Caltrans District 7
Los Angeles Regional Transportation Management Center (LARTMC)

"*Innovative Technologies at Work*"

October 2007

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The LARTMC – What is It?

- The LARTMC is a high-technology facility designed solely for purposes of managing traffic within the highly congested LA and Ventura County regions.

- The LARTMC serves forty three (43) distinct government functions and was designed with the technologies to support joint operations and act as the center for Intelligent Transportation Systems (ITS) and Emergency Response operations for the next 30 years.

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LARTMC – Who does it help?

- The LARTMC systems assist nearly 9.6 million people living in LA alone, not to mention the 20 million people living in the Southern California, a great deal of which travel to LA each day.

- Motorists are assisted through:
  - Roadway congestion monitoring on 525 miles of mainline roadway
  - Real-time information posted to nearly 20 real-time traffic websites – 24x7
  - Real-time traffic and video displayed on television stations daily
  - Display or real-time incident and travel time messages on nearly 109 changeable message signs daily
  - Prompt motorist aid as well as incident detection, verification and clearance both improving travel flows and reducing secondary incidents

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Agencies Involved

Vendors/Contractors Involved

Delcan
TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

at&t
Your world. Delivered.

DMJM H&N

ELECTROSONIC

Crosstown Electrical & Data, Inc

SWINERTON
INCORPORATED

LARTMC Technologies and Innovations

- Audio/Visual System
- Advanced Transportation Management System (ATMS) Software
- Real Time Traffic Data Portals
- ITS Fiber Optic Field Communications

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LARTMC Audio Visual System

Twelve 84” Dual Bulb Digital Light projection (DLP) displays

Two 10-Line, 40-character Electronic Message Boards (EMB)

Twelve 50” Digital Light Projection (DLP) display cubes

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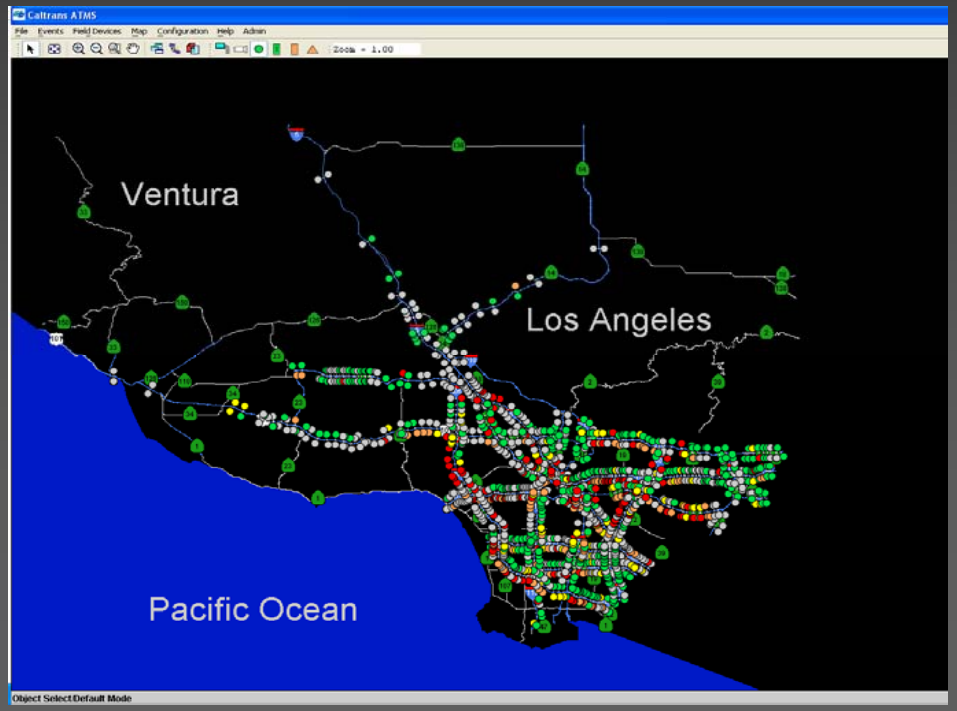
The ATMS software:

- Monitors over 525 miles of monitored freeway and highway
- 1,280 Traffic Monitoring Stations (TMS)
- Over 10,000 Inductive Loop sensors



Real-Time ATMS Map displaying 1280 vehicle detector stations

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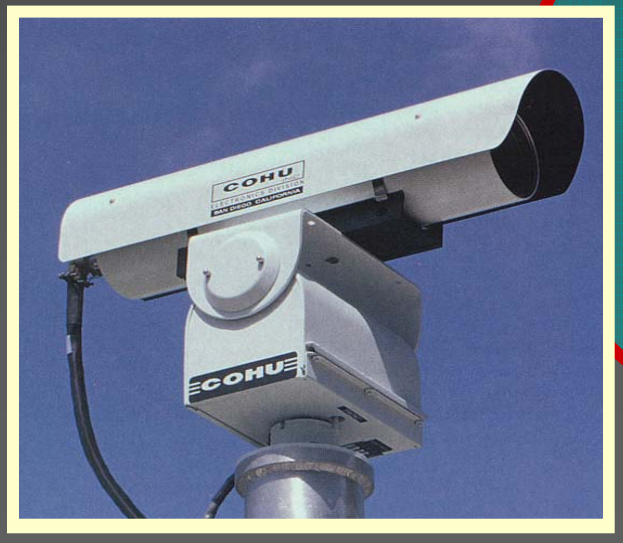
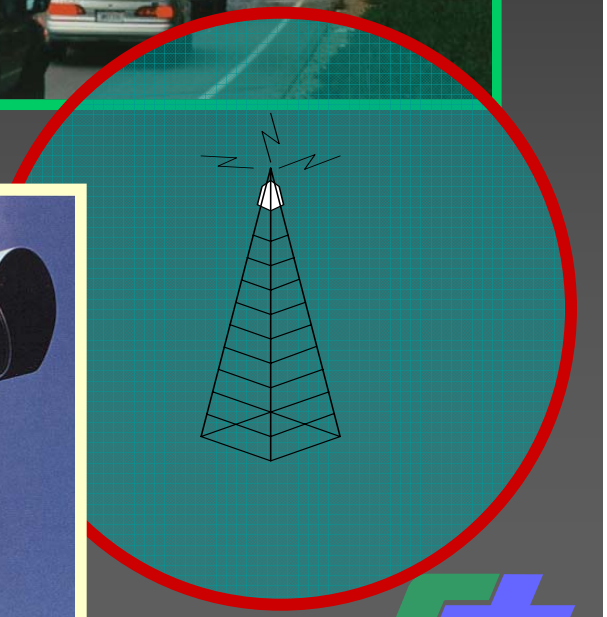
The ATMS Controls the following field devices:

- 109 Changeable Message Signs
- 960 Ramp Metering Systems
- 15 Highway Advisory Radio Stations
- 350 Closed Circuit television (CCTV) Cameras





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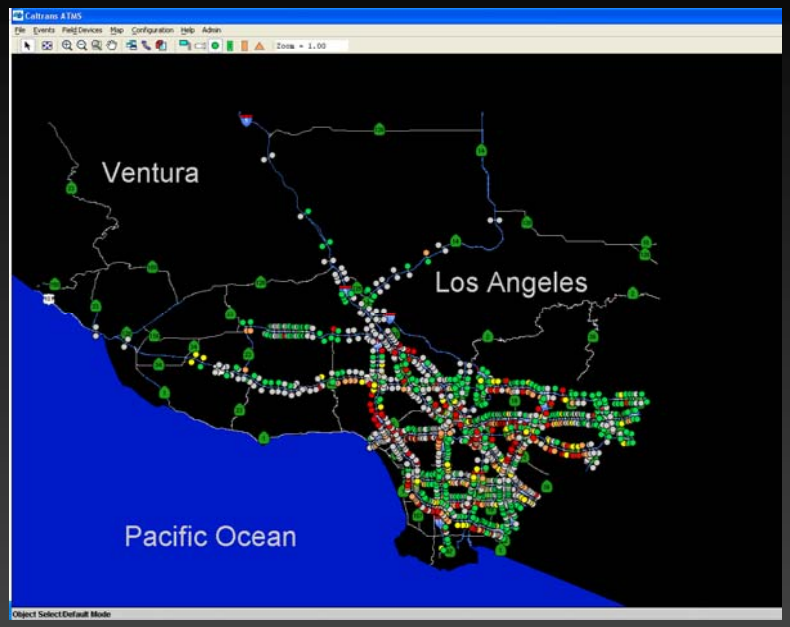
ATMS Software Features

ATMS "Base Map"



- **Map of Region**
  - **Depicts Roadways**
    - **Freeways, State Highways, Major & Minor Arterials**
  - **Shows Field Element Locations & Status**
    - **Induction Loops, Ramp Meters, CMS, CCTV, HAR & Beacons**
- **Overview of All ATMS Operations**
  - **Freeway Congestion**
  - **Ramp Metering Operations**
  - **Current and Scheduled Planned Event Operations**

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Functionality of Base Map

- **Map Manipulation**
  - **Multiple Pan & Zoom Options**
  - **Map Overview**
  - **New Map**
  - **Legend**
- **Control of Map Layers**
  - **Automatic “Decluttering”**
  - **User Controllable Views**

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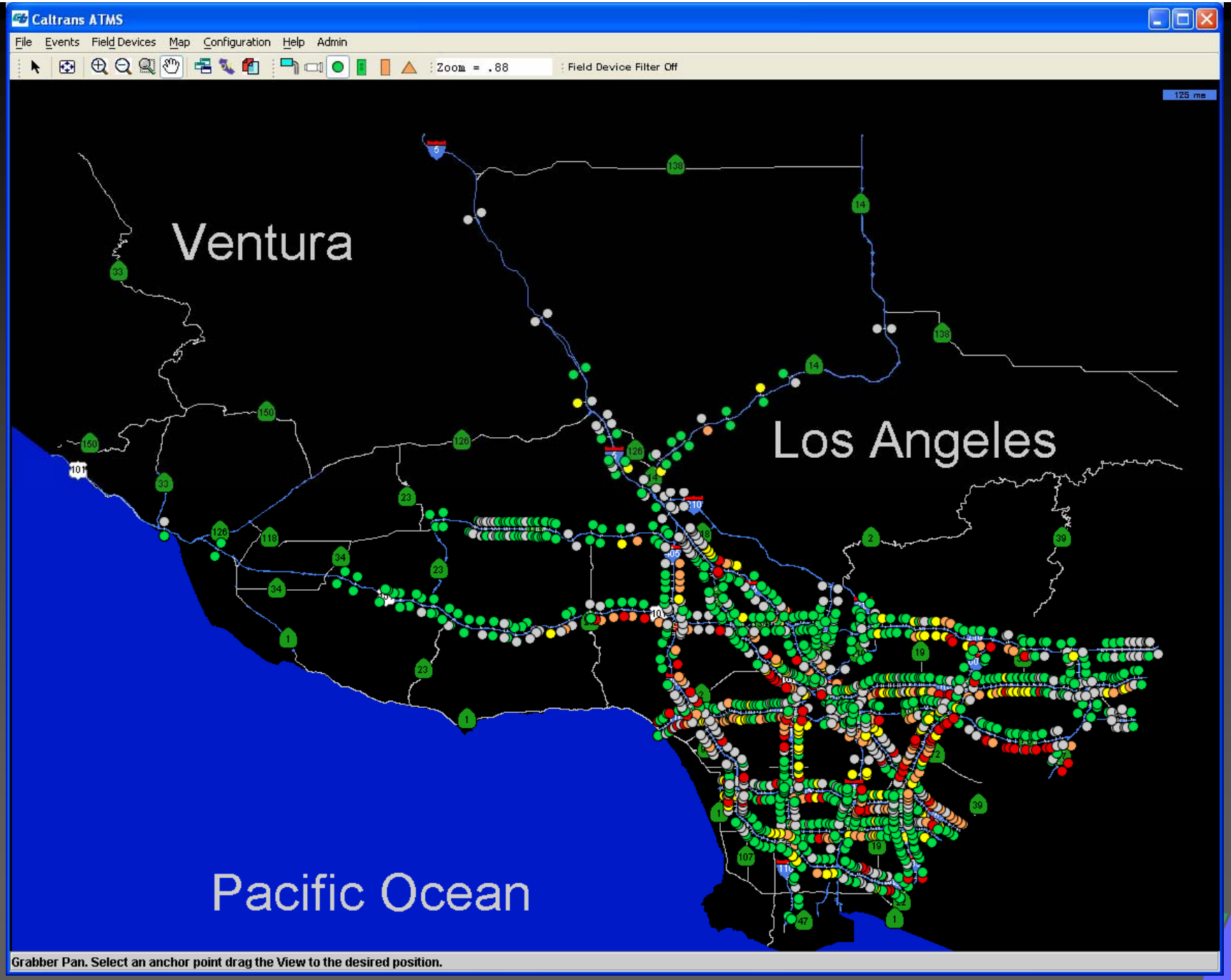
Caltrans ATMS
File Events Field Devices Map Configuration Help Admin
Zoom = .88
Field Device Filter Off
125 mi
Ventura
Los Angeles
Pacific Ocean
Grabber Pan. Select an anchor point drag the View to the desired position.

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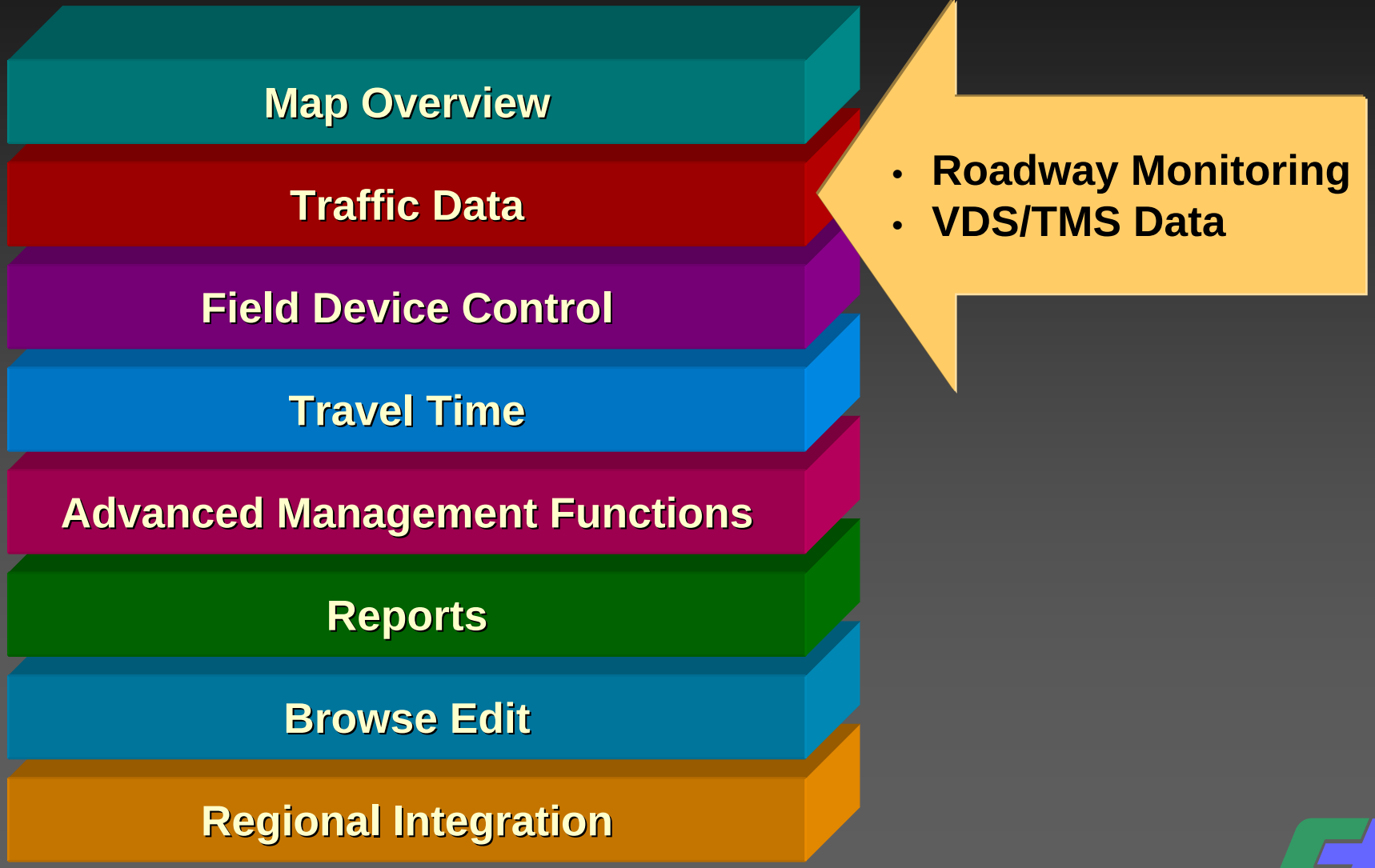
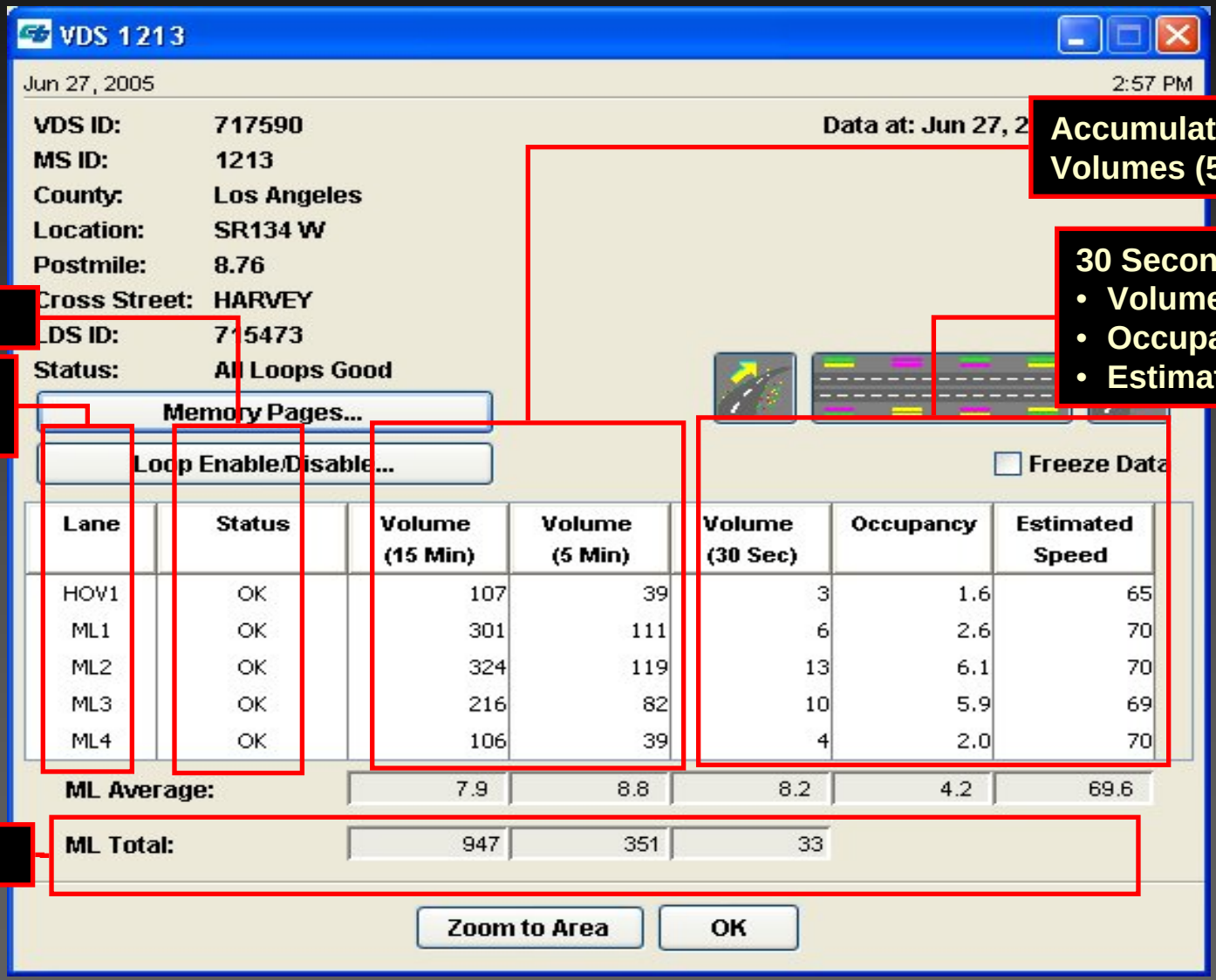
ATMS Software



