

Pre-cast Pavement Options

2005 Annual Pavement Workshop

November 9 & December 6, 2005
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Overview

- ◆ The Way Rehab Was...
- ◆ State of the Art or Stuck in the Past?
- ◆ The Future is Here
- ◆ The Concept and The Benefits
- ◆ *Caltrans* District 7 Pilot Project
- ◆ Lessons and Recommendations
- ◆ Predictions
- ◆ Summary

The Way Rehab Was...

- ◆ It took hours to remove one panel
- ◆ The base was damaged in the process and removed, increasing the quantity of removal
- ◆ Often, double the concrete was required, which doubled the time of construction
- ◆ Strength in Calcium Chloride Panels was only 80 PSI in 4 hours, 160 PSI in 8 hours
- ◆ Panels opened to traffic at 4 or 8 hours had a 2 year life before needing replacement

State of the Art

- ◆ With the non-impact method, removal of one panel takes less than 15 minutes
- ◆ The base is usually not damaged and can remain in place
- ◆ Rapid Strength Concrete (RSC) is usually 400 PSI in 4 hours, and documented at 2 hours
- ◆ Strength at opening allows panels to perform for 10 or more years, without damage

State of the Art...



Or Stuck in the Past...



Stuck in the Past

- ◆ Insisting to use an impact demolition method which takes hours per panel and damages the underlying base, or removes the base
- ◆ With approach slabs, removal also requires welders to cut the reinforcing steel
- ◆ For approach slabs, a large cage is delivered, and steel is tied by hand
- ◆ Excess quantities of concrete is needed
- ◆ Time is wasted, waiting, waiting, waiting...

The Future is Here

- ◆ Pre-cast concrete has been used extensively in structures and buildings for decades
- ◆ Pre-cast concrete pavement has been constructed in California, New York, and for decades in Texas
- ◆ FHWA has been advocating pre-cast concrete pavement for decades
- ◆ California, Indiana, Iowa, Michigan, Missouri, New York and Texas have several projects planned

The Concept

- ◆ Concrete panels, with reinforcing steel, are pre-cast at a plant, to the shape and depth of a pavement panel, including wedges and openings
- ◆ Panels may be pre-stressed and may have provisions for post-tensioning
- ◆ Old concrete panels are removed, and pre-cast panels are dropped into place
- ◆ 8" with steel, pre-stressing, etc., resists stresses better than 8" of plain concrete

Benefits

- ◆ Expedited Construction
 - Overnight or Weekend “invisible” construction
 - Replace several lanes at once
 - Reduced User Delays = Reduced User Costs
- ◆ Reduced Construction Costs
 - Replace in-kind and reduced thickness
 - Reduce/eliminate costs of adjustments for inlets, guardrail, light fixtures, signs, and grade reductions at structures

Benefits

◆ Controlled Fabrication Conditions

- Increased Durability (consistent mix, adequate curing, adequate air entrainment, etc.)
- Allows “poor weather” construction

