

Instrumentation and Monitoring of Precast Prestressed Concrete Pavement

Vellore S. Gopalaratnam

University of Missouri-Columbia

Transportation Seminar

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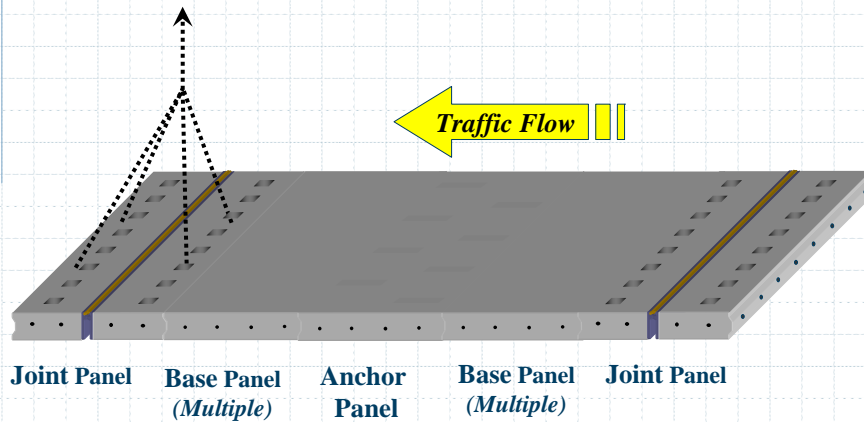
Organization

- Background
- Casting/Fabrication
- Construction
- In-service Performance
- Summary Observations

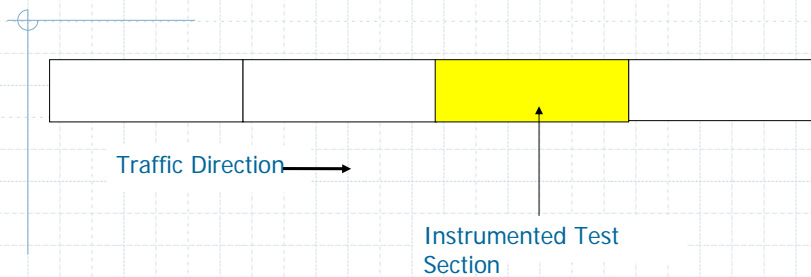


Pavement Design

- Comprises three panel types: joint, base, and anchor panels

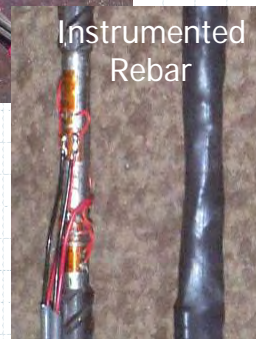
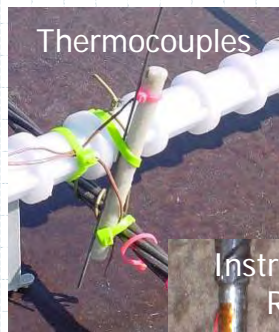


Precast Sections

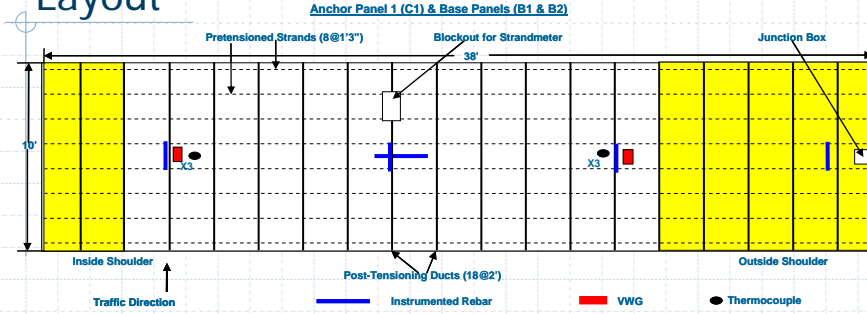


- Divided into four – 250' sections
- Each 250' section was post-tensioned together

