TO:

SUPERSEDED BY EI 95-010 EFFECTIVE 7/6/95

ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: SPECIFICATION FOR BRIDGE CONSTRUCTION - ITEMS 16555.5005 AND 16555.5505

Subject Code: 7.35-6; 7.27-1-555

Distribution: 30 Main Office 32 Regions 34 Special

APPROVED:

ARUN M. SHIROLE, Deputy Chief Engineer, Structures Division

Code: EI 90-10

Date: 4/18/90

Supersedes: EI 89-26

This Engineering Instruction transmits the texts for:

1. Item 16555.5005 - Permanent Concrete Traffic Barrier for Structures (Safety Shape - Full Section).

2. Item 16555.5505 - Permanent Concrete Traffic Barrier for Structures (Safety Shape - Half Section).

The above items are updated versions of items 16555.5004 and 16555.5504 of the same title.

The only change to the revised text is:

To allow one addition of water after initial discharge to concrete (Class J) used in slipforming structural barrier.

This change is expected to reduce costs, or to be cost neutral.

These items take effect with the letting of June 18, 1990. All structural barrier items other than 16555.5005 and 16555.5505 will be disapproved as of that date.

The item text will be stocked as a Main Office insert. Copies will not be required with the P.S. & E. submission.

ITEM 16555.5005 - PERMANENT CONCRETE TRAFFIC BARRIER FOR STRUCTURES (SAFETY SHAPE - FULL SECTION)

ITEM 16555.5505 - PERMANENT CONCRETE TRAFFIC BARRIER FOR STRUCTURES (SAFETY SHAPE - HALF SECTION)

DESCRIPTION:

A. WORK. The work shall consist of constructing concrete traffic barrier, of the safety shape configuration, at the locations indicated on the Contract Plans.

B. METHODS. Construction of the barrier shall be accomplished by cast-in-place methods. Slip forming will be allowed as an acceptable cast-in-place method.

Precasting methods of construction will be permitted. The precast barrier system design shall be approved by the D.C.E.S. The system design shall include, but is not limited to: the unit design, anchorage design, and barrier unit connection (locking) design unless the system does not employ locking as part of the design function. Approval procedures require static load testing, and may require dynamic crash testing.

C. SHAPE MODIFICATION. The barrier shape indicated on the plans shall not be altered. Minor modifications, to allow slip-forming, will be submitted to the Deputy Chief Engineer (Structures) for approval.

D. APPROVALS. For approval requirements and procedures refer to the Construction Details.

MATERIALS

A. MATERIALS. Materials used for this work shall meet the following requirements:

1. CONCRETE

a. Precast - Precast barrier shall be fabricated in accordance with the requirements of Subsection 718-29.

b. Cast-in-Place - Constructed Forms - The requirements of Section 501 pertaining to Class A Concrete shall apply.

c. Cast-in-Place - Slip Formed - The requirements of Section 501 pertaining to Class J concrete shall apply.

2. Epoxy Coated Reinforcing Bars.....709-04

3. Portland Cement Bonding Grout.....705-22(a)

4. Steel Tubes.....ASTM A500, Grade B or C

5. Steel Plates, or Bars.....ASTM A36

6. Anchor Bolts (Fully Threaded).....ASTM A449

7. Nuts.....ASTM A563 Grade DH

8. Washers.....Plain, Hardened

9. Concrete Grouting Material.....701-05

10. Concrete Repair Material.....701-04

11. Joint Filler.....705-08 Type I, or Type II

12. Curing Compound.....711-05

13. Locking and anchoring devices for precast units shall be made of steel conforming to the requirements of.....715-01 and 709-04, as applicable.

Note (a). Air entrainment for bonding grout is required. The air content shall be 8% ± 2%.

B. GALVANIZING. Galvanizing shall be done in accordance with the requirements of Subsection 719-01. All steel, except reinforcing steel, shall be galvanized.

C. FABRICATION TOLERANCES. All concrete barrier, regardless of the method of construction, shall conform to the following finished tolerances:

Bar Reinforcement Cover	-0" + 1/2"*
Width (top)	-0" + 1/4"
Width (Bottom)	-0" + 1/2"
Surface Straightness (Deviation from theoretical centerline of individual section of unit)	1/2" in 20 feet
Vertical Alignment (Deviation from a line parallel to the theoretical grade line)	1/2" in 20 feet
Horizontal and Vertical Misalignment between adjacent precast units	±3/16"

*Reinforcement cover shall be verified while the concrete is still plastic, except in the case of cured precast units. In that case, cover will be verified in accordance with established Department procedures. These procedures may include coring.

