TECH SOLUTIONS 611.0
STYROFOAM™ Brand HIGHLOAD Insulation for Insulated Railroad Embankments

Introduction

Railroad facilities such as track, at-grade crossings, switching yards, etc. are at risk of frost damage where the underlying soils are susceptible to frost heave and spring breakup. Engineers have found that STYROFOAM™ Brand HIGHLOAD Extruded Polystyrene Insulation, when placed beneath these railroad facilities, reduces the potential for damaging effects of frost heave or spring thaw weakening.

STYROFOAM™ Brand HIGHLOAD Insulation

STYROFOAM™ Brand HIGHLOAD 40, 60 and 100 Insulation products are extruded polystyrene foam insulation having high vertical compressive strengths developed specifically for in-ground civil engineering applications. Features of STYROFOAM™ Brand HIGHLOAD Insulation include:

- exceptional moisture resistance
- high R-value* retention
- high vertical compressive strengths: 40 psi, 60 psi and 100 psi (275 kPa, 415 kPa and 690 kPa)
- long-term compressive creep and fatigue resistance

Like all STYROFOAM™ Brand Extruded Polystyrene Insulation products, STYROFOAM™ Brand HIGHLOAD Insulation is durable, versatile and reusable – making it a preferred choice in a variety of high-load applications. STYROFOAM™ Brand HIGHLOAD Insulation is recommended for insulating railroad embankments to help protect the rail track from frost heave or thaw weakening damage.

A major Canadian study on the use of STYROFOAM™ Brand Extruded Polystyrene Insulation to help protect against frost damage to railroad embankments took place in Toronto, Ontario, in 1980.

Toronto Transit Commission (TTC) Insulated Railroad Embankment Test [1, 2]

General Information

In February 1980, the TTC used STYROFOAM™ Brand HIGHLOAD 60 Insulation to insulate two rail embankment test sites at the Kipling Station on the Bloor-Danforth Subway Line. The eastbound and westbound tracks were insulated with 10' x 100' (3 m x 30 m) sections using 1-1/2" (40 mm) thick STYROFOAM™ Brand HIGHLOAD 60 Insulation. Each test site had transition zones of 1" (25 mm) thick STYROFOAM™ Brand HIGHLOAD 60 Insulation at each end to ensure a gradual change from the fully insulated to the uninsulated soil areas along the track.

On the eastbound track, 1" (25 mm) thick STYROFOAM™ Brand HI-35 (now known as STYROFOAM™ Brand HIGHLOAD 40 Insulation) was placed diagonally at a 45-degree angle on each side of the 10' (3 m) wide pad of STYROFOAM™ Brand HIGHLOAD 60 Insulation.

Instrumentation was installed on the westbound track only, enabling temperature and load monitoring. The collected data would allow the TTC to refine its design criteria for the proposed Scarborough Light Rail Transit Line.

The instrumentation was located at approximately the center of the 100' (30 m) long insulated section with the thermocouple and pressure gauge leads terminating at a post to the north side of the track. Four thermocouples were located just above and just below the center line and edge of the insulation. Two semiconductor stress gauges, placed just above the insulation at the center of the tie and under one rail, would provide information on the loads experienced on the insulation due to passing trains.

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

STYROFOAM™ Brand HIGHLOAD Insulation for Insulated Railroad Embankments

Findings

- 1-1/2" (40 mm) thick STYROFOAM™ Brand HIGHLOAD 60 Insulation reduced subgrade temperature variation 26 percent to 36 percent during a winter that was 68 percent colder than normal (the normal air freezing index for the site is 896 degree-days °F, or 498 degree-days °C; during the 1980-81 winter, the air freezing index was recorded as 1,505 degree-days °F, or 836 degree-days °C).
- The maximum dead loads recorded on the insulation were 4.1 psi (28 kPa) at the center of the insulation and 8.4 psi (58 kPa) at the edge of the insulation. Both values were well within recommended design limits for creep for STYROFOAM™ Brand HIGHLOAD 60 Insulation.
- Maximum live loads due to RT-12 locomotives running at speeds between 17-20 mph (27-32 kph) overhead were recorded as 2.2 psi and 5.2 psi (15 kPa and 36 kPa) at the center and edges, respectively, on the insulation. Both values were within recommended design limits for long-term fatigue deformations in STYROFOAM™ Brand HIGHLOAD 60 Insulation.
- Vibration was reduced 16' (4.8 m) away from the insulated track center line, as compared with the uninsulated track.

References

1. Hurst, D.R., Carrington, M.C., *Bloor-Danforth Subway Kipling Station – Ballast Mat Temperature and Stress Measurements,* Research Memo #703, Toronto Transit Commission Engineering Department, Environmental Assessment & Section, September 1981.

2. Nash, P.T., *LRT Trackbed Test Program – Bloor-Danforth Subway Wood Ties & Ballast Section – STYROFOAM™ Ballast Mat Test,* Research Memo #505/FF, Toronto Transit Commission Engineering Department, Research Section, January 1981.

For Technical Information: 1-866-583-BLUE (2583) (English) 1-800-363-6210 (French)
For Sales Information: 1-800-232-2436 (English) 1-800-565-1255 (French)
DOW CHEMICAL CANADA ULC . Dow Building Solutions . 450 – 1st St. SW . Suite 2100 . Calgary, AB T2P 5H1
www.dowbuildingsolutions.com

Republished November 2008

Form No. 178-00766-1108P&M