

## CLOSEOUT REPORT

Submitted by the AASHTO TIG Lead States Team for  
the following technology:

# Construction Analysis Software Tools (CAST)

*Lead State Team Members, Participants, and Agencies:*

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Date: October 27, 2009

## **DISCLAIMER**

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the American Association of State Highways and Transportation Officials (AASHTO) or any individual member organization of AASHTO.

Where the names of products or manufacturers appear herein, their inclusion is considered essential to the objectives of this report. AASHTO does not endorse products or manufacturers.

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# **CLOSEOUT REPORT**

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the following technology:

## **Construction Analysis Software Tools (CAST)**

### **Introduction**

The American Association of State Highway Transportation Officials (AASHTO) Technology Implementation Group (TIG) selected Construction Analysis Software Tools (CAST) as a TIG Focus Technology in June 2006 by combining two similar technology submissions; 1) Construction Analysis for Pavement Rehab Strategies from California and 2) User Impacts of Fast-Track Construction from Utah. The goal of the CAST Lead States Team (LST) is to promote the use and adoption of the analysis tools in the AASHTO member states and other agencies. The analysis tools provide the following advantages:

- Improve work-zone safety and mobility,
- Optimize construction staging with the most cost effective solution, and
- Improve public perception and satisfaction.

To achieve the goal, the LST has provided member states with information on the CAST products. This closeout report summarizes LST activities and observations. The report is divided into the following five sections:

- Marketing Activities,
- Performance Measurement,
- Lessons Learned,
- Transition Plan, and
- Final Expenditure Information.

## Marketing Activities

The LST conducted outreach through technical meetings, webinars, presentations at conferences and workshops, and distributing marketing materials and publications.

### *List of Hosted Demonstration Workshops*

The team has hosted four demonstration workshops. Two video conferences and one webinar were delivered through the WASHTO-X program. An on-site technical workshop was held in Sacramento, California in March 2007. The attendee list and workshop notes are located in the Appendix A.

Date (in chronological order)	Workshop Title	Location	Total Attendance
December 8, 2006	Video Conference: Construction Analysis for Pavement Rehabilitation	WASHTO-X	12 States
March 20-21, 2007	Optimizing Traffic Management and Construction Work Zone Analysis	Sacramento, CA	50
September 18, 2007	Video Conference: Construction Analysis for Pavement Rehabilitation	WASHTO-X	15 States
January 8, 2008	Webinar: Construction Analysis for Pavement Rehabilitation Strategies (CA4PRS)	WASHTO-X	10 States

### *List of Presentations at Conferences and Meetings*

The team has made presentations at a number of national/ international technical conferences including TRB and AASHTO Sub-Committee annual meetings.

Date	Conference or Meeting Name, Location	Presenter Name, Organization	Presentation Title	TIG CAST Booth	Written paper? (Y/N)
October, 2006	AASHTO Annual Meeting, Portland, OR	Richard Land	TIG: CAST Project	N	N
January, 2008	TRB Annual Meeting, Washington, DC	EB Lee, UC Berkeley	-	Y	Y

June 2008	AASHTO Subcommittee on Maintenance/Standing Committee on Environment/A Management Monterey CA	Nadarajah (Siva) Sivaneswaran, Federal Highway Administration/E B Lee, UC Berkeley	-	Y	N
November, 2008	ITS World Congress, New York, NY	EB Lee, UC Berkeley	Traffic Monitoring Studies with Surveillance Systems	?	Y
February, 2009	Transportation Construction Management, Orlando, FL	Nadarajah (Siva) Sivaneswaran, Federal Highway Administration/E B Lee, UC Berkeley	CA4PRS: A Decision-Support Tool for Rapid Highway Renewal Projects	Y	Y
April, 2009	Concrete Pavement Technology Program, St. Louis, MO	EB Lee, UC Berkeley / Jonathan Hartog, Caltrans	I-15 Ontario Project: Technology Implementation for Accelerated Concrete Pavement Rehabilitation	Y	Y
June 14, 2009	AASHTO Traffic/System Ops. Sub-Committee Meeting, Manchester, NH	EB Lee, UC Berkeley / Jacqui Ghezzy, Caltrans	-	N	N
July 19, 2009	AASHTO Design Sub-Committee Meeting, Indianapolis, IN	Richard Land, Caltrans	-	N	N
August 2, 2009	AASHTO Construction Sub-Committee Meeting, Chicago, IL	EB Lee, UC Berkeley	-	N	N
August 31, 2009	AASHTO Value Engineering Conference, San Diego, CA	Michael Samadian, Caltrans/EB Lee, UC Berkeley	CA4PRS	Y	N

### **List of Publications**

The CAST brochure is included in the Appendix B.

Date Produced	Publication Type	Total Number Produced	Recipients and Distribution Method
December, 2007	CAST Brochure		Distributed at Conferences and Workshops

## Performance Measurement

The team conducted a fact-finding survey at the initial stage of this project. The survey requested information about member state's practices related to construction management and work zone traffic management. Also determined was their usage and interests in construction analysis software tools. Detailed survey results are shown in the Appendix C.

