Do not allow the contractor to fill the joint/crack to the pavement surface. Over-filling will cause wheel tracking and slippage of the mat during compaction and possibly a bump at the crack. Joints/cracks greater than 25 mm should be filled with shim course or cold patch. Joints or cracks less than 6 mm should not be cleaned and filled. The crack fill material cannot be properly placed in joints or cracks that small.

Further information can be found in §633-3.02 of the Standard Specifications.

The evidence of acceptability for Material Designation 702-0700, Joint and Crack Filler, requires the name of the primary source be listed on the Approved List, 7.42-3.1, "Bituminous Material Primary Sources, Asphalts Cements for Filler."

3. **Wheel Rut Shim**  
For paving overlay projects on highways that have wheel path ruts that are between 10 mm and 20 mm deep, the contract should include, Item 403.150001 - Asphalt Concrete Type 5 Shim Course. A representative of the Department should determine the beginning and ending point for wheel path rut shimming in each lane. The wheel path ruts are best measured with a 1.8 meter long straight edge with a graduated sliding pin in its center that can be locked into position with a thumb screw. Only the ruts 10 mm or deeper should be shimmed. Quite often wheel path rutting can be found where traffic must stand or travel slowly (i.e. approaches to signalized intersections, climbing lanes etc.) Wheel path ruts that are deeper than 20 mm are generally the result of a failure in an underlying pavement course. In this case, consideration should be given to milling the pavement to remove the failed pavement course that is causing the rutting. Discuss this with the Designer or Regional Materials staff. If the failed pavement course is not removed, the wheel path rutting will reappear early in the pavement's service life.

Prior to shimming the wheel ruts the pavement should be cleaned and tack coated. The contractor should tack only the areas that are to be shimmed. §401-3.11 of the Standard Specifications requires the type 5 shim material is placed with a 1.2 meter wide drag box so that only the two wheel paths in each lane are shimmed. A pneumatic rubber tired roller is used to compact shim course material as required in §401-3.12 of the Standard Specifications. Using a steel wheeled roller to compact the shim course material, will only bridge the wheel path ruts. The shim material will not be properly compacted and the wheel path rutting will return early in the pavement's service life.

4. **Truing and Leveling**  
Some pavements have irregularities that must be corrected before the paving courses can be properly placed. This is done through the use of a truing and leveling course. The truing and leveling course should be placed to remove surface irregularities, fill and patch holes, correct variations in banked pavement and establish pavement crowns. Isolated depressions and wheel ruts greater than 10 mm should be located, marked out

## SECTION 401 HOT MIX ASPHALT

and shimmed prior to placing the truing and leveling course.

For compacted thicknesses up to 40 mm a shim or top course mix should be used. A binder course mix should be used for compacted thicknesses in excess of 40 mm. Base course mix should be used for compacted thicknesses in excess of 100 mm.

Further information can be found in §401-3.07 of the Standard Specifications.

### 5. Cold Milling

When the condition of the existing pavement has deteriorated to a point where joint/crack filling and/or surface distress repair cannot be performed effectively, or, when changes in cross slope are needed, cold milling may be necessary. Milling machines must accurately mill to the required depth of cut and cross slope to within 6 mm. Be sure to check depth of cut and cross slope so you don't overrun the HMA quantities. The specified depth of milling should usually be at the interface of existing pavement layers, i.e. binder and top

Further information can be found in Section 490 - Cold Milling of the Standard Specifications.

### 6. Pavement Cleaning

Once the numerous repairs are made to the existing pavement the surface must be cleaned before the tack coat is placed. The tack coat will adhere better to a clean surface. Cleaning must be performed by mechanical sweepers or other methods approved by the Engineer.

Further information can be found in §633-3.01 of the Standard Specifications.

### 7. Pavement Termination

During paving operations the areas where the new paving meets the existing pavement must be terminated properly to provide a smooth transition. These areas usually include the beginning and end of a project and major intersecting side roads. A smooth termination is accomplished by providing an adequate transition length to take the new pavement elevation to the existing pavement elevation. The joint where the new pavement meets the existing pavement must be a sawn, keyed in, vertical joint.

An important point to consider when paving a smooth termination is how much the new mat will compact. The proper thickness of material must be placed so that when compacted it meets the existing pavement elevation and provides a smooth transition. A good rule of thumb to use is that the mat will compact approximately 20-25%. A mat placed at 48 - 50 mm will compact to 40 mm. This is accomplished by putting the paver screed on starting blocks (usually wood) when the paver pulls off the joint. The starting blocks should be of adequate size to allow the additional thickness of material to be placed.

Further information can be found in Section VII.H.2. Transverse Joints.

### 8. Driveway Rebates

Residential and commercial driveways must be terminated properly to provide a smooth transition. A smooth transition is accomplished by providing an adequate transition length to blend the new driveway with the existing driveway. The joint where the new driveway meets the existing driveway must be a sawn, keyed in, vertical joint.

## B. TACK COAT



## SECTION 401 HOT MIX ASPHALT

See Section 407 Tack Coat of the CIM.

### C. MIX TEMPERATURE

The Standard Specifications currently list mix temperature restrictions under §401-2.02 and Table 401-1 of Amendment No. 2 of the Standard Specifications. These requirements were developed for the Marshall and Standard mix specifications which used a method or recipe type of specification for compaction. With those specifications, it was appropriate for the Engineer to dictate the temperature of the mix at delivery because if the mix was too cool when delivered, the pavement would very likely not be compacted to the proper density.

The temperature restrictions currently listed in the specification do not fit in well with the new performance related specifications that are being used for the vast majority of paving that is being done on Department projects today. Under the performance related specifications, the Contractor is responsible for compacting the pavement within a specified density range. Mix temperature is one of the most important factors that affect compaction. Because the contractor is responsible for compacting the pavement, then the Contractor should have the authority to dictate the temperature of the mix as it is delivered to the project. Thus the current mix temperature restrictions as listed in Section 401 are not consistent with the philosophy behind performance related specifications.

The mix temperature restrictions currently listed in §401-2.02 should only be applied when the HMA item being used does not include a performance related compaction specification where the Contractor is responsible for achieving pavement density in the specified range. The mix temperature restrictions listed in both §401-2.02 and Table 401 of Amendment No. 2 should be enforced when using HMA items that employ the method type specification where the Contractor is responsible for using a specified roller train at a specified roller pattern or a specified number of passes. Such items include the use of all Standard mixes types 1,2,3,4,5,6 & 7, Marshall top course mixes such as type 6F and 7F, Special Specification 06403.XX7Y02 and possibly some other special specifications.

When using the performance related specification such as 18403.XXYZ02, the maximum mix temperature restriction of 165°C, as listed in Table 401 of Amendment No. 2, should be enforced unless otherwise directed by the RME. This restriction is in place to prevent mix with overheated asphalt from being delivered to the project. Overheating severely ages the asphalt causing it to be brittle, viscous, hard and not very sticky or ductile. Mix with overheated asphalt is likely to perform badly and should not be incorporated into the pavement. Some mixes using modified PG binders may require and be able to accommodate mixing temperatures higher than 165°C. Check with the RME in this case. He may choose to allow a mix with a modified binder to be delivered at higher temperatures.

Inconsistent mix temperatures, cool mix temperatures and mix temperatures that are very high, can contribute to pavement surface irregularities such as cracking, tearing, shoving, areas of broken aggregate and closely spaced transverse roller depressions. If the inspector observes surface irregularities such as these, he must notify the Contractor and work with the contractor to prevent the problem from continuing. The Contractor may choose to order a different or more consistent mix temperature in an attempt to correct the problem.

### D. WEATHER AND SEASONAL LIMITS

Cold weather paving. Maintaining heat in the mix is critical to achieve density and construct a quality pavement. It is for this reason that seasonal and temperature limitations are included in the specifications under §401-3.01. However, many times it is necessary for the Contractor to pave outside these limitations. Because of this factor and the desire to move toward performance related specifications, the Department has implemented a warranty procedure (see Section IX Warranty Paving). An approved warranty is the only mechanism which allows

## SECTION 401 HOT MIX ASPHALT

the Contractor to place **top course** HMA outside the weather, seasonal and temperature requirements of the specifications. **If** the Contractor elects to warranty the pavement and place HMA in cold weather, the following measures should be considered by the Contractor to help maintain heat in the mix and obtain the **required** pavement density. It must be emphasized that the Contractor is taking the gamble by warranting the pavement and does not have to use any of these measures to achieve density and minimize the risk of premature pavement failure.

- ! Produce and place mixes at the upper range of the mix temperature specifications.
- ! Reduce paving speed.
- ! Decrease the plant production rate.
- ! Use covered (required) and insulated haul vehicles.
- ! Operate rollers as close to paver as possible.
- ! Increase the number of rollers if practical.

Hot weather paving. - During hot weather periods, paving mats cool at a much slower rate. This fact must be taken into consideration by the Contractor given the temperature sensitive compaction behavior of today's HMA mixes. The best way to monitor mat temperature is the use of infrared temperature guns. This information is the Contractor's best tool to regulate the timing of the rolling operations to obtain the required density and pavement surface conditions. In addition the following suggestions should be implemented when paving above 29° C.

- ! Decrease the mix temperature by 9° to 12° C.
- ! Restrict the number of rolling passes only to that which is necessary to achieve compaction.
- ! Any rollers not working are to be parked off the mat.
- ! Vibratory compaction should occur when the mat has cooled enough that rolling does not cause surface tearing or shoving. This will vary for each individual mix.
- ! Finish rolling is intended to remove roller marks and irregularities, not to provide additional compaction. Finish rolling should be conducted after the mat has cooled to 65° C (slightly hot to the touch).
- ! Restrict traffic from the fresh mat until it has cooled to less than 60° C or cooler if possible.

Rain - If paving is planned for the following day and the forecast calls for rain, the Contractor must understand the risks of paving. Unless the warranty provision has been previously requested in writing and approved, and the Contractor has notified the EIC prior to the start of paving, the warranty cannot be used to pave in the rain. The Contractor can plan to pave without the warranty with the understanding that the EIC controls whether or not paving takes place based upon weather conditions at that time.

The EIC's decision on whether to proceed with paving when rain occurs and mix is still in the trucks is always difficult. Local radar images from internet weather services can be very helpful when making their decision. Depending on the forecast and the duration and severity of the rain, the following actions should be taken.

*Light continuing rain expected.* Notify the superintendent to stop asphalt delivery. Trucks already at the site or in transit can be placed if the pavement surface has been tacked and not puddled. Place the trucks as quickly as possible with rollers as close as possible.

*Heavy rain of short duration expected.* Notify the superintendent to stop paving. Hold further delivery and asphalt in trucks until rain passes. Once the rain has stopped, puddles must be swept from the pavement surface. After sweeping, the placement of HMA held in trucks can resume as long as specified temperature is met.

*Heavy continuing rain expected.* Notify the superintendent to stop asphalt paving and delivery. Inform the superintendent of the likelihood of HMA in trucks being rejected if rain is long in

## SECTION 401 HOT MIX ASPHALT

duration.

### E. EQUIPMENT

1. References
  - ☐Section 400 of the Standard Specifications and Addendums
  - ☐Special Specifications
  - ☐Contract Plans
  - ☐Proposal
  - ☐EIs and EBs
  - ☐MURK
2. Inspector's Tools/Equipment
  - ☐Surface Thermometer
  - ☐Two asphalt thermometers
  - ☐Ruler
  - ☐Tape or measuring wheel
  - ☐Slope board or smart level
  - ☐Calculator
  - ☐String line or straightedge
  - ☐Clipboard
  - ☐Tack sampling items
  - ☐Hardhat and high visibility clothing
  - ☐Appropriate footwear (**NO SNEAKERS**)
  - ☐Inspector's report and all other appropriate forms
3. Paver
  - ☐Engine governor is working properly
  - ☐Tires are in good condition/proper pressure or tracks are snug.
  - ☐The front rollers of the hopper move freely
  - ☐The hopper wings and flow gates operate freely
  - ☐The side gates are free of worn, broken or missing parts
  - ☐The feed conveyor slats are clean and undamaged
  - ☐Center "backfeed" augers or agitators are in place.
  - ☐Augers are in good condition
  - ☐Feeders work properly
  - ☐Screed has proper crown adjustment
  - ☐Crank assembly bearings are in good condition
  - ☐Strike off is adjusted properly and undamaged
  - ☐Screed bottom is smooth, free of wear, pits or warps to ensure smooth surface. It should also be clean - not set down in mud the night before.
  - ☐Burners operate properly on startup.
  - ☐Vibrators operate properly
  - ☐Grade control works properly
  - ☐Slope control works properly
  - ☐Machine is clean and free of caked asphalt
  - ☐There are no oil/fluid leaks to contaminate the surface
4. Rollers
  - ☐The rollers appear on the Approved List
  - ☐The drum is straight and undamaged
  - ☐The drum is clean of hardened mix - Diesel is not permitted
  - ☐Water supply and nozzles are working

## SECTION 401 HOT MIX ASPHALT

- ☐ Pads and scrapers are working and in good condition to keep drums/tires clean
- ☐ For pneumatic-tire rollers, the tires are inflated equally to the desired pressure and the tires are properly heated prior to and during use
- ☐ Diesel fuel may not be used on the tires. Only water or water mixed with small quantities of detergent or other approved material can be used. In no case will a solvent having an effect upon the bituminous pavement be used.
- ☐ There are no oil or fluid leaks to contaminate the surface
- ☐ For pneumatic-tire rollers, the pneumatic drive wheels may be coated with a fine mist spray of fuel oil or other similar material to prevent pickup.

5. Haul Trucks

- ☐ The body of the truck is in good condition and clean of old mix and/or any other debris that might contaminate the fresh mix.
- ☐ There are no oil or fluid leaks to contaminate the surface
- ☐ There is no fuel in the body - fuel is not an approved release agent
- ☐ There is not excessive release agent coming out of the body
- ☐ Every truck is equipped with a watertight solid tarp that covers the sides and back of the body and is securely fastened.
- ☐ Every truck must have an audible back up alarm in working condition.

6. Tack Distributor

- ☐ The nozzles on the spray bar or wand are clean and angled in the same direction.
- ☐ The tank is self contained and heated to ensure proper application temperature
- ☐ Tachometer, metering device, or calibrated tank is present in order to determine application rate
- ☐ There is a working thermometer to check temperature.
- ☐ There's a sampling valve
- ☐ There are no oil or fluid leaks to contaminate the surface

### F. RESPONSIBILITIES

The Contractor is responsible to safely construct a HMA pavement that meets density requirements and is free of "shallow ruts, ridges, other irregularities, or roller marks in the pavement." The assignment of these responsibilities to the Contractor is logical because the Contractor and his supplier have primary control of the quality of the asphalt mix, the traffic control, and the placement and compaction of the pavement. Section II. Paving Safety Issues and Section III. Maintenance & Protection of Traffic should be consulted for safety-related issues.

The performance of HMA pavements is largely dependent on the in-place density achieved during construction. This is the reason in-place density is the measured quality parameter in NYSDOT's performance related HMA specifications. The Department specifications require the HMA be compacted within certain density limits, as determined by cores or nuclear gauge monitoring. The next section, Section VII.G. Compaction Issues, covers HMA compaction. The Contractor is given wide discretion in how to compact the pavement to achieve the required density, including equipment selection, setup, and operation. However, long term HMA pavement performance is also significantly impacted by cracking, segregation, and other surface irregularities which may occur during construction. Ensuring the finished pavement surface is free of these problems is also the responsibility of the Contractor.

NYSDOT's HMA performance related specifications clearly require a finished pavement mat

## SECTION 401 HOT MIX ASPHALT

that is free of surface irregularities. Also stated “If these imperfections are present, correct the imperfections or relay the pavement at no additional cost to the Department as ordered by the Engineer.” Additionally, the specifications state “the loose mat should be checked, any irregularities adjusted, and all unsatisfactory material shall be removed and replaced,” and “remove any mixture that becomes loose and broken, mixed with dirt, or in any way defective and replace with fresh hot mixture and compact to conform with the surrounding area.”

From the specifications it is clearly the responsibility of the Contractor to obtain the required surface conditions as well as the specified density. NYSDOT inspection personnel will monitor these requirements on all projects. Specifically, inspection personnel should pay particular attention to the following:

- ! HMA shoving which results in pavement cracking or tearing, even if the cracks or tears appear to heal during the compaction operation.

- ! Mat spread resulting in an irregular longitudinal joint.

- ! Segregation, especially segregation associated with the beginning and end of asphalt loading into the paver.

- ! Surface irregularities, such as standing waves, longitudinal roller marks, closely spaced transverse roller depressions or areas of broken aggregate.

These non-density problems result in a poor riding surface and have a negative impact on the long term pavement performance. Therefore, attention must be paid to the quality of the mat immediately behind the paver and quick action taken to correct problems. Section VII. J. Mat Problem and Possible Solutions, contains information on common problems and potential solutions. If any significant areas or repeated smaller areas of a pavement exhibit any of these non-density problems, a progressive course of action should be taken (see Section VII. I. K. Compliance). Common sense should be used when determining what is a significant area or repeated smaller areas. In order to be uniform a significant area of a defect should be considered a continuous area of 30 lane meters or larger. The key factor in judging what constitutes repeated smaller areas is that the defect continues to occur periodically or randomly more than several times in the HMA pavement. Examples of repeated smaller areas of defects would be persistent truck end segregation, or continuing random areas of any of the defects mentioned previously. Further examples and discussion of HMA placement problems are included in Section VII. I. Control Checks of Asphalt Quantity. The Construction Supervisor and RME should be consulted if there is any question as to determining if an area or areas require correction.

### G. COMPACTION ISSUES

#### 1. Superpave 70 & 80 series specifications

##### a. Test Section

Prior to beginning test section paving, the inspector should have the following items and information:

- ! BR 340M **Exhibit 401-A**

- ! Materials Procedure MP 96-01 M

- ! Maximum theoretical density for the mix type (from plant and/or RME)

- ! Nuclear gauge serial number(s) (from contractor or testing service)

- ! Approximate gauge correction factor (from contractor, testing service)

## SECTION 401 HOT MIX ASPHALT

- ! Temperature gun and/or a thermometer
- ! Keel

Select a suitable location for the test section whose underlying conditions represent the entire project. Then:

- ! Randomly select three locations in the area more than 150 meters from the start of paving but less than 500m from the start of paving.
- ! If the area to be paved is less than 500m, then improvise and seek agreement from the Contractor. Call the RME if you have questions.
- ! Use random number tables in MP 96-01 M.

During paving of test sections, the paver should stop or slow considerably. Otherwise, by the time the gauge operator and roller operator are done with the test sections, the pavement will be too cool to compact, if it is necessary.

### b. Project Target Density (PTD)

The project target density for 70 and 80 series asphalt items is determined by the “peak method” in the test section. This method and associated record keeping are described below:

- ! At each location before taking the initial density reading, mark the location with keel.
- ! After the first two passes and each additional pass, the Nuclear Gauge Operator shall take 4 density measurements at the location. The inspector must witness and record the measurements. Calculate and record the average and the Density gain from the previous roller pass.
- ! The inspection report should include the compaction pattern, roller model, frequency and amplitude, and asphalt mat temperature, as well as the nuclear gauge readings for three locations in the test strip. Some Regions have developed a standard data sheet for recording this data in determining PTD.
- ! PTD is the average of the peak density at three locations.
- ! Check the average against the projected PTD =  $0.945 \times \text{Max. density} + \text{gauge correction factor}$ .
- ! If the average value is close to the projected PTD value (above), PTD can be used. Otherwise, see below.

Caution: Do not assume the peak density has been achieved when any of the following occur:

- i.* The mat moved considerably during the previous roller pass or if the mat got wider.
- ii.* The mat temperature is still hot ( $\geq 110^{\circ}\text{C}$ ); or cool ( $\leq 65^{\circ}\text{C}$ ).
- iii.* The peak density achieved is more than 75 kg/cubic meter under the projected PTD.

If the mat is hot, let the mat cool  $10^{\circ}\text{C}$  and have an additional roller pass done. An additional density measurement needs to be taken to calculate the peak density gain.

This process needs to be repeated until neither *i.*, *ii.*, nor *iii.* apply nor until the pavement shows signs of distress (cracking, crushed aggregate).

## SECTION 401 HOT MIX ASPHALT

If the mat temperature is below 65°C and either *i.* or *iii.* occurs, a new location is selected near the paver where the mat is warmer and the process is repeated.

### c. Routine Paving

After the PTD has been determined, routine paving can resume with the nuclear gauge. The Nuclear Gauge Operator marks locations to take readings with the keel in accordance with Materials Procedure 96-01. A nuclear density reading is defined as the average of four nuclear measurements taken at 90° at a location. The Nuclear Gauge Operator takes nuclear gauge readings at each location, randomly selected by the Engineer, approximately every 60 meters along the length of the pavement for each pass of the paver. The Nuclear Gauge Operator records these values on a BR 340M, **Exhibit 401-A**. The paving inspector checks periodically throughout the day to witness density measurements and verify that the nuclear gauge and operator are functioning properly. The EIC should review, complete and sign the BR 340M which is then included in project files.

If nuclear readings over two consecutive locations fall below 96% of the PTD or if the moving average of the last 10 nuclear gauge readings falls below 98% or exceeds 103% of the PTD, stop routine paving operations and construct a new test section. Normal production will only resume after establishing a new PTD. *Make sure the Contractor understands this.*

#### **Using a Different Nuclear Gauge**

Before a gauge other than the gauge used to establish the PTD can be used on the project, a new test section must be constructed and a new PTD be determined for the new gauge.

### 2. Superpave 60 series specifications

#### a. Test Section

Routine paving of this item is not permitted until a test section is constructed. Paving beyond the test section is optional, however, alert the Contractor of a possible deduction if core densities are not within the specified limits.

Prior to paving the test section, the inspector should have the following:

- ! BR 340M **Exhibit 401-A**
- ! Materials Procedure MP 96-01 M
- ! Maximum theoretical density for the mix type - (from plant and/or RME)
- ! Nuclear gauge serial number(s) - (from Contractor or testing service)
- ! Approximate gauge correction factor - (from Contractor, testing service)
- ! Temperature gun and/or a thermometer
- ! Keel

Location of test section should consider:

- ! Determine the location of the test section that is representative of the whole project.
- ! Consider M&PT & good construction practice.
- ! Determine whether paving will continue after the test strip. If yes, the remainder of paving is done at the Contractor's risk. There will be a possible

## SECTION 401 HOT MIX ASPHALT

deduction depending on core densities. An Interim PTD must be set at this time by having the gauge operator take density readings on the four core locations.

! Generate Core Location - Use Random Number Tables from MP 96-01 M. Core locations should be moved if they are closer than 3m to a transverse joint or 0.6m to a longitudinal joint. Move core location an additional 3m away from transverse joint and an additional 0.6 meter away from the longitudinal joint.

### Inspector's Responsibilities

The project inspector must have the following: BR 340M **Exhibit 401-A**, keel, temperature gun or thermometer, spray paint, MP 96-01 M, Polyethylene bags, Form BR 309 (**Exhibit 401-O**) Waterproof envelope (BR 11E), 100 mm wire reinforced tie, and red "NYSDOT Sampled" security seal. In addition, the paving inspector should:

! Record nuclear gauge(s) information. i.e., gauge manufacturer, model #, and serial # on the BR 340M. Both the Nuclear Gauge Operator and the paving inspector must be familiar with how to monitor mat densities and complete BR 340Ms.

! Verify the identification and certification of the gauge operator(s).

! Layout core locations and record the station & offset for each core on the BR 309.

! If dry ice is used to cool core locations, do not use dry ice until after the gauge readings are completed.

! Witness and record nuclear density measurement at each core location. If multiple gauges are used, the density readings are written on different forms.

! Make sure the gauge operator determines the nuclear gauge reading for each core location by averaging 4 measurements.

! Observe technique of Nuclear Gauge Operator - correct errors (short sticking, long sticking). Also see Section VII.G.5. Monitoring Nuclear Gauge Measurements.

! If more than one gauge needs to be calibrated, the gauges must be kept more than 10 meters (30 feet) apart.

! Remind paving superintendent that core samples need to be packaged per MP 96-04M. Cores, nuclear gauge readings, and loose mix samples must be delivered to Regional laboratories by the Contractor.

#### b. Project Target Density

##### **Determine Interim Project Target Density**

An Interim PTD is required if the Contractor elects to continue beyond the test section. Ask the paving superintendent or the Nuclear Gauge Operator what interim PTD will be used. The interim PTD should be greater than or equal to 94% of maximum theoretical density plus the assumed correction factor of the nuclear gauge. If not, let the Contractor explain why the Interim PTD is lower. Otherwise, the interim PTD will be the average of the nuclear gauge readings taken at the four core locations. The EIC should advise the superintendent, that if core densities or mat densities, recorded on BR 340M, **Exhibit 401-A**, under the interim PTD, are not satisfactory then payment adjustments are applied to any material placed after the test section but before the PTD has been



## SECTION 401 HOT MIX ASPHALT

determined by the RME. Additional cores are not required.

### Actual Project Target Density

Actual PTD will be calculated by the RME using the core densities and the nuclear gauge density readings. The PTD will be sent to the EIC by facsimile. See **Exhibit 401-F**.

#### c. Routine Paving

After the PTD has been determined, routine paving can resume. A nuclear density reading is defined as the average of four nuclear measurements taken at 90° at a location. The Nuclear Gauge Operator takes nuclear gauge readings at each location, randomly selected by the Engineer, approximately every 60 meters along the length of the pavement for each pass of the paver. The Nuclear Gauge Operator records these values on a BR 340M, **Exhibit 401-A**. The paving inspector checks periodically throughout the day to witness density measurements and verify that the Nuclear Gauge Operator is functioning properly. The EIC should review, complete and sign the BR 340M and it should be included with the project files.

If nuclear readings over two consecutive locations fall below 96% of the PTD or if the moving average of the last 10 nuclear gauge readings falls below 98% or exceeds 103% of the PTD, stop routine paving operations and construct a new test section. Normal production will only resume after establishing a new PTD. Make sure the Contractor understands this.

### Using a Different Nuclear Gauge

Only nuclear gauges that have an established PTD from a test section on your project can be used for routine paving on your contract. Before a new nuclear gauge can be used for routine paving, a new test section must be constructed and a PTD established for that new gauge.

#### d. Additional Coring Guidelines

The following guidelines will be used by the EIC to determine when additional pavement cores should be required during routine paving.

- i. Pavement density monitoring was not performed in accordance with the specification requirements. This would include, but is not limited to: not taking the required number of density readings (either at a specific location or at the required frequency), beginning to pave without a nuclear density gauge on site, and continuing to pave after the only calibrated nuclear density gauge on site breaks down.
- ii. There is a reason to believe that the nuclear density gauge readings do not accurately represent the actual in-place density of the pavement. Such reasons could be:

! BR 340M, not completed, in pencil, contains math errors, not submitted at end of the day, or not completed as paving progresses.

! Readings not taken at varying offsets.

! 2 consecutive nuclear gauge readings of  $\geq 1.03 \times \text{PTD}$ .

## SECTION 401 HOT MIX ASPHALT

! Very erratic nuclear gauge readings.

! Observations of improper nuclear gauge practices, refer to Section VII.G.5. Monitoring Nuclear Gauge Measurements.

- iii. There are situations when the EIC should require additional pavement cores to monitor the PTD being used on the project. These situations include, but are not limited to the following: new mix design or supplier, change of existing pavement being overlaid, change of paving equipment (i.e., paver or rollers) being used, and excessive plant variation. In these situations the nuclear density gauge tests will be used for acceptance. However, a new PTD will be established if different from the original PTD.

For *i.* and *ii.* above, if the average density of the four additional cores is not between 92% and 97% of the mixture's average daily maximum theoretical density, a payment adjustment will be applied to the material placed on the day represented by the pavement cores. The payment adjustment will be made according to Table 1 - Density Quality Adjustment Factors in the specification.

### 3. Superpave 50 series specifications

At the beginning of paving for this item, the Contractor has the option to either construct a test section or begin routine paving.

#### a. Test Section

! Determine the location of the test section that is representative of the whole project.

! Unless permitted by the Regional Construction Engineer, the test section will be constructed full pavement width. Example, four-lane divided roadway will have a test section constructed over two lanes in one direction.

! The test section is 50 to 500 centerline meters in one direction.

! Generate core locations by using the Random Number Tables from MP 96-04 M. Core locations should be moved if they are closer than 3m to a transverse joint or 0.6m to a longitudinal joint. Move core location an additional 3m away from the transverse joint and an additional 0.6 meter away from the longitudinal joint.

! Secure cores in a plastic bag and seal them as required in MP 96-04 M.

! Remind Contractor to deliver the cores and loose mix samples to the Regional laboratories.

! The RME will calculate the pavement QAFs. The QAF must be 1.00 before Contractor is allowed to go to routine paving.

#### b. Routine Paving

! Generate core locations by using the Random Number Tables from MP 96-04 M. Core locations should be moved if they are closer than 3m to a transverse joint or 0.6m to a longitudinal joint. Move core location an additional 3m away from the transverse joint and an additional 0.6 meter away from the longitudinal joint.

! Exclude the first 100 linear meters of daily paving when laying core locations.

! Secure cores in a plastic bag and seal them as required in MP 96-04 M.

## SECTION 401 HOT MIX ASPHALT

! Remind Contractor to deliver the cores and loose mix samples to the Regional laboratories.

! If the Contractor opts to go to routine paving at the beginning of paving for the item, the QAF for the first day's cores must be greater or equal to 1.00. Otherwise, the Contractor has to construct a test section as described above.

! The RME will calculate daily pavement QAFs and transmit them by facsimile. See **Exhibit 401-G**.

### c. Daily Sampling Requirements

! Pavement core locations will be clearly marked with a 150 mm diameter circle using spray paint, or equivalent.

! Pavement core locations will be marked only after the last compaction equipment has completed compacting the pavement in the area of the core locations.

! The EIC or paving inspector should be present during coring to secure cores.

! BR 309 must be filled out properly for each core, and put in a waterproof envelope (BR11E). Both cores and the envelope will be put in a plastic bag and sealed with 10 mm wire reinforced tie, and red "NYSDOT Sampled" security seal.

### 4. Monitoring shoulders - all series

The asphalt paving specifications also require the shoulders to be monitored to ensure the density is between 92% and 97% of the Maximum Theoretical Density. On shoulders paved separately it may be difficult to obtain the required density and care must be taken to not damage the shoulders.

#### **Shoulders Paved with an Adjacent Lane**

When the inspector witnesses a test location, have the Nuclear Gauge Operator take 4 measurements in the middle of the shoulder adjacent to the lane's test location. Label the location as the "shoulder" in the "Test no." column of the BR 340M. Record the measurements and the average nuclear density but don't include it in the moving average calculations.

#### **Shoulders Paved Separately**

Monitor and record the density measurement and average nuclear density every 60 meters on the BR 340M (**Exhibit 401-A**). Label it "shoulder" under the "Test no." column. Note that it may be difficult to obtain the required density and care must be taken not to damage the shoulder. If after satisfactory compaction by the Contractor the required density has not been met, it may be appropriate to accept the shoulder density before risking damage.

### 5. Monitoring nuclear gauge measurements

It is possible for a Nuclear Gauge Operator to use the gauge in a manner that results in gauge readings that are dramatically higher than or lower than the actual density of the pavement. Therefore, it is necessary to watch the gauge operator to make sure that only proper techniques are being used. The following are a summary of techniques that can be used to influence nuclear gauge readings.

## SECTION 401 HOT MIX ASPHALT

### Short Sticking

When measuring pavement density the gauge is operated in the “backscatter” mode. In this mode the source rod is positioned so that it locks into place in the first notch below the top notch or the “safe” mode notch. The handle should click and lock into this backscatter position. In many gauges it is possible to position the handle so that it locks in just above the notch. When the gauge takes measurement with the handle in this “short stick” position the reading generally jumps approximately 140 kilograms per cubic meter ( $\text{kg/m}^3$ ) or 6 percent. If a paving crew is having problems meeting the density specification, it is possible for a gauge operator to avoid having to perform a test strip by judiciously or accidentally “short sticking” a measurement or two to increase a reading that would otherwise be less than 96% of the PTD or in danger of bringing the moving average to less than 98% of the PTD.

### Long Sticking

This is when the operator takes a gauge reading with the handle locked just below the backscatter notch. This causes measurements to be dramatically lower than the pavement density. This may be detected by rocking the gauge. If the gauge rocks, the source rod is sticking out below the bottom of the gauge and the gauge is not sitting properly. “Long sticking” the readings at a test strip core location could lead to a lower and easier to achieve PTD. This could result in the pavement being compacted to actual densities that are less than what is required by the specification and subsequently a shorter service life.

### Dry Density Readings

Gauges that can be used on soils as well as pavements can take dry densities. Dry densities are to be used for soils work only and should never be used on pavements as the asphalt cement will effectively be mistaken for water by the gauge resulting in lower density measurements than the actual pavement density. The operator could use the Dry Density measurements to establish a lower and more easily achieved PTD. This could result in the pavement being compacted to actual densities that are less than what is required by the specification and subsequently a shorter service life.

### Improper Inputs in Thin Lift or Nomograph Mode Gauges

These gauges allow the density measurements to be adjusted to account for the effects of the underlying material on the reading. It is debatable if the thin lift mode or nomograph mode is ever useful in typical NYSDOT paving projects because the densities of underlying material usually asphalt concrete or Portland cement concrete are so similar that the gauge readings are not effected. The possible exception would be if a thin lift of HMA was being paved over subbase (i.e. detours, driveways, parking areas).

The thin lift or nomograph mode allows the operator to input the pavement thickness and the density of the underlying material. These inputs are located on a display screen that generally is not readily apparent. The operator must key punch to various displays and menus to display what the thickness and underlying density input values are. Although the underlying density input value does not significantly affect the gauge readings, the pavement thickness input can cause dramatic increases or decreases in the reading when compared to the actual pavement density. It is possible to use the inputs to establish a lower and easier to achieve PTD. It is also possible to use the inputs to increase the density measurements so that they indicate a higher pavement density than the actual density.

## SECTION 401 HOT MIX ASPHALT

### Other Situations that Can Affect Density Measurements

- ! Taking measurements under a bridge.
- ! Taking measurements with a truck or large piece of equipment nearby.
- ! Taking measurement with another gauge nearby.
- ! Taking measurements when the pavement is wet.
- ! Taking measurements when the gauge bottom or source rod is dirty
- ! Taking measurements on an uneven surface.

**Improper Density Reading Locations and Recording** Other ways that the pavement density can be misrepresented include:

*i.* Always taking readings in the middle of the mat where the mat gets a higher compactive effort and has the most lateral support. The object is to compact the entire mat not just the center meter. Materials Procedure 96-01 M requires the gauge operator to take readings at various and random offsets no closer than 0.6 meters from the edge of the lane. It is acceptable to allow the gauge operator to take measurements every 60 meters at the following offsets on the typical 3.6 meter wide lane. (0.6m, 1.2m, 1.8m, 2.4m, 3.0m, 0.6m, 1.2 m, .....). This eliminates the need to generate random offsets for the gauge readings.

*ii.* When no one is witnessing the readings, the gauge operator could record density measurements higher than the actual readings. This would enable the Contractor to continue paving despite achieving actual pavement densities that are less than what is required.

The way to prevent *i.* and *ii.* from occurring is to require the gauge operator to mark the gauge reading locations with keel. This enables the paving inspector to walk back and easily see that the density reading locations are at variable offsets. It also enables the paving inspector to have the gauge operator go back to the location of an earlier density measurement and compare the new measurements to the old measurements. If there is a significant difference then either the gauge is defective or the operator is not using it properly.

*iii.* The gauge operator can record incorrect averages and moving averages to make it appear that the density requirements are being met when in fact they are not. To prevent this the paving inspector should check the gauge operator's math at a random reading or two at each visit. A spot check for this type of error can also be performed when reviewing the completed BR 340M (**Exhibit 401-A**) at the end of the paving day. It is also important to insist that the BR 340M is completed in ink so that the recorded measurements and calculations can't be manipulated by the gauge operator.

The gauge operator should be doing all the necessary calculations including moving averages as he or she progresses, not at the end of paving. Otherwise it may not become evident that the specification density requirements are not being met until it is too late.

### H. CONSTRUCTION JOINTS

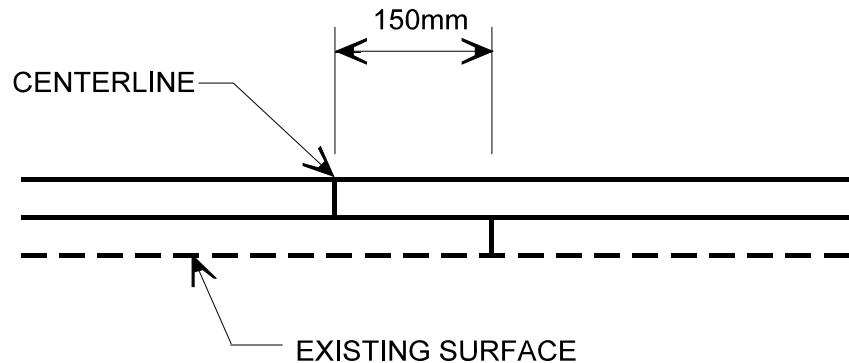
HMA paving results in construction joints in the pavement. There are transverse joints at

## SECTION 401 HOT MIX ASPHALT

the beginning and end of the project and at the end of each days paving. When lanes are placed adjacent to each other a longitudinal joint is created between the lanes. Proper joint construction can extend the service life of the pavement and provide a smooth riding pavement.

### 1. Longitudinal Joints

The paving operation should be planned so the longitudinal paving joints line up with the edges of the proposed travel lanes. When paving multiple courses the longitudinal paving joints of each course should be staggered at least 150mm to avoid a single vertical joint the depth of the pavement.



### Paving

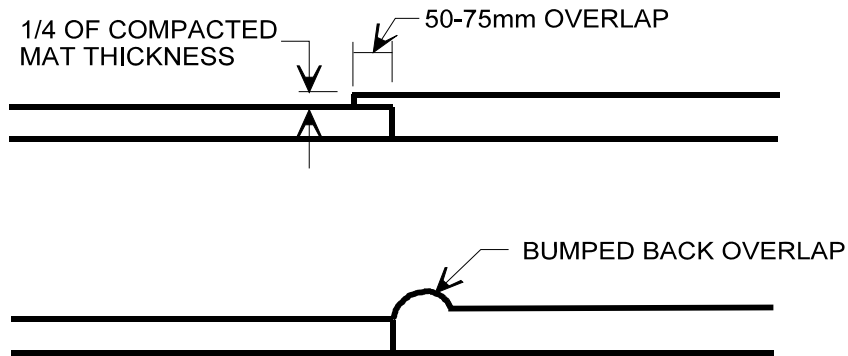
Paving operations should be planned so that no more than 30m of longitudinal pavement joint is exposed at the end of the work day unless a greater length is permitted by the contract documents. If permitted by the contract documents the Contractor must request permission, in advance, in writing, to leave a longitudinal tapered wedge joint exposed to traffic overnight. When the longitudinal tapered wedge joint is allowed overnight, the Standard Specifications require that maintenance and protection of traffic provisions be included in the contract documents to address how the project will be signed to alert the motorist of the uneven pavement condition. Paving operations should be planned so the exposed edge is only exposed to traffic for one night and not over weekends or holidays. When inclement weather is forecast the paving operation should be adjusted accordingly.

The Standard Specifications require that if the exposed longitudinal wedge joint becomes damaged and/or provides an unsafe condition for motorists the approval to expose the longitudinal pavement joint will be rescinded and no more than 30m of longitudinal pavement joint can be exposed at the end of the work day.

The Standard Specifications allow two methods to construct longitudinal joints.

**Butt Joint** - The second mat placed overlaps the first mat by 50 to 75mm. The thickness of the overlap material should be 1/4 the compacted thickness of the course. Any excess material should be removed, not broadcast onto the mat. The overlap material should be bumped back so it can be rolled into the joint.

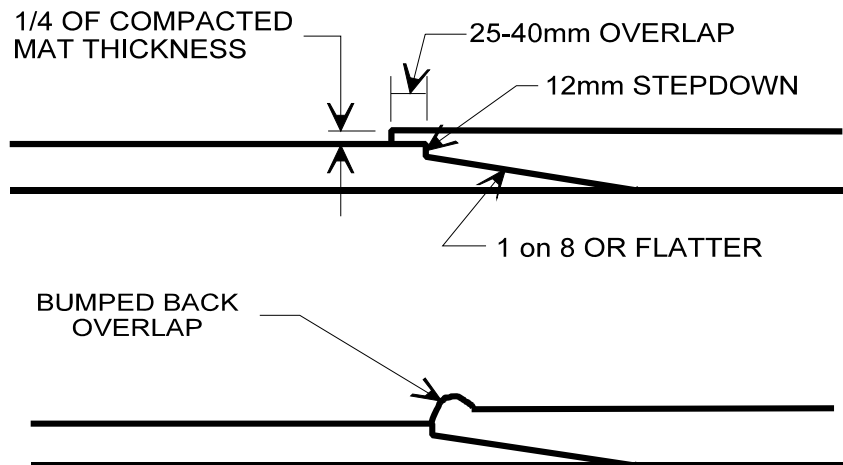
## SECTION 401 HOT MIX ASPHALT



LONGITU

DINAL JOINT CONSTRUCTION - BUTT JOINT

**Tapered Wedge Joint** - The first mat will be placed with an attachment to the paver that provides a sloping wedge (1:8 min.) with a vertical step-down at the longitudinal pavement joint. The step-down must be 12mm minimum after compaction of the mat. The second mat placed overlaps the step-down by 25 to 40mm. The thickness of the overlap material should be 1/4 the compacted thickness of the course. Any excess material should be removed, not broadcast onto the mat. The overlap material should be bumped back so it can be rolled into the joint.



LONGI  
TUDIN  
A L  
JOINT  
CONST  
RUCTI  
ON - TAPERED WEDGE JOINT

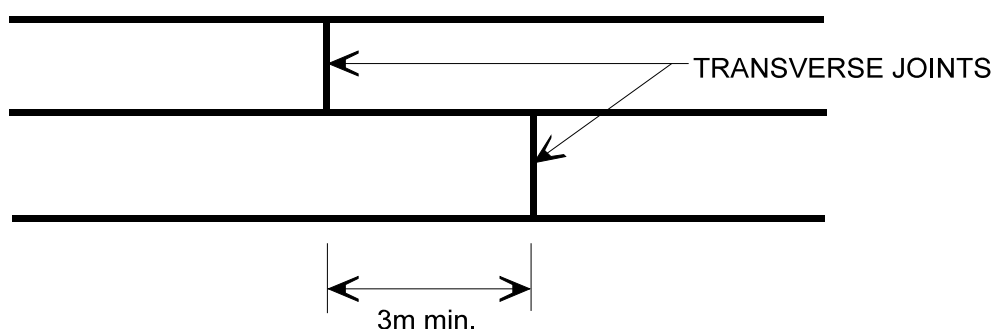
## SECTION 401 HOT MIX ASPHALT

Compaction of the longitudinal joint, using either construction method, should be performed with the roller operating in vibratory mode and as close to the paver as practical. The first pass should be made with the roller traveling toward the paver, on the hot mat, with 150-200mm of the roller drum protruding onto the cold mat. The second pass of the roller should be in the same position on the joint as it backs away from the paver. After applying these two passes compaction of the mat should be performed by starting at the low side of the mat and progressing to the high side.

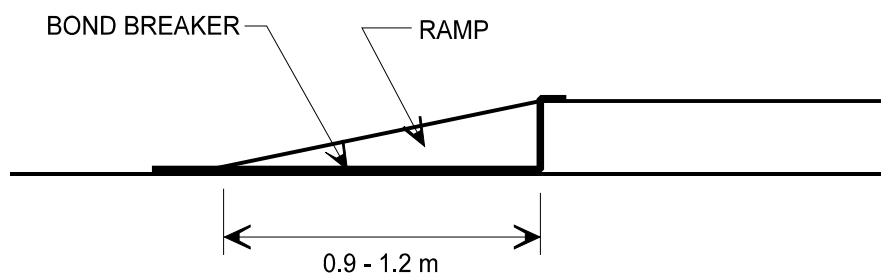
Further information can be found in §401-3.13, Joints, of the Standard Specifications.

### 2. Transverse Joints

Paving operations should be planned to minimize the number of transverse joints. Transverse joints in adjacent lanes should be staggered a minimum of 3m.



Transverse joints need to be constructed between the end of the previous days paving and the start of a new days paving. At the end of the days paving a location is chosen for the joint. Choose a location where the mat is at the desired thickness. At this location a vertical joint is constructed by raking, shoveling and removing the material downstream of the joint. A bond breaker of treated paper or plastic is put down adjacent to the vertical face and an asphalt concrete ramp is built. Treated paper or plastic is used so the ramp can be easily removed the following day. The mat and ramp are compacted after they are placed. The ramp provides a transition from the new mat to the existing pavement and prevents the roller from damaging the edge of the mat during compaction.



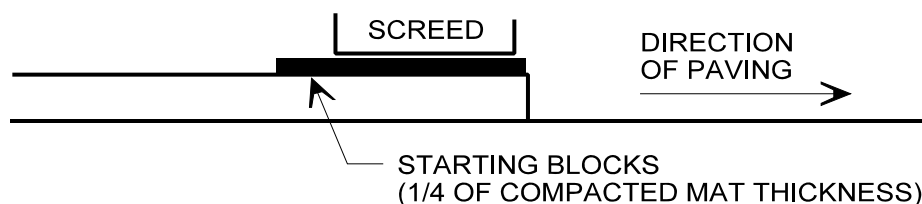
TRANSVERSE JOINT WITH TEMPORARY RAMP

A t  
the  
sta  
rt  
of  
the  
ne  
xt  
da  
ys  
pa  
vin



## SECTION 401 HOT MIX ASPHALT

g, the ramp and bond breaker are removed and the vertical faced joint is exposed. The vertical faced joint should be overlapped by 50-75mm and this material should be bumped onto the new mat so it can be rolled into the joint. Any excess material should be removed, not broadcast onto the mat. It is important to consider how much the new mat will compact. The proper thickness of material must be placed so that when compacted it meets the existing pavement elevation and provides a smooth transition. To provide this, the overlap should be  $\frac{1}{4}$  the compacted thickness of the course. This is accomplished by putting the paver screed on starting blocks (usually wood) when the paver pulls off the joint. The starting blocks should be of adequate size to allow the additional thickness of material to be placed. Once the screed is on the starting blocks, the angle of attack is set and the material feed system is activated and the auger chamber is filled with material. The mix in the auger chamber should be enough to just cover the auger shaft. Too much material will cause a bump and not enough will cause a dip.



Before the material is compacted at the joint it should be checked with a straight edge. Place the straight edge in a few locations on the uncompacted material so it extends over the existing pavement. The straight edge should be parallel to the existing pavement and at a distance above the existing pavement equal to the amount the mat will compact. If it is not, corrections can be made by adding additional material or the uncompacted material can be removed, raked and leveled. When done properly the joint will not feel like a bump in the pavement when it's driven over.

If possible, the joint should be compacted in the transverse direction. Boards of the proper thickness should be placed at the longitudinal edge of pavement so the roller does not damage the edge. It is not always possible to roll the joint in the transverse direction because of guide rail or traffic conditions. In these instances roll the joint in the longitudinal direction similar to routine compaction of the mat.

Further information can be found in §401-3.13, Joints, of the Standard Specifications.

### I. CONTROL CHECKS OF ASPHALT QUANTITY

#### 1. Mat thickness checks

During paving operations the thickness of the mat being placed should be checked. The thickness of the uncompacted mat behind the paver should be 20-25% thicker than the desired final thickness to allow for compaction of the mat. If screed adjustments are made to change the thickness of the mat, allow the paver to travel four paver lengths so the screed can respond to the adjustment and correct the thickness. Mat thickness checks should be performed periodically.

## SECTION 401 HOT MIX ASPHALT

### 2. Yield Checks

In addition to the mat thickness, checks for yield should be performed during paving operations. The yield check determines the amount of material placed and compacted at a certain width, length and thickness. The calculated yield should match up with the amount of material delivered in the haul unit.

When the haul unit arrives at the paver, estimate when the material in the haul unit passes the screed and mark that spot on the pavement. When the truck is empty, estimate when the last of the material in the truck passes the screed and mark that spot on the pavement. The length between marks should be compared to the length determined from the yield check calculation. If the lengths do not compare, adjustments to the width or depth of pavement should be made.

#### EXAMPLE:

Amount of material in haul unit = 20 MT(metric tons)

W, Pavement width = 3.6 m

D, Pavement thickness= 40 mm (0.04m)

F, HMA yield factor <sup>†</sup> = 2.404 MT/m<sup>3</sup>

L, Estimated length of paving

$L \times W \times D \times F = \text{MT of material}$

$L \times 3.6\text{m} \times 0.04\text{m} \times 2.404\text{MT/m}^3 = 20 \text{ MT}$

$L = 58 \text{ m}$  (compare to marks on pavement)

<sup>†</sup> Yield Factor - contact your regional materials unit or HMA supplier for the maximum theoretical density (Rice number) of the HMA you are using. The maximum theoretical density is specific to the mix type and supplier (i.e. all 12.5mm mixes do not have the same maximum theoretical density). Once you obtain the maximum theoretical density value, multiply it by the percent compaction. Usually between 92% and 97%. If this number cannot be obtained from cores use 94%. The resulting value is the yield factor.

