

9710900 TRAFFIC MARKING MATERIALS
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

Karen Byram
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Comment: (3-26-10)

Wet Weather S971-10.4.3 Durability does not address flattening of the profile. Since there is an option when an audible bump is required, shouldn't this be included? Reference S971-10.4.1.

Response:

Alan Lafferty
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Comments: (4-5-10)

Wet weather retroreflectivity should be a performance requirement and how it is obtained should be based on performance rather than cookie cutter as stated in the second paragraph of Section 702-4.2.

Proposed Specification 7020000 (Wet Weather Pavement Markings) direct focus is wet weather retroreflectivity and therefore section 702-4.3 is irrelevant since it is an audible requirement and the direct focus of Proposed Specification 7010000 (Audible and Vibratory Pavement Markings). Section 7020000 should be a performance specification that focuses strictly on wet weather retroreflectivity.

ASTM E2177 states” 1.2.1 Discussion—This test condition typically exists (1) after a rainfall has ended and the pavement markings are still wet or (2) as the markings are wet from dew or humidity. 1.3 Retroreflective performance obtained with this test in conditions of wetness does not necessarily relate to how markings perform in conditions of rain, that is, as markings are being rained upon.

ASTM E2176 states “1.2 – This method of measuring of the wet reflective properties (R_L) of pavement markings utilizes a method of continuously wetting the marking during measurement with the retroreflectometer.”

Testing of wet weather pavement marking systems should be tested in accordance with the most extreme condition the driver is going to experience under a heavy rainfall rather than a condition similar to being wet from dew or humidity.

Refer to Standard Index 518 sheets 2 of 3 (attached) requiring ground-in rumble strips constructed on all limited access facilities. Requiring an audible bump with a wet weather pavement marking system on a limited access facility is not cost effective and is a duplicated effort. [Section 518 Rumble Strips.pdf](#)

Shouldn't Proposed Specification 971-9.4.2 (Retroreflectivity) have an end of service life as required in Proposed Specification 971-10.4.2? This would ensure retained retroreflectivity with the audible and vibratory marking specification.

1. Section 971-9.4.2 Retroreflectivity

Revise add “The retroreflectance of the white and yellow pavement markings at the end of the three year service life shall not be less than $150 \text{ mcd/lx}\cdot\text{m}^2$.”

Response:

Paul Gentry
414-4118

Comments: (4-8-10)

Spec. 971-10.4.1. states “When the audible bump is required, the set to bear time shall not exceed seven minutes.” This gives reference that the bump “may or may not” be required with the Wet Weather Traffic markings. When you look at 702-4.3 Dimensions of Audible Bump, this gives the impression that the audible bump “is required.” In asking the question of bump or no bump, the reference is 702-1 Description which states “Apply wet weather markings in accordance with the Contract Documents.” which guides the designer. This is confusing, as I have had a couple of manufacturers asking the same question of where does it “specify or not specify” a audible bump requirement. The PPM states in Section 7.2.8.2 that audible and vibratory markings shall be installed on all flush shoulder rural projects “excluding limited access facilities.” and that they should only be used on centerline markings of two-lane roadways where there is a history of centerline cross over crashes.

1. Is this going to be the guidance that will be used for the audible requirement for 702?

This is with the understanding that the 702 material is to be used on a roadway that has a documented problem with wet weather nighttime crashes.

2. If so, is there a better way to explain this in the description, or at least make reference as to where the contract documents being written by the designer gets their guidance for “bump or no bump”?

Response:

Paul Gentry
414-4118

Comments: (4-8-10)

Specification 971-9.2 Composition strikes out the reference to Glass Spheres in the Component column and replaces with Reflective Elements. Under Test Method, it still makes reference to AASHTO T250. The method only references “Glass Beads”, of which a few materials (3M, Visimax, etc.) being used now and on future QPL striping materials do not meet. This test method needs to be removed for Reflective Elements as there is no mention of these in T250, only Glass Beads.

On one hand, according to 971-9.3 Reflective elements, we are leaving it up to the manufacturer to determine the reflective elements to be used in the intermix and this will be listed on the QPL. On the other hand, we are requiring that there will be a minimum of 40% reflective elements in the composition for both white and yellow.

This appears to be a conflicting statement.

Response:

Paul Gentry
414-4118

Comments: (4-8-10)

971-9.4.1 Set to Bear Traffic Time states that the thermoplastic shall set to bear traffic in not more than 10 minutes at ambient air temperatures of 80 degrees F. or less and in not more than 15 minutes for ambient air temperatures exceeding 80 degrees F 701 Audible Vibratory materials.

1. Should this not reflect 2 minutes or less for the baseline thermoplastic the same as Spec. 971-10.4.1 does for 702 Wet Weather Traffic markings?

The audible bump is what is being addressed here for the 10 and 15 minute time limits.

2. What is the reason for having different set to bear times for the 701 (stated above) and 702 (not to exceed seven minutes with no air temperature reference) audible bumps?

The verbage of physical requirements seems to read the same in both 701-4.3 Dimensions of Transverse Audible Bumps and 702-4.3 Dimensions of Audible Bumps.