Survey Information	2007 Survey	2009 Survey
# of agencies responding to survey	34	37
# of agencies that have at least tried a CAST technology or similar software tools for traffic management during construction	22	-
# of agencies interested in trying a new or improved CAST technology on an upcoming project	33	-
# of agencies currently using at least one CAST technology on a routine basis	-	29
# of agencies that have tried at least one of the CAST technologies but have not broadly implemented at this time.	-	6
Software use breakdown:		
AIMSUN	-	1
CA4PRS	-	5
CORSIM	-	21
FREQ	-	3
HCS (Highway Capacity Software)	3	-
IDAS	-	1
PARAMICS	-	4
PRIMAVERA	-	30
TRANSMODELER	-	1
QUICKZONE	6	-
QUEWZ	4	-
VISSIM	3	-
Others (Excel, Syncro, etc.)	6	-

## Lessons Learned

### ***Effective Tools and Methods***

*(From the viewpoint of your lead states team, which were the most effective marketing tools and methods they used, and why were they believed to be the most effective.)*

Webinar: as the number of webinars increased, the number of participants increased.

Caltrans upper management support (Larry Orcutt and Randy Iwasaki) who partnered with FHWA to allow the transfer of knowledge and technology to all state DOT's.

A FHWA champion (Jim) who acquired the license for all state DOT's overcame two barriers: propriety issues and financial constrains. This pushed the technology to be implemented at the state level. The second component was the communication to FHWA Division offices. This was the key for the success of this project.

Need strong marketing materials (brochure, one-page white paper).

One-on-one training was an extremely effective tool.

The timeliness of this technology in reference to the issues and problems with construction constrains that every DOT was dealing with.

Major reason for success: this technology was needed now by DOT's.

### ***Unique Tools and Methods***

*(List any particularly creative or unique elements or methods used by your lead states team that other lead states teams should consider using.)*

FHWA purchased the licenses for all DOT's.

### ***Ineffective Tools and Methods***

*(From the viewpoint of your lead states team, which tools and methods were much less productive than desired, and provide your team's recommendations concerning future use of these methods or activities.)*

Some initial webinars failed to engage DOT upper management. A team must get upper management buy in before getting middle management/users of technology involved. It is difficult to get traction within other DOT's without this type of movement.

Must find the correct level of entry to get DOT's to implement.

### **General Comments**

*(Provide any lessons learned not included above.)*

TIG should solicit and rate submissions based on the national issues/concerns.

Need champion with ability to drive implementation activity.

Some vendors did not show the same interest level providing information or participation.

Perhaps vendors did not see the value in participating in the projects.

## **Transition Plan**

### **Technology Transfer**

Contact	Office Name, Location	Phone	Email
Kenneth Jacoby	Office of Asset Management, Washington, DC	202-366-6503	ken.jacoby@dot.gov

### **Primary On-going Implementation Responsibility**

Contact	Committee Name, Organization	Phone	Email
Kenneth Jacoby	Office of Asset Management, Washington, DC	202-366-6503	ken.jacoby@dot.gov

### **Specific Future Actions Recommended**

Future Activity	Time Frame	Recommended Organization to Perform
Send letter, which includes final report and brochure to AASHTO Three subcommittees (Traffic, Design, Construction)	Upon completion of final report	AASHTO
Send letter to SCOH members concerning the license availability	Upon completion of final report	AASHTO
Publish case studies for various CAST Tools	2010-2011	FHWA
Continued meeting outreach efforts (eg presentations)	2010-2011	FHWA

***On the Web***

*Information will remain on the AASHTO TIG web site until such time that FHWA may be able to incorporate this information into their web site.*

## **Final Expenditure Information**

### ***Total Expenses***

\$29,515.46

## **Appendix A: Demonstration Workshop Information**

**Appendix A-1**

**WASHTO-X Video Conference**

**Title: Construction Analysis for Pavement Rehabilitation**

**Date: December 8, 2006**

**List of Registered Attendance** (Actual number of attendance is great than the number of registration because more people attended from one registered site.)

Name: Steve Mills Agency: FHWA Location: Alabama Phone: 334-223-7390 Fax: 334-223-7325 E-Mail: steve.mills@fhwa.dot.gov	Name: Jim Sorenson Agency: FHWA Location: FHWA HDQ. Room 3206 Phone: 202-366-1333 Fax: 202-366-9981 E-Mail: james.sorenson@dot.gov
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## **WORKSHOP**

### Optimizing Traffic Management Using Modeling Techniques for Major Urban Construction

March 20-21, 2007  
Sacramento, CA  
Double Tree Hotel

#### **Event Description**

FHWA decided to sponsor research for mainly Caltrans and Washington State DOT on network simulation models for construction work zone. FHWA sponsored the fund for this workshop to have the presentations from the experts in this topic area. The agenda and arrangement were prepared by the Caltrans, WSDOT, and UC-PRC.

