

SECTION 701 RAISED RIB SHOULDER WARNING DEVICES

701-1 Description.

Place raised rib shoulder warning devices in accordance with the Contract Documents and remove raised rib shoulder warning devices as required.

701-2 Materials.

701-2.1 Thermoplastic Material: Use only thermoplastic material listed on the Qualified Products List (QPL), meeting the requirements of 971-1 and 971-21. The Engineer will take random samples of the materials in accordance with the Department's Sampling, Testing and Reporting Guide schedule.

701-2.2 Glass Spheres: Use only glass spheres listed on the Qualified Products List (QPL), meeting the requirements of 971-1 and 971-14. The Engineer will take random samples of the glass spheres in accordance with ASTM D 1155 and the Department's Sampling, Testing and Reporting Guide schedule.

701-3 Equipment.

Use equipment capable of providing continuous, uniform heating of the material to temperatures exceeding 390°F [200°C], mixing and agitating the material in the reservoir to prevent accumulation and clogging of dispensing devices and maintain the material in a plastic state until applied. Provide easy access for cleaning and maintenance of all parts of the equipment which contact the material. Use equipment which has a screed extrusion die capable of simultaneously applying line widths up to a 12 inches [305 mm] with two or three ribs extending over 80% of the line width in the configuration shown on the plans. Do not use of pans, aprons or similar appliances which the dispenser overruns. Additionally, use equipment that meets the following requirements:

(a) capable of traveling at a uniform rate of speed, both uphill and downhill, to produce a uniform application of thermoplastic material and capable of following straight lines and making normal curves in true arcs.

(b) capable of applying glass spheres to the surface of the completed stripe by an automatic sphere dispenser attached to the striping machine such that the glass spheres are dispensed closely behind the installed line. Use a glass spheres dispenser equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material and applies the glass spheres in a manner such that the spheres appear uniform on the entire traffic stripes and markings surface with, 50 to 60% embedment.

(c) equipped with a special kettle with an automatic temperature control device, and material thermometer for positive temperature control for uniformly melting and heating and to prevent overheating or scorching of the thermoplastic material.

(d) meets the requirements of the National Fire Protection Association, state, and local authorities.

701-4 Application.

701-4.1 General: Apply raised rib shoulder warning devices to the pavement using screed extrusion equipment. The Engineer will conduct field tests in accordance with FM 5-541. Remove and replace raised rib shoulder warning devices not meeting the requirements of this Section at no additional cost to the Department.

Ensure that existing pavement markings are removed, such that scars or traces of removed markings will not conflict with new stripes and markings by a method approved by the Engineer.

Prior to applying pavement stripes and markings, remove any material that would adversely affect the bond of the pavement stripes and markings by a method approved by the Engineer.

Apply traffic stripes or markings only to dry surfaces, and when the ambient air and surface temperature is at least 55°F [13°C] and rising. Follow the manufacturer's recommendations for application temperature.

Offset longitudinal lines at least 2 inches [50 mm] from construction joints of portland cement concrete pavement.

Prior to installation of the raised rib thermoplastic material, apply a 2-part epoxy primer sealer recommended by the manufacturer, on all portland cement concrete surfaces.

Apply traffic stripes or markings, having well defined edges, over existing pavement markings such that not more than 2 inches [50 mm] on either end and not more than 1 inch [25 mm] on either side is visible.

Apply raised rib shoulder warning devices 6 inches [150 mm] wide with one drainage channel and raised rib shoulder warning devices 8 inches [200 mm] or greater with two drainage channels. The transverse width of each rib segment will not be less than 3 1/4 inches [80 mm]; the width of each drainage channel will not exceed 1/2 inch [13 mm].

Apply all final pavement markings prior to opening the road to traffic.

Apply striping to the same tolerances in dimensions and in alignment specified in 710-5.

701-4.2 Corrections for Deficiencies to Raised Rib Shoulder Warning Devices: Remove and reapply a 1.0 mile [1.0 kilometer] LOT centered around any deficiency, at no additional cost to the Department.

701-4.3 Thickness: Construct raised rib shoulder warning devices that after application of drop-on glass spheres (AASHTO M 247 Type I), will have a thickness of 0.6 to 0.7 inch [15 to 18 mm], including the base line, when measured above pavement surface at the edge of the raised rib shoulder warning devices.

