EA 08-472214

Jonathan den Hartog, P.E.

Project Location

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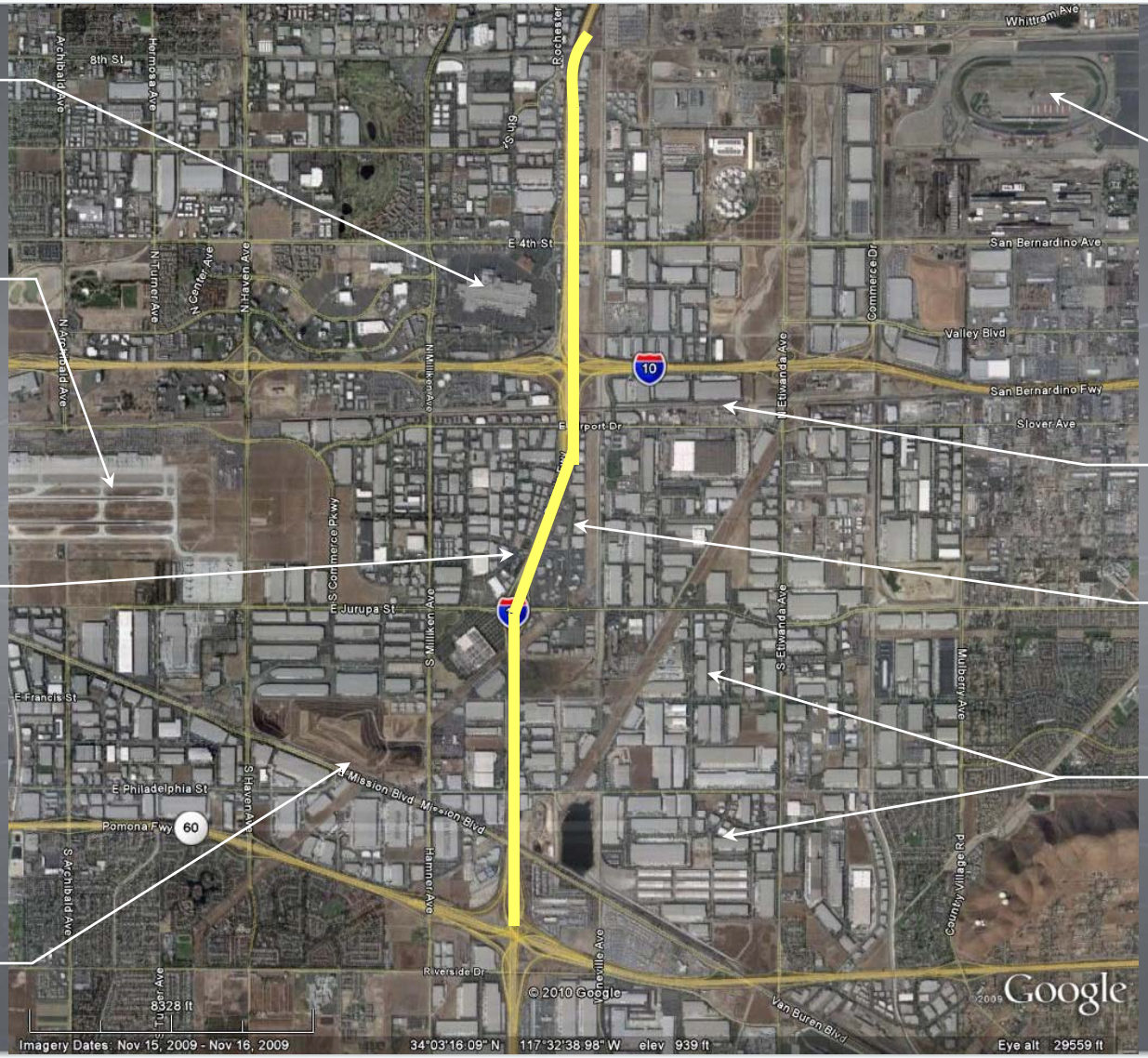

INTERSTATE 15
ONT FIX
with RAPIDWEEKENDS

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Project Location

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INTERSTATE 15
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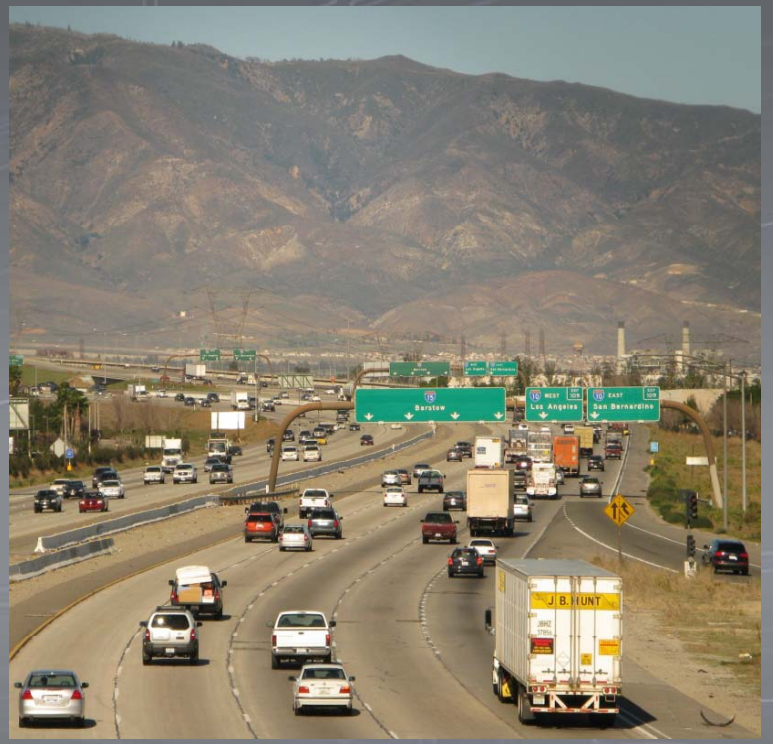
Project Features

- Median Paving
- Bridge Widening
- New Median Barrier
- Shoulder/Ramp Rehab
- Pavement Rehabilitation
  - 12 ln-mi lane replacement
  - Random slab replacements
  - Includes connectors
  - Precast Pavement (Super-Slab)



