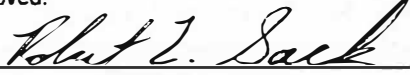


SUPERSEDED BY EB 24-026 EFFECTIVE 6/4/24		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 04-020
Title: DESIGN GUIDANCE FOR PORTLAND CEMENT CONCRETE (PCC) PAVEMENTS AND ARCHITECTURAL PAVEMENTS			
Distribution: ☐ Manufacturers (18) ☐ Surveyors (33) ☒ Local Govt. (31) ☒ Consultants (34) ☒ Agencies (32) ☒ Contractors (39) ☐ _____ ()		Approved:  Robert L. Sack, Deputy Chief Engineer, Research 7-APR-04 Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects scheduled for the letting of September 9, 2004.
- No issuances are superseded by this EI. This design guidance supplements the guidance issued in EI 02-003 Portland Cement Concrete (PCC) Pavements.
- Design guidance issued in this EI will eventually reside in the Comprehensive Pavement Design Manual.

PURPOSE: This EI transmits design guidance for:

- PCC Pavements
 - Friction aggregate requirements.
 - Surface texture.
 - Preformed Joint Sealers
 - Drainage Structure and Manhole Placement
 - Additional Subbase course
- Architectural Pavement
 - Friction aggregate requirements
 - Appropriate item numbers

TECHNICAL INFORMATION:

DESIGN GUIDANCE FOR PCC PAVEMENTS: The following guidance is intended for use in designing PCC pavements. Guidance is provided for selecting appropriate friction aggregate requirements, selecting an appropriate surface texture, and determining the appropriateness of preformed joint sealers.

Friction Aggregate Requirements for PCC Pavements: There are four levels of friction aggregate requirements for PCC pavement, types 1, 2, 3, and 9. Use the following table - *Friction Aggregate Types* to select the appropriate type for each project. The requirements for each type are given in Section 501. Use the Basis of Payment in Section 502 to select the appropriate item numbers.

The cost impact of these new requirements will vary greatly from project to project. The impact for any specific project will depend on the aggregate that would have been used had these requirements not been in place, and the aggregate that will be used based on these requirements. Designers should contact their Regional Materials Engineers to determine if the new requirement is likely to result in a change in aggregate, and estimate the cost impact from that change.

Friction Aggregate Types		
Traffic	Location	Friction Aggregate Type
High Volume ⁽¹⁾	Downstate ⁽³⁾	Type 1
	Upstate ⁽³⁾	Type 2
Low Volume ⁽¹⁾	All	Type 3
Nontraffic ⁽²⁾	All	Type 9

1. "High Volume" refers to 2- or 3-lane highways with design year, two-way AADT over 8,000, or for more than three lanes, with two-way AADT over 13,000. "Low Volume" refers to highways with lower volumes for the specified number of lanes.
2. "Nontraffic" refers to areas such as shoulders, gore areas, and gutters that do not routinely carry traffic.
3. "Downstate" refers to: the City of New York and the surrounding counties of Dutchess, Nassau, Orange, Putnam, Rockland, Suffolk, and Westchester. All other areas are referred to as "upstate."

Texturing PCC Pavements: Section 502 includes three different texture requirements. Include a note in the project plans identifying the required texture method. When possible, select one texture type for each project. Using multiple textures on a project is not recommended. If multiple textures are used on a project, clearly identify the limits of each texture type. If no method is identified, the specification requires the Contractor to apply a longitudinal tined texture.

Longitudinal tining imparts a texture on the pavement surface by dragging a rake with uniform tine spacing along the pavement surface parallel to the centerline. It is the preferred texturing method for design traffic speeds of 65 km/h (40 mph) or higher, but it can be used for pavements with any design speed. Longitudinal tining will reduce tire noise several decibels below that resulting from transverse tining.

Artificial turf drag imparts a texture on the pavement by dragging a section of artificial turf along the pavement surface parallel with the centerline. Artificial turf drag can only be used when design traffic speeds are below 65 km/h (40 mph). It is the preferred texturing method for pavements that will be constructed in short segments, such as intersections, where texturing is likely to be done by hand.

