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ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: PAVEMENT MARKING MATERIALS FOR CAPITAL PROJECTS

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BACKGROUND

Engineering Instruction 79-34 established Department policy for the inclusion of pavement markings in capital projects. That policy recognized the need to provide pavement markings that remain visible and effective throughout the year to regulate traffic and delineate the roadway. It was based on the Department's experience with several marking materials at that time.

Since 1979, pavement marking technology has advanced, and this Department has gained increased experience with various durable marking materials. Based on current knowledge and materials technology, the Department's marking program can be improved by adopting several changes based on the following points:

1) The need remains to provide pavement markings which are visible and effective throughout the year to regulate traffic and delineate the roadway.

2) Hot extruded thermoplastic reflectorized pavement markings have continued to perform reasonably well on new asphalt pavements in most cases.

3) Two component epoxy pavement markings have performed well on a number of portland cement pavements, and have also shown promise on asphalt pavements. Based on current experience, this material is the best choice for portland cement pavements and is an acceptable alternate on asphalt pavements.

4) Preformed tapes have generally provided excellent durability on both asphalt and portland cement pavements, but reflectivity declines to very poor levels with traffic wear. In addition, costs are high relative to other materials. For small total project quantities and for intersection markings, ease of installation makes its cost more competitive. Because of its excellent durability, this material is the best choice for intersection markings, and acceptable for roadways with high traffic volumes where reflectivity is not a critical need.

5) The characteristics of these pavement marking materials compared to traffic paint are given in Table II. The cost and durability figures represent the typical range expected over a large number of projects. Depending on local traffic, pavement, and climatic conditions, as well as individual project conditions, these may vary considerably.

The policy established here is based on the best information available to the Department at this time. Pavement marking technology has evolved rapidly over the past few years, and continues to evolve at this time. Pavement marking materials will continue to be evaluated intensively, and changes in this policy will be considered when it appears that improvements can be achieved.

POLICY

It is Department policy to apply durable pavement markings on all capital projects. Therefore, when pavement markings are required on a project, they are to be included as pay items in the contract plans and specifications. Allowable exceptions to this policy are as follows:

1) Projects not on the State highway system may be exempted from this policy if the maintaining agency does not agree to the use of the specified material.

2) Projects which are let and scheduled for completion in the same construction season if it is probable that the durable markings can not be placed due to their limitations on placement during cool weather.

3) Durable pavement markings shall not be applied to deteriorated pavement surfaces.

4) Durable pavement markings shall not be applied to pavements with bituminous surface treatments.

5) Traffic paint is not to be included in capital projects as a bid item. Where required by this policy, traffic paint will be applied by Highway Maintenance.

PROJECT INSPECTION

Projects that include the application of durable pavement markings on existing pavement surfaces shall be inspected during the design phase. The inspection will be made to determine the type or condition of the existing pavement for the purpose of selecting the marking material; and for the purpose of accurately estimating quantities of pavement surface preparation work. The Materials Bureau is available to assist in the inspection if requested by the Regional Design Engineer.

PAVEMENT TYPES

To select the appropriate pavement marking material, the type and condition of the pavement on the project must be determined. For the purpose of this policy, the determination of pavement types shall be guided by the following:

1. Asphalt Concrete

   A. New Asphalt - newly paved asphalt surface.

   B. Existing Asphalt - Good Condition - no or only minor evidence of physical defects; surface aggregate particles are well coated with asphalt material; pavement surface is generally clean to the extent that only dirt and loose debris is evident between aggregate particles - no or only minor evidence of oil and grease type contaminants are present.

   C. Existing Asphalt - Fair Condition - minor evidence of cracking, potholes and similar physical defects, but not to the extent that major repair is required; surface aggregate particles may be slightly polished and/or only partially coated with asphalt material; the pavement surface is oxidized or shows some loss of asphalt material; the pavement is moderately dirty to the extent that there is some evidence of embedded dirt, oil, and grease type contaminants between the aggregate particles.

   D. Existing Asphalt - Deteriorated Condition - the pavement is visibly cracked, potholed, ravelled, polished or otherwise structurally damaged to the extent that needed repairs are evident; there is little or no asphalt material on aggregate surface particles; the pavement surface is heavily oxidized and shows loss of asphalt material; the pavement surface is visibly dirtied to the extent that there are heavy deposits of built-up dirt, oil and grease type contaminants.

   E. Bituminous Surface Treatments - pavement surface consisting of an application of bituminous material followed by an application of aggregate (Items 410.01 and 410.02).

2. Portland Cement Concrete Pavements

   A. New Concrete - newly paved, textured concrete surface.

   B. Existing Concrete - Good to Fair Condition - no or minor evidence of cracking, scaling and similar physical defects, but not to the extent that major repair is required; worn surface texture; some polished aggregate.

   C. Existing Concrete - Deteriorated Condition - the pavement is visibly scaled, spalled, cracked, or otherwise structurally damaged to the extent that needed repairs are evident; the surface is heavily polished and extensive amounts of smooth aggregate are visible.