Traffic Volumes

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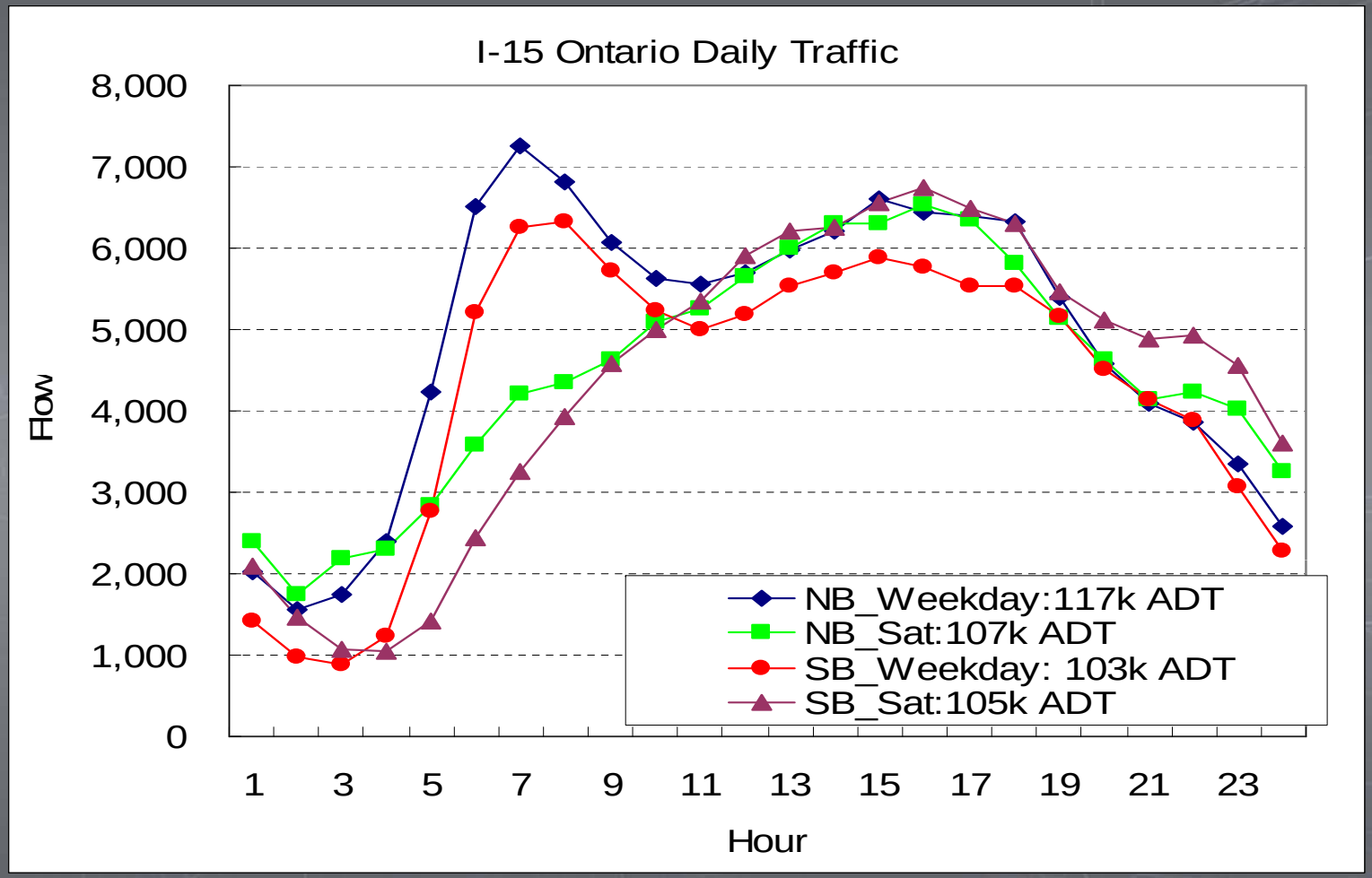

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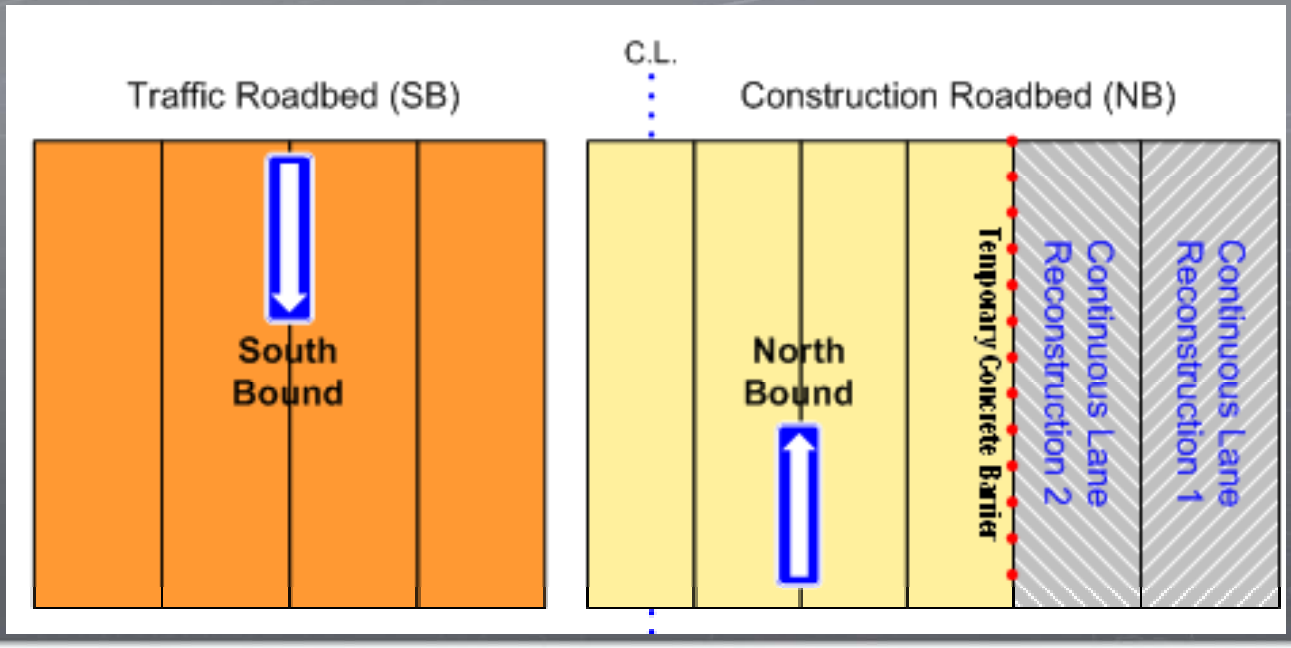
Construction Sequence

- Pave median, widen bridges
- Shift southbound I-15 two lanes toward the CL
- Rehab pavement weekday and weekend
- Repeat for northbound I-15