◆ *Why Post-Tension?*

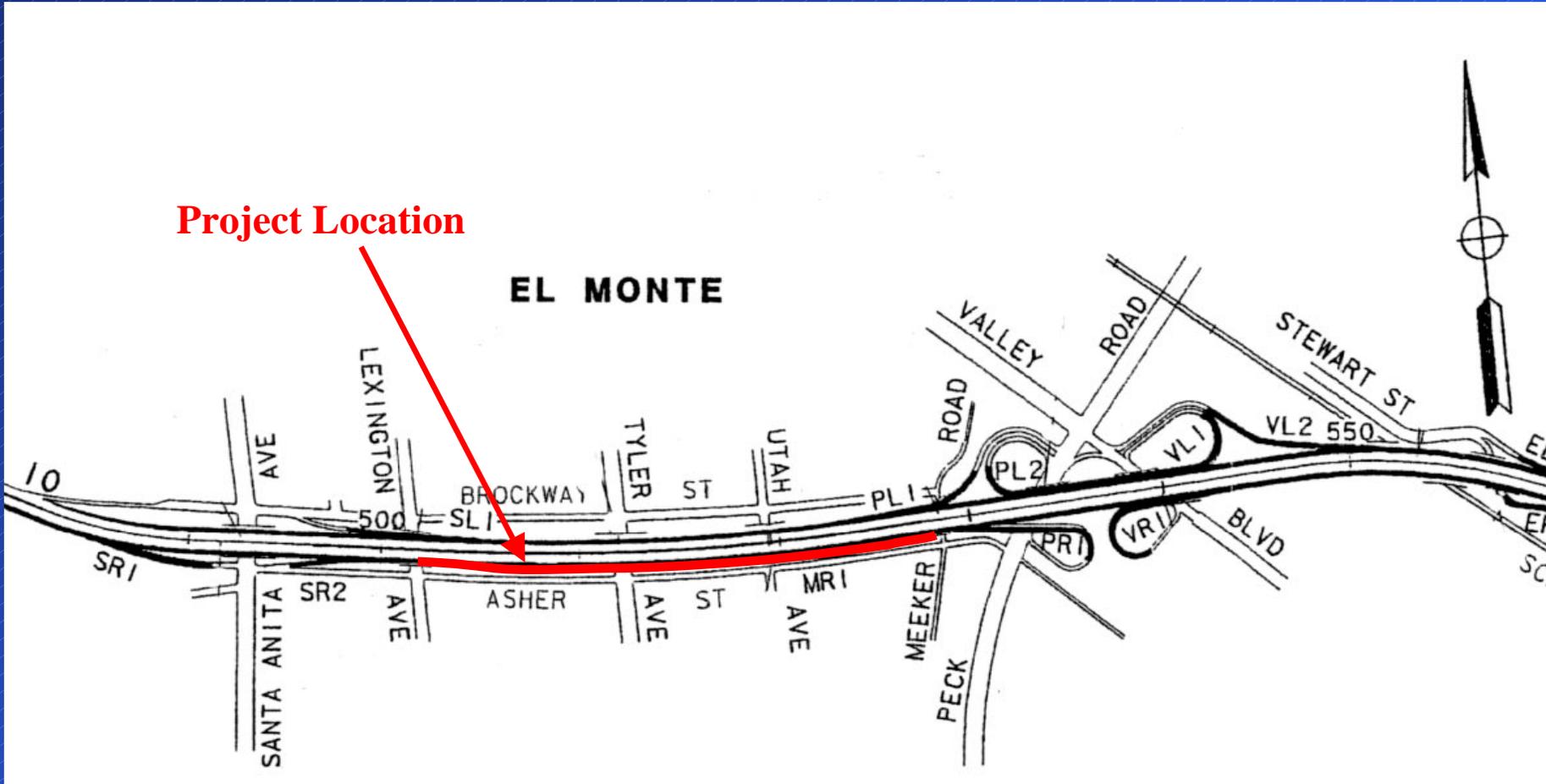
- Increased Durability (West Texas 6” Prestressed Pavement, I-35 in place 18 years, w/o distress)
- Reduced Slab Thickness (8” vs. 14”)

Caltrans District 7 Pilot Project

- ◆ Widening/Rehabilitation of I-10 near El Monte
 - 27 ft traffic lanes
 - 10 ft shoulder
- ◆ Precast Prestressed Concrete Pavement to replace 10" JCP
 - Pre-stressed/Post-tensioned
 - Equivalent to 14" JCP
- ◆ 248 ft total project length
- ◆ \$707 per cubic yard, in place