To share information among agencies and consultants about traffic modeling simulation and the decisions that can be made from these models. Information shared will include decision making based on information from the models, applying model outputs to project level work zones and traffic control, and making policy level decisions about organizational and business practices.

#### **Workshop Goals**

- 1) This workshop is not a chance to market or lobby for a product(s), applications, or services.
- 2) The workshop is to exchange ideas on the subject matter. The outcome will be improve the knowledge on the state of the art and to better inform States and FHWA on a series of tools and options to manage congestion impacts related to construction projects.
- 3) To understand how FHWA's new federal rule making related to work zones and traffic management is related to and compliments this effort. To coordinate operational, planning, and communications issues.
- 4) Identify and document best practices around the country, possibly looking at current research efforts and new developments.
- 5) Identify and document benefits for considering congestion management applications. Could be hard and soft costs items.
- 6) Identify tools and concepts for consideration and possible areas of application - potentially a broader national effort.
- 7) Consider the development of guidelines for using these tools and next steps and how to communicate this effort nationally.
- 8) Consider how operational and safety requirements need to be coordinated with project and program delivery.
- 9) Discuss basic goals of using these tool(s): project/program delivery commitments, and estimating and managing congestion and traffic operational impacts.

## Agenda

**Tuesday, March 20, 2007**

<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
8:00 to 9:00 am	Introductions, Housekeeping Overview, Expectations	Facilitator, All
9:00 to 9:30 am	Background, FHWA's Work Zone Final Rule	Tracy Scriba, FHWA
9:30 to 10:15 am	Traffic Model Simulation & Construction Applications	James Colyar, FHWA
10:15 to 10:30 am	BREAK	
10:30 to 11:15 am	Case Study: Des Moines, IA I-35 Reconstruction (MITSIM)	Tom Kane, Des Moines MPO & B and Mitish Jha, Earth Tech
11:15 to Noon	Case Study: Salt Lake City, UT I-15 Reconstruction (VISIM)	Doug Anderson, UDOT and and Peter Martin, Univ. of Utah
Noon to 1:30 pm	LUNCH	
1:30 to 2:30 pm	Case Study: Ontrario, CA I-15 Reconstruction (Danamaq)	Syed, Raza, and Johnathon, Caltrans and Mit Jha, Earth Tech
2:30 to 3:10 pm	Case Study: Michigan, Paramics	Do H. Nam, T-Concepts
3:10 to 3:20 pm	BREAK	
3:20 to 4:00 pm	Michigam: Adopting Organizational & Business Practices to Traffic Models	Catharine Jensen, Michigan DOT
4:00 to 4:50 pm	Case Studies: I-80, Saddle Brook, NJ and US 101, San Francisco	Kyle Winslow and David Thomas, Parsons Brinkerhoff
4:50 to 5:00 pm	Recap of Day's Session	

**Wednesday, March 21, 2007**

<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
8:00 to 8:45 am	Wisconsin DOT Experience with Traffic Models	John Shaw, Wisconsin DOT
8:45 to 9:30 am	Case Study: I-405, Seattle, Washington State DOT	Karl Westby, WSDOT and Mithilesh Jha, Earth Tech
9:30 to 9:45 am	BREAK	
9:45 to 10:45 am	Application of CA4PRS in Traffic Modeling	E.B. Lee, UC Berkeley and David Thomas, PB
10:45 to 11:15 am	Emerging Technologies	Lianyu Chu, UC Irvine
11:15 to 11:45 am	Next Steps: Where Do We Go From Here, Action Items	Facilitator, All
11:45 to Noon	Wrap-Up and Adjourn	

## WASHTO-X Event Agenda

**Title: Construction Analysis for Pavement Rehabilitation**

**Date: September 18, 2007 (Tuesday)**

**Time: 11:00AM – 1:30PM Eastern / 8:00AM – 10:30AM Pacific Daylight Time**

*(Please be ready to receive video conference calls 30 minutes in advance of the meeting.)*

### Event Description

Since 1998, Caltrans initiated Long-Life Pavement Rehabilitation Strategies (LLPRS) program with the goal of rebuilding approximately 2,800 lane-km of high volume urban freeway with pavements that are designed to last 30+ years with minimal future maintenance. Developed as a LLPRS planning tool, CA4PRS (Construction Analysis for Pavement Rehabilitation Strategies) software estimates how much pavement can be rehabilitated or reconstructed under different traffic closure strategies, considering project design and constraints and the number of lanes closed. The software provides a construction schedule baseline for the integrated analysis of pavement design, construction logistics, and traffic operations. It was designed to help state highway agencies and paving contractors develop sounder construction schedules that minimize traffic delay, extend the service life of pavement, and cut agency costs.

