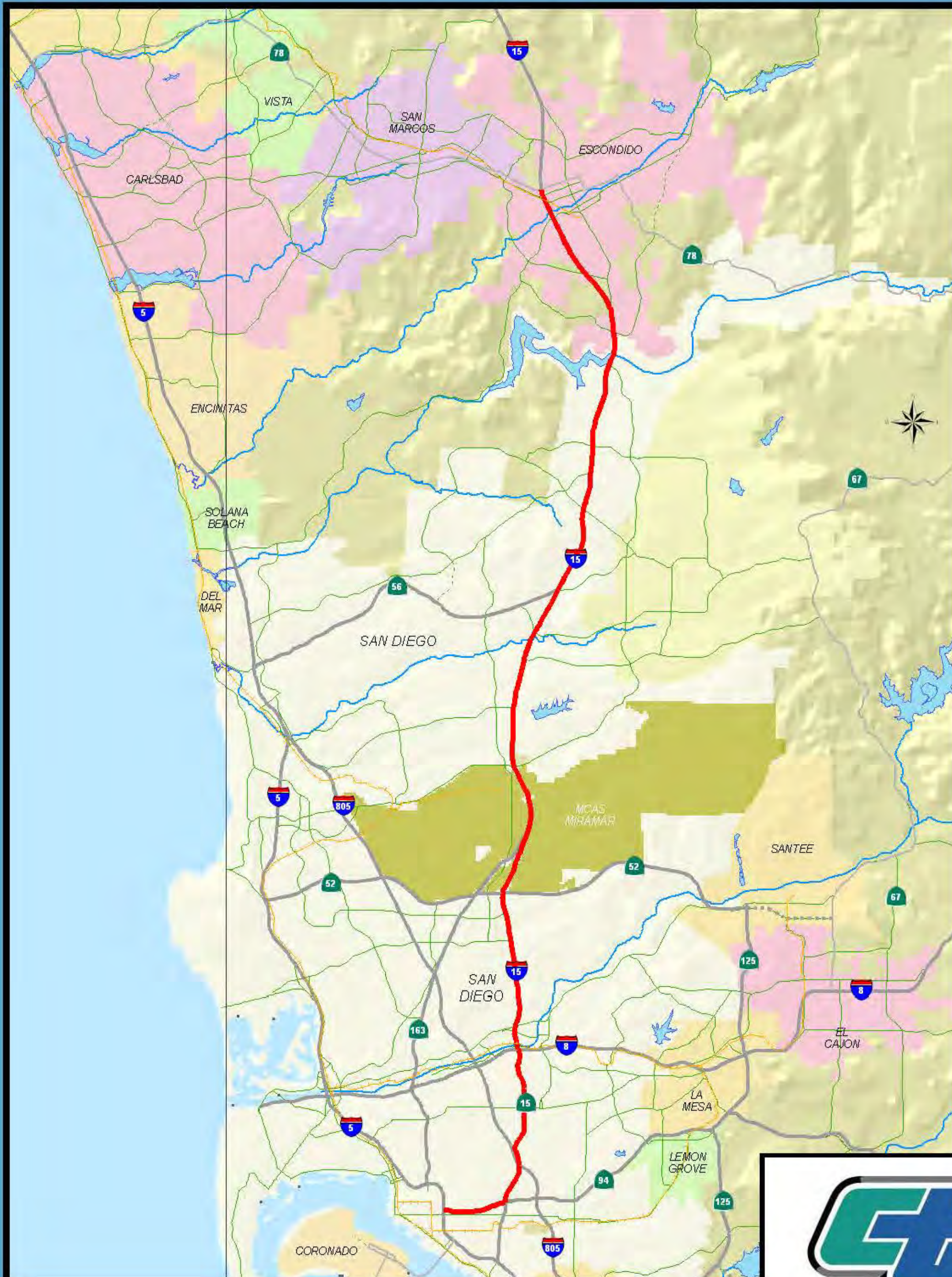
INTERSTATE 15

CORRIDOR SYSTEM MANAGEMENT PLAN



FINAL - January 2009

Acknowledgements

Many individuals aided in the preparation of material contained in the I-15 Corridor System Management Plan:

Caltrans District 11
Pedro Orso-Delgado, District Director
Bill Figge, Deputy District Director – Planning
William Valle, Chief Deputy – Maintanence and Operations
Joe Hull, Deputy District Director – Traffic Operations
Mike McManus, Deputy District Director – Maintanence

Christine Antoine, Associate Transportation Planner
Sandro Bermudez, Transportation Engineer
Connery Cepeda, Transportation Planner
Gerard Chadergian, Senior Transportation Engineer
Stacy Cottrell, Assistant Information Officer
Seth Cutter, Transportation Planner
Kimberly Dodson, Transportation Planner
Lawrence Emerson, Senior Transportation Engineer
Kelly Finn, Senior Environmental Planner
Brian Hadley, Senior Transportation Engineer
Shirley Hautanen, Associate Transportation Planner
John Hood, Graphic Designer II
Douglas Hooper, Transportation Engineer
Bob James, Associate Transportation Planner
Barbara Kent, Research Program Specialist II (GIS)
Jose Marquez, Transportation Planner
Victor Mercado, Transportation Engineer
Bruce Pastor, Associate Transportation Planner
Brian Pecus, Senior Transportation Electrical Engineer
Andrew Rice, Senior Transportation Surveyor
Michael Roy, Transportation Planner
Teresa Salazar, Graphic Designer II
Chris Schmidt, Senior Transportation Planner
David Stebbins, Senior Transportation Engineer
Debra Stout, Senior Transportation Planner
Kim Sturmer, Associate Transportation Planner
Dennis Thompson, Associate Transportation Planner
Aly Wayne, Transportation Planner

San Diego Association of Governments
Alex Estrella, Senior Transportation Planner
Craig Scott, *TransNet* Project Manager
Stephan Vance, Senior Transportation Planner

I-15 Corridor System Management Plan

Approved By: 12-10-08

GUSTAVO DALLARDA Date

I-15 Corridor Project Director, Caltrans District 11

Approved By: 2/4/09

JACK BODA Date

Mobility Management Director, San Diego Association of Governments

Approved By: Gary L. Gallegos 2-5-09

GARY GALLEGOS Date

Executive Director, San Diego Association of Governments

Approved By: 12/12/08

PEDRO ORSO-DELGADO Date

District Director, Caltrans District 11

CORRIDOR MOBILITY IMPROVEMENT ACCOUNT
PROJECT SCOPE, COST, SCHEDULE, AND BENEFIT BASELINE DATA

County: San Diego	Route: 15	PPNO: 0672G
Project Title: Managed Lanes South Segment		

We acknowledge the scope, cost, schedule, and benefits as identified on the attached project fact and funding sheets are the baseline for project monitoring by the California Transportation Commission and its Corridor Mobility Improvement Account Project Delivery Council. We certify that funding sources cited are committed and expected to be available; the estimated costs represent full project funding, and the description of benefits is the best estimate possible.

5-9-07 898

Gary L. Gallegos 3-26-07

Name: Gary L. Gallegos Date

Title: Executive Director

Agency: San Diego Associaton of Governments

Will Kempton 5-11-07

Will Kempton Date

Director

California Department of Transportation

John F. Barna 5-9-07

John F. Barna, Jr. Date

Executive Director

California Transportation Commission

CORRIDOR MOBILITY IMPROVEMENT ACCOUNT

Project Fact Sheet

Lead Agency:	**Caltrans**	**Fact Sheet Date:**	**03/23/07**
Contact Person	Gustavo Dallarda		
Phone Number	619-701-0472	Fax Number	619-688-2587
Email Address	gustavo_dallarda@dot.ca.gov		

Project Information:

County	Caltrans District	PPNO *	EA *	Region/MPO/ TIP ID*	Route / Corridor *	Post Mile Back *	Post Mile Ahead *
San Diego	11	0672G	81501	CAL18B	15	10.4	19.3

* NOTE: PPNO & EA assigned by Caltrans. Region/MPO/TIP ID assigned by RTPA/MPO. Route/Corridor & Post Mile Back/Ahead used for State Highway System.

