TECH SOLUTIONS 600.0
STYROFOAM™ BRAND HIGHLOAD INSULATION FOR HIGHWAY EMBANKMENTS

INTRODUCTION

Highways are at risk of damage in regions where underlying soils are susceptible to seasonal frost heave and breakup. Embankment insulation is an ideal means to protect highway construction from the ravages of frost effects. STYROFOAM™ Brand HIGHLOAD 40, 60 and 100 Extruded Polystyrene Insulation products under highway embankments can safeguard against frost heave and thaw weakening.

STYROFOAM™ BRAND HIGHLOAD INSULATION

STYROFOAM™ Brand HIGHLOAD Insulation products are extruded polystyrene foam insulation boards with high vertical compressive strengths of 40 psi, 60 psi or 100 psi (275 kPa, 415 kPa or 690 kPa) developed specifically for in-ground civil engineering applications and freezer floor slabs. STYROFOAM™ Brand HIGHLOAD Insulation features:

- exceptional moisture resistance
- high R-value* retention
- strong compressive creep and fatigue resistance
- long-term compressive strength

Like all STYROFOAM™ Brand Extruded Polystyrene Insulation products, STYROFOAM™ Brand HIGHLOAD Insulation is durable, versatile and reusable – making it a preferred choice for a variety of high-load applications. Designed for use in low-temperature applications where moderately heavy loads are expected, STYROFOAM™ Brand HIGHLOAD Insulation is recommended for insulating highway embankments.

VAL GAGNE, ONTARIO, RESEARCH RESULTS

Background

A major Canadian study to examine the use of STYROFOAM™ Brand Insulation to protect highway pavements took place from 1972 through 1977 in Val Gagne, Ontario.

The experiment measured the performance of STYROFOAM™ Brand HIGHLOAD 40 Insulation** at five thicknesses: 1", 1-1/2", 2", 2-1/2" and 3" (25 mm, 40 mm, 50 mm, 65 mm and 75 mm). All were covered with 18" (460 mm) of asphaltic concrete. Subgrade soils were mainly fat and gumbo clays, with water content from 22 percent to 67 percent. The water table was 4' (1.2 m) below the pavement surface. The entire site was instrumented to monitor ambient air and ground temperatures, pavement elevations and frost penetrations.

FINDINGS

The Val Gagne Insulated Highway Embankment Study found that:

- The design chart, as published in the Highway Insulation Brochure and reproduced in Figure 1, may be used to: 1) select insulation thickness to completely prevent frost penetration beneath the insulation to eliminate frost heave, or 2) reduce frost penetration beneath the insulation to control frost heave.
- A gravel-base cover of 18" (460 mm) protects the insulation from the effects of construction equipment and traffic.
- The insulation slows the escape of ground heat into the air during the winter and the replenishment of ground heat storage during the summer.

See Figures 2-10 for specific insulated frost heave treatments.

*R means resistance to heat flow. The higher the R-value or RSI, the greater the insulating power. RSI (R-value Système Internationale) is the metric equivalent of R-value.

**STYROFOAM™ Brand HIGHLOAD 40 Insulation was called STYROFOAM™ Brand HI-35 at the time of this test.

STYROFOAM™ Brand HIGHLOAD Insulation for Highway Embankments

General Information

The Ontario Ministry of Transportation has standardized insulation thicknesses. The maximum thickness of STYROFOAM™ Brand Insulation for southern Ontario (as of January 2004) is limited to 1" (25 mm), and for northern Ontario, 1-1/2" (40 mm). Although these thicknesses may not completely correct a frost bump problem, they will likely provide a tolerable ride and reduce the risk of differential icing.

Contact the Ontario Ministry of Transportation for specific requirements relating to your project.

