Plasti·Fab
EPS PRODUCT SOLUTIONS

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In Situ Thermal Performance of PlastiSpan Insulation Below-Grade

In 1995, the Expanded Polystyrene Association of Canada (EPAC) established a joint research project with the Institute for Research in Construction to assess the in-situ thermal performance of a number of expanded polystyrene (EPS) insulation used as exterior basement insulation in contact with the ground.

In October 1995, ten (10) EPS insulation specimens meeting CAN/ULC-S701-97, Type 1 and 2 were installed on the exterior basement wall of Test Hut #1 on the NRC Montreal Road Campus in Ottawa. These specimens were instrumented prior to backfilling and their thermal performance was monitored over two full years. Soil temperatures and moisture content were monitored concurrently. Weather events were recorded on a daily basis.

Analysis of the surface temperatures of the specimens detected the presence of water at their outer surface through various periods of heavy rain and major thaws. Over the same period, there was no evidence of significant water penetration through the EPS insulation layer to the surface of the concrete basement wall on the inside of the insulation.

The thermal performance of the EPS insulation specimens was found to remain stable over two years of monitoring. Temperature profiles at the specimen/soil interface, and corresponding observations of heavy rainfall or thaw periods, indicated that specimens 'handled' moving water at the specimen surface confirming performance as a capillary-breaking layer. As well, water movement at the exterior face did not significantly affect the thermal performance of the EPS insulation.

There is also independent evidence - no temperature deflections on the inside face, and clean interior surfaces observed on removal of the insulation - that the EPS insulation protected the concrete structure during these events. Since there was no evidence of water movement behind the EPS insulation board, the performance of insulating board with grooves in the surface against the basement wall and shiplap joints was indistinguishable from boards without grooves and butt joints.

Insulation specimens were retrieved after 30 months of exposure in the soil and laboratory testing performed on samples to determine thermal resistance, moisture content and mechanical properties for comparison to initial properties.

The following performance parameters had no effect on the observed performance of EPS insulation specimens used on the exterior of basement walls for this project:

- duration of exposure
- mean temperature of the specimen
- water movement at the outer surface
- density of product
- freezing cycles

Summary:
The following observations were made for the EPS insulation materials after being subjected to a 30-month field exposure:

LOW WATER ABSORPTION – After the two-year field exposure to high moisture content soil conditions, the moisture content of all EPS insulation board types was found to be less than 0.5% by volume.

NO LOSS OF R-VALUE – In-situ thermal performance of the EPS insulation monitored over the two-year period was found to remain constant. Laboratory tests conducted on samples retrieved after 30 months of exposure in the high moisture content soil confirmed no change in thermal performance when compared to pre-exposure properties.

NO CHANGE IN PERFORMANCE PROPERTIES – Control samples were tested at the start of the project, as well as, samples of the same material exposed to laboratory conditions for the two-year term of the project. Test results for samples retrieved after 30 months of exposure in the high moisture content soil exhibited no measurable change in performance when compared to either the control or laboratory-exposed samples.

NO ADVERSE EFFECTS FROM FREEZE-THAW CYCLING – The research project included development of a test protocol to provide a means of assessing performance of all types of insulation subjected to extreme thermal gradient and environmental cycling. NRC subjected EPS insulation to freeze-thaw cycling simulating exposure to extreme field conditions over an extended period and observed no effect on the thermal and mechanical performance of the EPS insulation tested.

In summary, the results of the EPAC/NRC research project confirm that ***PlastiSpan*** Type 1 insulation is the most cost effective insulation material for all types of below-grade applications including the exterior of foundations, shallow foundations and floor slabs in both residential and commercial construction.