Rapid Weekends

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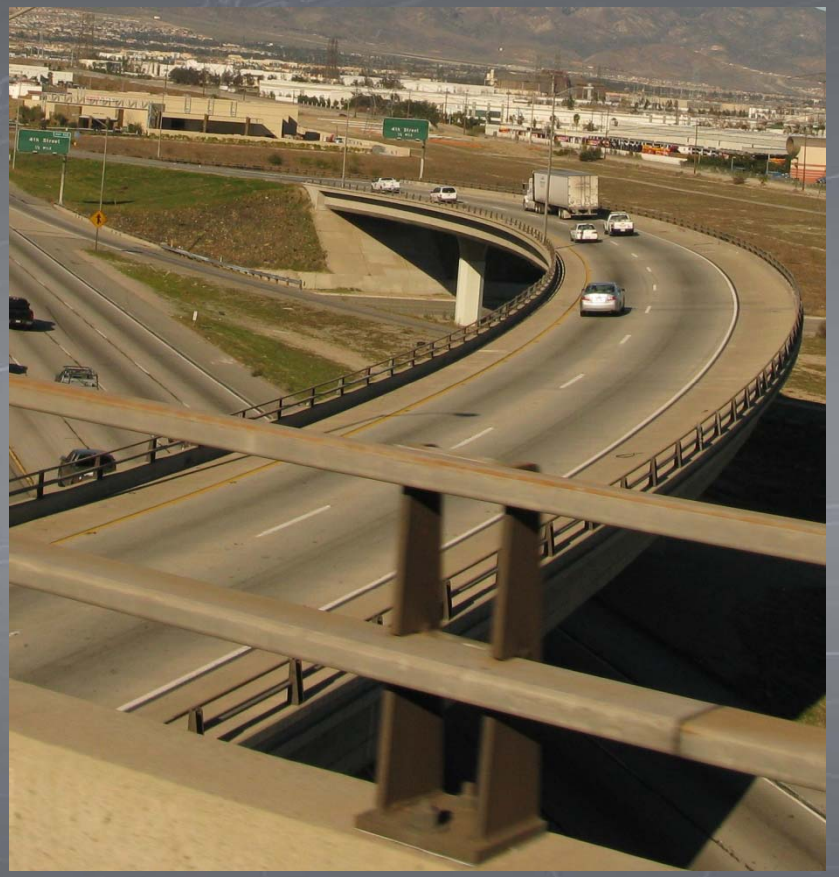
- 5 Major Stages,
  25 sub-stages
- 410 Working Days (~2 yrs)
- 55-Hour Weekend Closures
  - Beginning late Friday evening
  - Ending early Monday morning
- Approximately 30 weekends
- ~8 full roadbed closures



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Typical Closure

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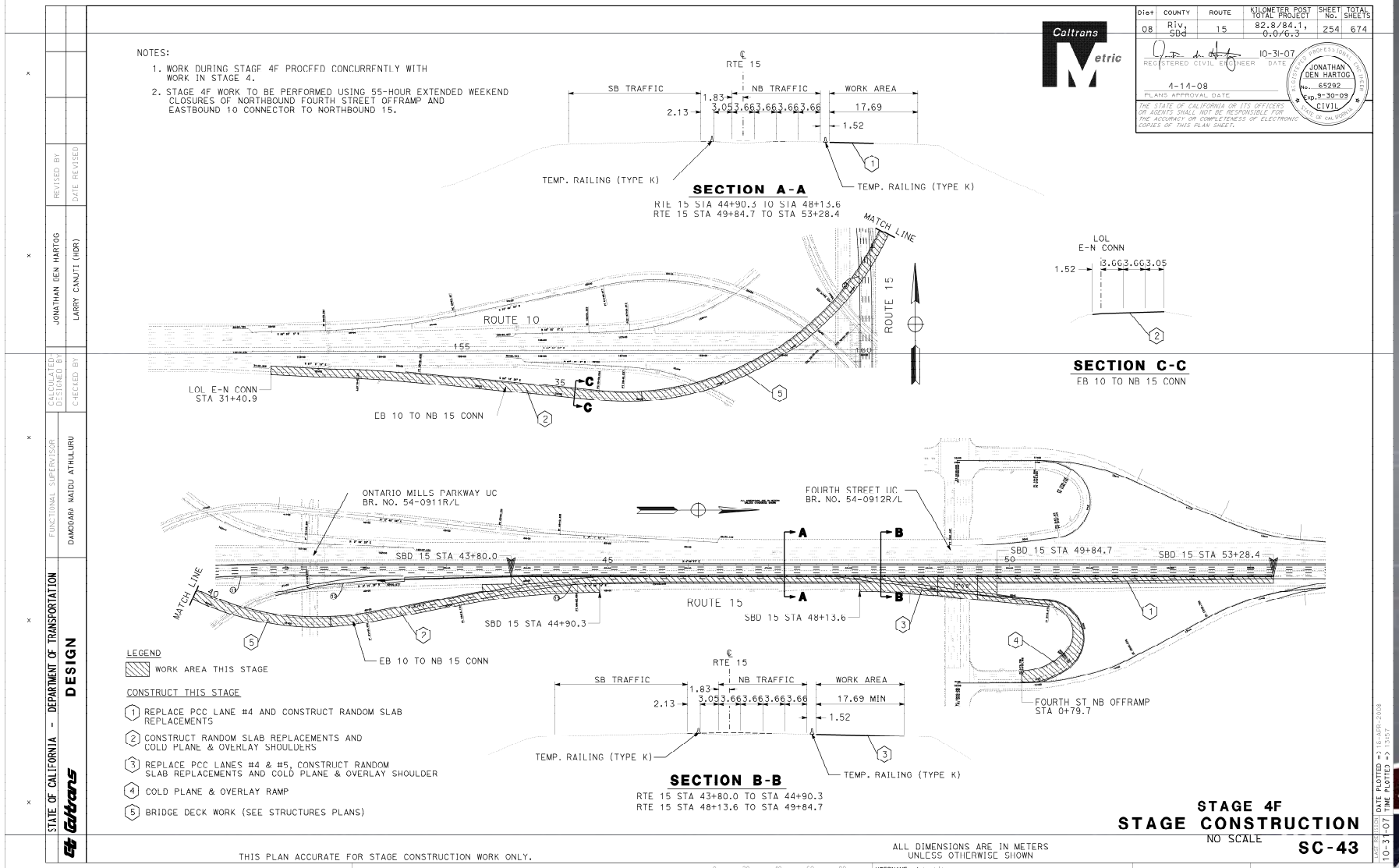
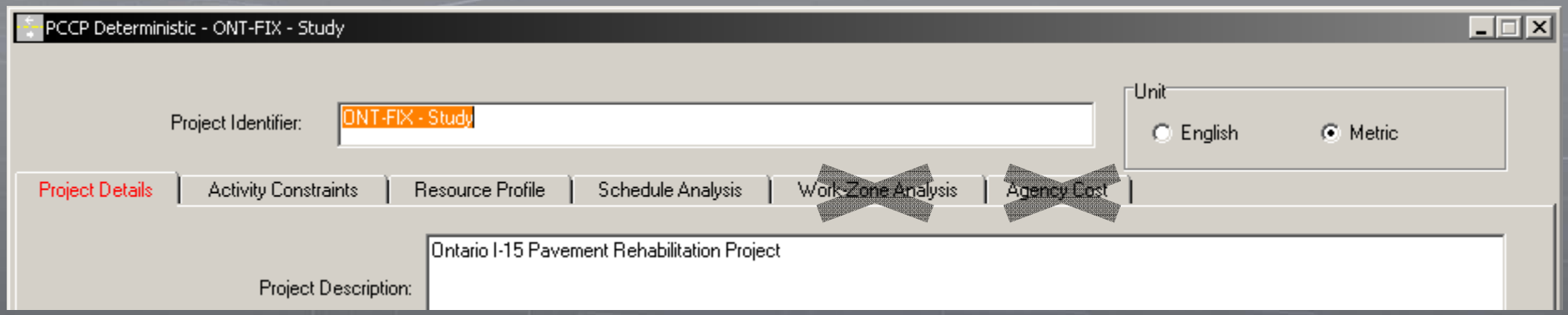


CA4PRS Study

- 2 Phase Study
  - Alternative Analysis And Comparison
  - Detailed Study of Preferred Alternative
- Performed by consultant sub