Figure 1: Average Penetration of Frost Beneath STYROFOAM™ Brand Extruded Polystyrene Insulation in Paved Highways

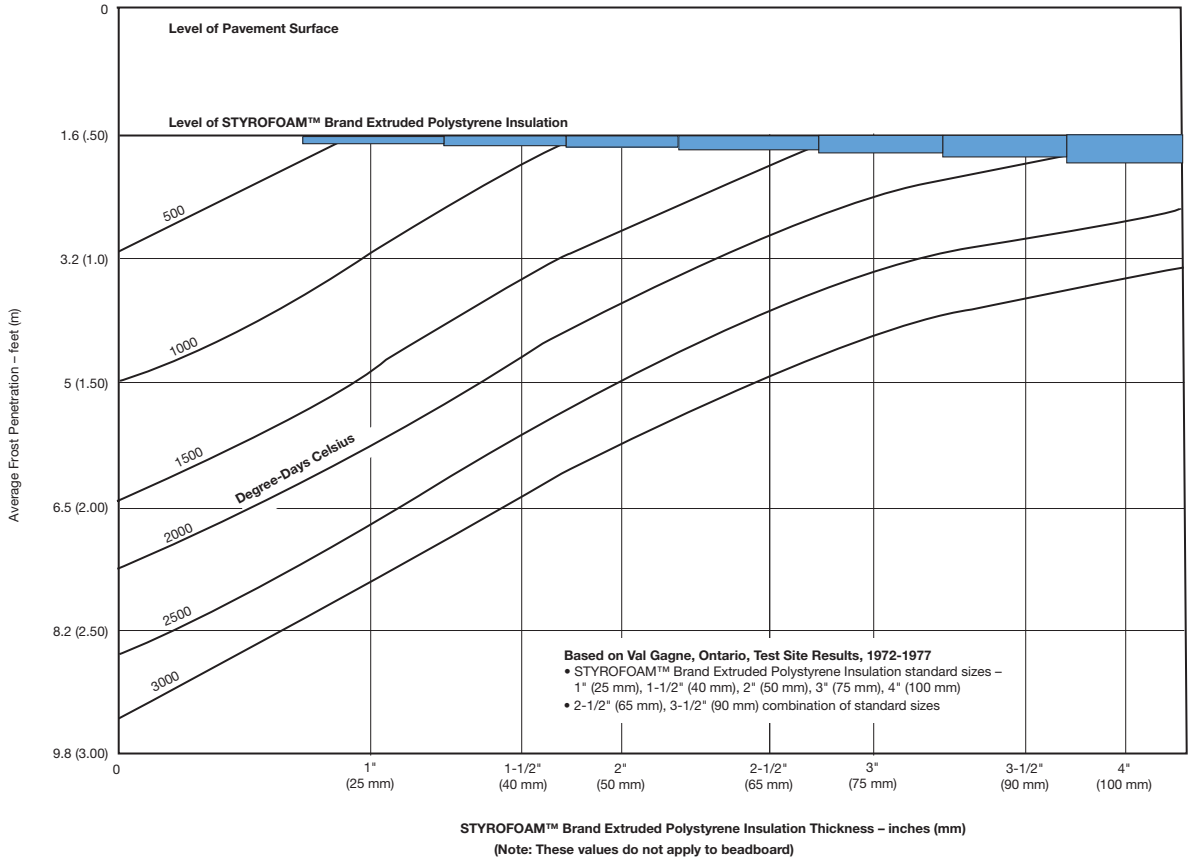
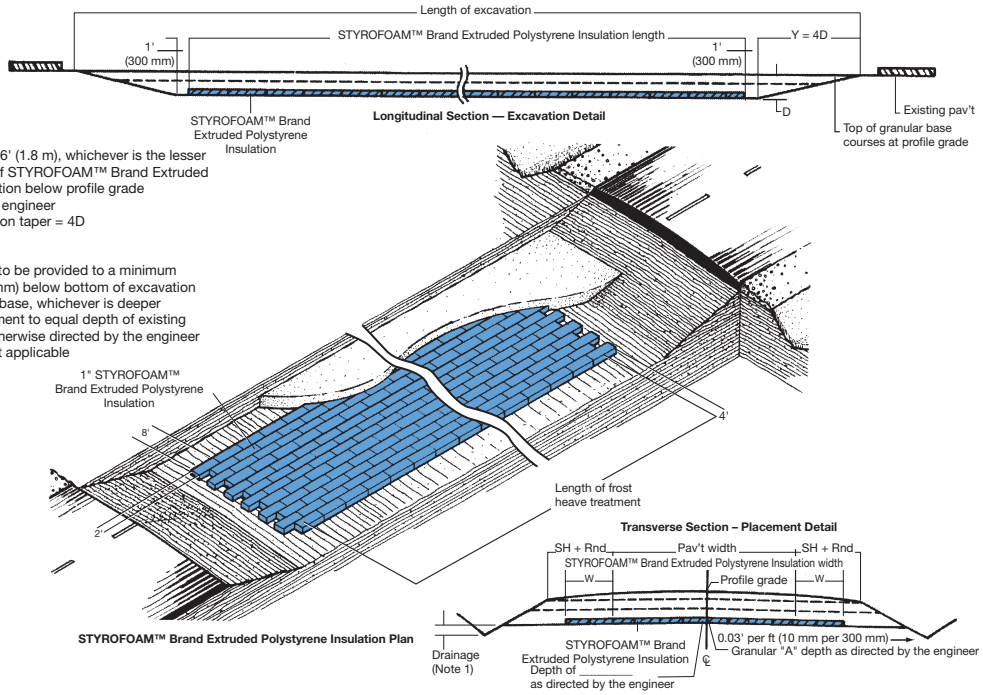


