I-57 Precast Post-Tensioned Pavement

2006 Missouri Concrete Conference

January 25, 2008

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Background History

- Initiated by FHWA Concrete Pavement Technology Program (CPTP) in 2000.
- CPTP Task 58 purpose – to examine the feasibility and cost-effectiveness of using precast prestressed concrete panels for rapidly rehabilitating or reconstructing existing pavements.

Background History

- Precast post-tensioned pavement advantages
  - Reduced tensile stresses in concrete
  - Reduction in required slab thickness
  - Bridging of small voids on uneven base
  - Rapid construction technique during off-peak traffic hours
  - Long-life performance

Background History

- Two FHWA Demo Projects previously constructed
  - Texas (2002) – multiple 250’ single ‘slabs’
  - California (2004) – 250’ single ‘slab’
- Missouri was selected to construct third project
- Panel design by The Transtec Group

Site Selection Criteria

- Rehab/Reconstruction needed
- High profile
- Moderate traffic
- Homogeneous soils
- Simple typical section
- Proximity to precast plant

NB I-57 in SE Missouri

- ‘Bootheel’ location
  - Flat
  - Sandy-silt soil
- Two 12’-lanes w/ 4’ I.S. and 10’ O.S.
- ~18,000 AADT
- 30 % trucks
- Tangent / no vertical curve

Existing Pavement

- 8-inch JRCP w/ 61.5’ joint spacing
- 4-inch dense-graded granular base
- Built in 1959
- Roughly 35 years of good service before full depth repairs started

Existing I-57

Project Length

- Whatever we could buy for $400,000
- Multiple of ~250’ sections
- Initially estimated 5 sections
- Ended up with 4 sections

End Transitions

- Pavement replacement on both ends
- Dowel load transfer
- Diamond grinding

Typical Section Design

- Existing pavement – 1.56% cross slope
- 2% cross-slope required
- Retain crown template

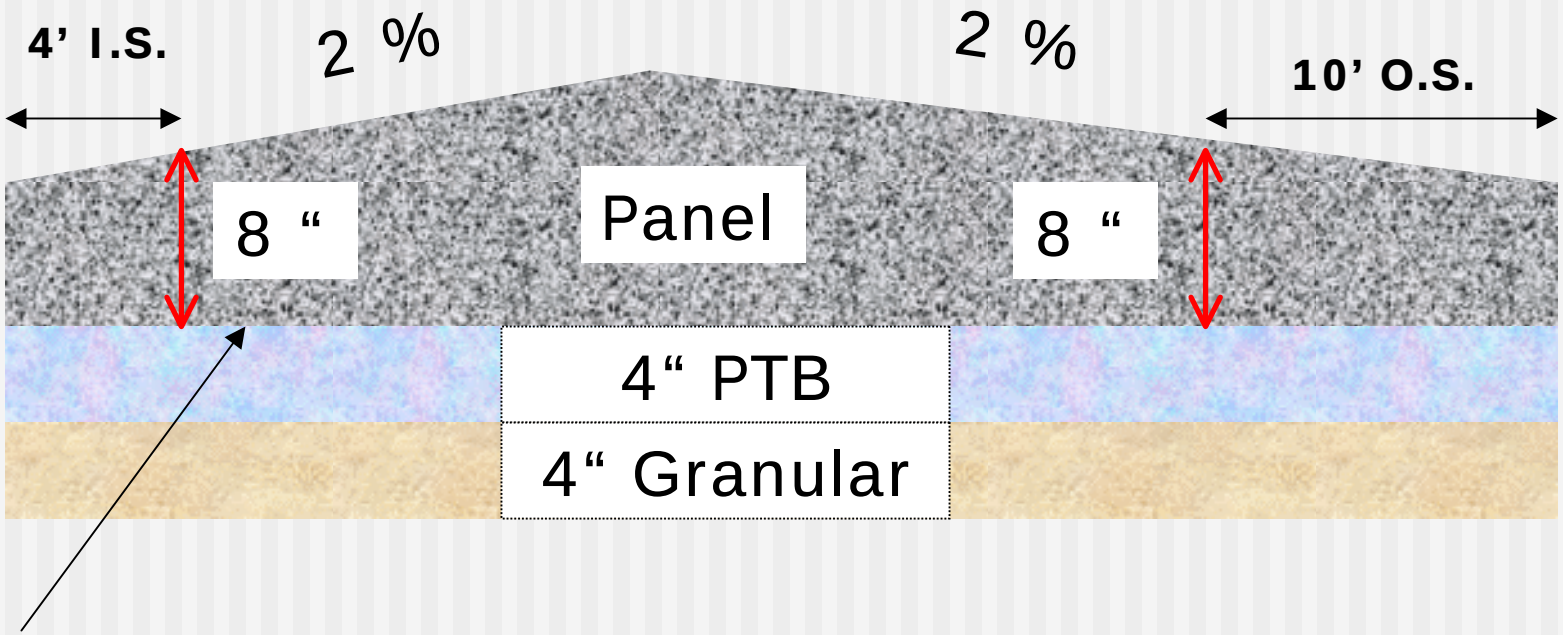
Typical Section Design

- Uniform thickness desirable, but not practical w/ crown design
  - Eccentrically-loaded prestress
  - Grading control
- Elected to flatten base
- Each panel ~ 20 tons