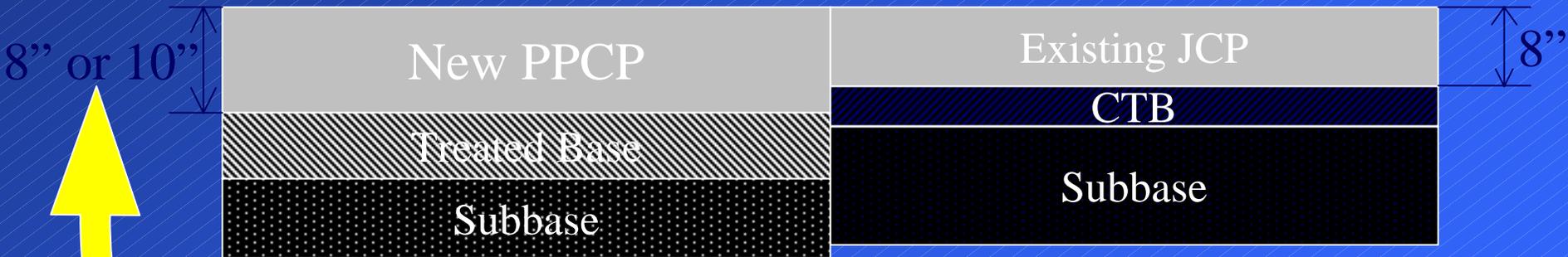
Caltrans District 7 Pilot Project

Project Location



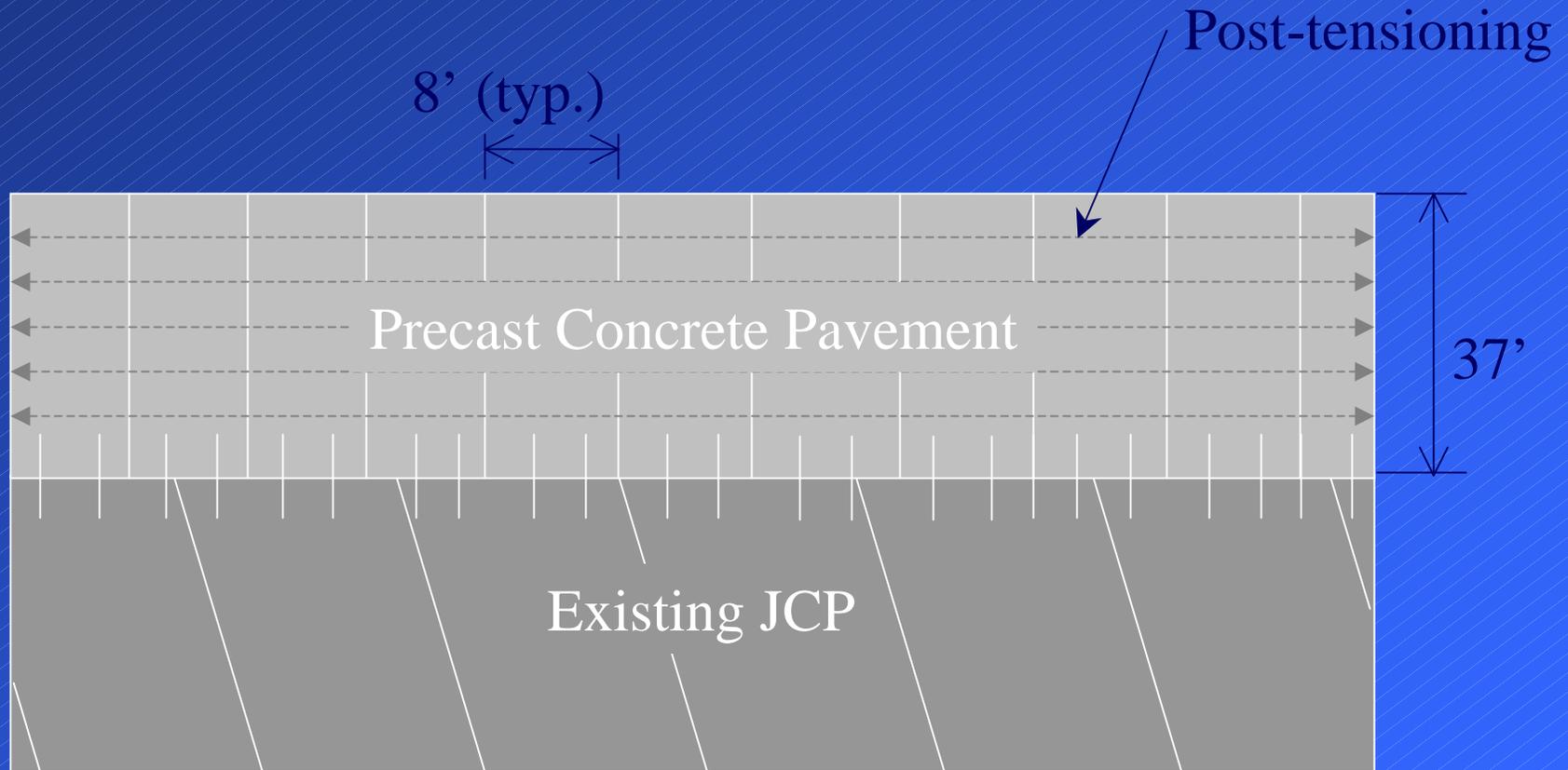
I-10 Reconstruction/Widening

Why use Prestressed?



Equivalent to 12" – 14" JCP !