Figure 2: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment – 1" (25 mm) Thickness



Legend:
W = Shoulder width or 6' (1.8 m), whichever is the lesser
D = Depth to bottom of STYROFOAM™ Brand Extruded Polystyrene Insulation below profile grade as directed by the engineer
Y = Length of excavation taper = 4D

Notes:
1. Adequate drainage to be provided to a minimum depth of 1'6" (457 mm) below bottom of excavation or existing granular base, whichever is deeper
2. Depth of new pavement to equal depth of existing pavement unless otherwise directed by the engineer
3. Transition length not applicable

Figure 3: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment – 1-1/2" (40 mm) Thickness

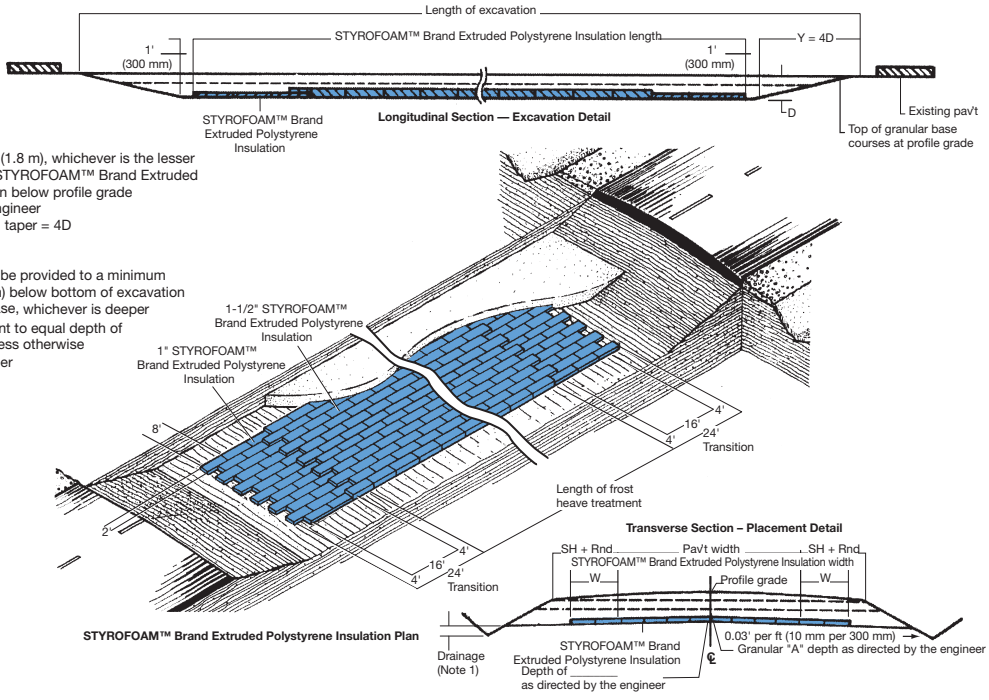


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Figure 4: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment – 2" (50 mm) Thickness