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CONSTRUCTION DETAILS:

A. APPROVALS.

1. CAST-IN-PLACE CONCRETE-MODIFICATIONS TO CONTRACT PLANS. The D.C.E.S. shall be supplied with three copies of pertinent details and necessary design computations. Every effort will be made to render a decision, in a timely manner, after all pertinent information has been received. However, the time required to render a determination will not be taken into account should the Contractor request an extension of time as provided for under subsection 108-04.

2. PRECAST CONCRETE. Precast barrier systems shall be approved prior to contract award. The Department will issue authorization letters to manufacturers of approved barrier systems. Requests to approve non-authorized manufacturers after the contract letting date will not be honored.

   The contractor is hereby forewarned that the approval process focuses upon precise test information and consequently tends to be lengthy. Therefore, requests to approve non-authorized barrier systems prior to contract letting may result in construction delays. Such delays, if they occur, will be totally the responsibility of the contractor who will absorb all connected costs.

B. GENERAL.

1. CLEANING. Surfaces against which barrier is to be placed shall be thoroughly vacuum cleaned.

2. DEFECTS. Defects are divided into two categories (minor defects and major defects). Minor defects in the barrier may be repaired in the field. Major defects shall be cause for rejection of the section, or the section shall be repaired in the manner directed by the D.C.E.S.

   a. 1 MINOR DEFECTS. Minor defects are defined as holes, honeycombing or spalls which are six inches, or less, in diameter, and which do not expose the outermost surface of the steel reinforcement.

   2 Surface voids 5/8", or less, in diameter, and 1/4", or less in depth are not considered defects. They do not require repair.

b. 1 MAJOR DEFECTS. Major defects are defined as:

a. Any defect, except as noted in B2a2 above which does not meet the definition of a minor defect.

b. Minor defects which, in aggregate, comprise more than five percent (5%) of the surface of the barrier section.

3. REPAIR.

a. MINOR DEFECT REPAIR. Repair shall be made with a material acceptable under Subsection 701-04. Methods of repair shall be acceptable to the Engineer. The color of the repaired portion shall match, as nearly as practicable, the color of the surrounding concrete. Repaired portions shall exactly match shape requirements. The repaired portion shall withstand a moderate blow from a 16 ounce hammer. Repair shall be done at no cost to the State.

b. MAJOR DEFECT REPAIR. Major defect repair, shall be pre-approved by the D.C.E.S. Repair shall be done at no cost to the State.

C. CAST-IN-PLACE CONCRETE: CONSTRUCTED FORMS. The requirements of Section 555, and Section 556 shall apply with the following modification:

"If the forms are removed before seven curing days have passed curing shall be continued in the following manner:

Concrete shall be cured by means of a clear curing compound. No curing blankets will be required. Curing compound shall be sprayed on the concrete surface immediately following the slipforming and handfinishing operations. The compound shall be applied by means of pressure spraying or distributing equipment at the rate directed by the Engineer, but not less than one gallon per 150 square feet of surface. The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide for adequate agitation of the compound during application, and shall be approved by the Engineer before work is started. Should the method of applying the compound produce a non-uniform film, or should the spraying equipment fail and duplicate equipment not be immediately available, the application of curing compound shall be discontinued

immediately and the curing shall be accomplished by another method acceptable to the Engineer. The Contractor shall stockpile sufficient approved coverings for protection of the concrete in the event of rain, non-uniform film application, or breakdown of spray equipment.

D. CAST-IN-PLACE CONCRETE: SLIPFORMED. The requirements of Section 555, Section 556 and the following, shall apply:

1. The forming of the barrier shall be accomplished by self-propelled equipment approved by the D.C.E.S. The requirements of subsection 555-3.03 shall not apply.

2. After all reinforcing bars have been placed, all bridge joints installed, and all other hardware placed in the area of the barrier, the Contractor shall perform a "dry run" over the entire length of the barrier installation location. It is necessary only to "dry run" a single day's placement during any given day; however, the entire barrier length shall be traversed.

