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COLD REGIONS STUDY CONFIRMS HIGHER R-VALUES FOR EXTRUDED POLYSTRYRENE COMPARED TO EXPANDED POLYSTYRENE IN BELOW-GRADE APPLICATIONS, SAYS XPSA

Alaska University Transportation Center Analyzes Decades-Old Insulation Samples Extracted from Roads and Airfields in Cold Climates

Washington, D.C. – According to the Extruded Polystyrene Association (XPSA), a report by Billy Connor for the Alaska University Transportation Center, University of Alaska Fairbanks (the Connor report) [1] demonstrates the relative stability of high R-value per inch XPS samples compared to the relative instability of the lower R-value per inch EPS samples.

Connor extracted 15 samples of polystyrene insulation from three different below grade locations in cold climate regions of Alaska; and he merged these 15 data points with 25 data points from two earlier similar studies [2].

PERMAFROST WARMING: BELEAGUERED INFRASTRUCTURE

Cold regions within Alaska and Canada as well as high-elevation mountain regions have thousands of miles of roadways and airfields that are susceptible to frost heave and permafrost thaw. Connor's in-field study on the performance of below grade insulation adds to our knowledge base of real world performance of insulations for such applications.

The deterioration of Alaskan highways was vividly described in a *Bloomberg* article by Greg Quinn titled "Climate Change Is Hell on Alaska's Formerly Frozen Highways: A critical artery is threatened by thawing permafrost" [3]. According to Quinn, "One solution is to keep heat away by building thicker embankments with larger gravel and rocks that help circulate cooler air, or by adding layers of insulation such as foam. More expensive options include installing pipes to vent out warmth."

The vulnerability of such infrastructure to climate change also was the subject of a decades-long research project on the extent of the problem globally as documented by B.K. Biskaborn and 46 co-authors in a report titled "Permafrost is warming on a global scale" [4].

FOAM INSULATION PERFORMANCE

The growing body of research on the effects of permafrost thaw on infrastructure places the recent in field study by Connor in perspective. The Final Project Report of the Connor study leads to the following conclusions:

- To deliver the same in-service R-value in cold regions to protect the permafrost in below grade applications, EPS needs to be 1.5 to 2 times thicker than XPS.
- Moisture absorption with EPS has a much greater negative impact on in-service R-value than moisture absorption and aging with XPS.

The test results indicate a rapid drop in R-value per inch for EPS in the first five years in service (with in-service R-values ranging from 3.13 to 3.70 per inch). By comparison, the R-values per inch for XPS only gradually dropped after five years in service on previously measured XPS samples (with R-values per inch ranging from 4.51 to 5.15). Furthermore, the Connor study showed the R-values per inch for XPS decreased gradually, levelling out to an average value of about 4.1 after 31 years in service. By comparison, R-values per inch for EPS decreased rapidly, levelling out to an average value of about 2.2 after 21 years in service.

THE LAST WORD ON RESILIENCE

According to John Woestman, Director of Codes and Standards for XPSA, "Through scientific study and empirical evidence, the resilience of XPS has been reaffirmed in below-grade applications in cold regions."

Woestman further explains, "A field study in one region of the country may not accurately predict the same performance in all regions of the country, considering the different climates and soil conditions. The Connor study combined data from three studies, which included multiple climates with severe freeze/thaw cycling. The studies provide critical long-term data, whereas the small-scale testing methods used to classify polystyrene foam insulation are not indicative of long-term performance."

"As the most recent of three such studies, the Connor study confirms the higher thermal resistance of XPS compared to EPS, which is attributed to the lower moisture absorption of XPS compared to EPS," says Woestman, "Taking into consideration many factors, the Connor study suggests using an EPS-to-XPS thickness ratio of 1.5 to 2.0."

REFERENCES

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ABOUT XPSA

XPSA represents all major extruded polystyrene (XPS) foam insulation manufacturers in North America. The association and its members are committed to the safety and integrity of XPS products. They invite interested parties seeking additional information to visit XPSA online at www.xpsa.com or to email office@xpsa.com

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