#### EXAMPLE:

maximum theoretical density = 2.557 MT/m<sup>3</sup>

$2.557 \text{ MT/m}^3 \times 0.94 = 2.404 \text{ MT/m}^3$

**SECTION 401 HOT MIX ASPHALT**

**J. MAT PROBLEMS AND POSSIBLE SOLUTIONS**

<b>NON-UNIFORM TEXTURE</b>	
BLISTERS:	
Moisture in underlying mat or grade	Allow mat or grade to dry before paving
Moisture in HMA	Contact Regional Materials Unit and HMA supplier
POOR SURFACE TEXTURE:	

## SECTION 401 HOT MIX ASPHALT

Worn screed plate	Replace screed plate
Cold screed plate	Check screed heaters
Screed vibration	Check if screed vibration is operating or needs adjusting
Change in HMA temperature	Contact Regional Materials Unit and HMA supplier
Change in HMA mix proportions	Contact Regional Materials Unit and HMA supplier
Aggregate size too large for thickness of mat	Increase mat thickness
Excessive raking or walking on loose mat	Use proper paving procedures
Random segregation	Contact Regional Materials Unit and HMA supplier
Centerline segregation	Contact Regional Materials Unit and HMA supplier
Edge segregation	Check if reverse augers or kick back paddles at gear box are worn or need cleaning
End of truck segregation	Contact Regional Materials Unit and HMA supplier If screed is extended require the use of an auger confinement tunnel
Surface shadows	Contact Regional Materials Unit and HMA supplier Do not dump hopper wings after each truckload Dump hopper wings when hopper is 1/3-1/2 full of HMA so segregated material gets re-mixed  Do not overload augers with HMA HMA level should be at auger shaft during paving
TRANSVERSE:	
Trucks bumping paver	Instruct truck drivers
Truck driver holding breaks	Instruct truck drivers
Mechanical problem with paver screed	Perform maintenance or replace paver screed
Paver screed set up incorrectly	Adjust tow point or angle of attack

## SECTION 401 HOT MIX ASPHALT

LONGITUDINAL:	
Screed extensions set up incorrectly	Adjust angle of attack and vertical position of extension to match main screed
<b>MAT TEARING</b>	
FULL WIDTH OF MAT:	
Unstable or tender HMA	Contact Regional Materials Unit and HMA supplier
Worn or warped screed plate	Replace screed plate
Cold screed plate	Check screed heaters
Paving speed is too fast	Reduce paving speed
Cold HMA	Contact Regional Materials Unit and HMA supplier
Aggregate size too large for thickness of mat	Increase mat thickness
CENTER OF MAT:	
Lack of lead crown in paver screed	Increase lead crown
Cold screed plate	Check screed heaters
Worn screed plate	Replace screed plate
Cold HMA	Contact Regional Materials Unit and HMA supplier
Fluctuating head of material	Adjust pavers material delivery system
EDGE OF MAT:	

## SECTION 401 HOT MIX ASPHALT

Too much lead crown in paver screed	Decrease lead crown
Cold screed plate	Check screed heaters
Worn screed plate	Replace screed plate
End gate not square	Adjust end gate
Cold HMA	Contact Regional Materials Unit and HMA supplier
Cold HMA buildup at end of auger	Adjust pavers material delivery system or auger extensions

## SECTION 401 HOT MIX ASPHALT

<b>CHECKING</b>	
Excessive deflection of underlying layer	For granular bases, improve density of base Do not pave on a saturated base For HMA layer, cut out and patch weak areas
Unstable or tender HMA	Contact Regional Materials Unit and HMA supplier
HMA too hot	Contact Regional Materials Unit and HMA supplier
Too much rolling	Contact Regional Materials Unit and HMA supplier
Poor bond between layers	Use proper rolling procedures Use proper cleaning and tack coat procedures
<b>SHOVING</b>	
Poor bond between layers	Use proper cleaning and tack coat procedures
Too much tack coat	Use less tack coat
Unstable or tender HMA	Contact Regional Materials Unit and HMA supplier
HMA too hot	Contact Regional Materials Unit and HMA supplier
High asphalt cement content	Contact Regional Materials Unit and HMA supplier
Rolling when mat is too hot	Contact Regional Materials Unit and HMA supplier
Reversing or turning roller too quickly	Delay compaction of mat
Roller too heavy	Use proper rolling procedures
Roller tire pressure too high	Use lighter roller Reduce tire pressure

## SECTION 401 HOT MIX ASPHALT

<b>ROLLER MARKS / BUMPS</b>	
<p>Unstable or tender HMA</p> <p>Rolling when mat is too hot</p> <p>Too much rolling</p> <p>Inadequate / improper rolling techniques</p> <p>Improper roller settings</p> <p>Reversing or turning roller too quickly</p> <p>Stopping roller on hot mat</p> <p>Mechanical problems with roller</p>	<p>Contact Regional Materials Unit and HMA supplier</p> <p>Delay compaction of mat</p> <p>Use proper rolling procedures</p> <p>Use proper rolling procedures</p> <p>Use proper rolling procedures</p> <p>Use proper rolling procedures</p> <p>Use proper rolling procedures</p> <p>Use proper rolling procedures</p> <p>Replace roller</p>
<b>SURFACE WAVES</b>	
<p><b>SHORT / RIPPLES:</b></p> <p>Unstable or tender HMA</p> <p>Change in HMA temperature</p> <p>Fluctuating head of material</p> <p>Erratic paver operation</p> <p>Mechanical problems with paver screed</p> <p>Improper set up or malfunction of paver grade control system</p> <p><b>LONG:</b></p> <p>See "SHORT / RIPPLES" above</p> <p>Running paver hopper empty between loads</p> <p>Long waves in underlying surface</p>	<p>Contact Regional Materials Unit and HMA supplier</p> <p>Contact Regional Materials Unit and HMA supplier</p> <p>Adjust pavers material delivery system</p> <p>Use proper paving procedures</p> <p>Perform maintenance or replace paver screed</p> <p>Check grade control system</p> <p>Keep material in paver hopper between loads</p> <p>Use proper pavement preparation</p>



## SECTION 401 HOT MIX ASPHALT

BLEEDING / FAT SPOTS	
<p>Poor quality HMA production</p> <p>High asphalt cement content</p> <p>Moisture in HMA</p> <p>Too much tack coat</p> <p>Release agent or fuel spilled on mat</p> <p>Traffic allowed on mat at high temperature</p>	<p>Contact Regional Materials Unit and HMA supplier</p> <p>Contact Regional Materials Unit and HMA supplier</p> <p>Contact Regional Materials Unit and HMA supplier</p> <p>Use less tack coat</p> <p>Find and correct source of spill</p> <p>Allow mat to cool before allowing traffic on it</p>
JOINTS	
<p>LONGITUDINAL:</p> <p>Poor joint compaction</p> <p>Poor vertical joint alignment</p> <p>TRANSVERSE:</p>	<p>Roll joint before HMA cools</p> <p>Check HMA temperature</p> <p>Use proper overlap of joint</p> <p>Check for edge segregation</p> <p>Inadequate compaction effort</p> <p>Check set up and operation of joint matching shoe</p> <p>Provide proper loose mat thickness</p> <p>Use proper overlap of joint</p> <p>Check for edge segregation</p> <p>Check for fluctuating head of material</p> <p>Improper raking of joint</p>

## SECTION 401 HOT MIX ASPHALT

Rough or uneven joint	Incorrect joint preparation Put paver screed on starting blocks and provide proper amount of HMA in auger chamber when pulling off transverse joint Check screed plate heaters Improper raking of joint Check for segregation Roll joint transversely
<b>POOR COMPACTION</b>	
Poor underlying layer  Poor quality HMA production  Change in HMA temperature  HMA segregation  Rolling too fast or not soon enough  Improper number of rollers and/or choice of rollers  Improper rolling pattern  Improper operation of rollers	Use proper pavement preparation  Contact Regional Materials Unit and HMA supplier  Contact Regional Materials Unit and HMA supplier  Contact Regional Materials Unit and HMA supplier Use proper paving practices  Use proper rolling procedures  Use proper rolling procedures  Use proper rolling procedures  Use proper rolling procedures

### K. COMPLIANCE

Section 99 Contract Administration Guidelines of the Contract Administration Manual (CAM) contains the principles of contract administration and contract compliance. Section 99 should be reviewed first, as the following section will summarize and discuss the same principles as they relate to asphalt paving situations.

#### **Contract Administration**

Progressive - The EIC/inspector must use incrementally assertive steps to gain compliance

## SECTION 401 HOT MIX ASPHALT

for asphalt paving deficiencies that are not corrected or are repeated. These steps are discussed in the next section and are the most effective way to ensure that the Contractor knows the Department is serious about compliance.

Constructive - Although pavement quality is the Contractor's responsibility, the EIC/inspector should offer to the Contractor any knowledge or assistance available to solve the asphalt paving problem. This should include contacting the Regional and/or Main Office Materials for technical advice.

Documented - The asphalt pavement deficiency, the action used by the EIC/inspector to gain compliance (verbal and written), and the Contractor's response and corrective action must be documented.

Informed - Steps taken by the Contractor and/or by the EIC/inspector to produce acceptable asphalt pavement must be in agreement with the specifications, department policy and technically sound. As the seriousness or time it takes to solve the problem increases, the problem should be communicated to the RME, Construction Supervisor and if necessary the Regional Construction Engineer and Main Office Construction Division and the Materials Bureau.

### Steps to gain compliance

1. Verbally Inform the Contractor - The Contractor must be verbally informed once the Inspector/EIC determines that a significant area or repetitive smaller areas of asphalt pavement are deficient or if any required procedure is not being followed properly. At this point the Contractor must inform the Inspector/EIC how the deficiency is going to be corrected and prevented from occurring again. A Contractor many times can immediately take measures to prevent further continuation of the paving problem. If this is the case, the inspector is to record the problem and the Contractor's action to fix the problem in the inspection report (IR).
2. Written notice to the Contractor - This is necessary in either of the following two cases.
  - a. Most problems with asphalt paving have many possible causes (see Section VII., J. Mat Problems and Possible Solutions). The Contractor should only be allowed to continue paving by trying to fix a probable cause of the HMA problem as listed in Section J. This would be a reasonable and rational attempt by the Contractor to fix the problem. If the Contractor's **reasonable** methods used that day do not work, a written notice should be given to the Contractor. The notice should describe the deficiencies, actions already taken, ask what future remedies will be utilized to prevent the problem from reoccurring, and when and how the past deficiencies will be corrected. A call to alert the Materials Engineer at this point should be made. If problems still occur on the second day using reasonable solutions, a written stop work order should be issued and a project level meeting called.
  - b. If the Contractor for some reason fails to acknowledge the problem or provide a plausible method of correction, a written stop work order should be issued. At this time the Construction Supervisor should be notified. A project level meeting should be called as the next course of action.
3. Project level meeting. - The EIC, inspection personnel, Construction Supervisor,

## SECTION 401 HOT MIX ASPHALT

Materials Engineer, Contractor's project manager, superintendent, foreman, and possibly the HMA supplier should be in attendance at this meeting. At the meeting someone from field staff should take minutes to be later distributed and put into the contract file. The subjects to be covered are payment of pavement already placed, options to fix pavement already placed, and most importantly what is to be done to prevent the problem from occurring again. Everyone should actively participate in formulating a solution. Paving should not resume unless there is a general agreement reached on how to proceed.

4. Article 8 No Estimate On Contractor's Non-compliance. - If the Contractor fails to correct areas of deficient pavement, those quantities of asphalt should not be included in an estimate for payment. The Construction Division Liaison should be notified when payment is withheld.

If after these steps are taken and the Contractor has still not complied with directives, steps 5 through 7 of CAM Section 99 should be started. These are meetings with the Regional Director, Construction Division and Contract Review Unit (CRU). These are progressive steps necessary to terminate a contract.

### VIII. PAYMENT

#### A. QUALITY UNITS

Quality payment adjustments are applicable for all HMA items in accordance with the specifications and provisions outlined in the contract documents. Quality payment adjustments are measured in Quality Units. Quality Units are calculated using the daily QAF and the appropriate accepted tons of HMA. Quality Units have a predetermined HMA Index Price. The HMA Index Price is based on weighted average bid prices and are assessed annually for each Region. One Index Price is used for all HMA quality adjustment items in a contract and applies for the contract duration. Regional Index Prices are established and updated annually by an Engineering Bulletin and are incorporated in the contract documents.

Separate quality payment items are used for each quality payment adjustment, i.e. plant production, pavement density, longitudinal joint density (future), and pavement smoothness (future). Quality adjustment items are paid using the appropriate pay item in the contract documents. Quality adjustments are calculated for each item using only the quantity eligible for that adjustment. The fifth digit to the right of the decimal of the quality pay item designates the appropriate quality adjustment. The sixth digit to the right of the decimal is reserved for revisions. The quality pay item for pay adjustments are linked to the core HMA pay item as shown below.

## SECTION 401 HOT MIX ASPHALT

**Quality Adjustment Items for:**  
**\_\_403.\_\_\_0\_ M = Specified Contract Item**

Quality Adjustment Items		Quality Adjustments Apply To
__403.___1_ M =	Plant Production Adjustment	All items paid by the metric ton <b>except</b> for ice retardant mixes.
__403.___2_ M =	Pavement Density Quality Adjustment	Only applies to SUPERPAVE 50 series items. <sup>1</sup>
__403.___3_ M =	Longitudinal Joint Density Quality Adjustment	Not for general use at this time. <sup>2</sup>
__403.___4_ M =	Pavement Smoothness Quality Adjustment	Not for general use at this time. <sup>2</sup>

Notes:

1. Quality Units for pavement density are calculated for mainline surface and binder course only, not the entire quantity which includes shoulders, maintenance crossovers, etc. The quantity used for the calculation must agree with the core item's Method of Measurement.
2. Quality Units for pavement smoothness and longitudinal joint density are calculated for the mainline surface course only, not the entire quantity which includes shoulders, maintenance crossovers, etc. The quantity used for the calculation must agree with the core item's Method of Measurement.

Quality Units must be calculated for each day's production by using the daily QAF for plant production, pavement density, longitudinal joint density and pavement smoothness. Quality Units are calculated as follows:

**Quality Units = (Daily Quality Adjustment Factor - 1.00) x (Appropriate Accepted Tons of HMA)**

When Quality Units are determined, it is possible to have positive or negative Quality Units. When the Quality Units have a positive value, the positive dollar amount must be entered using the appropriate quality adjustment item. When the Quality Units have a negative value, the negative dollar amount is a charge to the Contractor and must be entered against the appropriate quality adjustment item.

Example:

If a HMA quantity of 5645 Mg (4000 Mg for mainline and 1645 Mg for shoulders) of Item

## SECTION 401 HOT MIX ASPHALT

18403.125101 M is placed, the calculation of the maximum number of Quality Units for the Plant Production and Pavement Density Items would be as follows:

### ***Plant Production***

**(1.05 - 1.00) x 5645 MT = 282.25 rounded up to 283 Quality Units**

See **Exhibit 401-H and 401-I**, Plant Production Quality Adjustment Work Sheet and Instructions

### ***Pavement Density***

**(1.05 - 1.00) x 4000 MT = 200 Quality Units**

See **Exhibit 401-J and 401-K**, Pavement Density Quality Adjustment Work Sheet and Instructions

In the project documents, 283 Quality Units is allocated for the Plant Production Quality Adjustment Item and 200 Quality Units is allocated for the Pavement Density Quality Adjustment Item.

The contractor must notify the HMA manufacturer of any intended paving operation the day prior to paving. Also, the HMA manufacturer is required to notify the Regional Materials office by 3:00 PM of the day prior to any production. Quality Assurance testing is performed as determined by the RME.

## **B. PLANT QUALITY ADJUSTMENT**

The Quality Assurance Technicians (QAT) is responsible for calculating and transmitting the final plant QAF, including the production quantity to the project on form BR 343a (**Exhibit 401-C**).

## **C. DENSITY QUALITY ADJUSTMENTS**

### **50 Series**

The contractor has two options prior to the first day of mainline paving as follows:

#### **Option A: Test Section**

Prior to mainline paving, the contractor must construct a test section on the project site at a location approved by the Engineer. The test section must be at least 50 m, the full width of the pavement, and the same depth specified for the construction of the course which it represents. The maximum test section length is 500 centerline-meters if placed on the mainline. There is no maximum length if the test section is not placed on the mainline. Compaction equipment must be of the same type and weight that's to be used on the remainder of the course represented by the test section. The test section is paid for at 1.5 times the actual quantity paved, up to 200 actual metric tons per test section. A maximum of two test sections per item is allowed to be paid for at the 1.5 rate. Also, the pavement density QAF is not applied to the first two test sections. If the contractor has to construct

## SECTION 401 HOT MIX ASPHALT

more than two test sections and they are located on the mainline, then the QAF applies. Only one test section per item per day is allowed to be placed.

Routine paving operations for an item is only permitted when the QAF for the test section is 1.00 or greater. If the QAF is less than 1.00, another test section must be constructed as noted above.

### Option B: Routine Paving

Paving operations are started without constructing a test section. The 1.5 rate does not apply. All material placed is subject to a QAF in accordance with the specification. When the QAF on the first day of paving is less than 1.00, then a test section must be constructed in accordance with Option A.

If consecutive paving lots (as described in Materials Procedure 96-4M, Asphalt Concrete Statistical Pavement Density Determination) have a QAF equal to or below 0.85, paving operations for this item must be stopped and a test section must be constructed in accordance with Option A.

The QAF is not to be applied to material placed on ramps with a uniform full width section of less than 400 m in length, shoulders, maintenance widenings, crossovers, or bridges.

### 60 Series

The Department will test cores from a test section or from any day the Engineer requests cores. If paving is continued using an interim PTD immediately after the conclusion of a test section, or if the Engineer requests additional cores on any day after the first day, full payment will be made if the average density of the four cores is between 92% and 97% of the mixture's average daily maximum theoretical density. If the average density fails to meet this limit, **the quantity placed** will be adjusted as outlined in the Method of Measurement section.

The quantity of the material subject to payment adjustments will be determined from typical sections shown in the plans. The payment adjustments will be applied to material placed on mainline but not shoulders, ramps, maintenance widenings, crossovers, or bridges.

D. LONGITUDINAL JOINT ADJUSTMENT (trial use)

E. SMOOTHNESS ADJUSTMENT (trial use)

## IX. WARRANTY PAVING

### A. OVERVIEW

The warranty specification is a pilot program that was transmitted for use by memo, signed by the Office of Operations and the Office of Engineering in 1996 for late season paving. It was reissued again in 1997 by a memo from the Construction Division. In 1998, the warranty specification was revised to include both early and late season paving, and was issued by memo from the Office of the Commissioner and is still in effect. A copy of the 1998 specification is included as **Exhibit N**.

A Contractor has the option to provide a project warranty against defects in hot-mix asphalt concrete pavement **surface course** placed outside seasonal and/or weather limitations.

## SECTION 401 HOT MIX ASPHALT

Provided a Contractor has given the proper notification, the warranty may be started at any time during the project.

If elected, the weather and seasonal limitations of §401-3.01 will not apply to the contract for the **surface course** constructed under warranty. It will be within the discretion of a Contractor to determine what temperature and weather conditions are appropriate for the placement of bituminous pavement including early or late season placement of pavement outside of the surface course placement dates contained in §401-3.01.

A Contractor warrants that at the conclusion of the project warranty, the work shall be free of defects consisting of corrugations, slippage cracks, raveling, longitudinal joint separation, wheelpath rutting, potholes, and/or delaminations. An inspection of the pavement by the Department will determine that an acceptable pavement has been provided which is free from specified defects. If the specified defects are present the pavement shall be repaired at the Contractor's expense.

### B. REQUIRED NOTIFICATION AND DOCUMENTATION.

1. The Contractor must notify the Department in writing of the election of the warranty at least five working days prior to beginning warranty work.
2. The Engineer should discuss the Contractor's proposal with the area supervisor to ensure that the request fulfills the intent of the specification and must obtain verbal internal approval from the Construction Division prior to the start of the initial warranty work.
3. The warranty need only be elected once for the Contractor to warranty paving work. The Contractor can warranty different sites at different times once he elects the warranty. However, the Contractor must notify the Engineer that he is performing warranty work at additional locations, prior to starting work. The specification does allow partial day placements, as long as all other stipulations of the paving warranty specifications are met.

**If partial day warranty paving is performed then it is essential the inspector document the beginning and ending locations (by reference marker if possible), quantity placed, and beginning and ending time of warranty work. The inspector should get agreement from the Contractor on this documentation of the warranty work.**

4. The Engineer must prepare an order-on-contract (OOC) which serves only to incorporate the warranty specification into the contract. The OOC has no items associated with it. The explanation should state that the Contractor has elected to use the warranty specification and a copy of the warranty specification is to be attached to the OOC.
5. The quantity of warranty paving is entered into the Computerized Engineers Estimate System (CEES) program on a daily basis using the original item numbers with the word "warranty" added in the entry block titled LOCATION/DESCRIPTION.
6. The Contractor must document the warranty work by completing the Hot Mix Asphalt (HMA) Pavement Warranty Report (**Exhibit 401-L**) and must submit the warranty report to the Engineer as soon as the work is complete for each location of warranty work.



## SECTION 401 HOT MIX ASPHALT

7. The Engineer must sign and date the warranty report indicating acceptance of the warranty work upon completion by the Contractor. This acceptance must be given immediately to start the warranty and serves only to acknowledge that the work operation to be warranted has been complete and establishes the date the warranty begins. The Engineer should attach a copy of the warranty report to the Inspector's Report ("IR").
8. An estimate should not be processed for the warranty work until the warranty report is submitted and accepted by the Engineer.
9. The Engineer shall forward a copy of the warranty report to the RME and distribute all copies as indicated on the warranty report.
10. The RME shall note when inspection of the warranty work is required. For warranty work completed within a year of the contract completion date, the warranty runs from the date the Engineer approves the warranty report and terminates twelve (12) months from that date. For warranty work completed where there remains more than twelve (12) months until the contract completion date, the warranty runs from the date the Engineer approves the warranty report and terminates on the date the Department accepts the project. Please note that the duration of this warranty will exceed one year.

All inspections should be scheduled so if repairs are necessary, they can be made during times of good weather. The recommended time frame for inspection is in August or early September for late season paving.

### C. BOND DOCUMENTATION

Additional Performance and Labor and Materials bonds are required only if the warranty period extends beyond acceptance of the project by the Department. Based upon the information contained in the warranty report, the various items involved with the warranty work are compiled and a total cost, based upon the original bid, is developed.

The Contractor must submit and the Engineer must accept performance bonds and labor and material bonds which conform to §103-04 of the Standard Specification. The performance bonds and labor and material bonds which are submitted shall be for the full value of all warranty work submitted by the Contractor. In the event there is more than one warranty location on the project, the Engineer should use the sum of the full value of each of the warranties to determine the amount of the bond required.

The amount of the bond includes the dollar value of all of the pavement placed and shall include all items of work which would be necessary to restore the pavement which has been warrantied to its original form. For example, this may include the cost of milling, maintenance and protection of traffic, pavement markings, traffic signal loops or other costs that would be involved in repairing the pavement to eliminate the noted defects.

The bond must be in effect prior to contract acceptance by the Region. The Department should not close out any contracts without having these bonds submitted for the full amount of the warranty work.

## SECTION 401 HOT MIX ASPHALT

### D. INSURANCE

Additional insurance coverage is required **only** if the warranty period extends beyond acceptance of the project by the Department.

The Contractor must submit proof of insurance in accordance with §107-06, except for the commercial general liability coverage required by §107-06 B.e. of the Standard Specifications. The insurance shall be in place for the entire period of the warranty. In the event there is more than one warranty location on the project, the Engineer should determine the date when the last warranty period expires, and insurance coverage shall remain in force through that date.

The insurance required for a warranty which is in effect after contract acceptance are rows a, b, c, d, h, i, and k of Exhibit 107-06 A of the Contract Administration Manual (CAM), Certificate of Insurance. The Contractor must submit two copies of Exhibit 107-06 A to the Contract Management Bureau in Albany prior to contract acceptance.

The Regional Construction Engineer (RCE) or his designee must advise the Contract Management Bureau of the final warranty expiration date so they can determine proper insurance coverage is in effect. The insurance coverage must be in effect prior to contract acceptance by the Department. The Department should not close out any contracts without insurance being in effect.

### E. FINAL INSPECTION

The RME or his designee shall conduct the inspection, fill out the inspection form in **Exhibit 401-M**, and submit a copy of the inspection report to the RCE and Engineer. (The Engineer or Area Supervisor may also participate in the inspection.) The Engineer shall notify the Contractor whether the warranty work is accepted or rejected. If no defects or signs of distress are noted, the pavement is accepted and the Contractor is released from the warranty contract.

If defects or signs of distress are noted, the Engineer and RME shall meet with the Contractor and/or the Material Supplier to inspect the deficient work within 10 work days of the notice to the Contractor.

The final inspection will consider the following pavement conditions defective: corrugations (a series of ripples occurring at fairly regularly spaced intervals perpendicular to the pavement centerline), slippage cracks (crescent or half-moon shaped cracks formed by the pavement surface sliding or deforming), raveling (progressive deterioration of the pavement surface caused by the dislodging of aggregate particles except for pop outs resulting from occasional unsound aggregate particles), longitudinal joint separation, wheelpath rutting (no rutting in excess of 6mm), potholes (small holes that penetrate through the surface course), and delaminations (breaking up of the surface course into fragments).

### F. REPAIRS OF PAVEMENT

After the Engineer and RME meet with the Contractor and/or Materials Supplier to further inspect the defects in the pavement, and within five (5) days, the Department and the Contractor will agree when and how the Contractor will perform the corrective work. However, in case of an emergency requiring immediate corrective action, the Contractor and the Department shall agree on a corrective action immediately.

The Contractor is responsible for all costs associated with correcting the rejected work,

## SECTION 401 HOT MIX ASPHALT

including any independent testing necessary to resolve disputes. If the Contractor does not use his/her best efforts to repair the pavement within the time agreed to, or the Department and the Contractor fail to reach an agreement within the five day period (or immediately in the case of an emergency), the Department, after notice to the Contractor, shall have the right to perform or have a third party perform the necessary repairs and all costs will be the Contractor's responsibility.

No liquidated damages or Engineering charges are to be assessed upon the Contractor for performing repairs to warranty work.

### G. DISPUTES

In the event there is a dispute between the Contractor and the Department regarding the warranty work, the Contractor should pursue the dispute in accordance with §109-05 of the Standard Specifications. The Department and the Contractor should not progress any repairs, unless there is an emergency, until the matter has been fully disputed. Both the Contractor and the Department should note that in the event the warranty and subsequent dispute continues after final payment on the contract has been made, *the Department has no method to pay a Contractor for repairs made to the work*. In the event there is a dispute, the Contractor must keep all bond and insurance in place until the resolution of the dispute.

## **SECTION 403 - HOT MIX ASPHALT CONCRETE PAVEMENT**

### **Open-Graded Asphalt Surface Course**

Whenever Item 15403.2003 ASPHALT CONCRETE TYPE 10F and/or Item 15403.2004 OPEN-GRADED ASPHALT SURFACE COURSE TYPE 10FX appear in a contract, the construction guidelines listed below become applicable.

An open-graded mix provide a pavement with both surface and internal channels resulting from a high percentage of voids. The macrotexture and internal drainage characteristics of the pavement reduce "hydroplaning" of vehicle to roadway locations where there is a high incidence of wet weather accidents.

- A. The seasonal requirements along with mix and placement temperature limits are as specified in Table 401-1 of the Standard Specifications and are the same as those shown for Types 6F and 7F top mixes.
- B. The two specified passes of a static ten-ton steel wheel roller are generally sufficient to compact the mat, however some additional rolling to eliminate surface irregularities may sometimes be needed. This should be done when determined by the Engineer, but caution should be taken so as not to over roll which could cause fracturing of the course aggregate. Open-graded mixes cool faster than dense graded mixes. Rollers must stay up close to the paver to ensure proper compaction.
- C. Open-graded job mix formulas shall be prepared by the Producer and upon favorable recommendations by the Regional Materials Engineer, submitted for approval to the Director, Materials Bureau.
- D. The Materials Bureau's Field Engineering II section is available to provide assistance upon request (518) 457-4582.

### **Related Contract Provisions**

Standard Specification § 401-1, Plant Mix Pavements - General

## §18403-00 - JOINT AND CRACK SEALING

Five types of pavement preventive maintenance joint and crack sealing projects are included in Engineering Instruction 97-030 (EI 97-030). These include:

1. Routing and Sealing Cracks in Hot Mix Asphalt Pavement
2. Sealing Cracks in Hot Mix Asphalt Pavement
3. Resealing Transverse and Longitudinal Joints in Portland Cement Concrete Pavement
4. Sealing Cracks in Portland Cement Concrete Pavement
5. Filling Joints Between Portland Cement Concrete Pavement and Hot Mix Asphalt Shoulders

**Maintenance Resident Engineers** are responsible for selecting projects and appropriate treatments as discussed in EI 97-030. The purpose of this instruction is to help inspectors enforce the specification items for joint and crack sealing projects.

The following specification items cover Pavement Preventive Maintenance Guidelines for Joint and Crack Filling:

### **HOT MIX ASPHALT PAVEMENT (HMA)**

ITEM 18403.7601 M ROUTING, CLEANING, AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

ITEM 18403.7601 ROUTING, CLEANING, AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

ITEM 18403.7602 M CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

ITEM 18403.7602 CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

ITEM 18403.7603 M ROUTING, CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405 (PAYMENT BY LITER)

ITEM 18403.7603 ROUTING, CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405 (PAYMENT BY GALLON)

ITEM 18403.78 M SELECTIVE ROUTING OF CRACKS IN HOT MIX ASPHALT PAVEMENT

ITEM 18403.78 SELECTIVE ROUTING OF CRACKS IN HOT MIX ASPHALT PAVEMENT

ITEM 18403.79 CLEANING AND SEALING CRACKS WITH SELECTIVE ROUTING IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

ITEM 18403.79 M CLEANING AND SEALING CRACKS WITH SELECTIVE ROUTING IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

## **PORTLAND CEMENT CONCRETE PAVEMENT (PCC)**

ITEM 18502.701002 M - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 63 FT. PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.701002 - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 19 m PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.702002 M - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 20 FT. PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.702002 - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 6 m PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.7401 M - RESEALING LONGITUDINAL JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT

ITEM 18502.7401 - RESEALING LONGITUDINAL JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT

ITEM 18502.7601 M - SEALING CRACKS IN PCC PAVEMENT - SILICONE SEALANT

ITEM 18502.7601 - SEALING CRACKS IN PCC PAVEMENT - SILICONE SEALANT

## **JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS (SHOULDER JOINTS)**

ITEM 18403.7507 M FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING FIBER REINFORCED ASPHALT CEMENT

ITEM 18403.7507 FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING FIBER REINFORCED ASPHALT CEMENT

ITEM 18403.7508 M FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING ASTM D3405

ITEM 18403.7508 FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING ASTM D3405

## **BACKGROUND**

These specifications became effective as of April 23, 1998 under Engineering Instruction 97-030, Pavement Preventive Maintenance Guidelines for Joint and Crack Sealing. EI 97-030 superseded EI 90-001, EI 94-034, EB 90-011 and EB 95-036 to consolidate new and existing sealing specifications, improved guidelines for project and treatment selection and to update bid price estimates.

EI 90-001 issued preventive maintenance guidelines and specifications that allowed cracks to be filled with liquid sealant material (silicone, D3405, AC-20 with fibers) and struck off with squeegees to a finished width of 100 mm (4 in.). Material applied in this manner resulted in inadequate lateral support for two wheeled vehicles (motorcycles) because of the low friction associated with the smooth surface particularly when it

becomes wet. In 1995, the Department responded to complaints from motorcyclist regarding slippery pavement conditions by specifying a flush-fill, strike-off method of crack sealing.

Draft versions of the flush-fill, strike-off method specifications were refined during the 1996 construction season. The maximum overband width of sealants was reduced from 100 mm to 50 mm. Training seminars for regional personnel included sealing principles and techniques, selection and application of sealing materials and selection of projects for sealing. Seminars concluded with field demonstrations and were recorded on video tape that are available in each region for training purposes.

## **GENERAL REQUIREMENTS**

Because the general requirements for the specifications in EI 97-030 are very similar, categorizing them by wearing surface is appropriate. The three wearing surface categories are Hot Mix Asphalt (HMA), Portland Cement Concrete (PCC) and Shoulder Joints.

Three general requirements pertain to all treatments:

1. The maximum overband width of sealed cracks is 50 mm (2 in.)
2. Should more than 25% of pavement marking widths be obliterated by crack sealants the marking shall be replaced at the Contractor's expense
3. All materials (D3405, Silicones and Backer Rod) used in any joint or crack sealing project shall appear on the Department's approved list.

## **ITEMS IMPORTANT TO INSPECTORS**

The following items are important to inspectors assigned to joint and crack sealing projects. Subtle differences between items are pointed out by wearing surface category, HMA, PCC and Shoulder Joints:

### **1. RESIDENT ENGINEERS (HMA, PCC and Shoulder Joints)**

The EIC should give Resident Engineers an opportunity to review scheduled work to prevent conflicts between other maintenance and construction projects and allow them to inspect completed work.

### **2. EQUIPMENT (HMA, PCC and Shoulder Joints)**

#### **a) Air Compressor (HMA, PCC and Shoulder Joints)**

Air compressors must be equipped with filters and traps to collect moisture and oil. Inspectors should conduct periodic checks for moisture and oil in the compressed air by placing either a clean cloth or paper in the air stream. Checks are especially important when there are ambient changes in temperature and/or humidity. Maintenance, including changing of traps and filters, is to be provided by the Contractor with no additional cost to the State.

#### **b) Melters (HMA and Shoulder Joints)**

Melters must be double boilers (indirect heating) using either a heat transfer liquid or tubes to carry sealants (HMA)/fillers (Shoulder Joints) through a heated oil bath. Separate working thermometers are required to record temperatures of the sealant/fillers and the heat transfer medium. The melter must maintain the pouring temperature for sealants/fillers as indicated on their containers. Positive temperature controls and mechanical agitation or recirculating pumps are also required to maintain homogeneous mixtures.

Inspectors should witness the loading of material into the melter to ensure that it appears on the Department's Approved List and to record the amount of material being used. Samples may be taken by the inspector should the quality of the material be suspect.

#### c) Sealant Pump (PCC)

Sealant pumps must be capable of discharging moisture curing silicone sealants.

#### d) Saws and Routers (HMA, PCC)

Grooves (HMA) and reservoirs (PCC) must have vertical sides with minimal spalling at their edges. The Contractor must affect repairs or replace saws and routers to maintain vertical sides in grooves and/or reservoirs at no additional cost to the State.

#### e) Hot Air Lance (HMA, PCC and Shoulder Joints)

Hot air lances may be used by the Contractor to dry cracks. Care must be taken not to burn the existing HMA pavement as temperatures may reach 1,000°C (2,000°F).

### **3. CRACK/JOINT PREPARATION (HMA and Shoulder Joints)**

Crack and joint preparation is most critical to ensure proper adhesion of sealants (D3405) and fillers (AC-20 with fibers). Only primary or well-defined cracks, 3 mm ( $\frac{1}{8}$ " ) to 25 mm (1" ) wide, are to be sealed especially when low severity secondary cracks (alligator cracks) exist to prevent over application. When cracks are routed, their finished dimensions are 16 mm ( $\frac{5}{8}$ " ) wide by 13 mm ( $\frac{1}{2}$ " ) deep. When shoulder cracks are sealed they shall be thoroughly cleaned to a minimum depth of 13 mm ( $\frac{1}{2}$ " ). The maximum overband width of sealant shall not exceed 50 mm (2 in.).

Cracks and joints must be thoroughly **clean and dry** before sealing or filling and may require additional cleaning especially when nearby cracks are being routed. The Contractor should be instructed to allow for more drying time or may opt to use a hot air lance should there be more than a few isolated air bubbles appearing after the hot sealant is placed in the crack or joint.

### **4. JOINT PREPARATION (PCC)**

Like HMA and Shoulder Joints, joint preparation is most critical in sealing PCC joints and requires the same level of attention to cleaning and drying joint surfaces. The main difference between PCC joints and those is HMA and Shoulder Joints is a joint reservoir as shown in EI 97-030 under items 18502.XXXXXX (M).

When replacing compression seals and previously sealed joints, inspectors should make sure that existing lubricants and sealants are completely removed. Abrasive blasting of all reservoir surfaces followed by cleaning with compressed air will leave the concrete with a rough finish to improve bonding. **All joints must be sealed on the same day that they are prepared.**

For PCC pavements, transverse joints are sealed with silicone only and longitudinal joints may be sealed with either silicone or ASTM D3405 sealant. In either case, backer rod or bond breaker tape is used to isolate the joint sealant from the substrate. Backer rod that is approximately 25% larger than the joint shall be installed to a depth that allows for the proper thickness of sealant and recess below the pavement surface as depicted in EI 97-030 under items 18502.XXXXXX (M).

### **5. DISCHARGE TEMPERATURES of D3405 and AC-20 WITH FIBERS**

Discharge hoses must be insulated and capable of recirculating material through the melter. Discharge temperatures of the sealant material are checked by the inspector using thermometers supplied by the Contractor. Any method used in checking temperatures should be considered safe by the inspector to avoid burns from exposure to hot materials. Discharge temperatures must be above the manufacturer's recommended pouring temperatures but never exceed 163°C (325°F) for fiber reinforced material.

**Do not use sealants or fillers heated above their safety heating temperatures.**

Sealants and fillers may be heated longer than six hours if the manufacturer's recommendation allows it. Melters containing material heated more than six hours must be recharged with at least twenty percent more new material and provide a homogeneous mixture before being applied.



## 6. CURING OF D3405 and AC-20 WITH FIBERS

Traffic shall not be allowed on the sealant until it has cooled sufficiently and will not track. A low pressure, light spray of water may be used to accelerate cooling of the sealant and fillers. Blotting with fine aggregate is allowed when using filler material only **but not when using D3405**.

The cooled sealant shall produce a water tight seal and be approximately flush with the pavement surface. Sealants and fillers that are not satisfactory will be replaced by the Contractor at no additional charge to the State.

## 7. MEASURING QUANTITIES

### a) Silicone Sealant

Silicone sealant used by the Contractor is based on the linear meter or foot.

### b) D3405 and Fiber Reinforced Asphalt (FRA)

A volumetric (liters or gallons) method of measurement, corrected to 15°C (60°F) is used for D3405 and FRA . Correcting volumes to these temperatures is necessary because sealants and fillers expand when heated.

Determining corrected quantities of these materials are illustrated as follows:

1. Obtain the specific gravity of the material at 15° C (60° F) from the manufacturer or the Regional Materials Bureau.
2. Use the following formulas to convert to the volume measure:

#### **Metric Units D3405**

$$\frac{\text{Weight of D3405 used (kg)}}{\text{Sp. Gr. of D3405 @ 15° C}} = \text{___ liters of D3405 used}$$

#### **English Units D3405**

$$\frac{\text{Weight of D3405 used (lbs)}}{\text{Sp. Gr. of D3405 @ 60° F x 8.345 lbs/gal}} = \text{___ gal of D3405 used}$$

#### **Metric Units (FRA)**

$$\frac{\text{Weight of FRA used (kg)}}{\text{Sp. Gr. of FRA @ 15° C}} = \text{___ liters of FRA used}$$

#### **English Units (FRA)**

$$\frac{\text{Weight of FRA used (lbs)}}{\text{Sp. Gr. of FRA @ 60° F x 8.345 lbs/gal}} = \text{___ gal of D3405 used}$$

## SECTION 407 - TACK COAT

### Construction Guidelines

Whenever item 407.0101 TACK COAT appears in a contract, the following construction guidelines are applicable.

- A. Materials. Tack coats are produced by diluting a hard base emulsion with a suitable emulsifier solution. At the time of its use, the diluted tack coat must meet the material requirements listed in TABLE 702-09 Asphalt Emulsion Tack Coat.
- B. Documentation and Sampling. Quality assurance procedures for tack coat and other liquid asphalt materials are described in Materials Method 8.2, ASPHALT EMULSION - QUALITY ASSURANCE. The following two documents are important to inspectors:
  - 1. BR-162 (Exhibit 407A) Bituminous Materials Certified Shipment Notice. This form certifies that the material is from a certified lot. It must accompany all shipments of material. Inspectors should verify that the form is properly filled out and represents the shipment delivered. Receipt of this form is the basis of acceptance for incorporating the material into the work.
  - 2. BR-170 (Exhibit 407B) Bitumen or Mix Sample. This form must be filled out by the Inspector and transmitted to the Materials Bureau along with a representative sample of the material within five days.

Instructions for sampling and for completing the forms are in Materials Method 8.2.

- C. Preparing Tack Coat For Application. To prevent the emulsion (tack coat) from separating and to ensure that a uniform product is applied to the pavement surface, it is important that the tack coat be agitated thoroughly prior to its use. This agitation is imperative if the tack coat has been stored on the project in an auxiliary storage tank or haul vehicle. The liquid emulsion must be agitated in the storage tank or haul vehicle before it is loaded into the distributor vehicle. This agitation is normally accomplished by circulating the emulsion through a pump and back into the storage tank for a sufficient time to ensure complete remixing. One hour of circulation for each five thousand gallons of tack coat is normally sufficient to maintain a homogeneous emulsion. The circulation of stored tack coat should be done daily.
- D. Time To Paving. Paving Hot Mix Asphalt over a tack coat should not commence until the emulsion has broken (goes from brown to black in color). During normal paving weather, this requires approximately 15 minutes. If the weather is humid or damp, the time required for the emulsion to break is more than 15 minutes.

Curing (or breaking) of the tack coat can also be determined by touching it. A hard, tacky surface indicates that paving over the tack coat can commence. If the tack coat is not cured to a black, tacky condition and paving begins, the tack coat will act as a lubricant which defeats its original purpose of providing a bond between the existing surface and the new pavement.

- E. Maintenance of Traffic. Traffic should be kept off the tack coated area. In the event traffic must use a tacked area, this should occur only after the emulsion has completely broken and the pavement has dried. Traffic speed should be controlled to 20 mph or less.
- F. Application. No more tack coat should be applied than can be covered by the Hot Mix Asphalt mix in one day. It is recommended to apply tack coat in 305 meter sections. This should prevent a large area of tacked pavement having to be open to traffic because of a plant stoppage or bad weather. If traffic has to use a tacked area overnight, the area should be sanded with a clean sand prior to allowing traffic

on the area, and swept clean before the asphalt concrete is placed the next day.

## **References**

Materials Method 8.2, ASPHALT EMULSION - QUALITY ASSURANCE

## **Related Contract Provisions**

Standard Specification § 702, Table, 702-9

## SECTION 410 - BITUMINOUS SURFACE TREATMENT - SINGLE COURSE

### Pavement Surface Treatments

- A. Asphalt Emulsion. For asphalt emulsion quality assurance procedures, refer to Section B. Documentation and Sampling under Section 407-00 Tack Coat.
- B. Aggregate. The aggregate to be used should be compatible with the emulsion being used. Before construction begins, the aggregate should be tested for gradation and from an approved source. During construction, if the EIC or inspector notice a change in the appearance of the aggregate, the stockpile should be tested again.
- C. Application. An emulsion must "break" or set before the aggregate can adhere. "Breaking" is the reuniting of the asphalt globules from the emulsified phase, generally indicated by the color changing from brown to black. The rate of "breaking" is controlled by the specific type and concentration of emulsion and by the weather conditions. Therefore, weather should influence the Engineer's decision on how and when to run the job. The entire chipping operation should be as close together as possible. On warm breezy days, the emulsion will break quickly (3 to 5 minutes) and on overcast, damp, or humid days the break will be slower (10 to 15 minutes). Tracking by the roller can be minimized by using the tire watering system. Traffic should be kept off the section until the emulsion has broken and set.
- D. Cleanup. One or two days after the surface has been treated, it should be lightly swept to remove any loose aggregate.
- E. Technical Support

The Regional Materials Engineer and the Materials Bureau are available to provide assistance upon request.

### Related Contract Provisions

§407, Tack Coat

§618, Bituminous Materials

## **SECTION 411 - STABILIZED GRAVEL SURFACE COURSE**

### **General Requirements**

Granular material supplied under this item shall be stockpiled in accordance with the appropriate Departmental publication in effect on the date of advertisement for bids (Reference: GCP-17).

### **Project Procedure**

Inspect the construction of stockpiles. Record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer, in accordance with the appropriate Departmental publication in effect on the date of advertisement for bids (Reference: GCP-17).

The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpiles. Test results will be reported on Form-GE454M, (See Exhibit 203H) "GRANULAR MATERIAL DOCUMENTATION FORM."

The Engineer is directed to the Materials Inspection Manual, Part 2, Materials of Construction, Sub-part 2A, "Materials Under the Control of the Materials Bureau," and to the relevant sections of this manual, for control of the calcium chloride and sodium chloride.

The Inspector shall document on MURK-1d, "INSPECTOR'S DAILY REPORT," that the Stabilized Gravel Surface Course was mixed, placed, compacted and finished in accordance with the specifications.

### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. If variations to the stockpiling requirements are granted, a copy of the approval letter from the Director of the Geotechnical Engineering Bureau must be on file.
3. For granular materials, copies of test results (Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM") and, when applicable, a copy of the letter approving stockpile transfer, as well as the original GE-454M.

### **References**

GCP-17, Procedure for the Control of Granular Material  
Material Inspection Manual, Part 2, Materials of Construction, Subpart A

### **Related Contract Provisions**

§203-3.12, Compaction  
§304-2.03, Stockpiling

## **SECTION 500 RIGID PAVEMENTS**

### **SECTION 501 - PORTLAND CEMENT CONCRETE - GENERAL**

#### **Documentation**

Department procedures for acceptance of portland cement concrete are dependent upon on-site inspection and testing at the plant and project. The procedures used for plant inspections are contained in Materials Method 9.1, PLANT INSPECTION OF PORTLAND CEMENT CONCRETE. Procedures used for project inspection are contained in Materials Method 9.2, Field Inspection of Portland Cement Concrete. These inspection operations are conducted through the Regional Materials Office. The Regional Materials Engineer should be contacted prior to all certified concrete placements to ascertain that the concrete producer is approved and has acceptable material sources.

Concrete plants normally fall into one of the following categories for documentation purposes:

- ! Project Plant - A plant located on the project site for the purpose of serving one project, or
- ! Non-Project Plant - A plant located off the project site. These are usually commercial plants capable of serving more than one project at a time.

In general, records from project plants are incorporated into the project files. Records from other than project plants are maintained at the plant during production and then periodically removed and filed by the Regional Materials Engineer in the Regional Office files.

The Plant Inspector is responsible for maintaining a diary and test records, along with the material certifications, mix designs and cement sample logs. These documents are kept on file at the plant in an orderly manner so they can be readily consulted. The diary is used to record miscellaneous test data and information and also to record conversations between the Plant Inspector and the Producer. Comments relevant to the concrete produced for a given project should be included on the BR 316 provided to the project.

Of importance to the field inspection staff are the following documents which are prepared at the plant and provided to the project staff:

- Delivery tickets, with or without batch recordation information
- BR 316 - Daily Concrete Batch Plant Report, with Materials Acceptance Records
- BR 342 - Materials certification, only for certified batches
- Concrete Mix Computations

The plant inspector's responsibilities relative to these documents are contained in MM 9.1 Section 3 titled "Administrative Procedures and Record Keeping".

The following section provides some background information concerning these documents and guidelines on their incorporation into the project records at the project site.

#### **A. Delivery Tickets**

Each vehicle delivering portland cement concrete, or its ingredients, to a project is accompanied by a delivery ticket prepared by the Producer. The following minimum information is included on delivery tickets:

1. Delivery Ticket Number
2. Plant Identification, with plant name and location and/or facility number

3. Contract Number
4. Concrete Class or Item Number
5. Quantity (Nominal Batch Size)
6. Truck Number
7. Batch Number
8. An Automatically Applied Time-Date Stamp Which May Consist of One of the Following:

- ! Time - date stamp by printing device on a regular ticket (when no recorded batch weights accompany the load).
- ! Time - date printed by a batch weight recorder on a printed ticket.
- ! Time - date printed by a batch weight recorder on a printed tape. A copy of the tape shall be affixed to the regular delivery ticket.

The plant inspector should review at least three daily delivery tickets for each project and sign each ticket reviewed. A copy of the printed delivery ticket should be given to the plant inspector (see MM 9.1).

The Inspector at the project receives the delivery tickets at the site of placement. At the end of the day, the number of tickets received, the first ticket number, the last ticket number and the total quantity of concrete on all delivery tickets accepted are entered on the IR. The delivery tickets are turned into the Project Engineer with the IR and filed with the project records.

#### Delivery ticket waiver for project plants.

When, in the opinions of both the Engineer in Charge and the Regional Materials Engineer, adequate control can be maintained over on-site project plants, the use of delivery tickets may be omitted for Cement Concrete Pavement and/or Cement Concrete Foundation for Pavement after such decision has been duly documented in the records. During such periods of non-use of delivery tickets, all plant and project inspection personnel monitor the delivery of concrete to assure that all specification requirements are being met and that all batched concrete is accounted for.

#### B. Batch Recordation

Recordation equipment is used to provide a visual record of the materials incorporated into the concrete mixture. Recordation records are always maintained by the Plant Inspector and are filed at the plant and/or Regional materials Office. Delivery tickets supplied to projects for each batch of concrete produced can be any of the following:

- Delivery Ticket (hand or mechanical) without batching information.
- Delivery Ticket (hand or mechanical) with separate batching information attached.
- Delivery Ticket (mechanical printing) including batching information.

The adoption of one of the above procedures is based on an agreement between the Regional Materials Engineer, Project Engineer and the Producer. If unusual conditions exist, an alternate procedure may be agreed upon by the above personnel and noted in the project records.

#### C. BR 316 - Daily Concrete Batch Plant Report

A concrete acceptance report, BR 316a, "DAILY CONCRETE BATCH PLANT REPORT," (Exhibit No. 501-A) for concrete produced and authorized to be shipped to each project is completed by the Plant

Inspector at the end of the day. Inspectors at on-site project plants give the report to the Engineer in Charge at the end of the day. Inspectors at off-site plants issue a copy of the report to each project served by the plant and retain the original for the plant records. The report is forwarded to the projects as soon as possible after the report date. The reports are numbered consecutively by the Plant Inspector with Report 1 beginning on the first production day of any calendar year.

When the BR 316a is received at the project, the job stamp shall be applied and the total yardage and type shown on the BR 316a checked against the quantity received (total of delivery tickets) and type shown on the IR. The quantity shown on form BR 316 may be greater than the quantity received, but may never be less. Any differences should be resolved with the plant inspector. If plant reports are not received within one week of placement, contact the Regional Materials Office.

After checking and cross referencing, the Daily Concrete Batch Plant reports (BR316) should be signed and filed in the Concrete Batch Plant Report folder or attached to the Inspector's Report. The E.I.C. shall select the option, but only one option shall be used on the project.

#### D. Plant Inspector's Materials Acceptance Records

Before it can be considered for acceptance at the project site, evidence must exist that the Portland cement concrete dispatched from the plant was made from approved materials and was properly proportioned. The evidence is in the form of records kept in accordance with Section 3 of Materials Methods 9.1.

The records that the Plant Inspector keeps on file at the plant during production relating to material acceptance are as follows:

1. Aggregate Records, including Approved List Source, test results, and any certification materials that may be available.
2. Cement shipment certifications or cement shipment authorization and cement sample logs.
3. Plant Inspector's Diary (showing admixtures and water source).

In the case of on-site project plants, the aggregate records and cement shipment certifications along with the mix designs shall be ultimately incorporated into project files. For off-site plants, all acceptance documents shall be maintained in the plant records.

#### E. BR 342 - Materials Certification

When the Regional Materials Engineer agrees it is not feasible to provide plant inspection for small quantities, concrete may be accepted from an approved plant on the basis of a Producer's certification stating that the concrete conforms to specification. The certification shall be Form BR 342 - MATERIALS CERTIFICATION completed by the Producer as shown in Exhibit 501-B. In addition, recordation for each batch shall be maintained at the plant unless otherwise directed by the Regional Materials Engineer. Small quantities of concrete 25 cubic yards or less may be certified.

When this procedure is used, the following shall accompany each delivery.