   The "dry run" may be made with either the actual slip forming equipment, or with an exact "mock-up" of the equipment. The "mock-up"; if utilized, shall be the exact size, shape and dimensions of the slip forming equipment. It shall be a minimum of four feet long. Its movement shall be able to be correlated with a string, or survey, line indicating the correct offset location of the barrier.

3. After the "dry run" portion of the work has been completed and all obstructions have been cleared, the slip-forming equipment shall be demonstrated for capability. The demonstration shall be done in the presence of the Engineer. The Contractor shall make all adjustments, or alterations, to ensure that the equipment has the capability to produce an acceptable product. No work shall be done without the Engineer's approval. The capability demonstration will be required only once for each piece of forming equipment used on the project.

4. The Engineer's approval is for equipment capability only. The Contractor shall be entirely responsible for meeting the tolerances given under MATERIALS, subsection "C. Fabrication Tolerances". Sections which do not meet tolerance requirements are subject to removal and replacement at no cost to the State, at the discretion of the Engineer.

5. Central and Transit Mixed Concrete. The provisions of Sections 501-3.04 C and D shall apply for Central Mixed and Transit Mixed Concrete respectively, except that water may be added to the mixture one additional time at the point of deposition to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range. When the water addition is made after discharge the total number of revolutions shall not be more than 190.

   Truck Mixed Concrete. The provisions of Section 501-3.04 E shall apply except that after initial slump has been achieved, water may be added to the mixture one additional time to maintain the desired slump. The water addition may be made anytime after the beginning of discharge until approximately two-thirds of the load, as determined by the Engineer, has been discharged. After the water addition, the concrete shall be mixed at least 30 revolutions in the mixing range.

6. Concrete supply shall be sufficient to produce a continuous, completely shaped barrier. If concrete placement is interrupted, for any reason, the placement shall be protected from drying by several layers of wet burlap. A construction dam, or bulkhead, shall be installed if the interruption exceeds 30 minutes. If the interruption exceeds 90 minutes, further placement shall be discontinued. Concrete placement at this location may then resume only after 12 hours, measured from the time of delay, has elapsed.

7. Concrete placement may begin at the joint beyond the bulkhead without time constraints. If the length of placement between the bulkhead and the next joint is such that, in the opinion of the Engineer, it may not be slipformed, he will require the Contractor to form the section by methods other than slipforming.

8. Cold joints in the barrier, that is, joints formed due to the attachment of fresh concrete to set concrete, shall be made in the following manner. The set concrete shall have its surface cut to remove all loose, and otherwise unsatisfactory materials. Tools used for this purpose shall be approved by the Engineer, prior to use. The surface shall be scrubbed with wire brooms and shall be kept wet until new concrete is placed. Immediately prior to placing fresh concrete, the set surface shall be completely coated with portland cement bonding grout (705-22) thoroughly brushed in.

9. The Contractor shall make provisions to allow hand finishing, should it be necessary, on all surfaces. Hand finishing, if done, shall be done immediately after the passage of the slipforming equipment. Curing compound shall be applied only after hand finishing has been completed at any particular location.

10. Concrete shall be cured by means of a clear curing compound in accordance with the requirements of Part C.

11. Joints and construction grooves shall be introduced at the locations indicated on the Contract Plans. If sawcutting methods are employed the following requirements shall apply:

    a. The equipment shall be demonstrated, for capability, to the Engineer.

    b. No sawcuts, for any purpose, shall be made in the structural slab.

    c. In order to avoid sawcuts in the structural slab, the portion of the joint directly above the structural slab (3") shall be hand tooled immediately after finishing.

    d. All sawcuts shall be made normal to the structural slab surface.

E. PRECAST CONCRETE.

1. Immediately prior to installation, the barrier units shall be inspected for defects. Defects which conform to the definition of minor defects as given in the CONSTRUCTION DETAILS subsection B.2.a.1 shall be repaired in accordance with CONSTRUCTION DETAILS Subsection B.3.a.

   After the inspection for defects has been completed, the contact surface of all precast barrier shall be sandblast cleaned in accordance with the requirements of subsections 584-3.04A, 584-3.04C and 584-3.05 After sandblasting operations are completed the surfaces shall be thoroughly vacuum cleaned.

