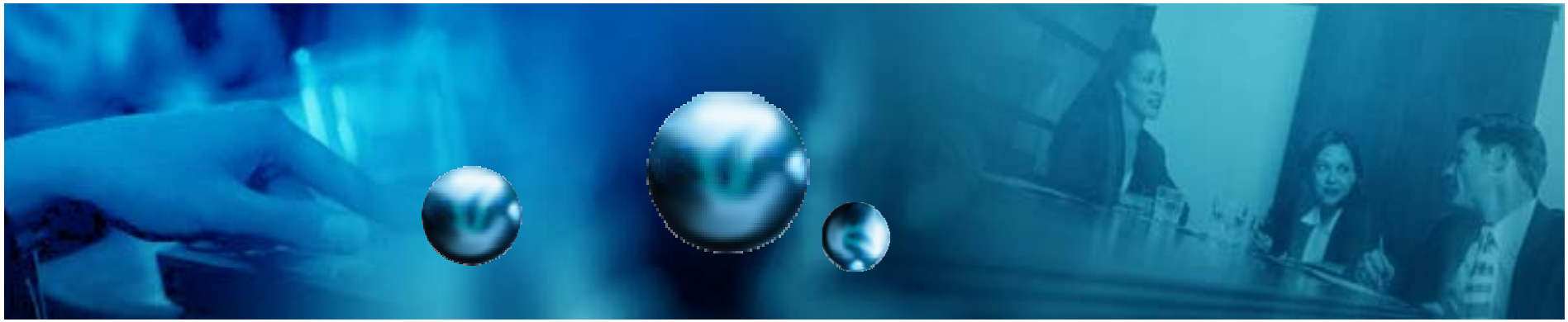
Environmental Issues Photocatalytic Cement and Pervious Concrete



Missouri Department Of Transportation

Bill Stone, MoDOT

Two-Lift Open House
September 28, 2010

History of MoDOT Involvement

- Approached about Photocatalytic Cement placement on trial basis
- Find existing project or upcoming project to place on project
- Location with impact to air quality
- Initial site was a weigh station potential project in District 10

Literature Search

- **April 1, 2009 – Concrete Products article**

  "…portland cement whose photocatalytic properties enable the product to use energy from ultraviolet rays to oxidize organic and inorganic compounds, removing them from the atmosphere and allowing rain to flush them from exterior surfaces."

- **September 1, 2008 – Concrete Products article**

  "Finished concrete uses ultraviolet sunlight to promote and accelerate oxidation at the surface of the structure. In addition to keeping the sculptures a bright white color, the cement allows for the conversion of smog-causing gases …using a process much like a catalytic converter in automobiles."

Literature Search

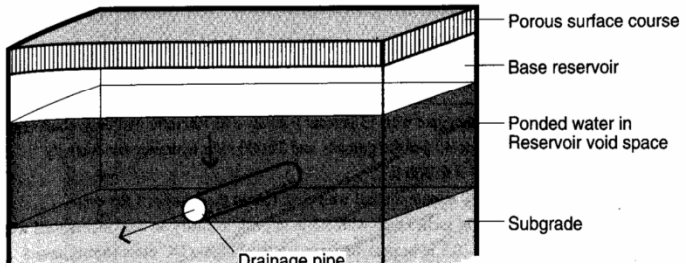
- **PICADA Project *Photocatalytic Innovative Coverings Applications for Depollution Assessment***
  - Began January 2002
  - De-soiling and de-polluting abilities arise from the photocatalytic properties of titanium dioxide TiO_2
  - Segrate Road Full Scale Test – NOX fall of about 50%

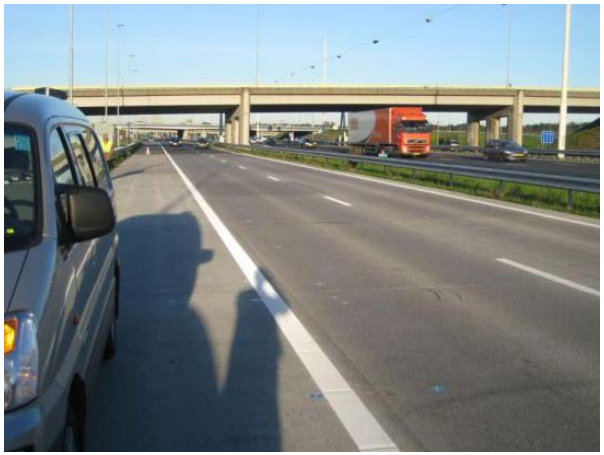
I-35 Bridge in Minneapolis

Two 30 foot high Gateway Elements at the entrances to the new I-35 bridge in Minneapolis, Minnesota.

