

Continued Development of California's Accelerated Pavement Reconstruction/Rehabilitation Approach

John Harvey, UCPRC

T. Joe Holland, Caltrans Research

With input from:

Jim Graham, Caltrans District 3

Bob McNew, Caltrans District 3



Overview

- For Long-Life Rehabilitation and Reconstruction Caltrans uses:
 - Pavement designs and specifications to minimize thickness, speed construction time
 - Continuous closures and full directional closures
 - Extensive traffic management planning
 - Continuous traffic monitoring and adjustments
 - Extensive public outreach
 - Provision of alternative transportation
- Outline:
 - Development of approaches
 - Details and experience
 - Lessons Learned

Want Long Life and Fast Construction and Minimum Traffic Delay

- Pavement design strategies:
 - longer life pavements take longer to construct
- Construction windows/traffic delays:
 - shorter windows less efficient for construction
 - some strategies impossible in 7-10 hour windows
 - which windows minimize total traffic delay:
55 hour weekend, 72 hour weekday, continuous?
- Requires
 - Pavement Engineering + Construction Engineering +
Traffic Engineering

Origins of the California approach

Los Angeles Times

LOCAL ▾

CALIFORNIA ▾

SPORTS ▾

ENTERTAINMENT ▾

BUSINESS ▾

Santa Monica Freeway to Reopen on Tuesday : Recovery: The contractor will get a \$14.5-million bonus for finishing earthquake repairs 74 days early.

April 06, 1994 | NORA ZAMICHOW and VIRGINIA ELLIS | TIMES STAFF WRITERS

- Northridge earthquake damaged four bridges on the Santa Monica Freeway in Los Angeles
 - Closure estimated to cost LA economy \$1M per day
- C.C. Myers, Inc. won the contract to replace them for \$14.9M
 - Contract completion 140 days
 - \$200,000 per day bonus for each day prior to the 140 days
 - Completed the job in 66 days, 74 days early



The Atlantic Photo

Origins of the California approach

Lessons Learned

Innovative materials

- fast-setting concrete for ramps

Full closures

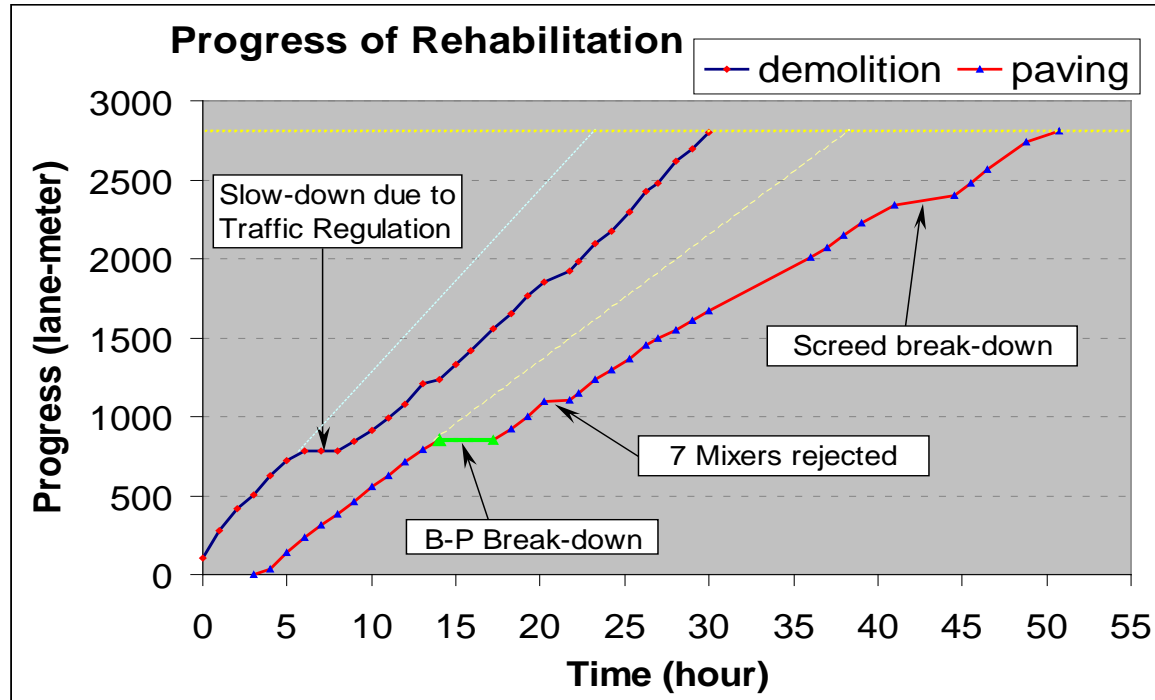
- unavoidable in this case

Schedule incentives

- if warranted by economic losses due to longer closures

I-10 Concrete Lane Replacement with 55 hour Weekend Closure in 2000

- 2.8 lane-km removed, replaced, opened to traffic
- Fast-setting concrete
- Moveable concrete barrier
- Back-up mixing plant
- Concurrent operations
- 1 ½ lanes available for traffic
- Need to remove closure and open within 4 hours if too much traffic delay



I-10 Concrete Lane Replacement with 55 hour Weekend



Lessons Learned

- Moveable barrier worked well for fast closure changes
- Some things contractors focused on were not necessarily the most important items controlling productivity
 - Contractors: mixing plant, paver speed
 - Experience: adequate trucking, dedicated lanes for each concurrent operation, it's a traffic problem on both sides of the barrier, need for simple and predictable materials

I-710 Long-Life Asphalt with 55 hour Weekend Closures 2002

- Total corridor
 - Ports to connectors
 - 32 miles, 6 to 10 lanes
 - Estimated \$650M total cost
- Four phases:
 - 1 to 3, completed 2002 to 2013
 - 4 in future
- Traffic ranges
 - 57,000 ADT, 28% trucks
 - 187,000 ADT, 14% trucks
 - 230,000 ADT, 8% trucks