Legislative Districts	Senate: 36, 39	Congressional:
	Assembly: 75, 77	
Implementing Agency (by component)	E&P (PA&ED): Caltrans District 11	PS&E: Caltrans District 11
	R/W: Caltrans District 11	CON: Caltrans District 11
Project Title	Managed Lanes South Segment	

Location - Project Limits - Description and Scope of Work (Provide a project location map on a separate sheet and attach to this form)
In San Diego from 0.1km South of Rte 15/52 Seperation to 0.3 km South of Route 15/56 Seperation. Construct Managed Lanes South Segment and Direct Access Ramp (DAR).

Description of Major Project Benefits

Daily Vehicle Hours of Delay Saved	29,386 Hrs.
Daily Peak Hour Person-Minutes Saved	2,145,180 minutes cumulative ~~22.0~~ Min.

Other: The Managed Lanes concept is part of a comprehensive regional plan to manage congestion and reduce delays on Interstate 15 (I-15) between State Route 163 (SR-163) and SR-78 by optimizing and increasing both freeway capacity and transportation alternatives in the corridor. The concept includes freeway and transit components and is a joint effort by Caltrans, the San Diego Association of Governments (SANDAG), and the Metropolitan Transit System (MTS).

Corridor System Management Plan	Month/Year
Lead Agency: Caltrans	12/31/08
Plan Adoption Date:	~~June-06~~
Plan Implementation Date:	~~June-08~~ 3/30/2010

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Expected Source(s) of Additional Funding if the Current Funding Plan Proves Insufficient

Project Delivery Baseline (Milestones)		**Unit 1 EA:2T0911**	**Unit 2 EA:2T0921**	**Unit 3 EA 2T0931**	**Unit 5 EA:2T0950**
Begin Environmental Phase (PA&ED)		12/11/1998	12/11/1998	12/11/1998	12/13/2005
Draft Environmental Document Milestone	Document Type:	CEQA-IS/ND, NEPA-EA/FONSI 10/22/02	CEQA-IS/ND, NEPA-EA/FONSI 10/22/02	CEQA-IS/ND, NEPA-EA/FONSI 10/22/02	CEQA-EIR, NEPA-EA/FONSI 9/29/08
Draft Project Report Milestone		10/28/2002	10/28/2002	10/28/2002	02/12/2008
End Environmental Phase (PA&ED Milestone)		03/27/2003	03/27/2003	03/27/2003	01/23/2009
Begin Design Phase		07/15/2002	07/15/2002	07/15/2002	02/01/2009
End Design Phase (Plans, Specifications, and Estimates Milestone)		10/15/2008	11/10/2008	06/30/2008	07/16/2011
Begin Right-of-Way		08/21/2006	08/21/2006	08/21/2006	02/01/2009
End Right-of-Way (Right-of-way Certification Milestone)		✓ 08/16/2007	3/1/08 ~~10/18/2006~~	10/1/07 ~~05/15/2007~~	06/18/2010
Begin Construction Phase		06/24/2008	07/23/2008	02/25/2008	03/12/2011
End Construction Phase (Construction Contract Acceptance Milestone)		02/21/2012	04/15/2012	01/17/2011	04/05/2013
Begin Closeout Phase		02/22/2012	04/16/2012	01/18/2011	04/06/2013
End Closeout Phase (Closeout Report Milestone)		03/26/2013	10/05/2013	07/20/2012	10/14/2014

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NOTE: The CTC Corridor Mobility Improvement Account (CMIA) Program Guidelines should have been read and understood prior to preparation of the CMIA Fact Sheet. The CTC CMIA Guidelines and a template of this Project Fact Sheet are available at: http://www.dot.ca.gov/hq/transprog/ and at: http://www.catc.ca.gov/

CORRIDOR MOBILITY IMPROVEMENT ACCOUNT
Project Fact Sheet - Project Cost and Funding Plan
(dollars in thousands and escalated)
Shaded fields are automatically calculated. Please do not fill these fields.