MATERIALS SELECTION

Longitudinal Markings.

The pavement marking materials used in the design of the project shall be as shown in Table I. Except as noted below, only one type of material shall be specified for longitudinal lines on an individual project. The material shall be selected based on the predominant type of pavement included in the project.

Many projects will include more than one type of pavement surface - the predominant pavement surface and the differing pavement surfaces of bridge decks, viaducts, ramps, access and adjoining roads. When differing pavement surfaces are included in the project the marking material that has been selected for longitudinal lines may not be suitable for application to these different surfaces. When this condition exists, a secondary marking material for use on the project may be selected from Table II. This table gives the characteristics of the available pavement marking materials and the pavement types on which they may be applied.

The intent of this procedure (secondary marking) is to ensure that a marking material will not be applied to a pavement for which it is unsuitable. However, it should be remembered that specifying a secondary marking material, especially for small quantities, may drive up the total cost of the pavement markings. Therefore, if a secondary material selected from Table II is suitable for the predominant pavement type as well, the designer should consider using the secondary material throughout the project. For example, a project with predominantly new asphalt pavement has a substantial quantity of portland cement bridge decks and intersecting roads. Rather than specifying epoxy as the secondary material on the concrete pavement, epoxy, which is shown in Table II to be suitable for new asphalt pavements, could be used throughout the project as the only marking material.

Conversely, on projects with small quantities of concrete pavement, preformed tape should be the most commonly selected secondary material for marking longitudinal lines. Although preformed tape is more expensive (due to high materials cost) than either extruded thermoplastic or epoxy, it becomes cost competitive in small quantity installations because of its availability and ease of placement. By comparison, both extruded thermoplastic and epoxy require different specialized striping equipment for application. This equipment is normally designed for production type work and not for small quantities of several thousand lineal feet. Unless this equipment will be available to the project, specifying extruded thermoplastic or epoxy as the secondary marking material for small quantities will normally result in inflated costs due to mobilization, and possible project delay due to equipment unavailability.

The designer must give careful consideration to all variables in the selection of a secondary marking material for longitudinal lines.

Preformed tape markings have proven to be exceptionally durable on both asphalt and concrete pavements. They have also demonstrated very poor reflectivity after a short period of time, and are much more expensive than alternate materials. However, on lighted highways where reflectivity is not as important for delineation, the superior durability (longevity) of the preformed tape may offset its higher initial cost. For this reason, the requirements of Table I may be waived and preformed tape specified for longitudinal markings on lighted highways with traffic volumes of 7500 AADT per lane or greater. Because of the additional cost, a designer who selects preformed tape must submit a justification for that selection with the PS&E submission.

Transverse and Special Marking Patterns, Letters and Symbols. Materials for transverse and special marking patterns, letters and symbols shall be selected from Table I. As defined by the MUTCD, transverse and special marking patterns are intended to include stop lines, crosswalk lines, clearance lines, crossbars, words and arrows. At the designer's option, hatch lines and other channelization markings may also be considered a special marking pattern.

PAVEMENT SURFACE PREPARATION

Durable pavement markings will not bond to pavement surfaces contaminated with dirt, coated with curing compound or striped with an existing painted pavement marking.

A general cleaning of all pavement surfaces prior to the application of extruded thermoplastic, epoxy and preformed tape markings is required by the specifications for these materials. This general cleaning is intended to remove oil, dirt, dust, grease and similar foreign materials, and payment is included in the pavement marking pay item. However, because of the much greater effort required to remove curing compounds from portland cement concrete pavement, and existing markings from both asphalt concrete and portland cement concrete pavements, their removal is specified as a separate item of work and is paid for independent of the pavement marking items. Therefore, the inclusion of surface preparation items 635.01, .02, and .03 shall be considered for all projects that call for the application of durable pavement markings. The pay item(s) and estimated quantities to be used in the design of the project shall be as shown in Table III.

Experience has shown that costs for surface preparation vary greatly depending on the quantity of work involved. Therefore, to provide for balanced bidding by contractors, on projects with existing pavement markings, the designer should visit the work site to accurately estimate quantities of surface preparation work. This inspection should be scheduled as close to the project's PS&E date as possible. It is also desirable to alert regional maintenance forces that durable markings are to be applied to the particular highway so they are not re-striped with traffic paint which will have to be removed as part of the capital project.

Surface preparation items are not to be used for the removal of temporary pavement markings applied by the Contractor under Item 619.15, Pavement Delineation; their removal is included in that item.