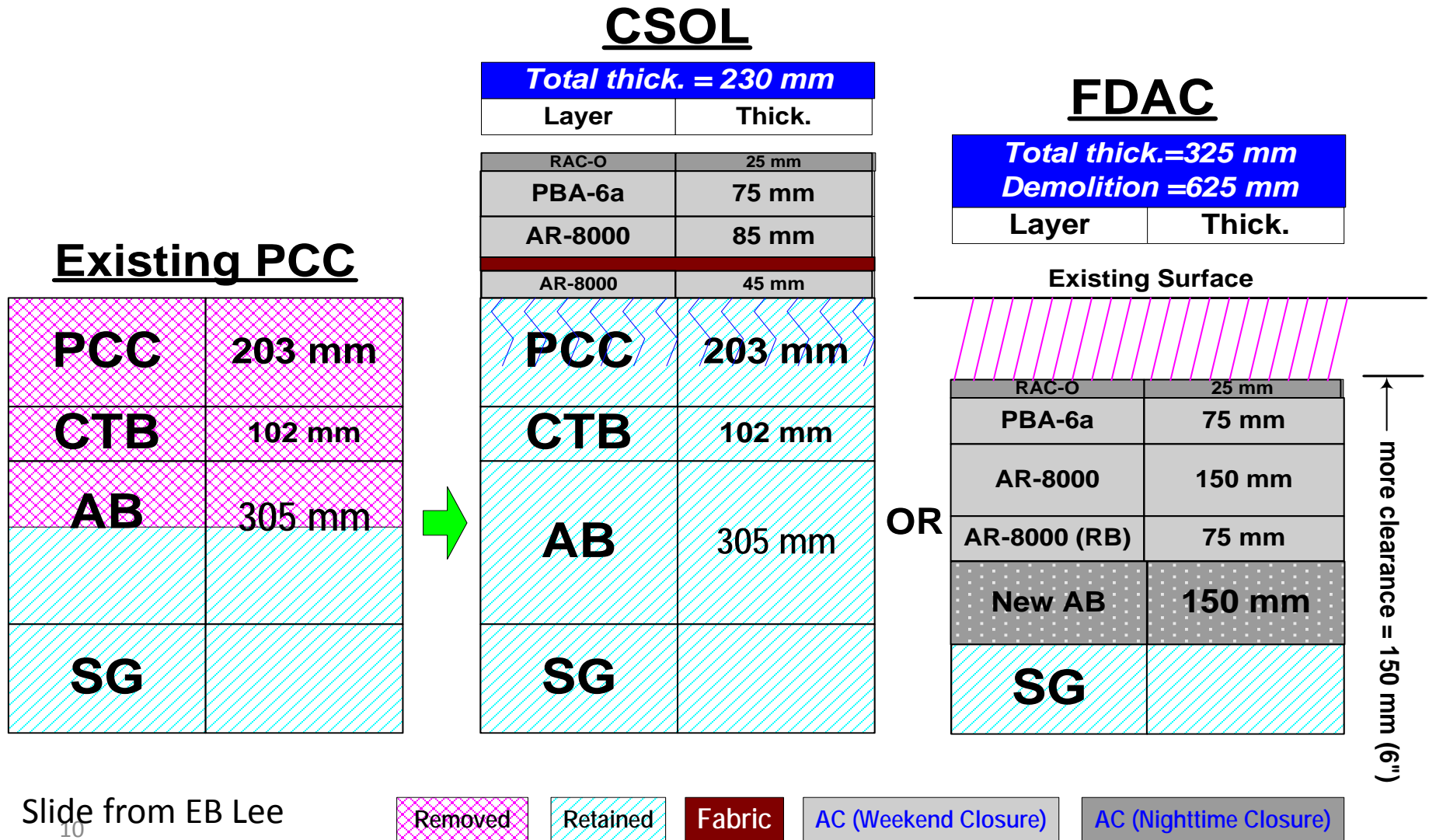
Before Construction

45 year old deteriorated PCC Pavement



AC Mix and Pavement Designs

Pavement Cross-section Changes



Reduce Thickness to Speed Full-Depth Construction Under Bridges

Traditional materials and ME design

535 mm thick (21 in.)

8 % air-voids

same mix design throughout

AR-4000 std binder

ME design using

- Improved compaction
- Stiffer binder
- Rich Bottom

300 mm thick (12 in.)