### Agenda Outline

- 5 min     **Welcome and House Keeping** – Doyt Bolling, WASHTO-X Program Director
- Presentations**
- 5 min     CA4PRS Participant Introductions
- 5 min     CA4PRS and work-zone traffic – Michael Samadian, Caltrans
- 5 min     Deployment and status goals – Larry Orcutt, Caltrans
- 30 min    CA4PRS modeling – John Harvey, University of California
- 45 min    CA4PRS Demonstrations – EB Lee, University of California
- 30 min    **Round Table: Open Discussion** (Each participating site is asked to introduce participants at its site and be prepared to briefly discuss their ideas, concerns, questions as appropriate, and submit questions and issues for discussion.)
- 5 min     **Closing Comments** – Doyt Bolling
- Adjournment**

**List of Registered Attendance** (Actual number of attendance is great than the number of registration because more people attended from one registered site.)

Name: Agency: Location: Phone: Fax: E-Mail:	place holder	Name: Agency: Location: Phone: Fax: E-Mail:	Michael Samadian Caltrans FHWA-CA (916)324-2048 Michael_m_samadian@dot.ca.gov
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Name: Agency: Location: Phone: Fax: E-Mail:	Kim Gilbert Colorado DOT HQ 303.398.6527 303.398.6504 kgilbert@dot.state.co.us	Name: Agency: Location: Phone: Fax: E-Mail:	Robert Locander Colorado DOT Lakewood, CO 303-398-6562 303-398-6504 robert.locander@dot.state.co.us
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## WASHTO-X Event Agenda

**Title: Construction Analysis for Pavement Rehabilitation**

**Date: January 8, 2008 (Tuesday)**

**Time: 1:30PM – 3:30PM Eastern / 10:30AM – 12:30AM Pacific Time**

### Event Description

Since 1998, Caltrans initiated Long-Life Pavement Rehabilitation Strategies (LLPRS) program with the goal of rebuilding approximately 2,800 lane-km of high volume urban freeway with pavements that are designed to last 30+ years with minimal future maintenance. Developed as a LLPRS planning tool, CA4PRS (Construction Analysis for Pavement Rehabilitation Strategies) software can be used to identify optimal rehabilitation strategies that balance the construction schedule with inconvenience to drivers and transportation agency costs. The software provides a construction schedule baseline for the integrated analysis of pavement design, construction logistics, and traffic operations. It was also designed to help engineers and planners develop sounder construction schedules that minimize traffic delay, extend the service life of pavement, and cut agency costs. Since 1999, the capabilities of CA4PRS have been validated on several major highway rehabilitation projects in states including California, Minnesota, and Washington. CA4PRS was selected by AASHTO's Technology Implementation Group as a 2006 priority technology and received 2007 International Road Federation Global Achievement Award for Research. This event will provide detailed background and capabilities of the software CA4PRS and a brief overview for its implementation and deployment status with proven case studies.