Transverse tining imparts a texture on the pavement surface by dragging a rake with nonuniform tine spacing across the pavement surface perpendicular to the centerline. This treatment can be used for pavements with any design speed. However, transverse tining is the noisiest of all texturing techniques and should be avoided, unless longitudinal tining methods are impractical.

Preformed Joint Sealers. New pay items for sealing transverse and longitudinal joints with preformed joint sealers (a.k.a. neoprene) have been created. Preformed joint sealers are the highest quality sealant for PCC pavements, therefore their use is encouraged in transverse joints. They are also the most expensive. It is acceptable to use preformed sealers in transverse joints and a lower quality sealant, such as silicone, in longitudinal joints.

Preformed sealers were the only sealant used by the Department for several years. Since the approval of silicone as a contractor option for joint sealing, preformed sealer use has greatly declined due to its higher cost. Separate pay items provide options for Regions that desire high-quality sealants in PCC pavements. They were most recently used in Region 6 on the Corning Bypass (Route 17), which was constructed in 1993. To date, they remain in excellent condition.

Preformed sealers can only be used when a pavement is constructed full-width without opening to traffic because the sealer must be stretched to the proper shape and wrapped around the vertical free edges of the pavement. Therefore, they cannot be used when the pavement is constructed one lane at a time with individual lanes opened to traffic before full-width construction is complete. This restriction will limit their use in PCC paving contracts.

The Materials Bureau will provide costs estimates to designers on a project-by-project basis if it is determined they should be used.

Drainage Structure and Manhole Placement. It is highly desirable to place drainage structures and manholes ("utilities") outside the traveled way. If they must be placed in the traveled way, optimal spacing of utilities will enhance pavement performance and reduce costs by:

- Reducing the amount of transverse joints required.
- Reducing the amount of reinforced concrete required to isolate a structure from the pavement.
- Reducing the amount of paving interruptions.
- Simplifying joint layout.
- Simplifying construction.

The portion of a utility that projects up into the pavement is the primary concern when developing a joint layout or paving. It is highly desirable to minimize the size of these projections into the pavement, therefore, use Telescoping Manhole Castings whenever possible (see Standard Sheets M502-19 and M655.14). Attempt to provide a minimum of 200 mm between the bottom of the PCC pavement and the top slab of the utility structure.

Consider the locations of existing utilities when positioning new utilities. Attempt to locate new utilities such that the centers of adjacent utilities (both new and existing) that project into the pavement are spaced at the following distances longitudinally along the pavement:

- 0.0 m. In this case, the utilities are aligned transversely across the pavement.
- L_{min} m. Determined in accordance with §502-3.06A, Transverse Joints.
- $nL_{max} + L_{min}$ m. Where "n" is any whole number.

Adjacent utilities are not necessarily in the same lane. They can be anywhere across a pavement. Also, attempt to locate utilities such that they are between wheelpaths and away from longitudinal joints.

Additional Subbase Course. The revised Section 502 requires the contractor to place the subbase up to 2.0 m wider (1.0 m per side) than the pavement and at the same line, grade, and cross slope as the subbase beneath the pavement. This will increase the likelihood of obtaining a smooth pavement. Designers must consider the area surrounding the pavement to determine what additional quantities are required and the ultimate disposition of the material. Clearly identify these requirements in the contract documents.

Typically, the widened subbase will be included in the finished work, e.g., part of the shoulder or beneath gutter, curb, or sidewalk. In these cases, no additional quantity is necessary. It is suggested to include a note in the contract documents effectively stating that "No additional payment will be made for regrading the widened subbase to its final grade," e.g., to change the subbase cross slope from that of the pavement to that of the shoulder.

If the widened subbase will not be part of the finished work, i.e., it is temporary for paving only, provide extra quantities in the contract documents to pay for its placement. The designer should then choose whether to pay for removal of the temporary subbase separately or to note that removal costs are included in the placement. In either case, the intent must be clearly indicated in the contract documents.

DESIGN GUIDANCE FOR ARCHITECTURAL PAVEMENTS, FRICTION AGGREGATE REQUIREMENTS: All items intended for use as architectural pavement or pavement treatments must have the 601 root.

