

7020000 WET WEATHER PAVEMENT MARKINGS  
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

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Karen Byram  
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Comment: (3-26-10)

Since audible bumps in wet weather markings is an option, shouldn't S702-4.3 start by stating "When audible/vibratory is identified in the contract documents..." or something to that effect? Also in S702-4.3 uniformity of the spacing is important. The last sentence of the last paragraph should be modified to "The longitudinal distance between bumps shall be uniform and be approximately 30 inches."

Response: The plans and pay items will designate if an audible bump is or is not required. Thank you for the comment. No changes made.

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Ray Pletcher  
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Comments: (3-30-10)

There is a minimum height for the bumps, but not a maximum.

Response: Maximum is limited by material cost. No changes made.

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Charlie Doyle  
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Comments: (3-31-10)

Disagree with the use of Elements as it is a proprietary spec/trademark product from 3M. suggest you use "Engineered Particles" or "Engineered Optics".

Response: The Department's definition of elements is generic and intended to include glass spheres and any other reflective media, engineered optics or engineered particles created for retroreflectivity in pavement markings. No changes made.

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Chris Sweitzer  
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Comments: (4-5-10)

Please note that the remedial actions required by 702-4.6 and 702-8 are different. The time requirements of 702-4.6 and the last paragraph of 702-7 also differ.

Response: Section 702-4.6 was added to determine the acceptable loss requirements for audible & vibratory products where the bump is a preformed object that is dropped in the marking rather than an integral part of the same marking material. Section 702-8 would be the remedial process for the baseline for preformed audible & vibratory bumps and for all integral marking products. Section 702-4.6 time requirements again covers a preformed object that is dropped in the marking rather than an integral part of

the same marking material. Section 702-7 would be the time requirements for the baseline for preformed audible & vibratory bumps and for all integral marking products.

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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.

Response: The dimension requirements are specified to ensure proper installation. No changes made.

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.

Response: Lane departure crashes are a much greater problem on our roadways than nighttime, wet weather, lane departure crashes. All of our roadways other than interstate and urban facilities would justify audible & vibratory markings but not necessarily wet weather markings. I am not sure the other manufacturers of wet weather products would want to restrict the use to only interstate and urban roadways. No changes made.

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.

Response: At this time, ASTM E2177 is the best method. The alternative method that will hopefully replace E2176 is still under revision and is not expected to be approved until late this fall at the earliest. We will continue to gather data from existing projects using DEV702 and also monitor the progress of the alternative method. No changes made.

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](#)

Response: The proposed wet weather specification can be used without the audible & vibratory bump, the bump is not a requirement. Our policy already indicates that audible & vibratory markings are not to be used on interstate facilities. There is no restriction on the use of wet weather products on interstate facilities as long as the benefit/cost ratio supports their use.

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.

Response: The audible & vibratory markings have the same service life as the proposed wet weather markings. Section 971-4.2 states "The retroreflectance of the white and yellow pavement markings at the end of the three year service life shall not be less than 150 mcd/lx·m²."

**1. Section 702-4.2 Thickness and Dimensions of Markings**

Revise to read "For thermoplastic markings provide a minimum thickness of 0.035 when measured above the pavement surface at the edge of the baseline."

Response: The thicknesses in the specification have been coordinated with all the manufactures during the developmental process. No changes made.

**2. Section 702-4.3 Dimensions of Audible Bumps**

Delete this Section.

Response: See response to your second comment above. No changes made.

**3. Section 702-4.4 Retroreflectivity**

Replace ASTM E2177 (Bucket Method) with ASTM E2176-01 (Standard Test Method for Measuring the Coefficient of Retroreflected Luminance (R<sub>L</sub>) of Pavement Markings in a Standard Condition of Continuous Wetting.

Response: See response to your third comment above. No changes made.

**4. Section 702-4.6 Loss**

Delete this Section.

Response: See response to you second comment above. No changes made

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Comments: (4-6-10)

The way this specification is written, performed materials such as tapes and preformed thermoplastic will not be allowed. Was this the intent?

Response: Yes.

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Paul Gentry  
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Comments: (4-8-10)

Spec. 702-4.6 Loss makes reference to time frames of "If more than 1% of the bumps are missing or broken (less than 50% remaining) within the first 45 days under traffic, replace all failed bumps at no expense to the Department.

**1. Is this percentage of bumps missing to be based on the total “net or gross” length of traffic striping material that was placed down on the project or by using one mile sections as referenced by FM 5-541(12-08) Part A- Project based Testing of Traffic Marking Materials?**

Response: The percentage is based on the total length of striping material. Language added to cover loss of consecutive bumps.

Those procedures only reference methods for thickness and retroreflectivity measurements at this time, but need to be updated to include this also.

Response: The procedure for project acceptance will be updated to include loss.

**2. In addition to this, who will be tasked with making these determinations of bump loss?**

Response: The contractor is responsible for determining the loss.

