CASE STUDY

New York State Pollution Prevention Institute

NYSP2I Evaluates Performance of KLAW Industries' Pantheon™ Cement Replacement Material

Challenge

KLAW Industries wanted a third party to evaluate the long-term performance of Pantheon™ as a replacement for cement in concrete.

Solution

NYSP2I partnered with the Center for Advanced Materials Processing (CAMP) at Clarkson University to evaluate the performance of Pantheon™ as a replacement for cement in concrete.

Results

Overall, Pantheon™ performs exceptionally well as a cement replacement material. Pantheon™ did not worsen ASR with aggregates ranging from non-reactive to highly reactive and achieved excellent freeze/thaw resistance at 20% replacement. Future work should investigate the compatibility and appropriate dosages of commercial air-entraining admixtures to promote freeze/thaw durability in concrete containing higher volumes of Pantheon™.

KLAW Industries

Located in Binghamton, NY, KLAW Industries (KLAW) has developed a patented process to repurpose glass from recycling facilities, otherwise destined for a landfill, into cement replacement material for concrete. Pantheon™ is the KLAW Industries trade name for this material. It is certified to the new ASTM C1866 standard that specifies ground glass for use in concrete and is listed on the NYSDOT Approved list under material code 711-15. Manufacturing Pantheon™ solves the problem recycling facilities face because of high disposal costs for glass, as well as the challenge of high material costs faced by concrete manufacturers.

"We had an incredibly successful project with NYSP2I and the team from Clarkson University. The results moved the needle for our company, helped us get regulatory approval for our material, and validated our technology significantly. We are excited to start another project."

Jacob Kumpon, KLAW Industries Co-Founder & COO

Challenge

KLAW wanted an independent evaluation of Pantheon™ in various blends of Portland cement to test the long-term performance characteristics of concrete containing Pantheon™.

Pantheon™ is a partial cement replacement for concrete created from post-consumer glass.

Solutions

The New York State Pollution Prevention Institute (NYSP2I) partnered with the Center for Advanced Materials Processing (CAMP) at Clarkson University (Clarkson) to evaluate the performance of Pantheon™ in concrete according to ASTM standards. The following performance parameters were assessed: (1) the potential for alkali-silica reaction (ASR) in Portland cement concrete made with Pantheon™ as a partial cement replacement, (2) the durability of Portland cement concrete made with Pantheon™ as a partial cement replacement in a freezing and thawing environment, and (3) the effect of partial cement replacement with Pantheon™ on the setting time and workability of Portland cement concrete. For each parameter tested, the performance of 100% Portland cement concrete was compared with that of concrete containing 20% and 30% Pantheon,™ by mass, of total cementitious material.

Results

- Partial cement replacement with Pantheon™ neither worsens nor improves ASR in Portland cement concrete with aggregates ranging from nonreactive to highly reactive.
- Adequately air-entrained concrete with 20% Pantheon™ can achieve excellent freeze/thaw resistance. Further evaluation should be completed before specifying concrete beyond a 30% replacement when freeze/thaw durability is required.
- Partial cement replacement with Pantheon™ does not significantly impact the workability or setting time of concrete.

Overall, Pantheon™ performs exceptionally well as a cement replacement material. Pantheon™ did not worsen ASR with aggregates ranging from non-reactive to highly reactive and achieved excellent freeze/thaw resistance at 20% replacement. Future work should investigate the compatibility and appropriate dosages of commercial air-entraining admixtures to promote freeze/thaw durability in concrete containing higher volumes of Pantheon™.

Partners

RIT · Binghamton University, State University of New York · Clarkson University · Cornell CALS, College of Agriculture and Life Sciences · Rensselaer · New York Manufacturing Extension Partnership

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 Funding provided by the Environmental Protection Fund as administered by the New York State Department of Environmental Conservation. The opinions, results, findings and/or interpretations of data contained herein are the responsibility of Rochester Institute of Technology and do not necessarily represent the opinions, interpretations or policy of New York State.