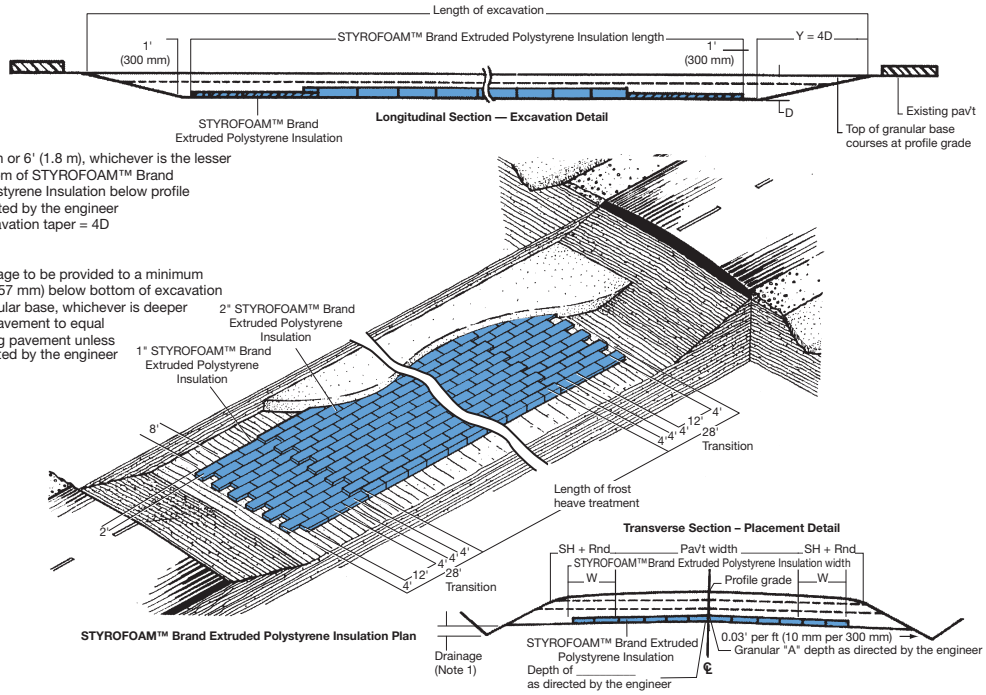


Figure 5: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment – 2-1/2" (65 mm) Thickness

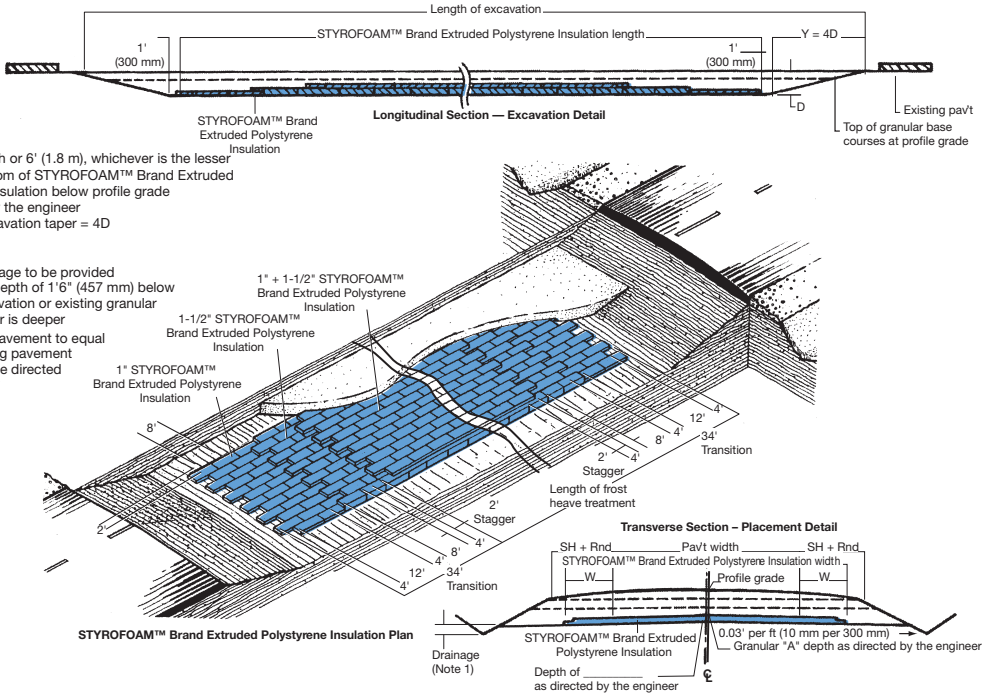


Figure 6: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment – 3" (75 mm) Thickness