Pervious Shoulder

- Stormwater
  - Water quality improvement
  - Water volume reduction
  - Delayed peak flow
- Urban Heat Island Mitigation
- Safety - Increased skid resistance





Monitoring Plan

- Will not use Before/After study
- Monitor Control Section
- Monitor Test Section with Photocatalytic Cement
- Air monitoring has been confirmed in laboratory studies
- Water quality study is planned to be conducted

Monitoring Plan

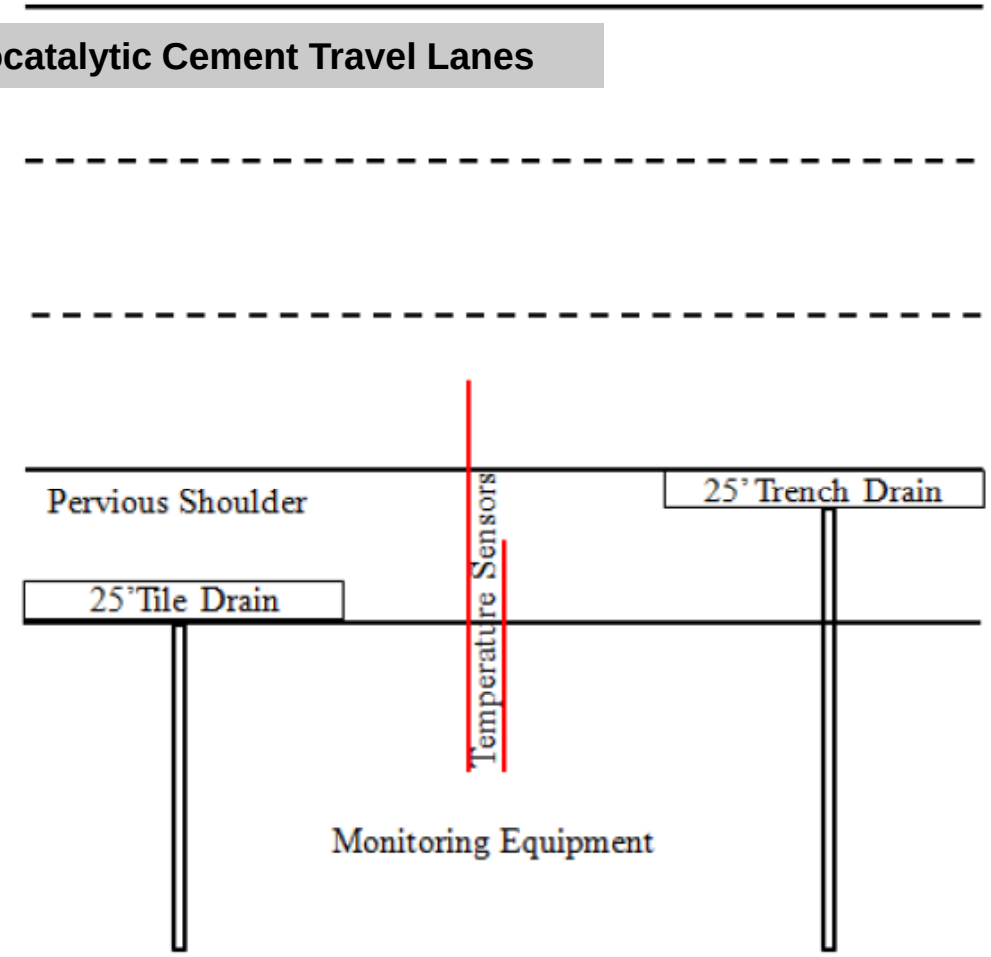
- Objectives of Research
- Quantify benefits to the environment of utilizing photocatalytic cement
- Study stormwater runoff
- Evaluate pollutants from that runoff
- Monitor temperatures of cement