75 mm polymer 5% air-voids

150 mm AR-8000

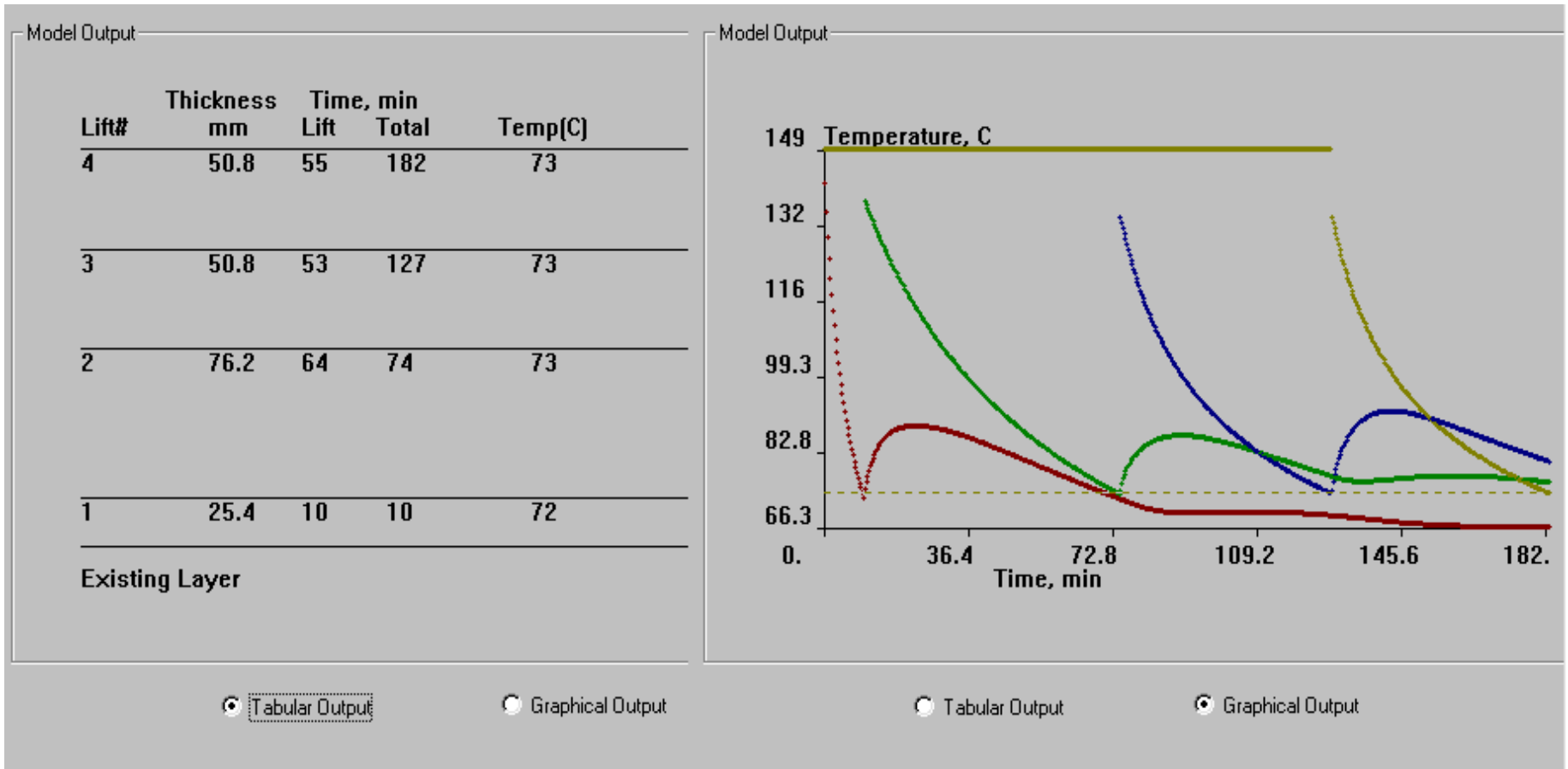
5% air-voids

75 mm AR-8000, 2% air-voids

+0.5% binder

Paving Sequences Set Up to Permit Sufficient Cooling Between Lifts

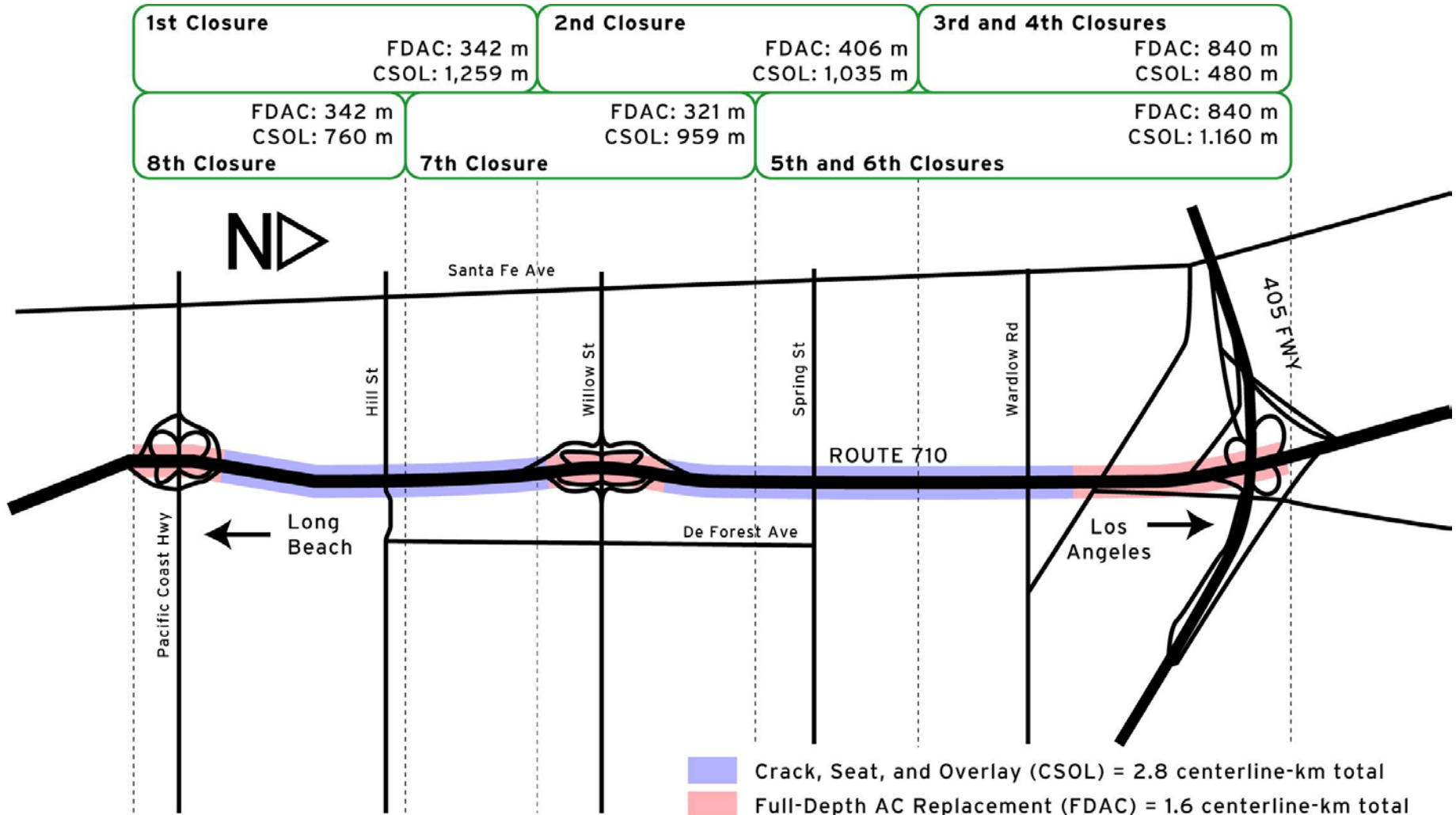
MultiCool Analysis Software sponsored to provide model



- Download www.ucprc.ucdavis.edu/SoftwarePage.aspx

Staged construction:

Full directional closures, concurrent demolition and paving, 2 to 3 simultaneous asphalt paving operations



Moveable concrete barrier to safely split traffic in each closure



Accelerated Rehabilitation Strategies (1/2)

- ❑ 55-hour Weekend Closures for Major Rehabilitation Works
 - Continuous operations Friday 10 pm to Monday 5 am
- ❑ Counter-flow Traffic
 - Upgrading of an outside shoulder to accommodate two-by-two traffic on temporary traffic roadbed
 - Traffic diversion through median crossovers
 - Moveable Concrete Barrier to counter flow traffic
- ❑ Incentives/Disincentives (Phase 1 example)
 - \$100K incentive per weekend if fewer than ten weekend closures
 - \$100K disincentive per weekend for more than ten weekend closures
 - Hourly disincentives if past Monday open time

Accelerated Rehabilitation Strategies (2/2)

□ Contractor's QA/QC and Pay Factor

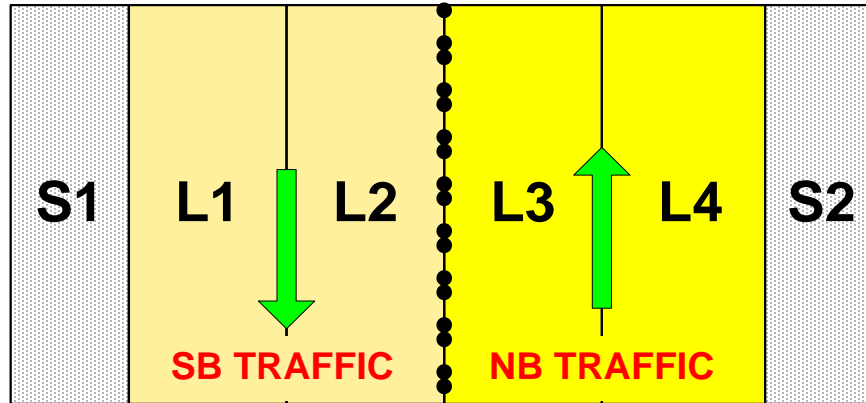
- Shear and fatigue test results for mix approval
- Field performance test results on asphalt content, gradation, and % of maximum theoretical density
- Quality pay factors for the three quality characteristics
- Maximum Obtainable Combined Pay Factor: 1.05
- Minimum Acceptable Combined Pay Factor: 0.90

□ Construction Work Zone Traffic Controls

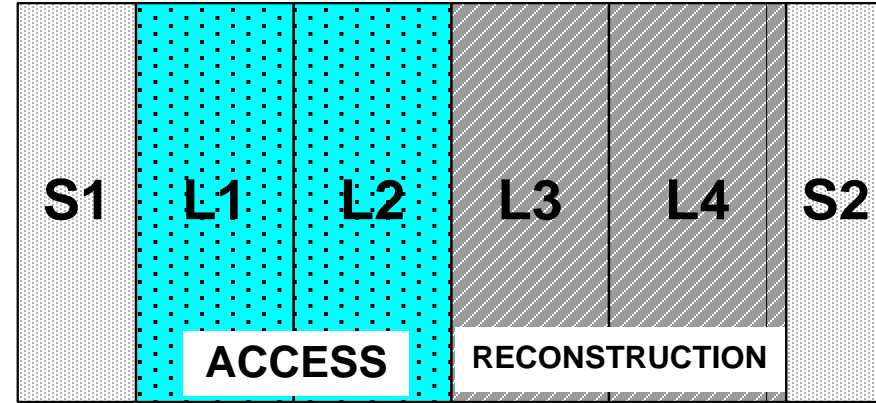
- Comprehensive Traffic Management Plan providing contractor construction access to ramps, and defining best closure times, lane closure schemes, required detours and alternative routes
- Extensive public awareness campaigns to inform the public of potential delay and alternative routes

Full Closure (Counter-flow Traffic)

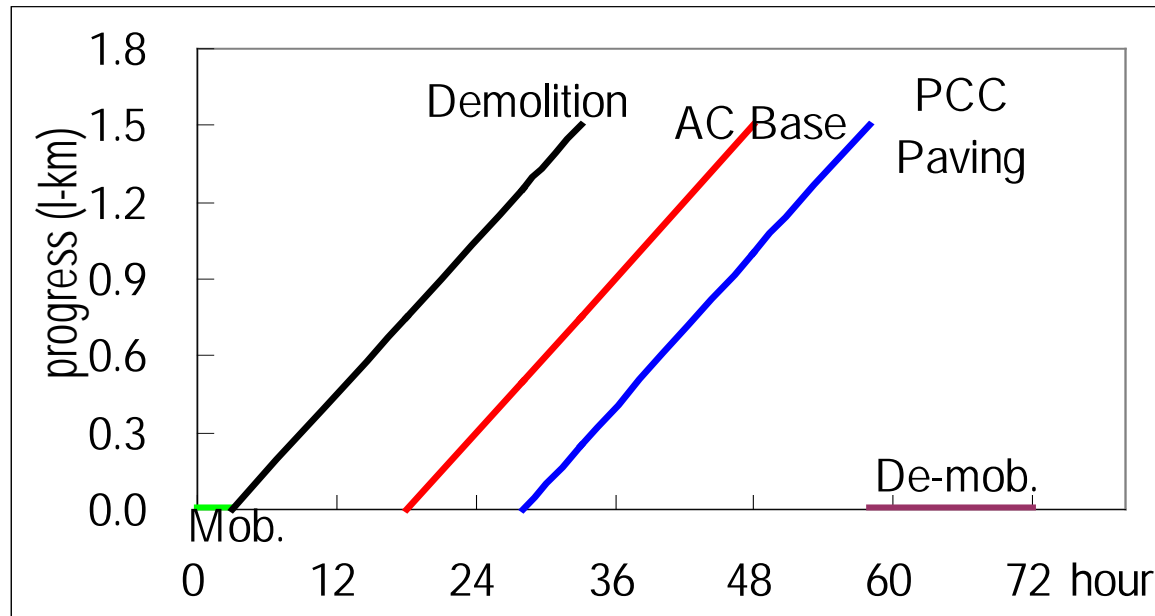
Concurrent operations: Every major operation gets its own access lane



Traffic Roadbed

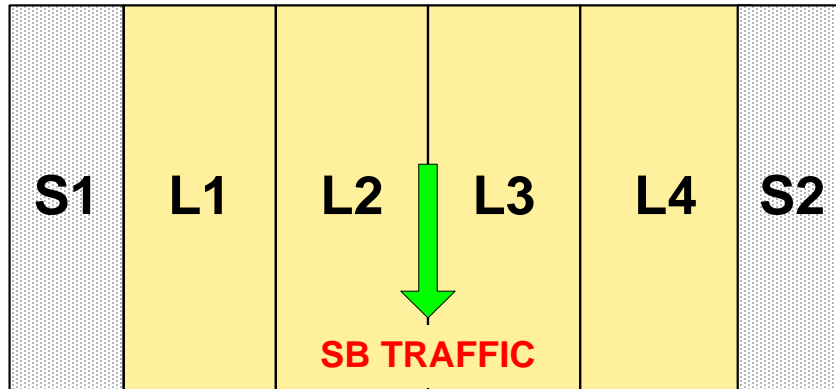


Construction Roadbed

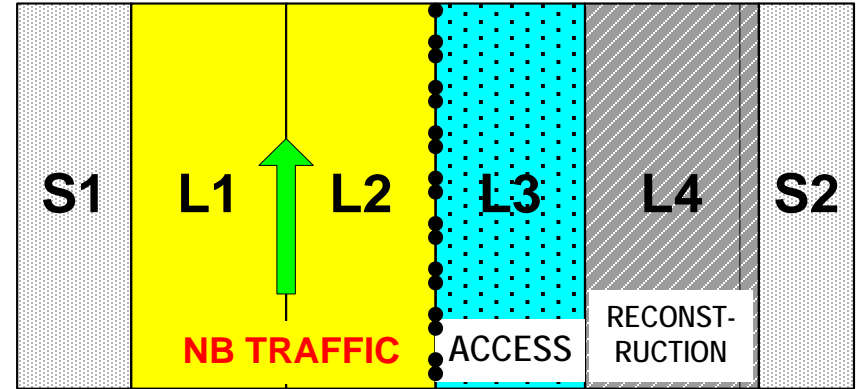


Half or Partial Closure

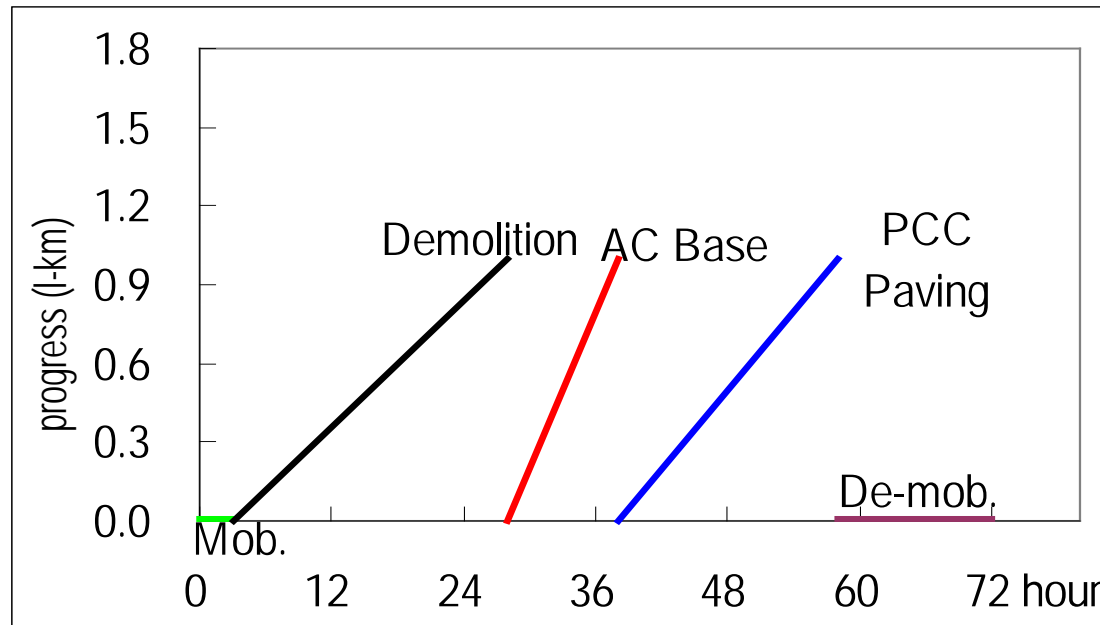
Sequential operations: Each operation has to wait to be able to use access lane



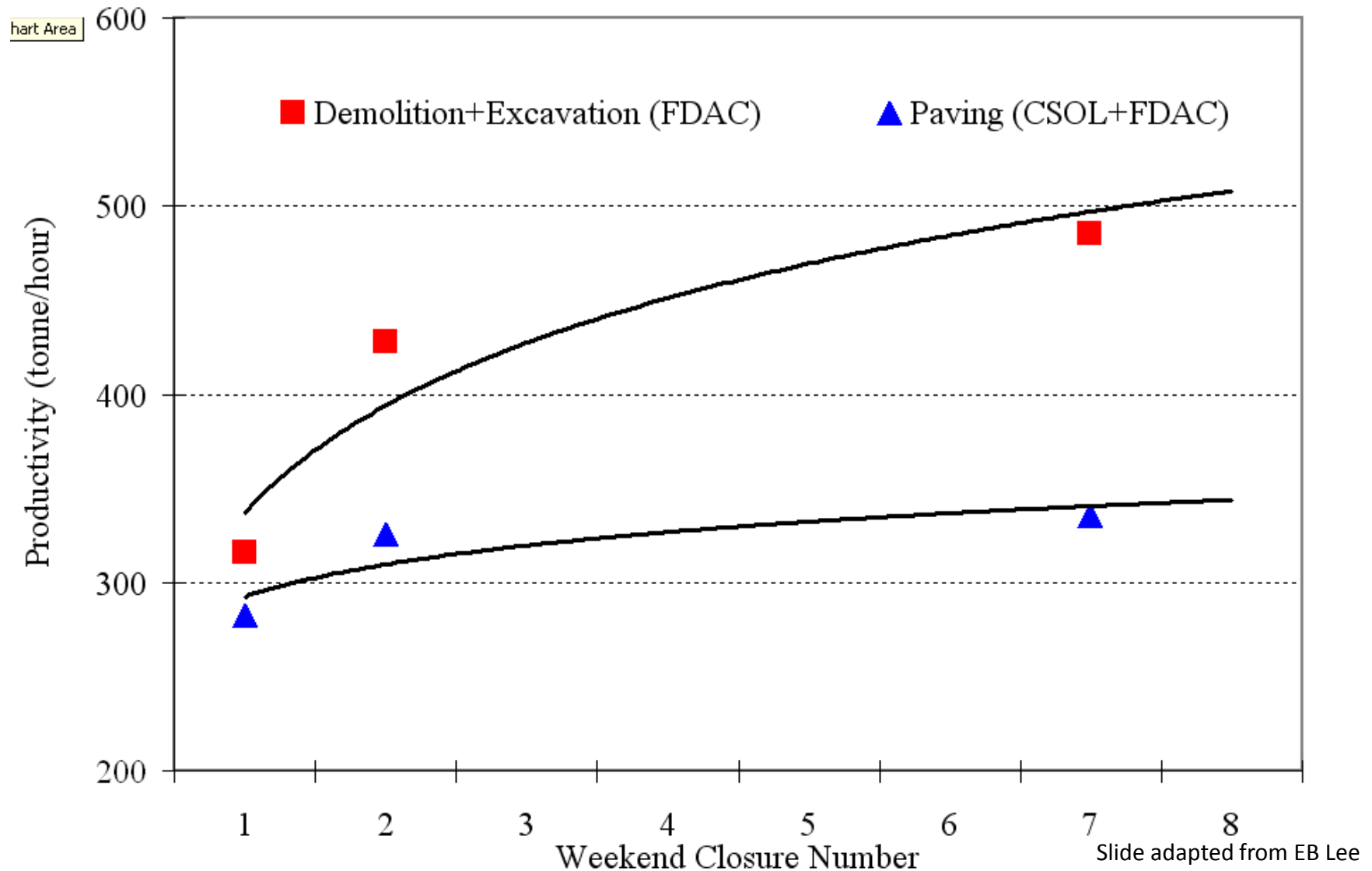
Traffic Roadbed



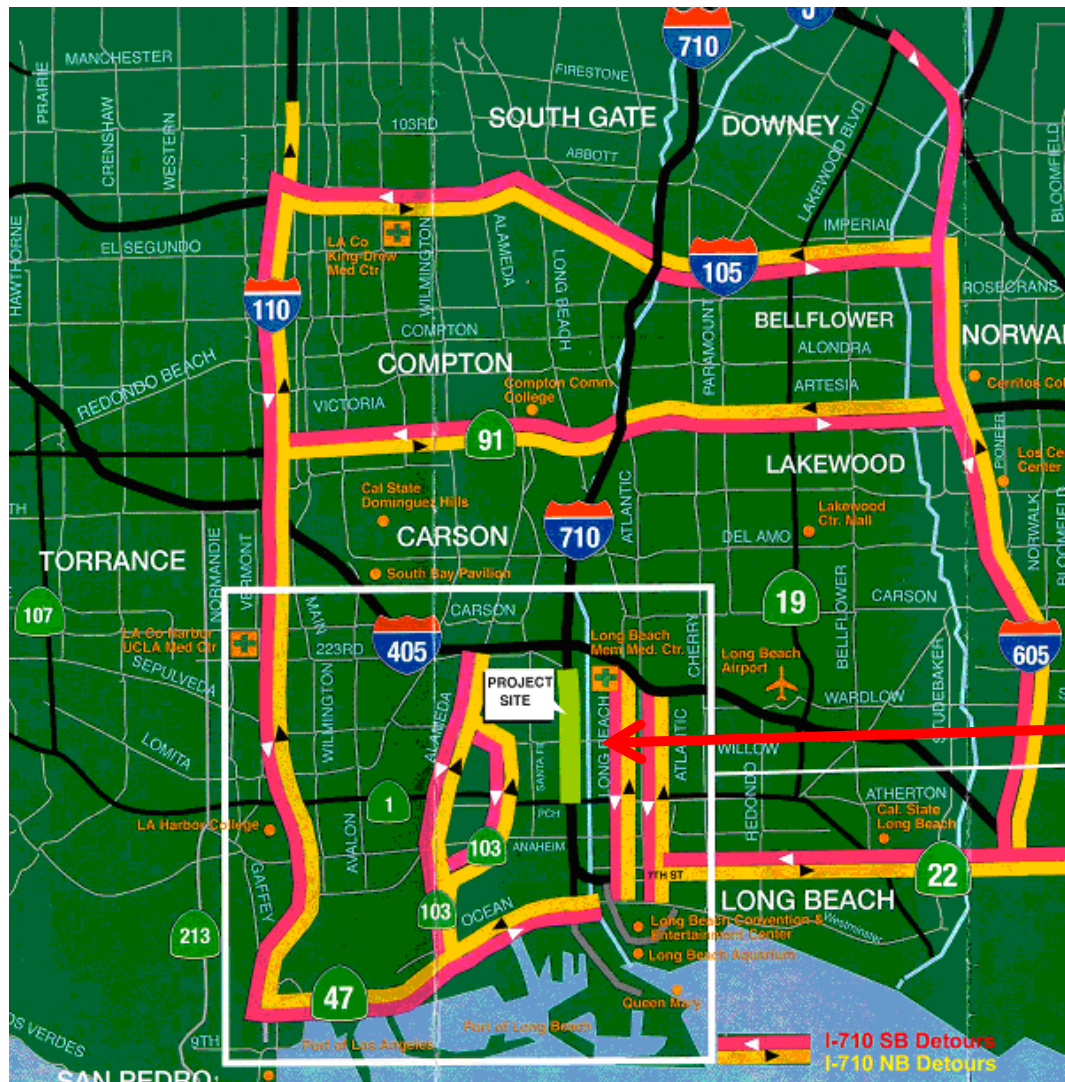
Construction Roadbed



Contractor's Learning Curve I-710 Phase 1



Negotiation with Local Government for Alternative Traffic Routes; Eliminate other construction in the area



Phase 1 Example of alternative routes and planning area

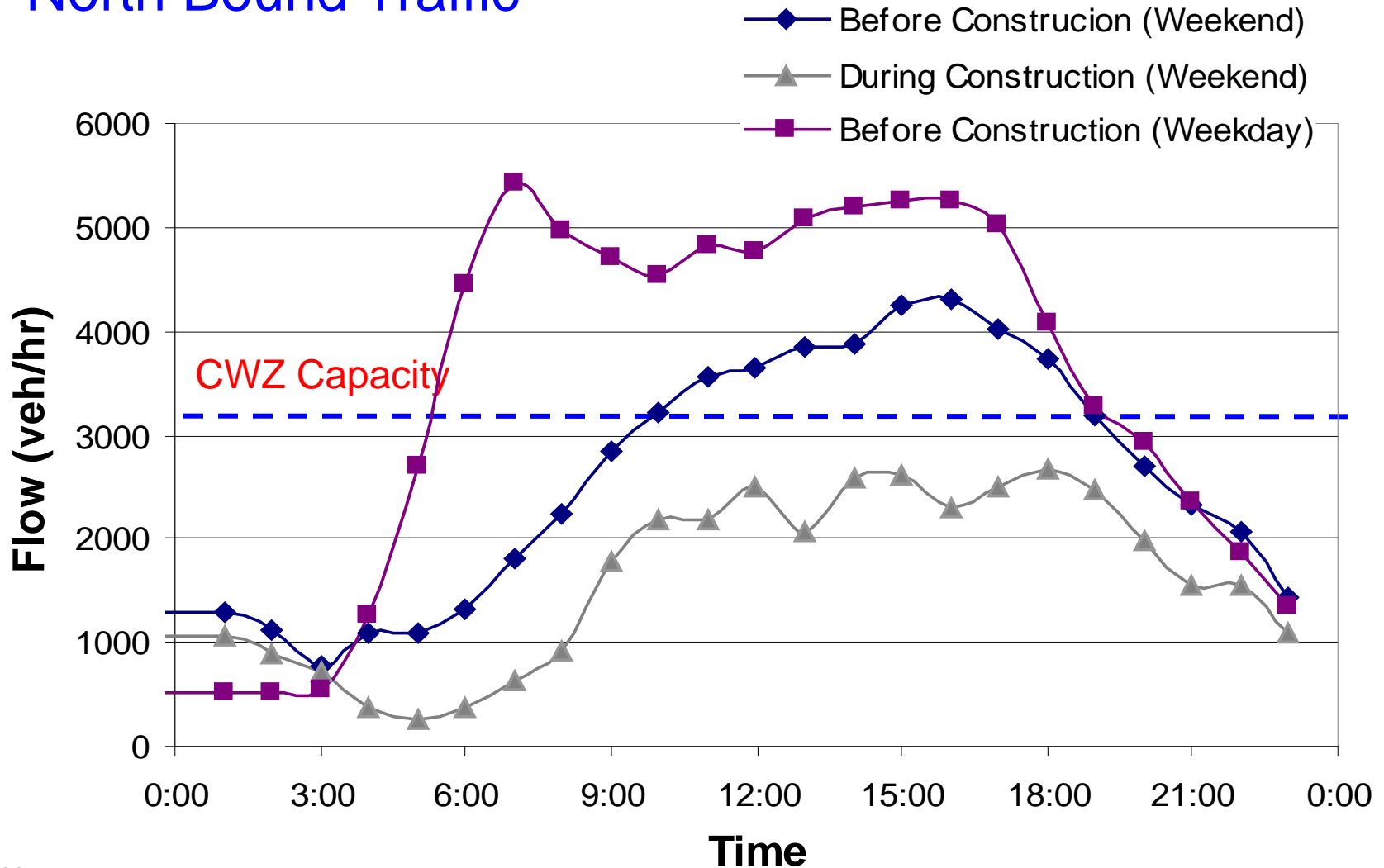
Construction site

Effectiveness of Traffic Management Plan Phase 1

Weekend Measurements		North Bound	South Bound
Before Construction	ADT (veh/day)	61,255	61,044
	Peak (veh/hr)	4,299	3,900
During Construction	ADT (veh/day)	38,667	35,544
	Peak (veh/hr)	2,733	3,498
Reduction	ADT	36.9%	41.7%
(%)	Peak	37.2%	35.8%
Peak Reduction Comparison	Simulation	31.2%	18.9%
	TMP	35.0%	45.0%

Phase 1 Construction Work Zone Traffic Flow Comparison

North Bound Traffic



After Construction

FDAC Section near PCH



Lessons Learned from Phase 1 (1/3)

- Software can help to standardize information and analyses for construction productivity and traffic delay
- RapidRehab (CA4PRS) software developed by UCPRC/Caltrans/industry
- Software database captures planning assumptions and data collected from field monitoring
- Software available through Caltrans and FHWA
www.dot.ca.gov/newtech/roadway/ca4prs/
www.fhwa.dot.gov/research/deployment/ca4prs.cfm

Lessons Learned from Phase 1 (2/3)

- Pre-bid conference should be mandatory
- For new performance-related test procedures
 - Work to reduce time required
 - Ensure tests and analyses done the same way
- Human resources “stretched” across multiple closures
 - maximum 3 to 5 successive closures with 1 or 2 in between
- Contractor should select closure locations
- Input from meteorologists is important for contractor
- Contingency planning is extremely important
 - materials, equipment, traffic, weather, accidents, work force

[Full table at www.ucprc.ucdavis.edu/PDF/UCPRC-SR-2008-04.pdf](http://www.ucprc.ucdavis.edu/PDF/UCPRC-SR-2008-04.pdf)

Lessons Learned from Phase 1 (3/3)

- Use of repeated weekend closures for similar types of operations led to noticeable productivity gains as well as learning effect
- Monetary Incentives proved to be effective in this fast-track project
 - Contractor earned \$200K incentive for early completion
- Pay factor effectively encouraged quality awareness and quality workmanship:
 - \$70K extra for meeting the minimum quality requirements
 - Some quality measures not met on early closures
- Monitoring to date indicates expected performance

[Detailed Lessons learned \(contractor and CT recommendations\)
Report at www.ucprc.ucdavis.edu/PDF/UCPRC-SR-2008-04.pdf](http://www.ucprc.ucdavis.edu/PDF/UCPRC-SR-2008-04.pdf)

More traffic lessons
learned on subsequent
asphalt and concrete
projects



Renewing...
INTERSTATE 710
To Last Longer & Ride Smoother

**LONG BEACH FREEWAY (I-710)
LONG LIFE PAVEMENT REHABILITATION PROJECT
FROM
FIRESTONE BOULEVARD
TO
ATLANTIC BOULEVARD**

10 Extended Weekend Closures
Friday, August 5 through October 2011

The graphic features a stylized map of California with a grey path representing Interstate 710. Two shields are shown: one large blue shield with "INTERSTATE 710" and one smaller red and blue shield with "INTERSTATE 710". The text "Renewing..." is in yellow, and "To Last Longer & Ride Smoother" is in white. The project details are in yellow and white text on a dark blue background.

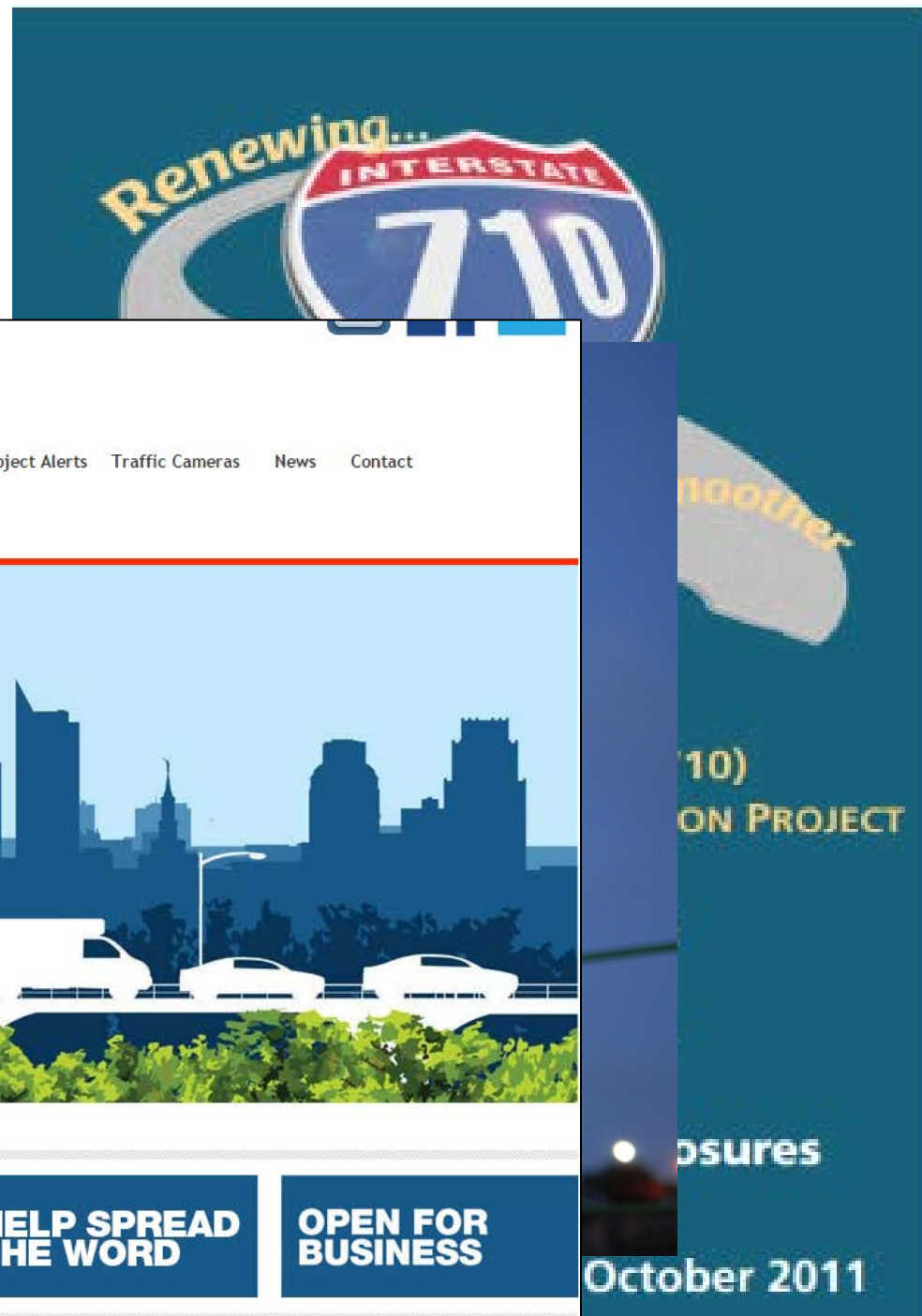
More traffic lessons
learned on subsequent
asphalt and concrete
projects



moother
10)
ON PROJECT
losures

Friday, August 5 through October 2011

More traffic lessons learned on subsequent asphalt and concrete projects



[Home](#) [About](#) [Current Stage Info](#) [Get Project Alerts](#) [Traffic Cameras](#) [News](#) [Contact](#)

**APRIL 22 -
JUNE 25
2014**



**PROJECT MAP
& SCHEDULE**

**ALTERNATE
ROUTES**

**HELP SPREAD
THE WORD**

**OPEN FOR
BUSINESS**

10) ON PROJECT

osures

October 2011

I-15 Devore Selection of Closure Type using CA4PRS

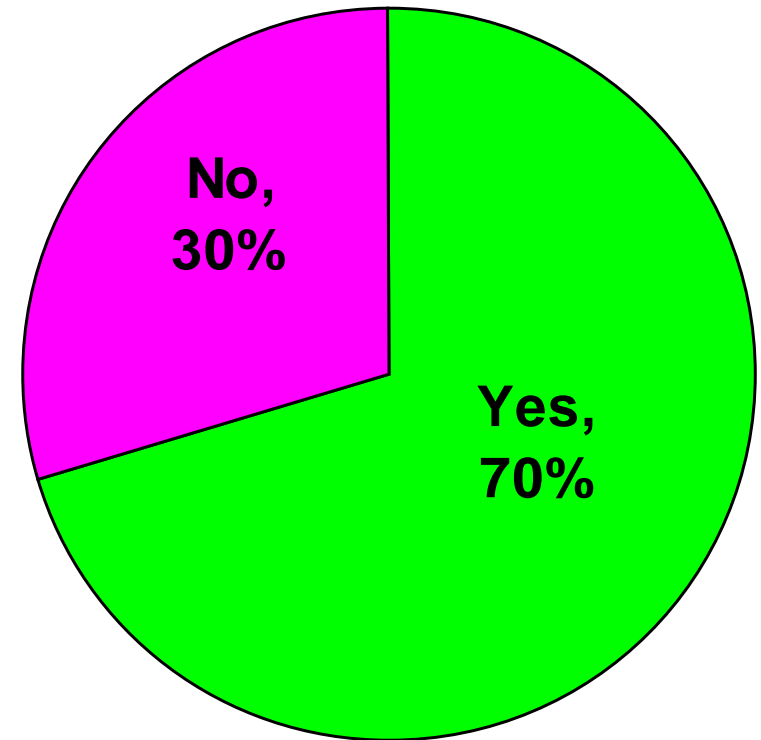
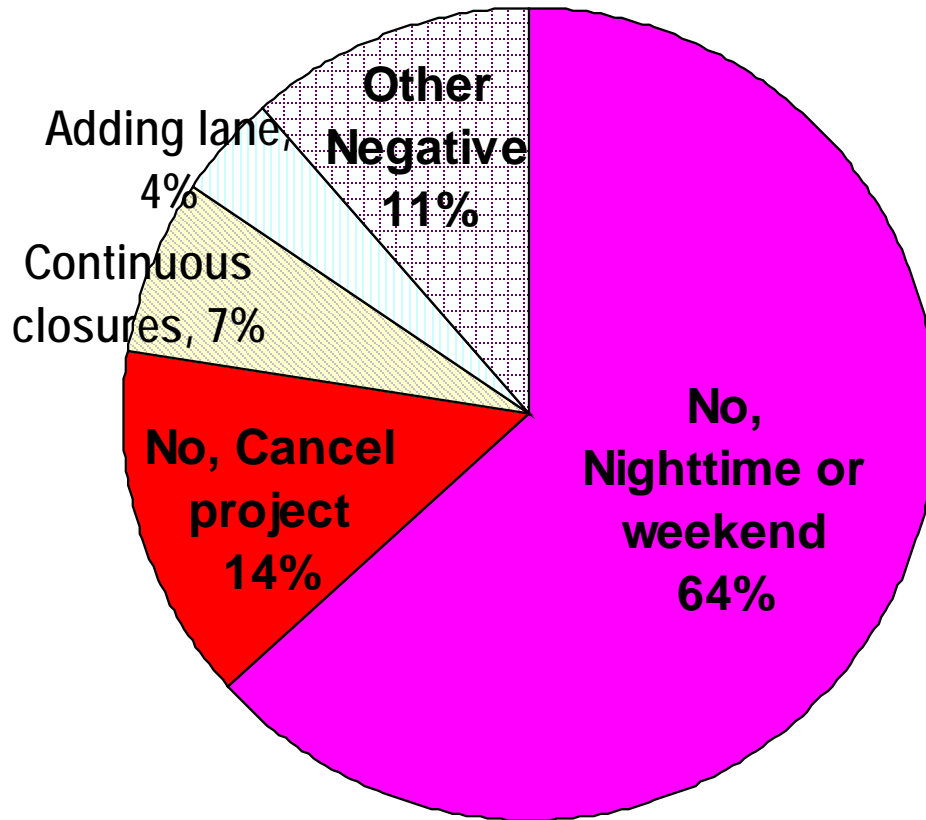
Construction Scenario	<i>Schedule Comparison</i>		Cost Comparison (\$M)			Max. Peak Delay (Min)
	Total Closures	Closure Hours	User Delay	Agency Cost	Total Cost	
1 Roadbed Continuous	<i>2</i>	<i>400</i>	<i>5.0</i>	<i>15.0</i>	<i>20.0</i>	80
72-Hour Weekday Continuous	<i>8</i>	<i>512</i>	<i>5.0</i>	<i>16.0</i>	<i>21.0</i>	50
55-Hour Weekend Continuous	<i>10</i>	<i>550</i>	<i>10.0</i>	<i>17.0</i>	<i>27.0</i>	80
10-Hour Night-time Closures	<i>220</i>	<i>2,200</i>	<i>7.0</i>	<i>21.0</i>	<i>28.0</i>	30

I-15 Devore Web-Surveys

Public Perception Changes

Before- construction

After-construction



Do you support 72-h (3-weekday) Weekday closures?

Do you support future "Rapid-Rehab" projects?

Lessons Learned: Traffic Management

- Consider contractor recommendations for staging
- More money spent for early finish
 - Fix 50 bridge rehab from \$17.3M to \$24.3M
 - Contractor bonuses (\$150k/day in continuous closures) and local government arrangements
- Local government arrangements
 - Change traffic light timing, restriping of lanes and intersection reconfigurations
 - Increased transit capacity
 - More police officers on parallel routes and at intersections
 - Arrangements with emergency services to maintain access
 - Arrangements with major employers for flexible hours, telecommuting, transit incentives, communication

Lessons Learned: Traffic Management

- Contractor did hour by hour scheduling
- Central traffic command during operations
 - Continuous monitoring and messaging
 - Daily teleconferences (all stakeholders, contractor, Caltrans, employers, public safety)
 - 24 hour look ahead, progress
 - Then given to media
- Media
 - “scare the heck out of everybody”
 - “the media is your friend” (with one exception)

Lessons Learned: Traffic Management

Councilmember Steve Hansen

- April 23, 2014 · Sacramento, CA ·
- Many of you have contacted me regarding the ongoing helicopter activity related to [#fix50](#) and the negative impact that they are having on the surrounding neighborhoods. Yesterday, at my request, the [Sacramento Police Department](#) contacted the media to ask them to not flight as early or to potentially share video. At this point, we've also asked Congresswoman Matsui's office to assist through the FAA to change this behavior. You can file noise complaints through 311 or feel free to email me (shansen@cityofsacramento.org) while we continue to work on this.

rans,

Questions?

Sully-Miller photo

CLOSURES



Alternate Northbound Routes Alternate Southbound Routes

10 WEEKEND CLOSURES

(Subject to change)

Weekend 1:	Friday - Mon.	Aug. 5 - 8
Weekend 2:	Friday - Mon.	Aug. 12 - 15
Weekend 3:	Friday - Mon.	Aug. 19 - 22
Weekend 4:	Friday - Mon.	Aug. 26 - 29
Weekend 5:	Friday - Mon.	Sept. 9 - 12
Weekend 6:	Friday - Mon.	Sept. 16 - 19
Weekend 7:	Friday - Mon.	Sept. 23 - 26
Weekend 8:	Friday - Mon.	Sept. 30 - Oct. 3
Weekend 9:	Friday - Mon.	Oct. 7 - 10
Weekend 10:	Friday - Mon.	Oct. 14 - 17

