7010000 AUDIBLE AND VIBRATORY PAVEMENT MARKINGS
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

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Greg Davis
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Comment: (3-26-10)
Specifications look good, but I would like to ask the following:

- Is 701-4.5 needed? It appears to be covered under 701-2.1. If 701-4.5 is needed, then should a similar requirement be included in 702

  Response: Yes. It will be added to 702.

- Should 701 include a similar statement concerning removal of existing pavement (see 702-10(c))?

  Response: Yes. It has been added. (see 701-10(c))

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Clinton Shaw
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Comments: (3-26-10)
1. 701-3(b): Delete the word “sphere” in the first sentence.

(b) capable of applying *reflective elements~~glass spheres~~* to the surface of the completed stripe by automatic ~~sphere~~ dispensers attached to the striping machine such that the *reflective elements*~~glass spheres~~ are dispensed closely behind the installed line.

Response: Agree. Change made.

2. 701-4.1: In the fourth paragraph add the word “than” as follows:

Apply striping to the same tolerances in dimensions and in alignment specified in 710-5. When applying traffic stripes and marking over existing markings, ensure that not more ***than*** 2 inches on either end and not more ~~that~~ ***than*** 1 inch on either side of the existing line is visible.

Response: Change made.

3. 701-4.3 first paragraph, add an “s” to word “edge”:

**701-4.3 Dimensions of ~~Transverse~~ Audible B*umps*~~ar~~s:** Apply the raised ~~transverse~~ b*umps*~~ar~~ with a profile such that the leading and trailing edge**s** are sloped at a sufficient angle to create an audible and vibratory warning.

Response: Change made.

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Karen Byram
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Comments: (3-26-10)

In S702-4.3 uniformity of the spacing is important. The last sentence of the last paragragh should be modified to "The longitudinal distance between bumps shall be uniform and be approximately 30 inches."

Response: Thank you for the comment. No change made.

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John Previte
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Comments: (3-29-10)
701-4.7 could be stated more clearly. The mixture of percentages and terms may confuse.
Suggest:…missing or failed (less than half of bump remaining)

Response: Agreed. Change made.

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Jonathon Addison
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Comments: (10-29-10)
701-3(b) (second line of text): Change '...automatic sphere dispensers...' to '...automatic reflective elements dispensers...'.

Response: The word sphere has been deleted.

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Ray Pletcher
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Comments: (3-30-10)
There is a minimum height for the bump, but not a maximum.

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

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Chris Sweitzer
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Comments: (3-31-10)
Areas requiring remedial action listed in 701-4.7 conflict with those in 701-8 as 701-4.7 only requires failed bumps to be replaced.

Response: 701-4.7 addresses the loss of preformed bumps dropped in the marking rather than bumps formed as an integral part of the same marking material. 701-8 applies to the failure types listed in 701-7 for the baseline material. No changes made.

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Charlie Doyle

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Comments: (3-31-10)
Disagree with the use of ELEMENTS as most contractors interpret that to mean 3M and their wet relective elements. This implies sole sourcing from 3M when other products are available in the marketplace which are as good or better. We would prefer that you use terminology such as "Engineered Optics" or "Engineered Particles".

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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Paul Gentry
414-4118

Comments: (4-8-10)
Spec. 701-4.7 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 meeting the responsibility for 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: The contractor is responsible for determining the loss. The initial 45 day and possible additional 45day 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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Paul Gentry
414-4118

Comments: (4-8-10)
701-4.2 Thickness states to apply base lines having a thickness of .100 to .120 inches, exclusive of the audible bumps, when measured above the pavement surface at the edge of the base line.

**1. Besides reducing the range of acceptable thickness for this material from the existing specification (.079 to .120 inches), how is an acceptable determination of line thickness going to be performed in the field if this material is placed over existing striping?**

It is easy enough to determine line thickness placed on a newly surfaced road, but these materials are now being placed down on projects over varying thicknesses of existing material. This has been particularly difficult to measure on open grade friction course on our Product Evaluation test deck for these materials. One would have to determine the millage of the existing surface marking prior to installation to be able to determine if the correct range of thickness is being applied. By placing down over existing markings, this should necessitate the contractor to be looking at the "more frequent" use of grinding or waterblasting of the existing pavement markings.

Response: This will be addressed in FM 5-541.

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Jerry Britt
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Comments: (4-12-10)
701-2.2: 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 701-2.2 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. 701-3 Equipment:
"reflective elements": Change the term "reflective elements" in this section to "retroreflective optics"

Response: See response to Charlie Doyle above.