Instrumentation



Typical Panel Design & Instrumentation Layout



- Precast Panels are 10' by 38'
- Pre-tensioned in the transverse direction and post-tensioned longitudinally after installation

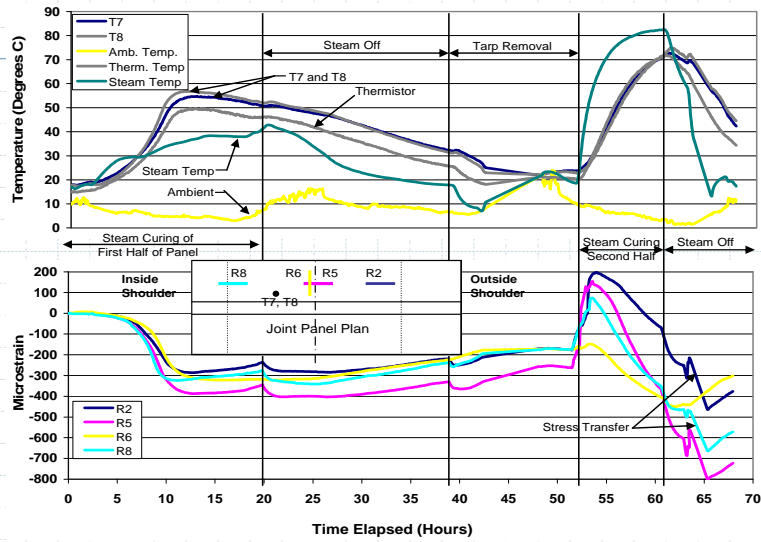
Casting



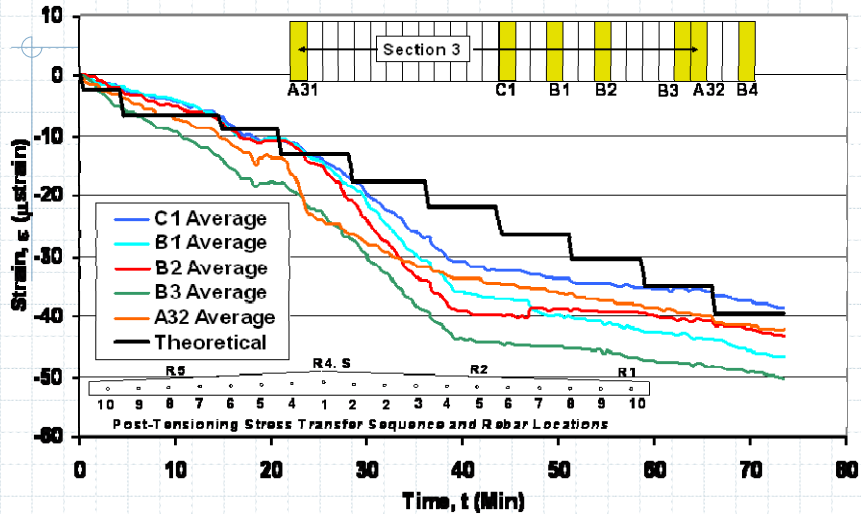
Construction



Curing and Hydration



Average Post-tensioning concrete strain in the panels

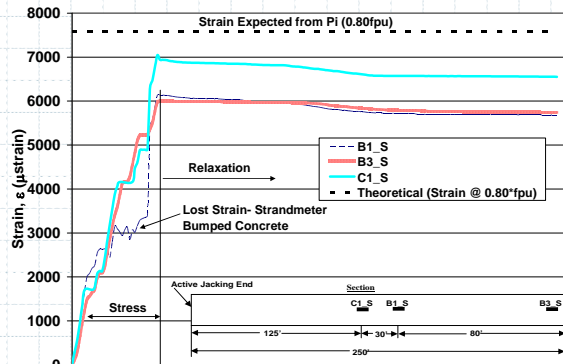


Strandmeter During Post-tensioning

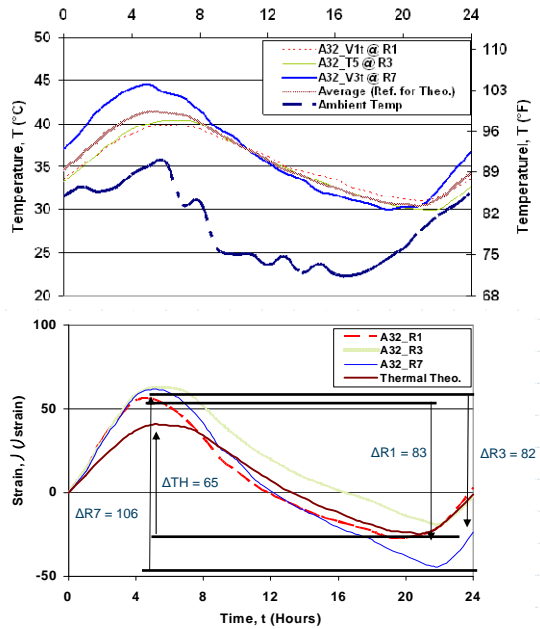