CA4PRS Study Purpose

- Validate the alternative chosen
- Provide a detailed estimate of:
  - Working days for the project
  - Number of closures needed for each stage
- Basis for Incentive/Disincentive

$150,000 per saved closure

(Max $900,000)

$175,000 per extra closure

Alternatives Analysis

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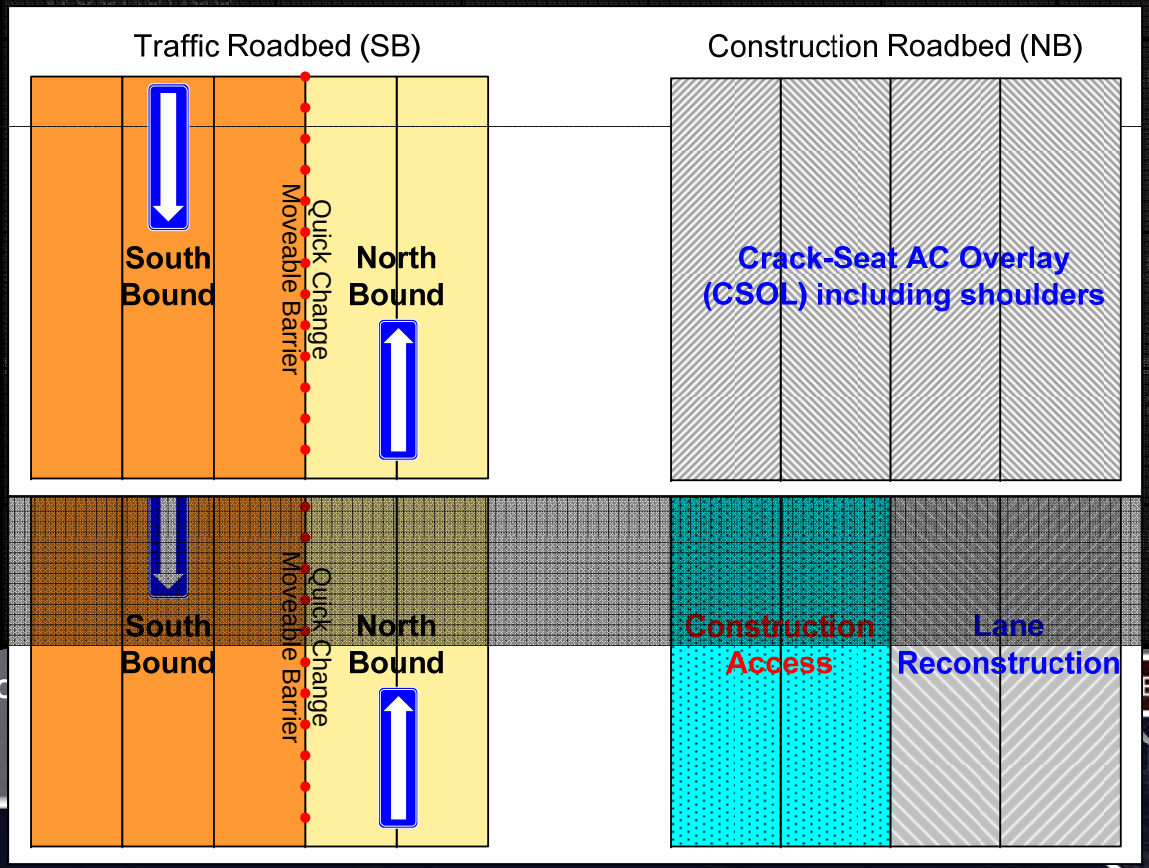
Scenario	Closure Duration	Traffic*		Cost ($millions)		Cost Ratio
		RUC ($M)	Delay (min)	Agency	Total**	
1 Original	35 weekends	3	16	78	79	100%
3 Contraflow	55-hr Weekend					5%
4 Progressive Continuous						3%
5 Traditional Nighttime						3%
6 CSOL 55-hour weekend						3%



** Total Cost = 1/3 RUC + Agency C

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RAPIDWEEKENDS

Road User Costs/Delay

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Scenario		Demand Reduction	1,500 vphpl* capacity			1,700 vphpl* capacity		
			Queue	Delay	RUC**	Queue	Delay	RUC**
			Miles	Minutes	$(Millions)	Mile	Minute	$(Millions)
1	Original	20%	8	61	20	2	18	2
		30%	2	16	3	0	0	0
3	55-hour Weekend	30%	51	363	119	34	210	63
		40%	25	179	45	13	81	17
4	Progressive Continuous	30%	51	363	123	34	210	51
		40%	25	179	47	13	81	13
5	8-hour Nighttime	5%	8	57	418	-	-	-
		10%	3	22	133	-	-	-
6-1	CSOL (Weekend)	30%	51	363	69	34	210	36
		40%	25	179	25	13	81	10
6-2	CSOL (Nighttime)	5%	8	57	120	-	-	-
		10%	3	22	38	-	-	-

* vphpl: vehicle per hour per lane
** RUC: Road User Cost

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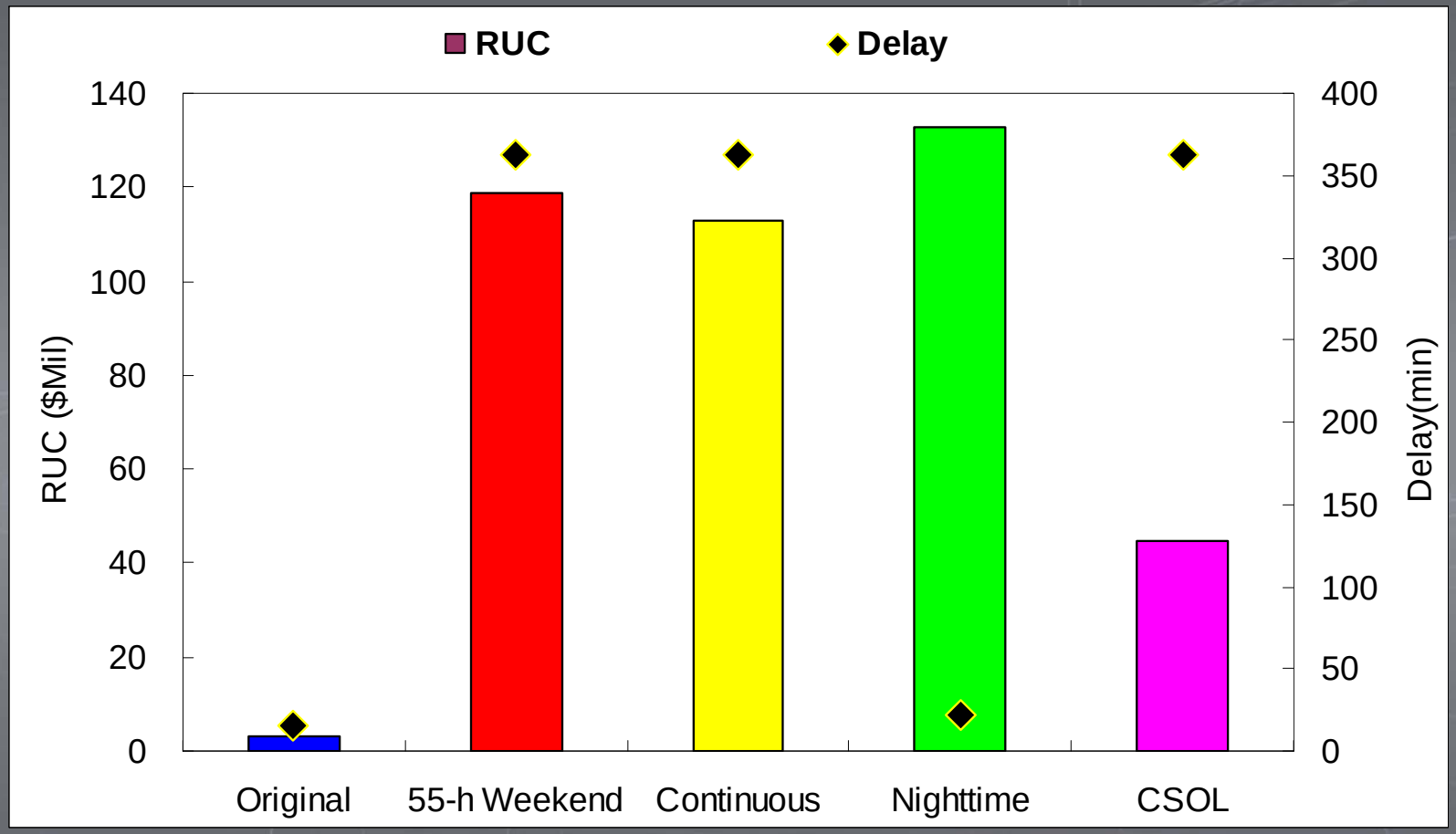
Road User Costs/Delay