2. All precast barrier shall be installed on grout beds conforming to the requirements of 705-22 as modified. The exact bedding placement requirements shall be established by the barrier system manufacturer. However, no grout bed shall be greater than 1/2 inch in thickness after the barrier has been installed in its permanent position. All grout bedding material shall be tooled flush with the barrier edge.

Care shall be taken to prevent grout from setting prior to barrier unit installation. If, in the opinion of the Engineer, the grout has set, or has begun to set, it shall be removed. No retempering will be permitted. The affected installation area shall be thoroughly cleaned of grout, by methods acceptable to the Engineer, and new grout shall be placed, all at no additional cost. All vertical adjustments shall be made by the addition, or removal, of grout. No wedges will be permitted.
Lifting of the barrier which, in the Engineer's opinion, will result in permanent voids occurring between the barrier unit and the grout bed, will not be permitted.

3. Unless otherwise noted joints between units shall utilize materials required by 705-08 and shall be installed in the manner indicated on the Contract Plans, or approved by the D.C.E.S.

4. Units which are damaged during installation, due to the Contractor's operations, shall be repaired, or replaced, as determined by the Engineer. Repair or replacement shall be done at no cost to the State.

5. Precast barrier anchored to the underlying support by means of drilled-in-bolts, may be anchored by one of two methods:

   A. Bolts chemically anchored to the underlying support. Holes drilled for this method will not go completely through the underlying support. Bolt installations will be subjected to load testing acceptance requirements.

   B. Bolts mechanically anchored to the bottom of the underlying support. Holes drilled for this method will go completely through the underlying support. Bolt installations will not be load tested.

   C. Requirements for Method A.

      1. Drilling shall be done by means of a rotary impact drill. Hole diameter-shall be in strict accordance with the grout manufacturer's instructions. If reinforcing steel is encountered, the reinforcing shall be cut and removed by means of a core drill. If approved by the Engineer, hole locations may be moved to avoid encountering reinforcing steel. The remainder of the drilling shall be done by rotary impact drill. Drilling with a lubricant will not be permitted. Water use is permissible. Concrete spalled, or otherwise damaged by the contractor's operations shall be repaired, in a manner approved by and, to the satisfaction of the Engineer, at no additional cost.

2. Unless otherwise specified in the Contract Documents, the minimum depth of embedment of the anchor bolt shall be in accordance with the following:

Anchor Bolt Diameter (inches)	Embedment Length (inches)
1/2	5.5
9/16	6
5/8	6.5
3/4	8
7/8	8.5
1	10
1-1/8	12
1-1/4	15

The Contractor may increase the embedment length beyond that shown on the Plans or specified in the above table provided 1) the increase is done at no additional cost to the State and 2) the hole stops at least 2 inches from the bottom of the structural slab.

3. Grouting material shall be a non-metallic, non-shrink grout, or polymer resin. It shall contain no products which promote the corrosion of steel. When cured, the material shall exhibit a maximum loss of four percent (4%) when tested for freeze-thaw resistance. Freeze-thaw testing will be done in accordance with Materials Method 215, except that the material will be subjected to 50 cycles of testing. Cured material shall not be reactive with salt water, portland cement, or petroleum products.

   The contractor shall supply the Engineer with two copies of the grout manufacturer's certification that the material meets the foregoing requirements.

4. All anchor bolts shall be inserted at least the specified depth into the hole. After insertion of the bolt, all excess grout shall be struck-off flush with the concrete face. Should the grout fail to fill the hole, additional grout shall be added to the hole to allow a flush strike-off.

5. A portion of each lot of grouted-in anchor bolts shall be designated by the Engineer for load testing. The first lot shall consist of the first 10 grouted in anchor bolts. The remaining lots shall be defined by the Contractor subject to the following:

1. The lot size shall not exceed 600 anchor bolts.
2. A lot shall only include anchor bolts installed during a single construction season.
3. A lot shall only include anchor bolts grouted with the same grout or resin.

Unless otherwise specified in the Contract Documents, the minimum load applied during the load testing shall be in accordance with the following:

Diameter (in.)	Test Load (lbs.)
1/2	10,900
9/16	13,900
5/8	17,300
3/4	25,600
7/8	35,300
1"	46,400
1-1/8	50,800
1-1/4	64,500

Table 1 shows the lot size (column L), the initial number of anchor bolts selected for testing (column N1) and the number of anchor bolts selected for additional testing (column N2).