Grade Preparation

- Compacted subgrade
- 4-inch unbound granular subbase
- 4-inch permeable treated base
- Poly sheeting

Cross-section Design



Panel Design

- 38’ width x 10’ length
- 10⅞“ at crown
- 8“ at shoulder point
- 7“ at inside shoulder edge
- 5⅝“at outside shoulder edge

Bid Proposal Development

- Stand-alone project - uncertain contractor interest
- District increased scope of project ($$) to include adjacent pavement replacement
- Tied to much larger rehab project on I-57 as combination bid

Bidding Summary

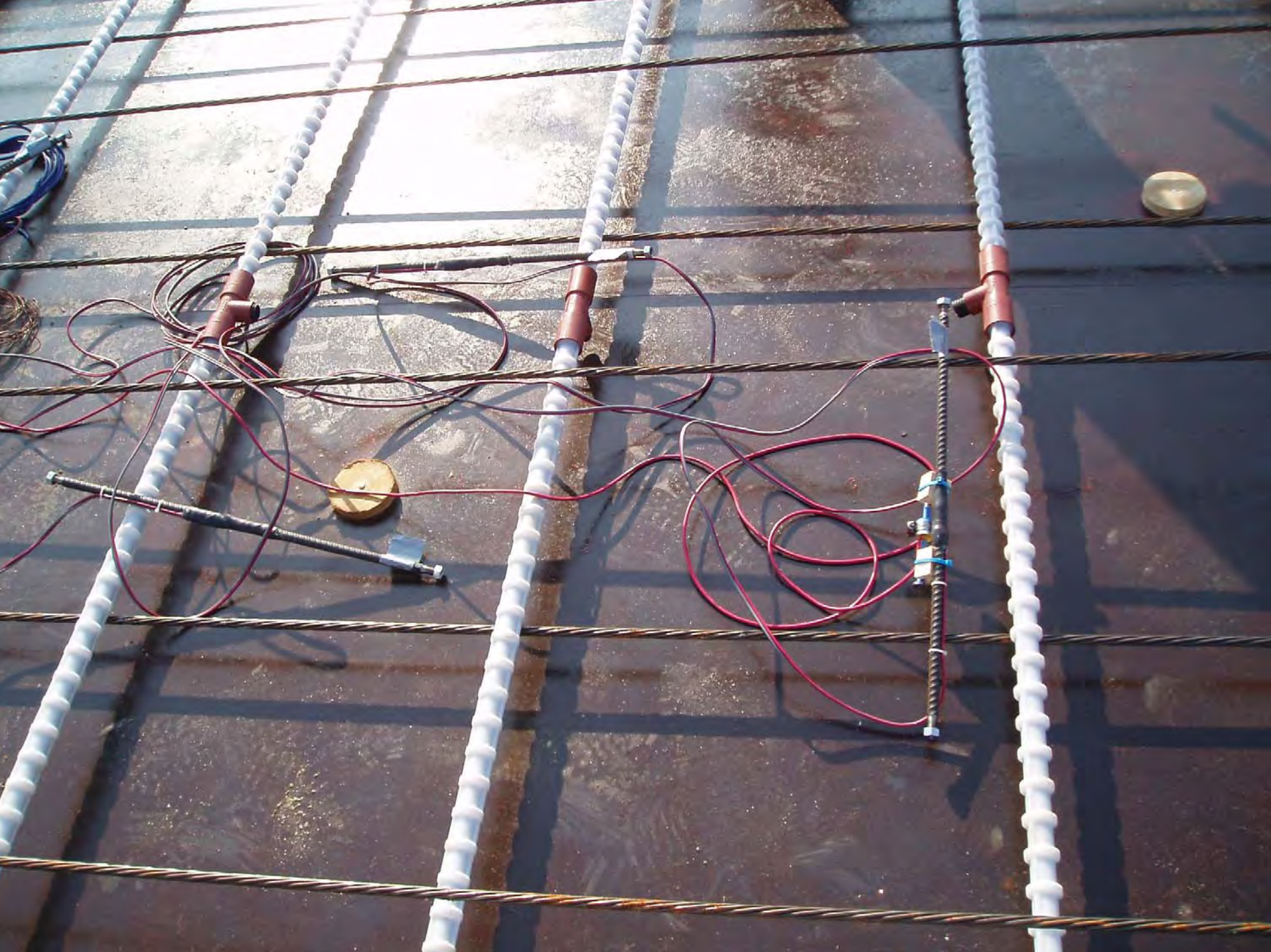
- 3 bidders
- E.E. unit price - ~ $200 / ($yd^2$)
- Low bid (Gaines Construction) - $248 / ($yd^2$)
- Contract awarded in May 2005
- CPI (in Memphis) - precast subcontractor
- December 31 completion date

Instrumentation Study

- Seven panels – 5 base / 2 joint
- First major instrumentation of precast post-tensioned pavement
- Research study w/ U. of Missouri-Columbia
- One-year study after installation
- Dr. Gopalaratnam – P.I.

