GeoPolymer Mortar System for Structural Rehabilitation of Sewer and Storm Infrastructure

Milliken Infrastructure Solutions, LLC

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What is a GeoPolymer?

- Alkali cements consist predominantly of alumino-silicates or polymer Si-O-Al bonds and are similar in chemical make-up to natural Zeolites. Traditional starting materials for geopolymers cements are fumed silica, fly ash & metal slag.

- The geopolymer’s primary structure is derived from an alkali activated alumina silicate reaction.

- The formation of the final product is a poly-condensation reaction versus the typical hydration process.
Geopolymers can be produced from commercially available industrial waste streams, creating a highly environmentally friendly product.

These materials are introduced and serve as “alternative cementitious” binders as well as “contributing fillers”, such that every particle within the geopolymer is providing some cross-linking characteristic.

The chemical reactions of geopolymer create only a fraction of the CO$_2$ emissions of standard cementitious materials.
Installation Process
Geopolymer material solutions offer significant chemical, physical, environmental, and economic advantages over traditional materials.

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<thead>
<tr>
<th></th>
<th>GeoSpray™</th>
<th>Portland Cement</th>
<th>Calcium Aluminates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Strength</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Early Strength</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>% Recycled Content</td>
<td>&gt;60%</td>
<td>&lt;20%</td>
<td>&lt;20%</td>
</tr>
<tr>
<td>Chemical Resistance</td>
<td>Very Good</td>
<td>Poor</td>
<td>Very Good</td>
</tr>
<tr>
<td>Self-Adhesion</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>CO₂ Emissions</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Single Pass Thickness</td>
<td>¾”</td>
<td>½”</td>
<td>½”</td>
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Case Studies

Jacksonville FL - Airport Storm Sewer
Houston TX - City Sanitary Sewer
GeoSpray™ Case Study-Cecil Field, Jacksonville

- Cecil Field serves as key maintenance facility for Military and Commercial Aircraft
- Corroded & deteriorating CMP Storm Sewer
- 1400 LF of 54”-66” diameter
- 30 day window-Completed in 26 days
- Contractor: IPR/PM Construction
GeoSpray™ Case Study-Cecil Field, Jacksonville

Criteria:

• Must be minimally disruptive
• Speed of application
• Small construction footprint
• Compliance to strict FAA regulations for Height, FOD, MOT
• TSA certification
• Contractor with experience and qualifications for trenchless applications
Diagram shows the proposed work project area, and how much it would have impacted the operations of airport activities. The small orange strip is the actual area IPR crews needed to install their GeoPolymer lining system.
GeoSpray™ Case Study-Cecil Field, Jacksonville

Area cordoned off per FAA

GeoPolymer system site footprint is small and airport remained in operation.
GeoSpray™ Case Study - Cecil Field, Jacksonville

GeoPolymer is applied quickly and cures fast for quick return to service.

Completed stretch of storm drain.
GeoSpray™ Case Study-City of Houston

• Pipe is under heavily traveled US Highway 59 in Northeast Houston

• Pipe was leaking at multiple joints with evidence of significant ground settlement

• 700 LF of 72” diameter

• 42 ft. deep

• Contractor: IPR South Central
• Originally planned to rehab with CIPP

• Due to high temperatures (100°F during the summer), city needed an alternative method

• Bypass was already in place and running

• The city was concerned that the pipe would not make it through the Fall.
The entry pit was already in place for CIPP.

GeoPolymer lining equipment in place once the infiltration was controlled.
GeoSpray™ Case Study-City of Houston

GeoPolymer being applied inside 72” RCP sanitary sewer.

The environmentally friendly Geopolymer lining system saved the City over 10% on this one pipe alone!
Before & After
Before ...
www.geopolymers.milliken.com