VDS Data Dialogue



Loop Status

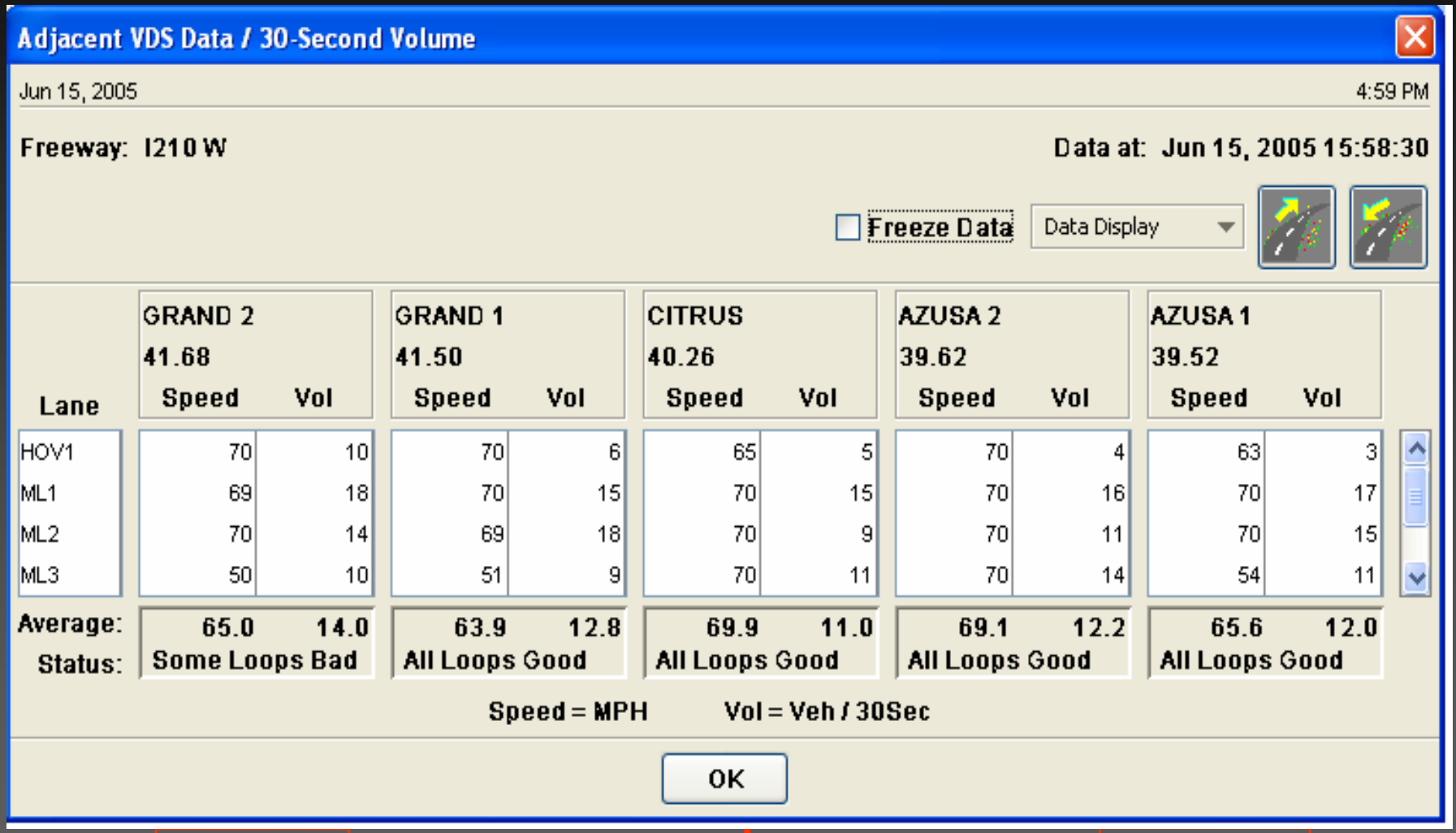
Loop Location

Station Totals

Accumulated Loop Volumes (5, 15 min)

30 Second Loop Data
- Volume
- Occupancy
- Estimated Speed

Multiple Station Data Display



Upstream

Primary VDS

Downstream

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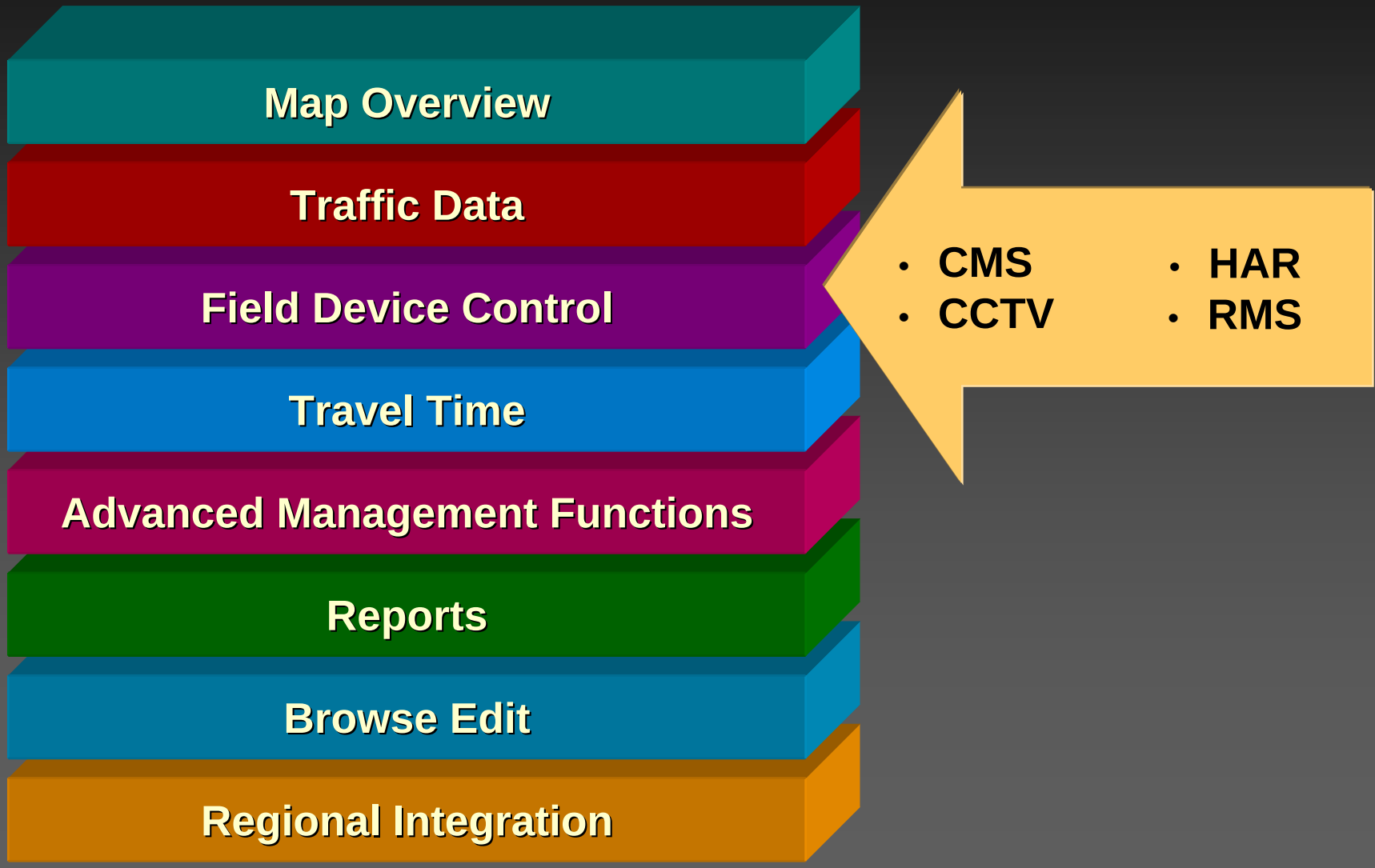
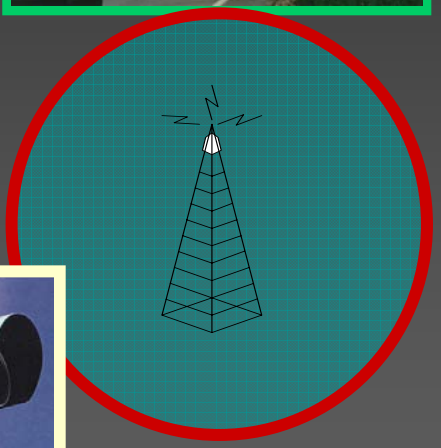
ATMS Software



Device Control

- Changeable Message Signs
  - Operational Status
  - Manual User Control
  - System Scheduled
- RMS
  - Operational Status (Mode, Rate)
  - Central Algorithm Configuration (SWARM)
- HAR & Beacons
  - Operational Status
- CCTV
  - Camera Selection (point and click)
  - Pan / Tilt / Zoom / Iris
  - Video Wall Control
  - Video Snapshot Configuration



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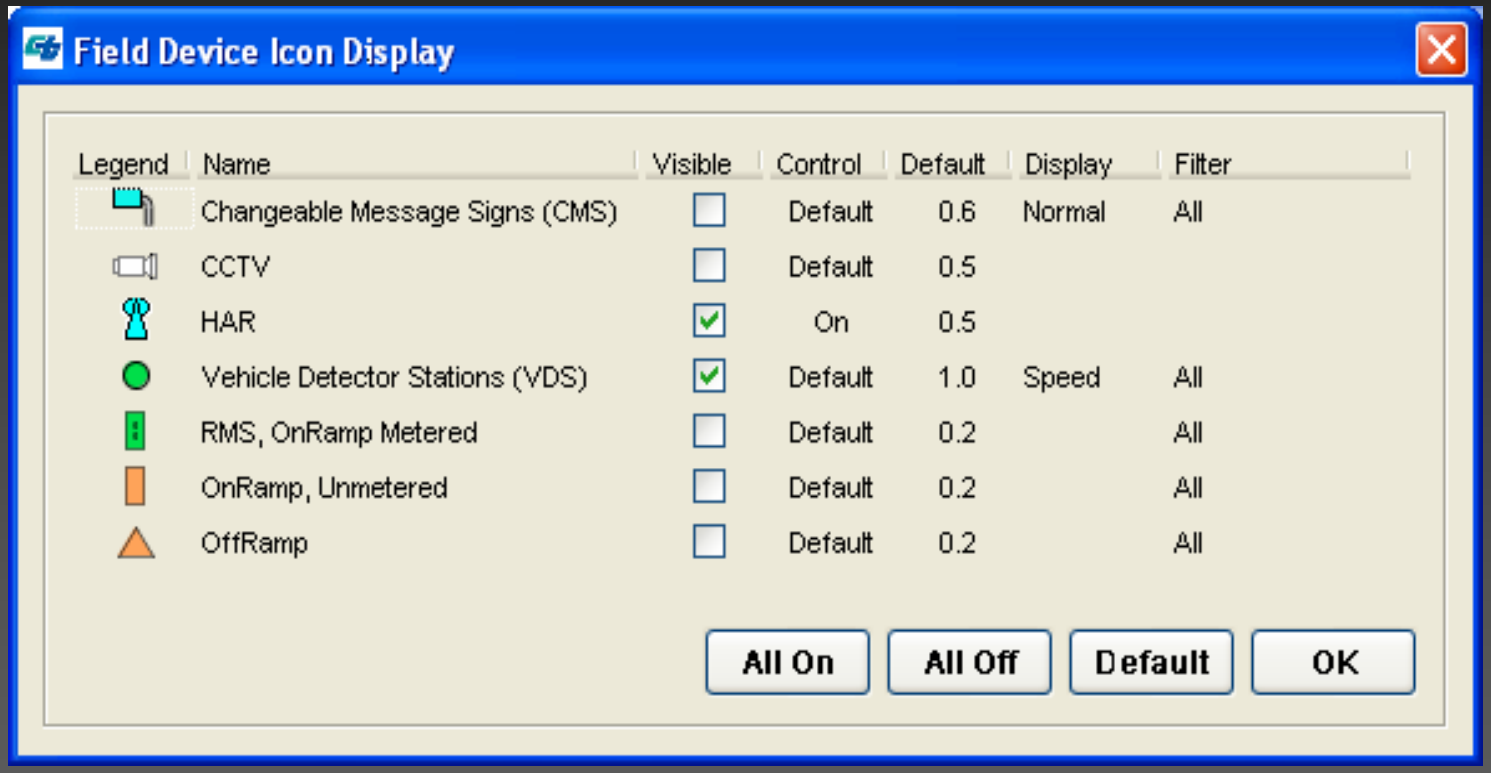
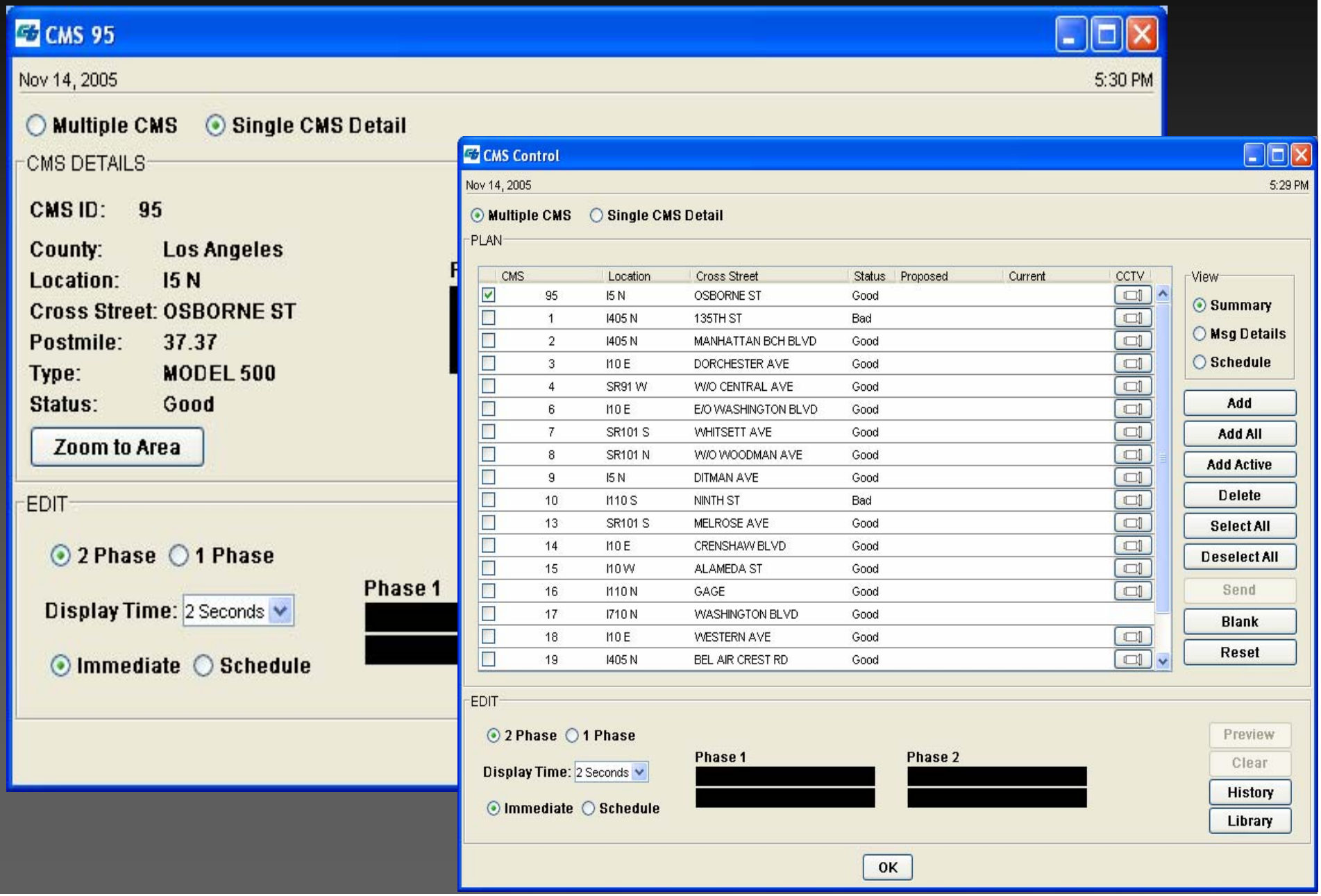
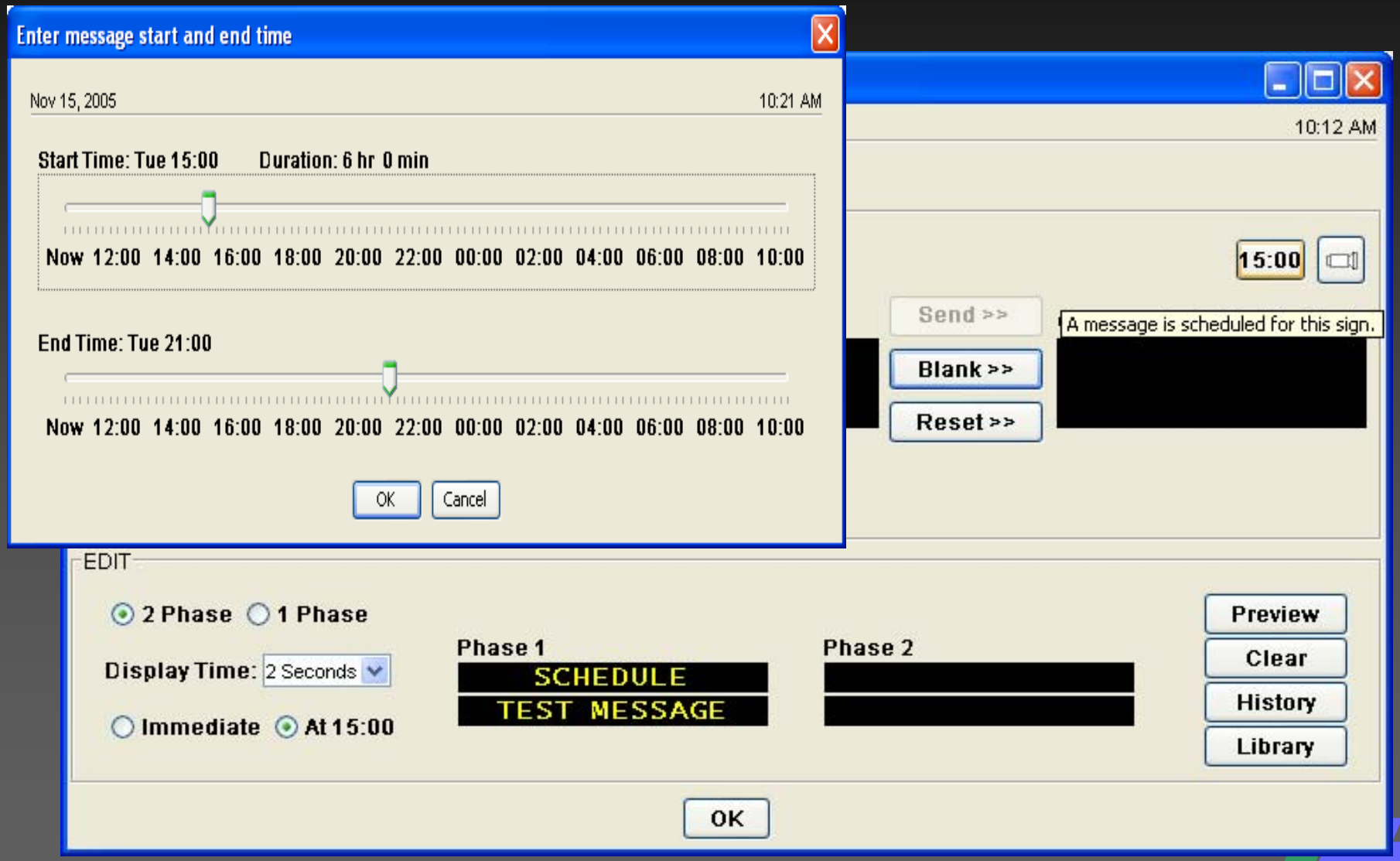
Field Devices - Icon Display