Precast pavers, paving bricks and stone pavers are not acceptable for use in pavement applications except under low traffic volumes with low truck traffic. Experience in New York State and many surrounding states indicates that these products do not create a durable pavement. If conditions are appropriate and a segmental pavement surface is desirable, use §704-23 Precast Concrete Street Pavers for pavement applications. The Materials Bureau expects to issue special specifications for statewide use of these and other architectural pavement options with further design guidance in the coming months.

When selecting an architectural pavement item, select the appropriate aggregate requirements according to the guidance provided in this EI (for PCC materials) or Chapter 6 of the Comprehensive Pavement Design Manual (for hot mix asphalt (HMA) materials). If the material is neither PCC nor HMA, contact the Materials Bureau for guidance regarding appropriate aggregate requirements for friction. The appropriate friction requirement should be named in the specification title; e.g. Type 1 or F2.

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Specifications for architectural treatments for sidewalks, driveways, or bicycle paths should reference these uses in their titles. Items with the 608 root are not appropriate for use in pavement applications (see EI 03-041).

IMPLEMENTATION: The Design Guidance given above should be used in conjunction with the specifications issued under EI 04-019 Revisions to Standard Specifications 502, 503, 608, 704, & 705 for Portland Cement Concrete (PCC) Pavement, and Architectural Pavement for all contracts containing items with the 502 root, beginning with projects scheduled for the letting of September 9, 2004.

TRANSMITTED MATERIALS: None.

BACKGROUND: To provide adequate wet-weather friction, a concrete wearing surface must have sufficient macrotexture and microtexture. *Macrotexture* is provided by manipulating the concrete surface during or after construction (e.g., artificial turf drag and sawcut grooving). *Microtexture* is the texture on the surface of the exposed aggregate particles.

As concrete pavements are subjected to traffic loads the cement paste abrades away, reducing macrotexture. If wear becomes excessive before the pavement reaches the end of its structural life, macrotexture can be improved through relatively inexpensive treatments such as sawcut grooving.

Traffic also reduces the microtexture of the concrete surface by polishing the exposed aggregate surfaces. The hardness of the aggregate determines its resistance to polishing under traffic. Once compromised, microtexture usually cannot be restored, and the only remedy is to overlay the surface.

Note: Microtexture is improved by diamond grinding. However, if the reduced microtexture prior to grinding is due to soft aggregate (aggregate not meeting the new requirements laid out in EI 04-019), after grinding the pavement will quickly polish again negating the effect of the diamond grinding. Department testing shows that even in low-polish situations such as rolling traffic, microtexture can return to its preground level in less than one year.

Because it is difficult and expensive to restore the microtexture of PCC pavements, it is essential that appropriate aggregate be used during initial construction of the slab. However, harder aggregates are more expensive and of limited supply, so it is not appropriate to simply use the hardest aggregates in every situation.

The required aggregate hardness depends on many factors including traffic volume and site geometry and driver behavior. The Department's research recognizes a difference in polishing rates from traffic in different parts of the State. EI 04-021, Revisions to Standard Specifications for Portland Cement Concrete (PCC) Production and Placement, contains requirements for four types of friction aggregate; Types 1, 2, 3, and 9. Each type is intended for use under specific traffic conditions and site locations. The aggregate requirements are in addition to all surface texture requirements such as tining or turf drag or diamond grinding. Increasing the macrotexture with these treatments does not compensate for using inappropriate aggregate.

The above design guidance for friction aggregate selection and texture selection was developed in cooperation with: New York Construction Materials Association, American Concrete Pavement Association, New York City Concrete Promotional Council, and Federal Highway Administration.

REFERENCES: The above design guidance was developed using the references listed in EI 04-019, Revisions to Standard Specifications 502, 503, 608, 704, & 705 for Portland Cement Concrete (PCC) Pavement and Architectural Pavement, along with unpublished information from FHWA.

CONTACT: For additional information regarding the new requirements for friction aggregate and pavement texture, contact Brad Allen of the Materials Bureau at (518) 457-3240, or ballen@dot.state.ny.us. For additional information related to Section 601 or Section 608, contact Robert Lohse of Landscape Architecture Bureau at (518) 457-3528, or rlohse@dot.state.ny.us. For any other information related to this EI, contact Bill Cuerdon of the Materials Bureau at (518) 457-3240, or wcuerton@dot.state.ny.us.