- ! The truck delivery ticket. (Same as for inspected deliveries.)
- ! The producer's certification, BR342, that the concrete was batched according to the contract specifications using accepted materials signed by a responsible employee of the company. This form is forwarded to the project as soon as possible after the report date, using the procedure established by the Regional Materials office.



! The recorded batch information (including time and date) for the batches delivered.

When the BR 342 is received at the project, the job stamp shall be applied. After checking and cross referencing, the BR342 should be filed in the Concrete Batch Plant Report folder (BR 316 folder) or attached to the Inspector's Report. The E.I.C. shall select the option, but only one option shall be used on the project.

#### F. Concrete Mix Computations

Standard class concrete mix designs are computer generated by the Department. Some adjusted standard class mix designs and special purpose mix designs are computed by the Regional Materials Engineer or by the Materials Bureau in Albany. Copies of the mix designs are filed at the plant with copies sometimes supplied to individual projects. The mix designs shall be in one or more of the following forms:

1. Copy of the computer mix design print-out sheet (standard mixes only).
2. Completed Form BR-329 (Exhibit 501-C) CONCRETE MIX DESIGN SHEET
3. Copy of mix design information and pertinent correspondence for mixes designed by the Materials Bureau in Albany (usually for special purpose mixes).

Any questions concerning validity of a mix design should be directed to the Regional Materials Engineer.

### Field Documentation for Structural Concrete Inspection

#### A. Structural Concrete Inspector's Daily Report - MURK 5

The MURK 5, shown as Exhibit 501-D, was developed to facilitate the documentation of information during the inspection of structural concrete. The front of the form contains the same general information as is required on the MURK 1 as discussed in section 90 of the Contract Administration Manual. The back of the form contains entry fields specific to the inspection of structural concrete placements.

When an inspector's assignment is to a structural concrete operation, the structural concrete inspector's report (MURK 5) will be their daily IR and shall be completed during the course of the work. The inspector should review the truck's delivery ticket before inspecting, sampling and testing portland cement concrete. Also prior to accepting portland cement concrete, check the truck for current inspection sticker from the Regional Materials Office. This sticker is located on the inside of the driver side door. Form MURK 5 is used for all structural concrete operations, regardless of mixer type. Refer to Materials Method 9.2, Field Inspection of Portland Cement Concrete, for specific procedures for inspecting, sampling and testing portland cement concrete.

The following guidelines apply to entries or entry fields required on the MURK 5. (Refer to Section 90 of the CAM for entries not covered here.)

1. High and low air temperature during placement.
2. Mixer type: Check appropriate box. Mixer type determines which columns will be filled in during concrete placement.
3. Truck or ticket number: From delivery ticket.
4. Load size: From delivery ticket.
5. End batch: End batch time is determined by the plant inspector and recorded on the delivery ticket.
6. Start mix: The time at which mixing begins for truck mix concrete. Determined by the project inspector in accordance with the specification.

7. End mix: The time at which mixing ends. The end mix time is determined by the project inspector for truck mix concrete. The end mix time is determined by the plant inspector for central mix concrete and recorded on the delivery ticket. Mix times must comply with the specification requirements.
8. Mixing revolutions: From counter (must be on Approved List) on truck. Mix revolutions must comply with specification requirements.
9. Start discharge: Time at which concrete is discharged. The start of discharge must comply with specification requirements. Start discharge times shall be recorded for all trucks delivering transit mix.
10. End discharge: Time at which concrete discharge ends. Required for all mixes. End of discharge times must comply with specification requirements.
11. Slump: Performed in accordance with Materials method 9.2., allowable values per Table 501-5 of the Standard Specifications. When slump is estimated and not measured, a note should be included, i.e., 51 millimeters EST.
12. Air content: Performed in accordance with Materials Method 9.2.
13. Remarks: Indicate loads from which cylinder samples were taken. Indicate rejected loads.
14. Concrete specifications: See specification tables 501-3, 501-4, and 501-5 for values for specific type of placement.
15. Delivery tickets: The inspector shall retain a copy of the delivery ticket accompanying each vehicle. The first ticket no., last ticket no., and total no. of tickets shall be recorded in the appropriate boxes at the end of the day.
16. Quantity dispatched from plant (BR 316a): This information is supplied at a later date from the plant inspector using procedures established by the Regional Materials Office.
17. Quantity received: Total of all delivery ticket material quantities received during the inspection period.
18. Quantity used: Quantity received minus quantity wasted/rejected. Payment quantities shall be computed in accordance with the item specification and may not agree with the actual quantity used.
19. Quantity wasted/rejected: The quantity of any concrete not placed in the forms shall be shown with an explanation, such as "wasted," "rejected" or "over ordered."

At the end of the day, Form MURK 5, together with all delivery tickets, shall be turned in to the Project Engineer.

## **Inspection Guidelines**

### **A. General - Placement and Curing Requirements**

Various concrete pavement and structural items contain provisions for placement finishings and curing of

concrete. In an attempt to summarize and create a quick reference to the placement temperature limitations and curing requirements for concrete pavements, structural concrete, bridge superstructures and various other related items, are presented as Exhibit 501-E. The tables are separated into three categories: Normal, Cold, and Hot Weather Curing Provisions. To use them, enter the correct table and refer to the concrete item number of interest. These tables also reference the user to applicable sections of the Standard Specifications for related provisions. Refer to MM 9.1, etc.

### GENERAL - CURING

Various concrete pavement and structural items contain provisions for curing. In an attempt to summarize and create a quick reference to the curing requirements for concrete pavements, structural concrete, bridge superstructures and various other related items, the following curing tables are presented. The tables are separated into three categories: Normal, Cold, and Hot Weather Curing Provisions. To use them, enter the correct table and refer to the concrete item number of interest. These tables also reference the user to applicable sections of the Standard Specifications for related provisions.

#### CONCRETE CURING QUICK REFERENCE CHART NORMAL WEATHER PROVISIONS

CONCRETE ITEM (MINIMUM CURING TEMPS)	ALLOWABLE CURING METHODS	CURING DURATION	REMARKS
ITEM 502 CONCRETE PAVEMENTS (AIR TEMP $\geq 4^{\circ}$ C)	-WHITE PIGMENTED CURING COMPOUND -POLYETHYLENE CURING COVERS -QUILTED COVERS	3-6 DAYS	§502-3.10 SEE TABLE 502-02
ITEM 555 STRUCTURAL CONCRETE - SUBSTRUCTURES (AIR TEMP $\geq 7^{\circ}$ C)	-CURING COVERS -CLEAR MEMBRANE CURING COMPOUND - CONTINUOUS BURLAP WETTING -WET BURLAP & CURING COVERS -FORMS	7 DAYS MINIMUM	§555-3.09A,B
ITEM 557 STRUCTURAL CONCRETE - SUPERSTRUCTURES (AIR TEMP $\geq 7^{\circ}$ C)	-CONTINUOUS BURLAP WETTING	14 DAYS	§557-3.12B
	-WET BURLAP AND CURING COVERS	14 DAYS	
ITEM 557 APPROACH SLABS	-CONTINUOUS BURLAP WETTING	7 DAYS MINIMUM	§557-3.12
ITEM 578 BONDED CONCRETE WEARING SURFACE (AIR TEMP $\geq 7^{\circ}$ C)	-CONTINUOUS BURLAP WETTING	7 DAYS MINIMUM	§578-3J
	-WET BURLAP AND CURING COVERS		
ITEM 579 STRUCTURAL SLAB CONC. - FULL DEPTH REPAIRS (AIR TEMP $\geq 7^{\circ}$ C)	-QUILTED COVERS -PLASTIC COATED FIBER BLANKETS	3 DAYS MINIMUM	§579-3.03

CONCRETE ITEM (MINIMUM CURING TEMPS)	ALLOWABLE CURING METHODS	CURING DURATION	REMARKS
ITEM 582 STRUCTURAL SLAB RECONSTRUCTION CONC. (AIR TEMP $\geq 7^{\circ}\text{C}$ )	-CURING COVERS -CLEAR MEMBRANE CURING COMPOUND - CONTINUOUS BURLAP WETTING -WET BURLAP & CURING COVERS -FORMS	7 DAYS MINIMUM	§582-3.06
ITEM 583 SHOTCRETE (AIR TEMP $\geq 7^{\circ}\text{C}$ )	-CURING COVERS -CLEAR MEMBRANE CURING COMPOUND - CONTINUOUS BURLAP WETTING -WET BURLAP & CURING COVERS -FORMS	7 DAYS MINIMUM	§583-3.03E
ITEM 584 SPECIALIZED OVERLAYS: (AIR TEMP $\geq 7^{\circ}\text{C}$ )			
- HIGH DENSITY	-CONTINUOUS BURLAP WETTING	4 DAYS	§584-3.10A
- LATEX MODIFIED	-WET BURLAP AND CURING COVERS -AIR CURE	1 DAY 3 DAYS	§584-3.10B
- MICROSILICA	-CONTINUOUS BURLAP WETTING	4 DAYS	§584-3.10C
- CLASS DP	-CONTINUOUS BURLAP WETTING	7 DAYS	§584-3.06B2

#### CONCRETE CURING MATERIAL SPECIFICATIONS:

711-02	QUILTED COVERS
711-03	PLASTIC COATED FIBER BLANKETS
711-04	POLYETHYLENE CURING COVERS (WHITE OPAQUE)
711-05	MEMBRANE CURING COMPOUND
711-06	BURLAP
711-07	FORM INSULATION

**CONCRETE CURING QUICK REFERENCE CHART  
COLD WEATHER PROVISIONS**

CONCRETE ITEM	AMBIENT AIR TEMPERATURE EXPECTED >0°C BUT <7°C	AMBIENT AIR TEMPERATURE EXPECTED TO FALL BELOW 0°C
ITEM 502 CONCRETE PAVEMENT	NO REQUIREMENTS	COVER WITH STRAW, HAY OR BLANKETS
ITEM 555 STRUCTURAL CONCRETE - SUBSTRUCTURES	§555-3.09D APPLIES	§555-3.06 APPLIES
ITEM 557 STRUCTURAL CONCRETE - SUPERSTRUCTURES	§555-3.09D APPLIES	§555-3.06 APPLIES - HEATED ENCLOSURE REQUIRED
ITEM 578 BONDED CONCRETE WEARING SURFACE	! §578-3L APPLIES - CURING COVERS REQUIRED ! IF TEMPERATURE <7°C FOR MORE THAN 24 HRS. - ENCLOSURE REQUIRED AS PER 555-3.06	§578-3L APPLIES - ENCLOSURE REQUIRED AS PER 555-3.06
ITEM 579 STRUCTURAL SLAB CONC. - FULL DEPTH REPAIRS	§555-3.09 APPLIES	§555-3.06 APPLIES - HEATED ENCLOSURE REQUIRED
ITEM 582 STRUCTURAL SLAB RECONSTRUCTION CONCRETE	! §582-3.06 REFERS TO §555-3.09D ! IF TEMPERATURE <7°C FOR MORE THAN 24 HRS. - ENCLOSURE REQUIRED AS PER §555-3.06	§555-3.06 APPLIES
ITEM 583 SHOTCRETE	§555-3.09D APPLIES	§555-3.06 APPLIES - HEATED ENCLOSURE REQUIRED
ITEM 584 SPECIALIZED CONCRETE OVERLAYS		
HIGH DENSITY	§584-3.14A APPLIES - HEATED ENCLOSURE REQUIRED	
LATEX	§584-3.14B APPLIES - HEATED ENCLOSURE REQUIRED	
MICROSILICA	§584-3.14C APPLIES - HEATED ENCLOSURE REQUIRED	
CLASS DP	§555-3.06B - HEATED ENCLOSURE REQUIRED	

**IN ALL CASES IF THE CURING TEMPERATURE DROPS BELOW 0°C, THE CONCRETE IS  
REJECTED.**

# CONCRETE CURING QUICK REFERENCE CHART HOT WEATHER PROVISIONS

CONCRETE ITEM	APPLICABILITY	CURING METHOD
ITEM 502 CONCRETE PAVEMENT	NO SPECIAL PROVISIONS	
ITEM 555 STRUCTURAL CONCRETE - SUBSTRUCTURES	AIR TEMPERATURE >29°C	! 7 DAY CONTINUOUS WETTING ! WET BURLAP & CURING COVERS (3 DAYS ADDITIONAL CURE REQUIRED, 10 DAYS TOTAL CURE) ! WET FORMS TO REDUCE SURFACE HEAT
ITEM 557 STRUCTURAL CONCRETE - SUPERSTRUCTURES	AIR TEMPERATURE >29°C	! 7 DAY CONTINUOUS WETTING ! WET BURLAP & CURING COVERS, 14 DAYS TOTAL CURE) ! WET FORMS TO REDUCE SURFACE HEAT
ITEM 557 APPROACH SLABS	AIR TEMPERATURE >29°C	! 7 DAY CONTINUOUS WETTING
ITEM 578 BONDED CONCRETE WEARING SURFACE	AIR TEMPERATURE >24°C	§578-3N APPLIES
	AIR TEMPERATURE >29°C	§578-3N APPLIES - NO PLACEMENT ALLOWED
ITEM 579 STRUCTURAL SLAB CONC. - FULL DEPTH REPAIRS	AIR TEMPERATURE >29°C	§555-3.09 APPLIES
ITEM 582 STRUCTURAL SLAB RECONSTRUCTION CONC.	AIR TEMPERATURE >29°C	§555-3.09 APPLIES
ITEM 583 SHOTCRETE	AIR TEMPERATURE >29°C	§555-3.09 APPLIES
ITEM 584 SPECIALIZED CONCRETE OVERLAYS		
- HIGH DENSITY - LATEX - MICROSILICA - CLASS DP	AIR TEMPERATURE >29°C	§584-3.12 APPLIES - REFERS TO §555-3.04 AND §555-3.09C

## SECTION 502 - PORTLAND CEMENT CONCRETE PAVEMENT

### Field Documentation

#### A. Concrete Pavement Daily Field Inspection Report - MURK 3

The MURK 3, "CONCRETE PAVEMENT DAILY FIELD INSPECTION REPORT" shown as Exhibit 502-A, was developed to facilitate the documentation of information during the inspection of concrete pavement. Refer to Materials Method 9.2, Field Inspection of Portland Cement Concrete, for specific procedures for inspecting, sampling and testing portland cement concrete.

When an inspector's assignment is a concrete paving operation, the concrete pavement daily field inspection report (MURK 3) will be their daily IR. The MURK 3 should contain the same general information required on the MURK 1 as discussed in Section 90 of the Contract Administration Manual.

The following guidelines apply to entries or entry fields required on the MURK 3. (Refer to Section 90 of the CAM for entries not covered here.)

1. High and low air temperature during placement.
2. The top part of the form shall contain the information required to describe the work area.
3. Mixer type.
4. Slump: Performed in accordance with Materials Method 9.2., allowable values per Table 501-5 of the Standard Specifications.
5. Air content: Performed in accordance with Materials Method 9.2.
6. Concrete specifications: See specification tables 501-3, 501-4, and 501-5.
7. Quantity dispatched from plant: From BR 316.
8. Quantity received: Total of all delivery ticket material quantities received during the inspection period.
9. Quantity used: Quantity received minus quantity wasted/rejected. Payment quantities shall be computed in accordance with the item specification and may not agree with the actual quantity used.
10. Quantity wasted / rejected: If any concrete is not placed in the forms, the Inspector shall make an estimate of the amount and note a brief explanation, such as "wasted," "rejected" or "over ordered."
11. Delivery tickets: The Inspector shall retain a copy of the delivery ticket accompanying each vehicle. The first ticket no., last ticket no., and total number of tickets shall be recorded in the appropriate boxes at the end of the day.
12. BR 316 Report number.

#### B. Concrete Mixing, Transporting, and Discharging Checks

The Inspector at the site of paving shall note on the delivery tickets the following information a minimum of five (5) times per full production day:

- ! Central Mix - Time, End of Discharge,
- ! Truck Mix - Time, Begin and End of Mixing, End of Discharge and Mixing Revolutions, and
- ! Transit Mix - Time, Begin and End of Discharge and Mixing Revolutions.

At the end of the paving operation for the day, the Inspector shall complete Form MURK 3b, "CONCRETE PAVEMENT DAILY FIELD INSPECTION REPORT". This report shall be turned into the Project Engineer with all delivery tickets.

## **Inspection Guidelines**

### **§502-3.09A Mechanical Finishing**

Some Contractors have elected to use tube floats during finishing operations for the purpose of eliminating small surface irregularities and openings.

Research on the effects of the tube float when operated with a water fog spray has shown a significant lowering of compressive strength in the surface mortar with only a negligible improvement in pavement rideability.

In order to minimize this loss of surface strength, all applications of water, by any method in conjunction with the operation of the tube float, shall not be allowed by the Engineer. The Contractor may use the tube float without the addition of water to the concrete surface and/or tube. Test areas have shown that the tube float, when operated dry, will generally work up a surface layer of soft mortar that is adequate to close the surface.

### **§502-3.16 Thickness Tolerance**

Section 502-3.16 of the standard specification, Thickness Tolerance, contains allowable tolerance limits for pavement thickness. On all projects, pavement "depth checks" are performed as part of the inspection process during placement to help ensure that the pavement will meet the required tolerances. In addition to this check, we can also verify the thickness by measurement of cores taken after the pavement is complete. The criteria used to select which projects will be cored is contained in Materials Method 11, METHOD FOR TAKING PAVEMENT AND FOUNDATION CORES. Regional Directors are authorized to waive or modify, at their discretion, the coring requirements of Materials Method 11 on small projects such as intersection TOPICS type, bridge rehabilitation and similar projects when the total quantity of materials is less than 1529 cubic meters of portland cement concrete pavement and foundation items.

Procedures for the identification of projects to be cored and the scheduling of coring are developed at each Region.

The procedures for taking cores, measurement of cores and the identification of rejected areas of pavement are contained in Materials Method 11.1 THICKNESS OF CONCRETE PAVEMENTS. Coring documentation procedures are contained in Materials Method 11.3, Form BR-166 - ( See Exhibit 401E) PAVEMENT CORE RECORD.

If the core results show that the pavement meets the thickness tolerance, the Engineer can accept the pavement.

If short cores are found, the Materials Bureau and the Regional Materials Engineer determine if additional cores are required. If additional cores are not needed, the original results are sent to the Region, the



Construction Division and, on Federal Aid projects, to FHWA. If additional cores are required, the Materials Bureau distributes final core results.

If the coring results identify an area of thin pavement, the deficient pavement must be removed and replaced at the Contractor's expense at no cost to the State, unless the Regional Director agrees to permit the deficient pavement to remain in place. If the deficient pavement is allowed to remain, it is Department policy that payment deductions shall be confined to the applicable cement concrete pavement item only. Payment should be made for the associated items, such as metal reinforcement, joint supports and ties, and construction and sealing joints, provided that these items conform to specifications.

**References**

MATERIALS METHOD 11.0, METHOD FOR TAKING PAVEMENT AND FOUNDATION CORES

MATERIALS METHOD 11.1, THICKNESS OF CONCRETE PAVEMENTS

MATERIALS METHOD 11.3, FORM BR-166 - PAVEMENT CORE RECORD

STANDARD SPECIFICATION SECTION 500, TABLES 501-3, 501-4 & 501-5

## SECTION 550 STRUCTURES

### SECTION 551 - PILES AND PILE DRIVING EQUIPMENT

Construction personnel involved in pile driving must pay close attention to the applicable sections of the Plans, Specifications, and the New York State Steel Construction Manual (NYS SCM). Construction Supervisors and Engineers-In-Charge (EIC's) must assure that Inspection Staff are trained and knowledgeable regarding their assignment and that good supervision oversight practices are employed for these particularly critical structural items.

To insure that piles are installed in accordance with all contractual and procedural requirements, the following discussion of key requirements is provided:

! Submittal of Form BD 138M, Pile And Driving Equipment Data.

The Contractor must submit to the Deputy Chief Engineer (Structures), D.C.E.S., Form BD 138M for approval. The form shown as Exhibit 551-A&B (reverse side) can be obtained from the Regional Office. All information listed on Form BD 138M shall be submitted as applicable to the D.C.E.S. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138M. Refer to Section 551-1.03 of the Standard Specification and Notes on the Contract Plans.

! Pile Points.

Piles shall be furnished with prefabricated or commercial shoes, as detailed on the Contract Plans, or as approved by the D.C.E.S. Refer to Section 551-3.01.C.1.a&b. of the Standard Specifications and details on the Contract Plans. A Welding Procedure Specification (WPS) is required to be submitted to the D.C.E.S.

! Pile Splices.

Full length piles shall always be used where practicable. When unavoidable, piles shall be spliced as detailed on the Contract Plans. The number, locations, and actual details shall be subject to the approval of the D.C.E.S. Refer to Section 551-3.01.C.2.a&b. and details on the Contract Plans.

! Welding.

Pile welding shall be in accordance with the provisions of the New York State Steel Construction Manual (SCM). All procedural directives discussed in Section 564, Structural Steel for "Structural Welding-Field" of this Manual are applicable to welding of piles on site. If the Contractor chooses to subassemble any portion of the pile by welding off site, the Contractor should be directed to notify the Structures Division, Metals Engineering Unit (MEU) ( 518) 457-4525 of the type and location of work so that the appropriate Quality Control approvals are obtained and In-Process Quality Assurance (QA) inspection by the State can be arranged, when necessary.

Department personnel involved in QA inspection of welding in the field may use the "Punch List" at the end of the above-referenced Section in this Manual as a quick reference for approvals and inspection.

Refer to Section 551-3.01.C.2.a of the Standard Specifications; Subsections 302, 306, 704, and 811 of the SCM; and Section 564 of this Manual.

- ! Material Deliveries.  
Deliveries of all pile material are to be recorded on the Inspector's Daily Report and Material Acceptance Record. Material Certifications must be referenced by the Manufacturer or Supplier to special project shipments. Payment quantities cannot exceed the quantity of acceptable material in the documented deliveries..
- ! Pile Driving Records.  
Copies of Pile Driving Records (Form BD-25M and Form BD-26M) should be transmitted to the Regional Office, the Geotechnical Engineering Bureau, and D.C.E.S. at the end of each driving day. Refer to Exhibits 551-,C & D for samples of these forms.
- ! When driving piles in or adjacent to a stream crossing, and the estimated length or minimum tip is not achieved, call D.C.E.S.at (518) 457-7677.
- ! If a conflict occurs with existing piles or other conflicts arise, call D.C.E.S. at (518) 457-7677.

**References**

NYS STEEL CONSTRUCTION MANUAL,§302, §306, §704 & §811  
STANDARD SPECIFICATION §564  
CONSTRUCTION INSPECTION MANUAL §564-00, STRUCTURAL WELDING - FIELD  
PILE DRIVING INSPECTION MANUAL  
STATIC PILE LOAD TEST MANUAL, GCP-18

## **SECTION 554 - MECHANICALLY STABILIZED EARTH STRUCTURES**

Standard Specification Section 554, Mechanically Stabilized Earth System (MSES), contains the contract requirements for constructing a mechanically stabilized earth system. MSES are wall systems that rely on the backfill behind the wall for their structural stability. Proper compaction of the backfill is of paramount importance in the construction of these walls.

### **General Requirements**

See the Geotechnical Engineering Bureau, Soils Engineering Manual SEM-14, MECHANICALLY STABILIZED EARTH SYSTEM INSPECTION MANUAL, for guidance on installation and backfilling MSES.

### **Project Procedure**

The following guidelines pertain to the inspection of backfill material.

1. The construction of stockpiles. Record the material source and stockpile construction features on MURK-1, "INSPECTOR'S DAILY REPORT." Regional Geotechnical Engineer may assist. The control and documentation of the materials and the construction of stockpiles for use in MSES are covered in the Geotechnical Engineering Bureau's Granular Control Procedure, GCP-17.
2. The Regional Geotechnical Engineer will supervise the sampling and arrange for testing of the stockpile. Results will be reported on GE-454M, (See Exhibit 203H) "GRANULAR MATERIAL DOCUMENTATION FORM." A copy of this form shall be on file.
3. Additionally, acceptance/rejection of the stockpile as MSES backfill will be reported in a letter from the Director of the Geotechnical Engineering Bureau. A copy of this letter shall also be on file.
4. The major controls of granular backfill placement are lift thickness, moisture content, compactive effort and density requirements. Maximum lift thickness and moisture content are stated in the specification.
5. Compactive effort depends on the compaction equipment supplied by the Contractor. A current list of evaluated compaction equipment is available from the Regional Geotechnical Engineer. For assistance in evaluating compaction equipment that is not on the current list, call the Geotechnical Engineering Bureau. Minimum effort, however, is also stated in the specification. Compaction equipment, lift thickness and number of passes shall be recorded on MURK-1, "INSPECTOR'S DAILY REPORT."
6. Moisture content is specified as being less than, or equal to, the Optimum Moisture Content. The Optimum Moisture Content shall be determined in accordance with the appropriate Departmental publication, in effect on the date of advertisement for bids, which incorporate moisture content determination (References: STM-9 & 10). The Regional Geotechnical Engineer can specify appropriate test(s).
7. Minimum densities shall be verified with compaction control tests performed on the job by the project's earthwork inspection personnel. These tests shall be performed in conformance with the procedures contained in the appropriate Departmental publication in effect on the date of the advertisement for bids (References: STM-9 & 10).
8. Test results shall be documented on MURK-1, "INSPECTOR'S DAILY REPORT," and Forms SM-384A, (See Exhibit 203E) "COMPACTION CONTROL DATA SHEET," SM-417B, (See Exhibit 203F) "FIELD COMPACTION SHEET - SAND CONE OR VOLUMETER APPARATUS," and/or SM-418B, (See Exhibit 203G) "FIELD COMPACTION DATA SHEET - NUCLEAR DIRECT TRANSMISSION." Retests of previously failing tests should be cross referenced to the original tests.

9. For rock backfill, the major controls are lift thickness and compaction. Maximum lift thickness is stated in the specification. The lift thickness shall be recorded on MURK-1, "INSPECTOR'S DAILY REPORT."

10. Compaction requirements will be determined by the specification.

#### Evidence of Acceptability

1. Compliance with all the specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement of bids.
2. For granular material, copies of test results (Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM") and, when applicable, a copy of the letter approving transfer, as well as the original GE-454M.
3. If variations to the stockpiling requirements are granted, a copy of the letter from the Director of the Geotechnical Engineering Bureau must be on file.
4. A copy of the letter from the Director of the Geotechnical Engineering Bureau specifying acceptance/rejection of the stockpile as MSES backfill.

#### **Repair and Rejection**

The Regional Materials Engineer should be contacted for guidance and recommendations regarding repair to the units. Table 14 of the Federal Highway Administration's Reference Manual, page 310, lists out-of-tolerance conditions that may occur during wall construction and possible causes.

#### **References**

Directive 124.1-11-3, Geotechnical Engineering Bureau Directive, Acceptance/Rejection Procedure - MSES Backfill

STM-9, Test Method for Earthwork Compaction Control by Sand Cone or Volumeter Apparatus

STM-10, Test Method for Earthwork Compaction Control by Nuclear Gauge

SEM-14, Mechanically Stabilized Earth System Inspection Manual

GCP-17, GEOTECHNICAL ENGINEERING BUREAU'S GRANULAR CONTROL PROCEDURE

Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines, FHWA Demonstration Project 82, Publication No. FHWA-SA-96-071.

Contact Geotechnical Engineering Bureau for copies of referenced material.

#### **Related Contract Provisions**

§203, Excavation and Disposal

§203-3.12, Compaction

§501, Class A Concrete

## SECTION 555 - STRUCTURAL CONCRETE

Adequate supervision of concrete construction is critical to insure a safe and durable product, particularly in view of its high cost for construction and maintenance. The following inspection guidelines should be studied carefully by E.I.C.'s and their inspectors well in advance of the work.

One of the more common failings of our concrete substructures has been improper placement of reinforcing resulting in insufficient cover. This can lead to early corrosion of the reinforcing if not epoxy coated, causing concrete delaminations and spalling. Maintaining proper air entrainment is another problem. Proper conveyance of the concrete from the truck discharge point to the placement location is critical in maintaining adequate air entrainment in the finished product. Another problem is cracking of structural elements. The method of placement and more commonly the effort exerted to ensure good consolidation and curing are critical in minimizing cracking. These, and other problems, can be minimized or eliminated by following proper construction practices and procedures.

### I. General

Proper planning should be undertaken by both the Contractor and the Engineer and the inspection force in advance of actual construction. Such planning should include a job meeting to discuss in detail, the equipment and procedures that will be employed by the Contractor. A major point of discussion should be the provision of adequate delivery of concrete and sufficient placing equipment to insure that the placement can be effectively accomplished. This should include a contingency plan to handle unanticipated equipment breakdowns or interruptions in concrete supply.

The Engineer and the inspectors, must be completely familiar with the specifications for the work, including any special specifications, special notes, addenda to the specifications, appropriate Materials Methods, and all other related information.

### II. Reinforcing Steel Operations

#### A. Handling and Storing Reinforcing Bars

Reinforcing bars must be properly handled, stored, and placed. Bars will normally be specified as being uncoated, or coated with a protective coating for corrosion resistance. Rebars with a fusion bonded, electrostatically applied epoxy protective coating (Materials Specification 709-04) are often specified for coated rebars.

Fusion bonded epoxy coatings are susceptible to damage if the bars are improperly stored and handled. Before shipment to the project site, epoxy coating applicators, and rebar fabricators are required to repair all damaged areas of coating. However, shipments of epoxy coated rebar should still be carefully inspected for coating damage after their arrival at the project site.

During unloading by the Contractor at the job site, careful handling procedures can reduce the potential for coating damage. Suitable lifting equipment and slings should be used to unload bundles of coated bars. Epoxy coated rebars should not be dropped or dragged during unloading or transfer for placement in the structure.

Coated bars that are stored before placement should be supported above the ground on wooden timbers or other suitable protective cribbing. The same protective measures should be used for stacking bundles of bars.

Extended periods of exposure to ultraviolet rays may result in deterioration of the protective epoxy coating. Storage outdoors requires that epoxy coated rebars be covered (top and sides) for protection from the weather. Provisions should be made for adequate air circulation to prevent condensation under the cover. Opaque (nontransparent) waterproof covers such as black polyethylene will serve to protect the coating from direct rays of sunlight. Also, the cover will

prevent water or water vapor from penetrating the coating to the steel at damaged areas or "holidays" (pinholes in the coating not visible to the naked eye).

#### **B. Installation of Reinforcing Bars**

After placement in the structure, reinforcing steel should be free of grease, dirt, mortar, and other foreign substances. Uncoated steel should have loose mill scale and rust removed. Proper bar spacing should be maintained both horizontally and vertically. This means that all straight bars must be reasonably straight. The location and stability of the reinforcing steel must be carefully checked prior to placement of the concrete.

Epoxy coated reinforcement requires more detailed inspection before the concrete placement. Ends of the reinforcement exposed from field cutting will require touch-up with a patching material. The Contractor may also have to repair damage to the coating resulting from improper handling or field bending. The specifications require repair to a coated rebar which is determined to exhibit "major" damage. "Major" damage is defined as an area greater than 6mm by 6mm. Any 3 meter length of bar should not have more than five areas of "major" damage.

Areas of "minor" damage (< 6mm by 6mm) are not required to be repaired. The average number of unrepaired "minor" damaged areas should not exceed an average of 1.8 per meter on any individual bar.

When repairs are required, the coating manufacturer's recommended patching material, normally a two-component epoxy, should be used according to the manufacturer's instructions. Technical data sheets normally list various application requirements. Damaged surfaces need to be cleaned by wire brushing before patching. Proper adhesion and performance of the patching material is dependent upon the cleanliness of the surface. Any loose material and rust must be removed.

Miscellaneous items such as chairs, tie wires, and other devices that are used in connection with the placement of reinforcing steel should meet the specification requirements. For uncoated reinforcement, chairs should have high density, polyethylene tips. Stainless steel chairs or epoxy coated chairs without, plastic tips are also acceptable. Chairs, tie wires, and other devices used to fasten epoxy coated reinforcement should be coated with, or made of a dielectric material. Epoxy or plastic (vinyl) coated products are generally used for these items.

After epoxy coated rebars are placed in the structure, care should be taken so that construction equipment or worker operations do not damage the coating.

#### **C. Plan Clearances**

Make sure that plan clearances are maintained between bars, joint assemblies and side forms. This is particularly important near scuppers, rail supports, etc., where additional reinforcing is used and clearances are small.

### **III. Forming Operations**

#### **A. Forms**

Forms should be properly supported and adequate to support the loads to be applied. Minor movements in forms can cause an unacceptable change in the dimensions of the final product; stability is essential to achieve proper reinforcement bar cover. The forms are the Contractor's responsibility, but the Engineer should be alert to any obvious weaknesses in the installation and call them to the Contractor's attention. The Engineer should compare commercially manufactured support system installations for conformance to the manufacturer's recommendations. Other

support systems should be checked for good workmanship.

## B. Joints

Joints must be properly constructed in conjunction with form, reinforcement, and waterstop placement as required.

Joints are classified as construction, contraction, or expansion and are described by the following:

### 1. Construction Joints

#### a. Definition

Construction joints are interruptions in the concrete placement provided to facilitate construction. In some cases, vertical construction joints are introduced in abutment stems and backwalls to reduce the possibility of cracks forming due to shrinkage of the concrete during curing, thus performing the function of a contraction joint as well.

#### b. Reinforcement

Reinforcing steel will always pass through construction joints. All construction joints are provided with keyways, unless otherwise specified.

#### c. Sealing

All construction joints will be sealed with a waterstop as indicated on the plans, unless otherwise indicated. Waterstops are required where leakage through the joint is likely and staining due to that leakage would be objectionable.

### 2. Contraction Joints

#### a. Definition

Contraction joints are interruptions in the concrete placement introduced to reduce the possibility of cracks forming due to shrinkage of the concrete.

#### b. Reinforcement

Reinforcement will not extend through a contraction joint. The object of a contraction joint is to allow sections of a large placement to act independently. The continuation of reinforcement through the joint would bond the segments together and defeat the purpose of the joint. All contraction joints will be provided with a key way.

#### c. Sealing

All contraction joints are provided with a waterstop as indicated on the plans, except where leakage through the joint is unlikely or where staining due to leakage was deemed to be unobjectionable.

### 3. Expansion Joints

#### a. Definition



Expansion joints are interruptions in the concrete placement provided to allow for movements due to thermal expansion.

b. Reinforcement

No reinforcement extends through the expansion joint. Reinforcement would act to tie adjacent sections together and hinder the free movement of the joint. Expansion joints in walls and footings are provided with a keyway.

c. Sealing

All expansion joints are sealed with a waterstop as indicated on the plans.

d. Footings

The requirements for expansion joints in footings are the same as stated in 3b and 3c above, except waterstops are not required.

C. Wall Layout to Accommodate Waterstops

At locations where a waterstop is to be installed, the walls should be laid out so that the rear faces of the two adjoining walls are to be flush at the joint in order to accommodate the waterstop.

D. Construction Joints Shown on Plans

All joints required will be shown on the plans. In the event of omission, the Engineer should bring it to the attention of the Regional Construction Supervisor for advice from the Structures Division.

**IV. Concrete Operations**

A. Prior to Placing Concrete

Prior to commencing the placement of concrete, all the following conditions must be resolved in a pre-placement meeting:

1. Placing Sequence

Check the placing sequence, if any, on the plans and follow it. Don't deviate from it without prior approval from the Deputy Chief Engineer of the Structures Division (518) 457-7677. If changes are made, make sure that all interested parties are aware of them in advance.

2. Need for Personnel and Equipment

Make sure that enough personnel and adequate equipment are on hand to perform the work and meet emergencies. The Contractor is responsible for proper progress of the work, however, the Engineer must be satisfied that a sufficient work force will be present to complete the concrete placement. Backup equipment, including spare vibrators, should be at the site.

3. Concrete Supply

Prior to placement, discuss with the Contractor the need for an adequate and timely supply of concrete to meet the specification requirements.

#### 4. Conveyance System

The conveyance system should be tested prior to the start of the placement. If belt conveyors are being used to deliver concrete to the placement site, they should be equipped with discharge hoods at transfer points to minimize segregation and reduce spillage. Scrapers should be utilized to keep the cement paste in the mix and off the conveyor belt. If pumps are used to deliver the concrete, hoses should be kept as level as possible. Extreme rises and falls in the hoses place greater pressures on the concrete and alter the air entrainment. Discharge of the concrete from pump hoses in a horizontal position is preferred. This will maintain a steady head of concrete and reduce the potential of air loss. Conveyance systems must be tested for their ability to deliver concrete, allowing for the established variances, within the required specification limits. Where conveyance systems cross areas ready for concrete placement, some form of protection (ie. drop cloths, plywood) should be used to catch mortar leakage from transfer points, pipeline joints, etc.

#### 5. Forms

Make sure that forms, and areas within the forms, are properly cleaned before allowing concrete to be placed. Compressed air or a vacuum cleaner should be used to clean them. All rubbish, sawdust, dirt, nails, and other foreign matter must be removed. Forms should be refaced regularly and coated with the proper form release agent.

#### 6. Curing Materials

An adequate supply of approved curing materials must be maintained at the project site. This should include not only the curing materials for the intended curing method, but suitable substitutes in case of malfunctions or inclement weather.

#### 7. Admixtures

When admixtures are to be used, a careful review of their use with the Contractor should be made well in advance of any placement. Generally, admixture use is at the discretion of the Contractor, however, some placement conditions require certain admixture use. At the pre-placement meeting admixture use should be discussed to determine expected results and alleviate potential problems. The Regional Materials Engineer should be contacted to provide instructions and oversight of proper use of concrete admixtures.

##### a. Air Entraining Agents (AEA)

Air entrainment is required for all concrete placed on Department projects. Concrete will entrain approximately 2% air without any admixture. AEA is necessary to achieve the desired air content. To determine proper dosage, concrete should be tested prior to placement. Testing should be performed at regular intervals to assure consistent air contents in the concrete. How the concrete is handled will effect the air content, as previously discussed, and testing at various locations should also be performed.

##### b. Set Retarding Water Reducers

Retarders slow the setting of concrete, allowing the concrete to remain plastic for longer durations. Retarders, by nature, will increase slump and can also effect the air content of concrete. Hydraulic forces on forms may increase when using retarders, as the height of concrete placement increases.

##### c. Water Reducers

Two types of water reducers are used by the Department: Normal Range and High Range. Both can be used to reduce the mix water while achieving the same slump, resulting in somewhat higher compressive strengths, or they can be used to achieve higher slumps without reducing mix water, improving workability.

Normal range water reducers can be used in any concrete placement, but are required for Class I and J concrete. Also, Class HP used for substructures requires a normal range water reducer and/or a set retarding water reducer to achieve a workable slump while maintaining the desired water to cement ratio. The Regional Materials Engineer should be consulted to determine appropriate admixture dosages and determination of water to total cementitious ratio.

High Range Water Reducers, also known as Superplasticizers, are generally used only for substructure repairs. Other uses may be considered, and must be approved by the Regional Materials Engineer.

d. Other Admixtures

Other admixtures such as corrosion inhibitors, coloring agents, accelerators, and others may be considered for use. The Regional Materials Engineer must be consulted prior to use any of these special admixtures.

8. Engineer's Approval

No concrete should be placed until the Engineer gives approval to do so. All checking, other than a few last minute checks, should be done the day before the placement. The entire section to be placed should be ready before allowing the concrete placement to commence.

9. Prewetting

Shrinkage cracking can result when fresh concrete is placed on a dry area. For instance, when an abutment backwall is placed on an abutment stem, the "dry concrete" from the abutment stem will draw away the "design mix water" from the fresh concrete and result in shrinkage cracks. Shrinkage cracking will typically occur at a point of weakness. In the abutment backwall this will be an vertical epoxy rebar, in an abutment stem on a footing this will typically occur at the weep hole and possibly other areas. When placing concrete barrier with the slip-forming method, cracking can be observed in the scored joints and other locations. This again, would typically occur at a point of weakness or at the vertical epoxy rebar. Sidewalks placed on a bridge deck would be another example. Good construction practice would be to prewet the area for a sufficient time when fresh concrete is to be placed on a dry surface in order to prevent the extraction of the mix design water. Cold weather conditions where heaters are used insure that previously placed concrete will really be dry. Providing a continually wetted area for a minimum of 12 hours prior to the start of the concrete placement will minimize shrinkage cracking.

B. Placing Concrete

All operations in the construction of structural concrete elements have an effect on the final product. Some of the most critical factors on the durability of structural concrete are

- proper concrete air entrainment
- proper concrete cover over the reinforcing steel
- proper consolidation of the concrete
- proper curing

Be sure that both the Contractor and material suppliers understand that the specifications will be followed. This includes testing of the concrete as per Materials Method 9.2. Be equally sure that, when the concrete placement is to commence, that the reinforcing steel is in its proper position. It should be adequately tied and anchored in accordance with the specifications, so that it will remain in the proper location throughout the concreting operations. It should be physically restrained from floating in the plastic concrete. **The placement of concrete shall not be allowed if the above conditions are not met.** Once placement of concrete has commenced, it must be handled in accordance with the specifications. The concrete should be placed as near its final position as possible. Internal vibration must be applied to achieve the proper consolidation. Vibrators should not be used to move concrete.

1. Concrete Acceptance

For concrete to be considered acceptable and function as intended, it must be placed within the proper slump and air content range. Visual inspection of the concrete should be performed as well to ensure there are no deviations in the mix and verify the proportioning of the mix. If a problem is found, the plant inspector should be notified and the mix checked. Air and slump tests should then be performed as required by the specifications and Materials Method 9.2. For a concrete to be durable, that is to withstand the weather through time, proper air entrainment and proportioning including water-cement ratio must be achieved.

Although workability is necessary, the addition of excessive amounts of water will reduce compressive strength, durability, and will increase the potential for shrinkage cracking. Water demand is increased in hot weather. Adjustments to the concrete should be made at the batch plant to ensure the concrete is produced to the desired mix criteria including water to total cementitious ratio.

2. Timing

A steady, continuous supply of concrete that meets specifications should be maintained at all times. The slump and air content should be consistent from load to load. Concrete should be placed in a uniform pattern within the forms such that no cold joints are formed.

3. Moving concrete

Concrete should be deposited uniformly within the forms. If concrete has to be moved, it should be with a shovel, hoe, or similar means such that segregation does not occur. It should not be piled in one end of the forms and allowed to flow to the other end. Concrete should be placed in uniform layers and thoroughly consolidated prior to placing the next layer. **DO NOT ALLOW CONCRETE TO BE MOVED WITH A VIBRATOR.**

4. Vibration

All concrete placed needs to be properly consolidated by vibration techniques. Internal vibration is generally the method used. Proper vibration and a good practice would be a three step process of insertion, consolidation, and removal with **each process taking 3 to 5 seconds** to insure proper consolidation and avoiding air pockets or honeycombs. Vibrators are to be inserted vertically at all times. Do not allow vibrators to be dragged horizontally through the concrete. Although over vibration is a concern, most vibration is not performed in the proper 9 to 15 seconds per insertion. Due to the "stickiness" of certain classes of concrete such as Class HP from the use of pozzolons proper vibration is extremely important. It is important to note that the duration of vibration will depend upon the frequency of the vibration (impulses per minute), size of vibrators at the slump of the concrete. This length of time must be determined in the field.

5. Delays

Try to avoid delays in placing concrete, but if they do occur take steps to slow the drying of

fresh, unfinished concrete. Wet curing blankets will help and should be readily available, but they shouldn't be so wet that water drips from them on to the fresh, unfinished concrete. Remember the concrete must be placed, finished and have curing applied in the shortest possible time. Use good judgement and avoid the possibility of cold joints.

### C. Finishing of Concrete

#### 1. Depth of Cover

Check the depth of cover of reinforcing steel during the course of the placement to ensure reinforcing has not moved. Record these checks on the inspector's report. If the cover is found to be deficient, the Contractor should be immediately notified and appropriate remedial action taken.

#### 2. Amount of Finishing

Try to keep hand finishing to a minimum. Over finishing of a concrete surface results in scaling. Do just enough to close up the small surface voids and secure a smooth surface within our tolerances. Try to **minimize or eliminate the use of bull floats** as they tend to build in ripples as a reflection of the reinforcing pattern when too much pressure is applied. Do not permit the application of water by the finishers. This changes the water/cement ratio of the surface layer and will result in a weaker concrete surface that will scale or wear early. The final goal is to achieve sound concrete throughout the entire structure.

### D. Curing of Concrete

Curing is to commence as soon as possible after the finishing operation is complete. **Concrete curing materials and apparatus must be in place within 30 minutes from the time of placement.**

#### 1. Considerations When Using Burlap

##### a. Saturation

It is important to ensure that the burlap is maintained uniformly wet over its entire surface area. Since burlap does not have sufficient wicking ability to transfer moisture to isolated areas, soaking hoses and sprinklers used to keep the burlap wet should be positioned such that water is directly applied to all portions of the burlap.

b. If a steady supply of water is not available, covering the burlap with plastic will prevent the loss of moisture. Periodic checks must be made to ensure the burlap remains wet.

#### 2. Timing

Apply approved curing methods at the proper times. Keep all covers properly overlapped. Rips or tears in the covers or loose fitting covers permit unwanted evaporation of moisture from the concrete. Keep wet type covers (burlap) wet at all times throughout the prescribed period of cure. Do not "tent" the covers.

#### 3. Traffic

Another factor that contributes to the cracking of concrete is traffic on an adjacent stage. The vibrations produced by traffic during the initial set of concrete may cause cracking. Where vibrations are a problem, provide a smooth riding surface through the construction zone and reduce traffic speed for the first 24 hours.

## V. Cold Weather Concrete Operations

### A. Background

Portland cement concrete is a versatile material which can be successfully placed under a variety of weather conditions. However, the quality and durability of the finished product is greatly affected by the atmospheric conditions present during the placement, and especially during the curing period. Hot and dry weather poses particular concerns during summer, while cold weather causes different concerns in the late fall, winter or early spring.

Placing and curing of concrete during cold weather is of special concern, since the Standard Specifications require the rejection of any concrete should the curing temperature fall below 0°C at any time during the curing period. Although the Standard Specifications which address cold weather concreting have been interpreted differently by individuals, especially during periods of cool or cold but not freezing weather, often we find ourselves in the situation of needing to place concrete late in the construction season in order to complete work prior to the seasonal shutdown, and to minimize disruption and inconvenience to the traveling public. While attempting to accomplish this, Engineers should not allow exceptions to, or modifications of, the specifications, particularly regarding the requirements for cold weather concrete placements.

Commonly, the Contractor seems to rush to place concrete on a "nice" fall day, and then wait until some time during the curing period to decide if any additional measures are required to maintain adequate curing temperatures. However, in most cases, the method of cure and even the decision to place concrete should be determined before placement, based upon the expected or predicted temperatures during and after concrete placement.

The intent of this section is to reiterate the important provisions of the current specification requirements, and to clarify the application of the various cold weather provisions. All information provided in this section is based on current specifications, and we suggest that reference be made to the applicable specification section for further details. Although this section addresses all types of concrete, particular attention is called out to **bridge deck placements and overlays** which comprise a significant portion of our concrete work, the durability of which is of the utmost importance.

### B. General Provisions for Cold Weather Concreting

#### 1. Required Permission

Prior to placing concrete under the provisions of §555-3.06 of the NYSDOT "Standard Specifications," permission must be granted in writing by the Engineer. Curing temperatures must be maintained between 7°C and 29°C. Continuously recording thermometers are required to document curing temperatures.

#### 2. Temperature of Surroundings

When concrete is placed in contact with steel members, reinforcing steel or previously placed concrete, the temperature of the steel and concrete shall be raised to a temperature of approximately 7°C before concreting. When concrete is placed in contact with earth or rock, the temperature of the earth or rock shall be 2°C or greater. The earth or rock shall not have any snow, frost or standing water on its surface. Further, the aggregates and/or water may require heating prior to batching. Refer to the specifications for further details.

#### 3. Maintaining a Uniform Temperature

When utilizing external heat, an effort should be given to maintain uniform heat throughout the enclosure. Localized "hot spots" can be more harmful to the concrete than cold areas. When

placing thermometers to monitor temperatures, consideration should be given to areas where the most extreme temperatures may occur. When the specified curing period is complete, the heat shall be gradually reduced at a rate not to exceed  $\frac{1}{2}^{\circ}\text{C}$  per hour until the temperature within the enclosure equals the outside temperature. The Engineer shall use a continuously recording thermometer to maintain a temperature record to document compliance with this prescribed rate of heat reduction.

#### 4. Safety Concerns

For all work employing heated enclosures, care must be given to provide sufficient ventilation to maintain adequate air quality for the safety of the workers. Additionally, adequate ventilation is needed to prevent surface disintegration of the fresh concrete from the build up of carbon dioxide gas. Further, adequate safeguards must be taken when placing heating equipment in the vicinity of flammable enclosures, materials or liquids.

#### 5. Insulated Forms

When utilizing heat retention by insulated forms, the insulation requirements vary depending on air temperature, concrete thickness and cement content. The Standard Specifications provide details for insulation requirements. Insulated forms must be removed in a manner such that the drop in temperature of the concrete is gradual. Further details regarding insulated form removal are provided in the Specifications.

### C. Critical Temperatures

Two temperatures are extremely important to cold weather concreting operations: the ambient air temperature and the curing temperature.

#### 1. Ambient Air Temperature

The ambient air temperature is defined as the temperature of the environment at the project site. This is the temperature which determines whether or not a concrete placement should commence and what precautions the Contractor must take to protect the concrete from cold weather.

#### 2. Curing Temperature

The curing temperature, defined as the air temperature at the concrete surface or between the concrete surface and its protective covering, typically is the same as the ambient air temperature. The curing temperature may be measured on any surface of the concrete. On deck slab pours, consideration should be given to checking curing temperatures on the bottom of the slab at the bottom forms, or at locations which represent the extreme temperature conditions.

### D. Structural Concrete Placements

#### 1. Circumstances Under Which the Cold Weather Provisions Apply

No concrete shall be placed when the ambient air temperature is below  $7^{\circ}\text{C}$ , unless the Engineer grants permission in writing under the provisions of the Standard Specifications.

If the ambient air temperature is  $7^{\circ}\text{C}$  or greater during the placement, but is expected to fall below  $0^{\circ}\text{C}$  at any time during the curing period, the provisions of the Standard Specifications shall apply in accordance with the cold weather concreting provisions.

