Key Challenges in Transportation and Why SE Can Help

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Typical Caltrans ATMS System

System Input

Internet

System Output

CHP CAD

Emergency Services

Minutes to: 405 10Min

Train Travel Time LA Station 30 Min

External Agencies

Transportation Management Center

CCTV

VDS

RWIS

CMS

HAR

HIGH WIND GUSTS AHEAD

Ramp Metering
Caltrans Districts and Transportation Management Centers

* ATMS
Integration with Regional Systems
Example District 3 STARNET

Figure 4 STARNET Overall Architecture
History of Systems Engineering in Caltrans

1990s
- Initial ITS National Architecture (FHWA/FTA)
- Initial ATMS deployed
- Initial Systems Engineering Training

2000-2009
- FHWA Systems Engineering Rule (FHWA/FTA)
- Initial Systems Engineering Process
- SE Guidebook For ITS
- Statewide Systems Engineering Training

2010-Now
- Evolved the SE Process
- Initial Standardization of SE
- Initial Single Model for ATMS
Key Challenge - Single Model for ATMS Statewide

• Integrate 6 ATMS Applications into 1 ATMS Application
• 5 Year Project Plan
• Moving Toward a Single Model for the ATMS Allowing Tailoring for Each District
• Integration of New Technologies into Legacy Systems – Google Maps, Decision Support System, AVMS
• Standard SE Process
  – Integration of Tools to Support the SE Process
Automation Support for SE
Key Challenge - Internal Caltrans Integration Capabilities

• Because of challenges with previous projects, Caltrans is moving system integration in-house
  – Transparency
  – SE Process Control

• SE Training to Improve Capabilities

• Using the Guidebook as a Bases for Processes

• Performing a Repeatable SE Process

• Using Document Templates that are Tailorable
Key Challenge - Using SE on all Caltrans ITS Projects

- Align the Divisions to Use a Standard SE Process
- Developing Internal Champions for SE
- Promoting SE within the Divisions
- Teaching How SE Aligns with Existing Division Practices
- Maintaining Management Support for the SE Process
Key Challenge - Streamline the SE Process

- Making the SE Process Leaner and More Effective
- Uniform SE Process (Tailorable Templates)
- Project Level Tailoring Guidance of SE Process
- Maximize the Automation of Requirements, Development, Verification, and Validation
ICM – Integrated Corridor Management

The key to ICM is integrating existing systems and management efforts with new concepts and relationships to develop a coherent multi-modal, multi-jurisdiction, corridor-wide transportation management system.

**Institutional Integration**
 Coordination to collaboration between various agencies and jurisdictions that transcends institutional boundaries.

**Operational Integration**
 Multi-agency and cross-network operational strategies to manage the total capacity and demand of the corridor.

**Technical Integration**
 Sharing and distribution of information, and system operations and control functions to support the immediate analysis and response.
Connected Corridor Elements

- Enhanced traffic monitoring systems
- Enhanced communication
- Freeway operations
- Arterial operations
- Enhanced traveler information
- Decision support system
Decision Support System

- **Modeling Tool / Calibration Check**
- **Evaluation/Simulation Model Parameters**

**Estimation**
- **State Estimation**
- **Input Data**
- **Current State**

**Prediction**
- **Demand Prediction**
- **System State Prediction**
- **Predicted ODs and routes**

**Demand Strategies**
- **Supp Strategies**

**Supply Strategies**

**Knowledge**
- **Demand Strategies**
- **Decision Thresholds**
- **Historical Performance**

**Actuation**
- **Commands to Corridor Devices**

**Operator Interface**

- **Data Validation & Normalization**
- **Field Data**
- **All Data**
- **Historical Data Archive**

**Data**

- **Traffic Data (flow, speed, etc.)**
- **Incidents & Events**
- **Asset Status**
- **Data Summary**

**All Data**

**Operational Support System**

- **Decision Support System**
- **State Estimation**
- **Historical Data Archive**

**Decision Support System**

- **Field Data**
- **Traffic Data (flow, speed, etc.)**
- **All Data**
- **Incidents & Events**

**Current State**

- **Demand Strategies**
- **Supp Strategies**

**System State Prediction**

- **Predicted ODs and routes**

**Modeling**

- **Evaluation/Simulation Model Parameters**
- **Demand Strategies**
- **Supply Strategies**

**Actuation**

- **Commands to Corridor Devices**
- **Knowledge**
Key Challenge - Connected Corridors

• Challenges with Multiple Agencies
  – How to Get Buy-in on a Multi Jurisdictional Project
  – Stakeholder’s Involvement

• The Goal is a Single Model for Use in All Corridors
  – Creating Standards, but Allowing Tailoring to Jurisdictional Needs