702-4.3 Dimensions of Audible Bumps: Apply the raised bump with a profile such that the leading and trailing edge are sloped at a sufficient angle to create an audible and vibratory warning.

Bumps on shoulder and centerline markings shall have a minimum height of 0.45 inches, including the base line. The height shall be measured above the pavement surface at the edge of the marking, after application of reflective elements. Bumps shall have a minimum dimension of 2.5 inches. Bumps may have a drainage channel, the width of each drainage channel will not exceed 1/4 inch at the bottom of the channel. The longitudinal distance between bumps shall be approximately 30 inches.

701-4.3 Dimensions of Transverse Audible Bumps: Apply the raised transverse bumps with a profile such that the leading and trailing edge are sloped at a sufficient angle to create an audible and vibratory warning.

Bumps on shoulder and centerline markings shall have a minimum height of 0.45 inches, including the base line. The height shall be measured above the pavement surface at the edge of the marking, after application of drop-on reflective elements. Bumps shall have an minimum length of 2.5 inches. The bumps may have a drainage channel, the width of each drainage channel will not exceed 1/4 inch at the bottom of the channel. The longitudinal distance between bumps shall be approximately 30 inches.

Response:

Paul Gentry
414-4118

Comments: (4-8-10)

Specification 971-10.4.3 Durability states that the thermoplastic material line loss must not exceed 5.0% at the end of the 3 year service life for the Specification 702 material.

1. Why does this not also include the verbage on” flattening of the profile or raised portion of the line” from 971-9.4.3 Durability for the Audible Vibratory materials.
2. How is this being determined in the field and who is the responsible party for enforcing these requirements?

Response:

Jerry Britt
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Comments: (4-12-10)
971-9.1: General

1. “Reflective”: A more appropriate reference would be retroreflective rather than reflective and would recommend that you replace the word “reflective” with “retroreflective” throughout the document.
- 2.“Element”: This is a term that in the industry has come to refer to a specific product made by a specific vendor. A more generic term should be used that does not infer a particular manufacturer’s product. I would recommend that you use the term “optic” and replace the word “element” with the word “optic”.
3. I would recommend a statement of definition under this section that defines “Retroreflective Optic”. Possible wording: A particle used in pavement markings to provide night time visibility of the pavement marking by retro reflecting a portion of the light from a vehicles headlights back to the driver. Retroreflective optics includes traditional glass spheres and multi-component retroreflective particles comprised of a pigmented core (typically white or yellow) covered with very small glass beads having a refractive index of between 1.90 and 2.4).
4. Wording in this section: “The pigment, reflective elements, and filler shall be well dispersed in the resin.” I would recommend the following: “The pigment, retroreflective optics and / or glass spheres, and filler shall be well dispersed in the resin.

971-9.2 Composition

5. Change the reference in the table of “Reflective Elements” to “Retroreflective Optics and / or glass spheres”

971-9.3 Reflective Elements

Change

971-9.3 Reflective Elements: The reflective elements in the intermix shall be determined by the manufacturer and identified for the QPL System.”
to

“971-9.3 Retroreflective Optics and / or Glass Spheres: The retroreflective optics and / or glass spheres in the intermix shall be determined by the manufacturer and identified for the QPL System.”

971-9.4 Physical Requirements

7. Indentation Resistance: There is no maximum hardness specified. If formulated to meet the specified set up time with no maximum hardness that has to be met the material can be excessively hard and brittle resulting in excessive cracking and bond loss when exposed to lower temperatures such as in the winter season. **A maximum hardness should be in the specification. Also recommend a load of 2.2 lbs for the test as a heavier load exceeds the capability of the testing instrument. The sample and the durometer should be conditioned at 115oF rather than 90oF as this is a more realistic condition for an asphalt roadway in the summer and is a more referenced conditioning temperature for this test in the industry.**

8. 971-9.4.1 Set To Bear Traffic Time

“The thermoplastic shall set to bear traffic in not more than 10 minutes at ambient air temperatures of 80°F or less and in not more than 15 minutes for ambient air temperatures exceeding 80°F.”

This particular section as written presents a major problem. The set times spelled out is not reasonable for an application done in the daytime under very high ambient and surface temperatures. This requirement should be dropped from the spec and the contractor should bear the responsibility of insuring that the product is sufficiently set before allowing traffic on the markings. This can be done by applying at night when the air and surface temperatures are as low as possible or by using water to cool the markings immediately after application. There is only so much that can be done from a formulation approach to minimize the set up time required. If you adjust the formulation to meet these requirements at the highest possible road and ambient temperature condition the resulting material will be too brittle in low temperature (winter time) conditions. This can result in excessive cracking and bond loss.