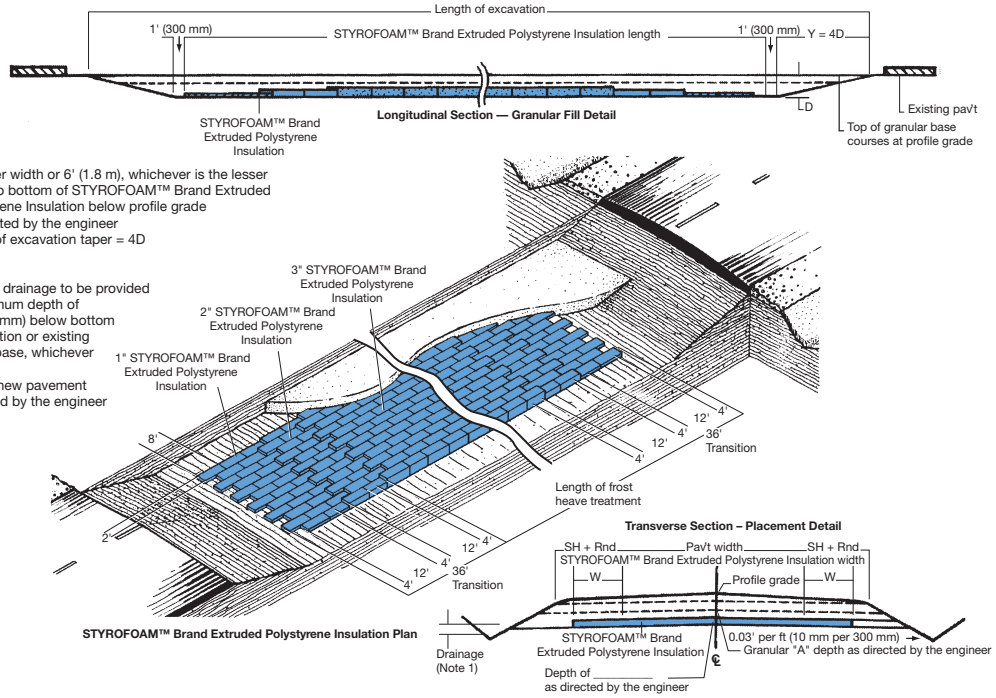


Figure 7: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment on Top of Existing Pavement – 1" (25 mm) Thickness