#### 2. Curing Days

a. Definition

If the ambient air temperature is 7°C or greater during placement, and falls or is expected to fall below 7°C but remain at or above 0°C during the curing period, the provisions of the Standard Specifications, Temperatures Below 7°C, shall apply. Under curing temperatures, the Contractor shall propose a suitable method to maintain the curing temperature above 7°C. In order to assure the Contractor's method is adequate, the Contractor shall supply maximum-minimum thermometers, and the number and placement of the thermometers shall be as determined by the Engineer. The Engineer will maintain a temperature record during the curing period. Should the curing temperature drop below 7°C, **that day shall not be considered a curing day** and the curing period shall be so extended until the required number of days is accumulated. A curing day is defined as any day, starting with the time the placement is completed, during which the curing temperature is 7°C or greater.

b. Aggregating Curing Time

Conditions may occur which prevent an entire day from qualifying as a curing day, but do not prevent portions of that day from reaching the required curing temperature, such as when the curing temperature drops below 7°C for a short period of time. In such cases, with the Engineer's permission, 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. In order to determine curing hours, the Contractor must supply continuous recording thermometers. The number and placement of the thermometers will be determined by the Engineer, and the Engineer shall also maintain a record of the curing temperatures. The aggregation of 24 curing hours will be credited as one curing day.

3. Rejection of Concrete

Should the curing temperature fall below 7°C for 24 consecutive hours, the remainder of the cure must then be accomplished in accordance with NYSDOT Standard Specifications §555-3.06. **If the curing temperature falls below 0°C at any time during the curing period, the concrete shall be rejected. In addition, if the minimum curing temperature is not maintained for a continuous 24 hour period, the concrete shall be rejected.**

E. External Heat and Enclosures

1. When External Heat and Enclosures are Necessary

Provisions for Concreting in Cold Weather, of the Standard Specifications, requires that curing temperature be maintained between 7°C and 29°C by either the provision of external heat, or the utilization of heat of hydration by insulated forms. The bottom of an enclosure shall be below the lowest portion of the superstructure. Therefore, the stay-in-place or bottom forms, or existing substrate concrete cannot be considered as the bottom of the enclosure. For Concreting in Cold Weather, the Contractor may supply maximum-minimum or continuously recording thermometers. External heat shall be applied for the required curing period, except that structural slabs must have external heat applied for 14 curing days.

2. Permission

The Standard Specifications are quite clear that if at time of placement, the weather prediction is for ambient air temperatures to drop below 0°C at any time during the curing period, the placement can only commence if permission to proceed is granted by the Engineer in writing.

3. Deciding What Steps are Necessary



However, confusion seems to occur when the ambient air temperature is above 7°C during placement, but may drop to near or below 0°C during the cure period. Simply stated, if the weather forecast is for temperatures below 7°C but above 32°F during the curing period, the Contractor shall propose a suitable method (such as protective covers or insulated curing blankets) to maintain curing temperatures above 7°C. Consideration should be given to providing protection for the top, bottom and sides of the slab. If the curing temperature remains above 7°C, no additional action is required. If the Contractor's method to maintain heat fails and the curing temperature falls below 7°C, **that day shall not be considered a curing day** and the curing period shall be so extended. Should the curing temperature fall below 7°C for 24 consecutive hours, the remainder of the cure must then be accomplished in accordance with of the Standard Specifications. Therefore, when placing concrete during periods when the temperatures could drop to near 0°C, the Contractor must have available on the site, material and equipment so as to be prepared to enclose and heat the concrete already placed and in cure.

F. Chart

The Quick Reference Concrete Curing Chart for Cold Weather Provisions (Exhibit 501-E) should be helpful when making placement decisions and determining which provisions apply for the placement and curing of structural slab concrete during cold conditions.

## VI. Hot Weather Concrete Operations

A. Problems

Particular attention must be paid to exposed concrete in flat work such as slabs, footings, etc. (Use the evaporation chart included in the Standard Specifications) Conditions of low humidity (under 10°C), high temperatures (over 29°C), and excessive wind velocity (over 24 kph) occurring together or alone will cause the evaporation rate to exceed the bleed rate. The bleed rate is the rate at which water rises to the surface of recently placed concrete by bleeding. This will cause a crust to form on the surface of the plastic concrete, even when retarders are used, and will result in screeding and finishing problems. Plastic shrinkage cracks will result when the bleed rate is excessive.

B. Solutions

When the previously noted conditions are unavoidable, curing procedures must be commenced as rapidly as possible. This must be discussed with the Contractor. The use of fog spray may be used but with caution. Water from fog sprays cannot be worked into the concrete surface during finishing. Windscreens are beneficial and should be considered if winds in excess of 24 kph are anticipated.

## VII. Underwater Concrete Placements (TREMIE)

For underwater concrete placements, contact the Materials Bureau in Albany.

## VIII. Contact

For any other concerns not covered here or questions dealing with portland cement concrete, please contact the Regional Materials Engineer, or the Materials Bureau in Albany at (518) 457-5956.

For general construction concerns, contact the Structures Division at (518) 457-7677.

## References

Material Method 9.2, Field Inspection of Portland Cement Concrete  
Construction Inspection Manual §502-00

## Related Contract Provisions

Standard Specification §709-04, Epoxy Coated Bar Reinforcement Grade 400



## SECTION 557 - SUPERSTRUCTURE SLABS AND STRUCTURAL APPROACH SLABS

### I. General

Adequate supervision of bridge deck construction is critical to insure a durable product, particularly in view of its high cost for construction and maintenance. The following inspection guidelines, along with all provisions covered in Section 555 of this manual, should be studied carefully by the E.I.C. and all inspectors well in advance of the work.

A properly constructed bridge deck should be durable, safe and ride well. This means it should be of the best quality construction, true to line and grade, ride smoothly, and have the proper surface texture. The structure should perform its intended function throughout its design life with little or no maintenance. The construction phase is even more demanding when integral wearing course design is used, because you only get one chance.

Some of the more common failings of integral wearing course bridge decks have been cracking, delaminating and spalling. Often the riding surface is rough, with improper texturing. These problems can be minimized or eliminated by following proper construction practices and procedures.

All operations in the construction of a bridge deck have their effect on the final product. Before any concreting operation commences, proper preparation must be performed. This primarily relates to the organization and planning of the Contractor. Proper planning should be undertaken by both the Contractor and the inspection force in advance of actual construction (see Exhibit 557-D). Such planning includes a required **Pre-Placement Meeting** (see Exhibit 557-E) to discuss in detail, the equipment and procedures that will be employed by the Contractor. A major point of discussion should be the provision of adequate concrete delivery and sufficient placing equipment to insure that the placement be accomplished. In addition, an agreement should be reached on contingency plans to handle unanticipated equipment breakdowns or interruptions in concrete supply.

As an Engineer or inspector, make sure that you are completely familiar with the specifications for the work, including any special specifications, special notes, addenda to the specifications, appropriate Materials Methods, and all related information.

### II. Structural Steel Welding Operations

A. The specifications and the Steel Construction Manual should be reviewed.

#### B. Tension Zones

Plans for steel bridges contain the following note: "No welding shall be allowed within the tension zones shown, unless specifically noted. The attachment of forming devices or other construction aids by welding within the tension areas shown is prohibited." (See CIM Section 557 IV - D. 2 Welding.)

Failure to comply with this requirement may lead to serious fatigue cracking of steel stringers, results in a shortened bridge life and/or high repair costs.

### III. Reinforcing Steel Operations

A. Handling and Storage - See subsection 555-II.A of the "Construction Inspection Manual".

B. Installation of Reinforcing Bars - In addition to the following, see subsection 555-II.B of the "Construction Inspection Manual".

Use only approved chairs to support reinforcing steel as defined in the specification. They should be the proper height to provide the correct spacing, clearance and cover. The chairs

should be coated or provided with a rubber tip at their end. They should be used in sufficient numbers to insure adequate and proper support, and to insure that proper clearance and spacing will be maintained when the concrete is placed. Bar mats should not sag excessively when walked on. Remember that at least four or five workers will be standing on the bar mat during placement operations. The reinforcing steel should be checked to confirm that it is adequately secured, to insure that it will follow the forms as the camber comes out of the beams, thereby insuring the proper cover on the bars. This is especially important in the area of maximum dead load camber (mid-span for simple beams). Mats should be tied together and may be tied to forms and/or structural steel or shear studs to achieve the above results.

**C. Maintaining Proper Position of Reinforcement Bars**

Make sure that bars are supported at transverse joints so they will not flex down into the end haunch area when walked upon. A plywood walkway placed over the reinforcing steel at joints and heavy traffic areas will prevent excessive sag. Chairs should be placed at points of cross slope change.

**D. Plan Clearances**

The Engineer should ensure that plan clearances are maintained between bars, joint assemblies and side forms. This is particularly important near scuppers, rail supports, etc., where additional reinforcing is used and clearances are small.

**IV. Forming Operations**

**A. Forms**

Forms should be adequately braced and provide sufficient support for the loads to be applied. Minor movements in forms or brackets can cause an unacceptable change in dimension X in Exhibit 557-A. The stability of dimension X is essential to the final riding quality and reinforcement bar cover of the finished deck. The forms are the Contractor's responsibility, but be alert to any obvious weaknesses in the installation and call them to the Contractor's attention. Other criteria are shown in Exhibit 557-A.

**B. Support Systems**

The Engineer should check commercially manufactured support system installations for conformance to the manufacturer's recommendations. Support systems should be checked for good workmanship.

**C. Haunch Depths**

The Engineer and Contractor must be in agreement on haunch depths before setting forms. This is especially critical on stay-in-place forms since the support angles which control the haunch depth are permanently attached or clamped to the beams (See Section II.D). Check and record haunch depths on the As-Built Record Plans after installation of forms.

**D. Permanent Corrugated Metal Forms For Concrete Bridge Slabs**

**1. Approval**

The Contractor shall submit to the Engineer for acceptance the Manufacturer's certification that all forms meet all design requirements stated in Specification Section 736-01 and all detail requirements shown on the Contract Plans.

**2. Welding**

Construction personnel involved in construction inspection shall insure that the Contractor is aware of the prohibition against welding in the area of stringers designated with "tension zones". Welding for the attachment of forms, ties, etc. shall not be permitted other than what is detailed on the Contract Plans. In those areas where welding is not permitted, strapping

is commonly used over and around the flange, which is attached to angles used to adjust for the haunch. If the plans for any bridge being constructed under your direction appear ambiguous or incomplete with regard to the definition of the "tension zone", contact the Deputy Chief Engineer, Structures (D.C.E.S.) at (518) 457- 7677 for clarification or interpretation of the plans. Only welding for the purpose of repairing a steel stringer will be allowed in the "tension zone", and this welding will only be allowed in conjunction with a Repair Procedure and a Welding Procedure Specification (WPS) approved by the Deputy Chief Engineer, Structures (D.C.E.S.).

Welding and welds shall be in accordance with Specification Section 557-3.03B, Repair Procedure and the WPS. Welding shall be performed by a NYS Department of Transportation Certified Welder and in accordance with the provisions of the New York State Steel Construction Manual (NYS SCM).

Welding is required to tack down galvanized stay-in-place forms to their galvanized form supports prior to securing to form supports by self tapping screws. This welding usually produces a small whitish spot on the exposed side of the form and, occasionally, may even burn through leaving a minute deposit of weld material exposed. These imperfections are not a significant aesthetic consideration and do not worsen appreciably with time. Therefore, field touch-ups of this type of spot should not be required.

Form (strap) welding in "tension zones" shall be considered critical welding. This work shall be inspected as frequently as necessary to assure that burn through and arc strikes are not incorporated into the completed work. A burn through has the potential of fusing the strap to the flange. The Contractor shall be directed to repair these deficiencies by a procedure approved by the D.C.E.S. before progressing with any deck work. Exhibit 557-B outlines the "special inspection zone".

3. Lap in Corrugated Metal Forms

The direction of lap in the forms is governed by the direction of concrete placement (see CIM Section 557 V. - A. 2 and 3). The form section being loaded with concrete (if not securely fastened) should lap over the unloaded section of the form in order to prevent separation of the overlap.

E. Joints

At bridge joints, the forms at the end of the deck slab must be supported solely on the superstructure steel for the span being formed. There should be no form work support or connection across a joint between independent spans or between an abutment and the span, unless otherwise detailed. This allows the joint forms to move with the top of the girders through dead load application and temperature movement. Section 555-II.B "Joints" of the Construction Inspection Manual should be thoroughly reviewed.

F. Drainage

Weeps should exist, or be drilled, in corrugated metal form joints as required by the specifications.

**V. Concreting Operations**

A. Prior to Placing Concrete

See Exhibits 557-D & 557-G of the Construction Inspection Manual.

1. Finishing Machine Preparation - see Exhibits 557-I & 557-J

The finishing machine must be approved by the Regional Construction Engineer (R.C.E.) and it must be in satisfactory operating condition. It would be beneficial to obtain a list of at least 3 of the last jobs where the finishing machine was used, along with the inspection personnel and their phone numbers. This would allow the Region to check on past performance of the machine.

The Engineer should obtain a copy of the machine's operating instructions and become familiar with it before making the dry run (see Exhibit 557-F) to ensure proper set up and operation. It is the Contractor's responsibility to adjust and operate the machine, but inspector familiarization is beneficial.

Screed rail positioning and support is one of the critical factors in deck construction. "Eyeball" the screed rail prior to the "dry run." Once the dry run is complete and proper clearances have been established, no adjustments to the rail supports should be made. Rails should not sag or wobble under the weight or action of the finishing machine. Use the recommended screed rail support spacing as shown in the manufacturer's manual or 600 mm whichever is less. It is recommended that rail cups be placed at shorter intervals. If screed rails are to be supported on the fascia forms, bracing should be supplied to properly resist both the deflection under the load of the finishing machine and the later movement caused by the oscillation of the machine. Check distance X (See Exhibit 557-A) before, during, and after the dry run of the machine.

The longitudinal wheelbase of the finishing machine must be considered when adjusting screed rails on multi-span structures. In setting the rails, take into account that, with a long wheelbase finishing machine, one end will be on the adjacent unloaded span while the other end will be on the loaded span (where the dead load camber has or will come out) as you load the span with fresh concrete.

In setting up the finishing machine and making the dry run, be sure possible differences in dead load deflection characteristics between the fascia girders and interior girders is considered. This is particularly important for deck replacements. It is recommended that finishing machines be oriented parallel to the skew of the bridge up to a skew of 35°. For greater skew angles, the machine should be operated at a skew angle of 35°.

Check clearances in a dry run over the entire span the day before the placement. It is recommended that the adjustment controls be locked or sealed in some manner so they will not be altered before placement begins. Some last minute clearance checks just before placing may be good insurance and reassuring to all involved. If it is necessary to raise the machine to back it off the span after the dry run, record this change so that the machine can be reset when moved back on the span for finishing.

If the finishing machine has hydraulically operated actions, take care to see that they do not leak fluid onto or into the concrete. The machine should be monitored for hydraulic fluid leaks throughout the placing and finishing operations as well. The same holds true for grease or fuel that may drip onto or into the concrete. See that gobs of excess grease are removed before they get into the concrete.

## 2. Placing Sequence

Check the placing sequence, if any, on the plans and follow it. Don't deviate from it without prior approval from the Deputy Chief Engineer (Structures). If changes are made, make sure that all interested parties are aware of them in advance. If there is no placing sequence shown for a continuous deck of two or more spans, the D.C.E.S. should be contacted at (518) 457-7677 for guidance.

3. Placing Direction

When grades exceed 3%, concrete is generally placed from the low point to the high point. When grades are less than 3%, concrete can be placed in either direction but, is generally placed from the fixed end towards the expansion end.

4. Admixtures

a. Set Retarding Water Reducers

Set retarding water reducers are required to be used for all deck placements. Careful review of their use should be discussed with the Contractor, during the **Pre-Placement Meeting**. Retarders slow the setting of concrete, allowing the concrete to remain plastic for longer durations. Retarders, by nature, will increase slump and can also effect the air content of concrete. The first few batches of concrete delivered to the project should be checked for air content and water to total cementitious ratio, with adjustments made as necessary on subsequent loads at the batch plant. Often a Contractor will request to reduce the dosage of set retarding water reducer on a deck placement as the placement progresses and less retardation is required. **Never reduce the amount of set retarding water reducer once the placement begins.** Changes to admixture dosages will change the air content, slump, and consistency of the concrete, altering the workability. Class HP concrete requires a set retarding water reducer to achieve workability while maintaining the desired water to total cementitious ratio. Consult the Regional Materials Engineer for admixture dosages and determination of water to total cementitious ratio.

b. Water Reducers

Only normal range water reducers should be used on bridge decks to reduce the mix water while achieving the desired slump. Class HP concrete may need a normal range water reducer along with a set retarding water reducer to achieve a workable slump while maintaining the desired water to cement ratio. The Regional Materials Engineer should be consulted to determine appropriate admixture dosages and determination of water to total cementitious ratio.

5. Work Bridges

Two work bridges are the minimum necessary to properly complete the work: one for finishers and one for cure application.

6. Expansion Bearings

Prior to placing concrete, make sure that all expansion bearings are clear and free to move as the dead load camber comes out. Forms at the expansion end of a span or bridge shall be made to allow for expansion before, during, and after the placement.

7. Prestressed beams or girders-surface preparation (see also EB 97-040)

Wet concrete placed over dry concrete beams cause shrinkage cracks. This results from the extraction of water from the wet concrete to the dry concrete, thereby reducing the design water requirements in the concrete mix. In order to minimize shrinkage and ensure proper bond prior to placing concrete the tops of the prestressed units must be:

- Thoroughly wetted
- Free from laitance and dirt

In order to be considered to be “thoroughly wetted” the tops of the prestressed units should be continuously wetted for a minimum of **12 hours prior to the start of a deck placement.**

Immediately prior to the deck placement the tops of the units must be visibly wet but without any standing water.

**Within 24 hours of the start of the deck placement** the tops of the prestressed beams shall receive a high pressure water wash to “remove latence and dirt”. The high pressure water wash shall be sufficiently strong to remove dirt and latence but not so strong that it damages the prestress beams, reinforcing mesh, or epoxy coating on the composite reinforcing. The pressure wash equipment shall be capable of providing pressure of 21-35MPa.

## B. Placing Concrete

All operations in the construction of structural concrete elements have an effect on the final product. Refer to Section 555-IV.B of this manual for concrete placing recommendations. Placement may only commence when proper weather conditions exist. The placement and Curing Flow Chart (See Exhibit 584-A) should be helpful in determining if a placement should commence. Concrete placement may only begin after a **Pre-Placement Meeting** has been held, environmental conditions are favorable, and the Contractor has established means of protecting the concrete from adverse environmental conditions both during placement and curing. Additional recommendations for bridge decks follow.

### 1. General - see Exhibit 557-H

Deck slabs on continuous structures are subject to transverse cracking during construction. The cracking is found in areas where the deck has already been placed and is caused by tensile elongation of the extreme fibers of the beams supporting those areas. The elongation is in response to the downward deflection of the structural support system in the remaining deck areas as the deck is being placed there. The frequency of the cracking can be reduced if proper construction methods are used, and strict control over the timing and sequencing of the deck placement operation is exercised, specifically: proper consolidation, paving train remaining close and immediate texturing and curing.

### 2. Placement Rates

#### a. Effects of Slow Placements

When the concreting operation progresses slowly, some of the previously placed concrete may take its “initial set” prior to full deflection of the steel. As additional concrete is placed during the same placement operation, cracks will occur in concrete which has set. To prevent this from happening, either the duration of the placement should be decreased, or the time to initial set of the concrete should be lengthened.

#### b. Responsibility

The time required to complete a placement depends on its size, complexity, concrete delivery logistics, available rate of supply, and Contractor efficiency.

Responsibility for attaining the highest practical rate of placement, and the shortest possible placement time, at any particular project location, rests with the Contractor.

#### c. Setting Time

The setting time for concrete can vary widely. It depends on many factors, such as mix design, use of admixtures, and atmospheric conditions. Retarding admixtures lengthen the initial set time of the concrete and are required in all bridge deck placements.

#### d. Avoiding Cracking - see Exhibit 557-H

To avoid cracking caused by the occurrence of initial set prior to completion of the placement, the duration of each placement shall be kept to a minimum, and no concrete shall be placed without sufficient retarding admixture.



To avoid shrinkage cracking, prewetting of existing concrete surface or prestressed units shall be performed. Also, timely placement of curing to prevent evaporation is necessary.

3. Loading Sequence - see Exhibit 557-H

a. Importance

Some continuous structures require a total volume of concrete too large to be placed prior to the occurrence of initial set at some point in the deck. The Contract Plans will divide the placement into a sequence of placements when the placement exceeds 275 cubic meters.

b. Location of First Placement

When a sequence of placements is used, the location of the first placement (positive moment areas) is critical. Concrete cannot be placed in negative moment areas first, because subsequent placements will impose tensile stresses on this concrete, resulting in transverse cracking.

c. Avoid Upward Deflections

If any placement results in the upward deflection of concrete previously placed in a positive moment area, the concrete in that area may crack. Consequently, it is necessary to place concrete in each positive moment area during the initial placement. If the volume of concrete required to fully place all positive moment areas is very large, this may be difficult. Initial set could occur before placement is completed. This shall be avoided. The placement rate can be modified. In some cases, the placement rate can be increased by the use of an additional finishing machine.

d. Skewed Structures

On skewed structures, placement of the concrete and operation of the finishing machine should parallel the skew angle up to a 35° skew. Loading the structure in this manner equalizes steel deflections. It may be necessary to operate the finishing machine at a reduced skew angle on certain very wide, highly skewed structures. For skews greater than 35°, the machine should be operated at a skew angle of 35° while the concrete is loaded parallel to the bridge skew, to ensure the stringers are loaded equally.

4. Early Application of Loads

Immediately after initial set, concrete has little or no compressive strength. At this time, minor loads or deflections can cause serious cracking in the new deck. However, compressive strength increases rapidly to a point where moderate stresses (due to loads or deflections) can be resisted. For this reason, deck concrete or machine operation, which will have any measurable effect on recently placed concrete, shall not be placed until adequate early strength may be assumed. Thus, subsequent placements will require a minimum 72 hour cure time between placements.

C. Finishing Concrete

1. Keep Off Finishing Machine

Do not permit workers to walk on, or climb upon, the finishing machine during a placement (except for the necessary operators). The extra weight can increase the deflection of the finishing machine and rails, and cause insufficient cover and/or deck thickness as well as ripples in the deck.

2. Concrete Roll in Front of Machine

Make sure that the proper roll of concrete is maintained on the screed. For full width screeds that oscillate transversely, it should be more or less uniform across its full length. Don't let the roll disappear.

When a single operation (strike-off and finishing) machine of the revolving cylinder or cone type is employed, the manufacturer's recommendation should be followed as to the roll of concrete in front of the cylinder or cone. In general, it should probably extend about two-thirds of the length of the cylinder or cone, beginning at the front end. The roll should not reach the back end of the cylinder or cone.

3. Depth of Cover/Slab Thickness

Again check the thickness of the concrete slab and the depth of cover on reinforcing steel after passage of the finishing machine. Record these checks on the inspector's report. If the cover or slab thickness is found to be deficient, the Contractor should be immediately notified and appropriate remedial action taken.

4. Deck Finishers

a. Required Number

An adequate number of finishers should be available, based on the contract plans, the deck width and amount of finishing required, to finish the deck.

b. Timing of Work

The finishers should be alert to the fact that the timing of their operation, relative to passage of the finishing machine, will change due to changes in weather conditions. On a hot summer day, excessive air temperature changes between early morning and early afternoon can occur, and together with changes in wind intensity, these affect the drying of the concrete surface. The finishers must adjust their operations to cope with these changes. Don't let the finishing lag far behind the concrete placement. This will result in a delay in the application of curing which is not acceptable. This also applies to placement during cold weather.

5. Amount of Finishing

Try to keep hand finishing to a minimum. Do just enough to close up the small surface voids and secure a smooth surface within tolerances. **Try to minimize or eliminate the use of bull floats** as they tend to build in ripples as a reflection of the reinforcing pattern when too much pressure is applied. Furthermore, excessive finishing destroys proper air entrainment at the surface, resulting in scaling and poor freeze/thaw resistance. **Do not permit the application of water by the finishers.** This changes the water/cement ratio of the surface layer and will also result in weaker surface concrete that will probably scale or wear early. The goal is sound concrete from top to bottom over the full expanse of the deck. It is not desirable, but preferable, to have a rough deck rather than a watered down one. Remember the finished deck will have turf drag and saw cut grooving. A perfectly smooth floated surface is not necessary. Pay particular attention to the straight-edge checks at the beginning and end of placements and at end joints

6. Surface Texturing

**Artificial turf drag texturing is to be applied immediately after finishing.** The turf drag texturing is applied manually and cannot be attached to the finishing machine. The turf drag texture shall stop 0.3 meters from the curb. The artificial turf drag must be cleaned or replaced when dirty or clogged with hardened concrete.

Difficulties can occur with the turf drag texturing application which has been known to tear the surface concrete, produce an excessively rough texture, and/or pull coarse aggregates

up from the surface. Application of the turf drag texturing is somewhat of an “art form” and takes a certain amount of skill and practice to properly perform. With the use of “stickier mixes” such as microsilica concrete and high-performance (HP) concretes, texturing has become more difficult but not impossible. **To achieve the best results, texturing should:**

- a. **Be applied as quickly as possible.** Concrete which has been exposed to the environment and allowed to dry will not texture easily.
  - b. **Be done with the artificial turf “attached loosely” to whatever is used as a handle.** Wrapping the artificial turf tightly around a bullfloat will cause variations of pressure during placement to be evident in the surface.
  - c. **Be applied using a uniform down pressure.** Sometimes the weight from the artificial turf and attached handle are too heavy for the application and a slight uplift is required.
7. Delays in Placing/Finishing
- If delays occur to placing and finishing of concrete, protection of placed but unfinished concrete must be performed. Cover in-place concrete with plastic to prevent evaporation. Class HP concrete is particularly sensitive to evaporation and cannot be easily finished if evaporation occurs.

D. Curing of Concrete

Curing is to commence as soon as possible after the finishing operation is complete, without causing any significant damage to the surface. The foregoing time period shall not exceed 30 minutes. The specifications require a minimum cure time of 14 days for superstructure slabs and 7 days for structural approach slabs. The Placement and Curing Flow Chart , Exhibit 557-C, should be helpful when making placement decisions and determining which provisions apply for the placement and curing of concrete during cold conditions. Many Engineers believe the texture of the wet burlap on the surface is cause for alarm. Beginning the curing process quickly is of greater concern than the burlap pattern being left on the deck. Curing should be achieved according to the methods allowed in the specifications.

1. Considerations When Using Burlap

a. Saturation

Burlap must be saturated just prior to its placement and it is important to ensure that the burlap is maintained uniformly wet over its entire surface area. Burlap does not have sufficient wicking ability to transfer moisture to isolated areas. Because of this, soaking hoses and sprinklers, used to keep the burlap wet, should be positioned such that water is directly applied to all portions of the burlap.

b. Potential Safety Hazards

When wet burlap is used on reconstruction projects, where traffic is maintained on the structure, the possibility exists that the travel lane may become continuously wet or, in cold weather, covered with ice as a result of the curing operation. You should be alert to such potential safety hazards and discontinue wet curing if it appears that a safety problem will be created. Also, if the ambient temperature falls to 0°C or below, and freezing water creates a safety hazard, wet curing should be discontinued. If wet curing must be discontinued,

immediately cover the burlap with curing covers and continue the appropriate curing for the specified time interval. Follow winter concreting requirements.

2. Timing

Apply approved curing covers at the proper time. Keep all covers properly overlapped. Rips or tears in the covers or loose fitting covers permit unwanted evaporation of moisture from the concrete. Keep wet type covers (burlap) wet at all times throughout the period of cure. Do not "tent" the covers.

3. Exposed Reinforcing Steel

Special care should be given to insure proper curing of the deck concrete in the fascia area when the reinforcing steel protrudes. Fit wet burlap covers tightly in and around the protruding reinforcing steel and keep it properly wetted down. **These covers should be in place within the first 30 minutes after placement (Ref. EI 98-037).**

Other potential trouble spots are the cavities which result from the removal of the pipe sleeve screed rail supports. When filling these cavities, be aware that any water trapped in them, not removed, which may freeze, will damage the concrete. When the pipe sleeve screed rail support fits over a stud that is welded to the top of the girder, the annular space formed around the stud is particularly susceptible to entrapment of water and subsequent freezing damage.

4. Traffic

Another factor that contributes to the cracking of concrete, with stage construction particularly with respect to decks, is traffic. The vibrations produced by traffic on bridges during the initial set of concrete may cause cracking.

The work zone, its approaches and traffic controls, should be laid out with the intent to minimize acceleration and deceleration, and if practical, speed on the bridge. The lane shift, merge or two way traffic tapers should be far enough from the bridge section to allow traffic flow to stabilize before reaching the bridge. A smooth riding surface, particularly the approaches to the bridge, and a uniform cross section is also recommended to maintain stable, uniform traffic flow. Low operating speeds are desirable, but difficult to obtain. If operating speeds can be safely reduced to 56 kph or less on the approaches to the work zone, a narrowed but uniform section across the bridge may help maintain desirable lower speeds. Flaggers signaling traffic to slow down can also be used. Reduced speeds should be maintained for a minimum of 24 hours.

E. Saw Cut Grooving

The saw cut grooving can be performed after the required curing period, but not before 7 days have elapsed. The grooving must be cut according to all specifications and approved by the Engineer in Charge. Grooving is important for maintaining surface friction during wet weather. Engineers should ensure that the debris or slurry from the saw cuts is being controlled and disposed of in an environmentally safe manner. For further explanation and details on saw cut grooving see Section 558 of the Construction Inspection Manual.

F. Sealing

Sealer should be applied after sawcut grooving operations, but prior to allowing traffic on the deck. This is particularly important for late season placements to protect new concrete from chloride ingress of early salt applications.

## VI. Cold Weather Concreting Operations

### A. Background

All subjects covered in Section 555-V of the Construction Inspection Manual, apply to structural bridge decks. In addition to those general concerns, there are many concerns specific to structural bridge decks. The minimum cure time is 14 days. Remember if 3 days are required, for instance before a closure pour is placed, there must be 3 days of "acceptable" cure time.

### B. Permission

The Standard Specifications are quite clear that if, at time of placement, the weather prediction is for ambient air temperatures to drop below 0°C at any time during the curing period, the placement can only commence if permission to proceed, under §555-3.06 of the New York State Department of Transportation Standard Specifications, is granted by the Engineer in writing. Regardless of written permission, curing and temperature must be maintained as required by the specifications.

### C. Special Requirements for Structural Bridge Decks - see Exhibit 557-H

#### 1. Thermometers

When the temperature for bridge slab placements is expected to drop below 7°C, the Contractor is required to supply continuously recording thermometers. The recordings of these thermometers will be used to determine the actual number of curing hours undergone by the concrete.

#### 2. Enclosures

For bridge deck slab placements, curing temperatures shall be maintained through the use of a six-sided enclosure with external heat. Therefore, in this case, **the application of insulated curing blankets alone to maintain adequate curing temperatures on a structural slab would not be acceptable.** The bottom of the slab must be completely surrounded by the enclosure, as the bottoms of the forms can not be considered part of the enclosure. The forms must be considered as part of the slab.

## VII. Hot Weather Concreting Operations

See Section 555-VI of the "Construction Inspection Manual" & Exhibit 557-H.

### Contacts

For any other concerns not covered here or questions dealing with portland cement concrete, please contact the Regional Materials Engineer, or the Materials Bureau in Albany at (518) 457-5956.

For general construction concerns, contact the Structures Division at (518) 457-7677.

### References

NYS Steel Construction Manual

NYS Standard Specifications §555-3.06

EB 97-040, Surface Preparation of Prestressed Concrete Beams Prior to Deck Placement

EB 98-037, Bridge Deck Construction Specification Improvements-Implementation of Recommendations by the Bridge Deck Task Force

### Related Contract Provisions

NYS Standard Specifications §736-01

Construction Inspection Manual §555-00

Construction Inspection Manual §558-00



## PRIOR TO THE POUR

The following should be checked by the inspection staff prior to the dry run of the concrete finishing machine.

- Forms have been installed with the correct haunch. Typically a 50 mm minimum haunch is required.
- Stay-in-place forms should be installed so that the form section being loaded with concrete first, laps over the unloaded section in order to prevent separation. Styrofoam inserts should be glued or taped in place. The pour direction is usually from fixed end to expansion end. When grades are greater than 3%, the pour should be from low end to high end.
- For concrete beams, check the elevations of the top of beam against the camber and deflection chart to determine high points which will be the control points for the minimum deck thickness.
- The lower mat of the reinforcing steel should be tied to shear studs. Both top and bottom mats should be supported to prevent sagging when walked on. Supports should be no more than 1.2 m apart, and no less than 150 mm from any finished edge. Bars should be properly supported at the transverse joints so that they will not flex down into the haunch area. The two mats should be tied together.
- The bridge rail anchor plates and posts are installed at proper locations. Threads of anchor bolts should be protected to prevent being spoiled by the concrete pour.
- Check the locations of all key ways, drip edges and utility brackets.
- Check the elevation and location of scuppers.
- All outer walkways should be adequately supported and safety railings installed. Walkways should be safely accessible from both sides of the span.
- Check the area round all of the bearings to ensure that they are clean of debris and free to move as the dead load camber comes out during the pour.

### **Exhibit 557-D**

## PRE-PLACEMENT MEETING

A Concrete Pre-Placement Meeting shall be held at least one week prior to the start of any concrete placement for superstructure slabs. All aspects of the proposed placement shall be reviewed and approved by the E.I.C. Minutes to this meeting shall be recorded and kept in the project files.

The following is a list of generic topics that should be addressed during the Pre-Placement Meeting. Project specific concerns should also be included.

1. Attendance: EIC, Resident, Inspector, Contractor, Concrete Plant Rep, Reg. Materials Engineer (RME).
2. Concrete: Quantity? Rate of placement? Number of trucks to be used? Is the plant approved? Will the Plant Rep be on site during the pour?
3. Concrete Mix Design: Allowable air content and slump. Type and quantity of admixtures to be used. (The RME should review the proposed dosage rates)  
NO WATER IS TO BE ADDED TO THE MIX ON SITE!
4. M & PT: Will lane closures be required? Flaggers? Where will trucks stage? Where will trucks wash out?
5. Concrete Placement: How will concrete be placed? (i.e. pumps, crane/bucket, mechanical buggies, etc.) What is the back up method?
6. Finishing Machine: Is the machine approved? When will the machine be dry run? Will mid-pour adjustment be required? Who will make them?
7. Curing Procedures: 14 day cure is required, except 7 days for structural approach slabs, curbs, sidewalks, and safety walks on bridges. Where will water supply come from? How will curing be monitored? Is cold temperatures anticipated? Are all materials on site? (Ref. EI 98-037)
8. Weather Conditions: No concrete shall be placed until environmental conditions are deemed favorable. The contractor shall provide the proper equipment to monitor air temp, humidity, and the evaporation rate. Table 555-3 of the Standard Specifications should also be used.
9. Work Force: Have the contractor supply a list of the work force for the day. Each person should be assigned to no more than one task.
10. Safety: Fall protection, overhead wires, vehicle backing, moving parts on the finishing machine, etc.

### Exhibit 557-E



## FINISHING MACHINE - DRY RUN

The dry run of the concrete finishing machine should be done the day before the pour.

1. Check the elevations of the end dams and bulkheads at all expansion joints.
2. Travel Rail: Typically 50 mm, schedule 80 pipe. Adjustable chairs (or cups) should be spaced no more than 600 mm inches apart. Each travel rail should maintain a constant height above the finished grade. Travel rails should always be parallel to each other.
3. Check the location of the crown, if any. A hinged joint of the finishing machine frame must be at the crown.
4. Carriage Rail: String line the carriage rail (both front and back) between breaks in grade. Any dip or bump in this rail will be reflected in the finished deck. Use a 1.2 m level or a slope board to check the pitch of the carriage rail. On skewed decks, the pitch may not be the same as the proposed pitch perpendicular to centerline.
5. Finishing Rollers: Visually inspect the rollers for cleanliness. Rollers should be parallel to each other, and to the finished grade. To check this, hold a 1.2 m level across the bottom of the rollers directly under the front carriage rail. Measure from the top of the level to the carriage rail, take measurements on both the left and the right side of the rollers. Both measurements should be identical. Repeat this under the rear carriage rail. The rear of the rollers should be 3 mm higher than the front.
6. Have the contractor start the machine. Let the carriage ride over the first end dam. The front of the finishing rollers should clear this form by less than 1.6 mm. As the machine is driven forward, this step should be repeated over all bulkheads. Deck thickness should be checked at a minimum 10 locations across the span. The cover above the top mat of steel should also be checked.
7. The carriage should be moved as close as possible to the longitudinal form. Use a straight edge across the bottom of the finishing rollers extended to the marked finish grade. The straight edge should line up with the grade mark.
8. Have the contractor set the carriage travel limits. Allow the carriage to run transversely across the deck. Watch that the carriage stops short of all forms and bridge rail supports.
9. While the machine is running, look for the following:
  - Does the travel rail sag between supports?
  - Does the travel rail wobble when the carriage changes direction?
  - Do the augers rotate in the correct direction?
  - Does the roller direction change when the carriage direction changes?
  - How far does the machine advance when the carriage direction changes?  
(5 to 150 mm is preferred)
  - Are there any signs of fuel leaks?

### Exhibit 557-F

## DAY OF THE POUR

- Inspectors should be equipped with and familiar with the following:
  - MURK 5 - Structural Concrete Report
  - Concrete thermometer
  - Slump cone
  - 2 Air meters
  - 2m Ruler
  - Adequate number of cylinder molds
  - Table 555-3 and worksheet
- Check that the following is on site:
  - Concrete pump and alternate
  - Backup power source for vibrators
  - Plastic and extra burlap to prevent a cold joint if the pour is delayed
  - Water supply for curing
  - Concrete supplier's representative
- Check that the finishing machine has not been tampered with since the dry run.
- Document weather conditions and evaporation rate prior to the start of the pour, and hourly during the pour, using Table 555-3 of the Specifications. Make appropriate changes accordingly.
- All concrete trucks should have NYSDOT inspection stickers (usually inside the cab), and counters in working condition.
- Temperature, air content and slump should be tested on the first truck. Advise the plant representative of any deficiencies.
- Keep an adequate amount of concrete in front of the augers of the finishing machine, usually half the height of the auger. Do not allow laborers to try to "grade" the concrete.
- Ensure that proper vibrating techniques are being used. Do not permit laborers to use the vibrators to move the concrete.
- Watch that the drag pan is properly sealing the finished concrete. The pan may have to be weighed down to prevent "skipping". Too much weight may cause ruts.
- Watch that finishers and laborers placing soaked burlap keep up with the concrete placement. If not, slow the machine and placement down.
- If the approach slab is to be poured continuously with the deck, construct the recess joint before placement of soaked burlap.

### Exhibit 557-G

## SPECIAL CIRCUMSTANCES

- Hot Weather: SIP forms should be cooled with water. Remove all excess water prior to concrete placement. Check evaporation rate often. Wet burlap should be placed as soon as concrete is finished and textured. Slow down the finishing machine if the laborers cannot keep up.
- Cold Weather: The ambient air temperature must be 7°C or higher. The surface temperature of all forms, steel, and existing concrete that will be in contact with fresh concrete shall be 7°C or higher. This may require insulating the area to be poured overnight prior to the pour. The contractor shall submit for approval by the E.I.C. a proposed curing procedure that will maintain the curing temperatures between 7°C and 30°C for the duration of the curing period. Refer to Specification Section 555-3.06.
- Continuous Structure Span: Remember, NO WELDING IN TENSION ZONES! This includes the installation of stay in place forms.

To minimize transverse cracking:

- The duration of each placement should be kept to a minimum and sufficient retarding admixture used to ensure initial set will not occur prior to the completion of the pour.
- If the volume of concrete is too large to be placed prior to the initial set, a pour sequence will be used. When a sequence of placement is used, the location of the first placement is very important. If any placement results in an upward deflection of concrete previously placed, the area of concrete will be prone to cracking. Generally a 72 hour waiting period between placements is required.
- On skewed bridge decks, it is important not only that the finishing machine be parallel to the skew, but the concrete placement should also parallel the skew.

## Exhibit 557-H

## SECTION 558 - TRANSVERSE SAWCUT GROOVING OF STRUCTURAL SLAB SURFACE

### Related Instruction

The final surface texture on bridge deck slabs and overlays is to be obtained by transverse sawcut grooving. Grooving shall not begin until the proper curing period has elapsed. Grooving is done before the penetrating sealer is applied.

Establishing containment to protect under feature is an important procedure to be included when transverse sawcut grooving bridge deck slabs and overlays. Transverse grooving involves wet cutting concrete and creates a lot of slurry. Slurry must be channeled and contained.

#### 1. Procedure

The grooving patterns shall be established as follows:

- a. Lay out a line 0.15 m from and parallel to all joint assemblies.
- b. Make the first full width pass which can be made near one end of the span.
- c. Fill in the skew areas and subsequent full width passes from the first full width pass (see Exhibit 558-A).
- d. Grooving shall terminate no closer than 0.30 m from curbs or drainage structures unless otherwise indicated on the contract plans.

#### 2. Grooving in Sections

When grooving a deck in stage construction, grooves will not have to be lined up from one part to the next; i.e., adjacent lanes or in the skew areas. Grooving shall never be overlapped for any reason.

#### 3. Curved Decks

Curved decks require special treatment. In general, the grooving passes should be made radial to the center of the curve with ungrooved gores at the outside of the curve (see Exhibit 558-B). If the radius of the curve is such that the width of the gores exceeds 0.10 m, the first pass shall be normal to the center line of the span at mid-span and subsequent passes shall parallel the initial pass (see Exhibit 558-C).

#### 4. Inspection

A constant check shall be maintained on the geometry of the grooves. The width and spacing of the grooves are important to ensure that the grooves perform their intended function. The depth of the groove is also necessary for the functional performance of the grooves and, in addition, it determines the usable life of the grooved surface.

If the Contractor is not obtaining proper groove geometry as required by the specifications, the operation shall be stopped and the equipment adjusted to obtain proper groove geometry; i.e., adjust blade spacing and/or replace blades. Occasional areas with a depth shallower than specified shall be allowed if they result solely from unevenness of the deck surface and constitute no more than 10% of any single pass.

#### 5. Traffic

When decks are overlaid in a "lane-at-a-time" configuration, traffic will be allowed to travel on a completed turf-dragged surface prior to sawcutting, if the Contractor chooses to apply the sawcutting full width.

Grooving is done before the penetrating sealer is applied.

## SECTION 562 - PRECAST CONCRETE

### **Receiving Units at the Job Site**

The Engineer shall review the specifications, the Prestressed Concrete Construction Manual, and the approved shop drawings for the precast concrete before receiving the units.. Units shall be inspected by the Engineer upon arrival at the construction site for compliance with all provisions of the specifications in addition to the following:

1. Inspector's Stamp of Approval on all units.
2. Receive Report of Acceptance of Structural Concrete from the transporter and check that the units meet the description. If any of the following conditions are not met, the chance of damage during shipment are increased:
  - A. The units are properly supported.
  - B. The units are adequately tied to prevent movement during shipping.
  - C. Plastic guards or other devices are used to protect the concrete where anchor chains would otherwise be in direct contact with the unit.
3. Any damage during shipment (cracks, spalls, etc.).
4. All dimensional tolerances in the specifications for the unit.
5. Bugholes or other visual defects of fascia units or other visible components.

Report all non-compliance to the Concrete Engineering Unit.

The Contractor shall handle and store the concrete units with extreme care to prevent damage to the units.

### **Rejection of Units**

Units which, as determined by the Engineer, are damaged beyond repair or which do not meet dimensional tolerances shall be rejected by the Engineer and replaced with acceptable units furnished by the Contractor.

Rejection of a unit shall be done only with the concurrence of the DCES.

### **Erection**

#### **Erection Plan**

A minimum 30 days prior to erection of the units, the Contractor shall furnish the erection procedure to the Regional Director, as required by Subsection 2.6 of the Prestressed Concrete Construction

Manual, with detailed information concerning the proposed method of construction, including handling of the precast units, and the construction equipment the contractor plans to use. Any handling of the precast units at the job site shall be considered as part of the erection. Erection shall not begin until the required erection plan, including erection drawings, have been reviewed and approved by the Department. No extra payment will be made to the Contractor for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Contractor's handling and erection equipment or the erection scheme.

### **Three Sided Frames, Footings, Invert Slabs, Wingwalls, etc.**

Manufacturer's Representative:

The Contractor shall require the Manufacturer of the precast units to provide technical assistance and an on site representative during installation.

Lifting:

Check for the piece mark and compare it to the framing plan in the shop drawings. The pieces are often not symmetric and their orientation is important. Each piece has inserts for the purpose of lifting and may also contain inserts for framing, railing, post tensioning, and drawing the pieces together after placement. Observe the lifting and ascertain that it is done according to the erection drawings, using the correct lifting inserts.

Placing:

The pieces are placed on shims within a channel in the footing. Each piece should be placed according to the contract drawings such that the roof slabs are all in the same plane. Sometimes this is a horizontal plane, sometimes it is on a slope. Avoid placing pieces such that the roofs or legs are placed in a sawtooth fashion.

### **Shear Key Joints**

Keyway Surface Cleaning:

The keyway surface shall be sandblast cleaned of any material which may prevent bonding (i.e. - oil, grease, water, dirt, etc.). This work may be done at the fabrication plant, or in the field. However, it shall be done prior to erection. If the sandblasting is to be done at the fabrication plant, the working drawings shall so indicate.

Preparation for Placement:

Prior to placing the grout, keyway surfaces shall be thoroughly wetted continuously with clean water during the preceding of 24 hours or as recommended by the grout material manufacturer. This wetting requirement will be waived if the keyway surfaces were coated with a penetrating sealer after the surface was blast cleaned.

After cleaning, the keyway shall be tightly sealed above the bottom of the shear key to prevent material loss. The work shall be done in such a manner that the sealing material shall be at least 5 mm above the shear key bottom. After sealing operations are completed, the Engineer shall inspect the work to ensure that the sealing material level is at least 5 mm above the shear key bottom. All sealed locations in violation of this requirement shall be corrected at no additional expense. No further work will be done to the shear key prior to the Engineer's inspection and approval of the sealing operations. The ends of the keyway shall also be sealed to prevent material loss.

Grout Mixing-General:

The following mixing requirements shall be adhered to:

1. Mixing shall be done as close as possible to the keyway to be filled.
2. All necessary equipment for mixing and placing shall be present at the work site prior to the start of mixing. All equipment shall be in good working order as determined by the Engineer.
3. Material which, in the Engineer's opinion is not pourable, exhibits signs of setting or hardening, prior to placement, shall not be incorporated in the work. It shall be removed from the work site.

Placement:

Placement of Cement Based Grout Material for Shear Keys.

1. The Grout manufacturer's instructions regarding mixing and placing shall be followed, except that:
  - A. No aggregate shall be added to the grout.

- B. The actual water to cement (W/C) ratio used shall comply exactly with the value given for the specific product as published in the Department's approved list titled: Cement Based Grout Materials for Shear Keys, §701-06.
  - C. Grout shall not be placed during rainfalls.
  - D. Grout shall not be placed if the ambient temperature is outside the range of 7°C to 35°C.
- 2. Only one shear key shall be filled at a time. Filling shall begin at one end of the key and proceed continuously to the opposite end. No placement interruptions will be permitted. Grout shall be thoroughly rodded as it is placed in the keyway. Grout shall be finished flush with the top of keyway. When a differential exists between top corners of adjacent beams at the shear key joint, the grout shall be filled to the higher beam and towel finished at a 1 on 4 slope to the lower beam.
  - 3. Curing shall be in accordance with the Grout Manufacturer's instructions unless otherwise required by the Engineer. The Contractor shall supply and place suitable curing blankets over the grout after placement. Such blankets shall be kept saturated damp, with clean water, for at least six (6) hours. Blankets shall be placed as soon as practicable after placement has been completed, but, under no circumstances, later than one (1) hour subsequent to placement.

Loading:

No loading of any span will be permitted until the following events have occurred, unless otherwise approved by the DCES:

- 1. All of the longitudinal shear keys of the span have been filled with shear key material.
- 2. At least 24 hours have elapsed from the time the last keyway was filled.
- 3. Tensioning of transverse ties is completed.

Tensioning of Transverse Ties:

These shall be tensioned to the force shown on the plans. Tensioning shall be done according to requirements of the specification. Tensioning shall be completed prior to performing any further work on the superstructure.

Grouting of ties shall be done according to requirements of the specification. Anchorage block-outs of fascia units shall be filled with anchorage block-out grout. Grout meeting the requirements of §701-05 or §701-06 shall be prepared and applied in accordance with the Manufacturer's instructions. Epoxy grout systems shall be prepared and applied in accordance with the Manufacturer's instructions. Epoxy grout systems shall be mixed and placed in accordance with the requirements of Subsection 502-3.15 of the Standard Specifications.

The temperature of the surface against which the grout is to be placed shall be at least 7°C. No placement of grout shall be permitted if the ambient temperature is less than 7°C. After the grout has been placed, it shall be dusted with the same brand and type of cement used in the production of the concrete units. Color to match the surrounding concrete surface.

## **Miscellaneous Repairs of Precast Concrete**

### **General**

Written repair procedures, together with sketches necessary to describe the deficiencies and the proposed repair, shall be prepared by the Contractor and submitted to the Engineer for approval.

### **Required Information**

When written repair procedures are required for the repair of defects, repair procedure drawings shall be prepared to show the defects in the plan view, elevation and section as necessary to adequately locate and describe the defect and the proposed repair. The proposed repair procedure shall be described in detail including, where applicable, the following information, listed in a proposed sequence of operation.

1. The reason or probable reason why the defect occurred.
2. Color pictures and sketches showing plan views and sections indicating the size of the defect.
3. Removal of unsuitable material. Prior to beginning the repair, all spalled or disintegrated concrete shall be removed by chipping the unsuitable material away until sound concrete is reached. The type and size of tools and the depth at which sound concrete is reached shall be determined by the Engineer.
4. Blast Cleaning Surfaces. All surfaces to be repaired shall be thoroughly blast cleaned.

### **Repair**

Repairs shall be made with one of the following materials: epoxy grout comprised of an epoxy resin system (721-01); epoxy polysulfide grout (721-03), mixed with fine aggregate or a (701 Series) cementitious grout. The grout shall be mixed and placed in accordance with the following:

#### **1. Mixing:**

No mixing shall be started until all preparations have been made to use the grout. The Contractor shall be familiar with the working life limitations of the grout being used, and his operations shall be governed accordingly. Mixing shall be carried out in strict accordance with the Manufacturer's instructions or directions contained in the Department's Approved List manual and the following:

- a. Mixing shall be done as close as possible to the portion to be repaired.
- b. All necessary equipment for mixing and placing shall be present at the site, and in good working order, prior to the start of mixing.
- c. The epoxy grout shall be proportioned by volume in the approximate ratio of two (2) parts fine aggregate to one (1) part epoxy. The exact ratio of sand to epoxy resin system shall be determined on-site to produce a dense void-free grout.
- d. Dry, fine aggregate shall be placed in the mix container first. It shall be thoroughly agitated prior to the addition of the epoxy.
- e. The two components of the epoxy system shall be thoroughly mixed together before added to the fine aggregate.
- f. The epoxy shall be added to the fine aggregate slowly, but mixing time shall not exceed three minutes.
- g. All epoxy grout, in any individual batch, shall be used within 25 minutes after the start of mixing of the two components to create the epoxy system. All grout not used within the time limit shall be discarded.
- h. The grout shall not be retempered.
- i. No solvent, thinner or other foreign material shall be added directly to either the individual components or the epoxy mixture.