Monitoring Plan

- Construction and Instrumentation
  - Water collection and trench drains
  - Rain gauge
  - Temperature gauge

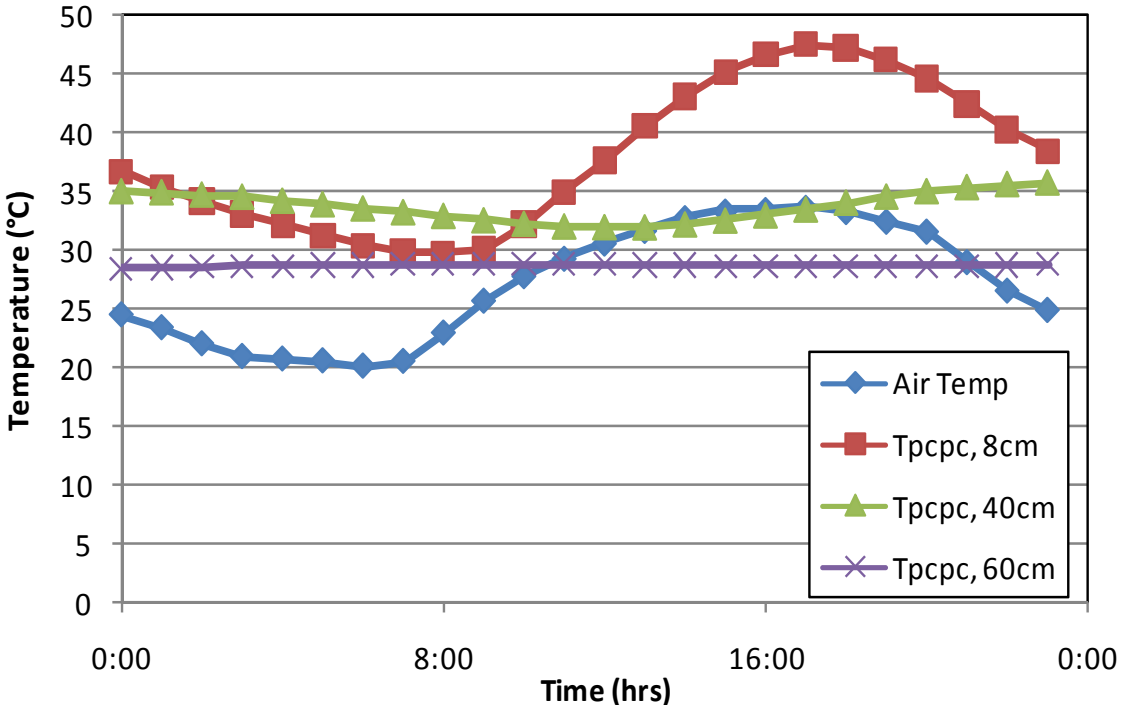
Monitoring Plan

Photocatalytic Cement Travel Lanes



Monitoring Plan

- Temperature Sensors throughout section



Hot Weather Temperature Behavior of a Pervious Concrete System (Kevern et al. 2009a)

Temperature sensors before aggregate base and concrete construction

Monitoring Plan

- Stormwater reductions through runoff and infiltration
- First flush stormwater quality (hydrocarbons, heavy metals)

Pervious concrete surface infiltration

First flush samplers in Texas

Monitoring Plan

- Laboratory testing and field monitoring
  - Field monitoring for the following
    - Stormwater volume
    - Stormwater pollutant concentration
    - Thermal characteristics
- Collected samples tested using HP5890 gas chromotograph

Monitoring Plan – Next Steps

- Enhance details of monitoring plan
- Continue to refine schedule of monitoring that is coordinated with Route 141 project schedule
- Finalize products and monitoring equipment that is to be used on the project

Thank You

Contact Information:

Bill Stone

Organizational Performance Administrator

573-526-4328

William.stone@modot.mo.gov