**3. Will the contractor be responsible for determining the bump loss?** If so, it would seem that the contractor is “off the hook” once the 45 day period has passed.

Response: Yes. The contractor is responsible for determining the loss. The initial 45 day and possible additional 45 day periods are a measure of installation. If the bumps remain after these periods then it is reasonable to assume they will provide the service expected.

**4. How is the department going to be able to determine exactly when the “more than 1%” of bumps were lost in that time frame, if the only party doing the checking is the same party that placed the materials down?**

Response: The Contractor is responsible for certifying installation.

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Comments: (4-12-10)

1. 702-2.2: Reflective Elements:

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.

Response: The heading in 702-2.2 will be changed to Retroreflective Elements.

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”.

Response: See response to Charlie Doyle above.

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).

Response: See response to Charlie Doyle above.

4. 702-4.2 Thickness and Dimensions of Markings (second paragraph)

“For profiled thermoplastic markings, provide a minimum height of 0.155 inches for the profile when measured above the pavement surface at the edge of the profile. Provide a baseline thickness of 0.035 to 0.050 inches. Provide individual profiles across the full width of the marking at approximately 1.0 inch on center with a space between profiles of 0.090 to 0.310 inches.”

**This should be dropped from the specification.** This is specifying a specific profile application. The state is mandating the performance requirements that the markings must perform to and should not mandate the type of profile that should be used as long as it meets the performance requirements. **I suggest that you replace this with the following:**

“For profiled thermoplastic markings provide a profiled baseline as listed on the QPL as an approved system”.

Response: The dimension requirements are specified to ensure proper installation. No changes made.

5. All applicable Sections:

“reflective elements”: Change the term “reflective elements” in all relevant sections to “retroreflective optics”

Response: See response to Charlie Doyle above.

6. General Comments:

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.

Response: The wet recovery values come from historical requirements in the previous wet weather specifications. Since this is already a wet recovery method we would not reduce the requirements. No changes made.

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Comments: (4-19-10)

1. Section 702-2.1 Thermoplastic: The term “system” leads me to believe the approval is being issued for a specific combination of a thermoplastic material (made by a specific manufacturer) and glass beads (of a specific gradation, manufacturer), etc. Will the QPL listing as shown on the QPL website identify this information?

Response: The QPL number for the system will provide the thermoplastic manufacturer and reflective element used. If glass spheres meeting the requirements of Section 971 are used as the reflective element, the type of glass sphere and rate of application will be listed as the system on the QPL. Any glass sphere manufacturer listed on the QPL may be used. If proprietary reflective elements are used, the type, model, etc. by manufacturer name and rate of application will be listed as part of the system on the QPL.

2. Section 702-2.2 Reflective Elements: “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 (except for 701 which I note is being changed to say this too).

Response: See response to Charlie Doyle above.

3. Section 702-4.3 Dimensions of Audible Bumps: Suggest language to ensure that the bump is made from same material as the base line is made from. I’ve seen some markings recently with bumps made from another material and they appear to have poor adhesion.

Response: The Department is not going to make this a requirement. No change made.

4. Suggest also that the choice between these different styles (flat line and inverted profile) be left to the designer. There’s a difference between the noise, vibration factor, etc., of these two methods and I could see instances where one of the products would be better suited for a particular areas.

Response: The contractor will choose the style, not the designer. Both styles with bumps provide the end result. No changes made.

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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: See response to Charlie Doyle above.

2. 702-4.2: For profiled thermoplastic markings, ~~provide a minimum...~~ profiles of 0.90 to .310 inches. Follow manufacturer’s recommendations and QPL test data for profile size, depth, and frequency.

Response: The dimension requirements are specified to ensure proper installation. No changes made.

3. 702-4.3: Bumps shall maintain the minimum height for ~~have~~ a minimum dimension of 2.5 inches.

Response: There are multiple ways of forming the bumps to provide audibility and this proposed change would be too restrictive. No change made.

4. 702-4.7: Loss – could this be combined into 702-7 Observation Period?

5. 702-7: Observation period “...markings shall show no signs of failure...” Could there be some sort of allowance here? This could be read to somewhat contradict 702-4.7.

Response: Comments 4 and 5: The loss is specific to address the bumps. The observation period is applies to the base line materials. No changes made.

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Ken Zinck (for Jack Davis)  
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Comments: (4-20-10)

1. 702-4.2 Thickness:

- a. Need to direct the Contractor to measure the pavement marking not just to the pavement surface but to the final layer of pavement surface (Friction Course).

Response: These markings are only applied on the finish surface.

- b. What is a profile thermoplastic marking?

Response: Examples are the inverted rib profile markings manufactured by RainLine and Gulfline.

2. 702-4.3 Dimensions of Audible Bumps:

- a. Will there be a tolerance on the height? Why do we not have a maximum? Again what pavement surface? Is it the final layer?

Response: Maximum is limited by material cost. No changes made.

- b. Will there be a tolerance on the dimension of 2.5"? We give a minimum but not maximum.