#### **2. Placing:**

The grout shall be placed against a clean, primed receiving surface, in accordance with the following:

- a. The receiving surface shall be cleaned of all oil, grease or other material, which may prevent effective bond, immediately prior to priming the surface with neat epoxy (epoxy without aggregate) or cementitious paste.
- b. The priming of the receiving surface shall be done immediately prior to the placement of the grout.



- c. The grout shall be placed quickly and continuously. It shall not be overworked.
- d. The temperature of the receiving surface shall be above 7°C at the time of grout placement.
- e. Grout placement shall not be permitted when ambient temperatures are 7°C or lower, unless methods of protection, acceptable to the Inspector, are employed. Methods of protection, if permitted, shall be continued for a period of 15 hours following grout placement. The 15 hour period may be shortened, at the discretion of the Inspector, but, under no circumstances will it be less than 12 hours. Methods of protection, if permitted, are conveniences granted by the State. As such, they are not considered extra work, and, therefore, they are not entitled to extra compensation.
- f. Upon completion of grout placement, the new surface of the repaired area shall be flush with the adjacent surfaces, unless the design of the unit specifically required otherwise.
- g. On surfaces which will be exposed to view after installation, the repaired area shall be color matched to the adjacent surfaces by use of cement dust, or other means acceptable to the Inspector.

3. Post Repair Inspection and Acceptance:

The Engineer shall inspect the whole unit especially the areas that have been repaired. The unit shall comply with all requirements of the specifications before accepting the unit.

## **SECTION 563 - PRESTRESSED CONCRETE UNITS (STRUCTURAL)**

### **Receiving Units at the Job Site**

The Engineer shall review the specifications, the Prestressed Concrete Construction Manual, and the approved shop drawings for the prestressed concrete before receiving the units.. Units shall be inspected by the Engineer upon arrival at the construction site for compliance with all provisions of the specifications in addition to the following:

1. Inspector's Stamp of Approval on all units.
2. Receive Report of Acceptance of Structural Concrete, Exhibit 563-A, from the transporter and check that the units meet the description. If any of the following conditions are not met, the chance of damage having occurred during shipment are increased:
  - A. The units are properly supported at the bearing points.
  - B. The units are adequately tied to prevent movement during shipping.
  - C. Plastic guards or other devices are used to protect the concrete where anchor chains would otherwise be in direct contact with the beam.
3. Damage during shipment (cracks, spalls, etc.).
4. Camber - within the tolerance of the camber shown on the contract drawings.  
Note: Measured camber in prestressed units can vary from the actual camber due to changes in atmospheric temperature, exposure to sunlight, variations in beam support location, etc.
5. All dimensional tolerances in the specifications for the unit.
6. Bugholes or other visual defects of fascia units or other visible components.

Report all non-compliance to the Concrete Engineering Unit.

The Contractor shall handle and store the concrete units with extreme care to prevent damage to the units.

### **Rejection of Units**

Units which, as determined by the Engineer, are damaged beyond repair or which do not meet dimensional tolerances shall be rejected by the Engineer and replaced with acceptable units furnished by the Contractor.

Rejection of a unit shall be done only with the concurrence of the DCES.

### **Erection**

A minimum 30 days prior to erection of the units, the Contractor shall furnish the erection procedure to the Regional Director, as required by Subsection 2.6 of the Prestressed Concrete Construction Manual, with detailed information concerning the proposed method of construction, including handling of the prestressed units, and the construction equipment the contractor plans to use. Any handling of the prestressed units at the job site shall be considered as part of the erection. Erection shall not begin until the required erection plan, including erection drawings, have been reviewed and approved by the Department. No extra payment will be made to the Contractor for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Contractor's handling and erection equipment or the erection scheme.

- A. The bridge seat shall be formed and screeded such that the bridge seat is level in the direction of the longitudinal axis of the beams. Bearing surfaces shall be properly finished and formed to provide full and even supporting surfaces for bearings, bearing plates and concrete units.
- B. Forms should be adequate to withstand the loads to be applied and they should be properly supported. The forms are the contractor's responsibility but the state representative should be alert to any obvious weaknesses in the installation and call them to his attention.
- C. Support systems should be checked for good workmanship. Compare insert locations with those shown on the shop drawings and contract drawings.

### **Adjacent Box Beams and Hollow Slab Units**

#### Seating of Beams and Slabs:

Box beams and hollow slabs should be firmly seated and not rock during the preparation and pouring of the shear keys. If any beam rocks, the reason for such rocking shall be discovered and corrected.

#### Transverse Tie Rods, Strands and Anchor Rods:

The installation of the tie rods, strands and anchor dowels shall comply with the requirements shown on the plans. However, the shear keys shall be grouted and transverse post-tensioning completed prior to the placement of the anchor dowels. Stage construction may require a different sequence for post-tensioning.

#### Differential Camber:

When differential camber between units is more than 10 mm the contractor shall submit a corrective action plan to the Engineer. EIC's are encouraged to contact the Concrete Engineering Unit of the Structures Division for guidance if necessary, before approving the plan.

### **Shear Key Joints**

#### Keyway Surface Cleaning:

The keyway surface shall be sandblast cleaned of any material which may prevent bonding (i.e. - oil, grease, water, dirt, etc.). This work may be done at the fabrication plant, or in the field. However, it shall be done prior to erection. If the sandblasting is to be done at the fabrication plant, the working drawings shall so indicate.

#### Preparation for Placement:

Prior to placing the grout, keyway surfaces shall be thoroughly wetted continuously with clean water during the preceding of 24 hours or as recommended by the grout material manufacturer. This wetting requirement will be waived if the keyway surfaces were coated with a penetrating sealer after the surface was blast cleaned.

After cleaning, the keyway shall be tightly sealed above the bottom of the shear key to prevent material loss. The work shall be done in such a manner that the sealing material shall be at least 5 mm above the shear key bottom. After sealing operations are completed, the Engineer shall inspect the work to ensure that the sealing material level is at least 5 mm above the shear key bottom. All sealed locations in violation of this requirement shall be corrected at no additional expense. No

further work will be done to the shear key prior to the Engineer's inspection and approval of the sealing operations. The ends of the keyway shall also be sealed to prevent material loss.

#### Grout Mixing-General:

The following mixing requirements shall be adhered to:

1. Mixing shall be done as close as possible to the keyway to be filled.
2. All necessary equipment for mixing and placing shall be present at the work site prior to the start of mixing. All equipment shall be in good working order as determined by the Engineer.
3. Material which, in the Engineer's opinion is not pourable, exhibits signs of setting or hardening, prior to placement, shall not be incorporated in the work. It shall be removed from the work site.

#### Placement:

Placement of Cement Based Grout Material for Shear Keys.

1. The Grout manufacturer's instructions regarding mixing and placing shall be followed, except that:
  - A. No aggregate shall be added to the grout.
  - B. The actual water to cement (W/C) ratio used shall comply exactly with the value given for the specific product as published in the Department's approved list titled: Cement Based Grout Materials for Shear Keys, §701-06.
  - C. Grout shall not be placed during rainfalls.
  - D. Grout shall not be placed if the ambient temperature is outside the range of 7°C to 35°C.
2. Only one shear key shall be filled at a time. Filling shall begin at one end of the key and proceed continuously to the opposite end. No placement interruptions will be permitted. Grout shall be thoroughly rodded as it is placed in the keyway. Grout shall be finished flush with the top of keyway. When a differential exists between top corners of adjacent beams at the shear key joint, the grout shall be filled to the higher beam and towel finished at a 1 on 4 slope to the lower beam.
3. Curing shall be in accordance with the Grout Manufacturer's instructions unless otherwise required by the Engineer. The Contractor shall supply and place suitable curing blankets over the grout after placement. Such blankets shall be kept saturated damp, with clean water, for at least six (6) hours. Blankets shall be placed as soon as practicable after placement has been completed, but, under no circumstances, later than one (1) hour subsequent to placement.

#### Loading:

No loading of any span will be permitted until the following events have occurred, unless otherwise approved by the DCES:

1. All of the longitudinal shear keys of the span have been filled with shear key material.
2. At least 24 hours have elapsed from the time the last keyway was filled.
3. Tensioning of transverse ties is completed.

#### Tensioning of Transverse Ties:

These shall be tensioned to the force shown on the plans. Tensioning shall be done according to requirements of the specification. Tensioning shall be completed prior to performing any further work on the superstructure.

Grouting of ties shall be done according to requirements of the specification. Anchorage block-outs of fascia units shall be filled with anchorage block-out grout. Grout meeting the requirements of §701-05 or §701-06 shall be prepared and applied in accordance with the Manufacturer's instructions. Epoxy grout systems shall be prepared and applied in accordance with the Manufacturer's instructions. Epoxy grout systems shall be mixed and placed in accordance with the requirements of Subsection 502-3.15 of the Standard Specifications.

The temperature of the surface against which the grout is to be placed shall be at least 7°C. No placement of grout shall be permitted if the ambient temperature is less than 7°C. After the grout has been placed, it shall be dusted with the same brand and type of cement used in the production of the concrete units. Color to match the surrounding concrete surface.

### **Stage Construction Camber Differences (Adjacent Beam Structures)**

On stage construction projects, particular attention shall be given to the camber of stage II beams. The Engineer shall ascertain that the required minimum slab thickness for stage II deck can be achieved. If the Engineer is not certain that the minimum slab thickness for stage II can be achieved, contact the Concrete Engineering Unit for direction.

### **Spread Box Beams, AASHTO I-Beams and Bulb Tees**

- A. Check the haunch depths before setting forms.
- B. Diaphragms temporary or permanent shall be installed properly before pouring the deck concrete.

### **Miscellaneous Repairs of Prestressed Concrete** **General**

When the Engineer determines that a unit with minor damage can be repaired the contractor shall be asked to submit a written repair procedure, together with sketches necessary to describe the deficiencies and the proposed repair. The Contractor shall be allowed to proceed with the repair only after a thorough review of the submitted procedure and approval by the Engineer.

### **Required Information**

When written repair procedures are required for the repair of defects, repair procedure drawings shall be prepared to show the defects in the plan view, elevation and section as necessary to adequately locate and describe the defect and the proposed repair. The proposed repair procedure shall be described in detail including, where applicable, the following information, listed in a proposed sequence of operation.

1. The reason or probable reason why the defect occurred.
2. Color pictures and sketches showing plan views and sections indicating the size of the defect.
3. Removal of unsuitable material. Prior to beginning the repair, all spalled or disintegrated concrete shall be removed by chipping the unsuitable material away until sound concrete is reached. The type and size of tools and the depth at which sound concrete is reached shall be determined by the Engineer.
4. Blast Cleaning Surfaces. All surfaces to be repaired shall be thoroughly blast cleaned.

## Repair

Repairs shall be made with one of the following materials: epoxy grout comprised of an epoxy resin system (721-01); epoxy polysulfide grout (721-03), mixed with fine aggregate or a (701 Series) cementitious grout. The grout shall be mixed and placed in accordance with the following:

### 1. Mixing:

No mixing shall be started until all preparations have been made to use the grout. The Contractor shall be familiar with the working life limitations of the grout being used, and his operations shall be governed accordingly. Mixing shall be carried out in strict accordance with the Manufacturer's instructions or directions contained in the Department's Approved List manual and the following:

- a. Mixing shall be done as close as possible to the portion to be repaired.
- b. All necessary equipment for mixing and placing shall be present at the site, and in good working order, prior to the start of mixing.
- c. The epoxy grout shall be proportioned by volume in the approximate ratio of two (2) parts fine aggregate to one (1) part epoxy. The exact ratio of sand to epoxy resin system shall be determined on-site to produce a dense void-free grout.
- d. Dry, fine aggregate shall be placed in the mix container first. It shall be thoroughly agitated prior to the addition of the epoxy.
- e. The two components of the epoxy system shall be thoroughly mixed together before added to the fine aggregate.
- f. The epoxy shall be added to the fine aggregate slowly, but mixing time shall not exceed three minutes.
- g. All epoxy grout, in any individual batch, shall be used within 25 minutes after the start of mixing of the two components to create the epoxy system. All grout not used within the time limit shall be discarded.
- h. The grout shall not be retempered.
- i. No solvent, thinner or other foreign material shall be added directly to either the individual components or the epoxy mixture.

### 2. Placing:

The grout shall be placed against a clean, primed receiving surface, in accordance with the following:

- a. The receiving surface shall be cleaned of all oil, grease or other material, which may prevent effective bond, immediately prior to priming the surface with neat epoxy (epoxy without aggregate) or cementitious paste.
- b. The priming of the receiving surface shall be done immediately prior to the placement of the grout.
- c. The grout shall be placed quickly and continuously. It shall not be overworked.
- d. The temperature of the receiving surface shall be above 7°C at the time of grout placement.
- e. Grout placement shall not be permitted when ambient temperatures are 7°C or lower, unless methods of protection, acceptable to the Inspector, are employed. Methods of protection, if permitted, shall be continued for a period of 15 hours following grout placement. The 15 hour period may be shortened, at the discretion of the Inspector, but, under no circumstances will it be less than 12 hours. Methods of protection, if permitted, are conveniences granted by the State. As such, they are not considered extra work, and, therefore, they are not entitled to extra compensation.
- f. Upon completion of grout placement, the new surface of the repaired area shall be flush with the adjacent surfaces, unless the design of the unit specifically required otherwise.

- g. On surfaces which will be exposed to view after installation, the repaired area shall be color matched to the adjacent surfaces by use of cement dust, or other means acceptable to the Inspector.

3. Post Repair Inspection and Acceptance:

The Engineer shall inspect the whole unit especially the areas that have been repaired. The unit shall comply with all requirements of the specifications before accepting the unit.

## SECTION 564 - STRUCTURAL STEEL

### Description

Under this section of the Specification, the contractor shall follow the requirements of Section 106-01, Source of Supply and Quality Requirements. Materials provided for the project have to be sampled and tested by groups within the Department. It is critical to the project that these notifications occur early in the project time line. The State must have Quality Assurance oversight of the fabrication and approved welding procedures must be in place prior to the commencement of work.

### Materials

Subsection 715-01 establishes the requirements for inspection and acceptance of steel plate and rolled shapes. The responsible person in the field should make certain that the material specified in the contract documents and approved shop drawings is that which is accepted at the site. The specification may call out steel with improved toughness requirements when the material is in tension or is used in a fracture critical application. These provisions should be clearly indicated in mill test reports (see Exhibit 564-C & D) submitted for acceptance.

### Basis of Payment

Original shop drawings that are approved and distributed become the property of the State after project completion and must be submitted to the Deputy Chief Engineer Structures (DCES) prior to final payment. This is under the provisions of Section 202.8 of the New York State Steel Construction Manual (SCM).

### Partial Payment

Under provisions of Section 100, the Contractor is eligible for partial payment for the percent of completed steel that is delivered but not erected. The Contractor requests the payment through the EIC. Upon confirming through the DCES that the steel has been fabricated in accordance with the SCM, partial payment can be issued for the stored steel.

### Additional Work

Field Fabrication

### Field Verification

In the case of rehabilitations, field measurements are critical to the proper reassembly or refabrication of the bridge superstructure. Often contractors will try to use "As Built" Drawings or existing Shop Drawings in lieu of field survey. This method assumes that no field modifications occurred during the original construction contract. Also, the plans may not consider remedial maintenance work that may have occurred on an interim basis. If the reconstruction notes direct the contractor to perform a field survey, this function **should not** be waived. This is especially true of riveted structures where the connections and splice patterns may be irregular or not meet current (SCM) guidelines for edge distance and center to center spacings.

### Field Drilling

This operation may be done by either using a twist drill or a core drill. The core drill is usually preferred because of the speed of operation. The drill will have a magnetic base and use a press type arm to apply pressure while drilling through the steel. This allows the operator to make cylindrical holes free from burrs. Chapter 10 of the SCM controls tolerances for out of round and percentage of non uniform holes in any pattern.

### Field Tolerances

Many of the shop and field dimensional tolerances for steel fabricated bridge components are listed in Chapter 12 of the SCM. These tolerances dictate the fabrication methods and controls that are in place in Chapter 11 under Assembly. These are most difficult to control when the fabrication is connecting main



members such as an extension to a steel cap beam or extending floor beams. The methods allowed are full size drilling from the solid or drilling subsized holes and reaming to full size.

## **Field Welding**

### **General**

Department personnel involved in field welding of structural steel (new or existing) shall ensure that the Contractor is in compliance with all applicable provisions of the Standard Specifications, the New York State Steel Construction Manual (SCM), and any special contract provisions.

Subsection 564-3, Structural Steel, Construction Details of the Standard Specification, states: “. . . all structural steel work, including, but not limited to fabrication, inspection, transportation, and erection shall be done in accordance with the provisions of the SCM.” This establishes the SCM as part of the Contract and is applicable to both shop and field work.

The Construction Supervisor, Engineer-In-Charge, or Resident Engineer, as applicable, shall verify that the Contractor has designated a Quality Control (QC) Inspector to act on the contractor's behalf as required under Subsection 302 of the SCM.

Under Subsection 306 of the SCM, the Contractor is responsible for performing fabrication/erection inspection and testing to ensure that materials and workmanship meet the requirements of the Contract Documents. The Contractor's QC Inspector may be supported in this task by Assistant Inspectors who may perform specific inspection functions under his/her supervision. Assistant Inspectors may be qualified by training and experience to perform the specific function(s) to which they are assigned.

As NYSDOT projects are typically shop welded and field bolted, field welding of structural steel is unusual. Field welding typically encompasses pile foundation work, bridge bearings, form work and the like. However, the requirements for structural steel set an example of good practice for all field welding.

## **Approvals**

### **Welding Procedure Specification (WPS)**

Subsection 704, General, of the SCM, states: “. . . all welding shall be performed in accordance with the provisions of a written Procedure Specification, as shown in Figure 704.” The completed Form (Figure 704) is referred to as a Welding Procedure Specification (WPS). The contractor must complete a separate WPS for each Welding Process (e.g., Shielded Metal Arc Welding, SMAW) and joint type shown on the Shop Drawings, or shown on the Plans, and submit them to the Structures Division, Metals Engineering Unit, for approval. No welding shall be allowed without an approved WPS. For reference, a sample WPS is attached (See Exhibit 564-A). WPS's are not transferable from project-to-project, unless a written waiver is provided by the Metals Engineering Unit.

### **Welding Processes - Procedure Qualification**

Subsection 705, Approved Welding processes of the SCM, states: “. . . all welding processes, except Shielded Metal Arc Welding (SMAW), must be qualified by tests performed by the Contractor as required by Section 8, Qualification.”

In general, SMAW (stick welding) is the only process approved for field welding. Exceptions to this may be considered for certain applications (e.g., cover plates, ballast plate) in which case Submerged Arc Welding (SAW), or Flux-Cored Arc Welding (FCAW) may be approved. For either exception, a Procedure Qualification Test (Section 8, SCM) is required. Procedure Qualification Tests require the Contractor to weld a test plate with the process and welding parameters proposed to be used in production. Various

specimens machined from the test plate are then tested by the Department. These tests need to be approved by the Metals Engineering Unit prior to processing WPS's.

SMAW (stick welding) is prequalified (Subsection 705, SCM) if the steel and electrodes are listed in Subsection 502 and Subsection 711.1 of the SCM, respectively. When these provisions are met, the Contractor may submit WPS's for approval without performing a Procedure Qualification Test.

### **Welder Qualification**

Subsection 809, General of the SCM states: "... each welder, welding operator, and tacker who performs work on Contracts for the State must be qualified for each process and position used by tests described in this Section." (Welders not currently NYS Qualified may obtain testing program information by contacting the Metals Engineering Unit).

Qualified SMAW (stick) Field Welders are issued a NYS Qualification Certificate and Work Record Card which must accompany the certificate for it to be valid. The certification card carries a validating signature, the welder's signature, positions qualified, and in the case of groove welds, the maximum thickness of steel the welder is qualified to weld. For the certificate to remain valid, the Work Record must be signed every six months from date of issuance by either a Region EIC or a Licensed P.E. (Any State). For reference, see Subsection 811.9b.

Prior to allowing a welder to work, the EIC, or Department Representative, must verify that the welder is qualified to weld in the position ((Flat, Horizontal, Vertical, Overhead), thickness (groove welds only), and process indicated on the approved WPS's. Position limitations are defined in Table 811.3 of the SCM.

NOTE: A welder reporting for work whose Work Record has minimally lapsed, but who otherwise is acceptable, may be granted a waiver of the six-month limit if the EIC requests a waiver from the Metals Engineering Unit. (This is an accommodation in recognition of the shortened construction season in the Northeast. The EIC should check his work quality more closely when he begins work.)

### **Workmanship and Technique**

#### **General**

The provisions of Section 7, Part B of the SCM, cover the essential parameters for producing quality welds by low hydrogen practice. Many of these provisions are directly controlled and implemented by welding in accordance with the approved Welding Procedure Specification (WPS). Each entry on the WPS must be verified and/or monitored during any field welding operation.

#### **Special Concerns**

Below are special concerns related to producing sound welds in the field.

1. Subsection 711.1, Electrodes for Manual Shielded Metal Arc Welding (SMAW) requires that Electrodes be furnished in hermetically sealed containers and shall be dried in an Electrode Oven for a 2 to 4-hour period between 232°C and 260°C before use. After drying, the electrodes shall be placed in a storage oven held continuously at a temperature of at least 121°C until used in the work.
2. E70XX and E80XX Electrodes, once removed from the storage oven, shall be used within 2 hours and 1 hour, respectively, or discarded. If the humidity is known to be less than 70%, the time may be doubled.

Electrodes may be redried once in lieu of discarding, if, and only if, the provisions of Subsection 711.1 are met. This requires an oven capable of reaching temperatures of 371°C to 426°C, which is not commonly available at the job site.

3. A Minimum Preheat and Interpass Temperature shall be maintained during all field welding. The actual temperature to be used shall be in accordance with the approved WPS. Subsection 708.1 of the SCM specifies the minimum preheat/interpass temperature of 121°C for field welding. Higher temperatures can be anticipated for certain combinations of material and thickness.

Exceptions to the stated minimum preheat/interpass temperature are made when welding studs or when welding sole plates of non-steel type bearings where the temperature of the bearing material cannot exceed 93°C.

4. When field welding of FCM's is required, welding shall be in accordance with Section 9 - Fracture Control Plan of the SCM. Implementation of the Fracture Control Plan shall be under the direction of the DCES, Metals Engineering Unit. All WPS's used for welding FCM's shall be so designated. No welding shall be allowed without the WPS so marked, regardless of approval. Field welding of FCM's is rare, particularly on new construction.

### **Weld Quality Inspection Obligations**

#### **Contractor**

Under Section 3 of the SCM, the Contractor is responsible for the acceptability of the product through Quality Control (QC) inspection and, when required by the Contract Documents, nondestructive testing. In general, the Contractor's QC Inspector and Assistant Inspectors are required to make all necessary inspections to ensure weld quality is in compliance with the Contract Documents.

Under Subsection 724 of the SCM, Visual and other Non-Destructive inspection methods for determining weld quality and acceptance are described in detail.

"Visual inspection of welding shall be performed before, during, and after completion of the welding" as stated under Subsection 724-1 of the SCM. Non-Destructive Inspection of welds by means other than visual (i.e., DT, MT, UT, or RT) shall comply with Subsection 724.2 of the SCM when specified on the approved shop drawings, repair drawings, or ordered by the DCES/Metals Engineering Unit.

#### **State (Department or Resident)**

1. General. Under Section 3 of the SCM, is the prerogative of the State. The State may waive independent QA inspection or perform this function with Department representatives as deemed appropriate.

Normally, the waiving of QA inspection is not an option for metal elements with welded connections. However, it is considered acceptable for most field welding applications to perform QA inspection on a limited task-specific basis; i.e., verifying Contractor's compliance with key functions of workmanship and technique that are essential to producing sound welds. (See QA Inspection Punch List for specific tasks.)

Department QA personnel need not be certified (i.e., AWS Certified Welding Inspector, CWI) unless required by the DCES, for a project-specific field welding operation. The Construction Supervisor, Engineer-In-Charge, or Resident Engineer, as applicable, shall verify that the Department's QA Inspector(s) are qualified to perform the specific functions to which they are being assigned.

The Structures Division, Metals Engineering Unit will provide technical support to Region Staff involved in steel inspections and is available to provide training and on-site inspection support when

necessary. Technical support may be arranged by contacting the Metals Engineering Unit at (518) 457-4525.

**NOTE:** QA inspection of field-welded Fracture Critical Members shall be under the direction of the DCES (Metals Engineering Unit).

2. QA Inspection Activities - Field. QA inspection is not intended to supplement or replace inspection that is the responsibility of the Contractor, but rather to monitor that the Contractor's QC program has been implemented and is producing results consistent with the Contract Documents. The QA Inspector's schedule shall effectively determine that the Contractor's QC in-process inspection and testing, where applicable, are insuring compliance with all material and workmanship provisions of the SCM. Any deficiencies in material or workmanship should be immediately reported to the Metals Engineering Unit for evaluation. Acceptance of structural steel welding in the field by the QA Inspector shall be based upon monitoring the Contractor's QC program as implemented and selective detailed inspection of materials and workmanship.
3. QA Inspection Punch List. Listed below are key activities which may be used as a quick reference by Department personnel involved in QA inspection of welding in the field.
  - A) If welding structural steel (564 items), contractor's QC Program has qualified and adequate staff.
  - B) Received from the Contractor: WPS's approved by the DCES (Metals Engineering Unit) for each joint type and position to be welded.

**NOTE:** Valid WPS must display Project's "D" Number.
  - C) Welders are NYS certified with current Work Record, and qualified for the process and position shown on the approved WPS.
  - D) Welding parameters shown on the approved WPS are being used, preheat monitored, and stick electrodes properly dried.
  - E) Visual inspection of welds. Include review of certified mill test reports (CMTRs), fitup, edge preparation and weld access holes or backing bars (welded pile splices) as appropriate prior to welding. During welding make sure slag is removed between passes, welding progression is per WPS (stringer beads, vertical up, etc.) and welds are free of cracks and porosity. After welding is complete, make sure slag is removed, weld profile is acceptable per SCM Figure 723, and free of defects per SCM Section 724. Pay particular attention to undercut/overlap, under fill and insufficient throat. Welds should be free of cracks and rejectable porosity.
  - F) Written report received from NYS qualified non-destructive testing (NDT) Technician documenting the results of weld joint testing, where required. Rejected welds repaired by a procedure approved by the Metals Engineering Unit.
  - G) Welding of fracture critical members must be approved by the DCES and directed by the Metals Engineering Unit.

### **Repairs**

Field Repairs, Corrections of Cambers or Heat Straightening shall be done in accordance with the NYS Steel Construction Manual. The work shall be done following a repair procedure prepared by the contractor

and approved by the DCES. No repair work involving heating, jacking or welding shall be allowed without an approved repair procedure.

### **Erection of Steel**

The guidelines for erection of structural steel are in the Steel Construction Manual under Section 14. Close coordination is critical between field personnel and the approver. The site layout should match the plan view shown of the approved erection drawing as the reviewer may not be familiar with the site.

The erection procedure drawing should be submitted for review 30 days prior to the scheduled day of lifting.

Maintenance and protection of traffic should be approved by the appropriate project staff member so that normal roadway traffic is maintained in accordance with the notes on the contract plans.

Safety and Health requirements are addressed in Section 107-05 of the Standard Specifications and MURK Part 1C.

### **Site Storage and Handling**

#### **Girder Delivery**

The girders should be delivered and stored with webs vertical unless a special delivery procedure was approved by the DCES.

The minimum support that a standing girder requires is two supports at the points one-fifth of the span from the ends. Occasionally, because of stability concerns the supports can be required at intervals as small as tenth points along its length.

During temporary crane shutdowns, the Girder should be lowered and released so that no damage is done to the flanges.

#### **Transportation Drawing**

As specified in Section 206.1, transportation drawings may be required for girders that are unusual in terms of temporary stress conditions. Examples are curved girders with overhangs greater than 7.5 meters, girders that must be shipped with webs horizontal or those that could buckle unless stabilized. These drawings should be submitted to the DCES for approval.

#### **Inspector's Responsibility**

The duties of the shop inspector are summarized in the Steel Construction Manual in Chapter 3. The inspector shall be responsible for Quality Assurance that ensures the bridge components meet all the standards and specifications required for its manufacture.

### **Shipping**

#### **B&GC4b - Report of Shipment of Structural Steel**

This form documents that the fabrication was in accordance with contract requirements. The EIC can expect to receive the above form from the inspection agency about the same time as the material test reports (MTR). The materials test reports contain the mechanical properties, chemical analysis and the certification of domesticity. For contract items where the engineer is the approver for the State, the MTR's will be delivered directly for him to issue the B&GC4b. (See Exhibit 564-B).

### **References**

NEW YORK STATE STEEL CONSTRUCTION MANUAL  
NYSDOT BRIDGE MANUAL  
NYSDOT STANDARD SPECIFICATIONS  
MURK PART 1C



## SECTION 565 - BRIDGE BEARINGS

### General

Bridge bearings transfer superstructure loads to the substructure while also providing for thermal movement and the deflection of the superstructure due to traffic loading. Although many different types of bridge bearings have been used by the NYSDOT, elastomeric and multi-rotational bearings are generally used on bridges of short to moderate length. Some examples of these are:

Elastomeric Bearings (plain or laminated)	used with prestressed units or prestressed I-Beams
Elastomeric Bearings (laminated) w/ external steel plates	used with steel stringers
Multi-Rotational Bearings (Pot Bearings & Disc Bearings)	used with steel stringers (longer spans)

The elastomeric bearing is the most commonly used bearing. It performs well during a seismic event because of its dampening ability and low height. *High steel rocker bearings* and the *low steel bearings* are no longer being used on new bridges and are being replaced wherever possible.

Bearings are designed to be placed perpendicular to the longitudinal axis of the stringer. With skewed bridges this is of the utmost importance in order for the bearing to function as designed. Curved steel stringers require that the bearings be placed perpendicular to a chord between the fixed bearing and each expansion bearing on the curved girder. Circular elastomeric bearings and multi-rotational bearings are often used on curved steel girders.

Pedestals shall be placed prior to the bearing and girder. (In other words, the bearing shall not be welded to the girder, the girder supported and the pedestal placed under the bearing.) This will not allow proper consolidation of the concrete and will not provide any assurance that the masonry plate will have full bearing. The pedestals shall be placed, bearings set and the girders erected, in that order.

### Bearing Adjustments

After being erected, steel stringers require the bearings to be *temporarily welded* to the stringer. The bearings are *permanently welded* to the stringer after the superstructure slab has been placed. The amount of camber to come out of the stringer dictates whether the bearing has to be adjusted. This involves jacking the superstructure, locating the bearing in the correct position and permanently welding the bearing to the stringer. A Welding Procedure Specification (WPS) is required to be approved by the DCES prior to welding. If the temporary weld is small enough, it can be incorporated into the permanent weld. If it is too large, it can be ground down and then incorporated. Any problems with the bearings being out of tolerance can be directed to the DCES at (518) 457-7677.

Prestressed boxes or slab units with elastomeric bearings receive no adjustments. The anchor rods are secured before the deck slab gets placed on the prestressed units, thereby denying any means to adjust the bearings. The amount of camber to come out of the prestressed units due to the deck slab loading is minimal and deformation of the bearing is not considered in their design.

**Elastomeric Bearings (plain or laminated), Items 565.18XXM (Type E.P.) or 565.19XXM (Type E.L.) respectively**

Elastomeric bearings (*without* external steel plates) are used with concrete prestressed box beams and prestressed slab units. The connection between the beam or slab and the bearing is made with an anchor rod through the unit and bearing and into the substructure.

The anchor rod holes are drilled in the substructure after the bearings and beams are in place. In order not to damage the bearing, the Engineer should ensure that the precast hole in the unit is aligned with the formed holes in the bearing before any drilling for the anchor rod is done.

**Elastomeric Bearings (w/external plates), Item 565.20XXM (Type E.B.)**

In order to make the connection of the steel stringers to the bearings, steel load plates are required. A tapered sole plate may be required by the Designer when the longitudinal grade is 1% or more or the required taper is 3mm or more. Careful attention must be paid to ensure that the tapered plate follows the profile grade.

The bearings are permanently connected to the substructure with anchor bolts into the pedestal. The attachment of the superstructure to the bearings is done by “field welding”. The amount of camber to come out of the steel stringers dictates that the bearings be *temporarily welded* after erecting the steel stringers. The Engineer should ensure that the Contractor does not cause debonding of the elastomer from the plate. This can result from overclamping by the Contractor in trying to draw the bearing and bottom flange together. The bearings may be *permanently welded* after the following is complete:

- the superstructure slab is placed
- at least 7 days of cure for the slab
- the necessary adjustments according to the plans and specifications.
- a Welding Procedure Specification (WPS) is approved by the Deputy Chief Engineer- Structures, (DCES)
- the welder is certified

The Engineer must ensure that the temperature is controlled (not to exceed 90°C as monitored with temperature crayons) in the vicinity of the elastomer during the welding process so as not to damage the elastomer or cause any debonding.

- The Engineer can check for damaged elastomer as follows: After the steel has cooled from welding, run your finger along the elastomer adjacent to the steel plate. If the elastomer was damaged from excessive heat during field welding, it will become soft and will adhere to your finger. Elastomer that was not overheated will be hard and will not rub off.
- The Engineer can check debonding by trying to insert a putty knife between the elastomer and the steel plate.
- If the Engineer suspects the elastomer was damaged or has become debonded as a result of field welding, they should contact the DCES.

**Multi-Rotational Bearings, Item 565.15XXM (Type M.R.)**



Multi-Rotational Bearings are commonly referred to as “pot bearings”. They are generally used in high load situations, or where the thermal movements are excessive for elastomeric bearings. Multi-Rotational bearings consist of a confined elastomeric element (pot design) or an unconfined polyether urethane disc (disc design) to accommodate rotation, a piston and a sliding element to accommodate thermal movements. The confined elastomer does not compress and with the help of sealing rings, it acts as a fluid when subjected to the rotation due to superstructure and traffic loading. The bearing must not be taken apart as this can result in damage to the sliding surface and/or piston and associated sealing rings. Any banding straps or temporary straps should be left in place until the superstructure is ready to be placed.

The expansion bearings of this type may be *guided* to allow movement in only one direction. Expansion bearings may also be *non-guided* to allow movement in any direction. The “guide bar”, if used, is located in the upper portion of the bearing.

Caution still has to be taken in regard to field welding the bearing to the stringer. The use of temperature crayons should be used to monitor the welding process since the elastomer will not be visible for inspection purposes. Refer to the above section on “Elastomeric Bearings (w/external plates)” for the welding criteria.

## **Shop Drawings**

Shop Drawings, if required, are approved by the Region. The Region determines which group will review and approve the Shop Drawings.

## **Painting**

All bearings shall be painted, unless noted on the Contract Plans (see EI97-028). Areas not to receive paint include:

- Machine finished surfaces in contact (pins, pin holes, surfaces in sockets at the top of rocker bearings and bronze or copper plates in sliding contact). These surfaces receive a coat of automotive grease.
- The bottom of the masonry plate does not require a coat of paint.

## **Arrival on the job site**

All bearings should be evaluated for verification of the evidence of acceptability upon delivery to the project site. The evidence of acceptability for each of the bridge bearing items is outlined in the Materials Inspection Manual (MIM) included in Part 2-A of the Manual for Uniform Record Keeping.

## **Contact**

If there are questions or problems with the Contract Plans or construction problems call the Regional Office or the Structures Division @(518) 457-7677 for assistance. This may range from an understanding of the details on the Contract Plans or Specification to an error in the actual layout of the bearings during construction. For instance, it may seem like only a trivial matter to elongate the circular hole in the masonry plate to allow installation of the bearing, but there are other design considerations or required repair that may not be apparent to all concerned. It may only involve a phone call to be assured that what is being proposed by the Contractor to correct a situation is in fact the correct solution or that there may be another solution to consider that may be better, cheaper or preferred.

## References

EI 97-028, BRIDGE DETAIL (BD) SHEETS BG1 THRU BG7 - BEARING DETAILS  
MATERIALS INSPECTION MANUAL  
BRIDGE MANUAL, SECTION 12  
SPECIFICATION -ITEM 565

## SECTIONS 566 & 567 - BRIDGE DECK JOINT SYSTEMS

### Description

There are various types of bridge deck expansion joint systems. The current systems are:

566-00 armored joint with compression seal,  
566-00 armored joint with preformed elastic strip seal  
567-00 modular joint systems.

The type and locations are shown on the Contract Plans.

Armored joints with compression seal consist of angles and a preformed compression seal and are supplied with different size seals. The system is installed into a blockout formed in the concrete structural deck.

Armored joints with preformed elastic strip seal consist of a steel extrusion and a molded gland and are used with concrete and asphalt overlays. On concrete overlays the joint is installed first and then the overlay is placed. On asphalt overlays the asphalt is placed first and compacted. The asphalt is then saw cut and removed to form a recess and the joint installed. The void between the steel extrusion and the cut asphalt is filled with elastomeric concrete.

Modular joints are manufactured in various sizes and are supplied with a series of steel separator beams and hollow type seals. The system is usually installed in a large blockout formed in the structural deck.

### Inspection

Joint systems are shop assembled and delivered to the work site ready for installation. They are accepted based on manufacturers certification that all materials and fabricating procedures used are in accordance with the requirements of the approved Shop Drawings and Specifications.

Field inspection shall include inspection for proper alignment with no bends or kinks, spacing and soundness of studs, and complete bond between the seal and the steel. A seal that is not completely bonded to the steel shall be rebonded with adhesive meeting the requirements of Section 567-2.02A6 of the Standard Specifications (a).

### Shop Drawings

Shop Drawings are required for any joint system supplied and shall meet the various applicable requirements of Section 566-2.02 and 567-2.04 of the Standard Specifications (a) and the NYS Steel Construction Manual (b).

Approved Shop Drawings shall include a detailed installation procedure recommended by the manufacturer. E.I.C.'s and inspectors should familiarize themselves with the procedures for the particular type of joint being installed to ensure that all requirements are met.

### Construction Details

Close adherence to the installation procedure provided by the manufacturer is essential to ensure a properly performing and watertight joint. The following operations are of particular concern:

#### Concrete Deck:

1. Dimensions of the blockout area should be checked against the dimensions shown in the Contract Plans and Shop Drawings.

2. Once installed in the blockout, the armored joint system should be adjusted to the temperature for the opening and grade, such that the top of the angles are approximately level with the surface of the surrounding deck. Joints set too high can result in the angles being clipped by the snowplows and damaged, so it is preferable to set the joints slightly low (0 to 3mm) rather than slightly high.
3. Before pouring the concrete header, all surfaces of the recess must be thoroughly cleaned by sandblasting around the joint and debris removed by subsequent air blasting with oil-free compressed air or vacuuming. Just prior to pouring, the surfaces of the recess shall be thoroughly coated with Material Section 721-03 Epoxy Polysulfide Grout or Standard Specification Material Section 705-22 Portland Cement Mortar Bonding Grout (a). No tape, placed on the angles for protection, shall cover the vent holes.
4. Slump and air tests shall be run on the header concrete, and close attention should be paid to placement, vibration, finishing, and curing. Header concrete is prone to developing shrinkage cracks because of the long length of concrete placed and the fact it is placed on dry concrete which will extract the design mix water from the concrete. Good construction practice would involve prewetting the area for a minimum of 12 hours prior to placement. As with all small placements, special care must be taken to avoid overworking the concrete. Concrete must be thoroughly worked under the angles with shovels or hoes not with vibrators. Vibration should be stopped as soon as the vent holes in the angles are completely filled with concrete. Hand finishing should be kept to a minimum, just enough to secure a smooth surface within tolerances, and the finishers should be watched carefully to insure they do not add water.
5. Curing the header concrete must be in accordance with Section 555-3.09 of the Standard Specifications (a).
6. Watertight Integrity Test shall be in accordance with Section 567-3.01H if required, see Standard Specification (a).

#### Asphalt Overlay with Elastomeric Concrete

1. Place asphalt on the entire structural deck including the joint area and compact to the specification.
2. Saw cut and remove asphalt to form a recess as indicated on the Contract Plans.
3. Set joint in recess. The steel extrusion opening should be adjusted to temperature at the time of installation and grade such that the top of the extrusions are level with the surface of the surrounding asphalt. Joints set too high can result in the steel extrusion being hit by a snowplow and damaged, so it is preferable to set the steel slightly low (0 to 3mm) rather than slightly high.
4. Before placing elastomeric concrete around the joint, all metal surfaces shall be abrasive blast cleaned to SSPC SP-6 Commercial Blast Cleaning (c). No visible rust will be permitted. All other surfaces coming in contact with the elastomeric concrete shall be abrasive blasted. The recess shall be vacuum or air-blown with oil-free compressed air.
5. Mix and place elastomeric concrete in accordance with the manufacturer's instructions, the specification, and insure the material is on the Departments "Approved List" (d). The two part elastomeric concrete liquids, part A (resin) and part B (hardener), must be thoroughly

mixed to ensure proper hardening. The mixing ratio shall be in accordance with that shown in the approved material detail sheets supplied with the material.

6. After the elastomeric concrete has been installed, cured and exposed to normal traffic for a minimum of five days, a Watertightness Integrity Test shall be performed in accordance with Section 567-3.01H of the Standard Specifications (a).

### **Stage Construction**

Installation procedures are the same for concrete and asphalt overlays, the only difference with stage construction is the seals or rubber is installed in one piece or spliced at the stage line for the particular joint system being installed.

Splicing of the steel extrusion of modular expansion joint system shall be in accordance with the approved Shop Drawings.

The following operation shall be performed with “field installation” of the seal or rubber:

1. All cutting and bending of the seals shall be performed as shown on the approved shop drawings.
2. Field splicing of the seal or rubber shall be performed by a factory representative.
3. Sandblast the area in contact with the seal or rubber and remove all debris by subsequent air blasting with oil-free compressed air or vacuuming.
4. Apply adhesive to steel surfaces and install seal or rubber. Care shall be exercised as not to damage the seal or rubber. Damage to the seal or rubber is grounds for rejection.
5. Watertight Integrity Test shall be in accordance with Section 567-3.01H if required, see Standard Specifications (a).

### **References**

- (a) New York State Standard Specifications.
- (b) New York State Steel Construction Manual, Section 2-Drawings and Section 7-Welding.
- (c) Steel Structures Painting Council, SSPC-VIS 1-89, Visual Standard for Abrasive Blast Cleaned Steel.
- (d) Current Materials Bureau’s “Approved List” (Material and Equipment for use on NYSDOT Projects). This list can also be found on the DOT Web Site.

## SECTION 582 - REMOVAL AND REPLACEMENT OF STRUCTURAL CONCRETE

### 582-3.02 Removal of Unsound Concrete

Concrete is usually evaluated by “sounding” it with an approximately 1.36 KG (3 lb.) hammer. When struck, sound concrete will produce a “solid” sound, while unsound concrete will produce a “hollow” sound. A rough surface, however, makes this more difficult (the hammer hits and breaks protrusions, instead of hitting a flat surface), and thus more care is needed to detect unsound areas.

In many construction situations, it is too noisy to hear very well. Another technique to detect unsound areas is to place your hand flat on the concrete surface. Then, hit the surface close to your hand with a hammer. Vibrations from unsound areas will be readily felt by your fingers. No vibrations will be felt in sound areas. Move your hand along the surface as you hit the concrete to find the limits of delaminated areas. Closing your eyes forces you to concentrate on the vibrations and where they end. Of course, be careful you don’t accidentally hit your fingers.

Unsound concrete is also characterized by the following:

1. After chipping, pieces can be pulled off with a finger or pried off with a knife.
2. After blast cleaning, pieces can still be pulled off with a finger or pried off with a knife.
3. Abrupt (right angle) recessed corners with visible lines at the bottom. These lines indicate fracture planes.
4. Fractured aggregate faces that contain discolorations or rings.
5. Discolored concrete or closely spaced visible cracks.
6. Any “hollow” sounding areas detected on a prepared surface. (Always resound areas ready for repair.)

Also see Exhibit 582-A, B, and C for guidance on concrete scaling, spalling and cracking.



## SECTION 583 - SHOTCRETE

### General

The most important aspect of shotcrete is surface preparation.

Shotcrete application is very dependent on three main factors: materials, equipment, and skill of the applicator. Only pre-approved materials are allowed for use in shotcrete. The best results are obtained from an experienced applicator using good equipment. Shotcrete characteristics (compressive strength, bond, durability, etc.) are significantly affected by application. Therefore, it is very important to be familiar with correct shotcrete practice to monitor the work.

The most comprehensive, up-to-date information, with detailed instructions, descriptions and problem solving suggestions, is included in A.C.I. 506R-90 "Guide to Shotcrete". Copies of this manual are available through the Regional Materials Engineer and the Materials Bureau in Albany.

### 583-1.02 Definitions

There are two approved methods of shotcrete application: Dry Mix and Wet Mix, with Dry Mix being predominant. If Wet Mix is proposed for use, please contact the Materials Bureau in Albany at (518) 457-5956 for air and slump information, (never added to our Specification Books), or for other shotcrete related matters.

### 583-2 Materials

The addition of small quantities of Approved List pozzolans may also be approved by the Materials Bureau on a project by project basis, either individually or as blended cement. Microsilica enhances adhesion, especially for overhead work, and results in less waste. Fly ash and microsilica reduce permeability and shrinkage by making shotcrete denser.

### Prebagged Shotcrete Material

If this material is proposed for use, please call the Materials Bureau in Albany at (518) 457-5956 as soon as possible, and submit a formal request.

### 583-2.02 Qualification Test

Qualification test panels may be cut or broken such that the interior of the panel and its reinforcement is exposed. Usually, the best face to examine is a clean, fractured one. Things to look for inside the panel are:

- A. Voids: A prime concern is voids behind reinforcement. This is very detrimental and requires a re-evaluation of the placement procedure and applicator technique. Increased care, closer proximity and/or the use of a blowpipe, should rectify this problem.

Scattered voids are also a problem when numerous, large, or interconnected. This can be caused by overly dry material, poor equipment or applicator error.

- B. Dry Pockets and Sand Lenses (Streaking): These problems are predominantly encountered in the Dry Mix procedure. A layered and streaked appearance could mean problems with the moisture content of the material (See C.I.M. Section 583-3.02, Preparation of Material), or operation of the equipment. If the equipment is inadequate, material propelled to the nozzle may not be a smooth, continuous flow, and slugging may occur in the hose. Also, the nozzle chamber should combine the cement and sand mixture with a constant flow of water to produce a uniform spray. The nozzle operator should recognize a too dry or wet spray, and be able to adjust the amount of water added.



## SECTION 583 - SHOTCRETE

Work should not proceed until acceptable visual results are obtained. Additional qualification test panels should be requested whenever changes in conditions, personnel, location, equipment, etc. affect the quality of placement.

Also, when unusual shooting circumstances arise, such as shooting at an angle, in tight corners, in narrow slots, etc., have a qualification test panel made to duplicate that shape. After the operator shoots that panel in circumstances similar to the actual site, remove the sides of the panel to inspect how well the shotcrete filled the panel area. Allow other tries if warranted. Then decide if that work should be done with shotcrete, another material or another method.

### 583-3.01 Surface Preparation

#### A. Concrete Structures:

See C.I.M. Section 582-3.02 Removal of Unsound Concrete.

#### Wire Fabric Installation (All Locations):

Provide shotcrete as much space and the least impedance to the repair surface as possible. In most cases, position the wire fabric parallel to the finished grade. Minimize lapping and maximize the space between layers. Also, do not utilize more than 1 overlap. Cut away additional layers or make sure the wires line up with each other.

### 583-3.02 Preparation of Materials

#### A. General:

It is very important that sand moisture content be maintained in the 3 to 6% range. If not, the cement may not stick to the sand, and be blown away. A quick test to determine adequate moisture content is to squeeze a ball of damp sand in your hand. If it is too dry, it falls apart. If it retains its shape and leaves no free moisture on your hand, it is okay.

#### B. Dry Mix Process:

Wetting agents break down the surface tension of water and thus work as a water reducer. Air entraining agents also act as wetting agents, but in the case of dry mix shotcrete, little or no air is entrained.

#### C. Wet Mix Process:

Wetting agents break down the surface tension of water and thus work as a water reducer. Air entraining agents also act as wetting agents, and in the case of wet mix shotcrete, a normal amount of air is entrained in the mixing process, but half or more is lost during the application process.

### 583-3.03-C. Quality Control

Shotcrete application is an art. A simple suggestion for providing a quick way to monitor shotcrete quality and eliminate problems before proceeding further is as follows:

When test panels are made, or whenever it is felt necessary, have the shotcrete applicator make an additional "sample" (smaller and unformed) on any suitable surface, including firm ground. Break this sample open as soon as practical and inspect it for deficiencies (as defined in C.I.M. Section 583-2.02 Qualification Test above). If problems exist, have the Contractor correct them, and check by having more samples made. When the deficiencies are corrected, have a quality control test panel made for laboratory evaluation.

#### 1. Test Panels:

## SECTION 583 - SHOTCRETE

All shotcrete quality control test panels sent to the Materials Bureau should arrive at the Laboratory within 14 days from date sampled. Each individual panel needs to be accompanied by one BR 240a form, filled out with the appropriate information as shown in Exhibit 583-A.

### 2. Test Results:

At the Laboratory, 50 mm diameter cores will be drilled from the panels, tested for compression, and strengths reported to the Engineer. Additional information on the condition of the shotcrete, such as sand pockets, voids, and laminations, will also be reported with the strength results.

If the Contractor desires, and the Engineer approves, six 50 mm diameter cores may be taken from each panel at the job site, under the direct supervision of the Engineer, and packaged for transmittal. The Engineer will fill out a BR 240 form for each set of cores (see test panels above), include it with the cores, and seal each package for transmittal to Albany for testing.

### 3. Coring:

If interconnected voids are found, the structural element represented by that core is rejected. Interconnected voids are defined the same as for the Qualification Panel; individual, isolated voids less than 25 mm in any direction, as determined by the Engineer.

If coring through in-place reinforcement would jeopardize the design integrity of any structural element, dummy rebars of the same size may be placed in the structure for coring purposes before shotcreting, and their locations carefully marked. One or more of these dummy areas may then be cored, as determined by the Engineer. Make sure that the shotcrete operator uses the same shotcreting shooting procedures everywhere.

*Screed Finish* - requires that the shotcrete be built up slightly over the guides and allowed to stiffen to the point where screeding will not pull or crack the surface.