### Agenda

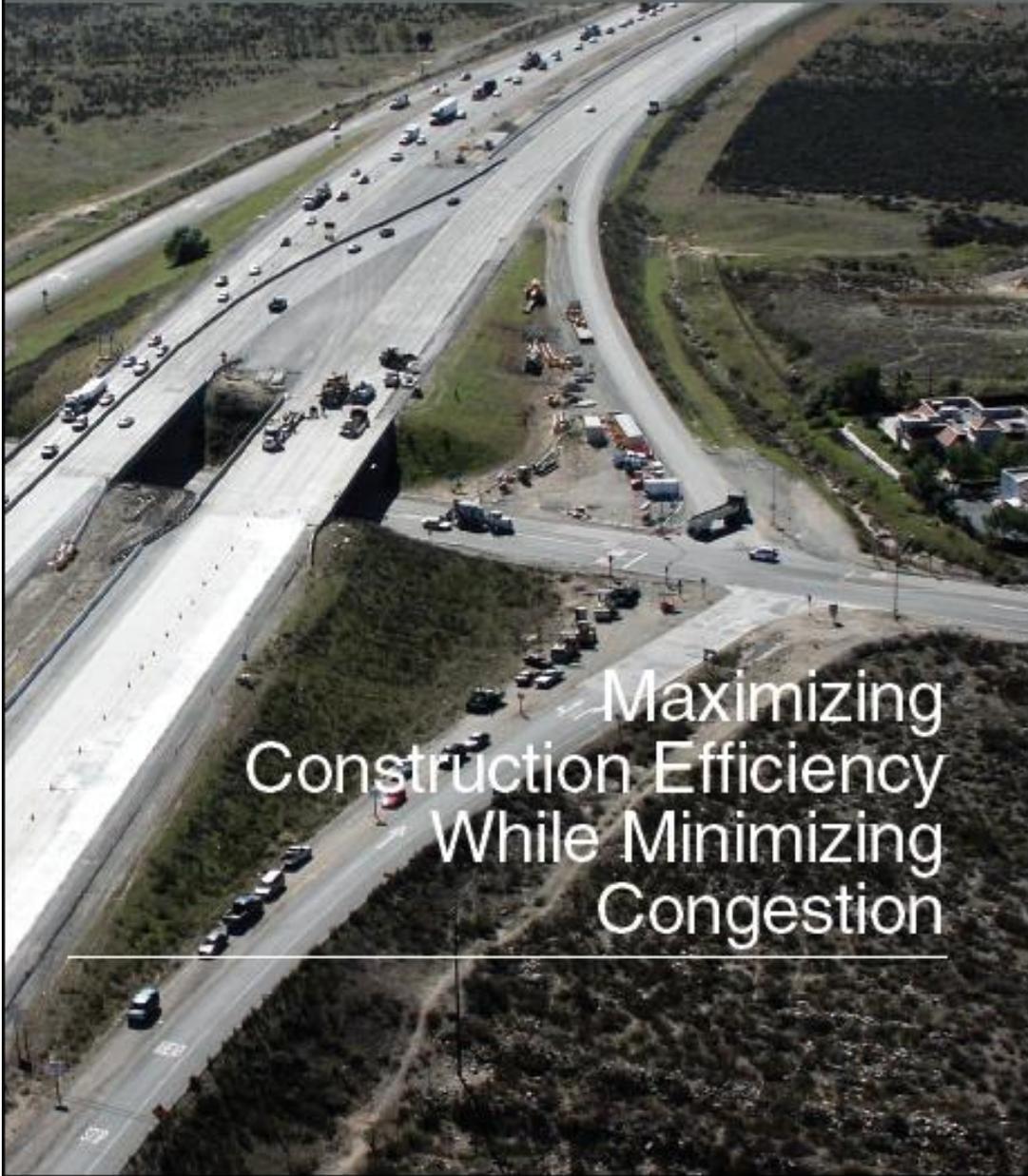
- |        |  |
|--------|--|
| 3 min  | <b>Welcome and House Keeping</b> – Doyt Bolling, WASHTO-X Program Director   |
|        | <b>Presentations</b>   |
| 5 min  | CA4PRS Participant Introductions   |
| 5 min  | Deployment Status – Larry Orcutt, Chief, Division of Research and Innovation, Caltrans   |
| 5 min  | CA4PRS and Work-Zone Traffic – Michael Samadian, Division of Research and Innovation, Caltrans   |
| 30 min | CA4PRS Modeling – John Harvey, University of California at Davis   |
| 40 min | CA4PRS Demonstrations – EB Lee, University of California at Berkeley   |
| 30 min | <b>Round Table: Open Discussion</b> (Each participating site is asked to introduce participants at its site and be prepared to briefly discuss their ideas, concerns, questions as appropriate, and submit questions and issues for discussion.) |
| 2 min  | <b>Closing Comments</b> – Doyt Bolling   |
|        | <b>Adjournment</b>   |

**List of Registered Attendance** (Actual number of attendance is great than the number of registration because more people attended from one registered site.)

Name: David Lim Agency: Caltrans Location: FHWA-CA Phone: (916) 324-2419 Fax: E-Mail: s.david.lim@dot.ca.gov	Name: Bernie Kuta Agency: FHWA Location: Phone: Fax: E-Mail: bernie.kuta@dot.gov
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## **Appendix B: Marketing Media**

**CAST** | CONSTRUCTION ANALYSIS SOFTWARE TOOLS



Maximizing  
Construction Efficiency  
While Minimizing  
Congestion

**CAST serves as an important weapon  
in today's battles against declining  
budgets, increasing congestion,  
and aging infrastructure.**

## WHY CAST? WHY NOW?

CAST technology features software packages that provide managers and other decision-makers with information on construction options that minimize traffic congestion and maximize safe, efficient mobility during roadway construction or rehabilitation projects—and beyond.

Using CAST, transportation agencies and their consultants can model various construction scenarios to determine which best serve the needs of all stakeholders.

Although it is tempting to think of CAST as a gadget in an agency's "toolbox"—it is more akin to a decision process through which various, key scenarios can be envisioned, "tested" and weighed against each other in terms of safety, cost, and impact on customers—as well as variables such as construction materials, methods, staging, and life-cycle costs.

**CAST also helps gather and organize data for Impacts Assessments and Traffic Management Plans required by FHWA's Work Zone Safety and Mobility Rule for federal-aid highway projects.**

One significant benefit of CAST technology is that it often produces a relatively clear map of the thought process involved in choosing key construction options. This makes it a useful component of public information efforts, providing stakeholders with a clear view of the factors involved in agency decisions that impact highway users.

CAST offers agencies, industry, and customers a virtual opportunity to "try before they buy," painting an accurate picture of how specific choices in the course of construction or rehabilitation are likely to perform in practice. In short, CAST helps agencies maximize the efficiency of the intricate construction planning, design, and implementation process.

## WHAT ARE MY OPTIONS?

Several popular software products are available in the marketplace to assist agencies with various aspects of construction analysis. Typical categories of options for these tools include:

- traffic simulation and analysis
- traffic management
- construction scheduling and cost analysis
- a combination of the above options.