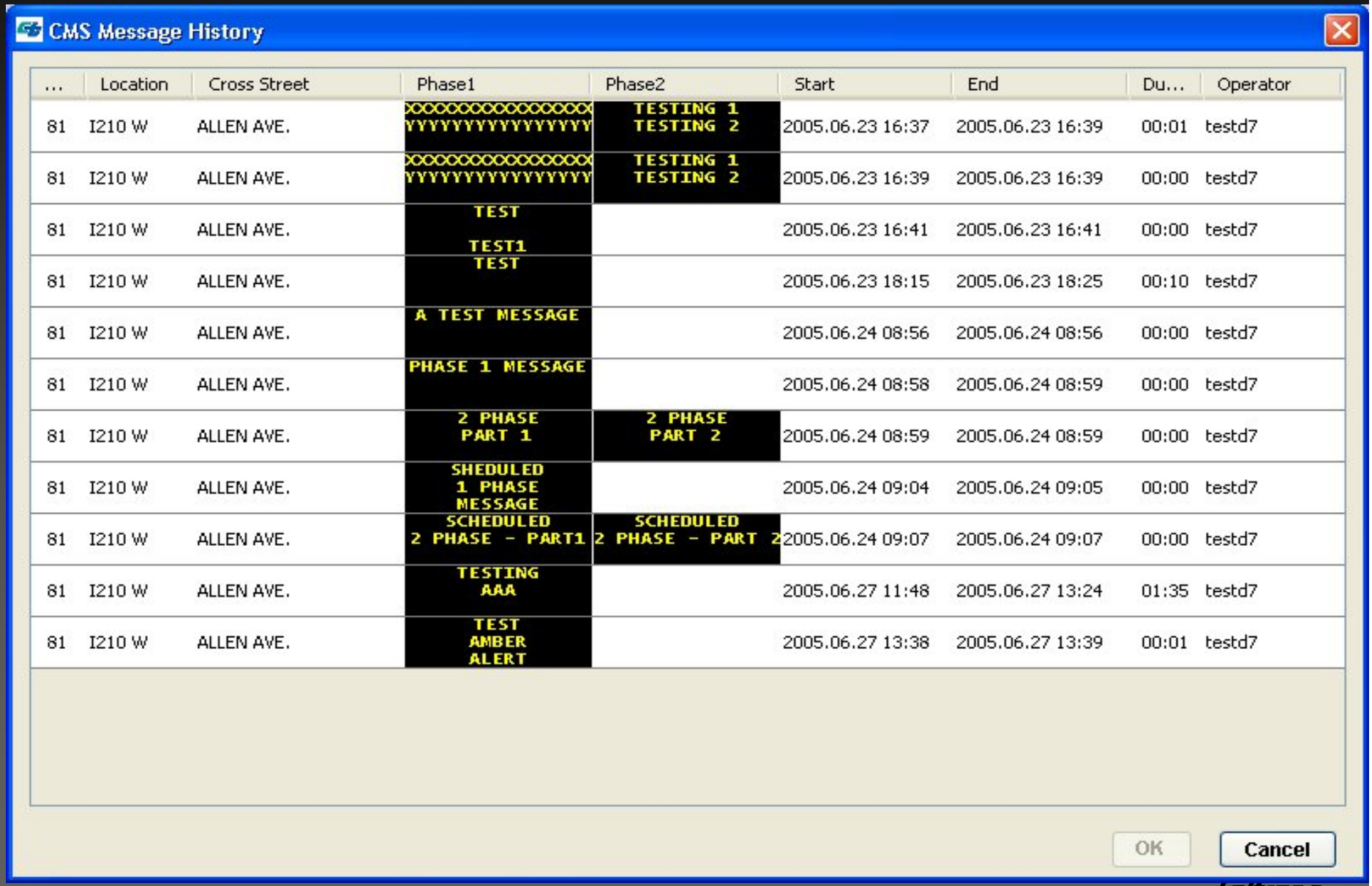
CMS Manual Control



CMS System Schedule



CMS Message History



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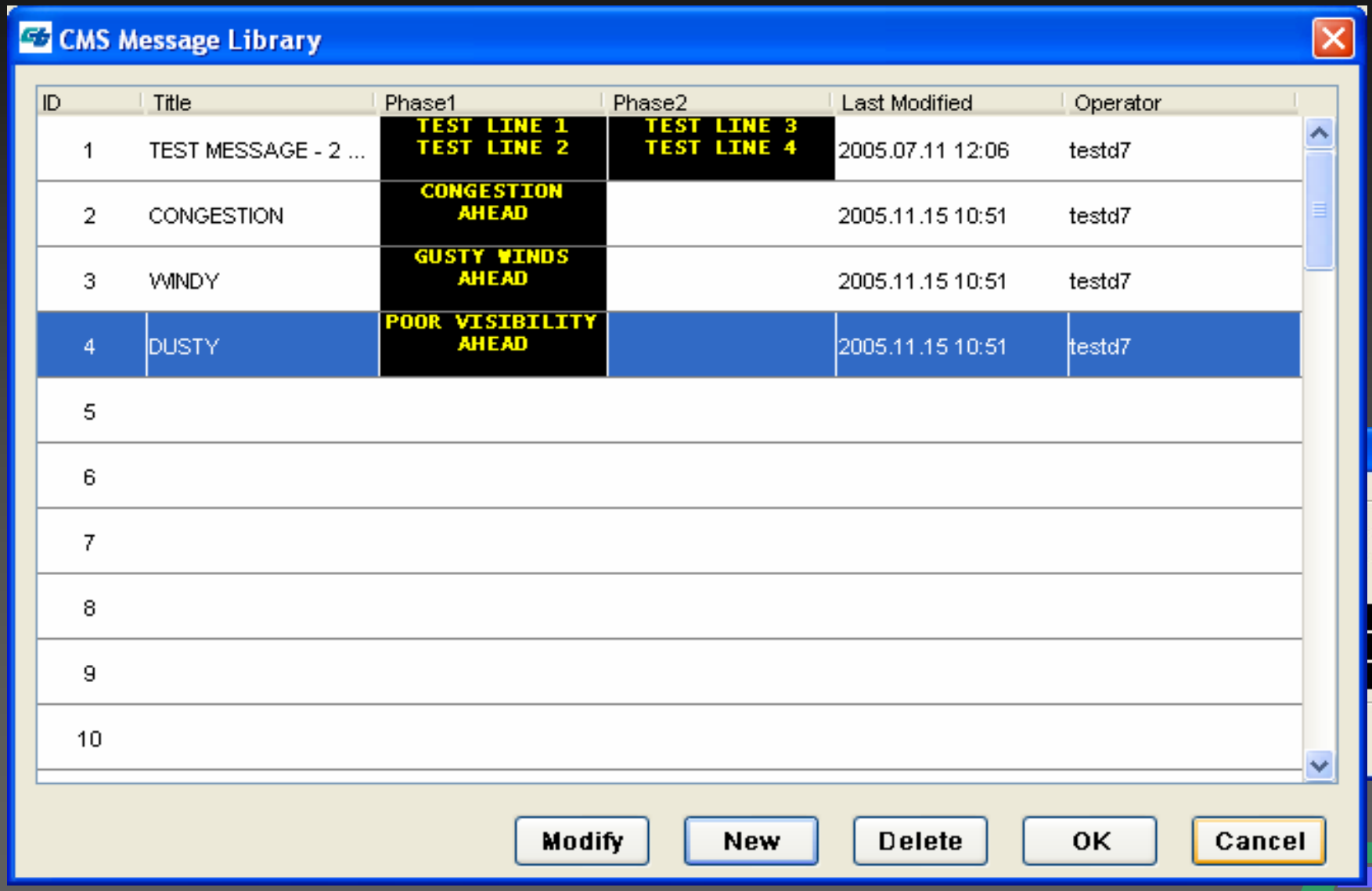
CMS Message Library



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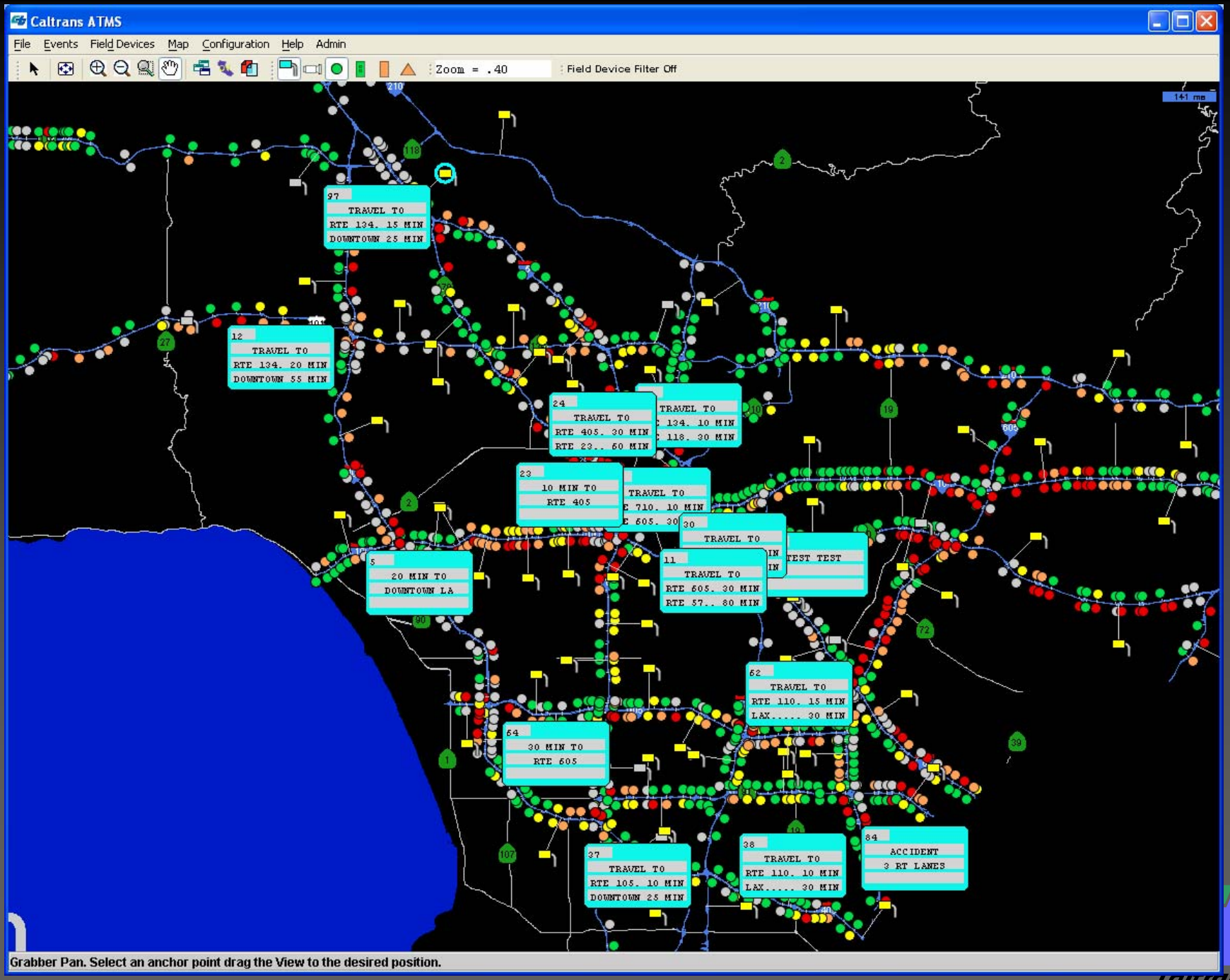
Caltrans ATMS
File Events Field Devices Map Configuration Help Admin
Zoom = .40
Field Device Filter Off
97
TRAVEL TO
RTE 134. 15 MIN
DOWNTOWN 25 MIN
12
TRAVEL TO
RTE 134. 20 MIN
DOWNTOWN 55 MIN
24
TRAVEL TO
RTE 405. 30 MIN
RTE 23.. 60 MIN
TRAVEL TO
134. 10 MIN
118. 30 MIN
23
10 MIN TO
RTE 405
TRAVEL TO
710. 10 MIN
605. 30
30
TRAVEL TO
TEST TEST
5
20 MIN TO
DOWNTOWN LA
11
TRAVEL TO
RTE 605. 30 MIN
RTE 57.. 80 MIN
62
TRAVEL TO
RTE 110. 15 MIN
LAX..... 30 MIN
64
30 MIN TO
RTE 605
37
TRAVEL TO
RTE 105. 10 MIN
DOWNTOWN 25 MIN
38
TRAVEL TO
RTE 110. 10 MIN
LAX..... 30 MIN
84
ACCIDENT
3 RT LANES
Grabber Pan. Select an anchor point drag the View to the desired position.

Ramp Metering

- Manual Control
  - Traditional Time of Day & Local Responsive
  - Controller Memory Configuration
- Multiple “Automated” Modes
  - 3 Central Algorithms
    - Swarm 1 - Adaptive System-wide
    - Swarm 2a - Headway-based local responsive
    - Swarm 2b - Density-based local responsive

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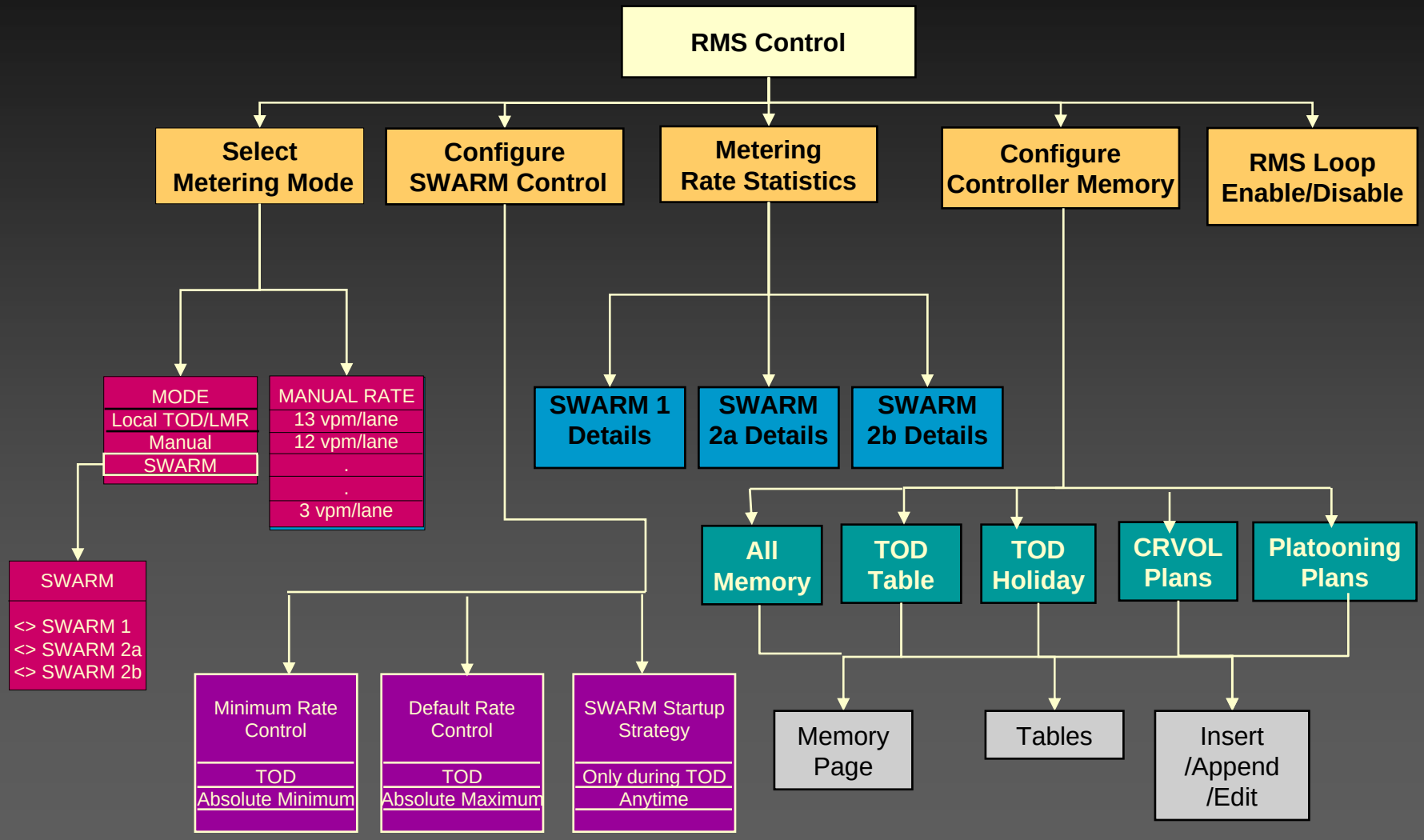
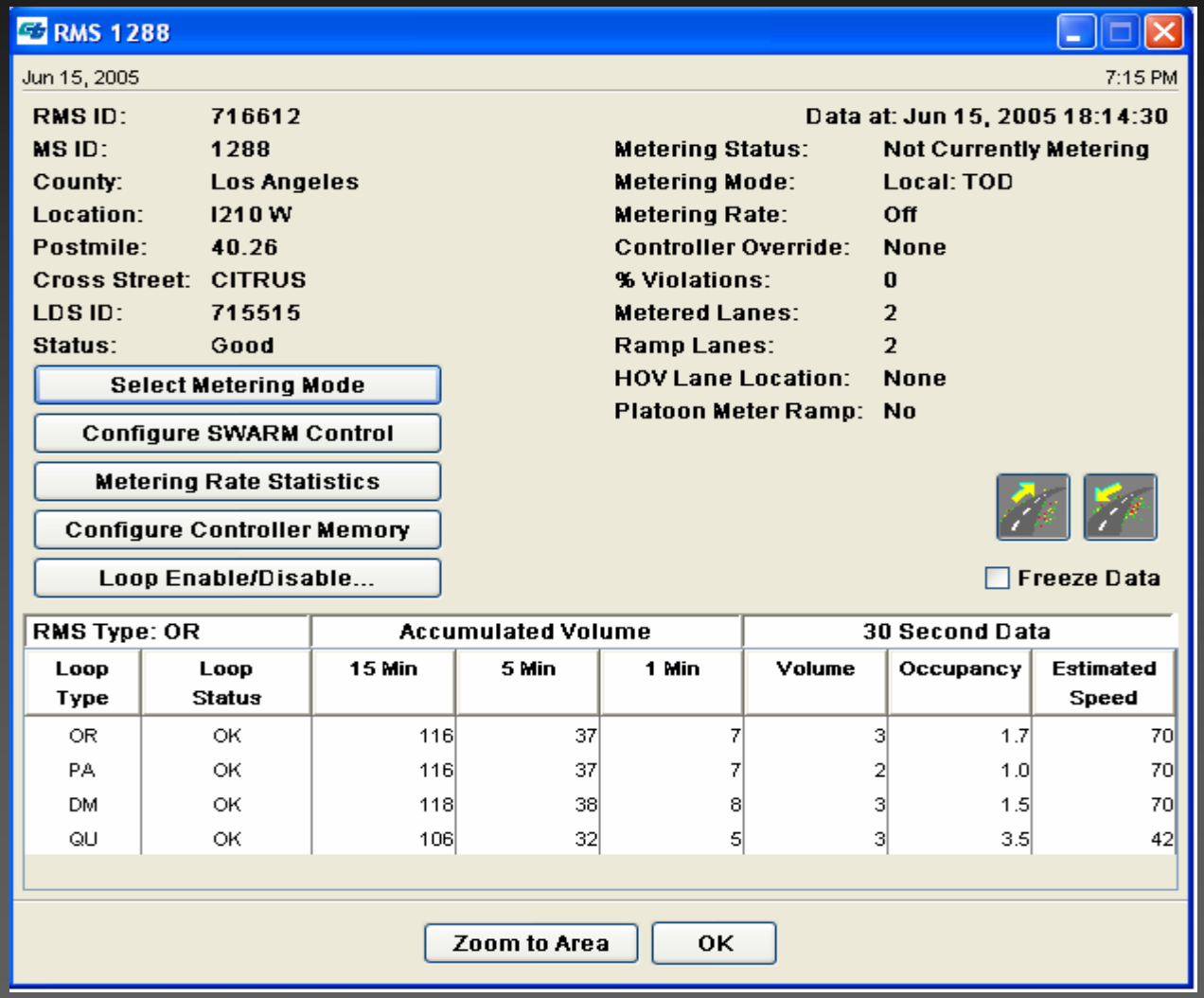
Flow of RMS Windows



Ramp Metering Control



RMS Type: OR		Accumulated Volume			30 Second Data		
Loop Type	Loop Status	15 Min	5 Min	1 Min	Volume	Occupancy	Estimated Speed
OR	OK	116	37	7	3	1.7	70
PA	OK	116	37	7	2	1.0	70
DM	OK	118	38	8	3	1.5	70
QU	OK	106	32	5	3	3.5	42