*Broom Finish*. Use a stiff bristle broom and keep it clean.

*Flash Coat Finish*. Details of this finish are in the A.C.I. Guide To Shotcrete.

### **583-3.03-E. Curing**

Curing compound (or any other type of coating, sealer, etc.) should not be used between lifts or layers because they act as bond breakers. If inadvertently used, it must be totally removed before commencing to shotcrete.

Although shotcrete is a fairly dense, low slump concrete, it is still very susceptible to drying shrinkage due to its small particle size and extensive, exposed surface area. The best cure is a wet cure. Apply all cures quickly.

### **Reference**

A.C.I. 506R-90, Guide to Shotcrete

## SECTION 583 - SHOTCRETE

### SHOTCRETE

<u>BR 240a Box Number and Title</u>	<u>Appropriate Contents</u>
1) Material - .....	Shotcrete (Specify Dry or Wet Process)
2) Item No. - .....	583
3) Date Sampled No. - .....	Date Panel Was Shot
4) Contract No. - .....	DXXXXXX
5) Supplier and Location - .....	Cement Supplier and Location
6) Quantity in Lot - .....	One
7) Lot No. - .....	If Applicable
8) Manufacturer and Location - .....	Applicator's Company Name and Location
9) Batch No. - .....	If Applicable
10) Date of Manufacture - .....	Should be same as 3)
11) Sampled At - .....	Job
12) Type - .....	Control Sample
13) Sampled From - .....	Location of Application on Job Site
14) Sampled By - .....	Region No. and Inspector's Name
15) Contractor and Project Location - .....	Contractor and Project Location
16) Additional Info - .....	Job Site Location
	Cement Type No.
	Approved Sand Source No. (From Current
	Approved List of "Sources of Fine and Coarse
Aggregate")	
	Sand/Cementitious Material Ratio
	Additives (Microsilica, Air Entrain., etc.)
Horizontal)	Shooting Position (Vertical, Overhead or

### Exhibit 583-A

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

### Related Instruction

Specialized overlays play a key role in extending the life of a reconstructed structural slab. The purpose of such overlays is to create an impermeable layer of concrete to prevent chlorides from attacking the top mat of bar reinforcement. To ensure that this layer works effectively, it is very important that the overlay is placed in a careful and conscientious manner. When these specialized overlays are improperly placed and/or cured, the resulting layer offers no more, and possibly less, protection to the deck than a normal concrete overlay.

The two types of overlay material available are Microsilica Concrete and Class DP Concrete. Microsilica is the denser and less permeable of the two. Microsilica concrete is more susceptible to cracking especially in thicker placements. This is why Microsilica should be properly cured and not used in placements over 75 mm. Microsilica is also stickier and more difficult to finish. Microsilica concrete requires the use of a High Range Water Reducer (Type F Water Reducing Admixture) also known as a Superplasticizer.

Class DP Concrete is standard Class D concrete modified with flyash and microsilica. It is easier to finish and work with than the Microsilica Concrete. It makes a good substitute to microsilica on decks having 100% rebar mat exposure. Class DP concrete can be used in any situation where Class D concrete is applicable. The use of a High Range Water Reducer is not allowed nor necessary in Class DP concrete.

Three methods of placement are open to the Contractor depending on the material and existing conditions. The methods are as follows:

#### Method 1 - Separate Placements:

This has been the standard method. When any amount of the top mat of bar reinforcement is exposed, the Contractor will place a layer of slab reconstruction concrete, either Class D or DP, and after the proper curing period, apply a Microsilica Concrete overlay.

#### Method 2 - Integral Placement of Microsilica Concrete:

One placement of Microsilica Concrete is applied to the bridge deck. This is applicable when there is no exposure of the top mat of bar reinforcement and the overlay thickness is not over 75 mm. This method may also be used when the following conditions exist:

- A. The area of the exposed top mat of bar reinforcement is 5% or less of the placement area, per span.
- B. No individual area of the exposed top mat of bar reinforcement exceeds 2.5 m<sup>2</sup>.
- C. No dimension of any area of the exposed top mat of bar reinforcement exceeds 2 m.

When these conditions are met and this method used, the Microsilica Concrete will serve as the slab reconstruction concrete in the areas of exposed top mat of bar reinforcement. The noted restrictions are necessary due to the increased difficulty in consolidating Microsilica Concrete and increased probability of cracking, especially in deeper placements.

#### Method 3 - Integral Placement of Class DP Concrete:

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

One placement of Class DP concrete is applied. This method may be used when 100% of the top mat of bar reinforcement is exposed. This method provides the Contractor with the option of removing the entire top layer of concrete and replacing it with a single placement of Class DP concrete which in many situations may be quicker and more cost effective than selective removal. This will also provide a more durable end product since the entire top layer of old concrete is replaced with new, more impermeable Class DP overlay concrete. Class DP requires an extended wet cure as compared to microsilica concrete, 7 days versus 4 days.

To ensure that the overlay is properly placed and cured, it is important that no details are overlooked, no matter how minute they may seem. These overlays are very sensitive and require conformance to all relevant specifications. Sections 555 and 557 of the Construction Inspection Manual should be thoroughly reviewed prior to beginning work on the project.

The following table outlines the sequence of events for the three methods of placement. Following the table are suggestions for improving the quality of the concrete overlay.

METHOD 1		METHOD 2		METHOD 3	
Overlay Thickness					
40 mm Min - 75 mm Max.		40 mm Min - 75 mm Max.		60 mm Min - 75 mm Max.	
Top Mat of Bar Reinforcement Exposure Conditions					
All Conditions (This method is acceptable whenever re-bar is exposed)		Less Than 5% and No Individual Area > 2.5 m² and No Individual Dimension > 2.0 m		100% Exposure	
Construction Sequence					
1	Selective or total removal of old concrete top layer	Selective or no removal of old concrete top layer		Total removal of old concrete top layer	
2	Blast Cleaning				
3	Preplacement Wetting (12 hrs. Min.)				
4	Bonding Grout Placement				
5	Placement of Class D or DP Slab Reconstruction Concrete	Go To STEP 11			
6	Finishing and Texturing				
7	3 Day Wet Cure				
8	Blast Cleaning				
9	Preplacement Wetting (12 hrs. Min)				
10	Bonding Grout Placement				
11	Placement of Microsilica Overlay Concrete			Placement of Class DP Overlay Concrete	
12	Finishing and Texturing				
13	4 Day Wet Cure			7 Day Wet Cure	

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

14	Saw Cut Grooving
15	Penetrating Sealer Application

### I. Construction Operations

#### 1. Removal of Old Concrete:

All deteriorated and unsound concrete (based on half-cell potentials, sounding, and/or chloride contents) should be removed to 25 mm around the top mat of bar reinforcement. Removal should be done using maximum 20 kg chipping hammers equipped with minimum 50 mm wide chisel tips. No pick tips should be used. Bush hammers should not be used due to the micro cracking caused by this type of equipment. For large areas of removal, hydro demolition has been found to be very cost effective.

#### 2. Blast Cleaning

One of the most important factors affecting the performance of reconstruction and overlay concrete is the bond strength between new and existing concrete. After damaged, or unsound concrete has been removed, a fine layer of powder exists on the concrete substrate. This must be removed along with any residual dirt or grease. High pressure air will not always remove the entire layer of dust. Sand blasting, shot blasting, or high pressure water blasting will do a sufficient job. The substrate can be considered clean when 50% of the coarse aggregate can be seen. If the dust and dirt are not removed, the slab reconstruction concrete will not bond to the deck, which leads to delaminations.

##### A. Blast Cleaning Checklist

1. Make sure the surface is clean after blast cleaning.
2. The surface must be free of grease, dirt, loose concrete, mortar and loose or injurious rust on the reinforcement.
3. Additional blast cleaning may be required if more than 48 hours pass before bonding grout placement or if the prepared surface is contaminated.

##### B. Position of the Top Mat of Bar Reinforcement

After all deteriorated concrete has been removed, care has to be taken to ensure that the top mat of bar reinforcement is in the correct position. If the reinforcement is out of position from being walked on, the new concrete will not encapsulate it and voids will form. These voids will reduce the bond strength and eventually lead to deterioration of the deck. To ensure that the steel mat is stationary, chairs and tie downs may be necessary.

#### 3. Structural Slab Wetting

Care must be taken to make sure that overlay concrete will properly bond to the structural deck. If an inferior bond is formed, the deck will soon delaminate and require repairs. The slab must be thoroughly wet to a saturated-surface dry (SSD) condition. A minimum wetting period of 12 hours, immediately prior to placement of all concrete overlays is necessary. The soaking of the deck allows

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

the bonding grout to better adhere to the structural concrete. If this step is not performed, the existing concrete will absorb water from the bonding grout and overlay concrete, causing the materials to dry out prematurely, creating a weak bond between the structural deck and the overlay concrete. There is also an increased potential for cracking in the overlay.

### 4. Bonding Grout

#### A. Material - §705-22

Bonding grout is simply a 50/50 mix of cement and sand with enough water to form a slurry with the consistency of thick cream. The sand and cement should be thoroughly mixed for one minute before the water is added to the mortar mixer.

#### B. Purpose

The grout acts as a glue between the new concrete and existing concrete. To assure a good bond, the surface must be well blast cleaned, free from dirt, dust, and chemicals, and in a SSD condition.

#### C. Application

There should be no standing water on the deck at the time of grout placement. Apply the grout in an even coat 3 mm  $\pm$  1.5 mm thick. Brushing on the grout with stiff brooms is an effective application procedure. If there is too much grout or not enough, the bond strength will be weaker.

#### D. Application Rate

In most cases the grout can be applied faster than the new concrete can be placed. Never allow the grout to be placed so far ahead of the new concrete that the grout dries out before the new concrete is placed over it. In most cases the grout placement should progress approximately 1 m - 1.5 m in front of the concrete placement. If the grout dries before placement of the new concrete, the new concrete will not bond to the deck. When this occurs the grout must be removed by blast cleaning and re-applied. **Under no circumstances should re-tempering the grout be allowed.**

### 5. Placement of Slab Reconstruction Concrete

#### A. Environmental conditions during placement.

It is essential that the new concrete properly bond to the existing concrete and reinforcement. If an adequate bond is not developed, cracking and delaminations will occur. Several simple things can be done to ensure that the concrete is being placed in the best possible environment.

##### 1. Temperature and Evaporation

While the temperature is not something that can be controlled, it is important not to ignore it. The contractor must supply an adequate recording thermometer to keep track of the substrate surface temperature. Differences between the substrate temperature and the temperature of the new concrete overlay should be kept to a minimum. Excessive temperature variation can cause cracking and de-bonding.

The ambient temperature has a great effect on the properties of concrete as well. Ambient temperature affects the speed at which concrete "sets up" and cures. If the ambient temperature is high, the concrete will set up quickly. If the ambient temperature is low, the concrete may not set up fast enough and cold weather placement procedures may be necessary. Either of these conditions will have adverse effects on the quality of the hardened concrete.

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

Using the temperature readings in conjunction with the relative humidity and the wind speed, the EIC or Inspector should calculate the hourly evaporation rates using Table 555-3 from the Standard Specifications book. If the evaporation rate is high, even when the temperature is not, no concrete should be placed. High evaporation rates will greatly increase cracking of the deck by drawing water out of the plastic concrete, causing shrinkage cracks. Conditions of low humidity (below 50%), high temperatures (30°C and above), and excessive wind velocity (20 kph and up), can cause the evaporation rate to exceed the bleeding rate. This will cause a crust to form on the surface of the plastic concrete, even when retarders are used, and may result in screeding and finishing problems. When the above unfavorable conditions are unavoidable, the use of a fog spray may be used but with caution or a wind screen is recommended. Water from fog sprays cannot be worked into the concrete surface during finishing wind screen is recommended. Also, if high temperatures are expected during the day, it may be necessary to place concrete at night.

### 2. Traffic

Another factor that is believed to contribute to the cracking of concrete, particularly with respect to decks, is traffic. The vibrations caused by traffic on bridges during the concrete's initial set can cause cracking. To reduce the cracking associated with this, traffic should be provided a smooth riding surface through the construction zone. A smooth transition from pavement to approach slab to deck should be provided to reduce bouncing of vehicles. Acceleration or deceleration of vehicles on the structure should be reduced as much as possible. The flow of traffic should be maintained at a constant rate. The operating speed of traffic should be reduced as much as possible; a speed limit below 55 kph is recommended for the first 24 hours. This will help to reduce vibrations during the most critical period.

### B. Placement

In all cases, the Contractor has the option of placing slab reconstruction concrete separately from the specialized overlay as long as the procedures for separate placements are followed. This includes the additional surface preparation and cure times.

#### Method 1 - Separate Placements

Whenever possible, it is desirable to have a uniform overlay thickness. Variations in the concrete overlay thickness should be kept to a minimum. Overlay concrete is more difficult to consolidate and finish, especially in thicker placements. Variations in thickness increase the chance for cracking as well. In situations where the placement thickness varies to a high extent (over 25 mm) throughout the placement area, it is advisable to place a separate layer of slab reconstruction concrete first. In most cases this material will be either Class D or Class DP concrete. It is essential that the slab reconstruction concrete is properly vibrated to insure consolidation and encapsulation of the reinforcement.

#### Method 2 and 3 - Single Placements - See 11. Overlay Concrete Placement.

### 6. Finishing and Texturing of Slab Reconstruction Concrete

For areas of exposed reinforcement less than 2.5 m<sup>2</sup>, hand finishing is allowed but excessive hand finishing should be avoided. For areas greater than 2.5 m<sup>2</sup>, use either the same machine which will finish the overlay or a manually driven vibrator equipped power screed from the Department's Approved List. Make sure that the equipment is in good working condition and properly set up.



## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

The slab reconstruction concrete should be screeded to the level of the surrounding concrete or in cases where there is 100% exposure, to 10 mm minimum over the top mat of bar reinforcement.

This is essential in order to maintain the proper cover over the reinforcement. The surface should then be roughened with a tinning rake, broom or similar device to provide a good bonding surface for the overlay concrete.

### 7. Curing of Slab Reconstruction Concrete

The curing covers must be applied as soon as possible after texturing. The slab reconstruction concrete has to be continuously wet cured for a minimum period of 3 days. The wet burlap and curing cover option is not allowed.

### 8. Blast Cleaning of Concrete Slab

The bonding of the overlay to the concrete slab is essential for the overlay to reach its full life expectancy. Laitance, dirt and other contaminants will be present on the new slab reconstruction concrete and any pre-existing concrete surface. Follow the recommendations noted in 2. Blast Cleaning.

### 9. Prewetting for Overlay Placement

The deck must be prewet for at least 12 hours immediately before the application of the bonding grout. At the time of bonding grout application, the deck should be in a saturated surface dry condition (SSD) but there should not be any standing water (puddling) present. Sprinklers can be shut off just prior to the start of placement, however, excessive water will negatively affect the bond between the overlay, bonding grout and deck. Standing water can be removed with a broom or by air blasts.

### 10. Bonding Grout for Overlay Placement

Again proper placement of the bonding grout is essential to achieve good bond. The grout must not be applied too far ahead of the overlay placement. Follow the recommendations of 4. Bonding Grout of this section.

### 11. Overlay Concrete Placement

A pre-placement meeting must be held well in advance of the overlay placement in order to work out any details with the Contractor. Follow the recommendations of section 5. Placement of Slab Reconstruction Concrete, of this manual, in addition to the following.

Careful attention should be given to the water content of the overlay concrete mix. All water must be added at the plant, no additions of water are allowed at the job site or on-route. The performance of the specialized overlay concrete relies heavily on impermeability. High water contents compromise the impermeability of the concrete and will reduce service life. If there are problems achieving a workable consistency, up to 2 additions of the water reducing admixture may be added at the job site as long as the maximum dosage rate is not exceeded. High range water reducer is used with microsilica concrete and normal range water reducer is used with class DP. The additions must be of the same admixture used in the initial batching procedure.

Specialized concrete overlays need particular attention paid to the weather requirements. The necessary equipment and materials should be on hand to control placement and curing of the concrete, i.e. vibrators, wet burlap, turf drag, etc. The finishing operation should be reviewed and a dry run performed prior to the concrete placement. Placement of concrete must be performed in accordance with the specifications. Concrete should be placed as near to its final position as possible. The concrete placement should be performed so that there is an excess of concrete in front of the finishing machine across its entire width. The Contractor must place enough concrete at the parapets

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

to prevent excessive shoveling of additional concrete and trowel finishing after the finishing machine has passed. Internal vibration must be used to achieve the proper consolidation. Vibrators should not be used to move concrete. Finishing of concrete should be performed in a timely manner. The concrete should not be overworked as this can cause tearing of the surface and increase the potential for scaling. When finishing concrete, **adding water to the surface or "blessing" is not permitted.** This process adds additional water to the concrete surface and greatly reduces its freeze/thaw resistance, resulting in scaling.

In situations where the overlay is used as the slab reconstruction concrete, and placed at the same time, it is very difficult to maintain a consistent consolidation. When the placement is of nonuniform depth, it is difficult to achieve maximum consolidation. Therefore, **it is important to internally vibrate all slab reconstruction concrete.** If this concrete is not properly vibrated, it will not encapsulate the reinforcement entirely, leaving voids.

### A. Microsilica Concrete

Workers are often worried about over vibration of microsilica concrete. Because of the manner in which microsilica fills the voids in the concrete mix, over-consolidation is much more difficult than with other concrete mixes. In fact, under consolidation is more of a problem. **The overlay should be well consolidated with internal vibrators throughout the entire placement and not just at construction joints or along bulkheads.** The internal vibration will create a 1.5 mm to 3.0 mm layer of "cream" on top of the overlay. This layer also aids in the surface texturing of the overlay.

### B. Class DP Concrete

This class of concrete handles the same way and is similar to another class of concrete you may be familiar with, Class HP. Due to the flyash in the mix, Class DP is easier to handle and finish than microsilica concrete, however, it does tend to have a slower set time and strength gain. It is very important when placing DP concrete in a single placement that sufficient consolidation is achieved through vibration. Class DP concrete should not be excessively hand finished because it will have a tendency to scale.

### C. Placement Position and Timing

#### 1. Alignment of Deck Profile

Along with all other concerns, deck rehabilitations require additional care. There should be no change in the depth of total concrete placement. That is, the placement thickness should be uniform. Since the overlay is the final riding surface of the bridge, surface irregularities should be kept to an absolute minimum. No irregularities can be greater than 3.0 mm. This should be checked often during finishing with the contractor supplied 3.0 meter straight edge. One common problem occurs when the rail cups, used to support the finishing machine, are placed more than 300 mm apart. This causes the rail to sag as the finishing machine passes.

#### 2. Time Requirements

The placement must proceed in a timely manner. When a delay in the placement is unavoidable, precautionary measures should be taken to ensure the best possible quality overlay. If a placement is delayed for 30 minutes or less, wet burlap or plastic should be placed on all unfinished plastic concrete, both ahead and behind the finishing machine, to protect it from drying. Placement can then continue for delays between 30 and 60 minutes, the same procedure may be used only if initial set has not occurred.

If a delay is for more than 60 minutes or if the concrete reaches initial set, all further placement must be discontinued for at least 48 hours, and the concrete bulkheaded. Further

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

material may be placed provided a gap, of at least 3.0 meters, is left between the initially set and freshly placed concrete. This gap is to allow sufficient clearance for the finishing machine. If proper procedures are not followed, the joint between the initially set and fresh concrete will never bond correctly, resulting in early distress to the deck. When concrete is to be placed in the bulkheaded area, all preparation and placement procedures should be followed.

### 12. Finishing and Texturing of Overlay Concrete

#### A. Basic Guidance for Operation of Finishing Machine.

This is a check list of how to operate a finishing machine for best results. A dry run must be performed prior to the placement to ensure that nothing has been overlooked. An experienced machine operator should run the finishing machine. No one should attempt to finish overlay concrete on a bridge deck unless they have previous experience through other projects. Section 557 of the "Construction Inspection Manual" should be thoroughly reviewed prior to the start of the project.

#### FINISHING MACHINE OPERATION CHECKLIST

1. Is 100 mm of material being maintained in front of augers?  
Is there a golf ball size (50-75 mm diam.) roll maintained in front of the smooth wheel roller?
2. Is the vibrator set between 3000 and 5000 VPM? Check this with a reed tachometer.
3. Is the carriage travel speed between 14 meters and 18 meters per minute?
4. Is the drag pan adjusted for best results?
5. Is the automatic machine advance set to a minimum of 50 mm?
6. On super-elevated decks, have the following been checked:
  - a. Finishing rollers rotate uphill only.
  - b. Finish will be done moving uphill.
  - c. Do not reverse direction of rotation of finishing rollers.
  - d. The machine will automatically advance on both sides.

#### • Texturing

As soon as the finishing machine has formed a uniformly smooth, dense surface, the overlay must be textured with an approved turf drag in one pass only. Application of the texturing should not be done forcefully such that aggregate is pulled up by the drag. Make sure that the concrete is not overworked in the areas being trowel finished.

**Note: It is not necessary that the concrete surface prior to texturing have all bug holes filled, or that the surface is smooth since texturing will be immediately applied and saw cut grooving will be done later. Irregularities (holes) < 6 mm do not need to be filled.**

### 13. Curing of Overlay Concrete

When the entire job has gone well to this point, and all of the material was well consolidated, and properly textured, the bridge will still not last its expected life if the overlay is not properly cured. All requirements for normal concrete curing apply here, and the specifications should be stringently applied. Only wet burlap with continuous wetting is allowed on overlays. Along with the normal concrete procedures, specialized overlays require some extra effort. Review curing procedures in accordance with Section 557 of the "Construction Inspection Manual".

#### A. Burlap

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

The overlay must be covered with clean wet burlap within 10 minutes of being placed. Make sure that the burlap is wet before it is placed on the deck. If the burlap is dry when first put down, it will draw (wick) water from the concrete, resulting in shrinkage cracking. Make sure that all specifications concerning time and overlap of the burlap are strictly adhered to. Do not worry about the burlap pattern appearing on the concrete surface. **Timely application of curing is more important than the texture and aesthetics of the overlay.**

### B. Slab wetting system

#### 1. Microsilica Concretes

These overlays must be kept continually wet for a minimum of 96 hours (4 days). Make sure before placement that the wetting system will be operational when needed.

#### 2. Class DP Concrete

DP concrete must be kept continuously wet cured for a minimum of 168 hours (7 days).

### C. Ensuring Proper Curing Period

Curing temperatures are to be maintained per specifications during the curing period. Extremely high or low temperatures are detrimental to freshly placed concrete. Differentials in temperatures, such as change between day and night temperatures, are also detrimental to fresh concrete.

## 14. Saw Cut Grooving

The saw cut grooving should be performed as soon as possible after the required curing period, 4 days for Microsilica Overlay Concrete or 7 days for Class DP Overlay Concrete. Grooving should be done before allowing traffic on the overlay. The grooving must be cut according to all specifications and approved by the Engineer in Charge. Grooving is important for maintaining surface friction during wet weather. Engineers should ensure that the debris or slurry from the saw cuts is being controlled and disposed of in an environmentally safe manner. Follow the recommendations in Section 558 of the "Construction Inspection Manual".

## 15. Penetrating Sealer Application

The sealer used must be from the Department's Approved List. Only a non-water based penetrating sealer may be used due to friction problems encountered with water based sealers.

## II. Cold Weather Concrete Operations

All subjects covered in Sections 555 and 557 of the "Construction Inspection Manual" concerning cold weather concreting, apply for specialized concrete overlays placed in cold weather. In addition to those requirements, specific requirements for specialized concrete overlays are as follows:

### 1. Minimum Temperature for Placement

Specialized concrete overlays for structural slabs may be placed if the ambient air temperature is 7°C or greater, the temperature of the deck after prewet is no less than 7°C, and rising air temperatures are predicted. Further, the prediction must be for ambient air temperatures of over 7°C for the 8 hours immediately after placement.

The temperature of the substrate must be as close as possible to the drop temperature of the overlay concrete in order to minimize thermal stresses between them. Excessive temperature variations can cause debonding and cracking.

### 2. Aggregation of Curing Hours

The curing period for specialized concrete overlays is accumulated in curing hours. A curing hour is defined as any hour, after covering with wet burlap, during which the curing temperature

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

remains at or above 7°C, as measured by a recording thermometer. The Contractor shall supply a continuous recording thermometer.

3. Requirements for Enclosures and External Heat
  - A. Low Curing Temperature

Should the 7°C minimum for placement be met, and subsequently the curing temperature drops below 7°C at any time during the curing period, the structure must be enclosed and external heat provided in accordance with §555 of the NYS Standard Specifications. There is no provision under Specification Section 584 to extend the curing period when the curing temperature falls below 7° C; once the curing temperature falls below 7° C, the application of external heat is required. **If the curing temperature drops below 0° C at any time during the curing period, the concrete will be rejected.**

- B. Low Placement Temperature

Prior to concrete placement, if the temperature is less than the 7° C minimum, concrete placement may not begin unless the structure is enclosed on 6-sides and external heat is provided for the entire curing period. In accordance with §555 of the NYS Standard Specifications, the existing deck slab cannot be considered to be the bottom of the enclosure.

The substrate should be uniformly heated.

- C. Removal of Enclosures and External Heaters

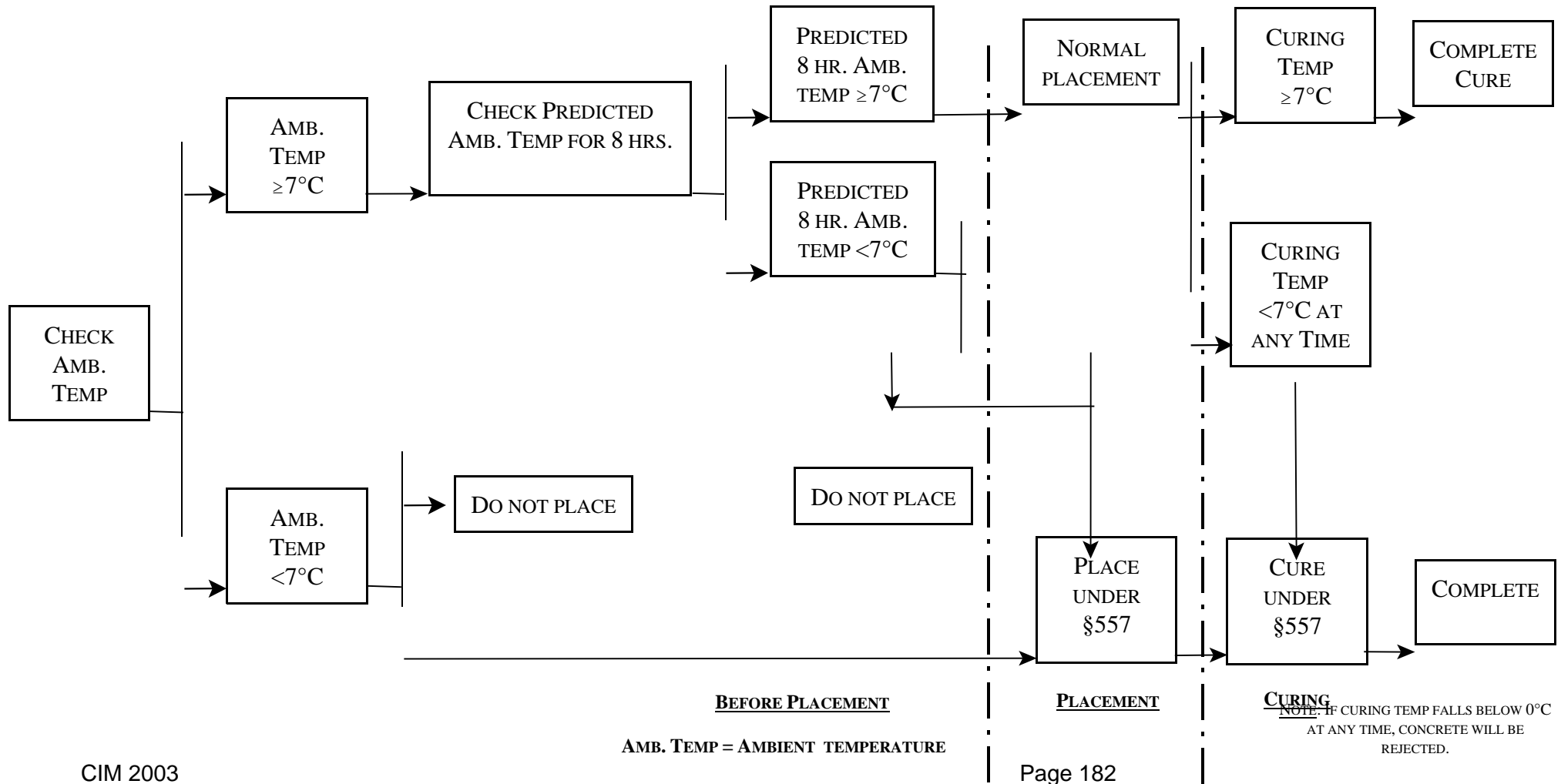
Once external heat provisions are required, they shall remain on the structure until the curing is complete, regardless of the ambient temperature. The temperature of the structure must be reduced at a slow rate after the cure period so as not to shock the concrete. This will allow internal free moisture to expand and escape slowly (prevent rapid freeze).

4. Chart

The Placement and Curing Flow Chart (Exhibit 584-A) should be helpful when making placement decisions and determining which provisions apply for the placement and curing of specialized concrete overlays during cold conditions.

SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS  
EXHIBIT 584-A

**Specialized Concrete Overlays for Structural Slabs**  
 Placement & Curing Flow Chart



## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 586 - MISCELLANEOUS STRUCTURAL RECONSTRUCTION**

#### **586-1.01 Drilling and Grouting Bolts or Reinforcing Bars**

##### **Materials**

These items allow only polymer grouts to ensure greater pullout strength. Not all approved grouts are compatible with all concretes. Therefore, certain specifications recommend that the contractor load test enough reinforcement bars and anchor bolts to ensure concrete/grout compatibility before production grouting begins. The contractor is responsible for performing this testing and determining compatibility.

##### **Construction Details**

##### **Preparation**

Improper preparation of the anchor hole is the principal reason for anchor failure. Care must be taken to ensure that the hole is cleaned, the walls scoured and all debris removed, and the hole is dried before grouting. The grout manufacturer should provide instructions for cleaning the hole, including a description as to how dry the hole must be to obtain maximum grout performance. The manufacturer shall also provide a method for determining when this degree of dryness has been reached. (Example: Place the compressed air “wand” to the bottom of the hole and release air for a minimum of two minutes.)

The typical cleaning procedure for a dry hole is to first blow out the dust and debris with compressed air using a “wand” placed at the bottom of the hole. This is followed by brushing the sides of the hole with a wire brush and then another compressed air cleaning similar to the first.

The EIC should check 30 percent of the holes in each lot to make sure the hole depth is in accordance with the contract documents. Because each size and type of anchor requires a different diameter drilled hole, the hole diameter should be carefully checked for each type of anchor specified. The contractor must use the hole diameter recommended by the grout manufacturer for the type and size of anchor being installed.

##### **Grout Storage and Handling**

Grout must be stored in accordance with the manufacturer’s instructions. The manufacturer should provide any information needed to safely handle the grout, and any required Material Safety Data Sheets.

Grout products requiring drill mixing must be thoroughly mixed to prevent incomplete material cure and substandard strength. The contractor should use the mixing time recommended by the manufacturer. For the products contained in caulking tubes using static mixers, sufficient material should be wasted before using material for anchor installation. This practice is necessary each time the material tubes are changed. The amount of material to be wasted should be the amount recommended by the manufacturer.

If capsule type materials are used, the manufacturer’s recommendation on spinning the anchor when mixing the grout materials should be followed. Care must be taken to prevent “overspinning”, which may result in no bond between the anchor and the adhesive material.

##### **Load Testing When Required**

Drilling and grouting of anchor bolts and reinforcing bars in portland cement concrete under these items include load testing as one of the requirements for acceptance. When load testing anchors, the jacking system is not specifically described in the contract documents. However, the contractor is provided the basic parameters for the jacking system. The object is to allow the contractor freedom to approach the task. The location of some anchors will require ingenuity in the design of the jacking systems.

The contractor determines the lot size of the anchor bolts to be load tested according to the requirements of the specification. When the lot has been selected, the Engineer chooses the location of the bolts to be



## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

tested in the lot by random selection. For all selection methods, the bolts must first be numbered, in a manner determined by the Engineer. Then, to identify the bolts for testing, the EIC can use either standard sampling procedures, such as random number tables found in statistics textbooks, or a computer program for selection of bolts to be load tested, obtainable from the Regional Construction Group Microcomputer Coordinator.

If the bolt pulls out before reaching load test level, it has failed. Failure cause is likely to be inadequate embedment length, insufficient concrete strength, grout incompatibility, or improper hole preparation. Also, if at any time during the load testing of an anchor, a crack(s) appears in the concrete within one foot (.3 meters) of the anchor, the test shall be considered a failure. In this case, failure is likely to be insufficient embedment length or inadequate concrete strength. If both are within the contract requirements, the designer should be contacted.

### **Concrete Repair at a Failed Anchor**

The failed anchor must be pulled free from the concrete and the damaged concrete surface repaired. In many cases, a one-to-two-inch (25-50 mm) thick cone of concrete will be pulled from the surface. The outer edge of the cone will break off flush with the base concrete surface. The concrete grout cannot be effectively tapered out to a zero thickness. Therefore, the periphery of the area where the cone broke out must be bush hammered. The area should be bush hammered to the point that the minimum thickness of grout used to patch the area will be ¼ inch (6 mm). Sandblasting of the entire area must be done before grouting is begun. The contractor should use a grout meeting NYS Standard Specification 701-05 Concrete Grouting Material. When the grout is applied there is no need to fill the hole into which the anchor was grouted.

After the grout has cured to at least 3000 psi (25 MPa) (grout strengths obtained from the grout manufacturer's instructions) the hole should be redrilled to at least the original diameter. After the hole is redrilled, the process originally prescribed for installing the anchor will be used to reinstall it. At this point it may be advisable to contact the grout manufacturer for advice about re-installation of the bolt.

### **References**

- 1) Engineering Instruction 97-007 - Specification 16586.20XXYYM and 16586.20XXYY "Drilling and Grouting Anchor Bolts and Rebars in Concrete."
- 2) NYSDOT Standard Specification 586.01
- 3) Special Specifications based on 1) or 2) above.

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

### SECTION 600 INCIDENTAL CONSTRUCTION

#### SECTION 603 -CULVERTS AND STORM DRAINS

A revision to the Standard Specifications for §603, Culverts and Storm Drains, was issued via Engineering Instruction 98-038. The effective date of the new specification is July 22, 1999. The revised specification addressed the following:

- Aluminum Coated Type 2 Pipe was added as an alternative culvert material
- Polymer Coated Steel was deleted from §602 and added to §603
- Polyethylene Pipe was added
- Clay Pipe was removed

#### **§603-2 Materials**

The acceptance criteria for the various culvert materials is identified in the corresponding §700, Materials Details, of the Standard Specifications. Materials Methods that describe the inspection techniques are MM-12 for metal culverts and MM-1 for concrete culverts.

#### **§603-3 Construction Details**

##### **§603-3.02 Laying Pipe**

Concrete: When lifting holes exist, lay pipe with the holes in the 12 o'clock position. If any pipe pieces have the word "top" marked on them, they should be oriented correctly. Typically, this occurs with elliptical pipe designs, but occasionally, round culverts with special steel reinforcements require these markings.

Metal Pipe: The thickness of the pipe must be verified with a micrometer caliper. Coating thickness should be verified with a Type 2 Fixed Probe Magnetic Gauge. The calipers and gauge are provided by the Contractor.

Polyethylene Pipe: The pipe after installation will have a maximum deflection of 5% of its nominal inside diameter. The Engineer may order the contractor to perform mandrel testing to determine the 5% specification compliance.

##### **§603-3.03 Bedding and Backfilling Pipe**

Adhere to the appropriate Standard Sheet for the proper procedures. Aluminum or aluminum-coated pipe must be coated with a zinc chromate primer or an approved alternative if it is to come in contact with portland cement.

Compaction: All pipes should be backfilled according to the appropriate Standard Sheets: Metal and Plastic 203-5R, Concrete 203-4R. In addition, lifts **should not** exceed 150 mm.

Controlled Low Strength Material (CLSM): If this material is specified, measures must be taken to assure that the pipe will maintain its line and grade during the placement of the CLSM. Depending on the pipe material, the Contractor must insure that the pipe does not float during the placement of the CLSM.

##### **§603-3.04 Damaged Pipe and Repair**

Concrete: The latest revision to the specification, §706-02, can be found in Engineering Instruction 98-019.

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

Repair of concrete pipe is discussed under Fabrication Requirements. Materials Method 1, Quality Assurance Procedure for Concrete Pipe Items, also covers quality assurance and repair procedures for concrete pipe items.

Metal: Damaged pipe coatings must be repaired according to Materials Method 12, Corrugated Metal Pipe and Corrugated Structural Plate for Pipe.

Polyethylene: Damaged polyethylene pipe may be acceptable provided the damaged section is removed. The remaining section may be incorporated at terminal locations only. The minimum length of a pipe section is 1 meter.

### **§603-3.06 Joints**

The maximum allowable space at all joints, regardless of material type, is 13 mm.

Concrete: If the Contract requires an internal pressure test, follow the procedures indicated in §603-3.06 C.

Metal: The circumference of consecutive sections may not vary by more than 38 mm. Arched pipe may require matched ends with a numbering system to identify the construction sequence of the sections.

Polyethylene: Only manufactured ends may be used at joints. No field cuts are allowed in this location unless approved by the Engineer.

### **References**

Materials Method 1

Materials Method 12

Engineering Instruction 98-019

Engineering Instruction 98-038

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 605 - UNDERDRAINS**

#### **Granular Filter Material**

##### **General Requirements**

Materials used for Underdrain Filter, Types I and II, must be stockpiled in accordance with the appropriate Departmental publication in effect at the time of advertisement for bids (Reference: GCP-17).

Underdrain Filter, Type III, shall meet the gradation and quality requirements of §703-07, Concrete Sand.

##### **Project Procedure**

Inspect the construction of stockpiles. Record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer.

The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpiles. Test results will be reported on GE-454M, (See Exhibit 203H) "GRANULAR MATERIAL DOCUMENTATION FORM." A copy of this form shall be part of the project records.

##### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. For granular material, copies of test results (Form GE-454M, "GRANULAR MATERIAL DOCUMENTATION FORM") and, when applicable, a copy of the letter approving stockpile transfer, as well as the original GE-454M.
3. If variations to the stockpiling requirements are granted, a copy of the letter from the Director of the Geotechnical Engineering Bureau must be on file.

##### **References**

GCP-17, Procedures for the Control of Granular Materials

GE-454M, Granular Material Documentation form

##### **Related Contract Provisions**

§203-1.01, Unclassified Excavation

§203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits and Direct Burial Cable

§206-5.01, Trench, Culvert and Structure Excavation

§603-3.01, Excavation

§703-07, Concrete Sand

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 608 - SIDEWALKS, DRIVEWAYS, BICYCLE PATHS, BRICK PAVING, GROUTED STONE BLOCK PAVING, AND PRECAST CONCRETE PAVING**

#### **Driveways**

Field reports indicate a wide variance in the restoration of driveways. With respect to driveway restoration, the following guidelines shall apply:

1. Comply with the Department's "Policy and Standards For Entrances to State Highway" (M.A.P. Code 7.12-34) governing entrances to state highways. The location and geometrics of such entrances are shown in this policy. The current edition booklet is available from the NYSDOT Business Administration Plan Sales Office.
2. Restore driveways in kind. If the drive was a gravel drive, restore it as a gravel drive, NOT a bituminous drive. When necessary, provide an asphalt driveway apron to control gravel kickback from getting onto the travel lane.
3. Whenever possible try to maintain original profile grade of the driveway. Adjust driveway entrances so that a car does NOT drag on entering or leaving. Driveway's grades should be field tested prior to paving.
4. Adjusting or restoration of any driveway shall be limited to that length which is required for a reasonable transition from the highway to the driveway. A rule of thumb the driveway should be paved a minimum of 10' beyond the edge of the travel lane due to concerns of overwashing and tracking gravel onto the travel lane.
5. Where the driveway is not a paved driveway, bituminous paving of the drive may extend from the edge of the pavement to a point no farther than the back of the ditch line or the curb line as the case may be. Where there is a curb, it may be necessary to pave a relatively short distance in back of the curb to meet the sidewalk or sidewalk area.
6. Entrances into open fields, or entrances that have very infrequent use, are not to be paved. Let the stabilized shoulder suffice.
7. Where there is a concrete driveway that has to be restored, the restoration from the edge of the pavement to the extreme edge of the shoulder shall be bituminous pavement, NOT Portland Cement Concrete.
8. A release from the property owner is needed before adjustments are made on private property. Refer to Section 107-14 of the Contract Administration Manual for further information regarding a release.

#### **Sidewalk Ramps**

When inspecting the construction of sidewalk ramps, and any associated curb treatments, care must be taken to ensure that the dimensions, lines and grades shown on the plans are adhered to. The Contractor should establish the line and grade of the proposed sidewalk ramps prior to placement of the curb. Any adjustments to meet field conditions must consider the design standards for accessibility. Refer to the Highway Design Manual, Standard Sheets or Engineering Instructions before any changes are considered. Questions related to accessibility guidelines should be referred to the Regional Landscape Architect.

#### **References**

MAP 7.12-34, POLICY AND STANDARDS FOR ENTRANCES TO STATE HIGHWAYS  
CAM, 107-14, FURNISHING RIGHT-OF-WAY

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 610 - TURF AND WILDFLOWER ESTABLISHMENT**

#### **General Requirements**

The work covered by this section includes work necessary to establish and care for turf and wildflowers, at locations as shown in the contract documents and/or as directed by the Engineer.

#### **Establishing Turf**

Section 610-4.02 of the specification indicates that establishing turf will be measured as the number of acres of surface area that have been satisfactorily seeded. However, section 610-3.02F of the specification requires that a satisfactory growth of grass be established prior to the acceptance of the contract. To ensure a uniform interpretation of the method of payment for turf establishment the following guidelines are offered:

The Contractor should be paid for establishing turf, Item 610.0203, as soon as the seed has been applied in accordance with the specification. After a suitable period of time, a satisfactory growth a grass must develop or the Contractor should be directed to reseed prior to the acceptance of the contract. If the seeding occurs near the completion of a contract, not allowing enough time to establish a satisfactory growth of grass, an Uncompleted Work Agreement as per Section 109-10 should be processed for the turf establishment work. It is possible that the period of time to establish growth may be in excess of six months if the turf establishment occurs in the late fall.

Contractors should be encouraged to seed at intervals throughout the contract according to the Department's Memorandum of Agreement with the NYSDEC regarding SPDES.

#### **Related Contract Provisions**

109-10, UNCOMPLETED WORK AGREEMENT

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

### SECTION 612 - SODDING AND PLACING EROSION CONTROL MATERIALS

Standard specification Section 612, Sodding and Placing Erosion Control Materials, contains the contract requirements for sodding and/or placing erosion control material to prevent undesirable erosion of earth exposed to flowing water. Unchecked erosion can damage and destroy highways, bridges, culverts and other facilities.

#### General Requirements

##### Sodding

The Engineer should assure that the sod which is not immediately planted is tightly rolled, or stored roots-to-roots. All sod in stacks shall be kept moist and protected from the sun and from freezing. The maximum period of time from harvesting to planting shall not exceed forty-eight hours. Sod that is stored on the project site prior to planting shall meet the moisture requirements of §713-14 at the time of planting.

The soil on which sod will be laid shall be moist to a depth of 50 mm to 75 mm. If the Engineer determines that the soil is too dry, the soil shall be watered prior to sodding. If it has rained prior to placing sod, and the soil is moist to a depth of 50 mm to 75 mm, watering may not be necessary.

##### Placing Erosion Control Materials

Erosion Control Materials shall be placed as specified in the contract documents and/or according to manufacturer's recommendations. No erosion control material shall be placed on frozen ground.

#### Project Procedure

##### Sodding

The Contractor shall exercise maximum care to retain the soil existing on the roots of the sod during transporting, handling and transplanting operations. There shall be a minimum of 50 mm of topsoil under all sod unless otherwise specified. Fertilizer shall be applied at a rate of 6 grams of nitrogen per square meter unless otherwise specified.

##### Furnishing and Placing Erosion Control Materials

Areas to receive an erosion control material shall be shaped, graded and compacted to the lines and grades shown in the contract documents or as directed by the Engineer. All erosion control materials shall be placed and firmly anchored as stated in the manufacturer's instructions. The contractor shall care for the areas where erosion control materials have been placed until acceptance of the contract or acceptance of the turf, whichever is later.

#### Evidence of Acceptability

Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent department procedures in effect on the date of advertisements for bids.

#### References

- \* Directive LAB 713-07R1 01/06/99 (Erosion Control Material Acceptance and Quality Assurance Procedures)
- \* NYSDOT's Approved List

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 613 - TOPSOIL**

#### **General Requirements**

If no preapproved sites are designated in the contract documents, topsoil shall be stockpiled. Topsoil shall be sampled by a representative of the Department in accordance with the Department's "SAMPLING PROCEDURE FOR STOCKPILED TOPSOIL."

#### **Project Procedure**

For stockpiled topsoil, record the material source and stockpile construction features on MURK-1d, "INSPECTOR'S DAILY REPORT." Request sampling from the Regional Landscape Architect. Form SM-449-1-5, (Exhibits 613 A-E) "TOPSOIL SAMPLE INFORMATION," shall be completed and submitted to the Geotechnical Engineering Bureau with the topsoil sample(s). A copy of the form shall be placed in the project file.

When stockpiling is required, the topsoil shall be tested and approved prior to use on the project.

#### **Inspection**

Inspectors should be aware that when seeding lawn areas, the seeding requirement mandates that the topsoil be screened. Without screening the topsoil is very difficult to rake.

#### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. For sources requiring stockpiling, a copy of test results on Form SM-449-1-5, "TOPSOIL ANALYSIS REPORT," shall be on file.



## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 620 - BANK AND CHANNEL PROTECTION**

Standard Specifications Section 620, BANK AND CHANNEL PROTECTION, contains the contract requirements for constructing blankets and walls of erosion resistant materials to prevent undesirable erosion of earth exposed to flowing water. Unchecked erosion can damage and destroy highways, bridges, culverts and other facilities. Therefore, it is important to construct the protective works such that they will fulfill their mission.

#### **General Requirements**

##### Stone Filling and Rip-Rap Items

The material used for these items shall be stockpiled. Stone is accepted for quality characteristics (soundness and durability) on the basis of a geologic evaluation of the material source or stockpile by a Departmental Engineering Geologist. Such evaluation may require a field evaluation and laboratory tests on samples of stone selected by the Engineering Geologist. Gradation shall meet the specification requirements and shall be accepted, or rejected, based on a visual examination of the material by the Engineer.

A Table relating dimensions and weight of stones having various shapes is included in Section 620 of the Standard Specifications to aid the Engineer in determining whether the specified gradation requirements have been met.

Control of stone filling and rip-rap items is covered in the appropriate Departmental publication in effect on the date of the bid advertisement GCP-14, PROCEDURE FOR CONTROL OF STONE FILLING AND RIP-RAP ITEMS.

##### Bedding Material

Material used for Bedding Material must be stockpiled in accordance with the appropriate Departmental publication GCP-17, PROCEDURE FOR CONTROL OF GRANULAR MATERIALS in effect at the time of advertisement for bids. The material must be free of soft, nondurable particles, organic material, and thin or elongated particles.

##### Concrete Block Paving

The concrete paving blocks shall comply to the specifications and tests set forth under Section 704-04. The blocks shall be sampled in accordance with procedural directives of the Department for entire stock lot quantities at the manufacturing location.

##### Gabions

The materials used for fabricating the gabion shall comply to the specifications and tests set forth under Section 712-15. The gabion filling material shall be stockpiled in accordance with the appropriate Departmental Publication (Procedure for the Control of Stone Filling and Rip Rap Items) Gabion fill is accepted for quality characteristics (soundness and durability) on the basis of a geologic evaluation of the material source or stockpile by a Departmental Engineering Geologist.

#### **Project Procedure**

##### Stone Filling and Rip-Rap Items

The Engineer shall furnish, in writing, to the Regional Geotechnical Engineer, gradation approval and an estimated quantity of material in stockpile. The Regional Geotechnical Engineer shall request geologic evaluation of the source from the Director of the Geotechnical Engineering Bureau when appropriate. The request may be either by letter or fax machine and shall indicate the project, source location and item(s).

The Engineer shall take action necessary to ensure that the requirements of the specifications and plans regarding weight, size, thickness, placement, etc. are complied with. The visual acceptance or

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

rejection of gradation, required by the specification shall be documented on "ENGINEER'S DAILY PROJECT DIARY," including identification of the individual making the determination.

The limits of stone filling and rip-rap bank and channel protection should extend to bedrock outcrops, boulders or other stable features when they don't significantly increase the quantities. In small drainage channels, extend the lining to a point where the grade of the channel becomes noticeably flatter.

Where Rip-Rap, Stone Filling (Medium) or Stone Filling (Heavy) is placed on Geotextile, do not permit stone to be dropped on the Geotextile from a height greater than one foot. Do not permit smaller sizes of stone filling to be dropped on Geotextile from a height greater than three feet.

### **Bedding Material**

Inspect the construction of stockpiles. Record the material source and stockpile construction features on "INSPECTOR'S DAILY REPORT." Request approval of the stockpile from the Regional Geotechnical Engineer. The Regional Geotechnical Engineer will supervise the sampling and arrange for the testing of the stockpile. Test results will be reported on GE-454M (See Exhibit 203 H) "GRANULAR MATERIAL DOCUMENTATION FORM." A copy of this form shall be part of the project records.

If the soil over which bedding material is to be placed contains a substantial portion of coarse gravel-size particles and/or is plastic, it may be possible to delete the bedding material. Contact the Regional Geotechnical Engineer to aid in this determination.

### **Concrete Block Paving**

Request approval of the lot quantity from the Regional Materials Engineer. The blocks shall be sampled by the Department's representative. Test results must accompany either the "shipment authorization form" or "shipment certification form". A copy of this form shall be part of the project records.

### **Gabions**

Inspect gabion forms for compliance with plans and specifications and document decisions on the Inspectors Daily Report and the Engineers Daily Project Diary.

The Engineer shall furnish, in writing, to the Department Geotechnical Engineer, gradation approval and an estimate of quantity of material in the stockpile. The Department Geotechnical Engineer shall request geologic evaluation of the source from the Director of the Geotechnical Engineering Bureau when appropriate. The Engineer shall take action necessary to ensure that the requirements of the specification and plans regarding size, placement, etc. are met. The visual acceptance or rejection of gradation required by the specifications shall be documented on the "Inspectors Daily Report" and the "Engineers Daily Project Diary" including the identity of the individual making the determination.