Stage Analysis (Sample)

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Stage	Station		No. of Lanes	Length		Rehab Type	Total	55-hour Closures
	Start	End		(m)	(lane-km)		(lane-km)	Estimate
4B, 4C	836+81	837+81	1	100.00	0.100	CLR	2.50	2
	SB I-15 Conn WB SR-60		2	773.20	1.546	CLR		
	SB I-15 Conn EB SR-60		2	1430.50	0.858	RSR		
2A	7+40	11+79	2	439.00	0.878	CLR	1.28	1
	Jurupa On-ramp SB I-15		2	500.00	0.400	ACR		
2B	20+90	22+77	2	187.00	0.374	CLR	3.01	3
	22+77	28+51	1	574.00	0.574	CLR		
	28+51	33+03	2	452.00	0.904	CLR		
	20+96	28+95	1	799.00	0.240	RSR		
	WB I-10 CONN SB I-15		1	337.70	0.338	CLR		
	SB I-15 Jurupa Off-ramp		2	500.00	0.400	ACR		
	WB I-10 Conn SB I-15		2	300.00	0.180	RSR		

Note: CLR=Continuous Lane Reconstruction; RSR=Random Slab Replacement; ACR=Asphalt Concrete Rehabilitation

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Traffic Study (Dynameq)

	Delay (min)	
Closure	**Study 1**	**Study 2**
WB10-SB15	5.5	8.4
EB10-SB15	4.1	7.7
SB15-WB10	4.5	72.6
NB15-E/W10	5.8	58.6
EB10-NB15	5.8	8.0
Reduce SB 15	3.0	
SB15-E/W60		121.4

Schedule

- NTP with CA4PRS study: May 2005
- 30% PS&E: February 2006
- Draft CA4PRS Report: March 2006
- CA4PRS study: October 2006
- 60% PS&E: January 2007
- Advertise: September 2008
- Award: January 2009
- Construction Begins: April 2009
- Anticipated Completion: December 2010

VALIDATION OF RESULTS

Screenshots

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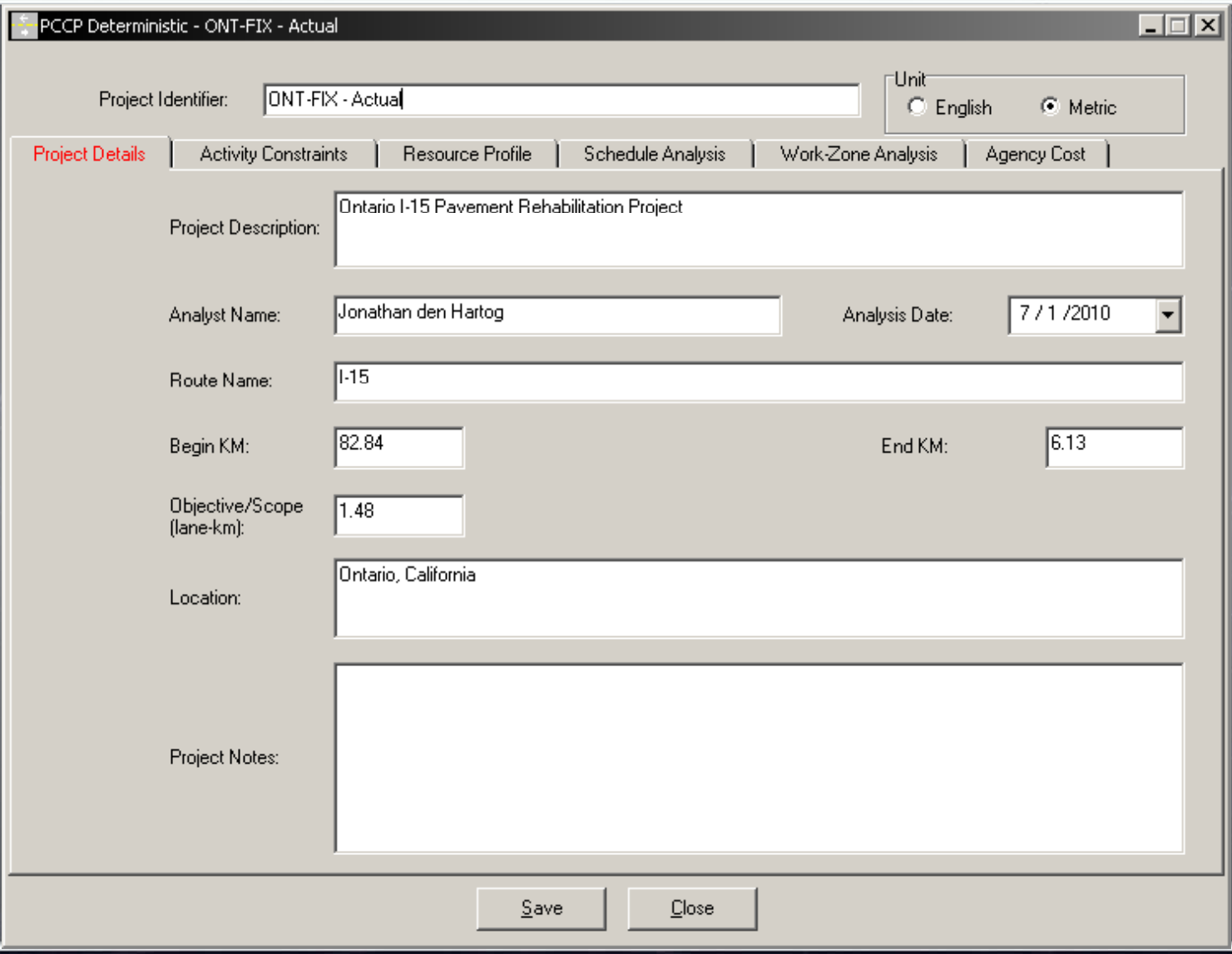