Study Objectives

- Early panel shrinkage
- Anchorage behavior
- Prestress losses during various stages (friction, relaxation, creep)
- Curling at joints
- Performance under traffic loads
- Daily and seasonal thermal effects

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Post-Tensioning

- 18 - 0.6” strands @ 2’ spacing
- Alternating stressing pattern from center
- Jacking force = 75% of ultimate strength
- Total target elongation after lock-off ~ 16 ¾”


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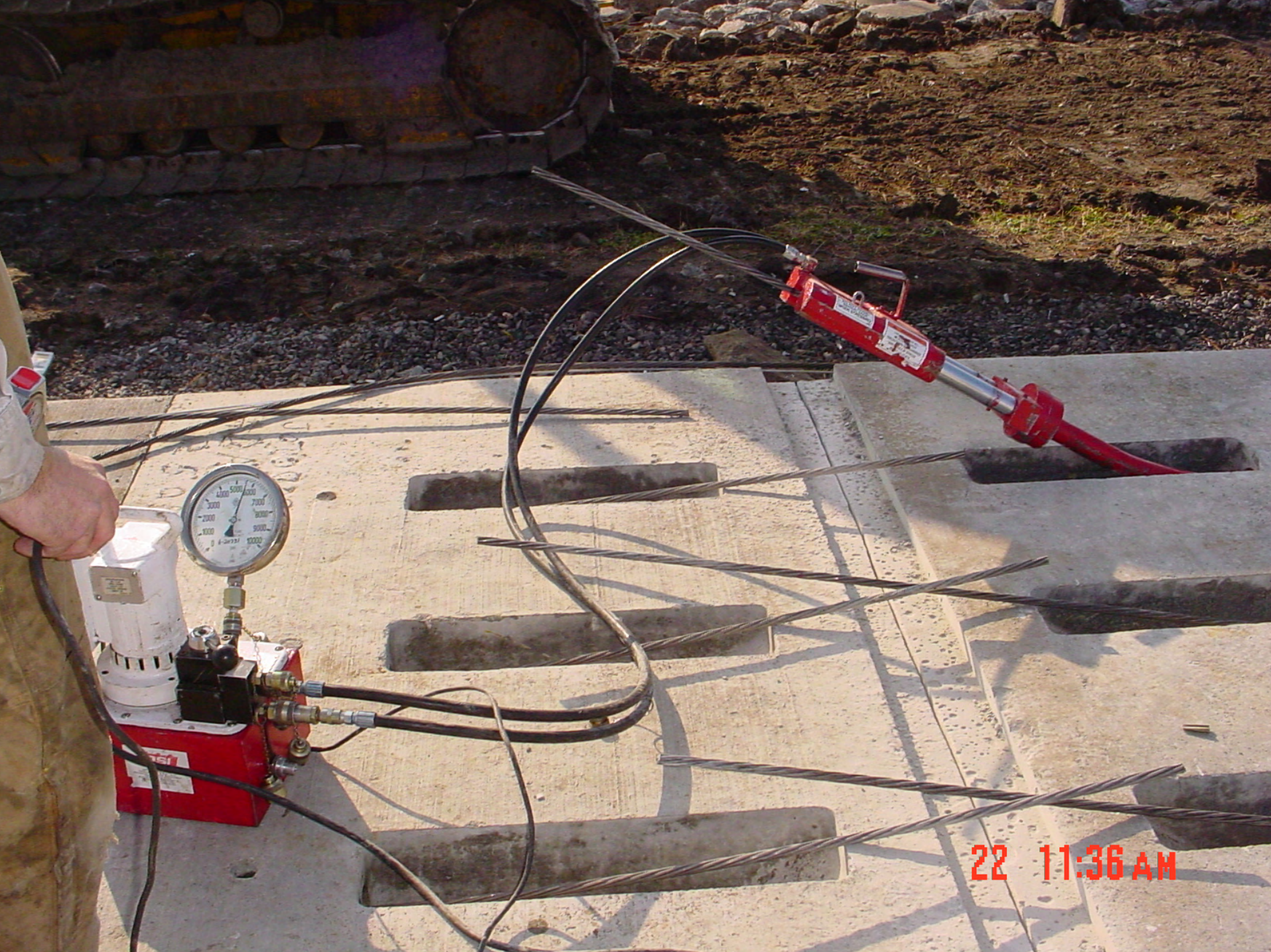
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GAS - EXIT 10

January 2008


STANLEY

Future Recommendations

- Limit weight of lift equipment on base
- Mark panel above centerline duct for alignment
- Ensure dowels well aligned and bond broken between joint panel halves
- Post-tension ‘slab’ before placing adjacent panels

Thank You!

Questions?

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