## **Evidence of Acceptability**

### **Stone Filling and Rip-Rap Items**

1. Compliance with all specification requirements for the item(s) involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.
2. A letter of evaluation from the Departmental Geotechnical Engineer stating that the stockpile is acceptable or a letter approving transfer, when applicable.

### **Bedding Material**

1. Compliance with all specification requirements for the Item involved, as well as conformance to the pertinent Departmental procedures in effect on the date of advertisement for bids.

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

2. For granular material, copies of the test results GE-454M (GRANULAR MATERIAL DOCUMENTATION FORM") and when applicable, a copy of the letter approving transfer, as well as the original "GRANULAR MATERIALS DOCUMENTATION FORM".
3. If variations to the stockpiling requirements are granted, a copy of the letter from the Director of the Geotechnical Engineering Bureau must be on file.

### Concrete Block Paving

1. Compliance with all specification requirements for the item involved, as well as conformance with the pertinent Departmental procedure in effect on the date of the advertisement for bids.
2. Copy of the test results on "shipment authorization form" or the "shipment certification form".

### Gabions

1. Compliance with all specification requirements for the items involved, as well as conformance to the pertinent Departmental procedures in effect on the date of the advertisement for bids.
2. A letter of evaluation from the Departmental Geotechnical Engineer stating the stockpile is acceptable, or a letter approving transfer of an approved stockpile indicating original quantity along with the remaining quantity to be used.
3. A letter stating that the material of the gabion form (baskets) conform to the requirements of the specification provided by the manufacturer on their letterhead and signed by an officer of the company.

### **References**

GCP-17, GEOTECHNICAL ENGINEERING BUREAU'S GRANULAR CONTROL PROCEDURE  
GCP-14, GEOTECHNICAL ENGINEERING BUREAU'S CONTROL OF STONE FILLING AND RIP-  
RAP ITEMS PROCEDURE  
GEOTECHNICAL ENGINEERING BUREAU'S BANK AND CHANNEL PROTECTIVE LINING DESIGN  
PROCEDURES

### **Related Contract Provisions**

203-3.12, Compaction  
701-01, Portland Cement  
703-03, Mortar Sand  
703-06, Cushion Sand  
703-07, Concrete Sand  
704-04, Concrete Block (Slope Paving)  
712-15, Gabions

## **SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS**

### **SECTION 625 - SURVEY OPERATIONS, ROW MARKERS, & PERMANENT SURVEY MARKERS**

#### **General Requirements**

All work associated with establishing or setting horizontal or vertical survey control, collecting survey field data or staking out field positions of proposed construction work, and preserving or stake out of land boundary markers is included under Survey Operations.

All work associated with the various types of ROW Markers and the Permanent Survey Markers shall include providing the markers as specified to the site, installing them as per the standard sheet, and certifying their location.

All work associated with boundary determinations or boundary monumentation can by state law, be performed only by or under the direction of a NYS Licensed Professional Land Surveyor, and therefore, all locations of these ROW Markers or PSM's can only be certified by a NYS Licensed Professional Land Surveyor. (Certifications can also be submitted by exempt Licensed Professional Engineers as permitted under Section 7209(m) of the NYS Education Law, but there are very few Engineers who still qualify under this exemption.)

#### **Project Procedure**

The procedure for successfully completing the installation of ROW Markers or PSM's shall include the following:

- 1) The Contractor provides the markers which meet the specification requirements.
- 2) The Contractor installs the ROW Markers as per the standard sheet and to the accuracy required by Section 625. PSM's are installed as per the standard sheet and at a location specified on the plans or as ordered by the Engineer.
- 3) The Contractor submits to the Engineer, the appropriate marker certification form which has been signed and sealed by a NYS Licensed Land Surveyor. The forms shall be submitted within 30 days of the completion of installing the markers. The Engineer forwards the forms to the Regional Land Surveyor for approval of appropriate information. The Regional Land Surveyor shall initial the approved certification form and return a copy to the Engineer. Upon receipt of the approved certification form, the Contractor will then be eligible to receive final payment for the markers. (Copies of the ROW Marker and Permanent Survey Marker certification forms are included as Exhibits 625-A and 625-B.)
- 4) The Engineer is responsible for placing the survey marker locations on the as-built drawings.
- 5) As per the specification requirements, the Contractor shall submit survey notes and calculations to the Engineer, prior to contract acceptance. (Be aware that the transmittal of the notes and calculations may be in an electronic format.)

#### **Inspection**

Inspectors should be aware of the material and installation requirements of the standard sheets, (such as including reinforcement in PSM installations), and to visually check the relative locations of the markers to other topographic features to verify their relative locations (such as proximity to ROW fencing, other ROW Markers, drainage structures, roadway pavement or sidewalks, or to adjacent property lines. Verification of precise locations is to be provided by the contractor on the certification forms.

## SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

## SECTION 625 - RIGHT OF WAY MARKERS - SURVEYOR'S CERTIFICATION

<p>JOB STAMP</p>	<p>LAND SURVEYOR or EXEMPT P.E. SEAL</p>	<p>I hereby certify that the Right of Way Markers listed herein were installed in accordance with and to the degree of accuracy required by Section 625 of the current version of the Standard Specifications of the New York State Department of Transportation.</p> <p>Date: _____ L.S. No. or Exempt P.E. _____</p> <p>Name: _____</p> <p>Signature: _____</p> <p>CERTIFICATION</p>
------------------	--	--

STATE HWY (SH) NUMBER:	NYS ROUTE NUMBER:	CITY/TOWN/VILLAGE:	COUNTY:
------------------------	-------------------	--------------------	---------

[illegible]

NOTES: 1) AS BUILT STATIONS AND OFFSETS SHALL BE LOCATED AND DIMENSIONED TO NEAREST MILLIMETER  
2) USE SEPARATE CERTIFICATION FORM FOR EACH STATE HIGHWAY  
3) SUBMITTED FORM SHALL BE MARKED WITH AN ORIGINAL STAMP OF THE LAND SURVEYOR'S SEAL

DATED: MARCH 2000

Exhibit 625 - A

# SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

## SECTION 625 - PERMANENT SURVEY MARKERS - SURVEYOR'S CERTIFICATION

JOB STAMP

LAND SURVEYOR or EXEMPT P.E. SEAL

I hereby certify that the Permanent Survey Marker listed herein was installed in accordance with and to the degree of accuracy required by Section 625 of the current version of the Standard Specifications of the New York State Department of Transportation.

Date: \_\_\_\_\_ L.S. No. or Exempt P.E. \_\_\_\_\_

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

CERTIFICATION

STATE HWY (SH) NUMBER: \_\_\_\_\_

NYS ROUTE NUMBER: \_\_\_\_\_

CITY/TOWN/VILLAGE: \_\_\_\_\_

COUNTY: \_\_\_\_\_

NYS PLANE COOR. SYS. ZONE: \_\_\_\_\_ NAME OF STATION (PSM NO.) \_\_\_\_\_

N =

E =

HORIZ. DATUM:

COMBINED FACTOR:

ELEV. = \_\_\_\_\_ meters DATUM: \_\_\_\_\_

BASELINE STA./OFF: \_\_\_\_\_ - \_\_\_\_\_ L/R

CENTERLINE STA.OFF: \_\_\_\_\_ - \_\_\_\_\_ L/R

DISTANCES & DIRECTIONS TO PRECEDING AND SUCCEEDING MARKERS

OBJECT

DISTANCE (METERS)

GRID BEARING

DESCRIPTION (TO FIND MARKER):

SKETCH OF MARKER (INCLUDING TIES):

NOTES: 1) SHOW NORTH ARROW AND DISTANCE TO NEAREST MILEPOST REFERENCE MARKER.  
2) ALL COORDINATES, DISTANCES AND ELEVATIONS SHALL BE CALCULATED AND NOTED TO NEAREST MILLIMETER.  
3) ALL TIES ARE TO BE MEASURED HORIZONTALLY WITH A STEEL TAPE, UNLESS OTHERWISE NOTED.  
4) SUBMITTED FORM SHALL BE MARKED WITH AN ORIGINAL STAMP OF THE LAND SURVEYOR'S SEAL.

DATED: MARCH 2000

Exhibit 625 - B

## SECTION 637 - ENGINEER'S OFFICE AND LABORATORY BUILDING

### Microcomputer Systems

#### General

With the construction field offices supplied with "Microcomputer Systems" from contractors, as well as from State inventories, it is necessary that all parties (contractors, DOT staff, and consultant inspection staff) have a clear understanding of their responsibilities and interactions.

Contractor supplied "Microcomputer Systems" are provided as a pay item of the contract. Projects meeting the microcomputer system warrant criteria automatically have the item specification added to the contract proposal by the Regional Design Group or Main Office Design Services Bureau. The warrant criteria includes minimum thresholds of engineers estimate dollar value, number of pay items and estimated project duration in months which must be met to have item included. Refer to the Engineering Instruction (EI) distributing the current version of the item specification. Item incorporation is verified by the Design Quality Assurance Bureau.

Exceptions to the warrant criteria may be requested. A memorandum to the Construction Division is required stating what the estimated project cost is, number of items, and project duration, with a short explanation. This should take place prior to PS&E so the item specification can be added to the project proposal if the exception is approved by the Division.

For those projects which meet the warrant criteria and have the item automatically included, but the Regional Construction Group Computer Coordinator determines the contractor provided item is not necessary, the item is to be deleted from the contract.

#### Regional Construction Group Supplied Microcomputers:

For use in field offices when the project did not meet the warrant criteria and/or the Regional Construction Group Computer Coordinator makes a determination that the project(s) should have a state owned microcomputer. The state microcomputer may serve as the primary (and sole) system on a project or may serve as the secondary system on a project that has a standard contractor provided microcomputer system.

When a Department microcomputer is assigned to a field office, or to a state employee for project level work, the use of the Computerized Engineer's Estimate System, CEES, is required. Regional Construction Group Computer Coordinators will make a determination, as they do on contractor supplied microcomputers, as to what other software and applications will be used. Of course, each Department microcomputer must have legal copies of software. Public Domain Software, and privately owned legal software may be used on the microcomputer by Department employees for State work only. However such software and use must be approved by the Construction Group Computer Coordinator who will also verify the software as "virus free" prior to installation. The approval of Public Domain Software and/or privately owned legal software is also applicable to Regional Construction Group and Construction Division microcomputers. Use of software should also be compliant with Department requirements.

When the Regional Construction Group Computer Coordinator determines that a Department Microcomputer System is to be assigned to a construction field office, the Engineer-in-Charge (EIC) shall inform the Contractor of this decision in writing.

The letter shall include a list of microcomputer components, including software, by serial number and decal number. All Department hardware shall have a decal number prior to its placement at a construction field office. The letter shall also include the approximate purchase cost of the microcomputer system.

#### Contractor Supplied Microcomputers:

## **SECTION 637 - ENGINEER'S OFFICE AND LABORATORY BUILDING**

The same uses of the CEES Program and other software apply as discussed above. Computer Coordinators have the same responsibilities. The contractor supplies the latest version of the software listed in the "Microcomputer System" item specification.

The contractor is not required to keep original diskettes or other media in the field office. Complete original manuals are required; these may be paper, CD-ROM or hard disk based. The determination as to whether a software copyright notice allows copies of original diskettes/media to exist is the contractor's responsibility. The contractor is responsible, as outlined in the item specification, to make the microcomputer system fully operational prior to the start of work; this includes software.

The Department's position concerning the contractor supplied microcomputer system is, that the contractor has obtained and is installing and/or using the item in conformance with his purchase agreement. With contractors for whom we enter into a contract, we accept in good faith that they are legally operating all aspects of the "Microcomputer System" item specification. We, the Department, do not police this activity. They in turn accept our license rights to install Department software on the equipment they provide. Both parties agree that at the completion of a project, each leaves with only what each is legally capable of possessing.

The contractor may be required, by order-on-contract, to provide other hardware or software, for example, see CPM specification. Prior to order-on-contract submittal, a justification memorandum discussing the need and anticipated costs and benefit must be sent by the Regional Construction Group Computer Coordinator to the Division for approval.

At the completion of a project, it is a Regional Construction Group responsibility to insure that the contractor supplied microcomputer does not contain Department software or applications or that any diskettes containing the latter are left with the contractor.

If the contractor requests a copy of the "00 CONR Diskette" it shall be provided to the contractor by the Regional Construction Group. A diskette should only be transferred to the contractor after project initialization has been performed and "00 CONR Printout" verification. CEES generated printouts and/or ASCII files may also be provided to the contractor if requested. However, the actual CEES program and data files are not to be provided to a contractor.

The use of engineering software (both Vendor and DOT developed applications) on both Department and contractor supplied microcomputers is allowable. Vendor products should not be loaded on machines as a general rule; only when the software is to be used and when either trained project staff or other Construction Group staff are available to use it. These users are to have obtained training in the software through appropriate DOT approved sources. Once a determination has been made to use Vendor products on a specific project, the Regional Construction Group Computer Coordinator should inform the Construction Division of its use, the version being used, and anticipated completion. The Construction Division, in conjunction with the RCG, will determine on a project-by-project basis if the vendor software products will come from DOT licenses or be provided by the contractor as a pay item or by Order-on-Contract.

### Consultant Inspection Staff Use of Microcomputers:

Consultant inspection staff, in regard to the use of contractor provided or State supplied Microcomputer Systems, should be viewed no differently than DOT staff. Consultant staff are expected to follow the direction of the Regional Construction Group and policies of the Construction Division. Dependent on the specific contract agreement requirements for a given project, a consultant may or may not be involved with field "office" duties. If not, then the consultant staff shall not use the microcomputer system.



## **SECTION 637 - ENGINEER'S OFFICE AND LABORATORY BUILDING**

If the consultant performs some office duties in combination with State forces or is responsible for all such duties with only a State EIC assigned to the project, then the use of the microcomputer shall be as follows:

1. The CEES Program is to be used and must be set up to operate as in non-consultant field offices. The use of a menu program is required if the Regional Construction Group uses the program on DOT-staffed projects.
2. The consultant must provide all Department required microcomputer outputs using the software included in the contractor provided or state supplied Microcomputer System.

The consultant shall not use contractor provided or State supplied Microcomputer System for non-DOT operations.

3. As with contractor orders-on-contract, a consultant may be directed to provide microcomputer hardware or software materials but only after the Division has approved the expenditure. A justification memorandum discussing the need and anticipated costs and benefits must be sent by the Regional Construction Group Computer Coordinator to the Division for approval.
4. The use of engineering software by consultant staff is allowable. The same rules govern their use as discussed under contractor provided microcomputers. If a Regional Construction Group requires a consultant to use either of these packages, then the Group must arrange for the training of consultant personnel. The expenses incurred by the consultant to participate in this Department training are not reimbursable.

### **References**

CEES Manual

Memorandum August 9, 1994, A. J. Torre to All Regional Construction Group, MICROCOMPUTER COORDINATORS

## SECTION 645 - SIGNS

### 645-3.04 Sign Face Construction

The signs shall be of the specified traffic sign color or colors. Signs manufactured with more than one piece of reflective sheeting shall exhibit color uniformly between pieces sufficient to provide overall uniform color for the entire device. Minor color streaks or color differences will be acceptable if they are judged not to be unsightly or distracting to the motorist. It will be the judgement of the inspector as to whether or not the noted color difference is unsightly or distracting.

### 645-3.07 Sign Locations

The Contractor's stake out of the signs will be checked for proper location, lateral clearance and orientation. (For Type A Sign Supports, see soil and embankment considerations in Section 645-3.08, below.)

### 645-3.08 Erection

Posts, supports, and sign panels will be inspected prior to installation. All signs shall be of the type and design specified. For Type A Sign Supports, post size, corrosion coating, splice hardware and assembly, sign area, spacing within a 2.13 m (7 ft) path, and embedment should be checked against the appropriate Materials Detail sheets. For Type B Sign Posts, post size, hinge and breakaway base dimensions should be checked against the Standard Sheets. Breakaway base welds will be checked for size and type against the Standard Sheets. Vertical alignment of the posts with breakaway bases shall be adjusted using the shims shown on the standard sheets and checked using a level.

Type A Sign Supports rely on a relatively shallow soil embedment depth to provide resistance to wind loads, and to firmly hold the support in place for proper breaking or slip-release when struck by an errant vehicle. Three factors can affect the soil's ability to provide the proper reaction forces to accomplish this: soil type, ground water, and slope. These are referred to in the Materials Details, as follows:

S - 1 Soils. Most soil conditions in New York state fit under the S - 1 category. This includes sands, gravels, and silts (and their mixtures.) All compacted shoulders fall into this category.

S - 2 Soils. Uniform-sized sand particles which are difficult to compact. Soil plates may be required for installations. Maximum number of supports allowed in a 2.13 m (7 ft) path may be reduced. (See requirements in the Materials Details.)

Plastic Soils. Soft clays or organic deposits should be avoided, if possible. If sign supports must be placed in this type of area, contact the Geotechnical Engineering Bureau for assistance with a foundation design.

Ground Water. Ground water in the soil embedment zone greatly reduces the ability of the soil to provide proper support. Sign support locations in areas with high ground water, should be avoided. If sign supports must be placed in this type of area, contact the Geotechnical Engineering Bureau for assistance with a foundation design.

Slope. Slopes steeper than 1 on 5 have a reduced ability to provide the required resistance to overturning of a sign support. This is compensated for by using a deeper minimum embedment. (See requirements in the Materials Details.)

Type B Sign Posts footing requirements are shown on the Standard Sheets.

On Type A Sign Support Systems and Type B Sign Posts, the lower portion of the splice, hinge plate, or slip base shall not extend more than 100 mm (4") above ground line as shown on the appropriate Materials Details or Standard Sheets. This is to prevent snagging of errant vehicles should they impact the breakaway device. Breakaway systems installed with the lower portion greater than 100 mm (4") above ground line shall be reset to conform to this requirement.

## SECTION 645 - SIGNS

For Type B Sign Posts, tensioning of the galvanized high strength bolts in the hinge assembly can only be done properly by the "turn-of-the-nut" method as detailed on the Standard Sheets. The inspecting torque performed with a torque wrench in the presence of an inspector is only intended to reveal or locate bolts that either did not receive "turn-of-the-nut" tightening or did not receive the tensioning procedure properly. Any movement experienced when checking with the torque wrench would indicate that the "turn-of-the-nut" method was improperly performed. That bolt and nut should then be loosened and retightened by the "turn-of-the-nut method. Bolts, nuts and washers loosened and retightened more than once shall be replaced.

### **645-3.11 Sign Posts and Support Systems**

#### **A. Type A Sign Support Systems.**

Type A Sign Supports limit the energy transferred to a striking, errant vehicle by means of a brittle (frangible) cross section or a breakaway splice system, or a combination of both. (Newer designs may use a frangible post combined with a slip plate system.) The number of supports allowed in a path wide enough for a passenger vehicle, 2.13 m (7 ft), is limited by the amount of energy the particular support configuration transmits to a test vehicle, as determined by crash testing. Materials Details show a table of allowable sign areas based on the two wind zones that are used throughout the State; however, if the centroid of the sign area is more than 4.27 m (14 ft) above the surrounding terrain, higher wind pressures (and consequently, smaller allowable sign areas) are required.

#### **B. Type B Sign Posts.**

Type B Posts limit the energy transferred to a striking, errant vehicle by means of a hinge assembly or slip plate system. The number of posts allowed in a path wide enough for a passenger vehicle, 2.13 m (7 ft), is limited by the amount of energy the particular post configuration transmits to a test vehicle, as determined by crash testing. Allowable sign area tables are found on the appropriate Standard Sheet.

## **SECTION 648 - SUBSURFACE EXPLORATIONS**

### **General Requirements**

Subsurface explorations are progressed for the purpose of gathering detailed information about soil, rock and groundwater. Soil samples are taken using specific test methods and are retained for engineering analysis. Rock and boulders are cored and the samples are made available to engineers for design purposes. Methods used to progress the boring, and conditions encountered during sampling and between the samples must be recorded on the log.

### **Project Procedure**

At the start of the project, the equipment must be inspected. The Engineer usually does this inspection with the assistance of the Regional Geotechnical Engineer or a Drill Supervisor from the Geotechnical Engineering Bureau (GEB) because of the specialized nature of the contract work.

Notes in the proposal frequently give specific direction on the following subjects:

- To what location(s) must the Contractor deliver the samples, and under what time restrictions?
- Who has the responsibility to perform the utility clearance and obtain permits prior to the start of the borings?
- Who has the responsibility to perform the visual descriptions and moisture content on the samples?
- Who has the responsibility to complete the final boring logs? (The pre-qualified inspector on each drill rig keeps a log of the borings regardless of who has the responsibility to complete the logs).
- What are the acceptable working hours for the specific contract?

### **Evidence of Acceptability**

1. Compliance with all specification requirements for the item(s) involved.
2. Thin-walled tube samples require inspection by the GEB Soil Mechanics Laboratory before they can be approved for payment.
3. The percent recovery of soil and rock core samples should meet or exceed minimum requirements, using the best possible drilling methods, before they will be considered acceptable.

### **Contact**

The Regional Geotechnical Engineer and/or the Director of the Geotechnical Engineering Bureau are available to assist.

## SECTION 655 FRAMES AND GRATES

### I. GENERAL

The Contractor shall provide Manufacturer's certification that the frame and grate is in conformance with Standard Specification §106-11, *Buy America*. The Contractor shall notify the Engineer-in-Charge of any frames or grates from foreign country producers and the Engineer-in-Charge will confirm that the Contractor's bid was based on using foreign steel and/or iron. If the bid was not based on using foreign steel, the Engineer-in-Charge will determine whether the total quantity of foreign steel and/or iron from all items surpasses the maximum allowed in §106-11. The entire quantity of any material above the maximum allowed will be rejected, unless a waiver is obtained by the Contractor from the approving authority.

Unless otherwise specified, frames, grates, covers and appurtenant parts shall be delivered to the work site free of any coatings other than galvanizing. Frames, grates, covers or appurtenant parts that fail to meet the specification requirements will be rejected and the Contractor shall remove them from the work site.

### II. CAST ARTICLES

**A. Approvals.** Cast articles may be approved by either of the two methods outlined below:

1. The Contractor shall provide Manufacturer's Certification that the casting is in conformance with one of the following:

Standard Sheet M655-9R1 *Cast Manhole Frames, Grates and Covers,*

Standard Sheet M655-11R1 *Cast Frames and Curb Boxes and Welded Frames,*

and the material is one of the following:

Steel - ASTM A27M Grade N-1

§715-02 Steel Castings

Malleable Iron - ASTM A47M, Grade 22010

§715-09 Malleable Iron Castings; or:

2. The Contractor shall submit two copies of the Material Details to the Engineer-in-Charge, at least ten days prior to the use of the product, for each type of casting supplied. The Engineer-in-Charge will verify that the Material Details appear on the Department Approved List by Manufacturer's name, reference number and approval date for that item. The Contractor shall provide Manufacturer's certification that the casting was manufactured in conformance with the approved Materials Details and the material is one of the following:

Grey Iron - AASHTO M105, Class 30B

§715-07 Proof Loaded Iron Castings

Grey Iron - AASHTO M105, Class 35B

§715-07 Proof Loaded Iron Castings

**B. Markings.** The Inspector will verify the identification markings listed below on the article. All castings, except those approved under A(1) above, shall have the identifying markings required in both AASHTO M105 and AASHTO M306, space permitted. These markings should be permanent and indelible:

Required Markings as per AASHTO M105:

Identifying mark of the Manufacturer

Part or pattern number

Required Markings as per AASHTO M306:

Country of manufacture

AASHTO designation or ASTM Designation number

Class of Cast Iron

Heat number and date

## SECTION 655 FRAMES AND GRATES

### III. FABRICATED ARTICLES

The Contractor shall provide the following certifications for all fabricated articles:

1. The Contractor shall provide Manufacturer's certification identifying each component of the fabricated item as conforming to one of the following steel materials; ASTM A36M, AISI Grade 1020, AISI Grade 1025, or ASTM A529M Grade 345. Mill certifications identifying the steel material compositions shall accompany the Manufacturer's certifications.

Longitudinal bars for grates G1, G2, G3, 10 PCB, 11 PCB, and 12 PCB shall be certified as meeting the requirements of ASTM A529M, Grade 345. Mill certification of ASTM A529M Grade 345 shall accompany Manufacturer's certification for these grates.

2. The Contractor shall provide Manufacturer's certification that the welding and galvanizing comply with the requirements of Section 655. The specification requires welds conforming to the New York State Steel Construction Manual (except the requirement for radiographic inspection), and any applicable standard sheets, plans, approved shop drawings, or proposal. The specification requires galvanizing in accordance with §719-01, Type I unless required otherwise.

3. The Contractor shall provide Manufacturer's certification that the fabricated article is in conformance with one of the following:

Standard Sheet M655-6 *Rectangular Grates*

Standard Sheet M655-8R2 *Parallel Bar Frames and Grates*

Standard Sheet M655-10R2 *Reticuline Grates*

Standard Sheet M655-11R1 *Cast Frames and Curb Boxes and Welded Frames* (For welded frames only.)

The Inspector will inspect the fabricated articles for conformance to the appropriate Standard Sheet. Non conforming articles will be rejected.

### IV. INSTALLATION

The Engineer-in-Charge will ensure that the frames are placed to line and grade and that the frames make a firm, full and even bearing on its underlying surface. The Engineer-in-Charge will ensure that grates and covers have full and uniform bearing contact with their corresponding frames. The system and its components shall be non-rocking when in place and under the influence of traffic or other loads. Non-rocking fits between grates, covers and their corresponding frames may be achieved by ground mating surfaces or machined and milled mating surfaces (horizontal and/or vertical)

### RELATED CONTRACT PROVISIONS

§715-02 *Steel Castings*

§715-07 *Proof Loaded Iron Castings*

§715-09 *Malleable Iron Castings*

§719-01 *Galvanized Coatings and Repair Methods*

### REFERENCES

HDM Chapter 13; Utilities

Standard Sheets M655-6, M665-8R2 to M655-14

Contract Administration Manual (CAM) §106-11, *Buy America*

## SECTION 663 WATER SUPPLY UTILITIES

### **BACKGROUND**

Water supply utilities typically belong to municipalities or water districts. The organization, staffing and capabilities of these organizations varies widely, as well as their material and construction requirements. The Engineer-in-Charge will frequently represent the interests of the Owner, though some Owners will require that their staff or consultant be present to observe work on the water supply system. These arrangements are spelled out in the Utility Agreement between the Owner and the State. Installation of new water main as a betterment or relocation/replacement due to other work requires a State Department of Health (DoH) permit. The DoH permit will outline disinfection, testing and certification requirements.

### **GENERAL REQUIREMENTS**

The requirements of the System Owner are contained in Special Notes entitled "Owner Requirements for Water Mains and Appurtenances". Read these notes to determine any Owner requirements for materials, installation, valve operation, testing, etc. A utility agreement may also contain requirements for inspection by Owner personnel, tapping requirements (some Owners will not allow wet tapping of a live main by Contractor personnel), valve operation requirements, etc. Contractor personnel should not operate valves outside the project limits, or valves within the project limits after they are placed in service, without Owner approval.

The following documentation is required for ductile iron water pipe, steel water pipe, valves, hydrants, tapping sleeves, line stop fittings, bolted couplings, wedge type mechanical restraint glands, high deflection restrained joint fittings, iron water main fittings, etc:

1. The Contractor shall provide Manufacturer's certification that the material is domestically manufactured in conformance with Standard Specification §106-11, *Buy America* (this need not be a separate certification). The Contractor shall notify the Engineer-in-Charge of any ductile iron water pipe, steel water pipe, valves, hydrants, tapping sleeves, line stop fittings, bolted couplings, wedge type mechanical restraint glands, high deflection restrained joint fittings or iron water main fittings from foreign producers. If the bid was not based on using foreign steel and/or iron, the Engineer-in-Charge will determine whether the total quantity of foreign steel and/or iron for all items surpasses the maximum allowed in §106-11. The entire quantity of any material above the maximum allowed will be rejected, unless a waiver is obtained by the Contractor from the approving authority. System owners are not the approving authority, and *Buy America* provisions supercede any local requirements regarding foreign steel and/or iron. If the Contractor's bid was based on using foreign steel and/or iron, no certification of domestic manufacture is required.
2. The Contractor shall provide Manufacturer's Certification identifying the material as one of the following and the bare fitting weight as listed in the appropriate AWWA Standard (currently listed only in lbs.). Some fittings are not listed under the above standards and the weight cannot be certified under these standards (though manufacture of the fitting can). The weight of those fittings shall be provided by the Manufacturer.

<u>Cast Material</u>	<u>AWWA Standard</u>
Gray Iron and Ductile Iron Full Body Fittings	C110
Ductile Iron Compact Fittings	C153

Note: The AWWA Standards are available on the IntraDot under **Organizations> Design Division> DQAB > Specifications and Standards Section > AWWA Standards**. The AWWA Standards contain a significant amount of information that may be valuable to the Engineer-in-Charge, however they are copyrighted, and may not be reproduced here.

## **SECTION 663 WATER SUPPLY UTILITIES**

### **Removals**

Unused/abandoned water supply pipe should be removed, but it may be abandoned in place. If abandoned in place, the ends shall be capped in accordance with the contract documents. All pipe abandoned in place shall be shown on the contract record plans. Removal and storage can become problematic if the Owner does not arrive to take the materials. The Contractor is not required to deliver, but if the Owner does not accept the responsibility to remove the material, the Contractor may dispose of it (properly). Requiring a Contractor to deliver removed materials outside of the contract limits is a violation of federal policy. The Owner should be notified by Certified Mail that the material will be disposed of if not removed in a specified time period. Iron or steel pipe has residual value, and may be scrapped. Iron, steel or plastic pipe may also be disposed of as Construction and Demolition (C&D) Debris at an approved facility.

### **Asbestos-Cement Pipe**

Large quantities of water supply pipe fabricated from asbestos-cement (AC) were installed across the State prior to the banning of asbestos containing products. AC pipe was originally white, but may be discolored, the surface is smooth, and has a texture similar to concrete pipe. AC pipe is non-metallic and will crack if struck with a hammer. In place, the material poses no health threat, but the material should never be cut, ground, tapped, swept or any other operation performed that may create dust. Dust from AC pipe poses a severe health hazard. Any operation, including cutting, tapping, removal, etc., may be performed only by a licensed asbestos abatement contractor under an asbestos removal permit from the Department of Labor (DOL). If AC pipe is encountered in the field, and not identified in the contract documents, stop all associated work adjacent to the pipe, backfill the area and contact the Regional Construction Environmental Coordinator for assistance. The Contractor shall ensure that workers, inspection staff and the public are protected from potentially objectionable and/or hazardous airborne dust and/or by-products in accordance with §107-05 and §107-15.

### **Shutdowns**

The Contractor shall only shut down a portion of the water supply system with the consent of the Owner. The Contractor shall provide a minimum of 48 hours notice to each customer, which may be provided by posting a written notice on the building entrance. The Contractor should attempt to schedule work, particularly for commercial customers, during days or hours that minimize impact on customers. The Contractor should provide the Engineer-in-Charge a plan for work, and confirmation that notifications were made. The temporary water service item is typically used to supply critical facilities (hospitals, commercial/industrial users, etc.) and should not be paid for to meet the Contractor's selected construction schedule or to correct Contractor created deficiencies.

### **Existing Valves**

The Owner should be asked to operate and exercise any existing valves that will need to be operated during construction, prior to the Contractor beginning work. The Owner may refuse to operate an existing valve if there is a chance that the valve will malfunction during operation, leaving the risk of failure and subsequent replacement cost to the State. If the valve breaks during operation, and the failure is not due to negligence by the Contractor, replacement of the valve may be a State responsibility. If there is a water main betterment as a part of the contract, the replacement of the valve should be the Owner's responsibility.

### **Excavation and Backfill**

Trench widths for water supply pipe excavation, installation and backfill are shown on the Standard Sheets. Safety related requirements for trench protection must be addressed. Materials containing fly ash or slag are corrosive to cast and ductile iron, and shall not be allowed to come into contact with cast or ductile iron water supply pipe or appurtenances. Pipe bedding shall only be installed when called for in the contract documents (typically in the Owner Requirements), or where unsuitable or unstable material is encountered during excavation.



## **SECTION 663 WATER SUPPLY UTILITIES**

### **Thrust Restraint**

Thrust restraint is required to prevent a pressurized pipe from separating due to movement. Many Owners will require redundant thrust restraint. External threaded rods are the least effective, due to corrosion and potential failure. Concrete thrust blocks are common, but can be expensive. The most effective types are restrained joints, where the joints are firmly bolted together. Restrained joints can be provided for existing pipe through the use of wedge type mechanical restraint glands. The thrust block sizes shown on Standard Sheet M663-2 are for standard conditions ONLY (1.5m burial, 1380kPa (200 psi) test pressure, 96kPa (2,000 psf) soil bearing capacity, and 1440 kg/cm (90 pcf) soil unit weight). These values are conservative for most applications. See the standard sheet for adjustment method, and refer to the Owner Requirements for test pressure. The Regional Geotechnical Engineer can provide assistance in evaluating soil conditions.

Example: Assuming the standard values for bury depth, soil bearing capacity and soil unit weight are acceptable, for a test pressure of 690kPa (100 psi), reduce the thrust block area by 50% (100psi/200psi). Maintain the minimum dimensions shown on the Standard Sheet.

### **Water Supply Pipe Installation**

Ductile iron pipe is available with three types of joints, as shown on the Standard Sheets. Push-on joints are assembled by simply pushing the plain end of a length of pipe into the bell end of another piece of pipe with a gasket installed. This provides no thrust restraint. A mechanical joint provides a limited amount of thrust restraint. A restrained joint mechanically locks a retainer ring welded to the plain end of a pipe.

The Contractor shall follow the Standard Sheets for pipe installation and installation procedures outlined in the pertinent AWWA Standards (C600, C603, C605). Care must be used in the handling of pipe, as the lengths are typically too heavy to be handled manually. Pipe shall be kept clean and free of dirt, typically by using temporary pipe plugs. Ductile iron pipe is supplied in 5.5m (18 ft) or 6.1m (20 ft) standard laying lengths, and installation of uncut lengths need not be field measured, but rather may be counted. Plastic pipe may also be measured in this manner, based on a standard full length. Pipes that are field cut must be field measured, deducting the amount of plain end that is inserted into the bell of the next section. The length of fittings must be deducted from field measurements of installed lengths, as fittings are paid for by weight.

Installation of steel water pipe is different from iron or plastic. Steel pipe is typically used for very large diameters (48 NPS and larger). Rather than gasketed joints and fittings, steel water pipe is installed with fully welded joints and the fittings are shop fabricated from lengths of steel pipe. Steel pipe is typically coated, on the inside and outside, and some of the coating will need to be done in the field. The use of steel water pipe normally requires a cathodic protection system to prevent corrosion. Follow the contract documents for installation and inspection of cathodic protection systems.

Water supply pipe of any kind should be kept as clean as possible during storage and installation. Pipe lengths should be visually inspected for debris prior to installation. If debris remains in the pipe, or enters from a wet trench, joint make-up will be difficult, joints may leak and hydrostatic testing and disinfection will likely be problematic. Dewatering of trenches and the use of pipe plugs will aid in keeping the pipe clean.

### **Polyethylene Encasement and Insulation**

Ductile iron pipe is frequently encased in polyethylene when installed in corrosive soil conditions. The encasement may be done using sheets or tubes, in accordance with AWWA Standard C105. Ends should be overlapped and taped. Fittings shall be encased using plastic sheets cut, fit and taped to encase the fitting.

Thermal insulation for buried water pipe is used when the bury depth over the pipe is less than the desired, typically 1.5 m (5 ft). This typically occurs when a water pipe is installed under a culvert or over some underground obstacle which reduces the bury depth. The insulation should extend along the water supply pipe to a point on either end that has a minimum 1.5 m ground clearance. The item for bridge mounted water mains includes insulation, and is not paid for separately.

## **SECTION 663 WATER SUPPLY UTILITIES**

### **Valves**

Valves shall be installed with firm, even bearing. The Owner may require concrete blocks, pavers, crushed stone, gravel, etc. to support the valve. The valve box is placed over the operating nut on the top of the valve, but not bearing on the valve. Some Owners will require that concrete, concrete block or similar walls be installed to support the edges of the valve box, to prevent it from bearing on the valve. Screw type valve boxes are easier to install, but may transmit wheel loads to the body of the valve if not properly installed. The separate pieces of slide type valve boxes will telescope together under pressure, preventing damage to the valve. The slide type is the preferred type of valve box and shall be provided unless the Owner requires otherwise.

### **Hydrants**

New hydrants shall not be connected to a main with a lateral pipe smaller than 6 NPS. Hydrants shall be supplied with a length(s) of anchor pipe up to 2.0 m long at no additional cost to the State. Anchor pipe, which is typically available in 300 mm increments up to 1 800 mm, may be provided from the supplier with retainer rings and glands installed, to reduce field cutting and welding. Use of the correct length anchor pipe will allow proper placement of the hydrant. Larger offsets from the main to the hydrant will require installation of additional lengths of pipe, typically 6 NPS. An anchor pipe is a short length of pipe with two plain ends, and retainer rings welded to either end. Glands are installed prior to welding on the second retainer ring, allowing the anchor pipe to be bolted to both the tee and to the valve, and another bolted to both the valve and the hydrant. This provides a fully restrained valve and hydrant without the use of external rods or thrust blocks.

Hydrants shall be installed so that the lower barrel does not extend more than 100mm above grade over a 1.5m span, to prevent snagging on the bottom of an errant vehicle. The groundline is identified by the Manufacturer using an offset from the flange, because hydrant barrels are typically manufactured from ductile iron, and the groundline cannot be cast on the exterior as previously done with cast iron barrels. The hydrant shall be installed with groundline within 25mm of finished grade, to provide adequate restraint of the lower barrel, which allows the upper barrel to break off if struck by an errant vehicle. Barrel extensions to adjust the height of the upper barrel are available in 150mm increments; no more than one extension will be allowed. Small adjustments of a hydrant barrel are difficult, and localized minor adjustments of finished grade may be necessary.

### **Hydrant Fenders**

Hydrant fenders should only be installed behind a raised curb, in a low speed (urban) setting.

### **Dry Hydrants**

A dry hydrant consists of a length of pipe with strainer on one end that is in a pond or other year round source of water, and a fitting on the other end that allows quick connection to a fire department pumper truck. Dry hydrants shall be installed as detailed on the plans. The maximum allowable static lift for a dry hydrant is 7.0m (23ft) at sea level and decreases to 5.7m (18.8ft) at an altitude of 1525m (5,000ft). This does not take into account friction losses in the pipe or fittings. The lift is measured from the centerline of the pumper (0.6m above ground) to the water elevation in the pond or water source. Care must be taken to ensure that the riser, which will have water in it up to the source water level, is at least 1.5m below grade, measured both vertically and horizontally.

## **SECTION 663 WATER SUPPLY UTILITIES**

### **Iron Water Main Fittings**

Iron water main fittings include bends, tees, crosses, reducers, plugs, etc. Fittings are available in mechanical joint (MJ), push on joint (POJ) and plain end (PE). Bends are referred to as a 1/4 bend (90°), 1/8 bend (45°), 1/16 bend (22-1/2°) and 1/32 bend (11-1/4°). Tees typically have the same size on the two ends opposite each other (run), and the same or a smaller size on the opposing end (branch). The size of a tee is written "run x branch", ie a 12x6 Tee has two 12 NPS ends opposite each other (run) and a 6 NPS on the opposing end (branch).

Iron water main fittings are available in two basic types, "full body" fittings (AWWA Std C110) and compact fittings (AWWA Std C153). Unless specifically noted otherwise in the Owner Requirements, "full body" fittings may be supplied in either gray iron or ductile iron. Compact fittings are only available in ductile iron. In accordance with AWWA Standards C110 and C153, all fittings shall have the following distinctly cast on them: pressure rating, nominal opening diameters, manufacturer's ID, country where cast and the number of degrees or fraction of circle on all bends. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.

Iron water main fittings are paid for by weight. Fitting weights for payment are those listed in the appropriate AWWA Standard, when available (not all fittings or sizes are covered by the AWWA Standards). Total the weights in pounds, convert the contract total to kilograms and round to the nearest whole kilogram.

The material certification required under §722-01 shall list a fitting description, quantity, bare fitting weight and source of fitting weight (AWWA C110, C153 or Manufacturer, if fitting is not listed in either standard). Payment will be made based on material weight listed on the material certification.

### **Wedge Type Mechanical Restraint Glands**

These glands are often known by their trade names, "Megalug", "Ford 1100", etc. The radial wedge bolts are tightened, and when the proper torque is reached, the outer portion of the bolt head snaps off, making the installation simple and reliable. The reliability may be compromised if the surface of the pipe opposite the wedges is dirty, or if the nuts are turned in the wrong direction with an air wrench, as the outer bolt heads will snap off. If this happens, or the device must be removed and re-installed, the bolts must be installed to the proper torque using a torque wrench.

### **Water Service Connections**

A water service connection consists of a corporation stop, a length of small diameter service pipe, a curb stop and curb box and another length of small diameter service pipe to the customer. A corporation stop is a brass fitting that is either direct tapped (threaded) into a water main, or installed through a tapping sleeve or saddle. A corporation stop is a small valve that allows the water to be shut off after installing the device on a pressurized main. The service line is then attached to it and the curb stop is installed. This then allows the curb stop to be shut off, while the corporation stop is turned on, and the main backfilled.

A variety of tapping machines are available to install corporation stops. Care shall be taken to ensure that the machines are safely operated when tapping active mains under pressure.

### **Water Meter Pits**

Water meter pits may be used in larger, commercial applications or when multiple structures on a single property are served from one service line. Meter pits are typically installed on the customers property, and will require a release. If a property owner does not grant a release, the (System) Owner may opt to discontinue service to that location. Unless otherwise noted in the Owner Requirements, meters shall be supplied by the Owner at no additional cost to the State or the Contractor.

### **Adjust Valve Box Elevation**

Valve boxes may be adjusted using adjustment rings or frames, or by adjusting the existing box to the required grade. Valve box construction, either slide type or screw type, facilitates adjustment.

### **Hydrostatic Testing**

Unless otherwise noted in the Owner Requirements, newly installed water supply pipe must be pressure tested to 1035kPa (150 psi) for a minimum of 2 hours. Allowable leakage amounts must be determined per AWWA Standard C600. Care must be taken to ensure that the main is restrained prior to pressurization, yet joints should be observed for visible leaks. No personnel should be allowed in a trench, excavation, meter pit or any confined space during the initial pressurization of a newly installed water supply pipe. Failure of a large diameter, high pressure water supply pipe may be hazardous to personnel in these locations. Valve operation to pressurize a newly installed water supply pipe shall be done gradually to prevent pressure fluctuations, if the valves are operated too quickly, or blow-off points are opened too quickly, escaping air pockets may cause water hammer, which may damage the system. The higher the system pressure, the greater the potential for problems and damage.

### **Disinfection**

Disinfection and testing shall be conducted in accordance with AWWA Standard C651 and the project DoH permit, if applicable. The testing results typically must be completed prior to activation and use. This may require that the existing main be left in service until the new main is approved. Testing results must be received from the Contractor prior to final progress payment.

Highly chlorinated or neutralized water used for disinfection should not be directly discharged to an environmentally sensitive water body or into a storm drainage system (open or closed) that outlets directly into a sensitive stream or water body. Highly chlorinated or neutralized water should be discharged to a sanitary sewer or municipal wastewater treatment facility if available. Highly chlorinated or neutralized water may be discharged into vegetated upland areas at least 100 feet from any surface water body. If this is not possible, contain highly chlorinated or neutralized water and aerate on site to allow chlorine to volatilize. If containing highly chlorinated or neutralized water on site is not feasible, discharge the water into a tank truck to be disposed of. Contact the Regional Environmental Contact for assistance.

### **RELATED CONTRACT PROVISIONS**

§715-02 *Steel Castings*

§715-07 *Proof Loaded Iron Castings*

§715-09 *Malleable Iron Castings*

§719-01 *Galvanized Coatings and Repair Methods*

Section 722, *Water Supply*

### **REFERENCES**

American Water Works Association (AWWA) Standards

Special Notes - "Owner Requirements for Water Mains and Appurtenances"

Highway Design Manual (HDM) Chapter 13; Utilities

Standard Sheets M663-1 to M663-7

Contract Administration Manual (CAM) §106-11, *Buy America*

## **SECTION 680 - TRAFFIC SIGNALS**

### **General**

This section is intended for the use of Engineers-in-charge and Traffic Signal Crewpersons as a guide for conducting in-progress and final inspections of traffic signal construction. Although this check list does not include every item that should be checked, it includes those items that when properly completed contribute to the safe and efficient long-term operation of the traffic signal.

Due to differences in regional signal construction practices, there may be items in this check list that do not apply in a particular region. The contract documents should be consulted to determine the applicability of an item.

Unless otherwise specifically cited in the check list item, the Standard Specifications and Addenda as well as Proposal Inserts, Special Notes and Engineering Bulletins comprise the reference documents for the check list items.

### **Traffic Signal Pole Foundation**

Anchor bolts properly aligned and plumbed to ensure proper signal pole orientation with respect to load attachment, hand hole and signal cabinet / wiring access hole.

Proper alignment and placement of the reinforcement bar cage.

Correct footing dimensions.

Proper number and orientation of conduits.

Proper specification concrete and placement.

### **Traffic Signal Pole Installation**

Signal poles properly mounted on the anchor bolts with mortar caps with adequate grouting.

Poles bonded with a continuous ground.

Weather head(s) properly installed and aligned.

All covers, disconnect boxes, nipples, conduits and pedestrian signs properly installed.

Eye bolts for spanwire properly installed and aligned.

All scratch marks properly field repainted and treated with appropriate regalvanizing material.

Site restoration properly completed.

Placement per plan or A.O.B.E.

Top of pullbox cover at proper level with respect to finish grade.

Mortaring completed around conduits and frame.

Wire hangars properly installed.

Splices properly done, secure and water tight.

## **SECTION 680 - TRAFFIC SIGNALS**

Proper amount of cable slack neatly coiled.

Ground rod installed properly.

Metal conduit properly grounded and bonded.

Location of flexible conduit properly marked.

### **Signal Controller Cabinets**

Cabinets properly and securely mounted to pole or cabinet base.

Cabinet mount at correct height above grade or work pad.

Service connection, field wiring and grounding properly done.

Output field wiring properly marked or color coded designating head number and indication connected to.

Input field wiring properly marked or color coded designating input source (detector, push-button, etc.).

Service conduit properly secured with meter pan or disconnect as required.

Ground rods properly installed and connected.

Metal conduits properly bonded.

Ground tests meets specifications.

Electrical functional tests satisfactory.

Proper cabinet lock and spare keys provided.

Copy of final wiring diagram in cabinet.

### **Traffic Signal Span**

Spanwire attached to poles with proper hardware and at proper height and sag.

Traffic signal heads and signs are placed, aligned, aimed and attached with proper hanging hardware in accordance with the contract documents.

Traffic signal heads and signs are the proper height above the roadway.

Wiring to heads is electrically and mechanically secure.

If required, tether spans to signal heads and/or signs are properly secured.

Signal cable secured to spanwire in proper manner.

Signal cable splices are made with staggered splices and are properly sealed.

### **Vehicle Detectors**

Vehicle detectors are located and installed per plan or A.O.B.E.

Proper wire size and type used in loop detectors and as lead in all detector types.

Loop detectors and all lead-ins are tested for continuity and leakage to ground.

### **Pedestrian Push-Buttons, Indicators and Signs**

Pedestrian push-button information signs and pedestrian indications have the proper wording and/or legend.

Pedestrian push-buttons, information signs and indications are properly installed, at the proper height and are visible.

Pedestrian push-buttons actuate the proper signal / pedestrian indications.

### **Evidence of Acceptance for Traffic Signal Materials**

#### Acceptance Documentation

Section 680-3.01 of the Standard Specifications discusses equipment list and drawings which may need to be obtained to ensure that material to be installed meets specifications. In addition, the Materials Inspection Manual states that except for Traffic Signal Poles and Roadway Loop Embedding Sealer, manufacturer's certification is considered adequate evidence of acceptance for traffic signal items. The requirement that catalog cuts must be submitted in addition to manufacturer's certification should be requested for only those items that have physical or electrical properties critical to the proper fit or operation with other components. An example would be a catalog cut showing the bolt hole sizes and pattern of a pedestrian push-button signal pole to be installed on existing anchor bolts. The need for catalog cuts as additional evidence of acceptability should be determined early in the construction process so that provision of this documentation does not delay contract completion.

#### Retention of Documentation

To aid the Traffic Signal Crews in the maintenance/repair of the items installed in the contract, a copy of the manufacturer's certifications and any catalog cuts should be maintained in the files of the Traffic Signal Crew Engineer-in-Charge.

### **Final Accounting for Federal-Aid Projects**

When traffic signals are constructed with Federal participation, the Department is required to document to the FHWA the quantity and cost of that equipment used in the project. Accordingly, the Engineer-in-Charge must complete Form TE200b (Exhibit 680-A) Traffic Signal Equipment Furnished by the New York State Department of Transportation Equipment Summary per Engineering Instruction 81-10.

### **References**

EI-81-10, TRAFFIC SIGNAL EQUIPMENT FURNISHED BY NYSDOT ON CONSTRUCTION CONTRACTS

## SECTION 687 - THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

### General

Thermoplastic is a durable-type pavement marking material that, when properly applied, can be expected to provide 3-5 years service on new bituminous concrete pavements. Thermoplastic markings are susceptible to damage from snowplows and should not be used in locations with significant plow activity. Thermoplastic adheres poorly and should not be used on portland cement concrete pavements.

### Project Procedure

The specifications for thermoplastic (Section 687) were prepared with the intent that they would account for and minimize field installation problems. In most instances, contractors have adhered to the specifications. However, problems have occurred on some projects that have identified a need for additional clarification of the requirements of Section 687. The following is provided to alert engineering personnel to the most important specification requirements and to set guidelines for the inspection of thermoplastic applications.

- A. Striping Contractor. Applicators of thermoplastic pavement markings are dealing with a unique item. In general, these contractors only work with the placement of pavement markings. To perform this work, a competent striping contractor has a large investment in his/her equipment (e.g., a mobile applicator is in the price range of \$200,000 - \$300,000). To obtain a return on his/her investment, the contractor must act as a "prime" or "sub" on several simultaneous on-going projects. To ensure timely contract completion, striping applicators should be thoroughly checked as to their current commitments, work schedules, and their ability to complete any additional work prior to their approval as a sub-contractor.
- B. Application Equipment. The Engineer is responsible for approving application equipment, both mobile and portable, prior to the start of work. In addition to thermoplastic applicators, any extra equipment for primer application and pavement cleaning should also be inspected and approved.