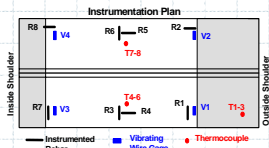
- Prestressing force lost in PT ducts = 61.8 lb/ft/duct

Post-Tension Strands

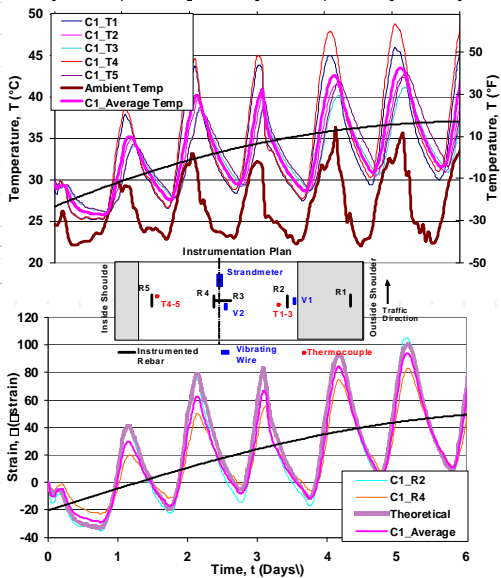
- 0.6" Diameter
- 7-wire Low Relaxation Strands
- Uncoated
- Stressed to 80% of ultimate ($U_c = 270$ ksi)



Daily Service Performance of a Typical Joint Panel (A32)



Service Performance for Week Long Period



Trends

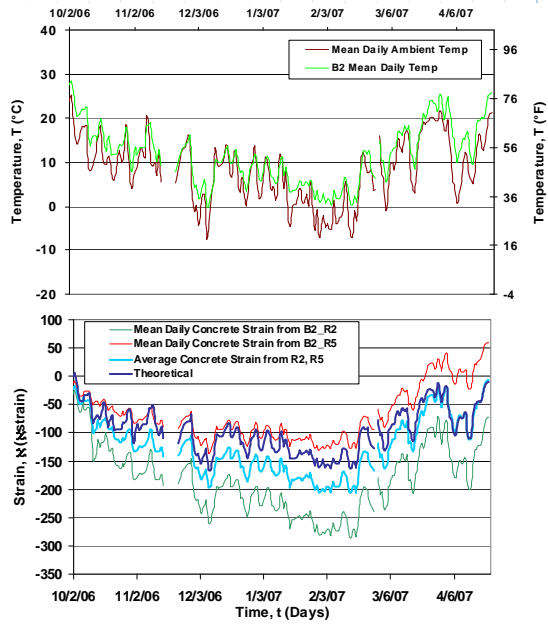
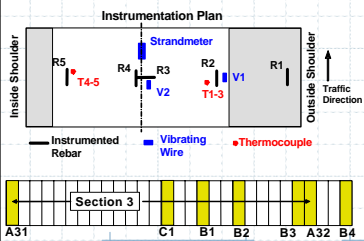
Increase in relative temp.
= 11 C