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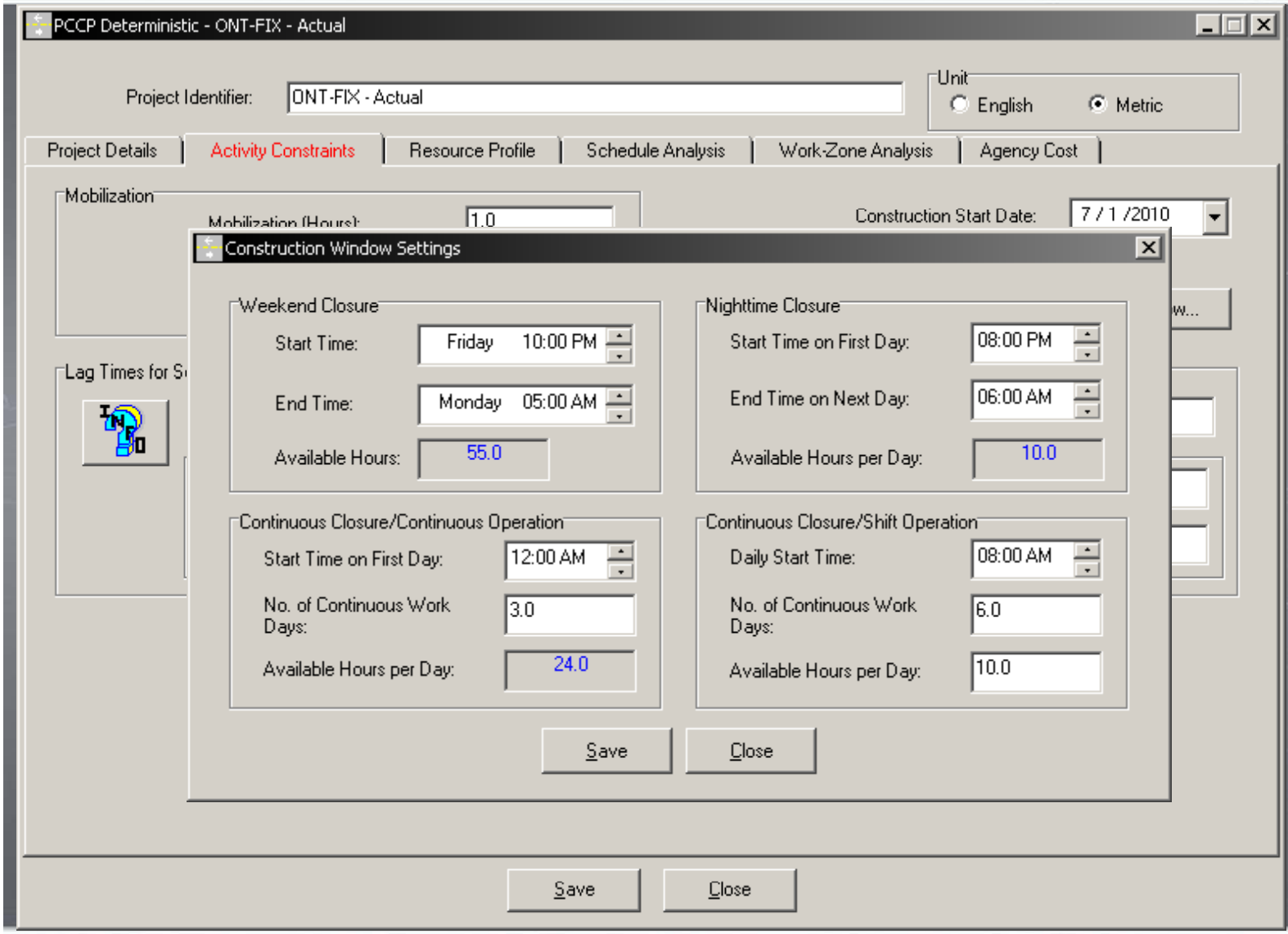