The following is a listing of the minimum equipment components for approved thermoplastic applicators:

1. Melting Kettle(s) - The melting kettle must be capable of heating the molten thermoplastic to temperatures above 204.5° C. The heating mechanism must employ a heat transfer medium (usually an oil bath or hot air); heating by direct flame is not allowed. A material temperature gauge must be visible on the kettle. Some melting kettles will also have a temperature gauge to record the temperature of the heat transfer medium. Do not confuse this with the material temperature gauge nor consider that it represents material temperatures - it does not.
2. Mixing and Agitating Equipment - Melting kettles and portable applicators must be equipped with mixers (agitators). Most melting kettles are equipped with a continuously operating mixer, however, it should be checked periodically to ensure that it is operational. Portable application equipment should be equipped with a hand or mechanical mixer - this is usually located on the top of the materials storage reservoir. If a portable applicator is not equipped with a mixing device, do not approve this equipment. If the portable applicator has a hand operated mixer, ensure that it is used during marking operations. One purpose of the mixer is to maintain uniform material temperatures and these are most subject to change in the application of thermoplastic markings with portable equipment.
3. Priming Equipment - When specified, primer material is to be sprayed on the pavement surface at the coverage noted in the manufacturer's instruction for use. Spray equipment for primer application may be mounted directly on a mobile type thermoplastic applicator or may be a separate push or mobile type spray machine. Priming equipment should be checked to ensure that it is operational.



## SECTION 687 - THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

4. Glass Bead Dispensers - Both mobile and portable thermoplastic application equipment are required to be equipped with a drop-on type bead dispenser. The glass beads are to be dropped onto the hot thermoplastic stripe immediately after its application. The purpose of the glass spheres is to provide initial nighttime reflectivity of the pavement marking - without them the newly placed line would be barely visible to the motorist under night driving conditions. The bead dispenser should be checked for proper operation and to ensure uniform rates of bead application over the entire marking's surface. The Contractor is required to clean up the excess beads.

If application equipment is not equipped with a bead-dispenser or if it is non-operable during marking applications, work is to be stopped until the problem is corrected. Do not allow contractors to apply glass beads by hand or other unapproved methods.

5. Extrusion Devices - All thermoplastic pavement markings are specified for application by the extrusion method using an approved extrusion device. Schematics of acceptable extrusion devices are shown in Exhibit 687-A. The first two schematics show devices which use an extrusion shoe riding directly on the pavement surface. The shoe is designed to hold and extrude a mass of hot molten thermoplastic onto the pavement surface in the form of a stripe of specified width and thickness. The third schematic depicts a device that extrudes a vertical ribbon of thermoplastic from a properly sized slot located approximately one inch above the pavement surface. The slot is surrounded by a heated jacket and air shroud. Line thickness is controlled by the operating speed of the applying equipment and low pressure that is used to extrude the material. The air shroud and pavement surface do not act as a shaping die. Exhibit 687-B is a schematic of an unacceptable extrusion device that has been used by a contractor. A primary objection to this device is that in a cool weather striping, air is allowed to cool the bottom of the extruded line prior to its contacting the pavement. This type application will result in a poor mechanical bond.

Material temperature gauges shall be affixed or incorporated in all extrusion devices in such a manner as to be visible and capable of monitoring the composition temperature throughout the marking operation. Striping work should not be allowed to start or continue unless the temperature gauge is affixed in the device. Some newer equipment may come equipped with a thermometer, etc. in the device; on older applicators it will be necessary for the contractor to determine an appropriate way to incorporate this.

- C. Inspection of Thermoplastic Marking Work. After contractor and equipment approval requirements are satisfied, marking operations may begin. The basic work consists of pavement cleaning; primer application; melting and extruding the thermoplastic material on the pavement in a molten state at elevated temperatures; and an immediate drop-on application of glass beads.

A thermoplastic line that is properly placed within the specification requirements will soften (melt) and fuse with the underlying asphalt to form a mechanical bond (interlock) with the aggregate portion of the bituminous mix. If the bituminous pavement is unclean or wet; if air, surface and material temperatures are lower than specified; if other requirements are not met; this mechanical bonding will not be accomplished. If this occurs, the full service-life of the marking will not be realized.

Three basic modes of thermoplastic failure can be identified -- bond, abrasion and shaving.

Bond - A loss of the entire thickness of stripe because of its failure to adhere or bond to the pavement. This failure mode is normally due to some sort of improper installation technique such as low temperatures, dirty pavement, etc. This failure is construction related.

Abrasion - Is a gradual wearing of the material from the top down, through traffic, debris and abrasives on the roadway, etc. Abrasion failures are not directly construction related. However, since the life of

## SECTION 687 - THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

the marking is proportional to its thickness, the application of markings thinner than specified will result in earlier abrasion losses.

Shaving - A cutting or shaving away of thermoplastic line by snowplows. This failure mode is common on the leading edge of skip line stripes where 50-203 millimeters (2-8 inches) of line loss is normal during the first winter's use. Shaving failures are not related to installation.

Because shaving and bond failure may appear to be similar, a point should be made to distinguish them. Snowplow action may accelerate bond failure but it does not cause it. The bond must fail or at least be weakened before plows aggravate it. With a shaving failure the pavement bond may be very strong, but the plastic is actually cut or shaved away by the plow blade. This can be evidenced by closely examining pavement surfaces under a skip-line stripe that shows leading edge loss - the textured underlying asphalt will show thermoplastic material that is still bonded to the pavement if the markings were adequately bonded. Lack of adequate bond is evidenced by a clean separation of the thermoplastic from the pavement surface.

Because bond failures are construction related, they can be minimized by proper engineering controls; primarily through correct and increased inspection at the project site. The following guidelines are intended to direct the Engineer in the inspection of thermoplastic marking operations:

1. Marking Location - To minimize damage from plow blades and from bituminous substrate failures, thermoplastic markings must be placed directly on the bituminous pavement and slightly offset from shoulder and construction joints. Do not apply edge line markings directly over the joint formed between the roadway and adjoining shoulder; no skip line markings over the longitudinal joint between travel lanes.
2. Equipment - Daily inspections of the contractor's equipment should be made to insure that it is operable and within the specification requirements.
3. Materials - Materials for thermoplastic marking operations are covered under Section 727-01. Solid thermoplastic composition is supplied in the form of slabs, blocks of granular powder and should arrive at the job site pre-accepted. Material specifications and the MURK cover the requirements for acceptance of thermoplastic, reflective glass spheres and primer materials.
4. Pavement Surface - Pavement surfaces must be clean, dry and at a minimum temperature of 12.5° C (55°F). Each of these factors is critical to satisfactory bonding. New bituminous surfaces are often over-looked but should be inspected for cleanliness. Dirt from construction traffic, wind blown debris, etc. may be present and the contractor should be required to remove the contaminants in the location of the marking applications. Existing bituminous surfaces should be carefully inspected for cleanliness. Heavy deposits of existing pavement markings, built-up roadside accumulations of dirt, etc. will all require removal. In some cases an air blast will be sufficient to clean the surface - in others more effort or different methods will be needed. Regardless, the contractor should not be allowed to apply thermoplastic markings until the pavement is inspected and cleaned to the Engineer's satisfaction.

Pavement surfaces must be dry. At the minimum all pavement should be visibly dry. However, even with a surface dry appearance sub-surface moisture can be present in amounts sufficient to affect proper bonding. If excess pavement moisture exists, it will usually result in blistering of the hot applied marking. Blisters will form as surface "bubbles" that may or may not have burst. They are easily spotted and if the condition occurs marking operations should be stopped until the pavement dries out.

## SECTION 687 - THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

The pavement surface temperature must be a minimum of 12.5° C (55°F) at the time of marking applications. Surface temperature should be verified at the start of each day's work. In cool weather conditions, the surface temperature should be checked periodically throughout the work day. Materials Method No. 20, BITUMINOUS PAVING INSPECTION, "SURFACE TEMPERATURES" describes a suitable procedure for determining pavement temperature. If at any time during work, the surface temperature falls below 12.5° C (55°F), marking operations should be stopped.

5. Air temperature - The ambient (air) temperature is to be a minimum of 9.5° C (49°F) and rising at the time of marking operations. Air temperature is to be verified at the start of each day's work and monitored as necessary during marking applications. If work has started and air temperatures fall below 9.5° C (49°F) and continual cooling is indicated, work should be stopped. Starting work at air temperatures lower than 9.5° C (49°F) should not be allowed.
6. Primer Applications - Primer is not used on "new" asphalt cement concrete pavement when the thermoplastic markings are applied within the same calendar year as the completion of the "new" asphalt paving.

When primers are used, they must be applied at the manufacturers recommended application rate and allowed to "set" for the specified cure time prior to the placement of thermoplastic. Rates of primer application should be checked to insure proper coverage (thickness). Primed pavement surfaces must be striped with the thermoplastic within the specified set time or within the same working day. Primed surfaces that are not striped over within these time limits must be reprimed prior to the application of thermoplastic markings.

7. Thermoplastic Application - The thermoplastic must be extruded on the primed pavement at a material temperature no lower than 204.5° C (400°F), as measured in the extrusion device, i.e., at the point of deposition. Immediately after placement, "drop-on" glass spheres are mechanically applied.

If the thermoplastic marking is not being applied at a minimum of 204.5° C (400°F), or if glass spheres are not dispensed, marking operations are to be stopped.

The material temperature requirement (minimum 204.5° C or 400°F) is one the most important factors affecting bond. It should also be one of the easiest to inspect because the extrusion device on approved equipment should contain a visible thermometer, or temperature recording device. This gauge allows for continuous monitoring of temperatures during marking work. The contractor's gauge in the device must be checked for accuracy. This can be done by comparing it with temperatures recorded on a stem-type thermometer that is commonly used to determine bituminous mix temperatures. Depending on the accuracy of the thermometer(s) variances of up to 12°C may occur. This degree of accuracy is satisfactory.

Strict attention must be paid to material temperatures. Time spent in melting and heating the thermoplastic material is non-productive time to the contractor. It is possible to extrude a "good looking" marking at temperatures much lower than 204.5° C (400°F), however, this material will not be well bonding to the pavement. It should also be noted that depending on the heat loss of the contractor's equipment between the kettle and the extrusion device, thermoplastic material in the kettle may require heating to temperatures greater than 204.5° C (400°F) to obtain the minimum specified temperature in the extrusion device. This is allowable provided that the manufacturer's recommended maximum material temperature, normally 230° C (450°F), is not exceeded.

8. Thermoplastic Thickness - The specified thickness of the extruded thermoplastic marking is (3.2 mm minimum to 4.8 mm maximum). The service life of a thermoplastic marking is directly related to its

thickness; e.g., a thin line will wear out faster. To insure that the proper thickness is being applied, both the wet and dry thickness of the line should be routinely checked. Wet thickness is inspected immediately after the line is extruded by inserting a thin, graduated machinists rule or a wet film gauge into the molten (liquid) plastic to the depth of the pavement substrate. The thickness of the line is simply determined by visually noting the depth of penetration. Dry thickness can be determined by various methods. One is to take a panel of known thickness, such as a piece of sheet metal, and place it in the path of the application equipment. After the thermoplastic has been deposited and has hardened on the panel, the total thickness should be measured with a micrometer and the panel thickness subtracted to indicate the line thickness.

9. Applied Marking - The applied markings should be inspected continually for overall workmanship. Markings should be of the specified width, with clean-cut edges. White and yellow colors should appear distinct. The drop-on application of glass spheres should appear uniform on the entire markings surface. The hardened thermoplastic should resist deformation, dirt pick-up, etc. by traffic. The markings should be firmly bonded to the pavement surface. Pavement bond of the hardened marking can be inspected by taking a stiff bladed putty knife and attempting "shock" the thermoplastic from the pavement. The putty knife should be positioned as parallel to the pavement as possible and pushed or hammered against the bottom edge of the marking, at the pavement interface. If only small pieces of marking can be chipped from the pavement, the bond is satisfactory. If large pieces of marking can be chipped from the pavement, the bond is satisfactory. If large pieces can be removed through the entire thickness of making and there is little visible evidence of the thermoplastic having melted or fused with the bituminous pavement, the bond is poor. Evidence of fusion (melting) will be visible in the form of bituminous material remaining on the underside of the removed marking. If the thermoplastic has melted and bonded with the underlying asphalt the majority of its underside will be coated with bitumen; if not only minor and "spotty" deposits of bituminous material will be present.

Questions concerning the application and the inspection of thermoplastic reflectorized pavement markings should be referred to the Materials Bureau, (518) 457-4285.

## **References**

MATERIALS METHOD NO. 2, BITUMINOUS PAVING INSPECTION, "SURFACE TEMPERATURES"

## **Related Contract Provisions**

Standard Specification §727-01

## **SECTION 691 - EEO TRAINING REQUIREMENTS**

Standard Specification Section 691, EEO TRAINING REQUIREMENTS, contains the contract requirements for the training of minorities, females, and economically disadvantaged persons. Training opportunities are provided in order to address the current under-representation of these groups in the skilled trades of the highway construction industry and to maintain a pool of qualified individuals to compete for journey worker positions which are created through attrition.

### **General Requirements**

Section 691 will be included in those contracts where there is an opportunity for meaningful and effective training. Meaningful and effective training is defined as when the duration and work of the contract provides a realistic and practical opportunity in the trade selected, for the trainee/apprentice to complete elements of the OJT/apprenticeship program in order to achieve journey-level status.

The trainee/apprentice shall be employed as such in the designated trade in accordance with the currently approved Form AAP 35 (Exhibit 691-A&B), "WORKFORCE AND TRAINING UTILIZATION SCHEDULE," to the extent that opportunities for training exist in the work of the contract in order to complete as much as possible of the approved OJT/apprenticeship program. It is expected that the contractor will provide maximum opportunity to progress the trainee/apprentice to the completion of their program.

### **Project Procedure**

#### Preconstruction Meeting

At the time of the preconstruction meeting, the contractor shall submit a completed AAP 35, a completed AAP 26 (Exhibit 691-C&D), a copy of the OJT/apprenticeship program(s) to be utilized on the project, and a cost analysis of item 691. Depending on scope, cost, schedule and craft it may be appropriate to propose single/multiple/shorter/longer programs. The goal is not to use the dollars, but to complete as much as possible of the approved OJT/apprenticeship program to progress the trainee/apprentice to the completion of their program. If apprentices are being proposed, an "APPRENTICESHIP AGREEMENT/DOCUMENTATION FORM" Form AT 401, formerly JT 401 (Exhibit 691-E&F), must be submitted as well. Prior to engaging in the recruitment of new trainees/apprentices, the contractor shall employ trainees/apprentices who are partially trained if available, in order to facilitate completion of their program.

In reviewing a contractor's AAP 35, the EIC and the RCS must evaluate whether the projected total workforce is reasonable and whether the proposed training effort will result in sufficient opportunity for meaningful and effective training without sacrificing productivity. For additional guidance, see OEODC's Directive A43-1-1, "AA PROGRAMS: PRECONSTRUCTION MEETINGS."

The EIC and the RCS should discourage the contractor from routinely shifting the trainee/apprentice to work in other trades. This would be inconsistent with the concept of meaningful training leading to journey-level status efficiently and expeditiously. If the contractor cannot arrange the work and assignments in a fashion to support the program, the proposed training program should not be accepted.

#### Monitoring

At the time the trainee(s)/apprentice(s) report(s) to the contractor for training under this item, the Training Coordinator shall notify the EIC and introduce the trainee(s)/apprentice(s) to the EIC at the earliest opportunity. Trainee(s)/Apprentices are identified to the EIC in order to facilitate monitoring of training activities.

The Training Coordinator will monitor the trainee's/apprentice's progress, paying particular attention to completion of work processes or phases within the training program. When a work process or phase is completed, the contractor is expected to rotate the trainee/apprentice to other work processes or phases of the OJT/apprenticeship program to the extent that such training opportunities exist. Otherwise, the trainee/apprentice can continue to work as long as there is work in their craft. Should

## SECTION 691 - EEO TRAINING REQUIREMENTS

a trainee/apprentice complete their training program during the course of the contract, the contractor is expected to retain the individual as a journey-level employee provided there is work remaining on the project.

The inspector assigned to the operation in which training occurs shall note on the daily IR a brief description of the trainee's/apprentice's activities and the number of hours of work in the craft. Inspectors are not expected to constantly monitor this work, but should simply observe with sufficient frequency to be able to reasonably conclude and report on the effort each day. A separate sheet containing a monthly summary of training may be kept at the field office to record the hours per day from each IR. Upon receipt of the AAP 26, the hours of training provided during the estimate period should be checked against the IRs (or the aforementioned monthly summary sheet) and certified payrolls. All calculations and backup documentation should be attached to the IR upon which the payment is made.

### Payment

The approved OJT/apprenticeship program(s) may, but is (are) not necessarily required to, utilize the total dollars included in the lump sum item provided that:

1. Minority and female EEO goal percentages are projected to be satisfied for each craft, considering the level of trainee/apprentice utilization along with the project's minority and female journey persons;
2. The required number of trainees/apprentices are trained for as long as the work of the contract will allow for meaningful and effective training *with concurrence* from the EIC and RCS.

The cost analysis of the training shall consist of the trainee's/apprentice's direct labor costs (actual hours x basic hourly rate), supplemental benefits, payroll taxes, insurance payments and 20% for profit and overhead (25% if a subcontractor is doing the training). Holiday pay is a benefit that is governed by the company's policy or its collective bargaining agreement. Overtime is subject to the Department's approval of overtime dispensation.

The Department will reimburse for apprentices at the apprenticeship rate approved by the New York State Department of Labor. The apprenticeship rate is dependant upon how many years of the program have been completed, class designation, etc. There may be circumstances where the contractor may choose to pay the apprentice more than the approved rate to cover hardship such as a long commute, lodging, etc. In these circumstances, the EIC must review and approve reimbursement that is in excess of the approved rate.

The contractor will not be reimbursed for the following:

1. Trainee(s)/Apprentices that are added to the workforce as a corrective action measure.
2. The cost of the Training Coordinator and Trainer.
3. When the trainee/apprentice is assigned to work outside of the craft in which they are being trained.
4. When the trainee/apprentice has completed a work process or phase and continues to work in the assigned craft without being rotated to another work process or phase.
5. When the trainee/apprentice obtains journey-level status during the life of the contract.

Once the EIC approves the estimate, a gross hourly rate will be determined if Method I, the agreed price method, is being used (see section 691-4, Method of Measurement). That rate will be multiplied

## **SECTION 691 - EEO TRAINING REQUIREMENTS**

by the acceptable training hours in the period. The dollar value will then be divided by the lump sum in the contract and the resulting percentage will be paid against the lump sum amount. For example: \$50 per hour (fully burdened rate) x 160 hours / \$505,000 (lump sum) = 1.58% x \$505,000 = \$8,000. The payment would be 1.58% of the total lump sum item.

Alternately, Method II, the force account method, could be used. When selecting Method II as an alternate method of payment for item 691, the contractor is not required to submit daily force account documentation but only to submit the MURK 13d, force account summation, at the end of the estimate period.

It is preferred that item 691 be administered and paid under Method I, agreed price. This process is simple and will require the least amount of time and effort by the contractor and Department personnel, compared to Method II, force account. Similarly, measurement and payment in hourly units is not intended to encourage work assignments by the hour. Frequent occurrence of hourly assignments or computation suggests that this is not a meaningful program and should be discontinued.

For additional guidance, see Contract Administration Manual Section 109-05, "EXTRA, FORCE ACCOUNT WORK, DISPUTE COMPENSATION AND RECORDKEEPING."

### **Evidence of Acceptability**

1. Compliance with Specification Section 691's requirements and conformance to pertinent Departmental procedures.
2. The trainee/apprentice was trained in accordance with the OJT/apprenticeship program.
3. The trainee/apprentice was rotated when feasible to other work processes or phases of the OJT/apprenticeship program when completing a particular work process or phase.
4. The Training Coordinator and Trainer are from the contractor's existing workforce (The Training Coordinator and Trainer may be the same individual).
5. The Training Coordinator administered the OJT/apprenticeship program in accordance with Specification Section 691's requirements and pertinent Department procedures.
6. The Trainer provided training in accordance with the OJT/apprenticeship program.
7. Under Method II, the contractor provides a MURK 13d for each estimate period that training was provided, with supporting documentation such as the AAP 26. The certified payrolls would be periodically checked against the MURK 13d and AAP 26 to verify the supporting documentation.

### **References**

OEODC's Directive A43-1-1, "AA PROGRAMS: PRECONSTRUCTION MEETINGS"

Contract Administration Manual Section 109-05, "EXTRA, FORCE ACCOUNT WORK, DISPUTE COMPENSATION AND RECORDKEEPING."

### **Contact Information**

Office of Equal Opportunity Development and Compliance  
Construction Contracts Unit, (518) 457-1129

## SECTION 697 - FIELD CHANGE ORDER

### General Requirements

The Field Change Order (FCO) provides a contract contingency allowance for the timely payment of authorized work that is necessary to fulfill the intent of the plans and specifications. The payments for eligible work will be paid with progress payments from the Dollars-Cents quantity of Field Change Order Item. Prior to processing the final agreement, the FCO payments will be reconciled through a final order-on-contract, such that the quantity of FCO payments are converted to the corresponding quantities of the pertinent contract pay items. When payments are transferred to the appropriate items, all quantities of FCO payments will be deleted.

### Eligible Work

Field Change Order Item payments shall be limited to work that is:

- ! Within the scope of the contract.  
*i.e. Bridge repair items of work would be outside the scope of a landscaping contract.*
- ! A quantity variation of existing contract pay items.  
*i.e. more accurate field measurements indicate that additional quantities of T&L was required to achieve planned grades.*
- ! A new contract pay item introduced as a result of omissions from the contract.  
*i.e. the plans require a specific item, however, the proposal did not contain a bid quantity for this item.*
- ! A new contract pay item introduced as a result of minor field adjustments in the details of the project.  
*i.e. unforeseen utility conflicts require minor rerouting of the planned drainage, which would require introducing a new catch basin item, as well as increased pipe quantities.*

All eligible items of work must also:

- ! have a known unit price either through bid price or agreed price, determined in accordance with § 109-05 A, *Contract Item Charges* or § 109-05 B.1., *New Item Charges, Agreed Prices*.  
Note that significant increases in major items of work or doubling of quantities for any other item of work will require that unit prices be reviewed and either affirmed or revised.
- ! be authorized in conformance with written procedures of § 104-03 of MURK Part 1A.

Disputed work, force account work, or work associated with Value Engineering Change Proposals are not eligible for FCO payment, and must be processed through an order-on-contract.

### FCO Payment Documentation

The EIC shall develop and maintain a system to document and track actions taken regarding FCO payments. Such actions would include, but not be limited to:

- ! Authorization to perform the work (if required - see Murk 1A § 104-03.)
- ! Identification and review of work item quantities and unit prices that will be used to compute the FCO payment.
- ! Summary of FCO payments made.

### Preparation of the Field Change Order

Once the need for extra work is identified and the authorization to perform the work is obtained, the Field Change Order can be prepared. The Field Change Order contains the Field Change Order Sheet, explanations for the added work (prepared in accordance with MURK 1A, § 109-05 B), and supporting bid/agreed price information.



## SECTION 697 - FIELD CHANGE ORDER

- ! Review quantities and unit bid prices of the required additional work. Note that significant increases in major items of work or doubling of quantities for any other item of work will require that unit bid prices be reviewed and either accepted or renegotiated with the Contractor (see MURK 1A, § 109-05 III. D.). Agreed prices for new items of work or renegotiated contract bid items will be established in accordance with MURK 1A, § 109-05 III. E.
- ! FCO payments will be computed as the quantities of added or altered work multiplied by the unit bid price or agreed price for that work. The total sum of these values equals the dollars-cents quantity of FCO payment for Item 697.02. The work item quantities and prices, and the FCO payments will be summarized on the CEES Field Change Order Sheet. The following CEES Field Change Order Sheet information will be completed similarly to the CONR -7 for orders-on-contracts unless noted otherwise (see MURK 1A, § 109-05 III. A.):

REGION NUMBER

COUNTY

NYS PROJECT IDENTIFICATION NO.

CONTRACTOR'S NAME

COMPTROLLER CONTRACT NO.

FEDERAL AID PROJECT NO.

FIELD CHANGE ORDER NO.; Enter the Field Change Order Number. Field Change Orders will have their own sequence and will not be sequential with Order-on-Contract numbers.

DESCRIPTION OF WORK

RELATED NYSDOT SPEC. ITEM. NO.

PRIOR APPROVED QUANTITY

UNIT OF MEASURE

UNIT PRICE

CHANGE IN QUANTITY

INCREASE IN FUNDS; The increase in funds resulting from the product of UNIT PRICE multiplied by the CHANGE IN QUANTITY.

TOTAL INCREASE IN FUNDS; The summation of all INCREASE IN FUNDS of all items in the FCO. This total will also represent the change in quantity for the FCO item.

Additional guidance on completing the Field Change Order Sheet can be found in the CEES User's Manual.

### Processing the Field Change Order

- ! The EIC will assemble the FCO to include the original Field Change Order Sheet and the required supporting documentation. The EIC signs the Field Change Order Sheet, makes a copy of the FCO for the field office, and sends the original FCO to the Regional Construction Office.
- ! The Regional Construction Office reviews the FCO for completeness and accuracy and approves the FCO by signature of the Regional Construction Engineer. The original plus one copy of the Field Change Order will then be sent to the Construction Division.
- ! The Construction Division will spot check the FCO and review the supporting data. Approval of the FCO is indicated by signature of the Director, Construction Division. The approved original Field Change Order will then be returned to the Regional Construction Office.
- ! Once the field office receives notification of the approved FCO, progress payments from the FCO item may be initiated. A copy of the approved Field Change Order Sheet must accompany payment estimates that contain a FCO item quantity.

## **SECTION 697 - FIELD CHANGE ORDER**

### **Payment Reconciliation**

At the completion of the project, but prior to submitting the final estimate, all FCO payments will be transferred to the appropriate contract work items and their appropriate fiscal share by a final reconciliation order-on-contract. The reconciliation, or final "clean-up" order-on-contract, will include all quantity overruns of existing contract items and new items of work that were previously paid under Item 697.02. It will also include the deletion of Item 697.02.

FCO payments shall not exceed the Dollars-Cents bid quantity. If sufficient quantity of Item 697.02 is not available to pay the total quantity of an added item of work, then pay the work item up to the available FCO quantity and submit the remaining quantity of work item in an order-on-contract (note: good tracking and documentation of FCO actions is especially important in these situations).

## **SECTION 698 - PRICE ADJUSTMENTS**

Standard Specifications Section 698, Price Adjustments, contains the contract requirements for providing additional compensation to, or repayment by, the Contractor for increases or decreases in the price of asphalt or fuel throughout the life of the contract.

### **Eligible Work**

Price adjustments will be determined for eligible work listed in the proposal and as described in the Standard Specifications.

### **General Requirements**

Asphalt and Fuel adjustments need to be computed for each estimate period. A summary of all adjustments shall be maintained to determine when, and if a payment is necessary.

No adjustments either positive or negative, will be made until the payment of the final estimate, unless the accumulated adjustment amount of either the asphalt (Item 698.01 M) and/or the fuel (Item 698.02 M) exceeds \$5000. When this value is exceeded, an order-on-contract (OOC) will be required to make payment. The OOC will pay the adjustment using a new item number, for example 4 #698.01 M (where the # is the Region number), and the original item number, 698.01, shall be reserved for the remaining adjustments in the final estimate. It is not necessary to process an OOC for overruns greater than the original quantity in the final. (The original quantity may be overrun in the final estimate for the asphalt and fuel adjustment items.)

An OOC shall be prepared each time the cumulative adjustment amount exceeds \$5000 for either of the adjustment items.

### **Payment Documentation**

Asphalt and Fuel price adjustments are to be computed as outlined in the Method of Computation section of the Specifications. These calculations are provided for in the Computerized Engineers Estimate System (CEES) and it is unnecessary to maintain manual records. CEES will generate a Fuel & Asphalt Report (Fuel & Asphalt Adjustment Worksheet) at the end of each estimate period and also provides a Fuel & Asphalt Adjustment Summary. This Fuel & Asphalt Summary Report is required to be submitted in the final estimate to the comptroller. CEES requires the eligible Asphalt and Fuel items and the index prices to be entered at contract set up. It is important to note that all eligible items should be entered at this point. If an item is added at a later date, CEES will only compute the adjustment from the date of entry, not from the contract start. Adjustments for these items used, prior to the date of entry will have to be performed manually. These manual adjustments will also have to be added to the Asphalt & Fuel Adjustment Summary.

To have CEES compute the Asphalt & Fuel Adjustments, the item number and quantity used must be entered into the Inspector's Reports. Additionally, the Monthly posted price for Asphalt & Fuel must be entered for each month.

At the end of an estimate period, CEES will generate a Fuel and Asphalt Adjustment Worksheet. This is for information purposes only. Also note that CEES will also generate a Fuel & Asphalt Adjustment Summary. It is the Engineers responsibility to monitor the total adjustments and determine if a payment is necessary. CEES will not include the adjustments in any period estimate.

Please refer to the CEES user manual for a detailed description of the data entry process for Asphalt & Fuel Adjustments.

### **Negative Adjustments**

CEES will calculate the negative adjustments as they occur. Any negative amount beyond the original contract quantity must be made as a Charge-to-Contractor under the corresponding item number. The

## **SECTION 698 - PRICE ADJUSTMENTS**

Charge-to-Contractor is usually included on the Final Estimate, although it is possible to include it on a payment estimate.

### **References**

Computerized Engineers Estimate System, CEES User Manual, version 3.1 Final," NYSDOT Construction Division.

109-03 Payments on Contract, NYSDOT Contract Administration Manual.

## **SECTION 700 MATERIALS DETAILS**

### **SECTION 704 - MASONRY UNITS**

#### **704-03 PRECAST CONCRETE - GENERAL**

##### **Erection Plan**

Erection shall not begin until the required erection plan, including erection drawings, have been reviewed and approved by the Engineer. No extra payment will be made to the Contractor for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Contractor's handling and erection equipment or the erection scheme.

The surfaces to which any sealant are to be applied shall be thoroughly dry and free from oil, laitence or any other material that would prevent the sealer from bonding to the concrete surface.

##### **Repair of Damaged Units**

Damaged units shall be repaired in a manner approved by the Engineer. Units which, as determined by the Engineer, cannot be repaired or which do not meet dimensional and camber tolerances shall be rejected by the Engineer and replaced with acceptable units furnished by the Contractor.

Rejection of a unit shall be done only with the concurrence of the DCES.

##### Miscellaneous Repairs of Precast Concrete

##### General

Written repair procedures, together with sketches necessary to describe the deficiencies and the proposed repair, shall be prepared by the Contractor and submitted to the Engineer for approval.

Prior to beginning the repair, all spalled or disintegrated concrete shall be removed by chipping the unsuitable material away until sound concrete is reached. The type and size of tools and the depth at which sound concrete is reached shall have the approval of the Engineer. All surfaces to be repaired shall be thoroughly blast cleaned.

##### Required Information

When written repair procedures are required for the repair of defects, repair procedure drawings shall be prepared to show the defects in the plan view, elevation and section as necessary to adequately locate and describe the defect and the proposed repair. The proposed repair procedure shall be described in detail including, where applicable, the following information, listed in a proposed sequence of operation.

1. The reason or probable reason why the defect occurred.
2. Color pictures and sketches showing plan views and sections indicating the size of the defect.
3. Removal of unsuitable material. Prior to beginning the repair, all spalled or disintegrated concrete shall be removed by chipping the unsuitable material away until sound concrete is reached. The type and size of tools and the depth at which sound concrete is reached shall be determined by the Engineer.
4. Blast Cleaning Surfaces. All surfaces to be repaired shall be thoroughly blast cleaned.

##### Repair

## SECTION 700 MATERIALS DETAILS

Repairs shall be made with one of the following materials: epoxy grout comprised of an epoxy resin system (721-01); epoxy polysulfide grout (721-03), mixed with fine aggregate or a (701 Series) cementitious grout. The grout shall be mixed and placed in accordance with the following:

### 1. Mixing

No mixing shall be started until all preparations have been made to use the grout. The Contractor shall be familiar with the working life limitations of the grout being used, and his operations shall be governed accordingly. Mixing shall be carried out in strict accordance with the Manufacturer's instructions or directions contained in the Department's Approved List manual and the following:

- a. Mixing shall be done as close as possible to the portion to be repaired.
- b. All necessary equipment for mixing and placing shall be present at the site, and in good working order, prior to the start of mixing.
- c. The epoxy grout shall be proportioned by volume in the approximate ratio of two (2) parts fine aggregate to one (1) part epoxy. The exact ratio of sand to epoxy resin system shall be determined on-site to produce a dense void-free grout.
- d. Dry, fine aggregate shall be placed in the mix container first. It shall be thoroughly agitated prior to the addition of the epoxy.
- e. The two components of the epoxy system shall be thoroughly mixed together before added to the fine aggregate.
- f. The epoxy shall be added to the fine aggregate slowly, but mixing time shall not exceed three minutes.
- g. All epoxy grout, in any individual batch, shall be used within 25 minutes after the start of mixing of the two components to create the epoxy system. All grout not used within the time limit shall be discarded.
- h. The grout shall not be retempered.
- i. No solvent, thinner or other foreign material shall be added directly to either the individual components or the epoxy mixture.

### 2. Placing

The grout shall be placed against a clean, primed receiving surface, in accordance with the following:

- a. The receiving surface shall be cleaned of all oil, grease or other material, which may prevent effective bond, immediately prior to priming the surface with neat epoxy (epoxy without aggregate) or cementitious paste.
- b. The priming of the receiving surface shall be done immediately prior to the placement of the grout.
- c. The grout shall be placed quickly and continuously. It shall not be overworked.
- d. The temperature of the receiving surface shall be above 10°C at the time of grout placement.
- e. Grout placement shall not be permitted when ambient temperatures are 10°C or lower, unless methods of protection, acceptable to the Inspector, are employed. Methods of protection, if permitted, shall be continued for a period of 15 hours following grout placement. The 15 hour period may be shortened, at the discretion of the Inspector, but, under no circumstances will it be less than 12 hours. Methods of protection, if permitted, are conveniences granted by the State. As such, they are not considered extra work, and, therefore, they are not entitled to extra compensation.

## **SECTION 700**

### **MATERIALS DETAILS**

- f. Upon completion of grout placement, the new surface of the repaired area shall be flush with the adjacent surfaces, unless the design of the unit specifically required otherwise.
- g. On surfaces which will be exposed to view after installation, the repaired area shall be color matched to the adjacent surfaces by use of cement dust, or other means acceptable to the Inspector.

#### **Related Contract Provisions**

Standard Specification §721-01

Standard Specification §721-03

## **SECTION 700 MATERIALS DETAILS**

### **SECTION 713 - LANDSCAPE DEVELOPMENT MATERIALS**

#### **713-01 TOPSOIL**

##### **General Procedure**

If topsoil is acquired from approved sites that are designated in the contract documents or in the proposal, sampling and testing of the material is not required. If approved sites for topsoil are not included in the contract documents, the material proposed for use as topsoil must be stockpiled, sampled and tested prior to its use. Topsoil sampling is done under the general direction of the Regional Landscape Architect (RLA). Samples will be collected by a Department representative (the Sampler) designated by the RLA or the Engineer-in-Charge (EIC). The Sampler will collect topsoil samples in the presence of the EIC and the Contractor or their representatives. Sample information shall be recorded on form SM 449-(1-5) ( Exhibit 713-01A) in accordance with the procedure outlined below. The material source and stockpile construction features shall be recorded on the Inspectors Daily Report.

Precautions shall be taken to assure that topsoil is not contaminated during stripping and other handling operations.

All samples taken from topsoil that has been amended with approved sewage sludge (meeting all NYS Department of Environmental Conservation regulatory requirements) shall be clearly identified and labeled as such on Form SM-449-(1-5).

##### **A. Sampling Procedure For Stockpiled Topsoil**

Sampling from stockpiles involves the consideration of how much topsoil each sample represents. In the case of small stockpiles, each stockpile should be sampled. In the case of large stockpiles, involving thousands of cubic yards, at least one sample should be taken for each 1000 cubic yards (cy). The total samples from a stockpile should fully represent all the materials of that stockpile.

This procedure applies for each stockpile up to 1000 cy, or for each 1000 cy in larger stockpiles. Section 106-02 Samples, Tests and Cited Specifications, of the Standard Specifications permits the EIC to require the contractor to furnish suitable excavation equipment, such as front end loaders, etc., necessary to properly sample a stockpile.

Once the number of samples to be taken has been determined, the following steps are to be followed for each sample:

1. The Contractor shall form a face for the full height of the stockpile at four locations to be specified by the Department's Sampler. A front end loader shall then be filled by channeling the full height of the face, from the bottom to the top, in one operation and the bucket shall then be lowered and emptied by rotation to form a small pile at each location.
2. The Sampler shall place a shovel full of soil from each of the four small piles into a large container.
3. Thoroughly mix the contents of the container.
4. Either by splitting or quartering, obtain enough material to fill the provided polyethylene bag and container with the soil from Step 3.



## **SECTION 700 MATERIALS DETAILS**

5. Material shall not be added to the stockpile after sampling. If material is added after the stockpile has been sampled, or the stockpile is otherwise tampered with, the Department's representative will declare the stockpile unacceptable.
6. The polyethylene bag shall be inserted inside the quart size cylindrical container. The sample shall then be placed into the bag to a point where the bag can be tied and the top be placed and sealed on the container for shipment. The bags and containers will be furnished by the Regional Landscape Architect or the Geotechnical Engineering Bureau.
7. After each sample has been taken, it shall be assigned a sample number and shipped to the Geotechnical Engineering Bureau for testing, unless it is a sample taken from topsoil which has been amended with approved composted sewage sludge or other such regulated material. Topsoil that has been amended with approved composted sewage sludge or other such regulated material shall be tested by an established Engineering or Agronomy firm which provides soils laboratory services. The test is to assure compliance with the ph, organic content and gradation requirements of Section 713-01 Topsoil. A copy of the specification shall be furnished to the laboratory by the Contractor. The testing of topsoil amended with approved composted sewage sludge shall be done at the Contractor's sole expense. All results shall be returned to the RLA.
8. A copy of Form SM-449-(5) for each sample should be inserted in the container, but not in the bag. The remaining copies of the form and the container should be sent to the Geotechnical Engineering Bureau or to the laboratory selected by the Contractor in the case of topsoil amended with approved composted sewage sludge. Form SM-449-(1-5) should be completely filled out so that the laboratory will have all necessary information. The Geotechnical Engineering Bureau or established Engineering or Agronomy firm will provide copies of the test results to the RLA.
9. The Regional Landscape Architect will forward a copy of Form SM-449-4 to the Engineer. A copy of SM 449-4 is shown as Exhibit 713-01A.

### **B. Resampling Procedure For Topsoil In-Place**

This procedure applies to topsoil in-place that was previously tested and found to be deficient in organic content or ph only.

As in sampling from stockpiles, sampling topsoil that has been placed and amended to correct organic or ph deficiencies involves the consideration of how much topsoil each sample represents. The sampling procedure for topsoil placed shall consist of the preparation of one composite sample for each acre of placed topsoil, or part thereof. Each composite sample shall represent full depth samples of placed topsoil from not fewer than ten individual locations per acre (or with depth samples of placed topsoil for 4000 square feet or part thereof).

Section 106-02 Samples, Tests and Cited Specifications, of the Standard Specifications permits the EIC to require the Contractor to furnish suitable excavation equipment necessary to properly sample topsoil that has been placed prior to amending the organic content.

Once the number of samples to be taken by this procedure has been determined, the following steps are to be followed for each sample.

1. The Sampler shall prepare one composite sample of placed topsoil for each acre of placed topsoil, or part thereof.

## **SECTION 700 MATERIALS DETAILS**

2. Each composite sample of placed topsoil shall represent full depth samples of placed topsoil from not fewer than ten individual locations per acre (or full depth sample of placed topsoil per 4000 square feet, or part thereof).
3. The Sampler shall place a shovel full of soil from each of the ten individual locations into a large container.
4. Thoroughly mix the contents of the container.
5. Either by splitting or quartering, obtain enough material to fill the provided polyethylene bag and container with the soil from step 3.
6. The polyethylene bag shall be inserted inside the quart size cylindrical container. The samples shall then be placed into the bag to a point where the bag can be tied and the top be placed and sealed on the container for shipment. The bags and containers will be furnished by the Regional Soils Engineer or the Geotechnical Engineering Bureau.
7. After each sample has been taken, it shall be assigned a sample number and shipped to the Geotechnical Engineering Bureau for testing as soon as possible, unless it is a sample taken from topsoil which has been amended with approved composted sewage sludge or other such regulated material. Topsoil that has been amended with approved composted sewage sludge or other such regulated material shall be tested by an established Engineering or Agronomy firm which provides soils laboratory services. The test is to assure compliance with the ph, and/or organic content requirements of Section 713-01 Topsoil. A copy of the specification shall be furnished to the laboratory by the Contractor. The testing of topsoil amended with approved composted sewage sludge shall be done at the Contractor's sole expense. All results shall be returned to the RLA.
8. A copy of Form SM-449-(5) for each sample should be inserted in the container, but not in the bag. The remaining copies of the form and the container should be sent to the Geotechnical Engineering Bureau or to the laboratory selected by the Contractor in the case of topsoil amended with approved composted sewage sludge. Form SM-449-(1-5) should be completely filled out so that the laboratory will have all necessary information. The Geotechnical Engineering Bureau or established Engineering or Agronomy firm will provide copies of the test results to the RLA.
9. The Regional Landscape Architect will forward a copy of Form SM-449-4 to the Engineer.

### **C. Allegation Of Sampling Errors**

Contractors who feel that an error was made in sampling the topsoil shall, within one working day, indicate the alleged error in writing to the EIC, who will refer the letter to the RLA. A copy of the letter will be sent to the Director of the Landscape Architecture Bureau for resolution.

### **Evidence of Acceptability**

The inspector shall prepare an Inspectors Daily Report indicating work accomplished and compliance with all specification requirements for the item or items involved. Such reports should account for the entire quantity of topsoil placed on the day of the report.

#### **A. Approved Sites Designated in the Contract Documents**

## **SECTION 700**

### **MATERIALS DETAILS**

If an approved site for the acquisition of topsoil is designated in the contract documents or in the proposal, sampling and testing of the material is not required. These sites have previously been determined to be acceptable by the RLA.

**B. All Other Sites**

The Regional Landscape Architect shall determine the acceptability of tested material based on the results given on Form SM-449. A copy of this determination on Form SM-449 shall be filed in the project records.

## **SECTION 700 MATERIALS DETAILS**

### **713-02 LIMESTONE**

#### **General Procedure**

When a shipment of limestone is delivered to the project site, it shall be accompanied by an invoice stating the quantity of material delivered. The Project Engineer shall ascertain that the manufacturer's name, net weight and guaranteed analysis appears on each container or accompanies each bulk shipment, and that the guaranteed analysis meets the requirements of the specifications.

#### **Evidence of Acceptability**

Manufacturer's label on containers or certificates accompanying bulk shipments indicating compliance with the specifications."

### **713-03 FERTILIZER**

#### **General Procedure**

When a shipment of fertilizer is delivered to the project site, it shall be accompanied by an invoice stating the quantity of material delivered. The Project Engineer shall ascertain that the manufacturer's name, net weight and guaranteed analysis appears on each container or accompanies each bulk shipment, and that the guaranteed analysis meets the requirements of the specifications.

#### **Evidence of Acceptability**

Manufacturer's label on containers or certificates accompanying bulk shipments indicating compliance with the specifications.

### **713-04 SEEDS**

#### **General Procedure**

Seed is accepted for sowing upon delivery to the project site on the basis of the labeled kind of seed, purity, and germination provided that the label indicates compliance with the Specifications. However, final acceptance of seed may be subject to Department performed sampling and testing to verify the labels and certifications.

Labels, shipment invoices, and, if the seed is sampled and tested, copies of completed Form LB-1, "SEED INSPECTION" along with a copy of the Laboratory Report must be retained to document the acceptability of the kinds and amounts of seeds delivered to the job. When seed for a project is to be sampled, the samples of each kind or lot of seed shall be drawn in duplicate prior to mixing or sowing. Form LB-1 "SEED INSPECTION", shown as Exhibit 713-04A, shall be completed in triplicate. The white and blue forms, together with one of the seed samples, shall be forwarded to the Department of Seed Investigations, N.Y.S. Agricultural Experiment Station, Geneva, New York. The other seed sample shall be left with the contractor. The yellow form shall be retained as the Region record of the sample.

Upon completion of the test, a copy of the Laboratory Report is to be forwarded to the Region Office. The Region shall forward a copy of this report to the Project Engineer and to the vendor.

#### **Evidence of Acceptability**

Labels, shipment invoices giving the kind, purity, germination and number of pounds of all seed delivered to the project, must be furnished.

## **SECTION 700 MATERIALS DETAILS**

In addition, Form LB-1, "SEED INSPECTION" and a copy of the Laboratory Report with test results must be retained in the project files if seed is sampled by the Department.

### **713-06 TREES, SHRUBS & VINES**

#### **General Procedure**

When a shipment of plants is delivered to the project site, it shall be accompanied by an invoice stating the quantity, sizes and kinds of plants delivered.

The Project Engineer shall inspect plants upon delivery to the project site and shall ascertain that all plants meet the specifications as to kind, quality, size and condition of tops and of roots, balls or containers, source and protection while in transit and any other requirements of the specifications, plans, or proposal.

(Inspection at the source may be performed, at the Contractor's expense, if requested by the Contractor and approved by the Engineer. Such inspection is for general acceptability of the stock and does not eliminate or take the place of inspection upon delivery to the project.)

The Project Engineer shall certify the acceptability of the plants by completing the top part of form HC 106a "CERTIFICATE OF INSPECTION" shown as Exhibit 713-06A. The Engineer shall reject any plants not meeting the specifications and shall record on the "CERTIFICATE OF INSPECTION" the quantity of each item accepted or rejected.

The Project Engineer shall retain copies of invoices and "CERTIFICATE OF INSPECTION." He/She shall also request and retain copies of the nursery inspection certificate that must accompany shipments of plants from outside New York State.

After the plants listed on the "CERTIFICATE OF INSPECTION" have been planted, the Engineer shall complete the lower part of form HC 106a "CERTIFICATE OF INCORPORATION".

#### **Evidence of Acceptability**

Invoices and nursery inspection certificates accompanying shipments and the Project Engineer's "CERTIFICATES OF INSPECTION" and "CERTIFICATE OF INCORPORATION."

## **SECTION 700 MATERIALS DETAILS**

### **713-07 EROSION CONTROL MATERIALS**

#### **General Procedure**

Erosion control materials shall be inspected when they are delivered to the project site. Each material is to be properly identified by a label on the container. If the material contains no label, it is to be rejected immediately. Properly labeled material is next verified as appearing on the Approved List. The project staff shall cut a representative swatch of the product that was delivered to the project site and send it to the Regional Landscape Architect who shall visually compare the swatch to the sample provided to the Regional Landscape Architect by the (Main Office) Landscape Architecture Bureau. If there is a visual discrepancy, the material is to be rejected immediately. The Landscape Architecture Bureau will make a determination of subsequent actions.

The project staff shall also remove two square meters to test for quality assurance. The two square meters shall be submitted to the Geotechnical Engineering Bureau.

This procedure pertains to Class I, II, III erosion control materials only, Class IV products do not require a submission. The results of the quality assurance testing will not affect the use of a material on the project for which it is supplied. It is for the purpose of monitoring any changes in manufacturing processes which may affect the original properties that were determined at the time of initial approval.

#### **Evidence of Acceptability**

Manufacturer's label on the container, the material appearing on the Department's Approved List, and the Regional Landscape Architect confirmation that the swatch taken from the delivered product matches the sample provided by the Landscape Architecture Bureau.

#### **References**

Directive LAB 13-07R1

### **713-08 MATERIAL FOR PROTECTION OF PLANTS**

#### **General Procedure**

When these materials arrive at the project site, the Project Engineer shall ascertain that they meet the specifications.

Antidesiccants shall be accompanied by an invoice stating the quantity of material delivered, and shall be labeled with instructions for their use.

#### **Evidence of Acceptability**

The Project Engineer's record of inspection and approval.

### **713-11 WOOD FIBER**

#### **General Procedure**

When a shipment of Wood Fiber which is an approved first generation wood derivative is delivered to a project site, it shall be accompanied by an invoice stating the quantity of material delivered. The Project Engineer shall ascertain that the wood fiber has been supplied in the manufacturer's standard containers labeled in compliance with the specifications and is in good condition.

#### **Evidence of Acceptability**

## **SECTION 700 MATERIALS DETAILS**

Manufacturer's label indicating compliance with the specifications and the Project Engineer's record of inspection and approval.

### **713-12 MULCH ANCHORAGE**

#### **General Procedure**

When a shipment of mulch anchorage arrives at the project site, it shall be accompanied by an invoice stating the quantity of each type of material delivered. The Project Engineer shall ascertain that the material meets all of the requirements of the specifications including packaging and labeling, and is in good condition.

#### **Evidence of Acceptability**

The manufacturer's certification as to compliance with the specifications and the Engineer's record of inspection and approval, plus the results of any laboratory tests.

### **713-13 PESTICIDES**

#### **General Procedure**

When a pesticide arrives at the project site, it shall be accompanied by an invoice stating the quantity delivered. The Project Engineer shall ascertain that the material has been supplied in the manufacturer's standard containers marked with the name of the material, the name of the manufacturer, the net quantity contained therein, and that it meets all the other requirements of the specifications.

#### **Evidence of Acceptability**

Proper labeling which indicates conformity with the specifications.

### **713-14 SOD**

#### **General Procedure**

Sources of sod shall be made known to the Engineer at least five days before cutting and are subject to inspection and approval by the Engineer before cutting. When a shipment of sod arrives at a project site, it shall be accompanied by a certificate indicating compliance with the regulations of the New York State Department of Agriculture and Markets. The Project Engineer shall ascertain that the sod meets all of the requirements of the specifications and has arrived on the project site in satisfactory condition.

Unless otherwise specified on documents, sod should be a mixture of permanent grasses; such as blends of bluegrasses and fescues. It is not uncommon to have a monoculture, including monocultures of non-permanent grasses such as perennial ryegrasses in sod. This is not acceptable unless so specified.

#### **Evidence of Acceptability**

Project Engineer's record of inspection and approval and a certificate indicating compliance with the regulations of the New York State Department of Agriculture and Markets.

### **713-15 ORGANIC MATERIAL**

#### **General Procedure**

When a shipment of Humus, Peat or recycled and/or composted organics arrives on a project site, it shall be accompanied by an invoice stating the quantity of material delivered. Unless otherwise approved,

## **SECTION 700**

### **MATERIALS DETAILS**

duplicate samples are taken by project personnel, either at the intended source of supply or upon delivery to the project site. One sample is retained at the project and the other is shipped to an approved laboratory together with a copy of the material specifications.

#### **Evidence of Acceptability**

Manufacturer's label or certification indicating compliance with the specifications.