I-10 Reconstruction/Widening



Caltrans District 7 Pilot Project

- ◆ Based on Texas Pilot Project Strategy
 - Panel length and width: 8 ft long, 37 ft wide
 - Slab length (120 ft and 128 ft, respectively)
 - Pretensioned transversely, post-tensioned longitudinally
 - 0.6” Grade 270 strand
 - 36” strand spacing
- ◆ Placement over LCB
- ◆ Provision for under-slab grouting
- ◆ 1” expansion joint detail

Fabrication Bed, *Perris, CA*



Base Panel Pour



Central Stressing Block Outs



Expansion Joint *in the Rain*



Preliminary Finishing



Covering for Overnight Cure



Lifting New Panel



Panels Curing in the Yard



Demonstration Installation



Demonstration with Onlookers



Night time Panel Installation



Night time Panel Installation



Lessons & Recommendations

- ◆ 8' long panels with a key-way worked well, with some chipping
- ◆ Use fiber reinforced concrete to add strength to key-way, to prevent chipping
- ◆ Broom-texture works well, especially if post-grinding is specified
- ◆ Install bond-breaker to underside of panels at the plant
- ◆ Set panels on a bed of grout in lieu of under-slab grouting

Predictions

- ◆ Pre-cast pavement slab and lane replacements will be very common within the next 10 years
- ◆ Pre-cast panels for rapid emergency slab replacements will be on hand at for installation by Maintenance
- ◆ Standard Plans and Specifications will be available in the next two years
- ◆ Pre-cast pavement slabs will reduce the time and cost of construction and maintenance
- ◆ Life-cycle costs will be significantly reduced

Summary

- ◆ Controlled fabrication improves quality and durability
- ◆ Allows poor weather construction options
- ◆ Reduce construction costs and user delays
- ◆ Reduce grade and fixture adjustment costs
- ◆ Restore aging pavement sections with equivalent 40+ year designs
- ◆ Cost effective compared to other strategies
- ◆ An effective method for rapid repair and rehabilitation of PCC pavements.

Summary

- ◆ Several U.S. projects are pending
- ◆ Successful completion of a full width and partial width installation in Georgetown, Texas, and a “triple” width variable cross-slope section in El Monte, California
- ◆ Successful completion of individual panels and panel-groupings in New York
- ◆ Pre-cast concrete pavement is the future of pavement repair and rehabilitation

Frequently Asked Questions

- ◆ Why are the panels only 8 feet long?
- ◆ Will the perpendicular transverse joints at an even spacing create driver hypnosis or harmonic suspension in vehicles?
- ◆ What if the base is uneven?
- ◆ Are the panels cast on site or at a pre-caster's yard?
- ◆ If a panel fails, how do you repair it?

Frequently Asked Questions

- ◆ Are the post-tensioning strands epoxy coated?
- ◆ Can you grind the panels?
- ◆ Why do you want to texture in the longitudinal direction, and not the transverse direction?
- ◆ Why would you want to make a panel thinner than the existing pavement?

Acknowledgements:

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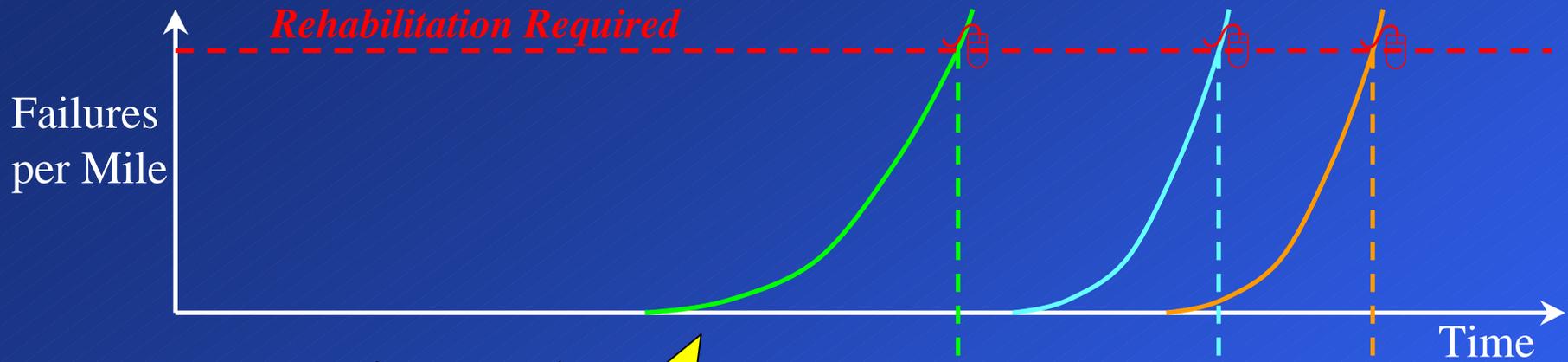
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