TABLE I - PAVEMENT MARKING MATERIALS SELECTION

PREFERRED PAVEMENT MARKING MATERIAL

PREDOMINANT PAVEMENT TYPE	LONGITUDINAL MARKINGS	TRANSVERSE & SPECIAL MARKING PATTERNS: LETTERS & SYMBOLS
1. ASPHALT CONCRETE PAVEMENTS		
A. NEW ASPHALT	EXTRUDED THERMOPLASTIC(1)	PREFORMED TAPE
B. EXISTING ASPHALT GOOD CONDITION	EXTRUDED THERMOPLASTIC OR EPOXY(1)(2)	PREFORMED TAPE
C. EXISTING ASPHALT FAIR CONDITION	EPOXY(1)	PREFORMED TAPE
D. EXISTING ASPHALT DETERIORATED CONDITION	TRAFFIC PAINT(4)	TRAFFIC PAINT(4)
E. BITUMINOUS SURFACE TREATMENTS	TRAFFIC PAINT(4)	TRAFFIC PAINT(4)
2. PORTLAND CEMENT CONCRETE PAVEMENTS		
A. NEW CONCRETE	EPOXY(1)	EPOXY AND PREFORMED TAPE(3)
B. EXISTING CONCRETE GOOD TO FAIR CONDITION	EPOXY(1)	PREFORMED TAPE
C. EXISTING CONCRETE DETERIORATED CONDITION	TRAFFIC PAINT(4)	TRAFFIC PAINT(4)

(1) Where quantity of markings is less than 3000 linear feet preformed tape is to be specified.
(2) One marking material may be specified, or project may include both items to be bid at contractor's option.
(3) Epoxy is to be specified for transverse and special marking patterns. Preformed tape is to be specified for letters and symbols.
(4) Traffic paint to be applied by Highway Maintenance, not as a bid item in capital projects.

TABLE II - PAVEMENT MARKING MATERIALS CHARACTERISTICS

PAVEMENT MARKING MATERIAL	PAY ITEMS	SUITABLE PAVEMENT TYPES	REQUIRED SURFACE PREPARATION	EXPECTED SERVICE LIFE (YEARS)	REFLECTIVITY [9]	FIRST COST [6] ($/FT.)	ANNUAL COST [8] ($/FT./YR)
EXTRUDED THERMOPLASTIC [1]	687.0101-.0401	NEW ASPHALT EXISTING ASPHALT GOOD CONDITION	REMOVE EXISTING PAVEMENT MARKINGS	4-7 NEW 3-6 EXISTING	VERY GOOD	.32	.046-.08 .053-.107
EPOXY [2]	18685. 060101-060401	NEW ASPHALT EXISTING ASPHALT GOOD CONDITION FAIR CONDITION NEW CONCRETE EXISTING CONCRETE GOOD-FAIR CONDITION	REMOVE CURING COMPOUND ON CONCRETE & EXISTING PAVEMENT MARKINGS	3-5	EXCELLENT	.24	.048-.08
PREFORMED TAPE [3]	18688. 0101-0401	NEW ASPHALT EXISTING ASPHALT GOOD CONDITION FAIR CONDITION NEW CONCRETE EXISTING CONCRETE GOOD-FAIR CONDITION	REMOVE CURING COMPOUND ON CONCRETE & EXISTING PAVEMENT MARKINGS	4-8	POOR	1.25	.156-.312
TRAFFIC PAINT [4]	640.0101-.0201,.03 .04	ALL	NONE	1/4-1/2	GOOD	.03 [7]	.06-.12 [7]

(1) Extruded Thermoplastic - requires application at 50+°F ambient and surface temperatures; requires special application equipment; contractor availability unlimited.

(2) Epoxy - requires application at 50+°F ambient temperature; requires special applicating equipment; contractor availability limited.

(3) Preformed Tape - ambient and surface temperature restrictions-seasonal limitation (refer to specification); no special applicating equipment required; contractor availability unlimited.

(4) Traffic Paint - requires application at 40+°F ambient temperature; no special applicating equipment required; contractor availability unlimited.

(5) Expected Life is based on the performance of longitudinal markings under moderate traffic volumes, transverse lines and intersection markings will wear faster.

(6) Relative cost for large quantities. Bid prices may vary greatly with quantity.

(7) Refers to modified alkyd traffic paint applied by NYSDOT.

(8) Annual cost includes only the bid price of the applied markings. It does not include other costs such as design, construction inspection, or related construction activities.

(9) Reflectivity on an unlighted highway under dry night conditions. Under wet night conditions, only thermoplastic provides adequate reflectivity.

TABLE III

USE OF PAVEMENT SURFACE PREPARATION ITEMS

PAVEMENT TYPE	CONDITION OF EXISTING PAVEMENT MARKINGS	ESTIMATED QUANTITIES FOR PREPARATION OF PAVEMENT SURFACE
New asphalt	None	None required. Do not include surface preparation items.
New concrete	None	Items 635.01,.02 and .03 included in the proposal with quantities equal to the quantities of new pavement markings, to remove concrete curing compound.
Existing asphalt or concrete (good-fair condition)	Good-fair condition	Items 635.01,.02 and .03 included in the proposal with quantities equal to the quantities of existing pavement markings that require removal.
Existing asphalt or concrete (good-fair condition)	Obliterated (Refer to standard specification-ŝ635)	None required. Do not include surface preparation items.