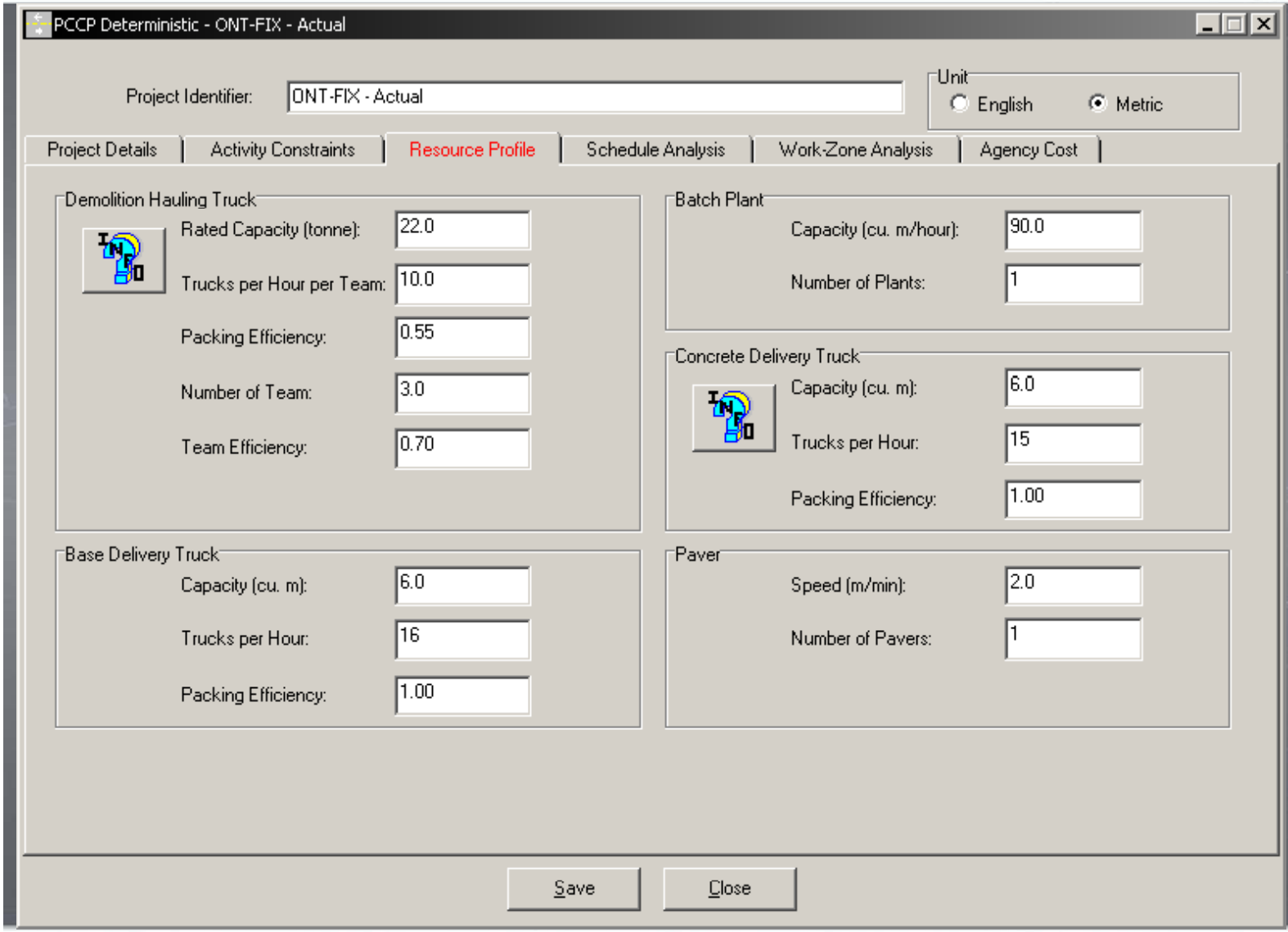
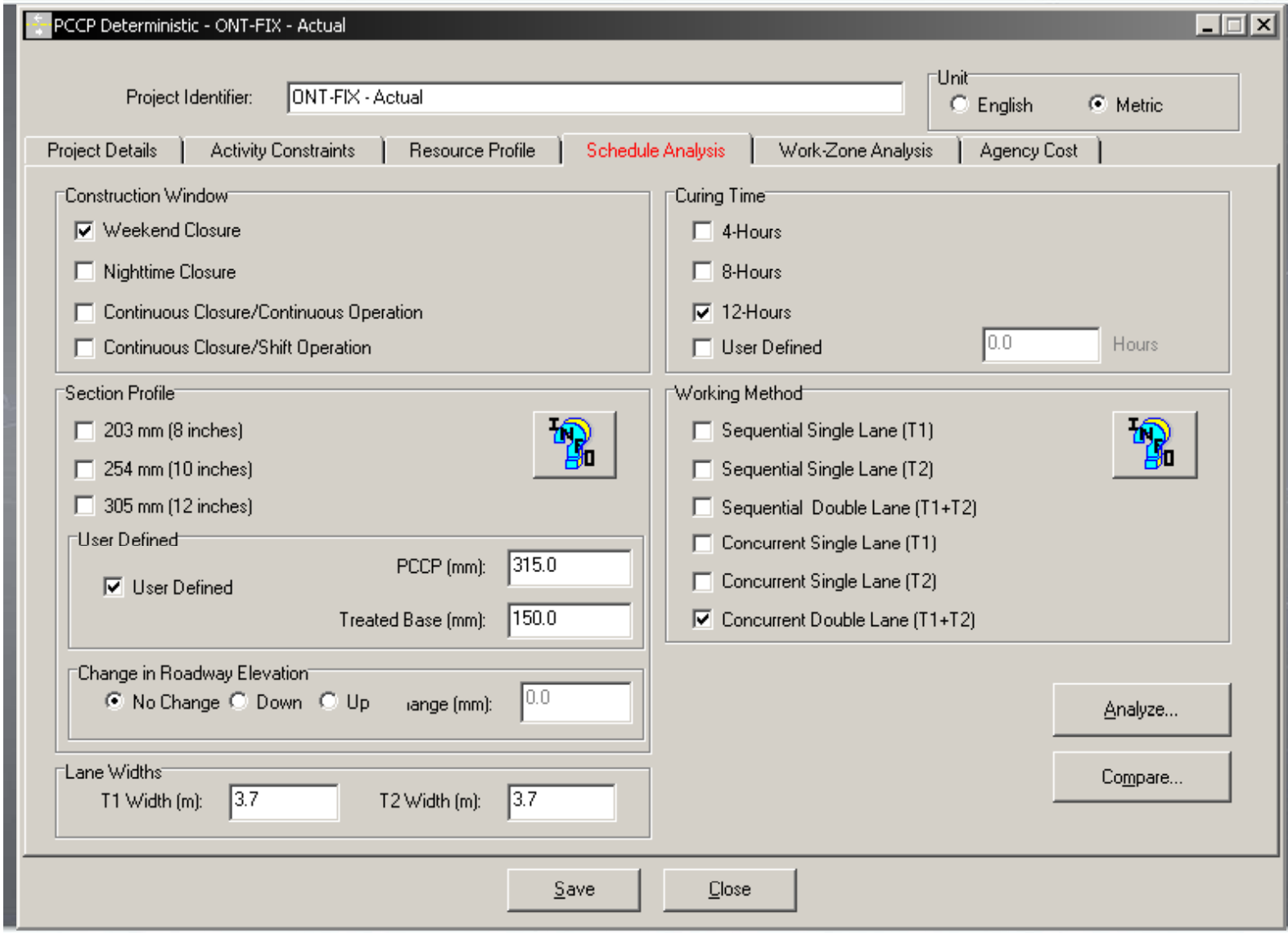
Screenshots