### Traffic Simulations:

*These tools help evaluate the impact of a work zone on traffic at local or network levels. Three levels are available, depending on scope and complexity:*

- Microscopic (Based on individual vehicles and detailed characteristics like grade, curvature, car following and lane changing theories. Often focused on immediate construction area.)
- Mesoscopic (Based on individual vehicles. Predicts at an aggregate level, using average speed on travel link.)
- Macroscopic (Based on flow, speed, and density of broader traffic sectors; generally

network, corridor, or region-wide.)

### Traffic Management Tools:

*These tools aid in the modeling of:*

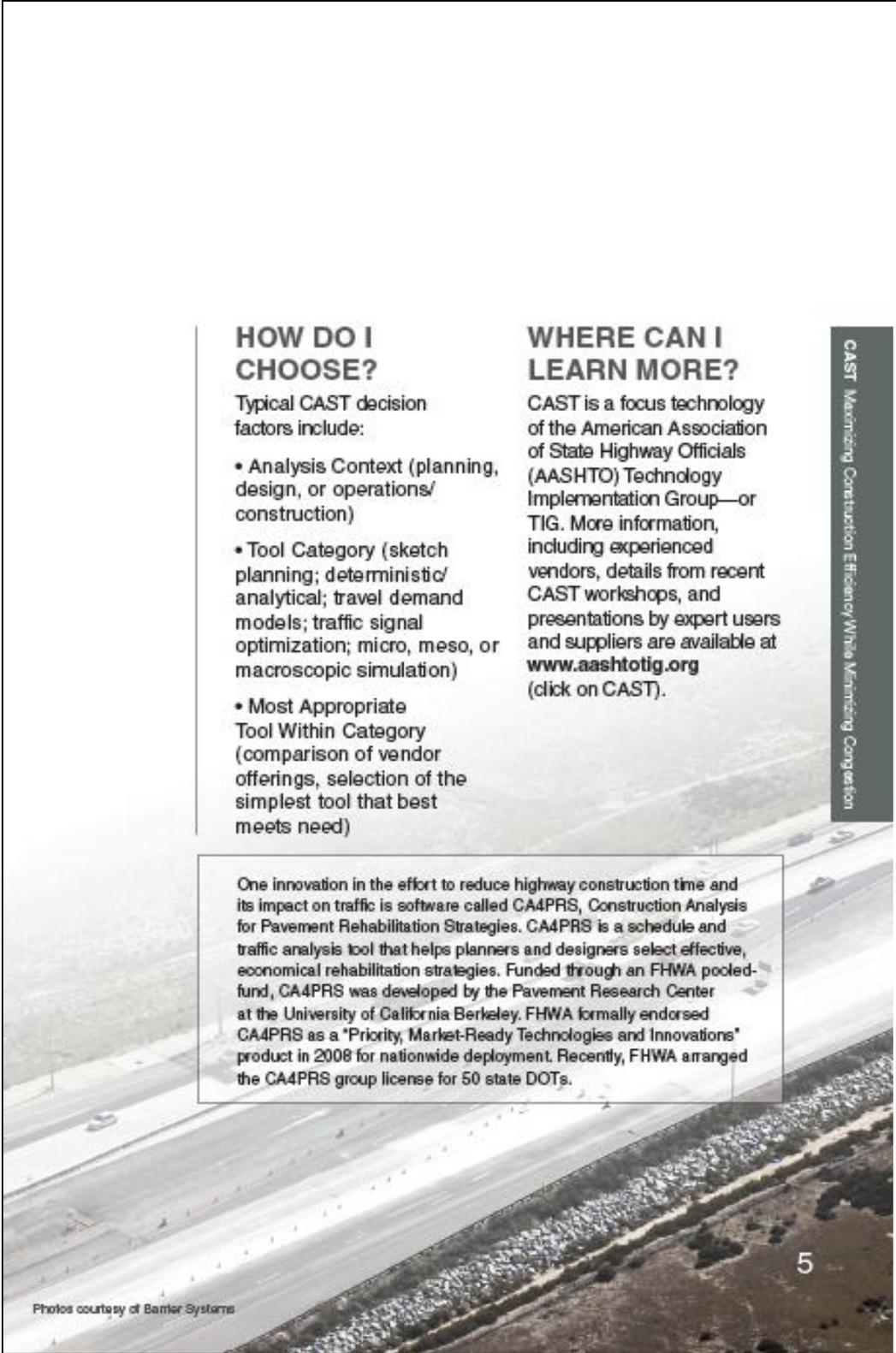
- Traffic demand and handling
- Optimal signalization
- Analytical/deterministic factors (Usually yields basic level of service estimates regarding density, speed, and delay.)
- Sketch planning (Produces general, often "first-cut," travel demand and traffic operations estimates.)
- Schedule estimation

### Construction Analysis Tools:

*These tools aid in the design of an effective construction plan by assisting in:*

- Stage planning
- Construction scheduling
- Cost analysis

CAST products vary by vendor and can be used alone, in sequence, or in tandem with one another. Functional integration of various CAST tools may be on the horizon, but at present, different tools are generally deployed for different needs or at different phases of the overall project.