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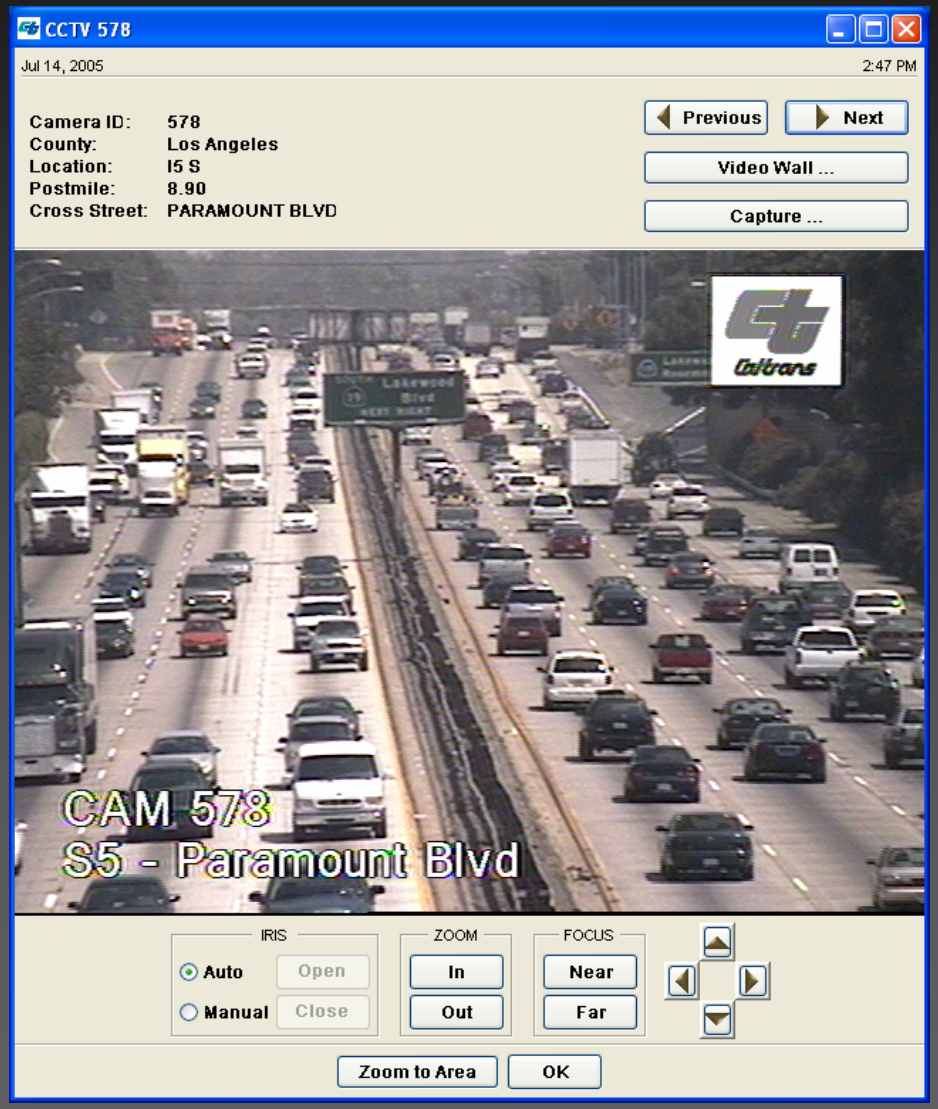
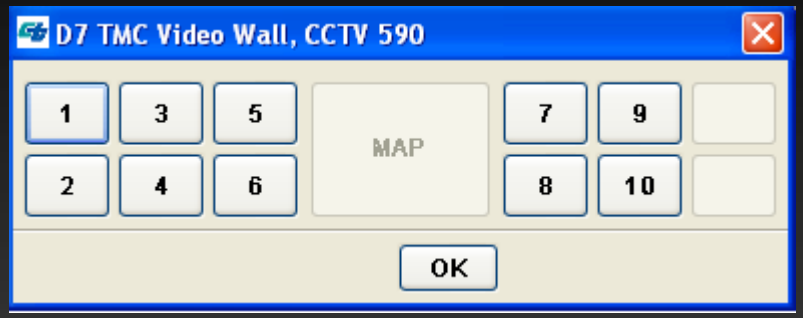
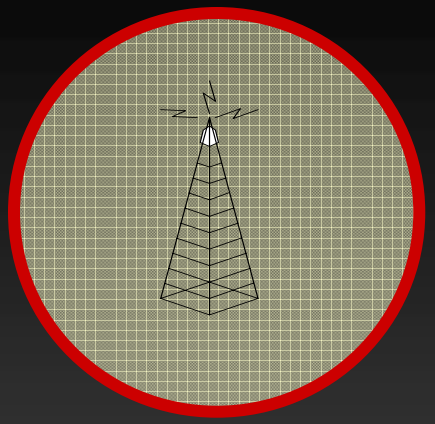
CCTV Interface



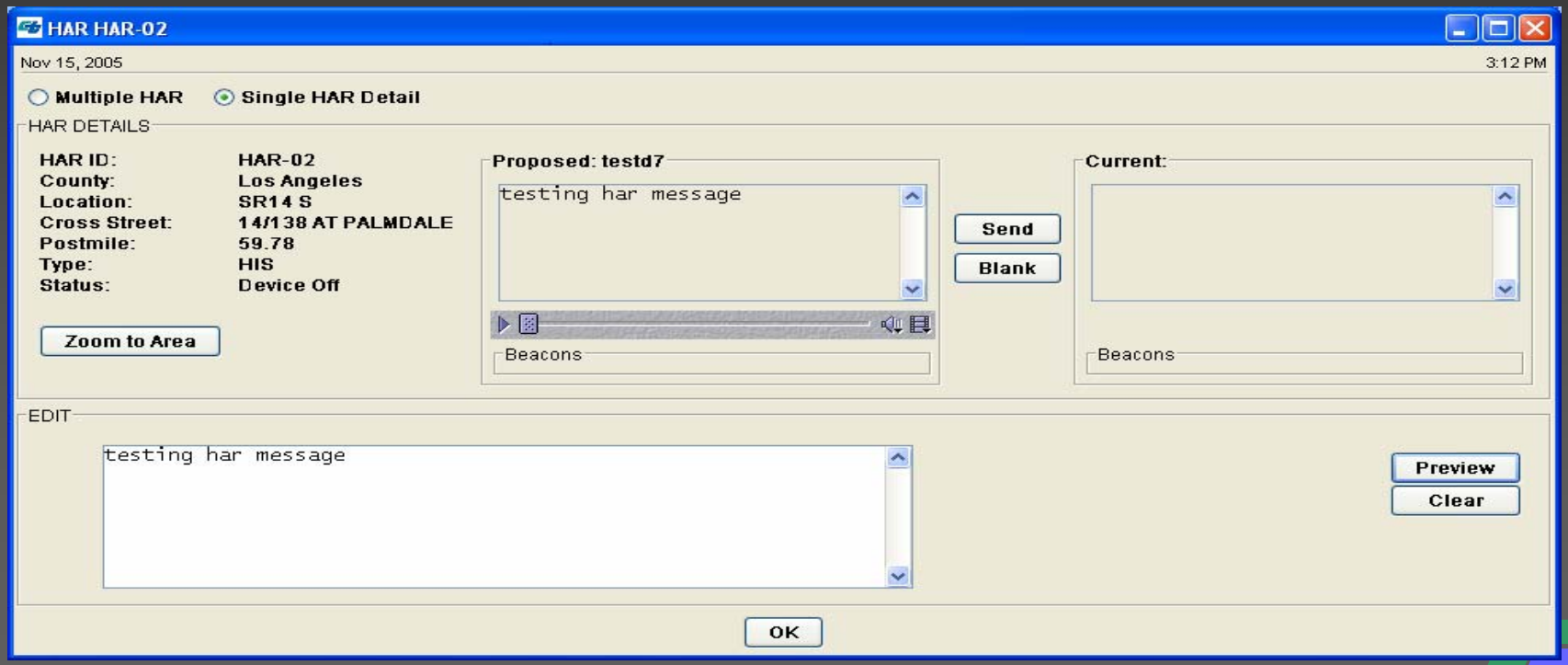


Video Wall Control

HAR & Beacon Control



- Notepad serves as a place for users to record HAR use and beacon use
- Programmatic interface to HAR under development



Electronic Message Board (EMB) - EMB CMS (for LARTMC)

Electronic Message Board Control

Jun 27, 2005 3:07 PM

CMS Board | Event Board

Manual Automatic

CMS #	MESSAGE	CMS #	MESSAGE
5	CONV CTR 13 MIN	1	TRAVEL TO
	I-710 20 MIN		LAX 4 MIN
9	SR60 4 MIN	2	41 MIN TO
	SR170S 31 MIN		R. REAGAN FRWY
11	SR19 13 MIN	42	TRAVEL TO
	AZUSA AV 25 MIN		I-105 3 MIN
3	CONV CTR 16 MIN		
	CSULA 23 MIN		
6	TRAVEL TO		
	CONV CTR 9 MIN		

Send Clear OK

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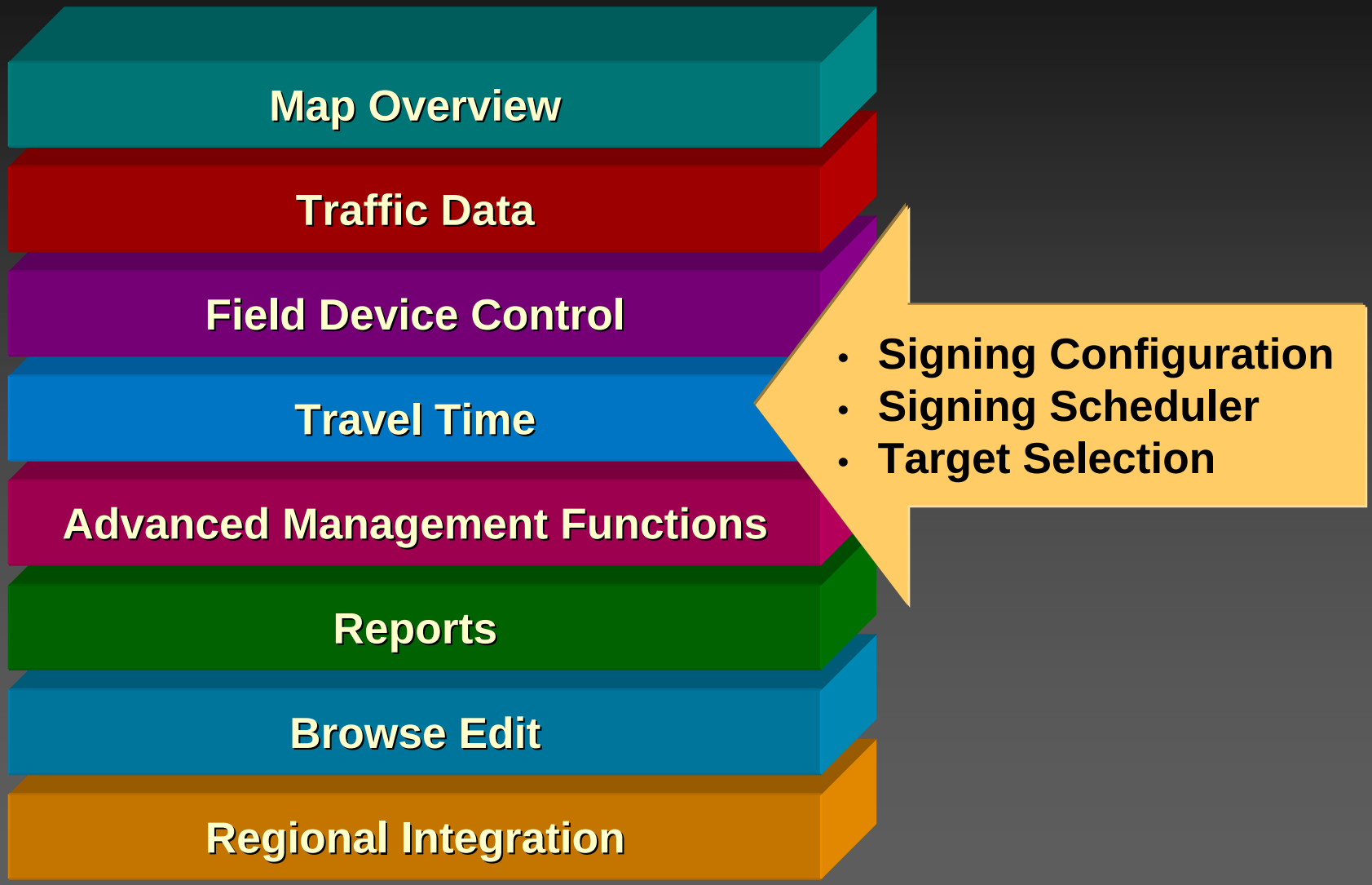
Agenda


Map Overview
Traffic Data
Field Device Control
Travel Time
Advanced Management Functions
Reports
Browse Edit
Regional Integration
• Signing Configuration
• Signing Scheduler
• Target Selection

Congestion Signing Configuration

Congestion Signing Configuration

Jun 27, 2005 3:08 PM

Global Congestion Signin... Activate Deactivate Scheduler ...

	CMS	Location	Cross Street	Status	Congestion Signing
	1	I405 N	135TH ST	Good	Active
	2	I405 N	MANHATTAN BCH BLVD	Good	Active
	3	I10 E	DORCHESTER AVE	Good	Active
	4	SR91 W	W/O CENTRAL AVE	Good	Active
	5	I10 E	MOTOR AVE	Good	Active
	6	I10 E	E/O WASHINGTON BLVD	Good	Active
	7	SR101 S	WHITSETT AVE	Good	
	8	SR101 N	W/O WOODMAN AVE	Good	Active
	9	I5 N	DITMAN AVE	Good	Active
	10	I110 S	NINTH ST	Good	Active
	11	SR60 E	INDIANA ST	Good	Active
	12	SR101 S	WHITE OAK AVE	Good	Active
	13	SR101 S	MELROSE AVE	Good	Active
	14	I10 E	CRENSHAW BLVD	Good	Active
	15	I10 W	ALAMEDA ST	Good	Active
	16	I110 N	GAGE	Good	Active
	17	I710 N	WASHINGTON BLVD	Good	Active
	18	I10 E	WESTERN AVE	Good	Active
	19	I405 N	BEL AIR CREST RD	Good	Active
	20	I5 S	S/O BROADWAY	Good	Active
	21	I110 N	EXPOSITION	Good	Active
	22	SR91 W	DOWNEY AVE	Good	Active
	23	I10 W	WESTERN AVE	Good	Active
	24	SR101 N	MELROSE AVE	Good	Active
	25	I5 N	N/O PIONEER BLVD	Good	Active
	26	I10 W	CRENSHAW BLVD	Good	Active
	27	I10 W	W/O NATIONAL BLVD	Good	Active
	28	I10 W	E/O ROBERTSON	Good	Active
	29	I405 S	VAN OWEN ST	Good	Active
	30	I10 E	CITY TERRACE O/C	Good	Active
	31	I10 E	MAPLE ST	Good	Active

Select All

Deselect All

Activate

Deactivate

Select Targets ...

OK

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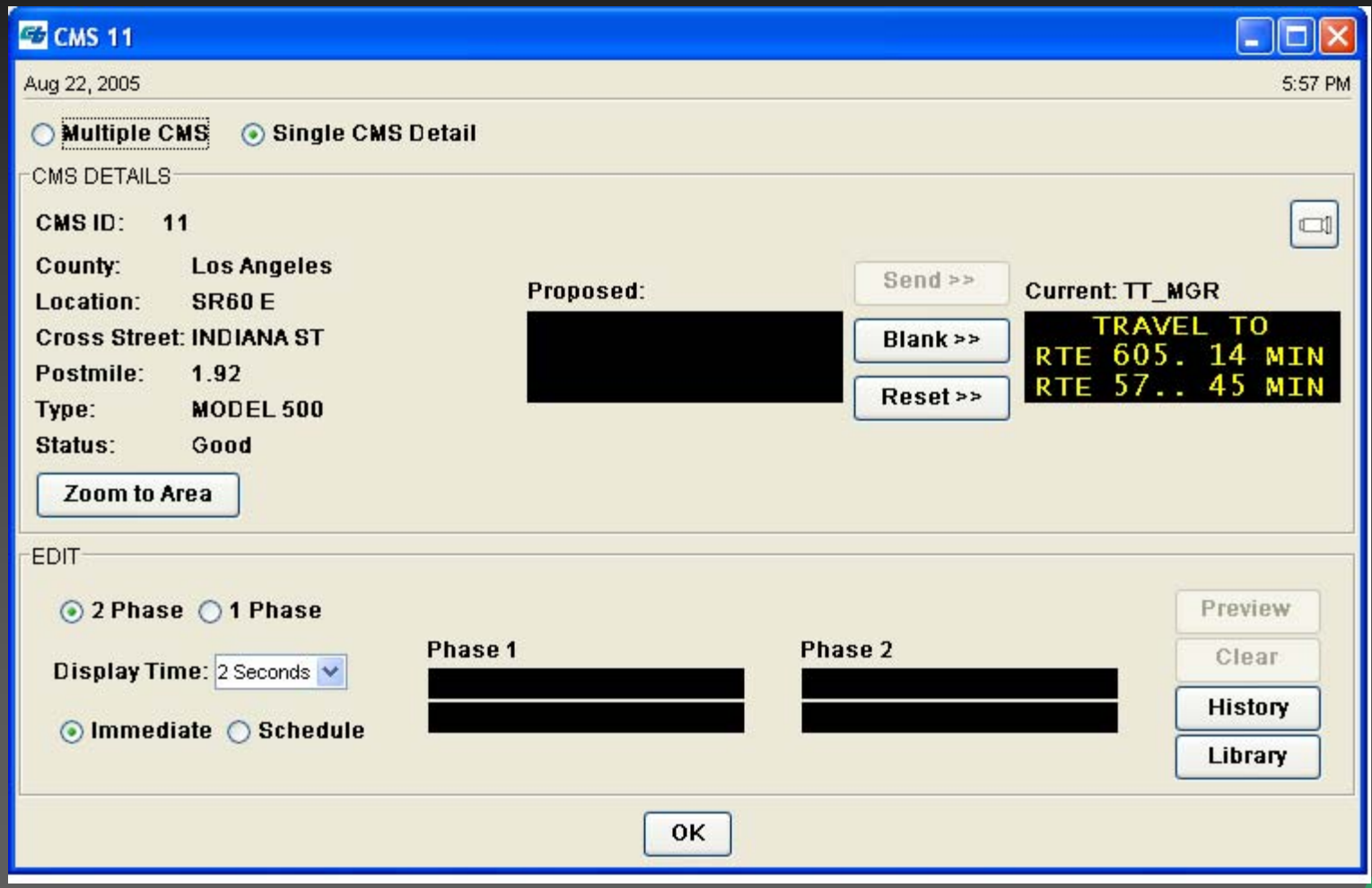
Sample Travel Time Message



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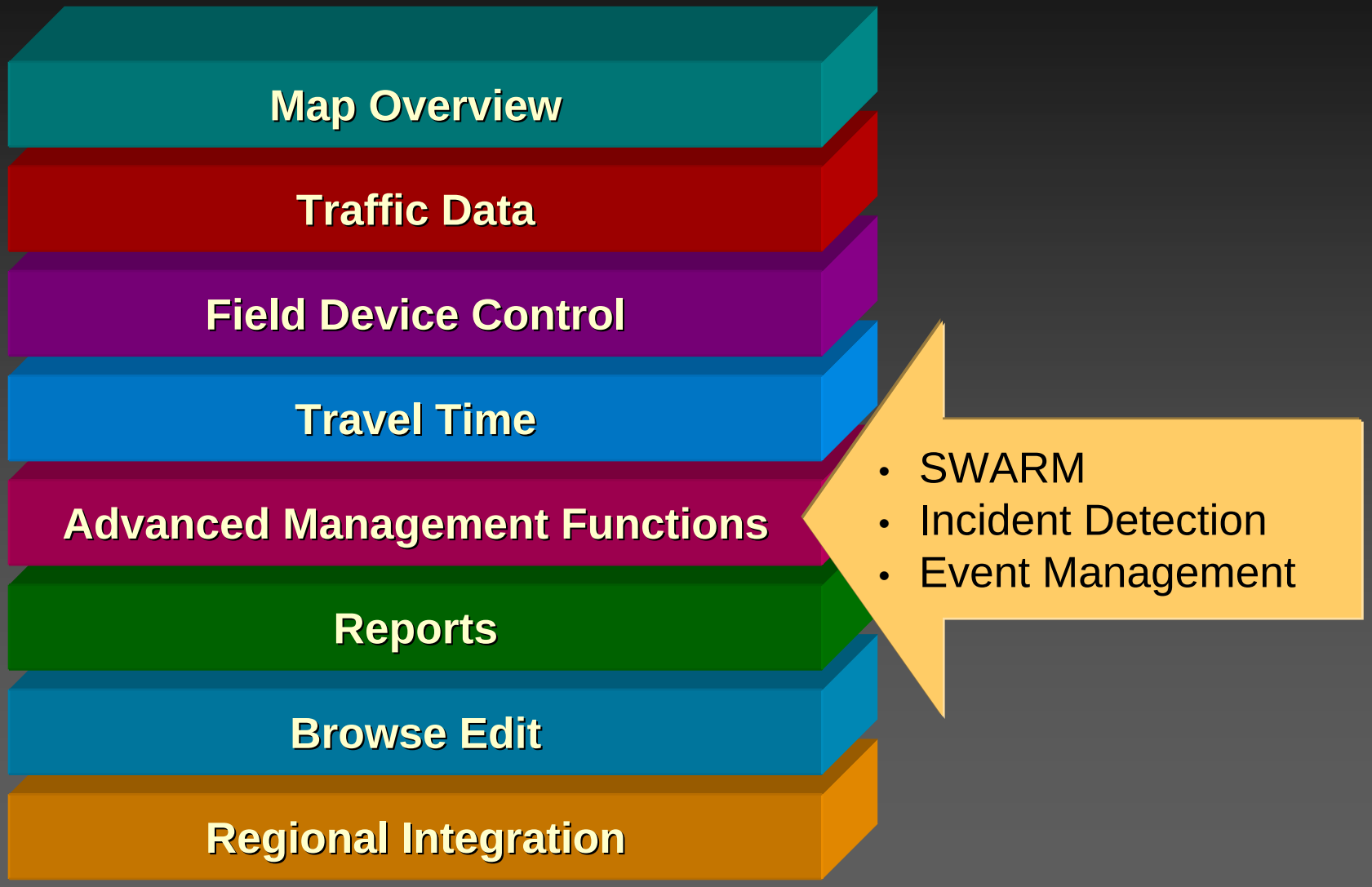
Agenda