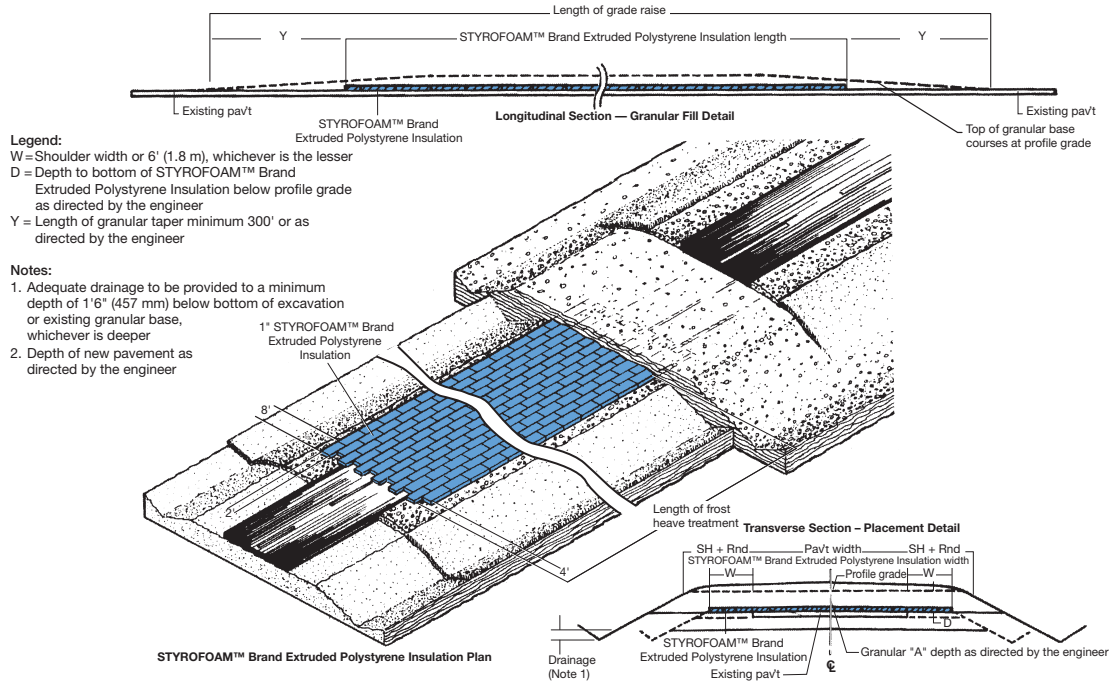
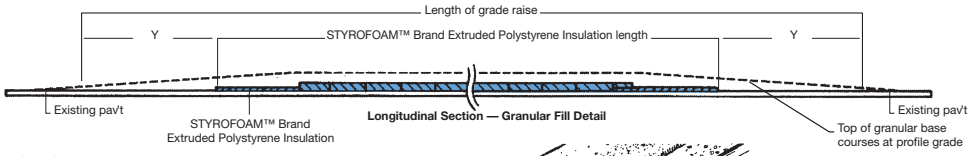
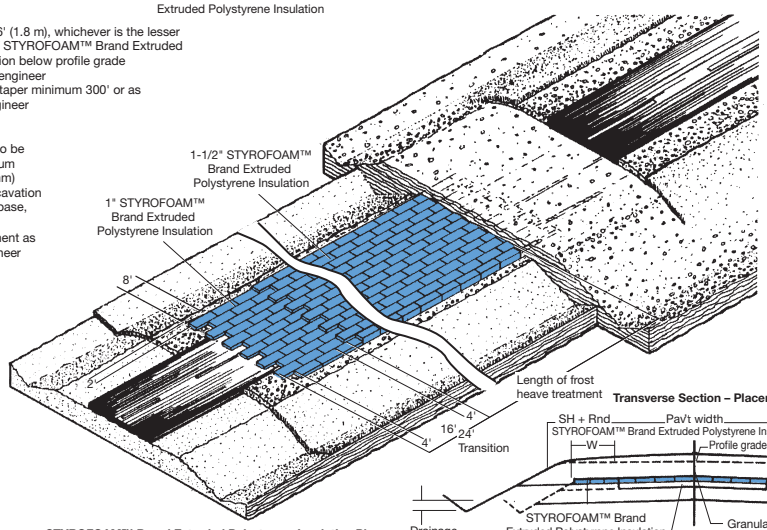


Figure 8: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment on Top of Existing Pavement – 1-1/2" (40 mm) Thickness



Legend:
W = Shoulder width or 6' (1.8 m), whichever is the lesser
D = Depth to bottom of STYROFOAM™ Brand Extruded Polystyrene Insulation below profile grade as directed by the engineer
Y = Length of granular taper minimum 300' or as directed by the engineer

Notes:
1. Adequate drainage to be provided to a minimum depth of 1'6" (457 mm) below bottom of excavation or existing granular base, whichever is deeper
2. Depth of new pavement as directed by the engineer



STYROFOAM™ Brand Extruded Polystyrene Insulation Plan

Transverse Section – Placement Detail

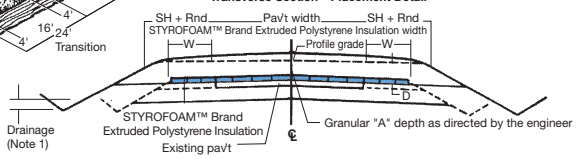
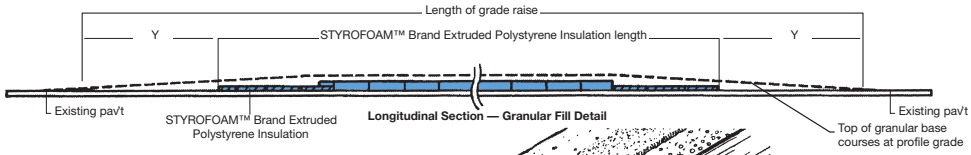


Figure 9: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment on Top of Existing Pavement – 2" (50 mm) Thickness