### HOW DO I CHOOSE?

Typical CAST decision factors include:

- Analysis Context (planning, design, or operations/ construction)
- Tool Category (sketch planning; deterministic/ analytical; travel demand models; traffic signal optimization; micro, meso, or macroscopic simulation)
- Most Appropriate Tool Within Category (comparison of vendor offerings, selection of the simplest tool that best meets need)

### WHERE CAN I LEARN MORE?

CAST is a focus technology of the American Association of State Highway Officials (AASHTO) Technology Implementation Group—or TIG. More information, including experienced vendors, details from recent CAST workshops, and presentations by expert users and suppliers are available at [www.aashtotig.org](http://www.aashtotig.org) (click on CAST).

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 pooled-fund, CA4PRS was developed by the Pavement Research Center at the University of California Berkeley. FHWA formally endorsed CA4PRS as a "Priority, Market-Ready Technologies and Innovations" product in 2008 for nationwide deployment. Recently, FHWA arranged the CA4PRS group license for 50 state DOTs.

Photos courtesy of Barrier Systems



## Construction Analysis Software Tools

### Common Applications

PRODUCT	WORK ZONE TRAFFIC										CONSTRUCTION ANALYSIS			
	Analysis Type		Traffic Simulation Level				Traffic Management				Scheduling	Stages Planning	Cost Analysis	
	Local Basis	Network Basis	Micro	Meso	Macro	User Delay Time/Cost	Detour Planning	Impact of Signs						
AIMSUN		o	o	o	o	o					o			
TRANSMODELER	o		o	o	o				o					
PARAMICS	o		o						o					
COFSIM		o	o						o					
IDAS	o	o						o						
FREQ	o	o						o					o	
CA4PRS *	o							o					o	o
PRIMAVERA						N/A							o	o

\* FHWA has a group license of this product for 50 State DOTs. Contact the CAST team leader of FHWA Headquarters for more information.

**CAST** | CONSTRUCTION ANALYSIS SOFTWARE TOOLS

*For additional CAST resources,  
visit [www.aashtotig.org](http://www.aashtotig.org)  
and click on CAST.*

## ABOUT TIG

Dedicated to sharing high-payoff, market-ready technologies among transportation agencies across the United States, TIG promotes technological advancements in transportation, sponsors technology transfer efforts, and encourages implementation of those advancements.

For more information visit  
[www.aashtotig.org](http://www.aashtotig.org)

## CAST LEAD STATES TEAM

TIG's Lead States Team on Construction Analysis Software Tools includes DOT and FHWA representatives who can help you evaluate the use of the technology in your agency. Turn to team members for insight, expertise, and advice.

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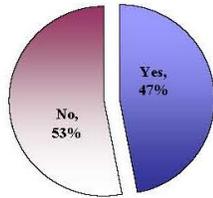


Publication Date: January 2009

## **Appendix C: Survey Results**

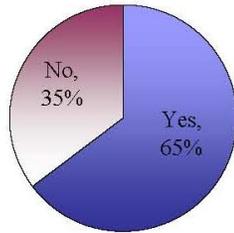
# Summary of Initial Survey Regarding Awareness and Use of CAST Technologies (2007)

Questionnaire	Responses			
	Yes	No	% of Yes	% of No
Are you aware of the changes to Federal rules for work zone safety and mobility that are taking effect in summer 2007?	34	0	100	0
Have you developed a policy/procedure to deal with the new Federal work zone rule?	18	18	47	53



**If so, briefly describe your policy/procedure.** About 50 percent of states have developed guidelines for the development of Transportation Management Plans for projects, while other 50 percent of states are in the process of consolidating these into a uniform policy to comply with the rule.

Does your policy have a plan to implement the new Federal work zone rule?	22	12	65	35
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**If so, briefly describe your plan.** The development of a plan for implementing the new rule is currently underway in most of states that responded in 'yes.' In Florida, a plan is being already put into place through compliance.

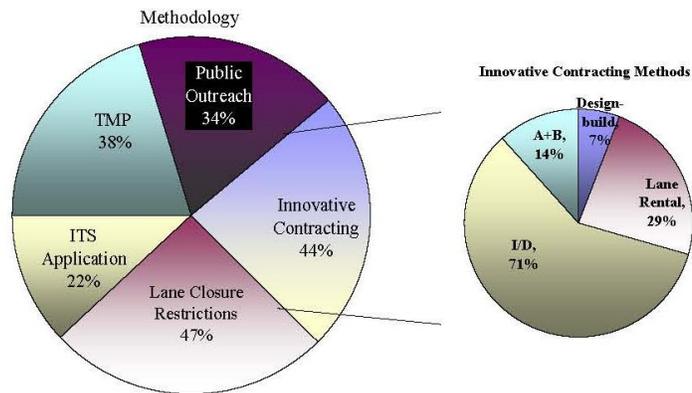
**What methodology do you use to minimize congestion during construction?**

Note: Two states (GA & SD) out of 34 respondents did not answer to this question. The sum of the percentage cannot be equal to 100 because of many overlaps.