Map Overview
Traffic Data
Field Device Control
Travel Time
Advanced Management Functions
Reports
Browse Edit
Regional Integration
• SWARM
• Incident Detection
• Event Management

System Wide Adaptive Ramp Metering

- Develops metering rates based on real time conditions
- SWARM 1 - Network
  - Looks at the complete system
  - Forecasts traffic conditions x minutes into the future
  - Changes metering rates now to avoid predicted future problems
- SWARM 2
  - Looks at local traffic conditions near ramp
  - Based on current data
  - SWARM 2a - Headway (time between vehicles)
  - SWARM 2b - Storage

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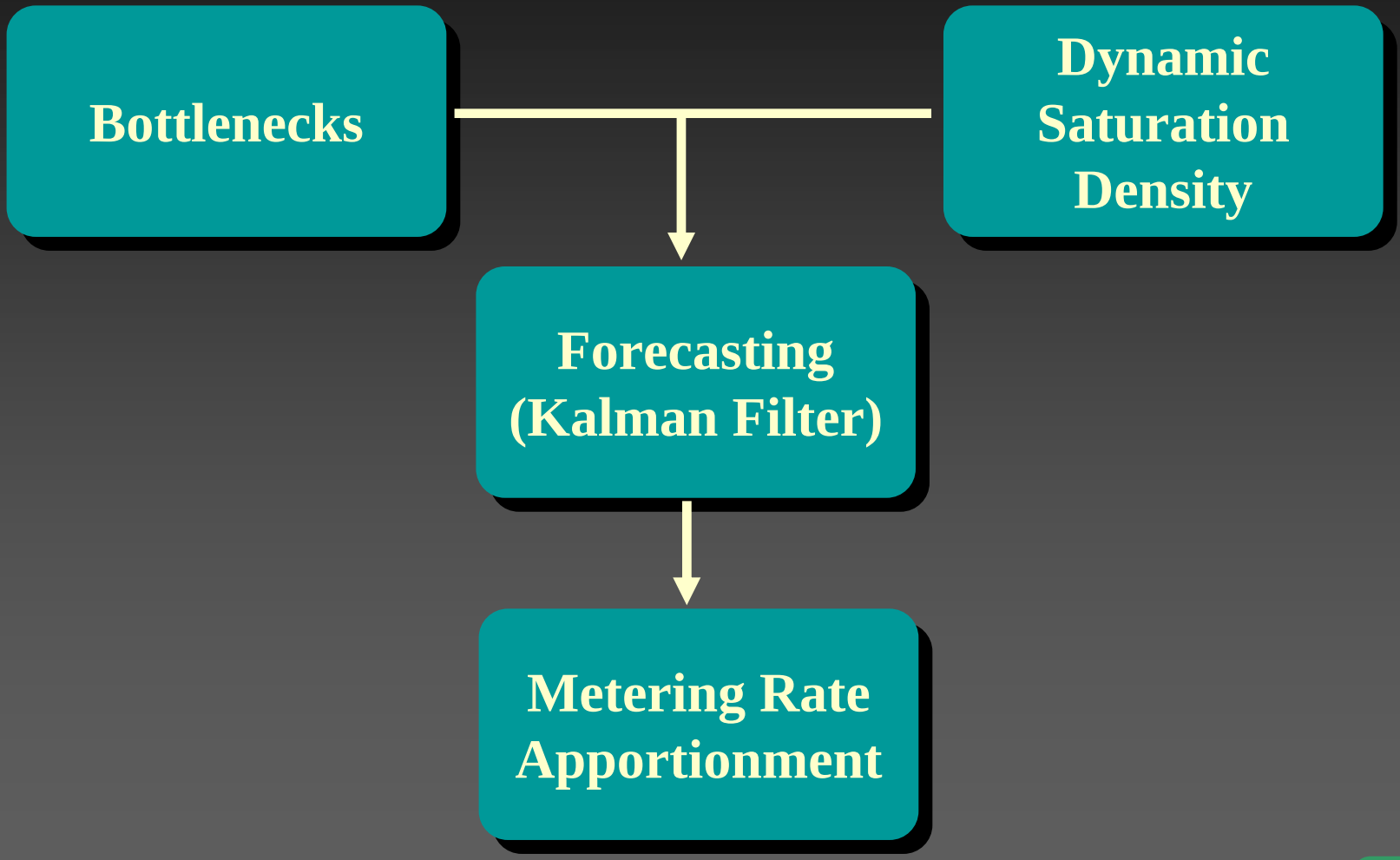
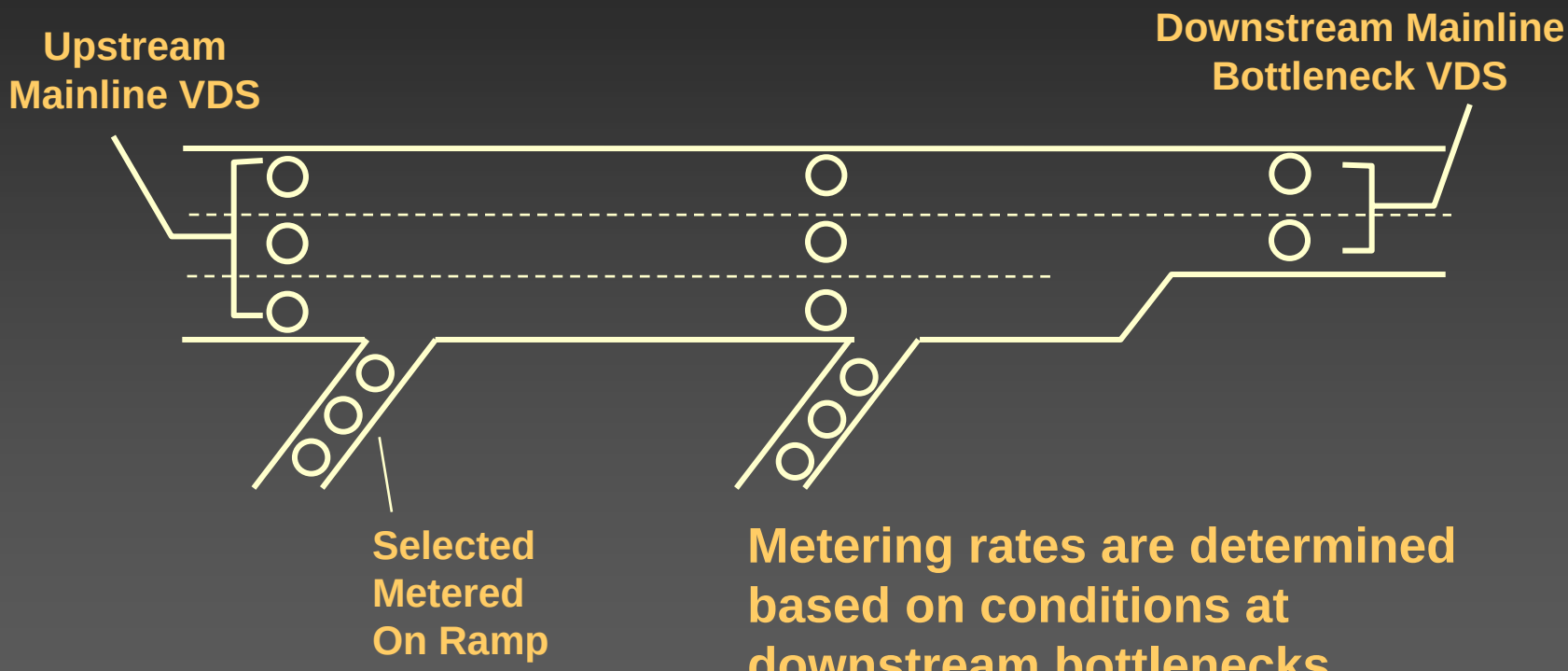
SWARM 1

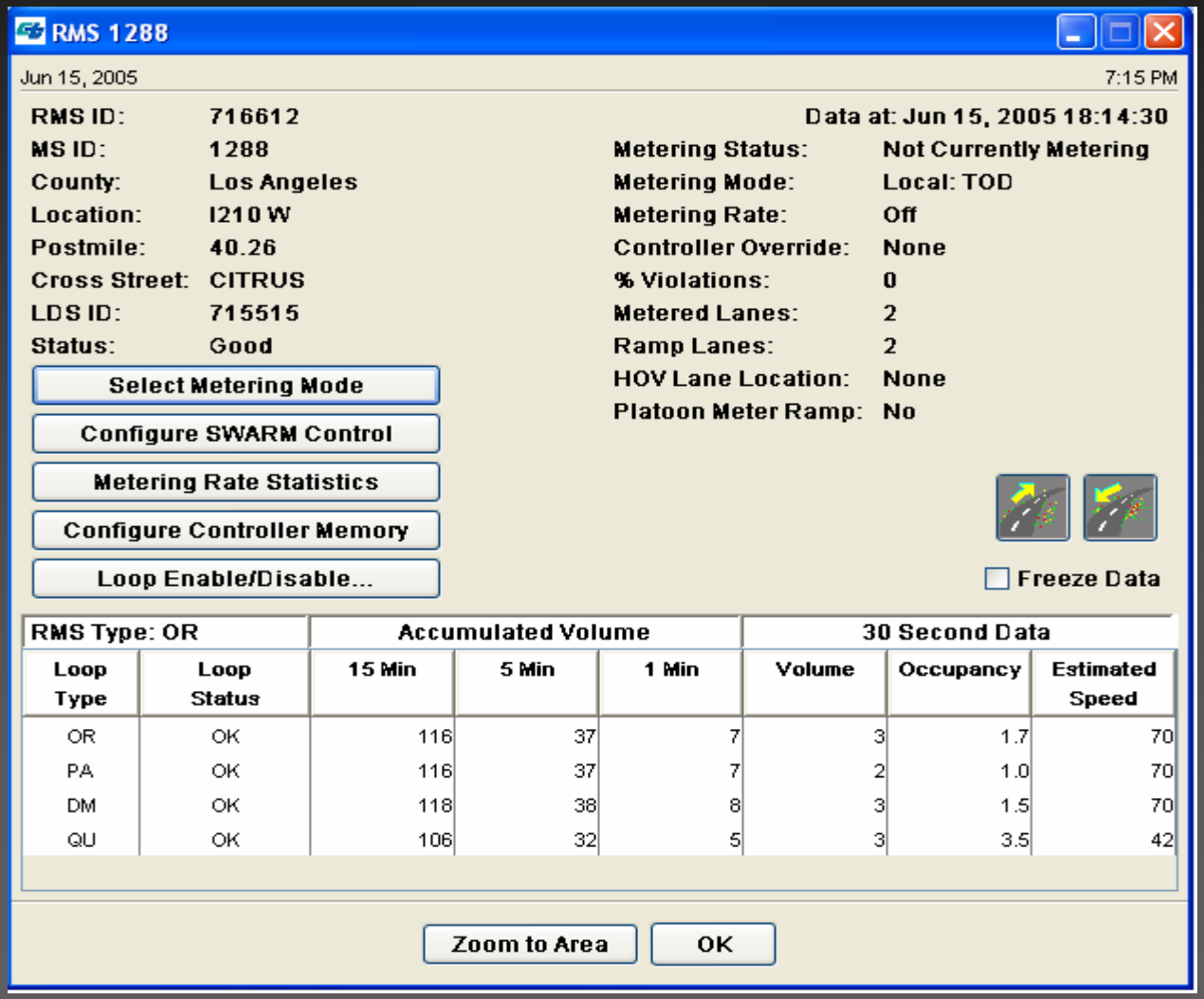

Bottlenecks
Dynamic Saturation Density
Forecasting (Kalman Filter)
Metering Rate Apportionment

SWARM 1 VDS Locations



Metering rates are determined based on conditions at downstream bottlenecks

Ramp Metering Control



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Configure SWARM Control

Set controls that govern how SWARM rates are determined and implemented

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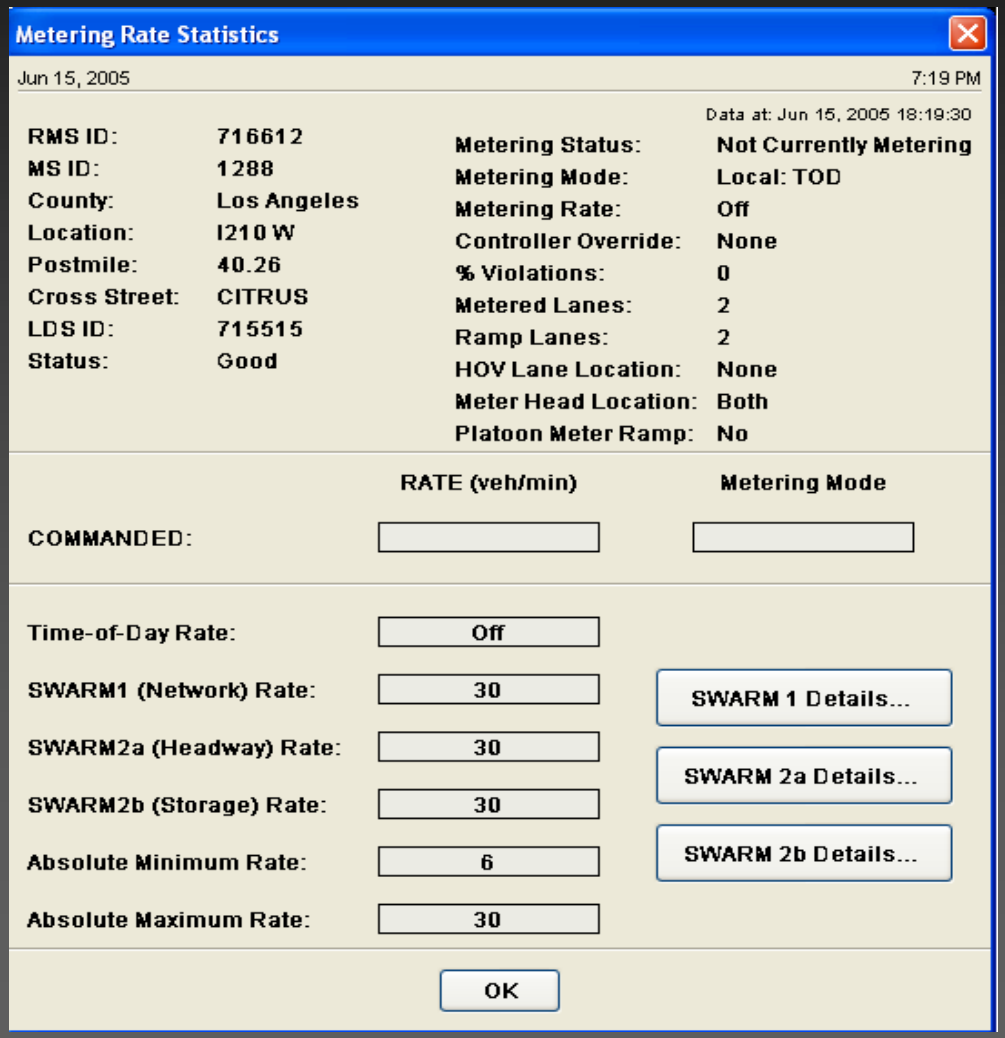
Metering rate statistics



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Automatic Incident Detection

- Uses APID: All Purpose Incident Detection algorithm
- Algorithm considers Prevailing Congestion Levels
- Algorithm Tuned for Each Mainline VDS
- Operator “Alarmed” for Potential Incident

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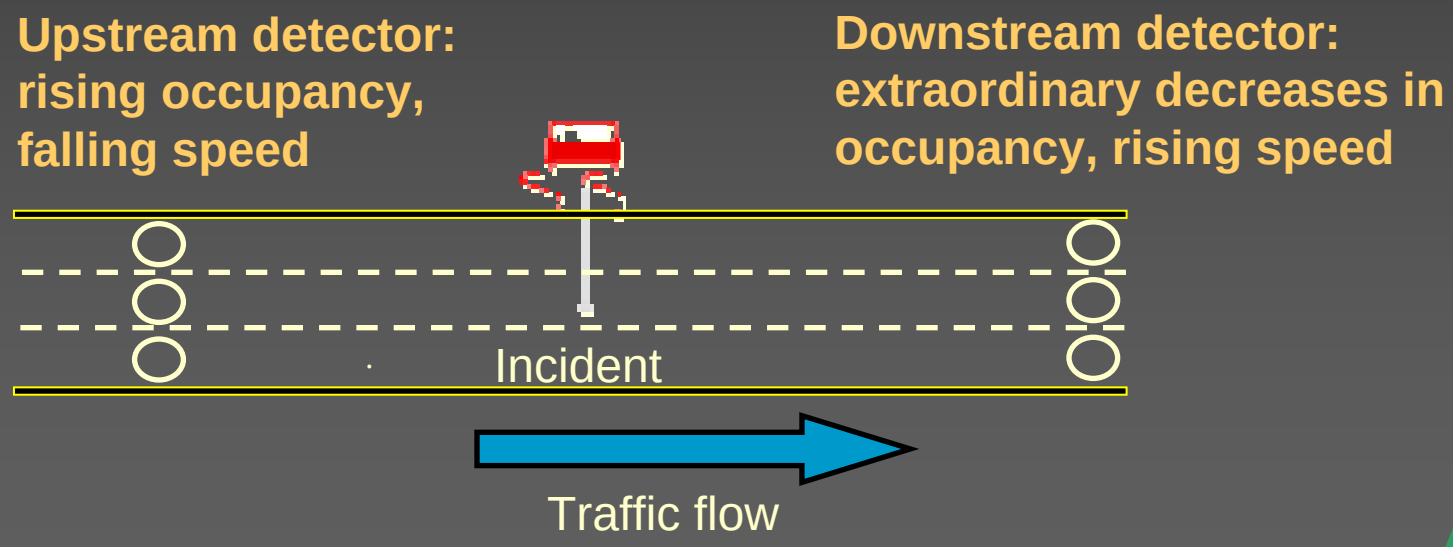
APID

- Compare upstream and downstream stations for differences in occupancy
- Test individual stations for rates of increase and decrease in occupancy
- Test upstream stations for extraordinary increases in occupancy