Increase in relative strain
= 68 mstrain

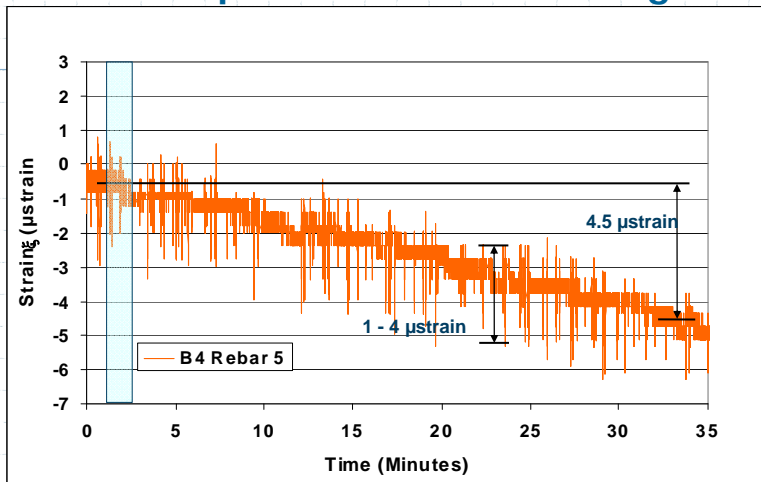
$$68 / 11 = 6.2$$

(Close to CTEconcrete as assumed of 6.0)

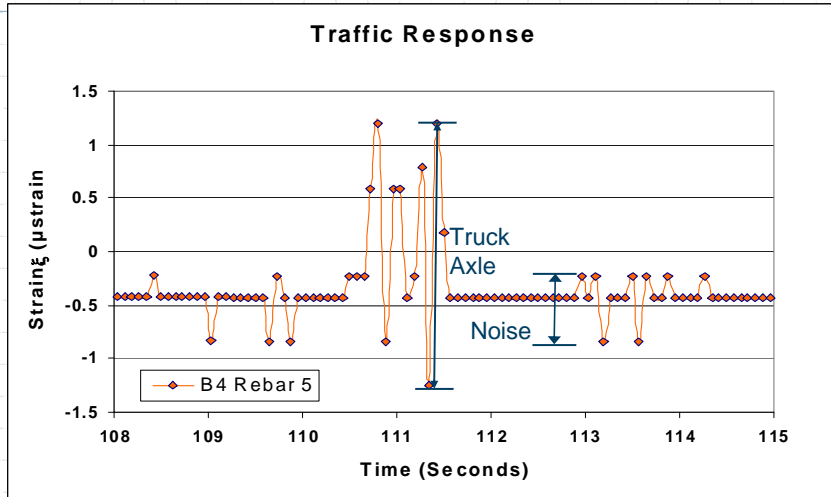
Seasonal Service Performance of a Typical Base Panel (B2)