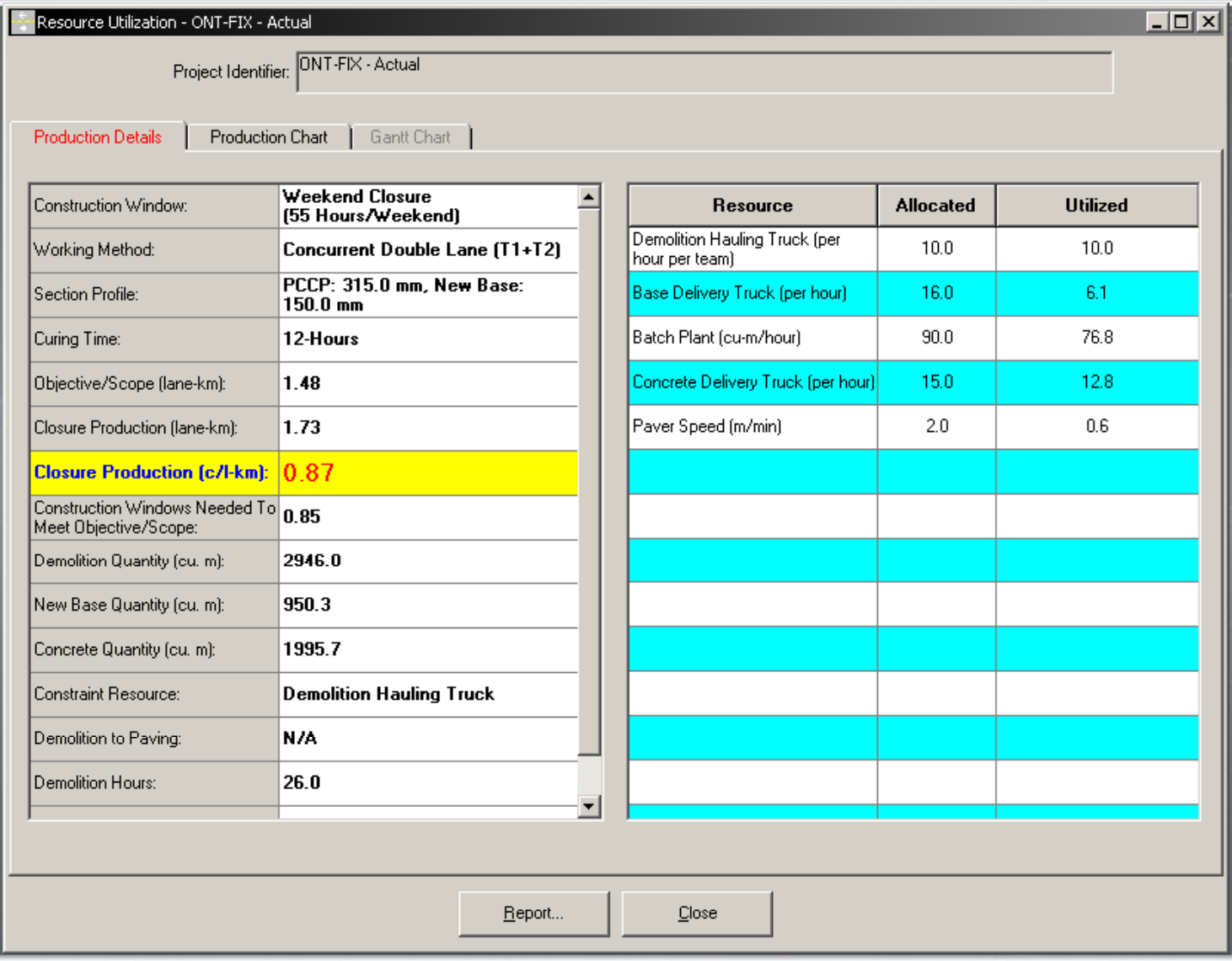
Screenshots



Screenshots



Screenshots



Inputs: Predicted Vs. Actual

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Tab	Input	Study	Actual	Unit	Default Values
Activity Constraints	Mobilization	3	1	hrs	2-3
Acti					4-6
Acti					1-2 (Sequential), 9-10 (Concurrent)
Acti					1-2 (Sequential), 9-10 (Concurrent)
Resi					22
* Resi					10 for cut & lift, 12 for impact methods
* Resi					0.5 for cut & lift, 0.6 for impact
Res					2
* Resi					
Resi					10 for bottom dump, 6 for end dump
Resi					10
Resi					
* Resi					100
Resi					6-7
Resi					15
Resi					
* Resi					2
Resi					
Sche					
Sche					

Resource Utilization - ONT-FIX - Study

Project Identifier: ONT-FIX - Study

Production Details | Production Chart | Gantt Chart

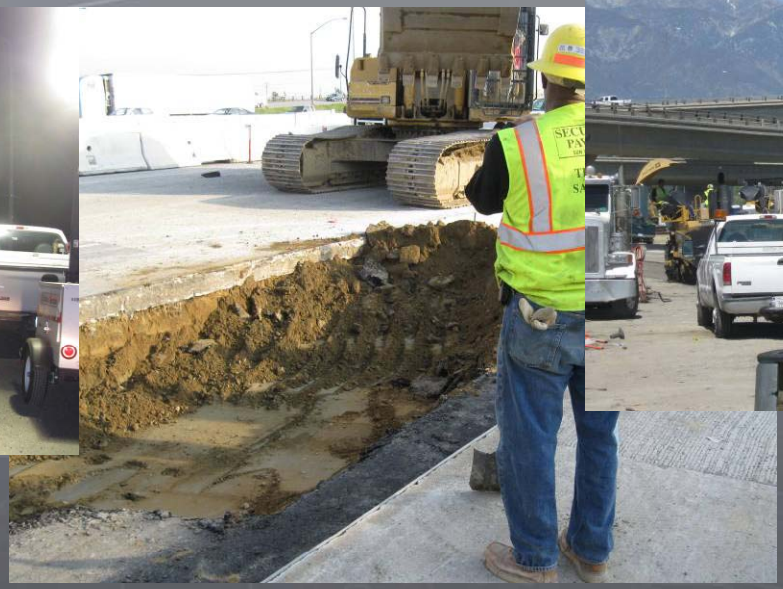
Construction Window:	Weekend Closure (55 Hours/Weekend)
Working Method:	Concurrent Single Lane (T1)
Section Profile:	PCCP: 315.0 mm, New Base: 150.0 mm
Curing Time:	12-Hours
Objective/Scope (lane-km):	2.50
Closure Production (lane-km):	0.69
Closure Production (c/l-km):	0.69
Construction Windows Needed To Meet Objective/Scope:	3.64
Demolition Quantity (cu. m):	1167.4
New Base Quantity (cu. m):	376.6
Concrete Quantity (cu. m):	790.8
Constraint Resource:	Demolition Hauling Truck
Demolition to Paving:	N/A
Demolition Hours:	17.0

Resource
Demolition Hauling Truck (per hour per team)
Base Delivery Truck (per hour)
Batch Plant (cu-m/hour)
Concrete Delivery Truck (per hour)
Paver Speed (m/min)

Report... Close

Predicted Vs. Actual

- Random slabs as night work
- Sometimes paving two lanes wide on connectors
- Combined stages
- Concurrent vs. Sequential



Predicted Vs. Actual (PRELIMINARY)

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Stage			No. of Weekends			
Plan[1]	Study[1]	Stage Description	Study[2]	Actual[2]	Revised Inputs[3]	Notes
4B,C	5B,C	SB I-15 connectors to E/W SR-60	2	2		Contractor was restricted by width of connector, which forced him to pave one lane at a time. Only 2 demo teams used. Thus very similar to study
2B,C	2B,C	SB Jurupa offramp, W10-S15 conn, E10-S15 conn	4	2	2	Study had separate closures for 2B, 2C. Contractor chose to combine stages.
2D,E	2D,E	SB I-15 connectors to E/W I-10	5	2	2	Contractor may have included more in 2E,F combination, also need to determine how contractor handled 3-lane widths
2E,F	2E,F	Fourth St SB ramps	3	1	1	Added 2E work north of S15-E10 connector diverge

Footnotes (Column descriptions)

1. 'Plan' is the stage designation as it is called out on the project plans. 'Study' is the stage designation as it is called out in the design study. Differences exist because of changes that occurred between when the study was completed and the project design was finished.
2. 'Study' is the number of closures (weekends) estimated to be needed by the design study to complete the work for the stage. 'Actual' is the number of closures actually required to complete the work.
3. 'Revised Inputs' indicates how many closures were estimated to be needed using the revised inputs for CA4PRS shown in the previous slide.

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Time Spent

- Pre-Construction Study:
  ~160 hours
- Validation of Results:
  ~40 hours

Lessons Learned

- Construction experience is IMPORTANT
- Design input important for efficiency
- Breadth of knowledge required
  - Traffic
  - Pavement
  - Construction
  - Estimating
- Team approach may be best

For Further Study

- More detailed field validation.
- How much did the economy effect traffic volumes, allowing the combined closures?
- What kind of traffic diversion did we get?
- Document experience with precast pavement (Super-Slab) to validate precast module.

Contact Info

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More info:

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

http://www.fhwa.dot.gov/crt/lifecycle/ca4prs.cfm

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