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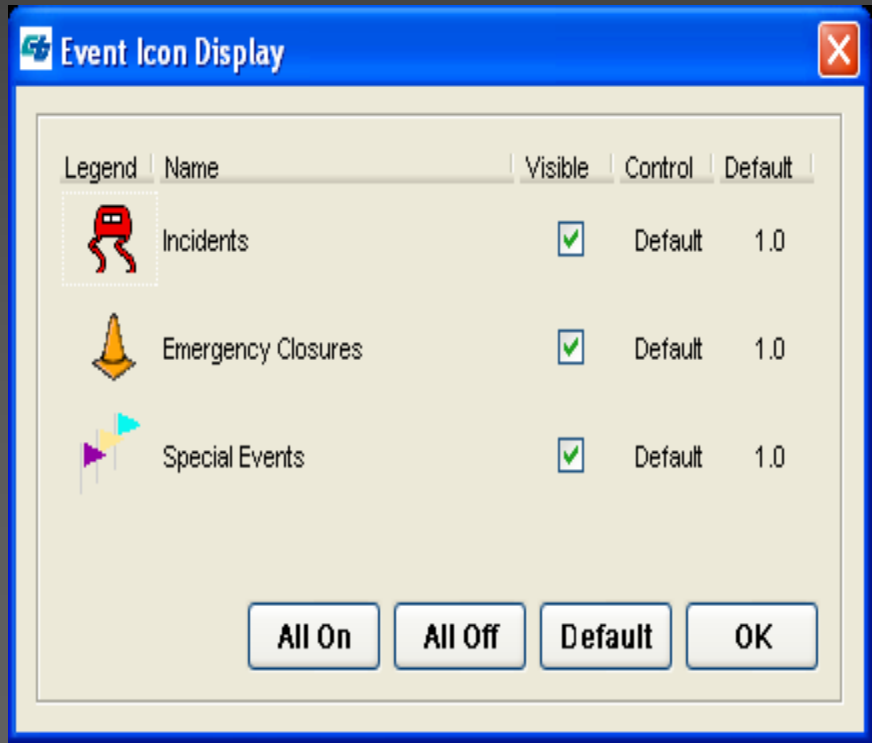
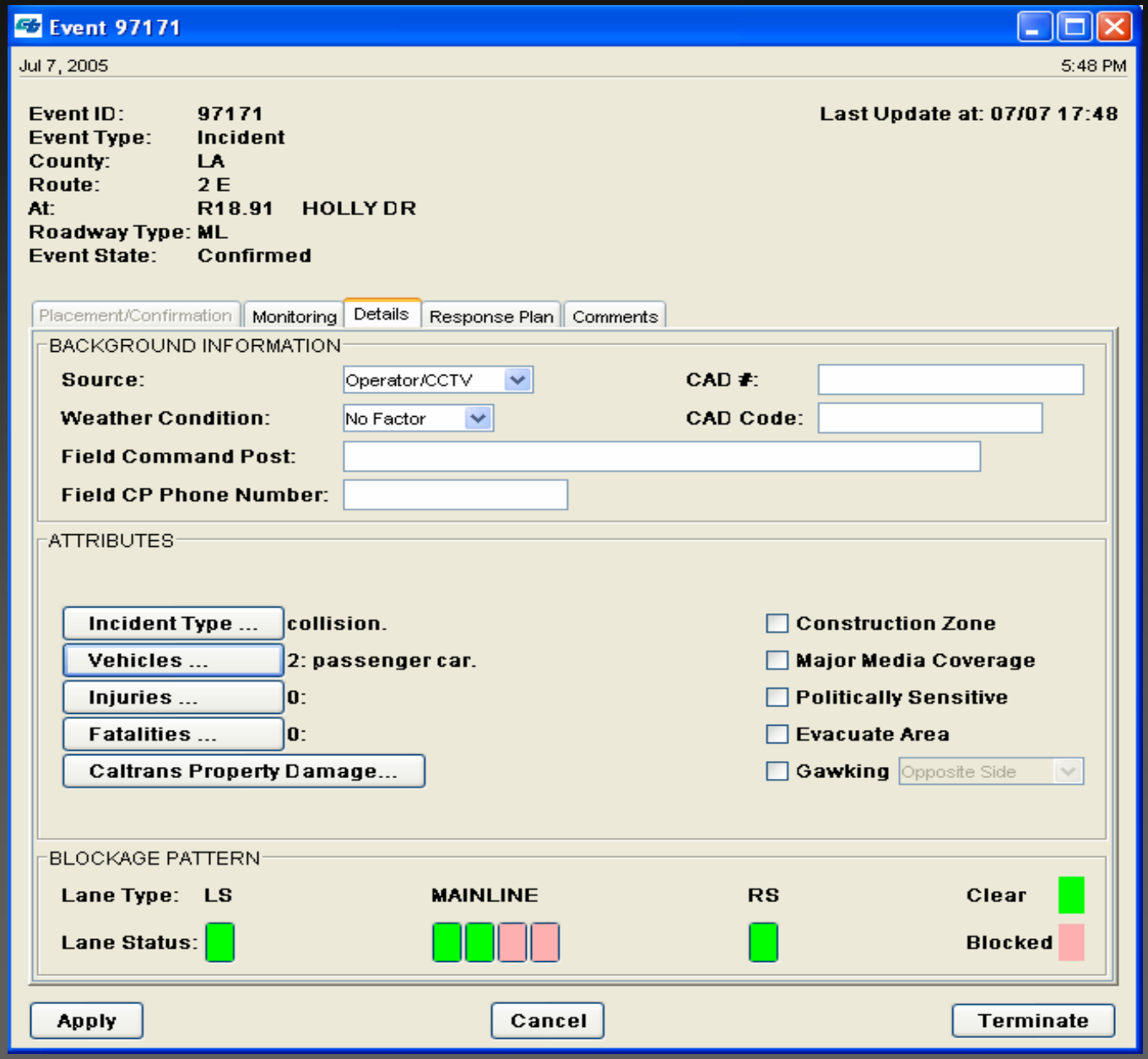
Event Management

- Multiple Types of “Events”
  - Incidents (Manual or Automatic)
  - Emergency Closures
  - Special Events
- Response Plan Generation
  - Automatically Generated
  - Manually Generated



Event Details



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Response Plan Generation

- Expert System Generated
  - Rules-based system for generating responses to a complex set of conditions
  - Provides a scaleable, adaptable solution
  - Developed utilizing agency expertise for operational responses
  - Aids operators in management of complex events
  - Standardized responses
- Operator Scripted

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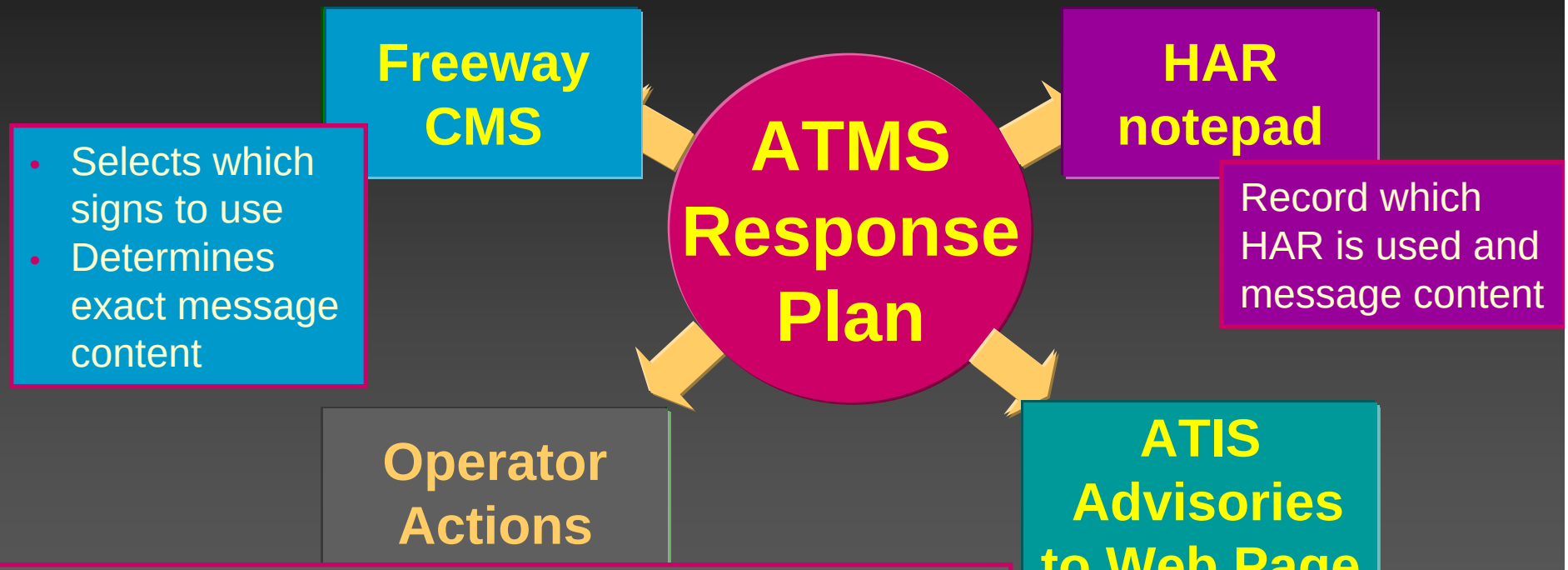
Response Plan Elements



- Selects which signs to use
- Determines exact message content

Record which HAR is used and message content

- Request Sigalert
- Issue Traffic Advisory
- Advise TMT Leader
- Notify Headquarters Communications
- Advise Maintenance
- Recommend to Dispatch FSP
- Contact TMC Senior and Lead Officer
- Notify Duty Officer
- Advise Local Agencies
- Advise Adjacent Districts

Interface to output advisories to WEB Page

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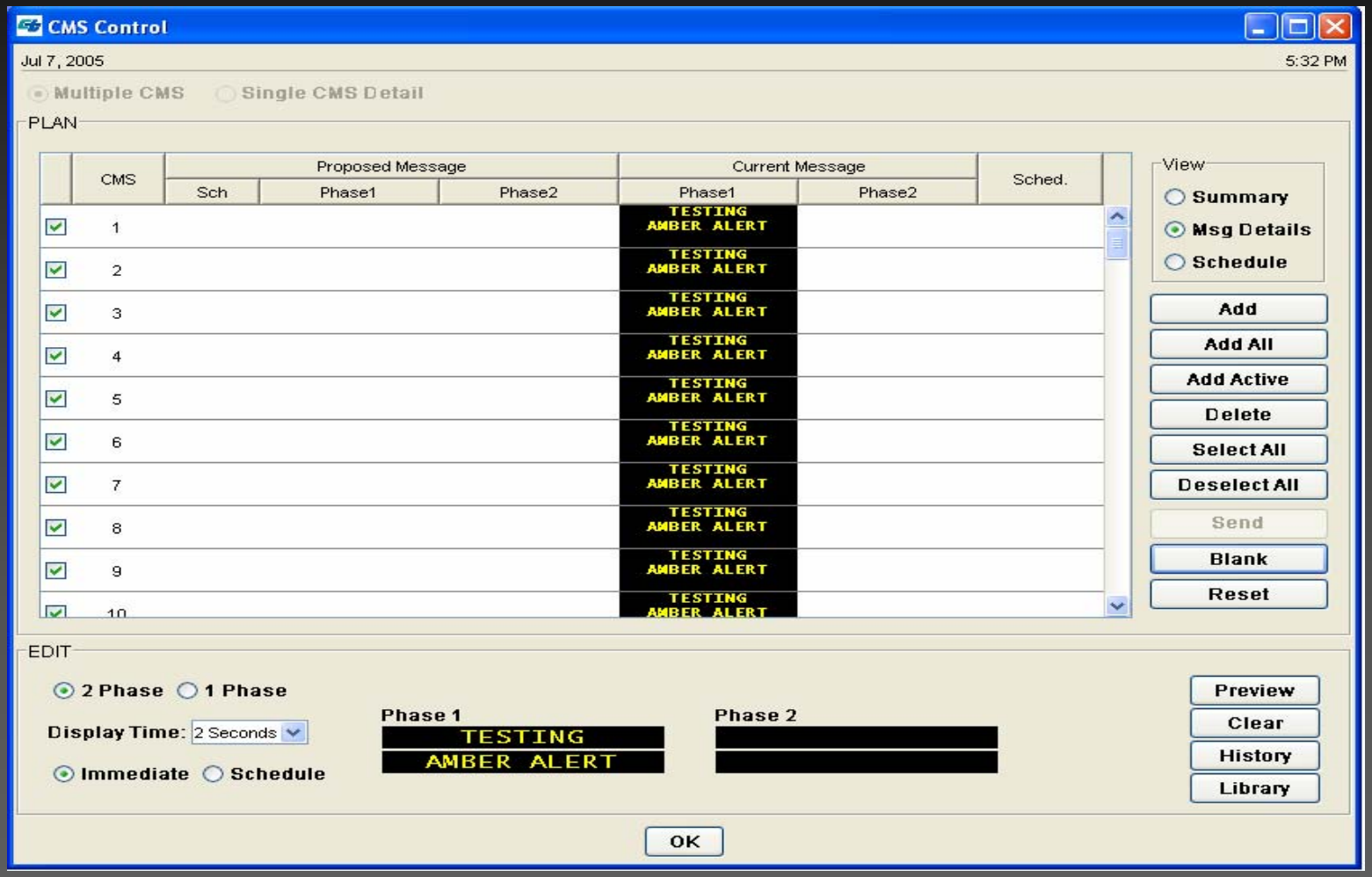
AMBER alert



Can select all signs and send messages with single mouse click

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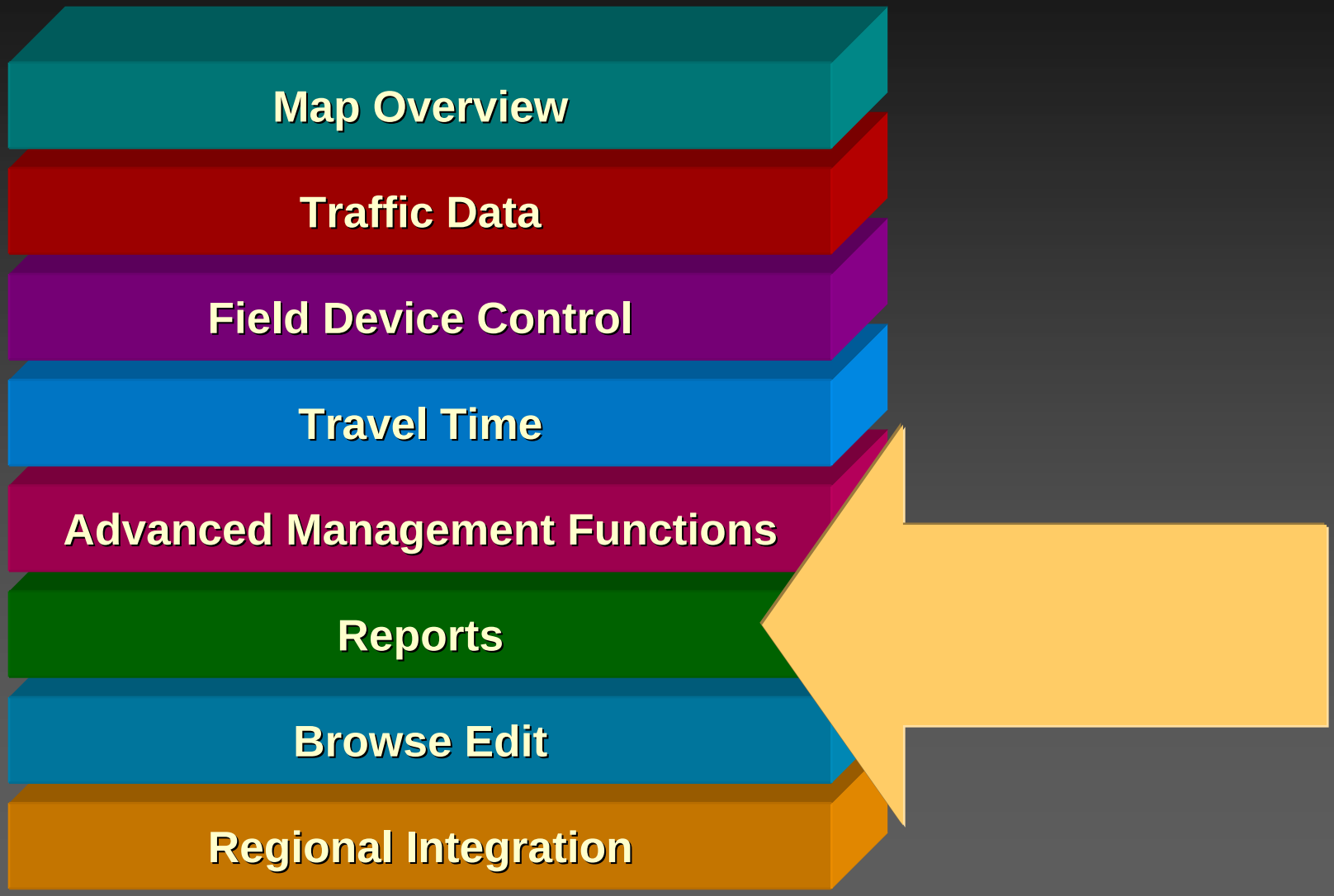
Agenda


Map Overview
Traffic Data
Field Device Control
Travel Time
Advanced Management Functions
Reports
Browse Edit
Regional Integration

Types of Traffic Data Reports (36 total reports)

- Traffic Data Reports
- Traffic Data Plots
- System Performance Reports
- Special Applications Reports
- Ramp Metering Reports

Five Years if data is stored on a 4 Terabyte RAID system

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Sample Report Output

Runtime: 07-19-2005, 10:48

TRAFFIC DATA REPORT
30 Second Loop Data

FROM: 07-19-2005 09:00:00 TO: 07-19-2005 09:30:00

STATUS:
1=Good, 2=suspect, 3=Soft Failed, 4=Hard Failed, 5=No Response, 6=Disabled, 0=unknown

A = Adjusted , ND = No Data, NA = Not Applicable
All values are suspect until verified by engineer

VDS DESCRIPTION: LA-91-M, PM: R 19.40 SHOEMAKER — Main Line / HOV — VDS ID: 766555

JUL-19-2005	HOV 1				ML 1				ML 2				ML 3				ML 4				ML STATION		
TUESDAY	VOL	OCC	SPD	ST	VOL	OCC	SPD	ST	VOL	OCC	SPD	ST	VOL	OCC	SPD	ST	VOL	OCC	SPD	ST	TOT VOL	AVG OCC	EST SPD
09:00:30	9	4.5	72	1	19	9.9	66	1	13	6.3	70	1	9	11.3	33	1	12	6.9	83	1	53	8.6	65
09:01:00	4	1.5	89	1	36	20.4	60	2	6	2.7	76	1	7	6.9	41	1	5	2.8	86	1	54	8.2	62
09:01:30	1	26.5	1	1	0	0.0	NA	2	0	0.0	NA	2	0	47.8	NA	2	1	27.6	2	1	1	16.9	2
09:02:00	9	15.5	20	1	15	7.3	70	1	15	7.1	72	1	11	11.5	39	1	6	3.7	78	1	47	7.4	65
09:02:30	5	3.5	51	1	27	14.3	64	2	16	7.0	76	1	6	7.0	35	1	6	8.0	36	1	55	9.1	62
09:03:00	6	5.5	39	1	10	5.2	65	1	12	5.9	69	1	8	8.0	41	1	12	8.8	65	1	42	7.0	62
09:03:30	6	29.9	7	1	12	6.5	63	1	14	6.9	70	1	11	12.2	37	1	4	2.5	76	1	41	7.0	59
09:04:00	0	69.8	NA	2	25	14.4	59	2	15	7.2	71	1	8	6.4	51	1	7	4.1	81	1	55	8.0	64
09:04:30	0	69.8	NA	2	36	24.1	51	2	9	3.8	80	1	10	9.4	43	1	8	4.8	79	1	63	10.5	58
09:05:00	0	69.8	NA	2	19	9.0	72	1	17	7.9	75	1	13	10.3	52	1	10	7.0	68	1	59	8.6	67
5mt:	**40**				**199**				**117**				**83**				**71**				**470**		
09:05:30	0	69.8	NA	2	9	4.5	68	1	9	4.4	69	1	6	7.8	31	1	7	4.3	78	1	31	5.2	64
09:06:00	0	69.8	NA	3	17	7.7	75	1	16	7.2	75	1	10	10.1	40	1	5	5.9	41	1	48	7.7	64
09:06:30	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	ND	NA
09:07:00	0	69.8	NA	3	14	17.1	28	1	12	5.1	80	1	9	8.7	42	1	6	5.7	50	1	41	9.2	50
09:07:30	0	69.8	NA	3	32	25.2	43	2	11	5.6	67	1	9	9.1	40	1	11	6.9	76	1	63	11.7	53
09:08:00	0	69.8	NA	3	0	0.0	NA	2	0	0.0	NA	2	1	29.2	1	1	1	24.9	2	1	2	13.5	2
09:08:30	0	69.8	NA	3	26	15.3	56	2	12	5.8	71	1	11	11.9	38	1	11	8.1	65	1	60	10.3	58
09:09:00	0	69.8	NA	3	21	9.4	76	1	12	5.6	73	1	10	11.5	36	1	7	4.9	68	1	50	7.8	66
09:09:30	2	60.8	NA	3	32	18.9	58	2	17	8.1	72	1	9	8.6	43	1	5	6.3	38	1	63	10.5	58
09:10:00	15	12.3	NA	3	15	8.0	64	1	10	4.6	75	1	11	7.5	60	1	11	10.0	53	1	47	7.5	63
5mt:	**0A**				**184A**				**110A**				**84A**				**71A**				**449**		
09:10:30	4	4.4	NA	3	29	16.9	58	2	17	8.5	68	1	14	12.3	47	1	10	8.2	58	1	70	11.5	58
09:11:00	3	3.5	30	1	17	10.4	56	1	10	4.9	70	1	10	9.2	44	1	7	6.0	56	1	44	7.6	56
09:11:30	0	0.0	NA	2	0	0.0	NA	2	0	0.0	NA	2	0	0.0	NA	2	1	19.3	2	1	1	4.8	2
09:12:00	3	1.9	55	1	14	6.7	71	1	13	7.0	65	1	7	12.9	22	1	6	3.2	89	1	40	7.5	63
09:12:30	10	6.0	57	1	24	16.1	51	2	16	8.8	62	1	12	12.7	39	1	12	8.3	69	1	64	11.4	55
09:13:00	4	18.2	7	1	17	8.6	67	1	15	7.3	70	1	12	14.0	35	1	7	6.6	51	1	51	9.1	58
09:13:30	2	68.9	1	2	26	13.4	66	2	13	7.6	59	1	9	8.7	42	1	10	6.8	70	1	58	9.1	61
09:14:00	0	69.8	NA	2	1	15.2	2	1	0	0.0	NA	2	1	21.2	2	1	1	47.0	1	1	3	20.8	2
09:14:30	0	69.8	NA	2	29	15.9	62	2	13	6.8	65	1	8	9.3	35	1	4	5.1	38	1	54	9.3	57
09:15:00	0	69.8	NA	2	17	7.6	76	1	13	6.4	69	1	7	7.5	38	1	7	8.1	41	1	44	7.4	63
5mt:	**24A**				**174**				**110**				**80**				**65**				**429**		
15mt:	**93A**				**558A**				**337A**				**247A**				**207A**				**1349**		

