

Below Grade Testing Confirms R-Value Retention



The Expanded Polystyrene Association of Canada (EPAC) conducted a joint research project with the National Research Council of Canada/ Institute for Research in Construction (NRC/ IRC) to evaluate the durability performance of expanded polystyrene (EPS) insulation in an exterior below-grade application.¹ EPS insulation, thermal performance, site weather conditions and soil moisture content were instrumented and monitored throughout the project.

The in-situ thermal performance of the EPS insulation was monitored over a 30-month exposure period using thermocouples attached to EPS insulation and the concrete wall. The monitoring of thermal performance detected the presence of water at the outer surface of the EPS foam during periods of heavy rain and major thaws; however, the surface of the concrete basement wall showed no evidence of water penetration through most of the height of the wall.

In addition, material properties for EPS insulation removed after the 30-month exposure were determined. Testing confirmed that all types of EPS insulation retained their specified thermal and mechanical properties even after being subjected to in-situ freeze-thaw cycling. The moisture content of EPS insulation samples removed after the 30-month exposure was in the range of 0.01 to 0.96% by volume.

Key issues highlighted from the 30-month field exposure period of the research project include:

- The moisture content of EPS insulation directly exposed to high moisture content soil conditions was found to be less than 0.5% by volume on average at the end of the exposure.
- In-situ thermal performance of the EPS insulation monitored during the exposure period remained constant, i.e., there was no loss in thermal resistance.
- Laboratory test results from samples removed after the exposure confirmed thermal performance and durability, i.e., there was no change in material properties.

A second part of the research project included development of a durability test protocol that subjected test material to extreme thermal gradient and environmental cycling, including freeze-thaw cycling.² Testing performed by NRC on samples of the same material that was subjected to the 30-month field exposure confirmed that all types of EPS insulation retained their specified material properties even after being subjected to the durability test protocol. The NRC test protocol was subsequently developed into an ASTM standard test method to provide a means of assessing durability performance of all types of insulation.³

Sources

¹ Normandin, N., Maref, W., Bomberg, M.T. and Swinton, M.C., 'In-Situ Performance Evaluation of Exterior Insulation Basement Systems (EBIS) - EPS Specimens', National Research Council of Canada Report No. 3132.1, March 1999.

² Normandin, N., Bomberg, M.T., and Swinton, M.C., 'Development of a Draft Test Protocol for Evaluating Durability Under Environmental Cycling of Insulation Products for Exterior Basement Applications', NRC Report No. 3132.2, December 1999

³ ASTM C1512-07, Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products, published by ASTM International.

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