Methodology being used	Frequency	%	State
Innovative Contracting Methods (ICMs)	14	44	AR, CA, DE, FL, IA, KY, MN, MS, MO, NM, NY, UT, WV, WI
Design-build	1	7	UT
Lane rental	4	29	MS (ONE PROJECT), MO, NY, UT
Incentive/Disincentive	10	71	AR, CA, DE, KY, MN, MO, NM, NY, WV, WI
Bidding on cost and time (A+B)	2	14	MO, NY
Lane Closure Restriction (e.g., nighttime or weekend construction)	15	47	AR, CO, DE, FL, ID, IN, IA, MA, NV, NM, NY, UT, VT, WX, WI
ITS Application	7	22	MA, OK, OR, PA, TX, UT, WI
Traffic Management Plan including the use of alternate routes	12	38	AK, CA, CO, DE, KS, KY, MI, MT, ND, OR, VA, WY
Public Involvement	11	34	CA, CO, IA, MI, NY, ND, OK, PA, TX, UT, VA

**In summary,**

1. The most widely used methodologies for lessening traffic inconvenience are: innovative contracting methods and lane closure restrictions
2. Among four different ICMs, the incentive contracting method stood out as the most preferred one by state highway agencies.
3. Like California, New York state also uses extended full closures (24/7) to complete the project in minimal time.
4. The state of New York and Texas reported that they have implemented a very strong, extensive public outreach program.
5. The state of Missouri and New York have used all of the ICMs, except design-build.
6. Florida is the only state reporting that the selection of pavement material design is being used to minimize congestion.
7. Indiana has an interstate lane closure policy that limits restrictions based on traffic.



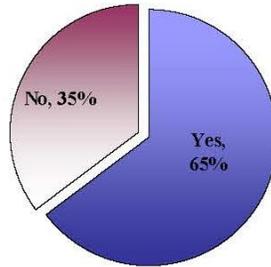
Does your Department use any software tools for traffic management planning during construction?

22 12 65 35

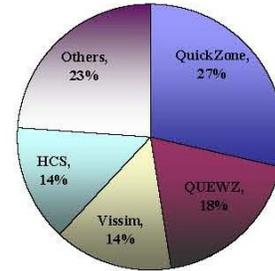
If so, what software is used?

Software	Frequency	%
QuickZone	6	27
QUEWZ	4	18
Vissim	3	14
HCS (Highway Capacity Software)	3	14
Others (Excel, Syncro, Construction Congestion Cost)	5	23

Does your state use any software tools for TMP?



Software Usage (among 22 states that use any computer tools)



Do you use software tools for estimating user impacts and costs for highway construction?

18 16 53 47

What software tools do you use?

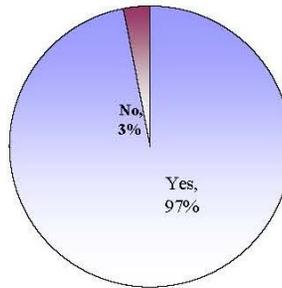
Various: QUEWZ (4), AASHTO User Benefit Analysis (3), QuickZone (2), self-developed Excel spreadsheet, FHWA Excel-based program, Construction Congestion Cost

Do you have any plans to improve the tools/methods you use for traffic management in construction zones?

16 18 47 53

If there were a tool (new or improved) available for minimizing project costs and user impacts from construction, would you be interested?

33 1 97 3



**Final Survey of States Regarding Awareness and Use of CAST Technologies**

Responses were received from 67 Individuals from 37 States (response from S. Korea is not included in table below).

		AIMSUN	CA4PRS	CORSIM	FREQ	IDAS	PARAMICS	PRIMAVERA	TRANSMODELER
Awareness	YES	7	15	29	10	9	10	37	12
	no pilot study	6	10	7	7	8	5	5	10
	pilot done	1	3	21	3	1	4	30	1
	pilot on going		2						
	plan to try			1			1	2	1
	NO	28	21	8	25	25	26		22
No Answer	2	1		2	3	1		3	
SUM	37	37	37	37	37	37	37	37	37
This product is considered routine. *			2	18	1	1	2	25	2
Will implement. *				1	1			1	

\* The states answered "yes" to this item is considered as they have done a pilot study.

(% of states indicating awareness of CAST technologies)

		AIMSUN	CA4PRS	CORSIM	FREQ	IDAS	PARAMICS	PRIMAVERA	TRANSMODELER
Awareness	YES	19	41	78	27	24	27	100	32
(%)	NO (incl. no answer)	81	59	22	73	76	73	0	68
Pilot Study (%)		14	33	76	30	11	50	86	17