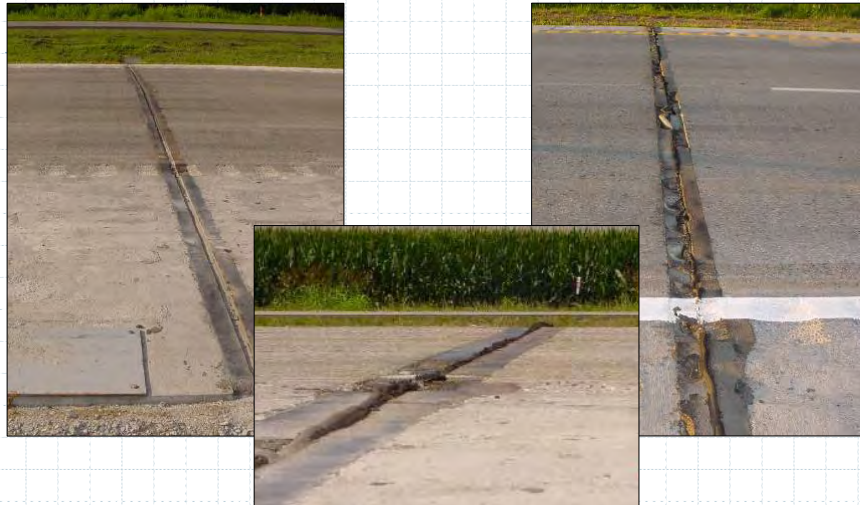
Pavement Response to Traffic Loadings



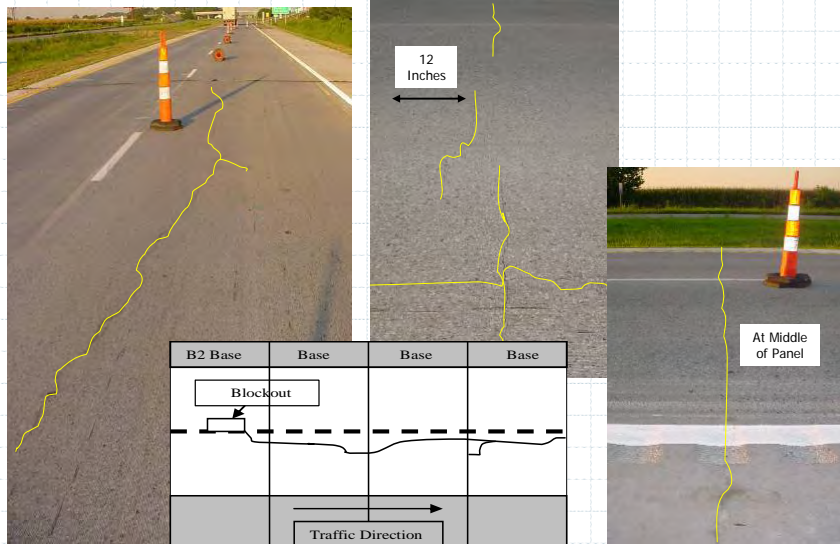
Individual Vehicle Induced Strains



Service Observations – Joint Panel



Service Observations - Cracking



Page 19

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Possible Causes of Cracking

- Thermal cracking from high temperature swings during fabrication process
- Curling causing longitudinal cracking
- Epoxy was allowed to cure before PT

Page 20

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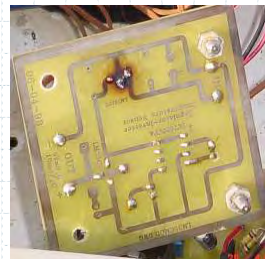
Weather Related Issues

- Summer heat waves were problematic for sensitive circuitry.
 - Addition of a shade roof
 - Larger heat sinks, with strategically placed fans
 - Military grade parts since exceeding Max. Junction Temp.



Weather Related Issues

- Water and Lightning won't stay away
 - Condensation and leakage due to worn seals
 - Corrosion
 - Addition of circuit protection diodes
 - in line and on regulators
 - Path to ground



Summary Observations

- Overall the project provided useful insights on the performance of precast pavement system
- Need to avoid thermal shock during early age
- Fabrication/alignment issues to be addressed
- Joint performance can be improved
- As-built post-tensioning stress location dependent
- Friction plays a role – incorporate in design
- Thermal strains single-most significant loading
- Cracking could be minimized through more careful fabrication/construction

Page 23

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Questions?

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