971-10.1: General

9. “Reflective”: A more appropriate reference would be retroreflective rather than reflective and would recommend that you replace the word “reflective” with “retroreflective” throughout the document.
10. “Element”: This is a term that in the industry has come to refer to a specific product made by a specific vendor. A more generic term should be used that does not infer a particular manufacturer’s product. I would recommend that you use the term “optic” and replace the word “element” with the word “optic”.
11. I would recommend a statement of definition under this section that defines “Retroreflective Optic”. Possible wording: A particle used in pavement markings to provide night time visibility of the pavement marking by retro reflecting a portion of the light from a vehicles headlights back to the driver. Retroreflective optics includes traditional glass spheres and multi-component retroreflective particles comprised of a pigmented core (typically white or

yellow) covered with very small glass beads having a refractive index of between 1.90 and 2.4).

12. Wording in this section:

“The pigment, reflective elements, and filler shall be well dispersed in the resin.”

I would recommend the following:

“The pigment, retroreflective optics and / or glass spheres, and filler shall be well dispersed in the resin.

13. 971-10.2 Composition

Change the reference in the table of “Reflective Elements” to “Retroreflective Optics and / or glass spheres”

14. 971-10.3 Reflective Elements

Change

”971-10.3 Reflective Elements: The reflective elements in the intermix shall be determined by the manufacturer and identified for the QPL System.”

to

“971-10.3 Retroreflective Optics and / or Glass Spheres: The retroreflective optics and / or glass spheres in the intermix shall be determined by the manufacturer and identified for the QPL System.”

15. 971-10.4 Physical Requirements

Indentation Resistance: There is no maximum hardness specified. If formulated to meet the specified set up time with no maximum hardness that has to be met the material can be excessively hard and brittle resulting in excessive cracking and bond loss when exposed to lower temperatures such as in the winter season. A maximum hardness should be in the specification. Also recommend a load of 2.2 lbs for the test as a heavier load exceeds the capability of the testing instrument. The sample and the durometer should be conditioned at 115oF rather than 90oF as this is a more realistic condition for an asphalt roadway in the summer and is a more referenced conditioning temperature for this test in the industry.

16. 971-10.4.1 Set To Bear Traffic Time

“When applied at the temperatures and thickness specified by Section 702, the striping material shall set to bear traffic in not more than two minutes. -When the audible bump is required, the set to bear time shall not exceed seven minutes.”

This particular section as written presents a major problem. Section 702 says “Apply traffic stripes and markings only to dry surfaces and when the ambient air and surface temperature is at least 50oF and rising for asphalt surfaces and 60oF and rising for concrete surfaces.” This addresses only minimum temperatures and does not address the possible high end temperature

range that the application could be done under. The set times spelled out is not reasonable for an application done in the daytime under very high ambient and surface temperatures. This requirement should be dropped from the spec and the contractor should bear the responsibility of insuring that the product is sufficiently set before allowing traffic on the markings. This can be done by applying at night when the air and surface temperatures are as low as possible or by using water to cool the markings immediately after application. There is only so much that can be done from a formulation approach to minimize the set up time required. If you adjust the formulation to meet these requirements at the highest possible road and ambient temperature condition the resulting material will be too brittle in low temperature (winter time) conditions. This can result in excessive cracking and bond loss.

971-10.4.2 Retroreflectivity:

17. How were the criteria for minimum wet retroreflectivity performance established? The minimum requirements for Europe are considerably lower (50 – 75 mcd wet). The higher values may eliminate products that perform well at more competitive costs to the department.

18. All applicable Sections: Comments: • “reflective elements”: Change the term “reflective elements” in all relevant sections to “retroreflective optics”

Response:

Matthew Schindler
813-649-1336
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Comments: (4-19-10)

1. Section 971-9.3: “Reflective Elements” are not defined in any other specification for pavement markings or in the 971 specification. Other material specifications say “glass spheres” and give specific qualities of the spheres that are required. Suggest going back to “glass spheres” as used in all the other pavement marking material specifications
2. Section 971-10.3: “Reflective Elements” are not defined in any other specification for pavement markings or in the 971 specification. Other material specifications say “glass spheres” and give specific qualities of the spheres that are required. Suggest going back to “glass spheres” as used in all the other pavement marking material specifications

Response:

Mark Bjorklund
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Comments: (4-20-10)

1. The use of the term “reflective elements” in this industry is commonly linked to one manufacturer in particular, and I recommend that an even broader term be used such as “reflective media” to minimize the confusion that this may create.

Response:

Tom Wood
443-253-9036
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Comments: (4-21-10)

1. Both 971-9.3 and 971-10.3 make no reference to the specification that the "reflective elements" that can be used - only that they must be identified as part of the system. I believe this is in place to allow the use of enhanced performance reflective media, but just want to make sure that it is understood that the opposite may also occur. FLDOT make receive lower quality reflective elements than intended.
2. Relative to a previous comment, the term "Reflective Element" is now open to interpretation. There is no definition to what this actually means so properties such as glass bead milkiness, roundness, etc are no longer meaningful. I am not sure that this is necessarily a bad thing since the emphasis is now more focused on the ability of the product to perform in the field.

Response:

Grier Kirkpatrick
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Comments: (4-22-10)

3M Reflective Elements, along with any other reflective optic/media, should be allowed for all categories in 971. Setting the desired levels of performance is the easiest way to enable industry to supply the best solutions at the best price. One way or another, we all find a way.....

Response:
