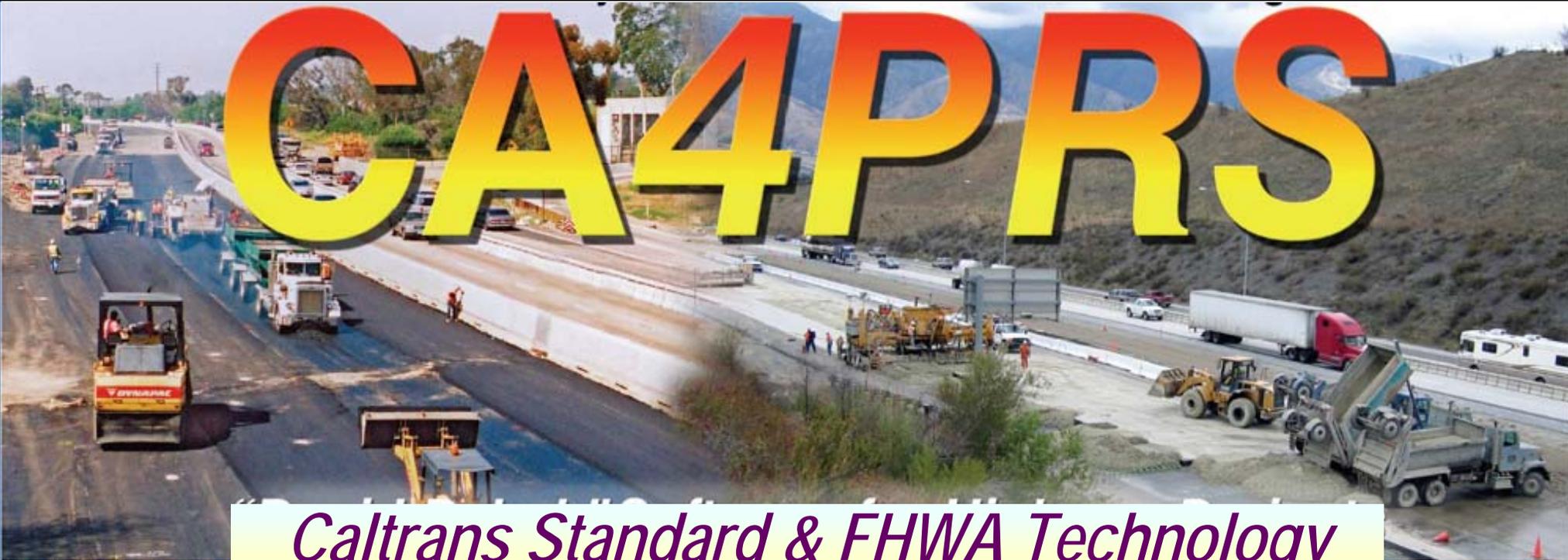


# CA4PRS



*Caltrans Standard & FHWA Technology*

## Construction Analysis for Pavement Rehabilitation Strategies (*Caltrans LMS #:100181*)

### 3-Day Hands-on Training Workshop for District Engineers

**Instructor: Dr. E.B. Lee, PE, PMP**

**University of California at Berkeley  
Institute of Transportation Studies**

# Welcome to CA4PRS Training!

---

- Self-introduction
  - Name, Unit, Career
- CD and Free-License for DOT
  - CD (CA4PRS & LCCA), User Manual, Brochures
- Course Binder
  - Handout and Screenshots
- Support: E.B. Lee at UC Berkeley
  - 510)665-3637; [eblee@berkeley.edu](mailto:eblee@berkeley.edu)
  - Google CA4PRS

# 3-Day Course Schedule

- **Session 1: Introduction and Overview**
  - Highway Rehabilitation and Tools
  - CA4PRS Overview and Modeling
- **Session 2: Construction Schedule** *DAY 1*
  - Concrete Rehabilitation Strategies: PCCP
  - Closure-hours and Schedule Sensitivity
  - AC Rehabilitation Strategies: MACO
- **Session 3: Work-zone Traffic** *DAY 2*
  - Delay Analysis: Demand-Capacity Model
  - Lane Closure Practice: Schedule-Traffic
  - Simulation Models for TMP
- **Session 4: Cost and Integration** *DAY 3*
  - Concrete Rehabilitation Strategies
  - Interaction with Life-cycle Cost Analysis

---

# **INTRODUCTION**

## **Highway Construction & CA4PRS (Tool)**

# Highway Infrastructure Sustainability

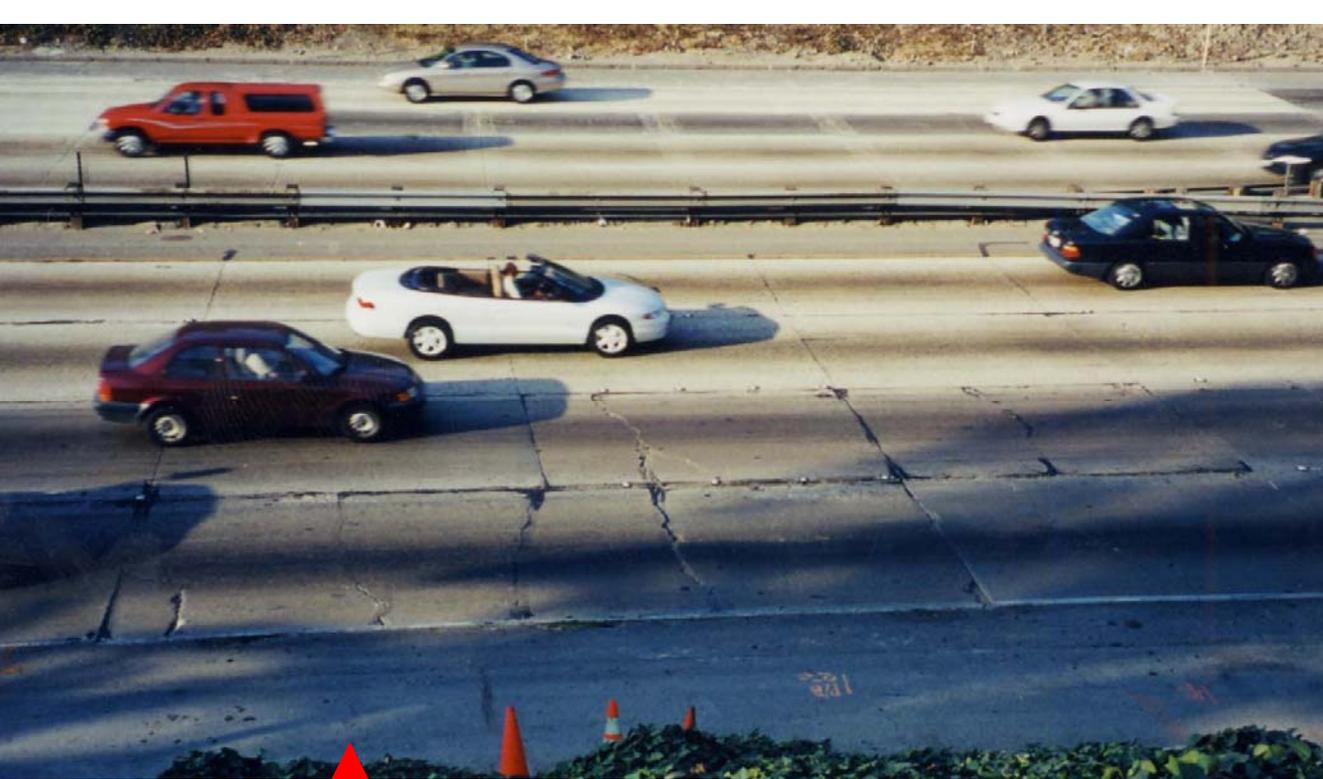
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- **Highways Need Renewal**

- Interstates & state highways reached their design life
- DOTs shift their focus to highway sustainability (4-R)
- 1,400 Caltrans Projects ('00-'08): 50% are M&R
- Combine with Capacity increase (Widening)
- More work-zones and lane closure

- **Adverse WZ Impacts**

- Impacts travelers, communities, businesses
- Mobility: Responsible for 12% of delay
- Safety: 40,000 injuries, 1028 fatalities in CWZ (2003)
- Improve WZ Mobility and Enhance Safety



Traffic Congestion  
through Construction  
Work-zone



Pavements  
Deterioration  
Needs  
Renewal



# Highway Construction WZ Traffic

---

- **Challenges: Competing Objectives**
  - Longer-lasting Design
  - Faster Construction delivery
  - Tolerable WZ Traffic delays
  - Agency Budget constraint
  - *Need **Integration and Tools***
- **Federal Work-zone Rule: 23 CFR Part 630 Subpart J**
  - Improve WZ Safety and Mobility (Oct 2007)
  - Develop agency-level policy for statewide process
    - *Caltrans: Deputy Directive (DD-60R; Sep 2007)*
  - Implement project-level standard procedures
    - WZ impact assessment: Regional network
    - TMP strategies in PS&E
    - Public outreach with stakeholders

# CA4PRS Development Overview

- **Decision-support tool for Practitioners**
  - Help agencies and contractors to select more efficient and economic highway construction strategies
  - Estimate Construction Schedule, analyze Traffic Delay, and compare Agency Cost
- **Development and Implementation**
  - FHWA pooled fund for SPTC (CA, FL, MN, TX, WA), developed by UC Berkeley ITS (since 1998: \$2M)
  - Caltrans 'Standard' and FHWA endorsed 'Technology'
  - FHWA/AASHTO Free-group License for 50 DOTs
- **Awards and Recognition**
  - 2007 International Road Federation (IRF)



**CA4PRS 2007 International Road Federation Award Ceremony (March 20, 2008)**



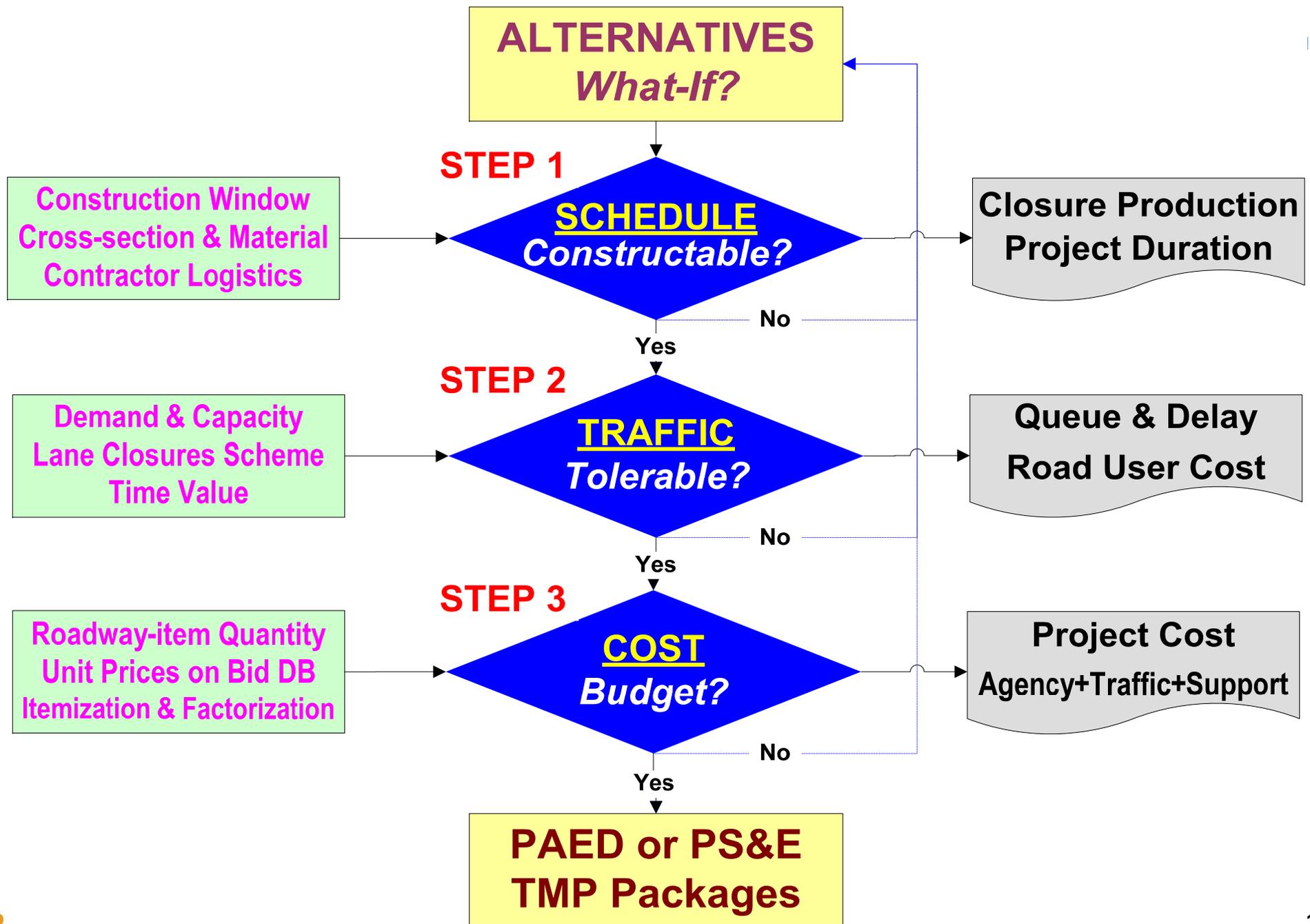
The Director (Mr. Kempton) Emphasized to Implement CA4PRS on more (All) Caltrans Projects.



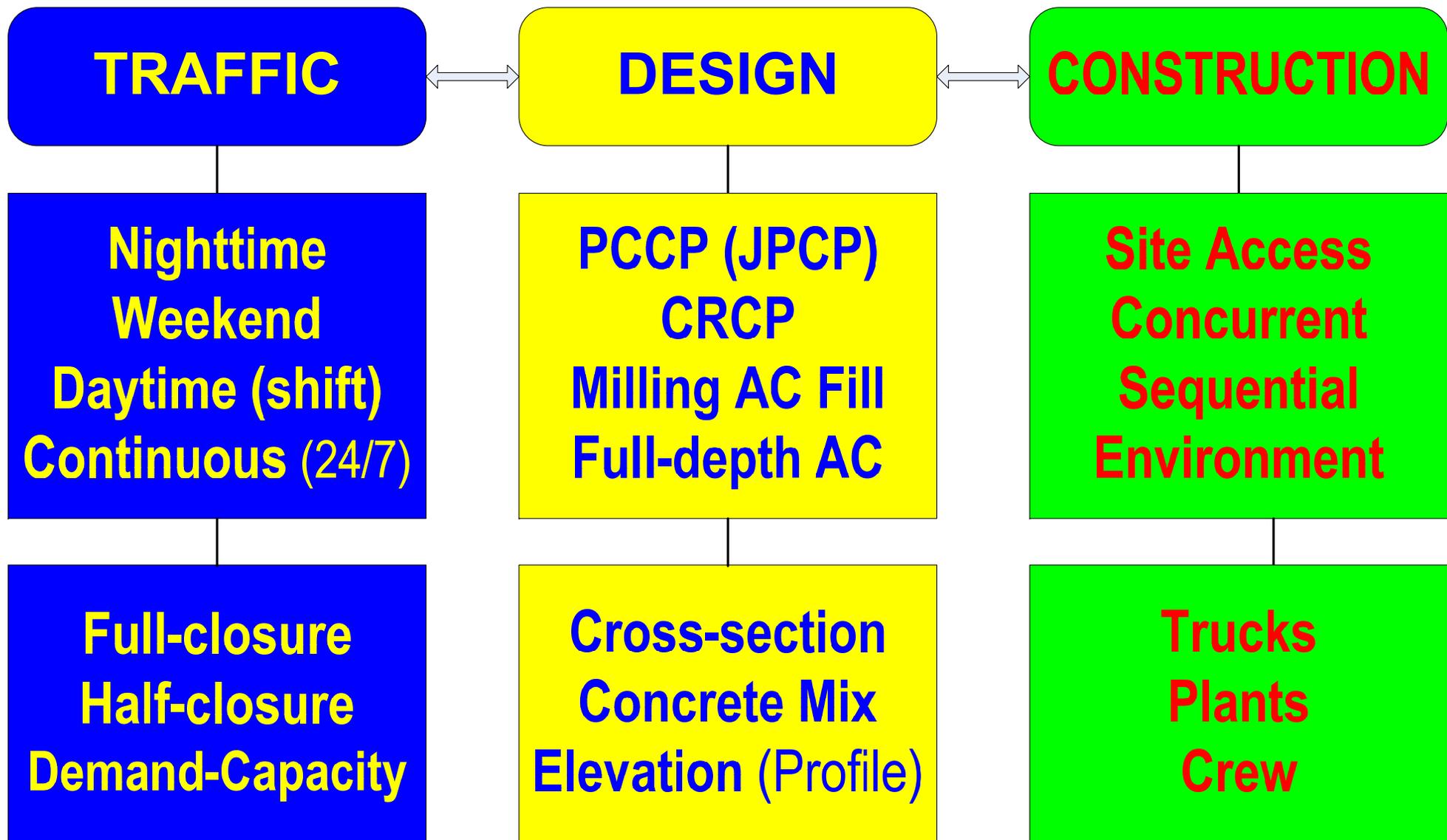
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# CA4PRS Modeling

# CA4PRS Process Framework



# CA4PRS Alternatives Comparison



# Concrete Pavement Cross-section

CONCRETE	205mm (8")
CTB	102mm (4")
AB	305mm (12")
SG	



CONCRETE	205mm (8")
CTB	102mm (4")
AB	305mm (12")
SG	

OR

CONCRETE	305mm (12")
BASE	152mm (6")
AB	152mm (6")
SG	

(a) Existing Concrete Pavement

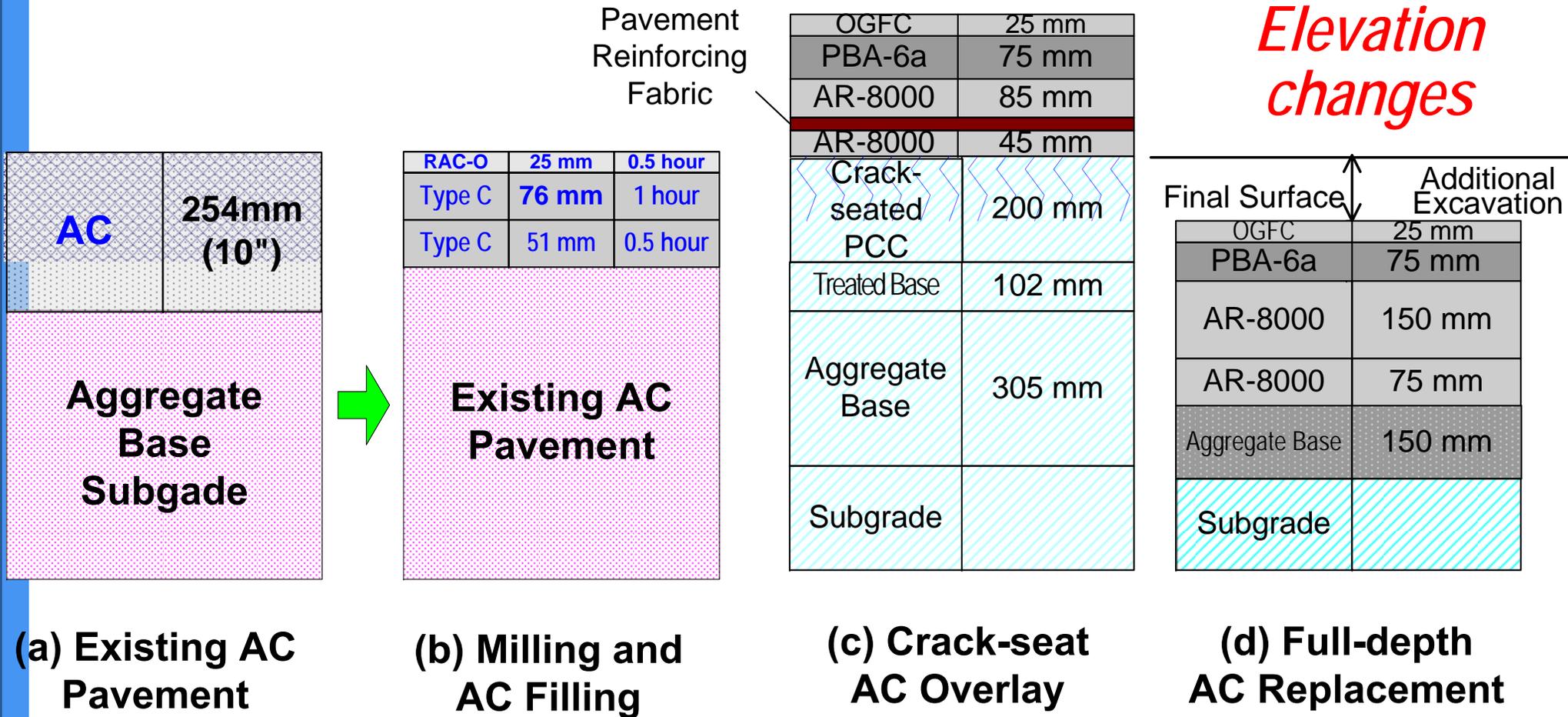
(b) Concrete Slab Replacement

(c) Concrete Slab & Base Reconstruction

*CA4PRS Compares Cross-section Change Alternatives from SCHEDULE-TRAFFIC-COST Perspective, as the baseline of LCCA.*

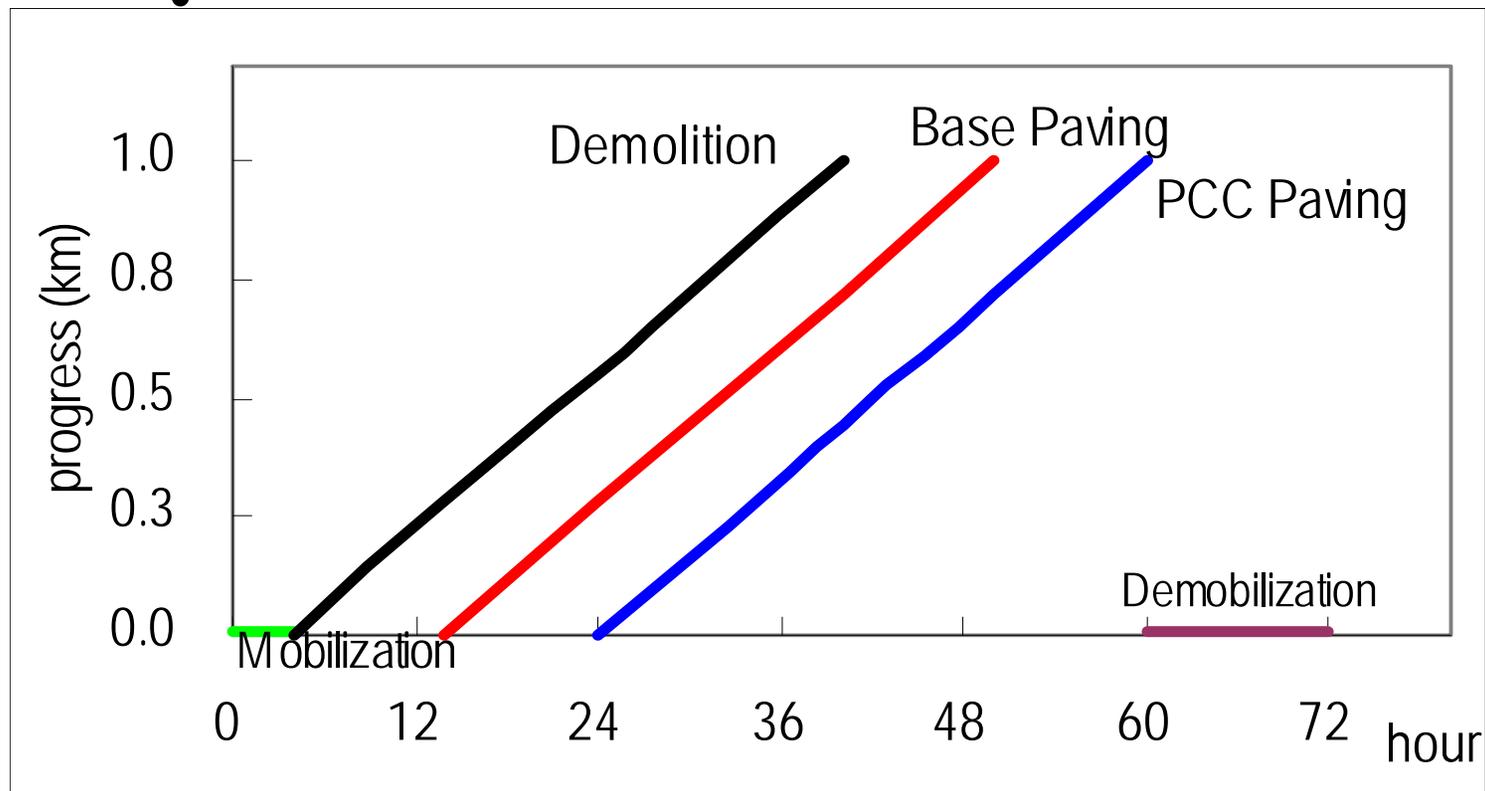
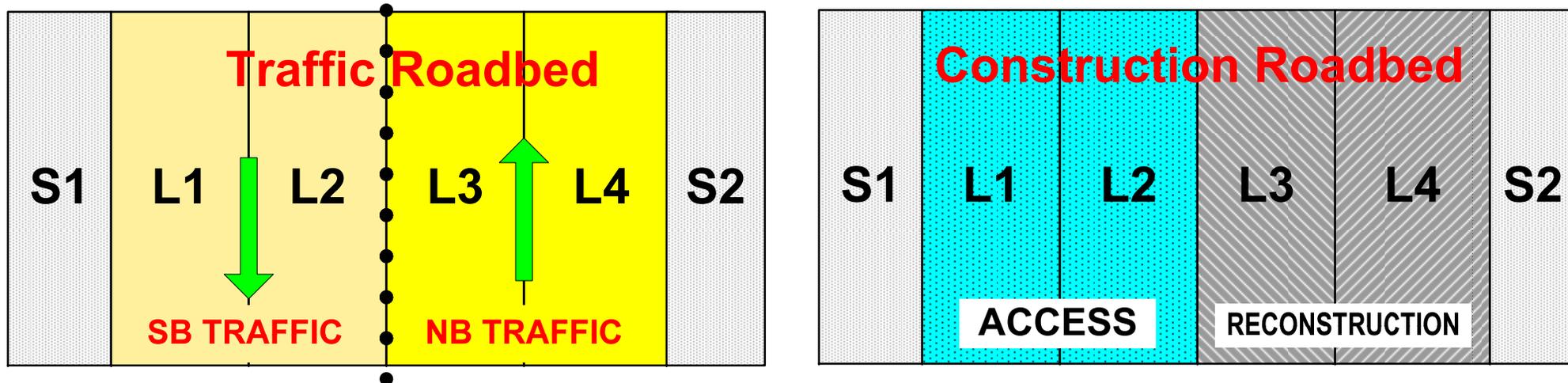
# Asphalt (AC) Pavement Cross-section

## Schedule-Traffic-Cost Comparison



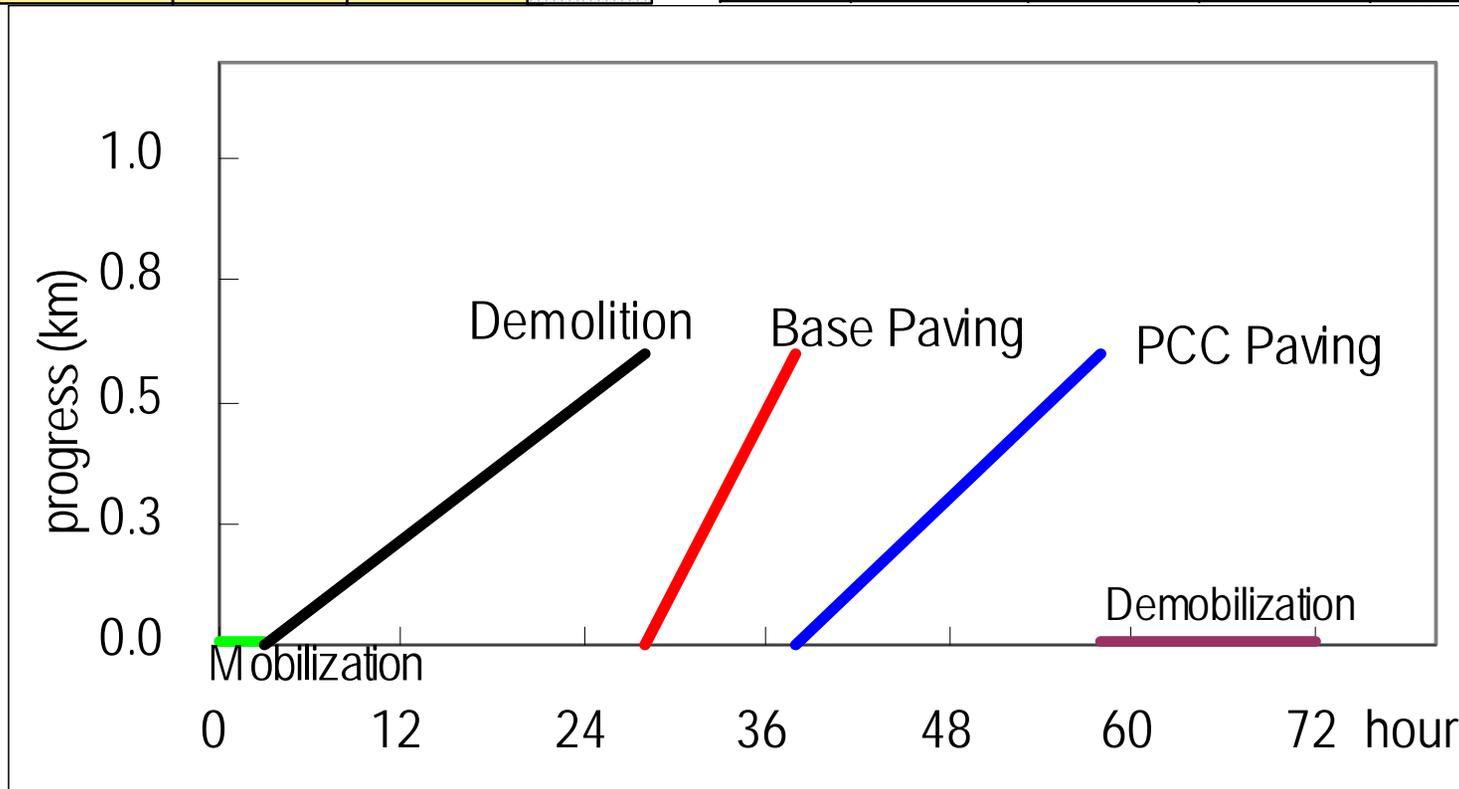
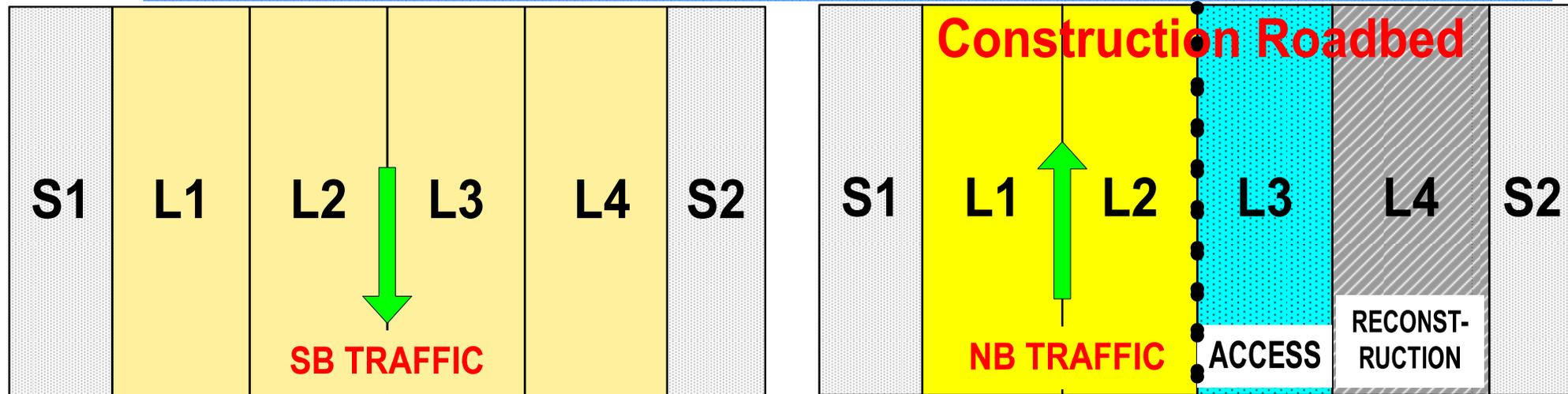
# Closure $\Leftrightarrow$ Access $\Leftrightarrow$ Production

## Full Closure for Concurrent Method



# Closure $\Leftrightarrow$ Access $\Leftrightarrow$ Production

## Half Closure for Sequential Method



# Constructability: Demolition Methods, Loading-cycle, Hauling-Trucks

## PCC Slab Saw-cut & Lift Method



## Packing (Hauling) Efficiency



## PCC Slab-Cracking & Excavation Method



## AC Milling (Clod-plane) Method



# Constructability: Mix-types, Discharging-cycle, Delivery-Trucks

**FSHCC: Ready-mixer Truck**



**JPCP (RSC): End-dump Truck**



**CRCP: End-dump Truck to Pump**



**HMA: Semi-bottom Truck (Windrow)**



---

# Implementation Projects

# CA4PRS Implementation Projects

**I-15 Devore Project  
2004**

**I-10 II (LA) Project  
(PS&E) 2010**

**I-10 Pomona Project  
1999**

**I-15 Ontario Project  
(PS&E) 2009**

**I-710 II (LA) Project  
(bid) 2008**

**SR-91 Riverside Project  
(PAED) 2015**

**I-710 Long Beach Project  
2003**

**D4: I-880 Oakland, I-80 Vallejo,  
I-280 San Jose, US-101 San Jose**  
**Use by other sponsoring DOTs**  
**- I-5 Seattle (WA), PCC**  
**- I-494 St. Paul (MN), AC**

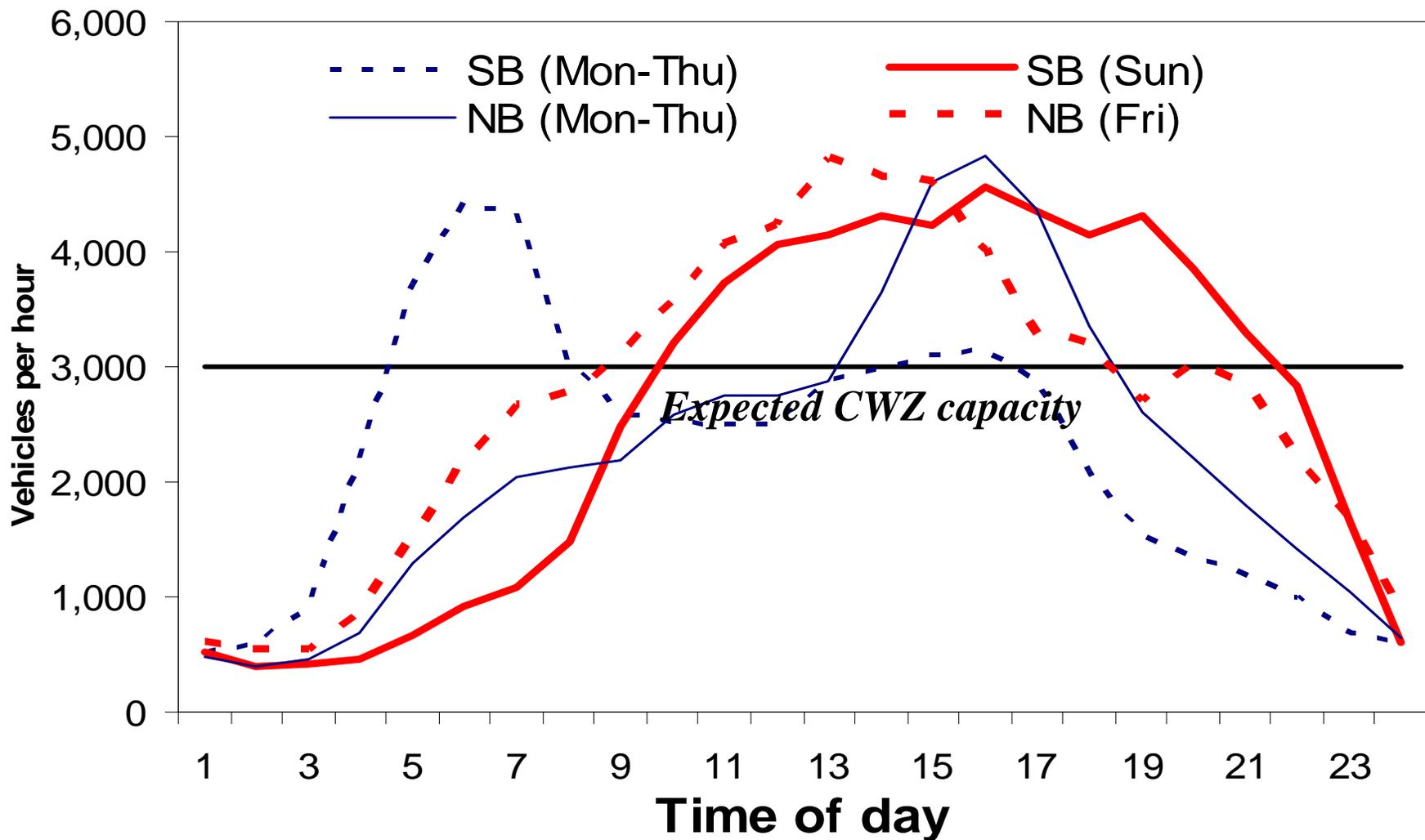


## D8 I-15 Devore (3 mile) PCC Project (24/7), 2004



# I-15 Devore Daily Traffic Patterns

- Approximately 120,000 ADT (10% trucks)
- Weekdays Commuters + Weekend Leisure



# I-15 Devore Preconstruction Analysis with CA4PRS: Schedule-Traffic-Cost

Construction Scenario	<i>Schedule Comparison</i>		Cost Comparison (\$M)			Max. Peak Delay (Min)
	Total Closures	Closure Hours	User Delay	Agency Cost	Total Cost	
One Roadbed Continuous (24/7)	2	400	5.0	15.0	20.0	80
72-Hour Weekday Continuous	8	512	5.0	16.0	21.0	50
55-Hour Weekend Continuous	14	770	14.0	17.0	31.0	80
9-Hour Night-time Closures	220	2,200	7.0	21.0	28.0	30

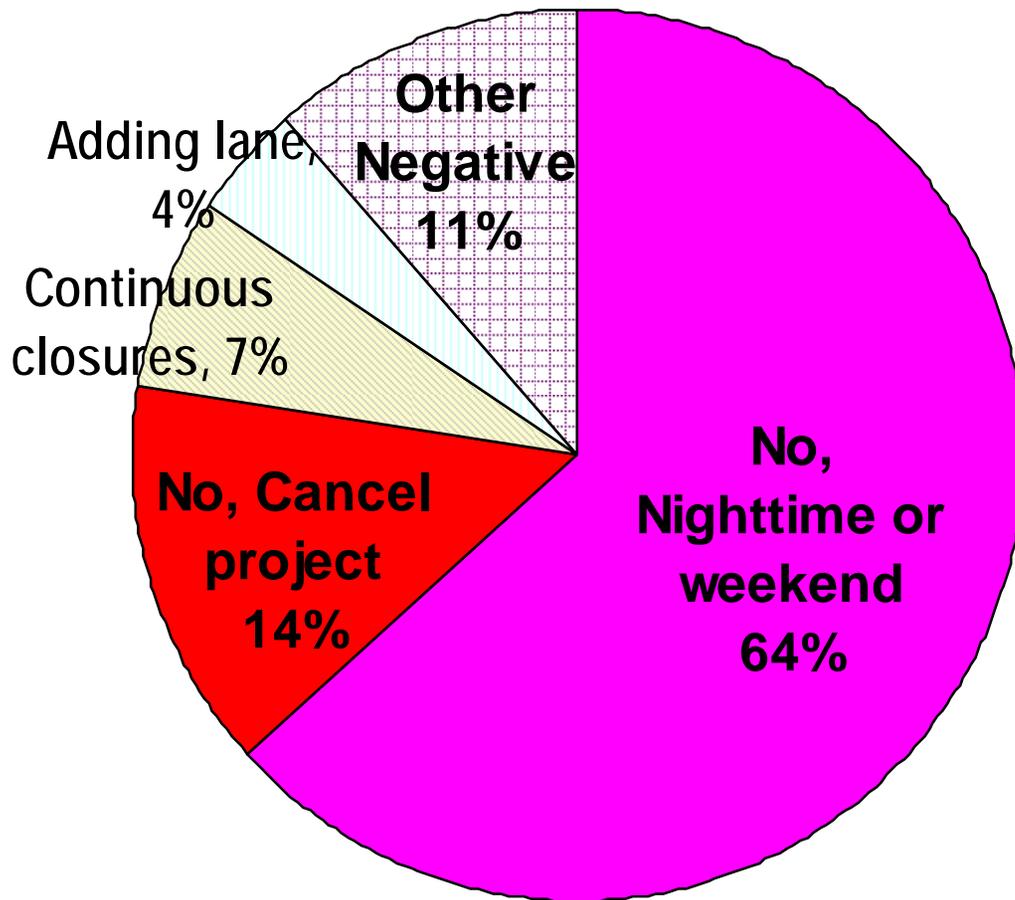
Using CA4PRS on I-15 Devore, "Rapid Rehab (24/7)", saved \$6M agency cost and \$2M road user cost, compared to nighttime closures.

# I-15 Devore Web-Surveys

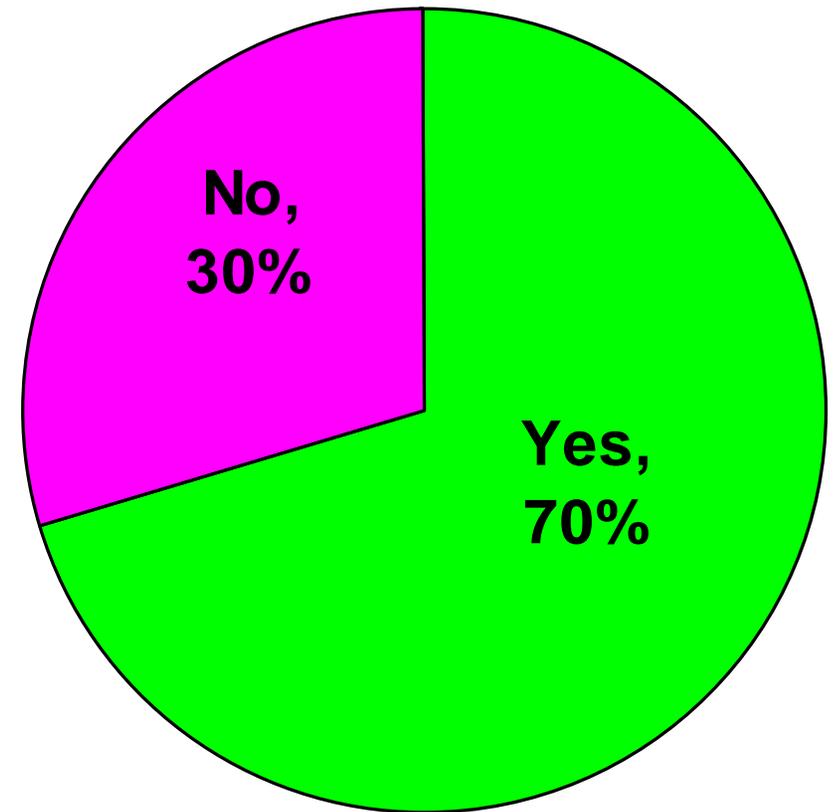
## Public Perception Changes

**Before- construction**

**After-construction**



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



**Do you support future "Rapid-Rehab" projects?**

# CA4PRS Implementation in Project Life Cycle

---

- Planning stage: PSSR and PA&ED
  - Project prioritization: **Value Engineering and LCCA**
  - Project scoping and alternatives evaluation
- Design stage: PS&E and TMP package
  - Construction schedule: **Working-days estimate**
  - Construction staging-plan and Constructability check
  - Work-zone analysis: TMP and **lane requirement charts**
  - Contracting methods: A+B, Incentives/Disincentives
- Construction stage: Contractor's work plans
  - Public information (media) and outreach strategies
  - Validate contractor's work plan
  - Evaluate contractor's request of change orders

# CA4PRS Training and Continuous Enhancement

- **Windows PC-based Stand-alone Application**
  - MS ACCESS database and VB6 for user-interfaces
- **3-day Hands-on user training workshops**
  - About 50 trainings (900 engineers): Caltrans +10 DOTs
  - Online (self-paced) training course in development
- **Enhancement roadmap (current version is 2.0)**
  - Version 1.0 and 1.5: Schedule module for Rehab
  - Version 2.0: Work-zone Traffic module (V2.1 for Cost)
  - .....
  - Version 2.5: Precast panel replacement (2009)
  - Version 3.0: Roadway widening module (2009)
  - Version 3.5: Interchange & Bridge replacements (2010)
  - Version 4.0: Interaction with LCCA – Realcost (2011)

---

# **Constructability References**

# Scenarios for Hands-on Training

---

- Copy screenshots for inputs: course-binder
- PCCP (JPCP): I-15 Devore Project
  - 72-hour (3-D) weekday vs. 55-hour weekend closure
  - 12" full-depth PCC vs. 8" PCC slab replacement
  - Full closure (Concurrent) vs Half closure (Sequential)
  - 9-hour Nighttime closure => 8-hour => 7-hour closures
  - Deterministic vs. Probabilistic approach
- CRCP: I-35 Austin Project
- CSOL and FDAC: I-710 Long Beach Project
- MACO: I-15 Mountain Path Project
- Traffic (RUC): I-15 Devore and PeMS
- Cost: I-15 Devore Nighttime vs Extended closures

# AC Cooling-time Control with Multicool

**MultiCool Data**

Construction Start Date: 7/17/2003

Latitude (Deg North): 40

Existing Surface

Material Type: PCCP

Moisture Content: Dry

Moisture State: Unfrozen

Surface Temperature (C): 21.1

Mix Specifications

Mix Type: Dense Graded

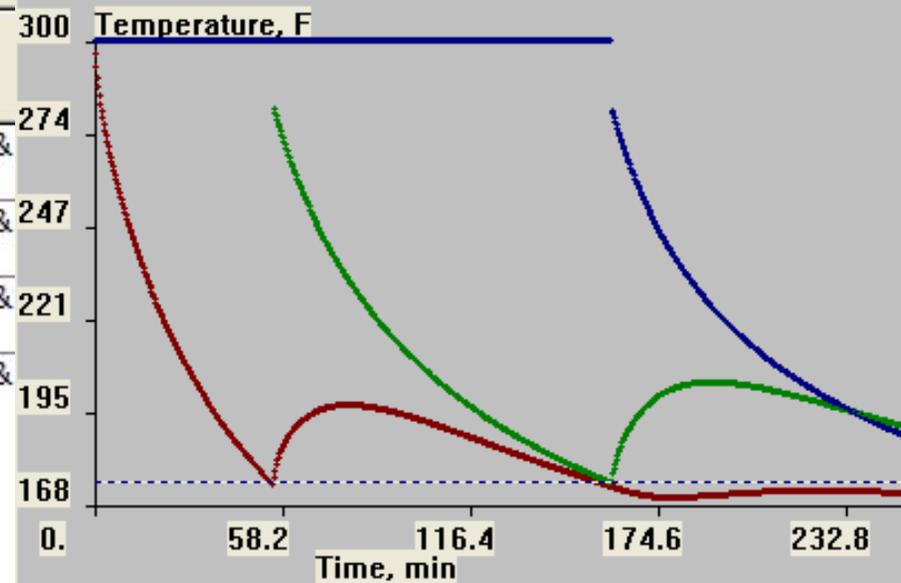
Delivery Temperature (C): 148.89

Stop Temperature (C): 73.89

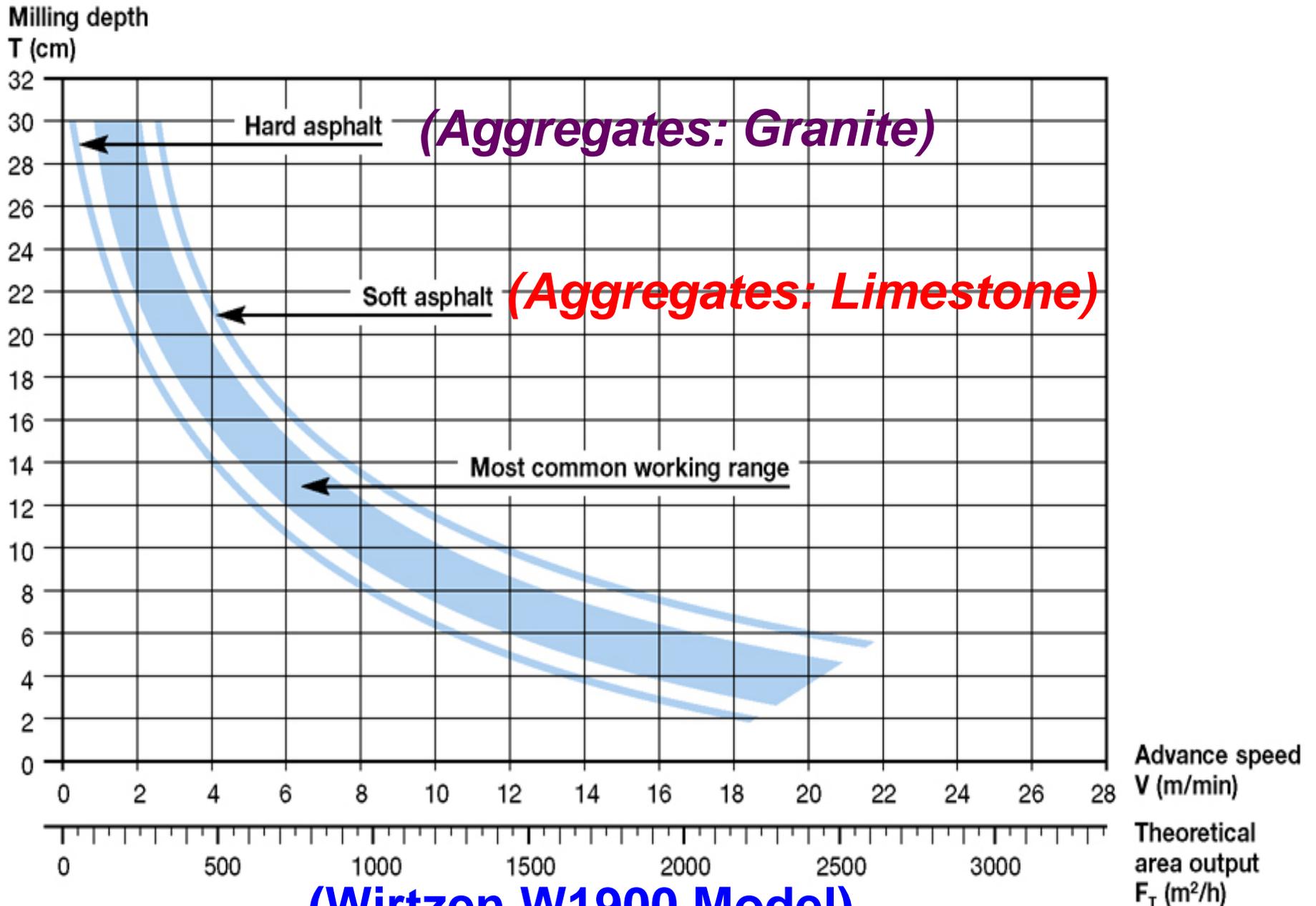
Open to Traffic Temperature (C): 61

Environmental Condition

Period	Time	Ambient Temperature (C)	Average Wind Speed (kph)	
1	12:00 AM	12.8	8.1	Clear &
2	06:00 AM	15.6	8.1	Clear &
3	12:00 PM	26.7	8.1	Clear &
4	06:00 PM	18.3	8.1	Clear &

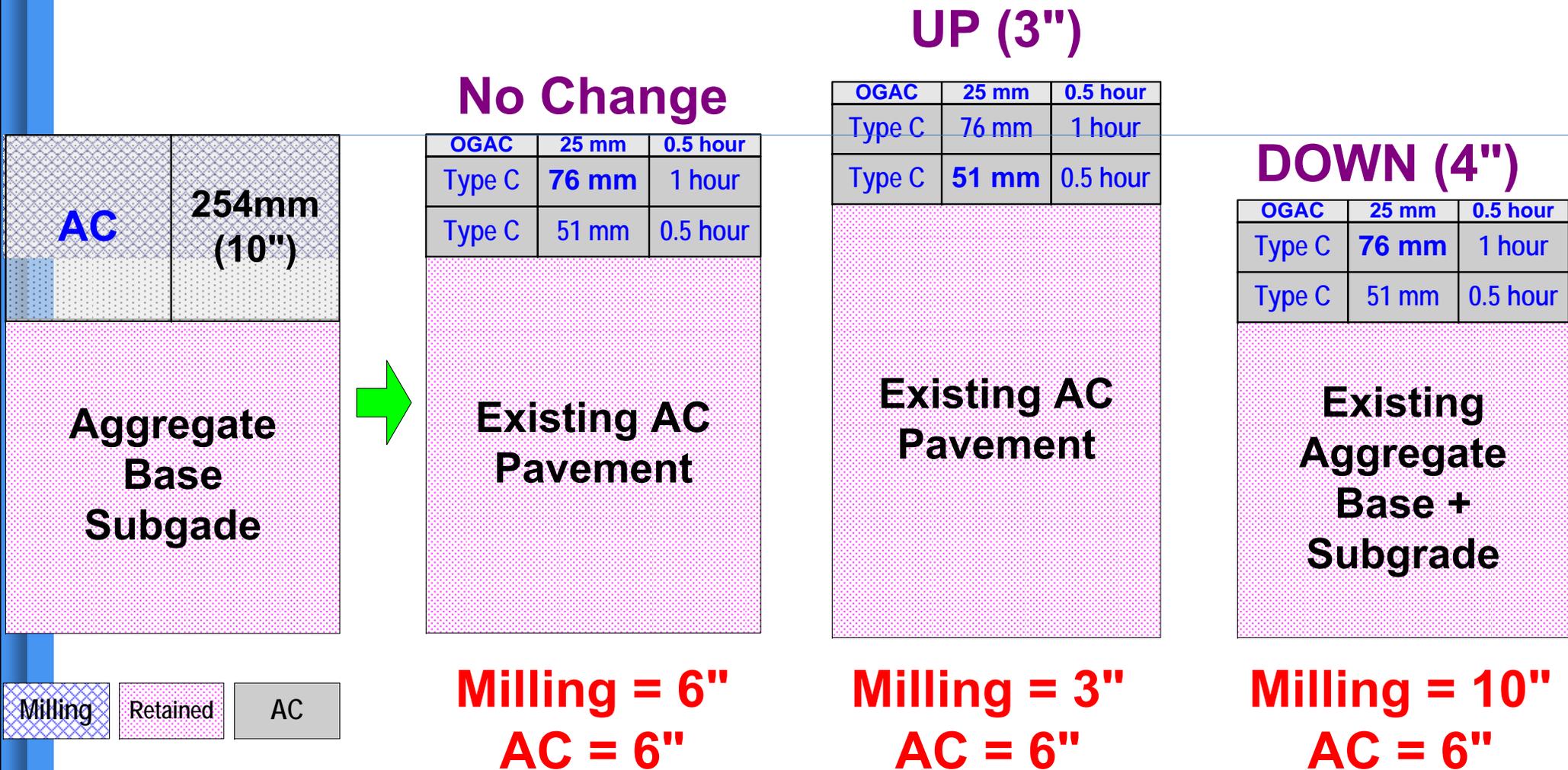


# Milling (Cold-plane) Machine Production



(Wirtzen W1900 Model)

# Roadway Elevation Change No-, Up-, or Down-elevation



---

# **CWZ Traffic Analysis and TMP Strategies**

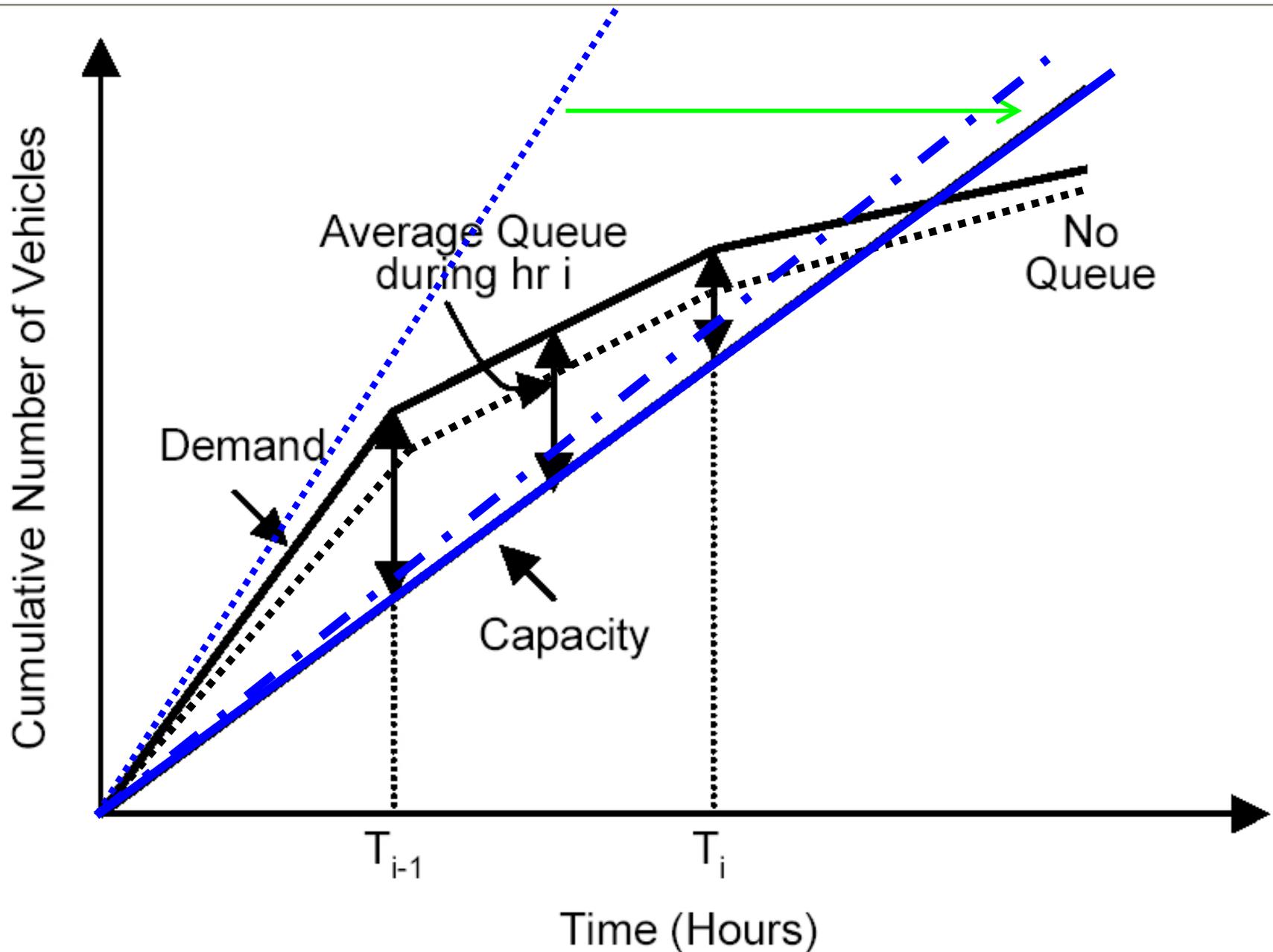
# Analysis Tools WZ Traffic for TMP

---

- **Traffic analysis model (tools)**
  - Corridor model (D-C): CA4PRS, Quickzone, FreQ
  - Simulation model: Micro-, Meso-, Macroscopic
  - Planning model: EMME/2, TransCAD, TranPlan, Syncro
- **Microscopic/Meso simulation software**
  - Micro: Corsim, Paramics, VISSIM, TransModeler,
  - Meso: VISUM, DynamEQ, DynaSmart-P
  - Assess the work zone impact on network (limited)
  - Graphics (animation) are good: video presentation
  - Expensive license, labor extensive inputs, and iterative calibration: => outsourcing to consultants
  - **Not geared for construction work-zone analysis**
    - *Imitate incidents, WZ behaviors?, Weekend O-D?, NGSIM?*

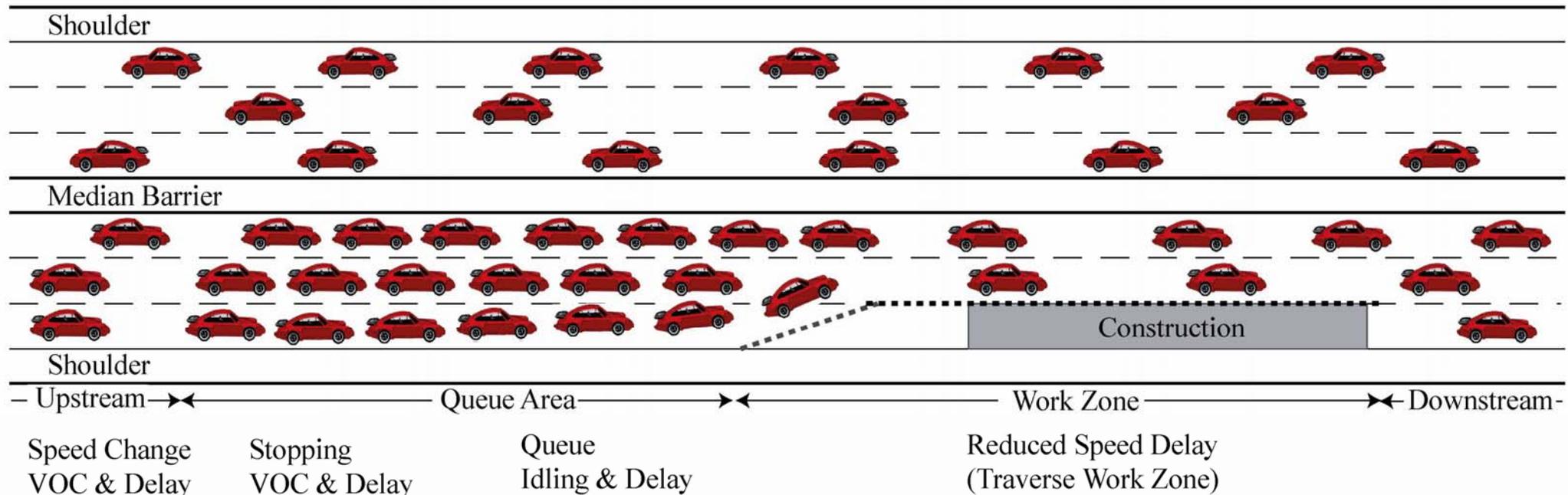
# Work-zone Delay: Demand-Capacity Model

## Highway Capacity Manual (Chap. 29)



# Road Use Cost Components for Demand-Capacity Model

- Road user cost (RUC)
  - ✦ – Delay cost (traveler's time value): cars and trucks
  - Vehicle operation costs: maintenance, fuel, emission, crash
  - Detour cost: circuitry or diversion (need network analysis)
- RUC components – Unrestricted or forced flow



# Work-zone Capacity Adjustment Based on Highway Capacity Manual 2000 (22-7 and 22-8)

**Adjusted Capacity (vph) = Basic Capacity (pcphpl) × H × W × S × N**  
(PCPHPL = Passenger Car per Hour per Lane)

## (1) Basic Work Zone Capacity (PCPHPL)

Closure-type	Two-lane Highway	Multi-lane Highway
Lane-drop only	1,200	1,800
Median Cross-over	1,100	1,600

## (2) Heavy Vehicle Adjustment Factor (H):

$H = 100/[100+P(PCE-1)]$ ; P = percentage of truck,  
PCE = Passenger Car Equiv.; (Down or level: 1.5, Rolling: 2.5, Mountain: 4.5)

## (3) Lane Width Adjustment Factor (W)

Width 12.0 ft (W = 1.00); 11.0 ft (W = 0.95); 10.0 ft (W = 0.90)

## (4) Shoulder/Lateral Clearance Adjustment Factor (S)

Both Shoulder (S = 1.00); One Shoulder (S = 0.95); No Shoulder: S = 0.90

## (5) Number of Lanes Open (N)

# Traffic Data System for WZ Analysis

## PeMS: <http://pems.eecs.berkeley.edu>

PeMS 9.4

Home | Feedback | Acco



California > Dynamic Maps

MyPeMS

Real Time | Daily Averages | Bottlenecks | Diagnostics | Incident Segments | TSN Info

California

- Freeways
- Routes
- Dynamic Maps
- Google Maps
- Field Elements
- Detectors
- Aggregates
- HICOMP
- Congestion Pie
- Detector Health
- Data Fidelity
- Census
- AADT/Peak Hour
- Incidents
- CHP

Tools

- Field Element View
- Photolog
- Data Clearinghouse
- Holidays

This is a cooperative effort between UC Berkeley and Caltrans and is subject to our Terms of Use. Powered by BTS.

Image Generated: 12/22/2008 10:00 AM  
Speed as of 12/22/2008 10:00 AM

**I-10-E : GARFIELD 2**  
Mainline - 4 Lanes  
CA PM=24.029 (Abs)  
LDS=715275, MS ID  
Speed = 62.2 mph

The main map shows a detailed view of the Los Angeles area, including West Hollywood, Alhambra, Cudahy, El Segundo, Manhattan Beach, Hermosa Beach, Torrance, Palos Verdes Estates, Lomita, and Stanton. It displays numerous detector locations marked with green circles and yellow triangles, along with freeway routes and traffic data points. A legend for I-10-E : GARFIELD 2 is visible on the right side of the map.

User: ca4prspems  
PW: horsee9

# Traffic Information (Real-time) for Public Outreach

(<http://Map.Commuteview.net>)

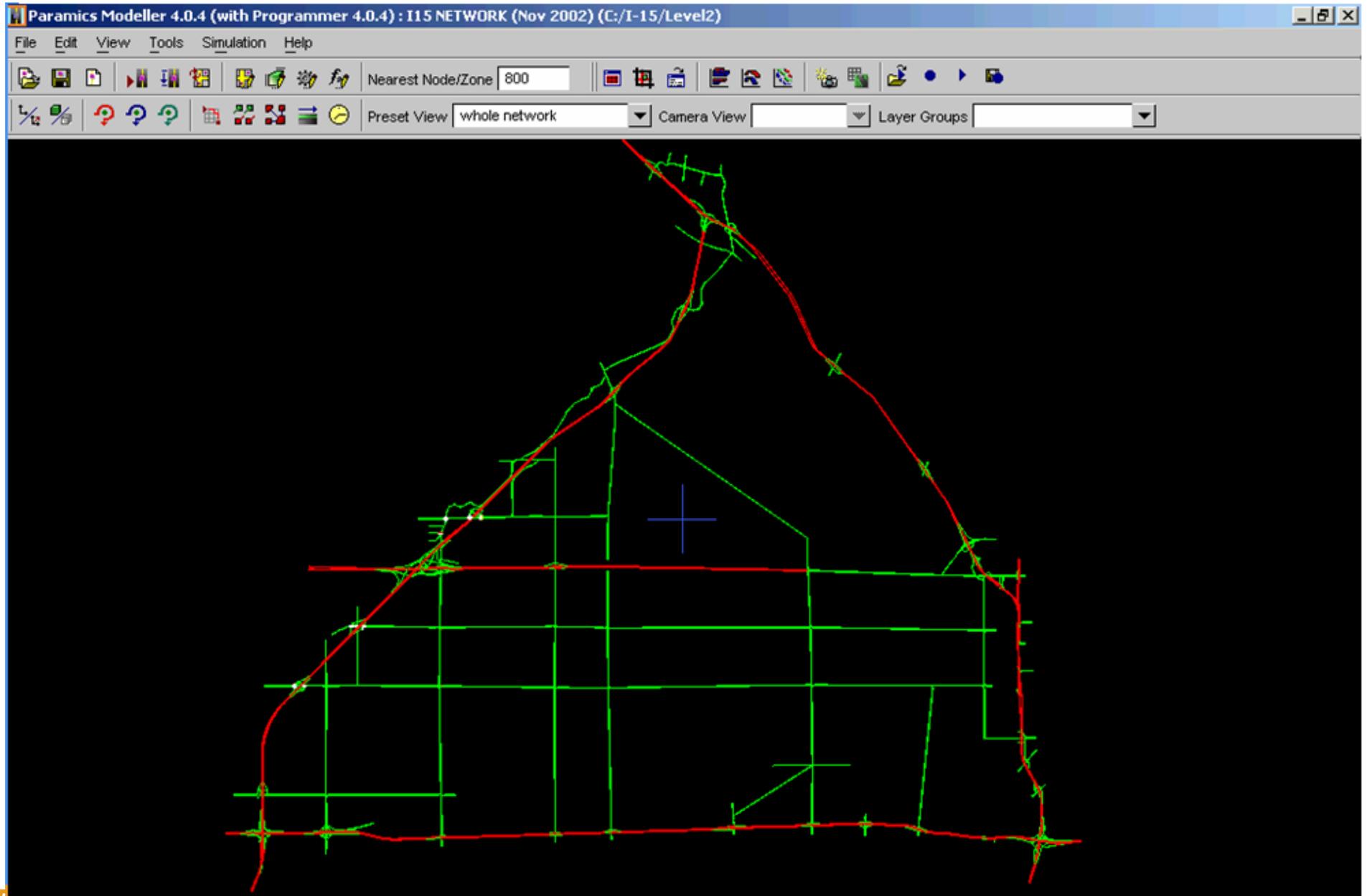
The screenshot displays the CommunityView website interface. At the top, the browser address bar shows the URL [http://map.commuteview.net/communityview/nhtml/es\\_main.html?8](http://map.commuteview.net/communityview/nhtml/es_main.html?8). The main content area features a large traffic map of Southern California, with various cities and highways labeled. The map uses color-coded lines to indicate traffic levels: green for light, yellow for moderate, and red for heavy. A legend on the left side of the map provides details on event types (Incident, Signal Alert), devices (CMS, CCTV, Streaming CCTV), and traffic levels (Free Way or Arterial). A 'HELP' button is located at the bottom left of the map area. On the right side of the page, there are navigation tabs for 'About Site', 'Weather Cond', 'Constr Info', and 'Travel Times'. Below these tabs are logos for Los Angeles County Public Works, County of Los Angeles, Metro, RCTC, and Governments SANBAG. At the bottom right, a window titled 'Caltrans Camera - Wind...' is open, showing a live video feed of a highway. The camera feed includes a timestamp 'Monday, April 02, 2007 - 10:37:38 AM' and text overlays: '085-15 N/O FOURTH ST' and 'NB I-15 N/O 4th'. A small information box at the bottom left of the map area displays: 'S 15 near 0.2 No Summit', 'MINUTES TO: RTE 10 7', and 'RTE 91 23'.

# I-15 Devore WZ Capacity: Full-closure Dynamic Lane Configuration Using QCMB



**QCMB Operation Video**

# I-15 Devore Simulation for TMP: Paramics Microscopic Network Traffic Analysis



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# **Cost Comparison** **(LCCA Interaction)**

# Caltrans Bid Cost DB Website

## http://sv08data.dot.ca.gov/contractcost



### CALIFORNIA DEPARTMENT OF TRANSPORTATION CONTRACT COST DATA

Skip to: [Content](#) | [Footer](#) | [Accessibility](#)

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- Contact Us

Contract Cost Data | Caltrans District 8... We're Here to Get You There |

- Contract Cost Data Home
- Code Search
- Other Resources
- Search Tips
- Help

[Caltrans](#) > [District 8](#) > **Cost Data**

Welcome to the Contract Cost Database Search Page. This site allows you to search historic bid data for Caltrans construction cost data. Use of the [conditions of use](#). For more help on using this site [click here](#). For the most recent bid data [click here](#).

### Search Parameters

Item Code or Description\*

Include data from  bidder(s). (Note: Does not include irregular bidders).

To make multiple selections from the boxes below, hold the control key down as you make selections. Leave the boxes unselected or blank to query for all the values.

District(s)	Year(s)
<input type="checkbox"/> District 01	<input type="checkbox"/> 2008
<input type="checkbox"/> District 02	<input type="checkbox"/> 2007
<input type="checkbox"/> District 03	<input type="checkbox"/> 2006
<input checked="" type="checkbox"/> District 04	<input checked="" type="checkbox"/> 2005
<input type="checkbox"/> District 05	<input type="checkbox"/> 2004
<input type="checkbox"/> District 06	<input type="checkbox"/> 2003
<input checked="" type="checkbox"/> District 07	<input checked="" type="checkbox"/> 2002
<input checked="" type="checkbox"/> District 08	<input checked="" type="checkbox"/> 2001
<input type="checkbox"/> District 09	<input type="checkbox"/> 2000
<input type="checkbox"/> District 10	<input type="checkbox"/> 1999
<input type="checkbox"/> District 11	<input type="checkbox"/> 1998
<input type="checkbox"/> District 12	<input type="checkbox"/> 1997

[clear selection](#)   [clear selection](#)  
[show counties](#) | [show map](#)

**Optional Parameters:**  
(Fill in as many as you need, or leave them blank to search all)

**Total Price (for item)**

Min \$

Max \$

**Quantity**

Min

Max

Unit   convert to this unit whenever possible

### DATABASE STATS

- 883,743 records in database
- Latest bid-open-date imported: 10-02-2008



\* indicates required field

# Roadway Items: Code and Unit-price in Caltrans Bid DB

Code	Description	Unit	Price
150846	REMOVE CONCRETE PAVEMENT	M2	\$ 18
153103	COLD PLANE ASPHALT CONCRETE PAVEMENT	M2	\$ 5
190101	ROADWAY EXCAVATION	M3	\$ 40
250201,301,401	AGGREGATE SUBBASE (Class 2~4)	M3	\$ 40
260201, 301	AGGREGATE BASE (Class 2~3)	M3	\$ 55
280000	LEAN CONCRETE BASE	M3	\$ 170
390102~3	ASPHALT CONCRETE (TYPE A~B)	TONN	\$ 85
390126	RUBBERIZED ASPHALT CONCRETE (TYPE G)	TONN	\$ 105
<b>390131</b>	<b>HOT MIX ASPHALT CONCRETE</b>	<b>TONN</b>	<b>\$ 100</b>
390132~3	HOT MIX ASPHALT CONCRETE (TYPE A~B)	TONN	\$ 115
390134	HOT MIX ASPHALT (OPEN GRADED)	TONN	\$ 115
<b>401000</b>	<b>CONCRETE PAVEMENT</b>	<b>M3</b>	<b>\$ 265</b>
401005	CONCRETE PAVEMENT (APPROACH SLAB)		
401108	RAPID STRENGTH CONCRETE PAVEMENT (REPLACE)	M3	\$ 760
???	PRE-CAST CONCRETE PAVEMENT	M2	\$ 350
839701	CONCRETE BARRIER (TYPE 60)	M	\$ 150
510086	APPROACH CONCRETE SLAB (TYPE N)	M3	\$ 800
510086	APPROACH CONCRETE SLAB (TYPE R)	M3	\$ 1,200
390046	PLACE ASPHALT CONCRETE DIKE	M	\$ 6