5. 701-4.2 Thickness:

> "Apply base lines having a thickness of 0.100to 0.120 inches, exclusive of the audible bumps, when measured above the pavement surface at the edge of the base line."

This is too tight of a thickness range, particularly if the installation is done on existing pavement markings with a conventional extrusion die. For this type of application you can get the affect of the underlying line on the newly installed markings. If you adjust the die to take into account the base line to reach the desired end result of 120 mils maximum then you can end up with a new coat of material that is too thin to properly adhere and to hold the drop on retroreflective optics. **If this is for new construction I would open the base line to 0150 inches maximum**. There has to be some wording if this is intended to go down over old existing markings to address this issue.

Response: The thickness range applies to maintenance and new construction contracts. The range will be increased to a maximum of 0.150 inches.

> "As an alternative to the flat base line, a profiled baseline meeting the following dimensions may be applied. The profiled baseline shall have a minimum height of 0.155 inches, when measured above the pavement surface at the edge of the inverted rib profile. The thickness in the bottom of the profile marking shall be 0.035 to 0.050 inches. The individual profiles shall be located transversely across the full width of the traffic stripe at approximately 1.0 inch on center, with a bottom width between 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:**

> "As an alternative to the flat base line, a profiled baseline may be installed as listed on the QPL as an approved system".

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

6. 701-4.3 Dimensions of Audible Bumps Section 701-4.6 Reflective Elements Section 701-5 Contractor's Responsibility for Notification.
   "reflective elements": Change the term "reflective elements" in these sections to "retroreflective optics".

Response: See response to Charlie Doyle above.

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Matthew Schindler
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Comments: (4-19-10)

1. Section 701-2.1 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 mixture (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, product number, etc. by manufacturer name and rate of application will be listed as part of the system on the QPL.

2. Section 701-2.2 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 702 which I note is being changed to say this too).

Response: See response to Charlie Doyle above.

3. Section 701-4.3: 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. 701-4.3 ….minimum height of 0.45 inches…after the application of drop on reflective ~~elements~~ media. Bumps shall maintain the minimum height for ~~have~~ a minimum dimension of 2.5".

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

3. 701-4.7 Loss - could this be combined into 701-7 Observation Period?
4. 701-7 Observation period "…markings shall show no signs of failure…" Could there be some sort of allowance here? This could be read to somewhat contradict 701-4.7.

Response: Comments 3 and 4: The loss is specific to address preformed bumps. The observation period applies to the base line material and bumps formed as an integral part of the baseline. No changes made.

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

1. 701-4.2 Thickness: 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.

2. 701-4.3 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. 701-4.7 Loss: We are not sure if this section means:

New Spec reads;

***701-4.7 Loss:*** *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. If more than 2% of the bumps fail within the first 45 days under traffic, the replacement period will extend an additional 45 days from the date all replacement bumps were installed. If, at the end of the additional 45 days, more the 2% of all bumps (initial and replacement) fail, replace all failed bumps at no expense to the Department.*

a. 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%.

b. The area in parenthesis appears to be in conflict with first sentence which refers to 1%. Please have this clarified.
   or:
   If the parenthesis section which states (less than 50% remaining) refers to how to determine whether a bump is "broken". It should still be clarified to avoid any confusion maybe it should read (less than 50% remaining of the bump).

Response: Language has been added to clarify this subarticle.

4. I did see in the 701-4.1 in the 4th 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 4th paragraph.

Response: See response #2 to Clinton Shaw.

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Tom Wood
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Comments: (4-21-10)

701-4.2 – Thickness: Just wondering of the measuring procedure has been finalized. I understand and agree with the fact that the 100 mil minimum is better than 80 mils, just want to make sure it can be properly measured in the field. If nothing else, the 80-120 requirement allowed for more margin of error in the measurements.

Response: The 120 has been increased to 150. Thickness over an existing marking will be addressed in FM 5-541.

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Robert Whitney
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Comments: (4-22-10)

Section 701-4.3, Second Paragraph, states: "Bumps shall have minimum dimension of 2.5 inches." My question is, where are they measured at. Should add they will be measured at widest area at the bottom of the bump where the base line meets the bump. Since we are manufacturing these bumps while moving and putting over 2000 per mile they will have some deformity.

Response: The width is measured at the bottom of the bump.

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Stefanie Maxwell
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Comments: (4-22-10)

Add the following as a third paragraph to Article 701-4.2: 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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