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Sample Special Applications Report: CMS Message Approval

Runtime: 11-14-2005, 18:27

SPECIAL APPLICATION REPORT
CMS Message Approval History
FROM: 07-01-2005 00:00:00 TO: 07-15-2005 18:26:30

Page: 65

CMS ID	DATE	ACTIVATION TIME	DEACTIVATION TIME	MESSAGE DURATION		MESSAGE APPROVED	TIME DISPLAYED	EVENT ID	OPERATOR ID
74	07-02-2005	14:32:06	15:04:54	00:32:48	LINE 1	S 605 CARPOOL LN		97244	shollo
					LINE 2	CLSD AT PECK			
					LINE 3				
					LINE 4				
					LINE 5				
					LINE 6				
94	07-02-2005	14:32:06	15:04:54	00:32:48	LINE 1	S 605 CARPOOL LN		97244	shollo
					LINE 2	CLSD AT PECK			
					LINE 3				
					LINE 4				
					LINE 5				
					LINE 6				
74	07-02-2005	15:04:54	09:00:51	17:55:57	LINE 1	ARRIVE ALIVE			shollo
					LINE 2	DON'T DRINK			
					LINE 3	AND DRIVE			
					LINE 4				
					LINE 5				
					LINE 6				
94	07-02-2005	15:04:54	09:00:37	17:55:43	LINE 1	ARRIVE ALIVE			shollo
					LINE 2	DON'T DRINK			
					LINE 3	AND DRIVE			
					LINE 4				
					LINE 5				
					LINE 6				

California Department of Transportation - District 7

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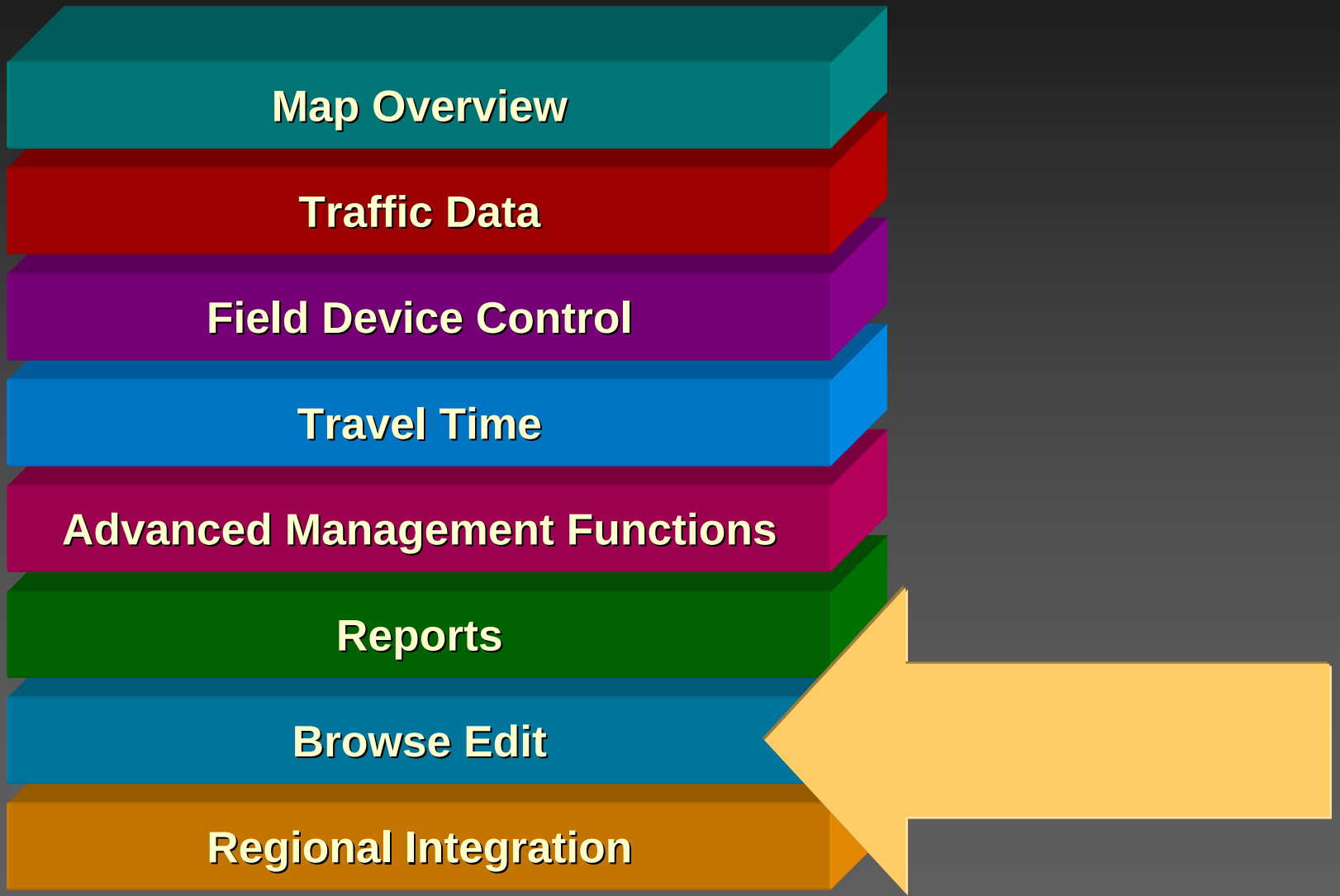
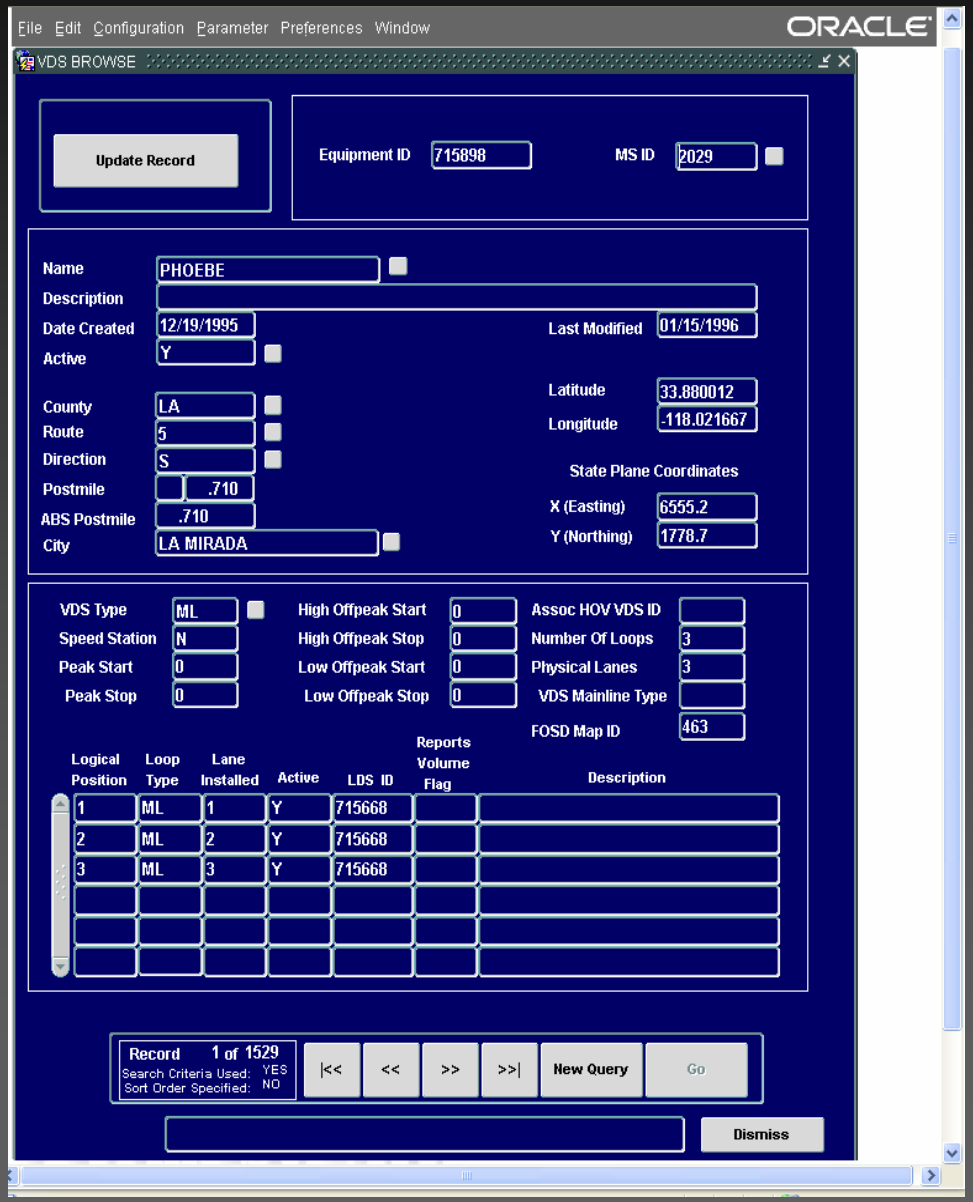
Agenda


Map Overview
Traffic Data
Field Device Control
Travel Time
Advanced Management Functions
Reports
Browse Edit
Regional Integration

Browser and Editor



- Allows user to view information from the database
- Filters can be used to narrow the number of records to be viewed
- Users with proper access privileges may edit information

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LARTMC Traffic Data Portal

- Numerous other agencies and information service providers receive data from Caltrans via the TMC systems
- RIITS is the key traffic information data portal system, whose equipment is housed at the LARTMC

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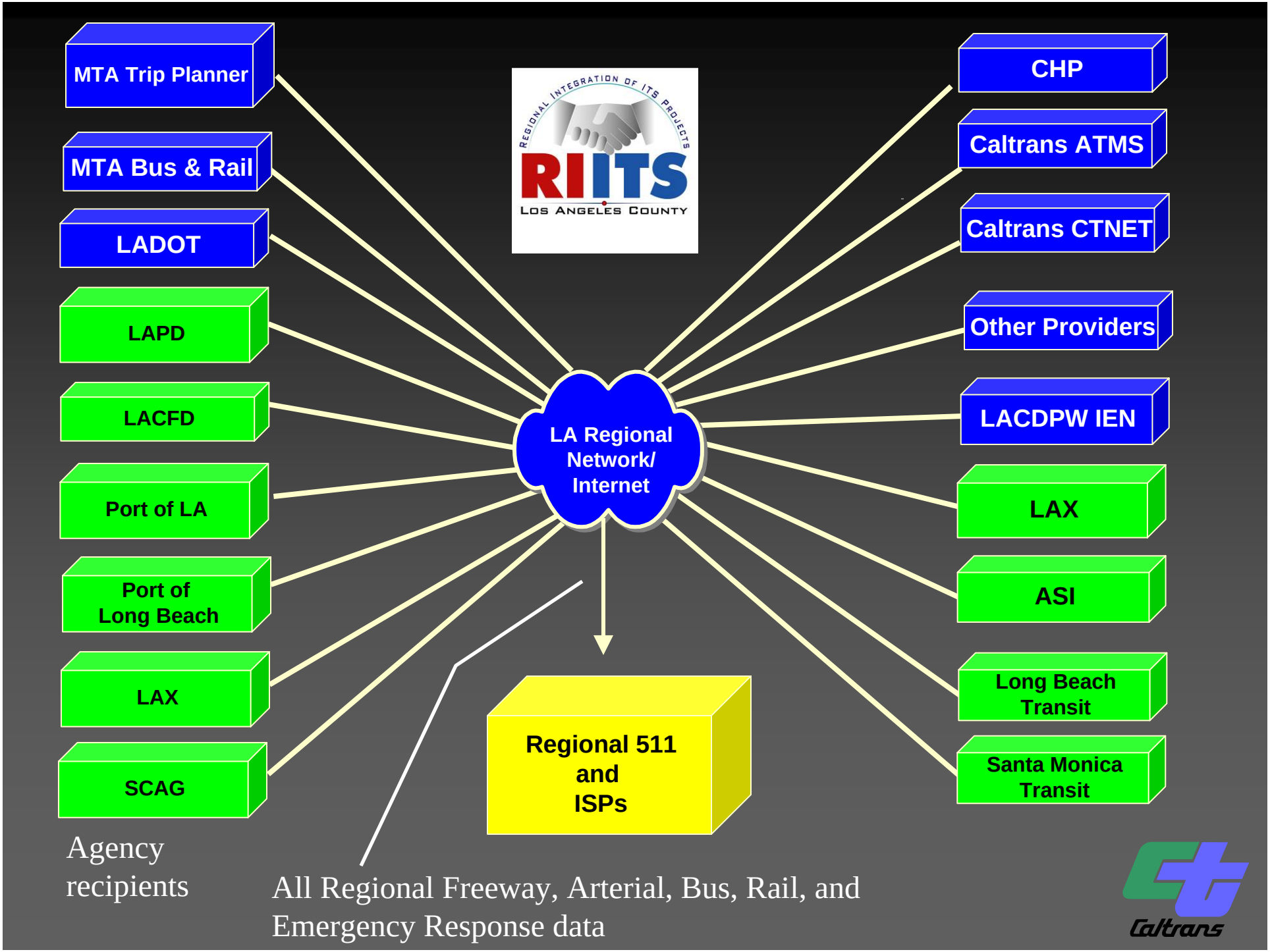
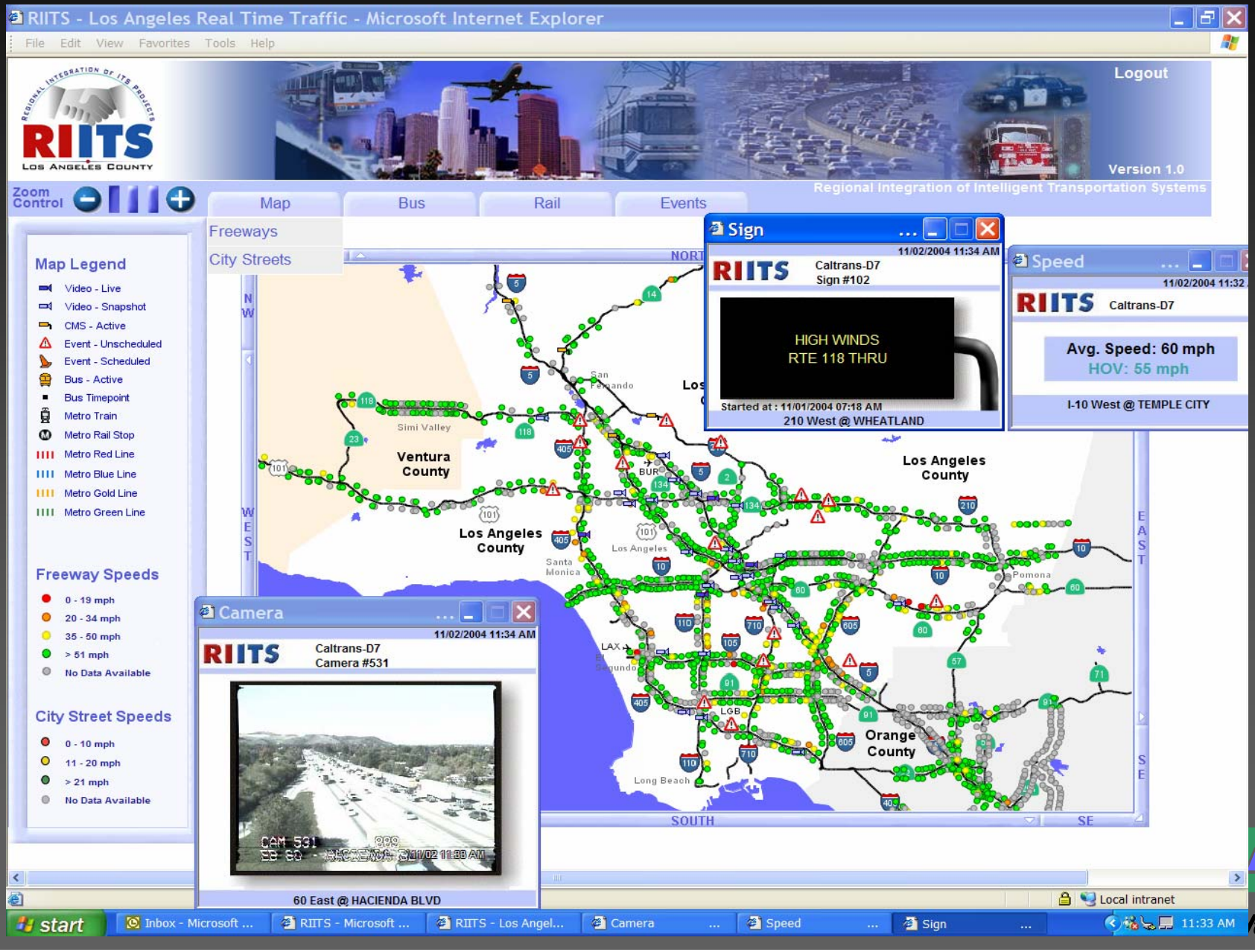

MTA Trip Planner
MTA Bus & Rail
LADOT
LAPD
LACFD
Port of LA
Port of Long Beach
LAX
SCAG
REGIONAL INTEGRATION OF ITS PROJECTS
RIITS
LOS ANGELES COUNTY
LA Regional Network/ Internet
Regional 511 and ISPs
CHP
Caltrans ATMS
Caltrans CTNET
Other Providers
LACDPW IEN
LAX
ASI
Long Beach Transit
Santa Monica Transit
Agency recipients
All Regional Freeway, Arterial, Bus, Rail, and Emergency Response data
Caltrans

RIITS


RIITS - Los Angeles Real Time Traffic - Microsoft Internet Explorer
File Edit View Favorites Tools Help
RIITS
Los Angeles County
Logout
Version 1.0
Regional Integration of Intelligent Transportation Systems
Zoom Control
Map
Bus
Rail
Events
Freeways
City Streets
Map Legend
Video - Live
Video - Snapshot
CMS - Active
Event - Unscheduled
Event - Scheduled
Bus - Active
Bus Timepoint
Metro Train
Metro Rail Stop
Metro Red Line
Metro Blue Line
Metro Gold Line
Metro Green Line
Freeway Speeds
0 - 19 mph
20 - 34 mph
35 - 50 mph
> 51 mph
No Data Available
City Street Speeds
0 - 10 mph
11 - 20 mph
> 21 mph
No Data Available
Sign
11/02/2004 11:34 AM
RIITS
Caltrans-D7
Sign #102
HIGH WINDS
RTE 118 THRU
Started at : 11/01/2004 07:18 AM
210 West @ WHEATLAND
Speed
11/02/2004 11:32
RIITS
Caltrans-D7
Avg. Speed: 60 mph
HOV: 55 mph
I-10 West @ TEMPLE CITY
Camera
11/02/2004 11:34 AM
RIITS
Caltrans-D7
Camera #531
60 East @ HACIENDA BLVD
Ventura County
Los Angeles County
Orange County
Simi Valley
Santa Monica
Long Beach
Pomona
NORTH
SOUTH
WEST
EAST
NW
SE
Local intranet
start
Inbox - Microsoft ...
RIITS - Microsoft ...
RIITS - Los Angel...
Camera ...
Speed ...
Sign ...
11:33 AM