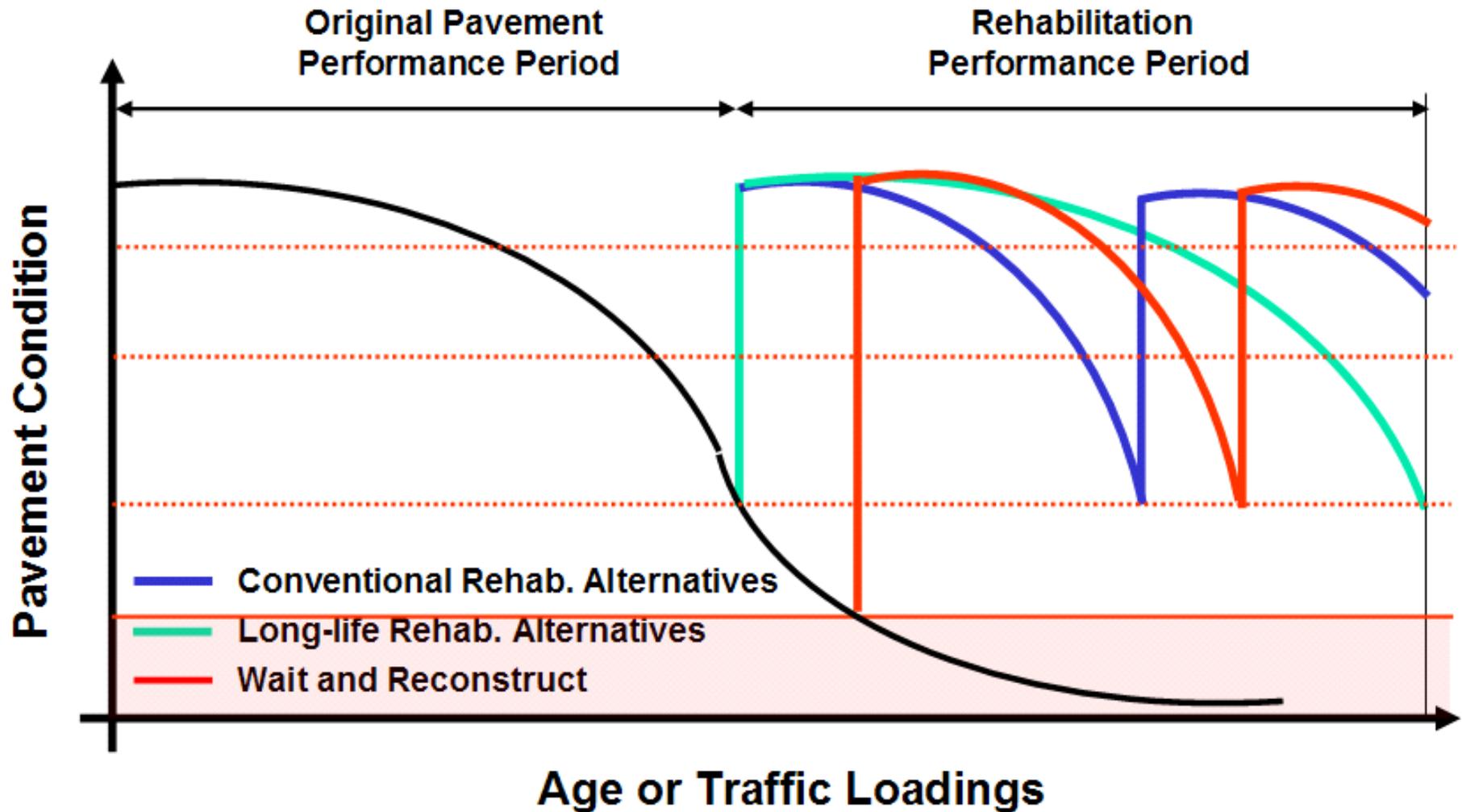
# Caltrans Cost Estimate Factors

## (550 major Maintenance & Rehab: 2003-2008)

Rehab Size	TMP %	Daily TMP	Duration (Days)
0 - \$5M	6.1%	\$2,003	82
\$5M - \$10M	3.9%	\$2,322	137
\$10M - \$20M	3.6%	\$2,522	215
\$20M - \$100M	2.6%	\$2,716	271
\$100M	2.4%		

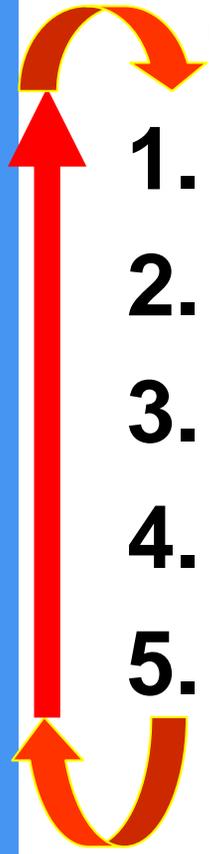
Type	TMP (%)	Mobilize (%)	Support Factor
Minor Maintenance (HM1)	9.7	5.3	0.19
Major Maintenance (CAPM) Rehab (HM21), Reconstruct	3.5	7.9	0.2
Roadway Widening	1.6	8.6	0.28
Realignment	2.1	8.4	0.25
New Roadway Construction	0.9	9	0.24
Bridge Maintenance	6.9	8.4	
New Bridge (Structure)	0.8	9.2	
Others	1.6	12.5	
Average	7.5	7.5	

# Life Cycle Cost Analysis (LCCA) Requirement: Investment Decision for Infrastructure Sustainability



Net Present Value of Agency Cost and RUC for Initial Construction, and Future Maintenance & Rehabilitation

# Caltrans LCCA Process (Steps)



1. Establish Design Alternatives (2-3)
2. Determine M&R Sequences and Timing
3. Estimate Schedule, Agency & User Costs
4. Compute Life-Cycle Costs in NPV
5. Analyze Results  Recommendation

Alternative Design Life	CAPM	10-Yr	15 or 20-Yr	25 to 40-Yr
CAPM	20 years	20 years	20 years	
10-Yr	20 years	20 years	35 years	55 years
15 or 20-Yr	20 years	35 years	35 years	55 years
25 to 40-Yr		55 years	55 years	55 years

- *User Manual*

- *Online Training*

# CA4PRS - LCCA Interaction (Group)

---

- **Example: I-710 III LA PCC Rehab Project**
  - LCCA in PSSR stage: 3 mile x 4 (2) lanes / Direction
- **Alternative 1 (Rigid)**
  - 1<sup>st</sup>: 12" PCC+6" ACB Reconstruction (Design: 35 years)
    - *12 lane-mile: 20 x 55-h weekend closures*
- **Alternative 2 (Rigid => Flexible)**
  - 1<sup>st</sup>: 9" PCC Slab replacement (Design: 20 years)
    - *12 lane-mile: 10 x 55-h weekend closures*
  - 2<sup>nd</sup>: 6" Crack-seat AC Overlay (Design: 15 years)
    - *36 lane-mile (3 mile x (4+2) x 2 direction); 250 x 8-h nights*
- **CA4PRS => LCCA Interaction: 50 YR NPV**
  - CA4PRS provides basic inputs to LCCA (Realcost)
    - *Schedule estimate (Working days)*
    - *Work-zone delay (Road user cost)*
    - *Agency cost (Construction cost)*

# LCCA Analysis Comparison

	DESIGN		SCHEDULE		AGENCY COST		ROAD USER COST	
	Activity	Design Life	Const. Window	Closure Number	Current Amount	PV	Current Amount	PV
<b>ALT. 1</b>	12" PCC + 6" ACB	35 Yr	55-h Weekend	20	\$35M	<b>\$35M</b>	\$10M	<b>\$10M</b>
	TOTAL				\$35M	<b>\$35M</b>	\$10M	<b>\$10M</b>
<b>ALT. 2</b>	8" PCC Slab	20 Yr	55-h Weekend	10	\$23M	<b>\$23M</b>	\$5M	<b>\$5M</b>
	6" CSOL	15 Yr	8-h Nighttime	250	\$19M	<b>\$9M</b>	\$8M	<b>\$4M</b>
	TOTAL				\$42M	<b>\$32M</b>	\$13M	<b>\$9M</b>

# Caltrans LCCA Implementation

## FHWA Realcost Software (V2.5)

RealCost 2.5 Beta Switchboard [English Units] Build: 2.5.0 Beta

### Project-Level Inputs

-  Project Details
-  Analysis Options
-  Traffic Data
-  Value of User Time
-  Traffic Hourly Distribution
-  Added Vehicle Time and Cost
-  Save Project-Level Inputs
-  Open Project-Level Inputs

Show Traffic Data Input Form.

### Alternative-Level Inputs

-  Alternative

### Input Warnings

-  Show Warnings

### Simulation and Outputs

-  Deterministic Results
-  Simulation
-  Probabilistic Results
-  Report

### Administrative Functions

-  Go To Worksheets
-  Clear Input Data
-  Save LCCA Workbook As...
-  Exit LCCA



1	CA4PRS	Construction Analysis for Pavement Rehabilitation Strategies
2	LCCA	Life-Cycle Cost Analysis
3	HDM	Highway Design Manual
4	HCM	Highway Capacity Manual
5	CRCP	Continuous Reinforced Concrete Pavement
6	JPCP	Joint Plain Concrete Pavement
7	PCCP	Portland Cement Concrete Pavement
8	CSOL	Crack and seat (PCC and AC) Overlay
9	FDAC	Full Depth AC (Replacement)
10	MACO	Milling and Asphalt Concrete Overlay
11	ACB	Asphalt Concrete Base
12	LCB	Lean Concrete Base
13	RSC	Rapid Strength Concrete (12-hour mix)
14	HMA	Hot Mix Asphalt
15	AADT	Annual Average Daily Traffic
16	AWIS	Automated Work Zone Information Systems
17	CMS/VMS	Changeable Message Sign/Variable Message Sign; (DMS, PMS)
18	COZEEP	Construction Zone Enhanced Enforcement Program
19	CWZ	Construction Work Zone
20	LRC or LOC	Lane Requirement Charts or Lane Open Charts
21	FSP	Freeway Service Patrol
22	PCE (cphpl)	Passenger Car Equivalent (car per hour per lane)
23	PIO / HAR	Public Outreach Officer / Highway Advisory Radio
24	RUC	Road User Cost
25	PID	Project Initiation Document
26	PSSR	Project Scope Summary Report
27	PA&ED	Project Approval and Environmental Document
28	PS&E	Plans, Specifications, and Estimates
29	TMP	Transportation Management Plans

**Acronym**

# CA4PRS on Caltrans Web

- » Research Reports and Summaries
- » Functional Research Areas
- » Deployment Support
- » California University Transportation Centers
- » Research Connection
- » Discussion Forum
- » Related Links
- » DOT Links
- » Site Index

[Caltrans](#) > [DRI Home](#) > [Roadway](#) > CA4PRS

## Construction Analysis for Pavement Rehabilitation Strategies Caltrans "Rapid Rehab" Software



*A Decision-Support Tool to Integrate Design, Construction, and Traffic for Highway Projects*

### Development Background

State transportation agencies are increasingly shifting their focus from constructing new highways to rehabilitating and reconstructing existing facilities. Because highway rehabilitation projects often cause congestion, safety problems, and limited access for road users, agencies face a challenge in finding economical ways to rehabilitate deteriorating roadways in metropolitan areas while keeping the traveling public as safe as possible and minimizing disruptions for local communities and surrounding businesses.

One innovation in the effort to reduce highway construction time and its impact on traffic is software called CA4PRS, Construction Analysis for Pavement Rehabilitation Strategies. CA4PRS is a schedule and traffic analysis tool that helps planners and designers select effective, economical rehabilitation strategies. Funded through an FHWA (Federal Highway Administration) pooled-fund, multistate consortium (California, Minnesota, Texas, and Washington), CA4PRS was developed by the University of California Pavement Research Center (UCPRC) through the UC Berkeley Institute of Transportation Studies. FHWA formally endorsed CA4PRS as a "[Priority, Market-Ready Technologies and Innovations](#)" product in 2008 for national wide deployment. Caltrans IT recently added CA4PRS into the [standard software list](#) for its statewide implementation.

[Click Here to  
Access CA4PRS  
Software](#)

This is free for Caltrans only.  
Installation password is provided  
on the [DRI Intranet](#).

[Implementation](#)

<http://www.dot.ca.gov/hq/research/roadway/ca4prs/index.htm>

# More CA4PRS Information?

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- **GOOGLE “CA4PRS”**

- <http://www.dot.ca.gov/hq/research/roadway/ca4prs/index.htm>