Response: No. Maximum is limited by material cost and width of line. No changes made.

- c. Why is the wording bumps shall be approximately 30 "? Could you not say bumps shall be 30 " with a 1" tolerance? It would give something to hold them to.

Response: The wording is based on installation methods and a restrictive tolerance does not add additional value.

3. 702-4.4 Retro- reflectivity: If removed and replaced to what depth, should the line be removed to?

Response: It depends on how thick the line is.

4. 702-4.6 Loss

If 1% are damaged or missing then why would we have the statement (less than 50 % remaining) For example: You have 1000 bumps on your roadway. 1% = 10 but 50 % would be 500 so do we have a range from 10 to 500 bumps missing before this applies. The 50% needs to be removed and hold the contractor to the 1% and 2%.

Response: Language has been added to clarify this subarticle.

5. I did see in the 701-4.1 in the 4<sup>th</sup> paragraph, I believe it should read; When applying traffic stripes and markings over existing markings, ensure that not more than 2 inches on either end and not more than 1 inch on either side of the existing line is visible.

This is also the in 702-4.1 only the first than is there but the second than is a that. Change it to read the same as 701-4.1 in the 4<sup>th</sup> paragraph.

Response: Change made.

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Jennifer Marcato  
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Comments: (4-21-10)

There are some points relating to Proposed Specification 702 that I would request clarification on.

1. Section 702-4.3 Dimensions of Audible Bumps:

a. Does the minimum dimension relate to length, width, diameter, or all of the above?

Response: It relates to all.

b. Must the bump be centered on the stripe?

Response: It should be close to the center.

c. Is the longitudinal distance calculated center to center, or between the end of one bump and the beginning of the next?

Response: It is calculated center to center.

2. Section 702-4.6 Loss / Section 702-7 Observation Period and Contractor's Warranty / 702-8 Corrections for Deficiencies.

a. Are bumps only required to stay in place for the initial 45 days (and possible additional 45 days)? Or are they required to stay for the entire 180 day observation period?

Response: They are expected to stay for the entire service life of three years. The initial 45 day and possible additional 45 periods are a measure of installation. If the bumps remain after these periods then it is reasonable to assume they will provide the service expected. The Department recognizes there will be some loss either due to application error or areas where turning movements or heavy equipment displaces the bumps.

b. Are 1%/2% figures referring to the total job, or within some subset of the project?

Response: They are referring to the total job. We have inserted additional language that no more than three bumps in a row shall be missing in the initial application.

c. Do contractors merely have to replace each bump, or remove and reapply 1.0 mile sections?

Response: It depends on how the bumps are installed and whether can be placed individually. If the bumps are integral to the marking then the 1.0 mile lot would apply.

d. Does initial reflectivity have to be maintained for the 180 day observation period?

Response: Yes.

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Tom Wood  
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Comments: (4-21-10)

1. General Statement: It is my understanding that the 702 Markings may be applied with or without bumps. If this is true, I would suggest that FLDOT consider areas that contain Section 701 - Audible and Vibratory Pavement Markings as meeting the requirements for 702 - Wet Weather Pavement Markings. It is highly likely that the profile markings will provide superior guidance to the motoring public than the flat line "wet weather" marking without bumps.

Response: The guidance to designers is to install audible & vibratory marking in accordance with the FDOT policy. Wet weather markings are only to be installed where the history of night time; wet weather, lane departure crashes can be justified by a benefit/cost ratio.

2. 702-4.2 Thickness and Dimensions of Markings: Is there a reason to define the requirements of the profile markings? FLDOT is limiting the ability of vendors to develop innovation ways of providing the desired performance by means other than what is currently on the market. I am not familiar with the status of any patents that are in place, but if there are any on the specified profile design, the holder of the patent has a competitive advantage.

Response: The dimension requirements are specified to ensure proper installation. No changes made.

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Stefanie Maxwell  
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Comments: (4-22-10)

Add the following as a third paragraph to Article 702-4.2: Measure, record and certify on a Department approved form and submit to the Engineer, the thickness of white and yellow pavement markings in accordance with FM 5-541.

Response: Change made.

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Grier Kirkpatrick  
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Comments: (4-22-10)

The initial dry reflectivity levels are not consistent with standard double drop dry requirements. The 702 specification should be treated like the current double drop specification, in that it is a safety enhancement from the previous specification version, thus higher dry values are better for night time visibility and pavement marking longevity.

An initial continuous wetting value - obtained in independent, consistent laboratory setting using a proven test method- should be added to 702, so as to avoid spending time and money on monitoring dry only products. As new ASTM wet weather test methods are adopted, the 702 specification should be modified accordingly. FDOT should rely on standard ASTM test methods for obtaining wet weather reflectivity. The 701 specification is no longer needed and also falls short in the dry reflectivity requirements. 702 should replace it and become the rural road policy along with other flat line applications.

Response: See responses to Alan Lafferty's comments.

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