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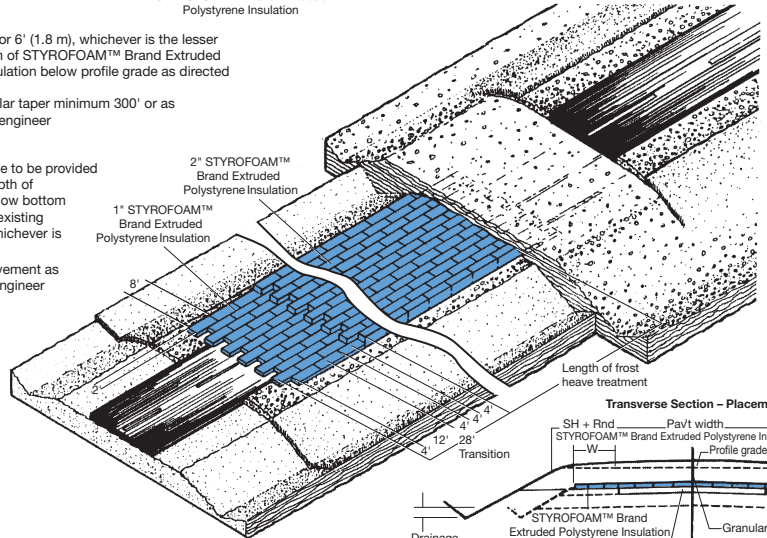

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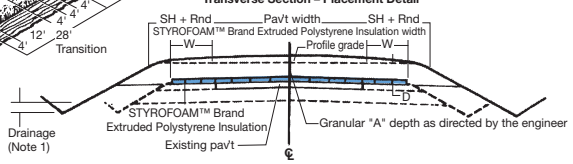
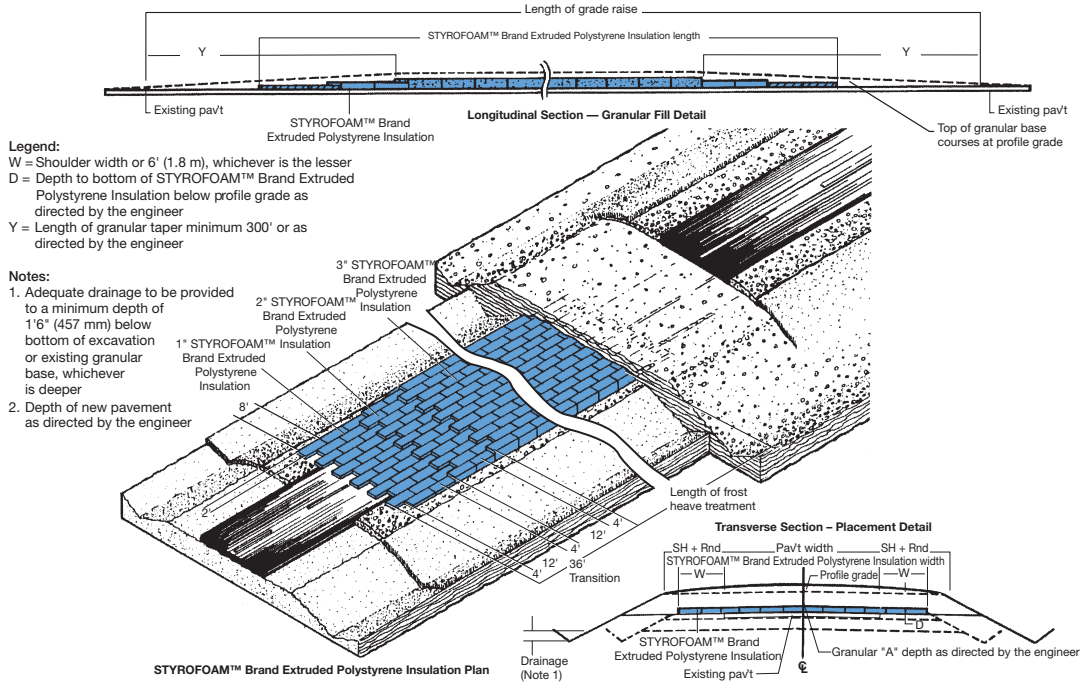


Figure 10: STYROFOAM™ Brand Extruded Polystyrene Insulation Frost Heave Treatment on Top of Existing Pavement – 3" (75 mm) Thickness



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