Tech Brief

Geopolymer for Protective Coating of Transportation Infrastructures

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HERE'S THE PROBLEM

Surface deterioration of exposed transportation structures is a major challenge. In most cases, such surface deterioration could lead to structural problems due to the loss of cover and ensuing reinforcement corrosion.

AND, HERE'S THE SOLUTION

To develop a coating to minimize deterioration that will have long-term performance. Such a coating will be durable, bond well to the surface, and be compatible with parent surfaces in terms of expansion or contraction during temperature changes.

THESE ARE OBJECTIVES…

- To develop an inorganic matrix called *Geopolymer*, for use as a coating material.
- To develop the Geopolymer so that it provides a glossy surface to which paint will not stick, and therefore, provide protection against graffiti in urban areas.

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HERE IS WHAT WE DID…

This research program consisted of three main components: (1) evaluation of the Geopolymer for durability, (2) application techniques, and (3) techniques for removal of graffiti.

The initial component explored was the evaluation for durability. Durability tests were designed to evaluate both the performance of the coatings and the behavior of the interface.

The matrix composition creating the Geopolymer consisted of a liquid component, three types of silicafumes, two types of fillers, two activators, two fiber types, water repellent agent, and added organic polymers.

A sample preparation was created using a reinforced mortar plate using ASTM Type 1 cement, concrete sand and welded mesh mire, to create a parent surface for the coating. The coating matrix was prepared using high shear mixture for the laboratory investigation.

Freezing and thawing were two tests used to evaluate the polymer. Glossy and semi-glossy appearances of the surfaces indicated that the coating did not deteriorate. Wetting and drying, however, provided more severe deterioration, as evidenced by cracking in the samples.

The second component of this study was evaluation of application procedures. The matrix could be applied with a brush, squeeze or sprayer. It was found that the brush worked best for smaller areas, and the sprayer for larger areas. The components could be mixed with paddle mixers used for mixing paint, and the tools then cleaned with water. It is recommended that the parent surface be wet in order to obtain saturated-surface dry condition.

The third component of this research was the analysis of the graffiti removal on the Geopolymer surface. Use of abrasion wheels for removing graffiti did not have any adverse affects to the coating. Since the coating has a very hard surface, the abrasion wheels will provide a very efficient graffiti removal, with minimal waste.

CONCLUSION:

As expected, the alumino-silicate matrices displayed excellent promise for application as a protective and graffiti-resistant coating. The coating provides a hard surface from which graffiti can be easily removed with abrasion wheels. The matrix can also be formulated to provide durable coating, under wet-dry and freeze-thaw conditions. It is compatible with various concrete surfaces, steel, and wood.

WHAT IS THE NEXT STEP?

The next step would be demonstrating the feasibility and performance of this chemical composition. Using the matrix for demonstration projects involving all three types of surfaces (wood, steel, concrete). Large piers and retaining walls in urban areas would be prime examples.

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A final report is available online at http://www.state.nj.us/transportation/research/research.html

If you would like a copy of the full report, please FAX the NJDOT, Bureau of Research, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for:
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