Table 1.

L	N1	N2
1-30	All the bolts in the lot	--
31-50	30	--
51-75	38	--
76-100	44	21
101-200	49	26
201-300	50	30
301-600	55	30

If all of the N1 anchor bolts selected for testing pass the load test, then the lot shall be accepted.

If the lot size is 75 or less and one or more of the N1 anchor bolts fail the load test, then all the anchor bolts in the lot shall be tested.

If the lot size is 76 or greater and only 1 of the N1 anchor bolts fails the load test, the Engineer shall designate an additional N2 anchor bolts for testing. If none of the N2 anchor bolts fail the load test, the lot shall be accepted. If any of the N2 anchor bolts fails the load tests all of the anchor bolts in the lot shall be tested.

If the lot size is 76 or greater and more than one of the N1 anchor bolts fail the load testing then all the anchor bolts in the lot shall be tested.

Anchor bolts shall be deemed to pass if the specified test load is attained without permanently displacing the anchor bolts. NOTE: THIS LOAD TESTING SHOULD BE NON-DESTRUCTIVE. LOADING SHOULD BE STOPPED AS SOON AS THE MINIMUM ACCEPTABLE PULL-OUT RESISTANCE IS ATTAINED.

6. The testing equipment shall consist of a calibrated jack system, a frame to distribute the jack load, couplers to connect the jack to the anchor bolts, and safety devices. Prior to starting the testing, the Contractor shall supply the Engineer with a certificate of calibration for the jack less than 6 months old.

   Supports for the frame used to distribute the jack load shall be located outside a circle centered at the anchor bolt and of a diameter equal to 2 inches plus twice the anchor bolt embedment length but need not exceed 24 inches. The frame and jack shall be positioned so that the load is applied along the centerline of the anchor bolt. Chains or cables shall be used to connect the various pieces of the tensioning system so that free projectiles will not be created by a failure of an anchor bolt anchorage, coupling or other portion of the tensioning system.

7. All anchor bolts which fail load testing shall be replaced and load tested in accordance with the foregoing requirements at no additional cost.

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5D. Requirements for Method B.

1. The requirements of subpart 3C1 shall apply.

2. Grouting material shall meet the requirements of subsection 701-05. It shall be mixed and placed in strict accordance with the grout manufacturer's instructions unless otherwise modified by the contract documents.

3. Both hole and bolt shall be clean and dry at the time of bolt insertion. The bolt shall be held in place such that it will remain vertical during subsequent grout placement. The method of bolt retention shall be such that the grout will be held within the hole until setting is complete.

   Barrier units mechanically anchored to the underlying support by means of bolting shall be grouted into place in accordance with the following:

   a. Grout shall be made in accordance with the grout manufacturer's written instructions. Two copies of the manufacturer's instructions shall be delivered to the Engineer a minimum of two weeks prior to the beginning of barrier installation work.

   b. Grout shall be placed only if the ambient air temperature is at least 50°F and is predicted to rise. No grout shall be placed if the ambient air temperature falls below 45°F, unless external heat has been provided in the manner required by subsections 555-3.06A, and 3.06B. The underlying support may be used as the floor of the enclosure if the Engineer approves.

   c. External heat shall be maintained for a minimum of seven curing days. A curing day is defined by subsection 555-3.09. After seven curing days have passed, or the grout has reached a minimum compressive strength of 3500 p.s.i., whichever occurs last, the enclosure may be removed. All work of providing external heat shall be done at no additional cost.

METHOD OF MEASUREMENT. The work will be measured as the number of linear feet of concrete traffic barrier installed. Measurement will be taken along the centerline of the top of the barrier. No deduction will be made for joints.

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BASIS OF PAYMENT.

A. The unit price bid per linear foot shall include the cost of all labor, materials and equipment necessary to complete the work. This price shall also include the cost of bar reinforcement, drilling, and testing.

B. In the case of barrier constructed by cast-in-place methods, 40% of the linear footage will be paid for after all of the bar reinforcement has been placed and approved by the Engineer. This payment shall include the cost of chairs, supports, fastenings, connections and any splices not specifically indicated on the plans. If the Engineer permits the substitution of larger bars than those specified, or the D.C.E.S. permits splices not indicated on the plans, the payment will not be increased nor will any extra compensation be considered.