Construct base lines having a thickness of 0.079 to 0.085 inch [2 mm to 2.2 mm], exclusive of the raised ribs, when measured above pavement surface at the edge of the base line.

The Engineer will measure raised rib shoulder warning device thickness using one of the following devices: Micrometer, Vernier Calipers or a Starrett No. 270 Taper Gage.

When using a micrometer or vernier calipers, the Engineer will place black tapes or metal plates of known uniform thickness in the area where the raised rib shoulder warning devices are to be placed; after placement of the raised rib shoulder warning devices, the sample is removed from the pavement and measured for thickness with a proper correction for the film base.

When using a Starrett No. 270 Taper Gage, the Engineer will place a metal straight edge lengthwise across the raised rib shoulder warning devices and sliding a taper thickness gage underneath the metal straight edge until contact is made.

701-4.4 Audible Requirements: Construct raised rib shoulder warning devices meeting the following minimum requirements when tested by the Engineer, in accordance with FM 5-541:

In a car at 50 MPH [80 KPH]	Equal to 80 dB
In a car at 60 MPH [97 KPH]	Equal to 90 dB

701-4.5 Glass Spheres: Apply reflective glass spheres to all raised rib shoulder warning devices, at the rate of 0.10 lb/ft² [0.5 kg/m²] of material with, 50 to 60% embedment.

701-4.6 Retroreflectivity: Construct white and yellow raised rib shoulder warning devices that will attain an initial retroreflectance of not less than 300 cd/ft² [300 mcd/lx·m²] and not less than 250 cd/ft² [250 mcd/lx·m²], respectively. Ensure that the intermittent and final retroreflectance of white and yellow pavement markings are not less than 150 cd/ft² [150 mcd/lx·m²].

701-4.7 Color: Use white thermoplastic material that is pure white, free from any tint and showing no deviations from magnesium oxide color standard greater than the following:

Scale Definition	Magnesium Oxide Standard	Sample
RD	100	75% minimum
Reflectance		
a. Red-Green	0	-5 to +5
b. Yellow-Blue	0	-10 to +10

Use yellow thermoplastic material which visually matches Federal Test Standard Number 595-color 33538, and meet the following criteria for chromaticity coordinates (x,y):

x	0.455	0.510	0.472	0.530
y	0.444	0.485	0.400	0.456

701-4.8 Durability: Durability will be measured as the percent of thermoplastic material completely removed from the pavement. The thermoplastic material line loss shall not exceed 5.0%.

701-5 Contractor’s Responsibility for Notification.

Notify the Engineer prior to the placement of raised rib shoulder warning devices. Furnish the Engineer with the manufacturer’s name and LOT numbers of the thermoplastic materials and glass spheres to be used. Ensure that the approved LOT numbers appear on the thermoplastic materials and glass spheres packages. Submit a certified test report to the Engineer indicating that the materials meet all requirements specified.

701-6 Protection of Newly Applied Raised Rib Shoulder Warning Devices.

Do not allow traffic onto newly applied pavement markings until they are sufficiently dry to permit vehicles to cross them without damage. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause, at no additional cost to the Department.

701-7 Method of Measurement.

The quantities to be paid for under this Section will be the length, in net miles [kilometers], of raised rib shoulder warning devices, authorized and acceptably applied.

701-8 Basis of Payment.

Prices and payments will be full compensation for all work specified in this Section, including, all cleaning and preparing of surfaces, furnishing of all materials, application, curing and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work. Final payment will be withheld until all deficiencies are corrected. Removal of raised rib shoulder warning devices shall be paid for under Pay Item 711-7 [Pay Item 2711-7].

Payment will be made under:

Item No. 701-1-	Solid Raised Rib Shoulder Warning Device - 6 inch.
Item No. 2701-1-	Solid Raised Rib Shoulder Warning Device - 150 mm.
Item No. 701-2-	Solid Raised Rib Shoulder Warning Device - 8 inch.
Item No. 2701-2-	Solid Raised Rib Shoulder Warning Device - 200 mm.
Item No. 701-3-	Solid Raised Rib Shoulder Warning Device - 10 inch.
Item No. 2701-3-	Solid Raised Rib Shoulder Warning Device - 250 mm.
Item No. 701-4-	Solid Raised Rib Shoulder Warning Device - 12 inch.
Item No. 2701-4-	Solid Raised Rib Shoulder Warning Device - 300 mm.