Current Information Service Providers

- ClearChannel (Airwatch)
- Eeminder
- Fox-TV
- Inrix
- KABC-TV
- KKTV Fox-11
- KCOP UPN-13
- Traffic.com
- Jaytu Technolgies (Sigalert.com)
- Traveler Advisory News Network
- TrafficGauge, Inc.
- Westwood One

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LARTMC Communications Technologies

- Synchronous Optical Network (SONET) for data
- Fiber Optic multiplexer video transmission system (analog video with digital transmission over fiber)
- Next Generation (2.5G) mobile telephone
  - GPRS and CDMA2000
  - Used for communications with certain CMS, VDS and RMS (Construction Zones)

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Current Communications Network

- Two Parts:
  - Data Subsystem
    - Fiber Optic SONET Ring Backbone
    - Data nodes with D4 channel banks act as field data concentrators
  - Video Subsystem
    - Video nodes with digital fiber multiplexers act as field video site concentrators
    - Communication hubs are secondary concentration and testing points

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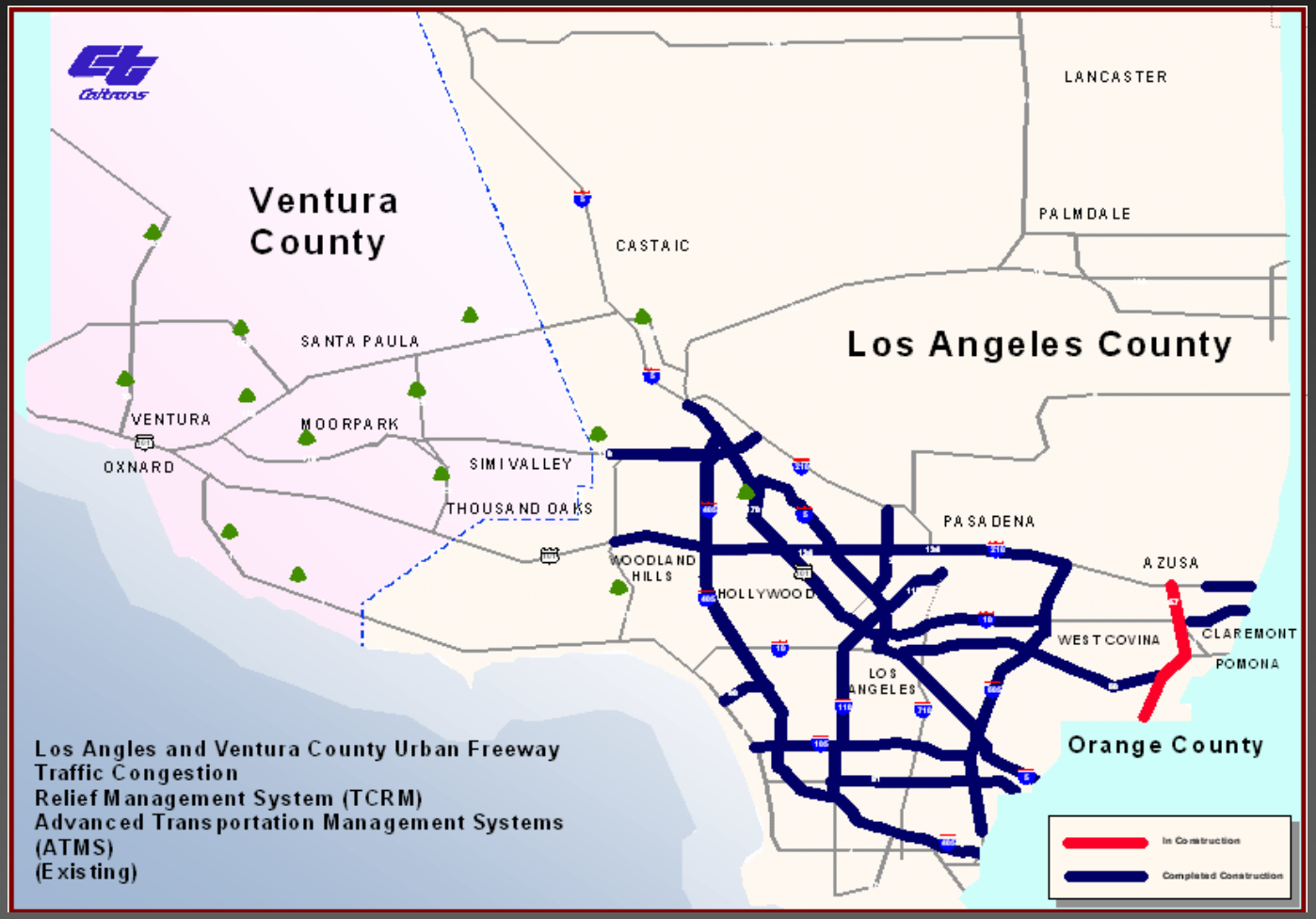
Existing ITS Infrastructure



Dark Blue represents existing fiber optic cable plant

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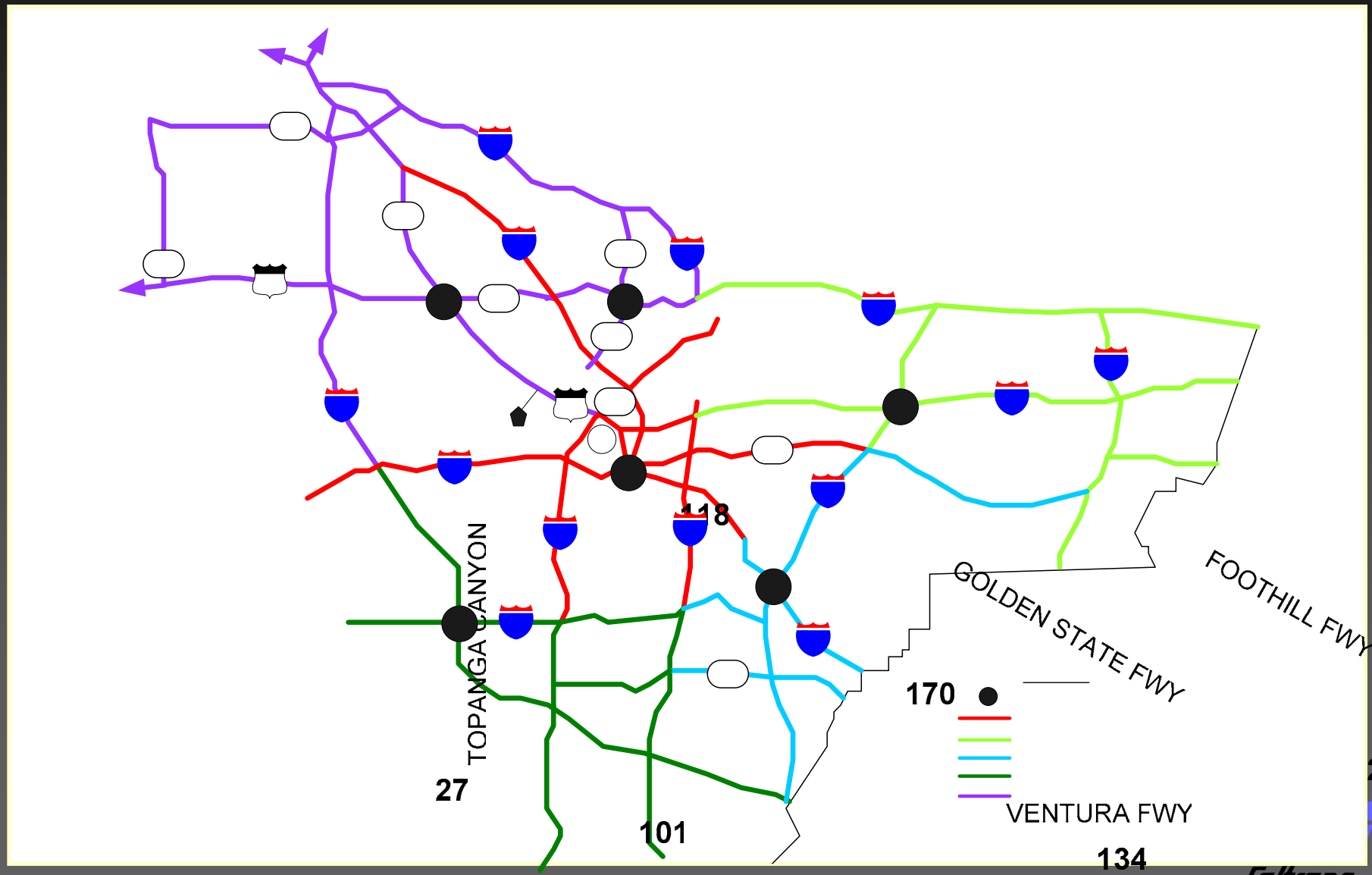
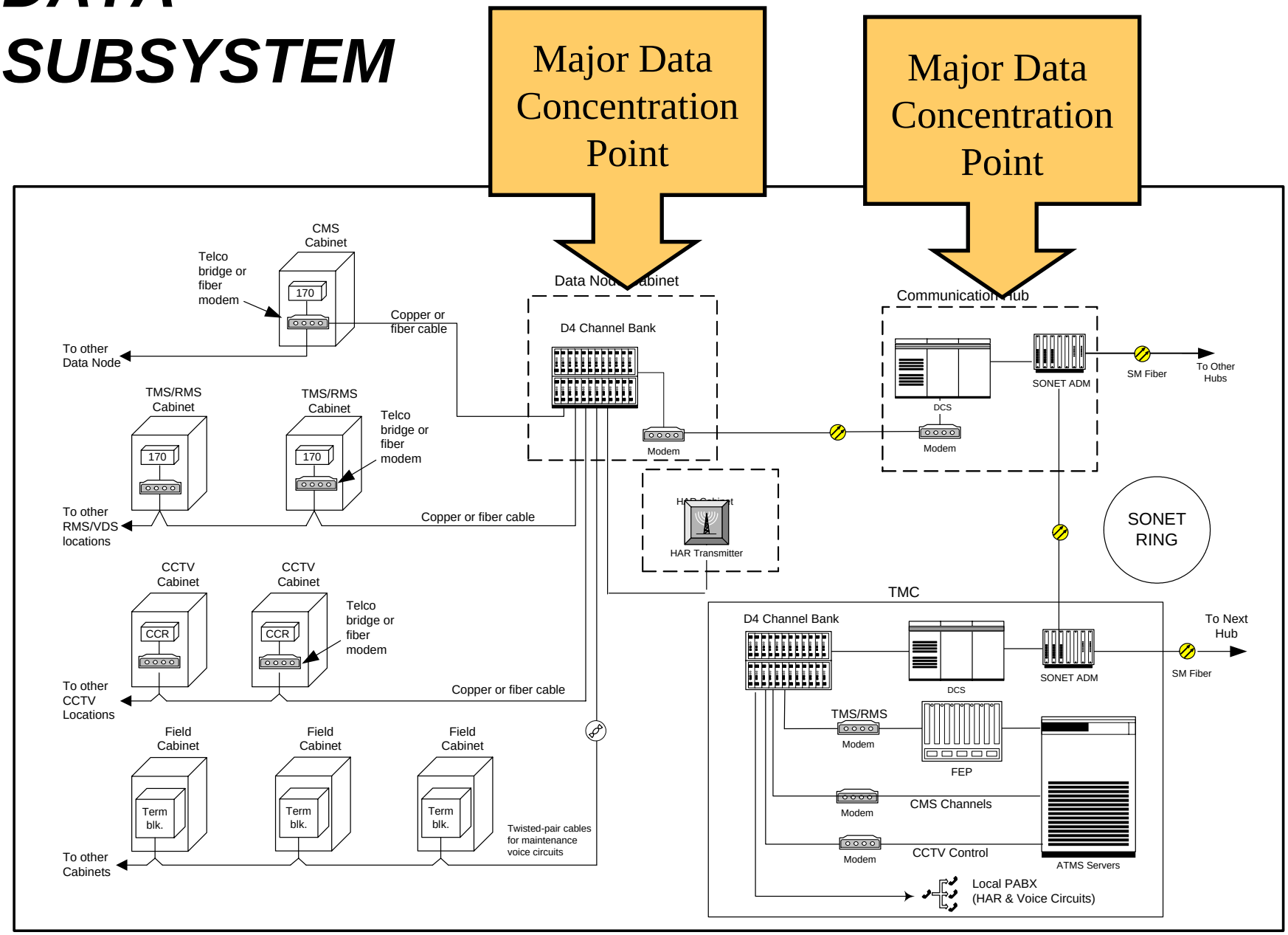
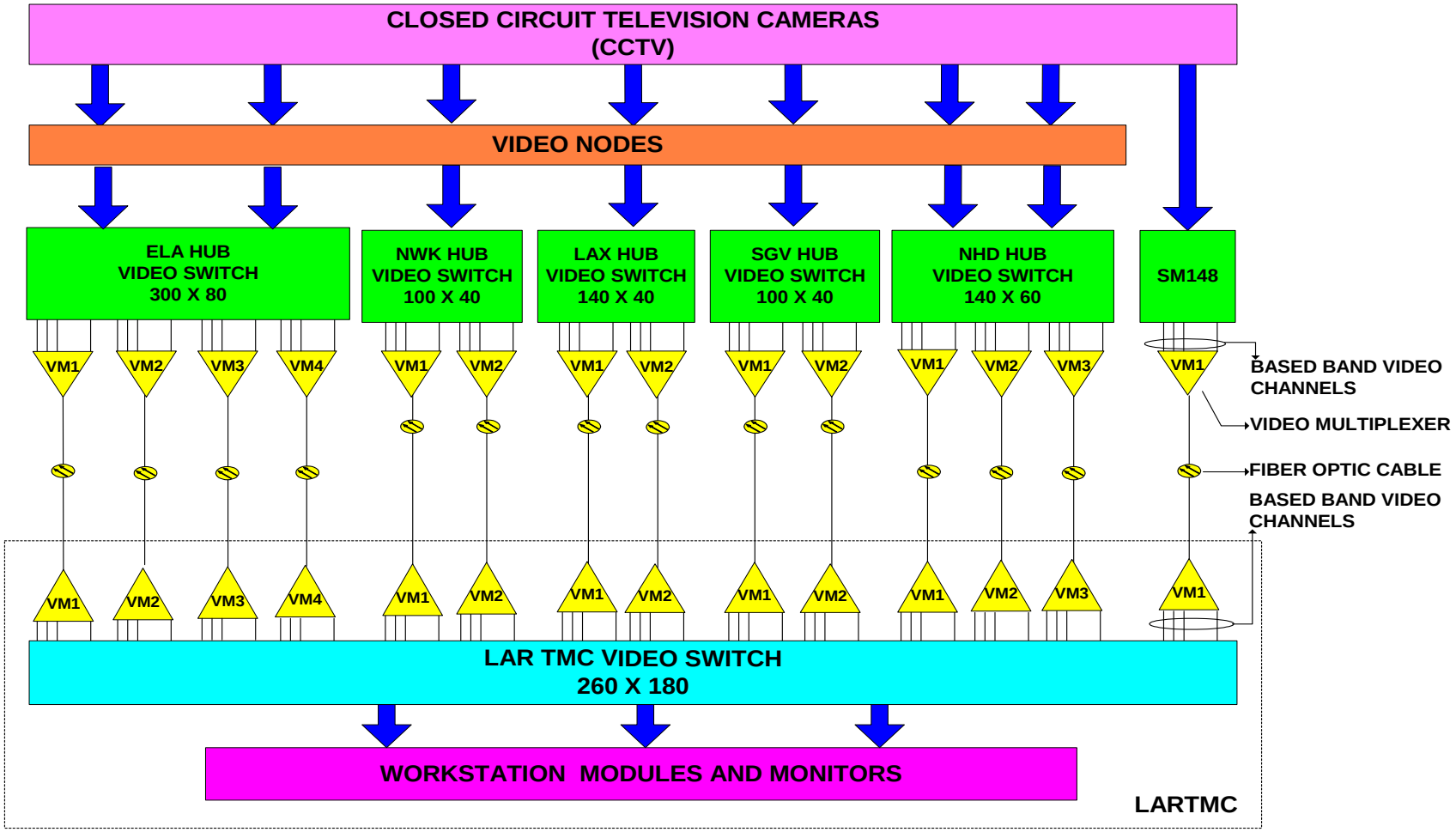
Data Subsystem
SONET Node/Hub Locations



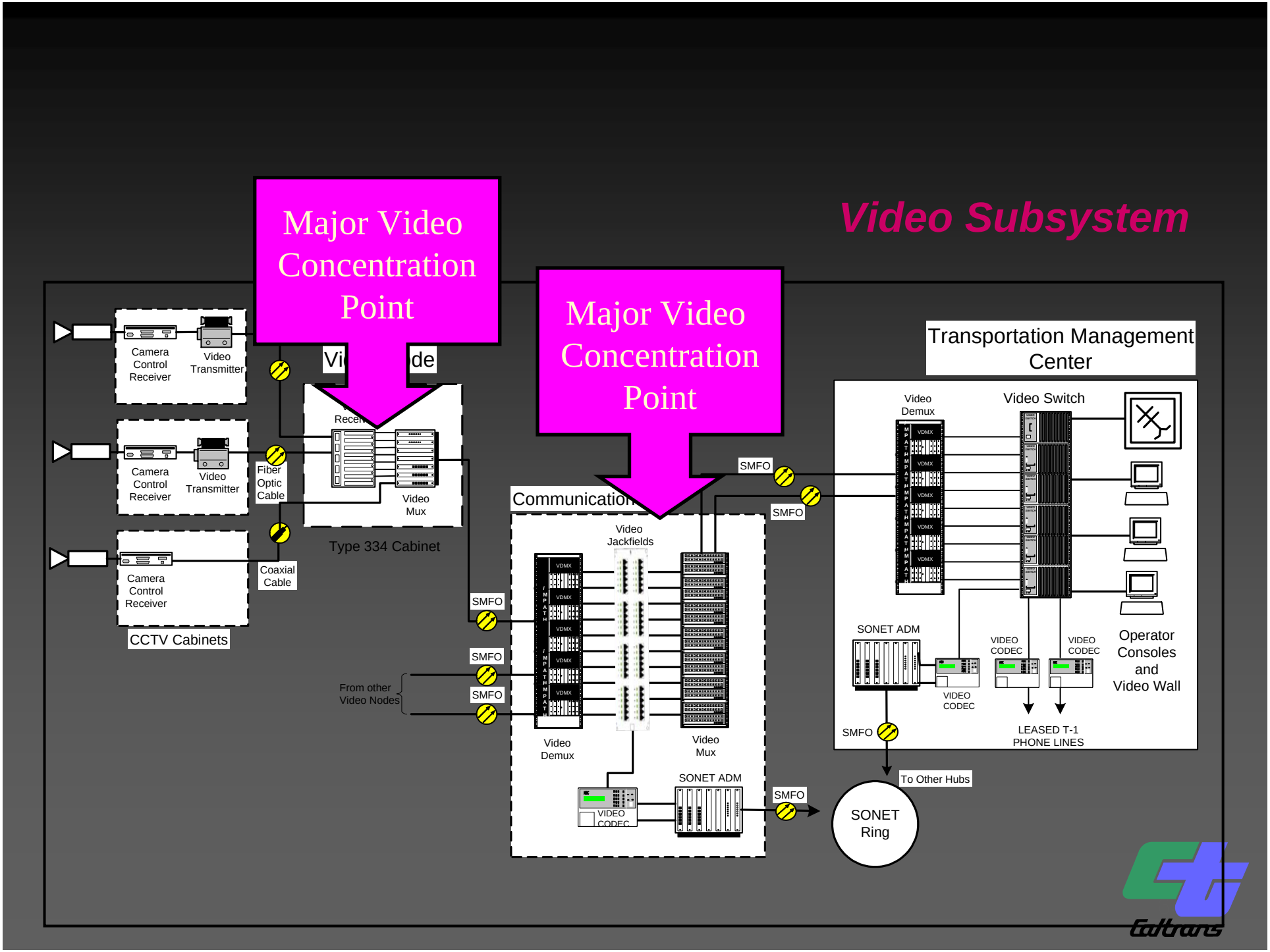
DATA SUBSYSTEM



Video Subsystem



Video Subsystem



The End

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