				Date: 23-Mar-07
County	CT District	PPNO *	EA*	Region/MPO/TIP ID *
San Diego	11	0672G	81501	CAL18B
Project Title:	Managed Lanes South Segment			

* NOTE: PPNO and EA assigned by Caltrans. Region/MPO/TIP ID assigned by RTPA/MPO

Proposed Total Project Cost								Project
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)	2,431	0	0	0	0	0	0	2,431
PS&E	59,569	0	0	0	0	0	0	59,569
R/W SUP (CT) *	3,300	0	0	0	0	0	0	3,300
CON SUP (CT) *	0	50,000	0	8,000	0	0	0	58,000
R/W	16,024	0	0	0	0	0	0	16,024
CON	0	300,000	0	42,000	0	0	0	342,000
TOTAL	81,324	350,000	0	50,000	0	0	0	481,324

Corridor Management Improvement Account (CMIA) Program

Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E								0
R/W SUP (CT) *								0
CON SUP (CT) *		50,000						50,000
R/W								0
CON		300,000						300,000
TOTAL	0	350,000	0	0	0	0	0	350,000

* NOTE: R/W SUP and CON SUP to be used only for projects implemented by Caltrans

Funding Source:	CMAQ							
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E	43,379							43,379
R/W SUP (CT) *								0
CON SUP (CT) *								0
R/W								0
CON								0
TOTAL	43,379	0	0	0	0	0	0	43,379

Funding Source:	STIP-RIP NHS							
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E	10,000							10,000
R/W SUP (CT) *								0
CON SUP (CT) *								0
R/W								0
CON								0
TOTAL	10,000	0	0	0	0	0	0	10,000

Funding Source:	STIP-RIP AUGMENTATION							
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E								0
R/W SUP (CT) *								0
CON SUP (CT) *				8,000				8,000
R/W								0
CON				42,000				42,000
TOTAL	0	0	0	50,000	0	0	0	50,000

Shaded fields are automatically calculated. Please do not fill these fields.

CORRIDOR MOBILITY IMPROVEMENT ACCOUNT
Project Fact Sheet - Project Cost and Funding Plan
(dollars in thousands and escalated)
Shaded fields are automatically calculated. Please do not fill these fields.

				Date:	23-Mar-07
County	CT District	PPNO *	EA*	Region/MPO/TIP ID *	
San Diego	11	0672G	81501	CAL18B	
Project Title:	Managed Lanes South Segment				

* NOTE: PPNO and EA assigned by Caltrans. Region/MPO/TIP ID assigned by RTPA/MPO

Funding Source:	TRANSNET - MC							
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)	2,431							2,431
PS&E	6,190							6,190
R/W SUP (CT) *	3,300							3,300
CON SUP (CT) *								0
R/W	16,024							16,024
CON								0
TOTAL	27,945	0	0	0	0	0	0	27,945

Funding Source:								
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E								0
R/W SUP (CT) *								0
CON SUP (CT) *								0
R/W								0
CON								0
TOTAL	0	0	0	0	0	0	0	0

Funding Source:								
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E								0
R/W SUP (CT) *								0
CON SUP (CT) *								0
R/W								0
CON								0
TOTAL	0	0	0	0	0	0	0	0

Funding Source:								
Component	Prior	07/08	08/09	09/10	10/11	11/12	12/13	Total
E&P (PA&ED)								0
PS&E								0
R/W SUP (CT) *								0
CON SUP (CT) *								0
R/W								0
CON								0
TOTAL	0	0	0	0	0	0	0	0

Shaded fields are automatically calculated. Please do not fill these fields.

INTERSTATE 15 CORRIDOR SYSTEM MANAGEMENT PLAN (CSMP)

EXECUTIVE SUMMARY

The purpose of the Corridor System Management Plan (CSMP) for Interstate 15 (I-15) is to provide a comprehensive strategy for managing, operating, and improving the I-15 corridor, as well as to provide a timeframe for prioritizing improvements and resources based on current and future performance.

The CSMP utilizes a multi-disciplinary, multi-functional approach to coordinate and synthesize information. Coordination efforts include many functional areas within the District, including but not limited to Planning, Traffic Operations, Maintenance, and Program Management. These efforts also extend to the local jurisdictions and the County, as well as to the San Diego Association of Governments (SANDAG), the region's Metropolitan Planning Organization (MPO). Three separate documents bundled together constitute the I-15 CSMP: the I-15 System Management Plan (SMP), the I-15 Managed Lanes Operations (MLOPS) Plan, and the I-15 Managed Lanes Traffic Incident Management (TIM) Plan. The latter two documents were approved by the California Transportation Commission (CTC) in April 2007, allowing the I-15 Middle Segment project to move forward.

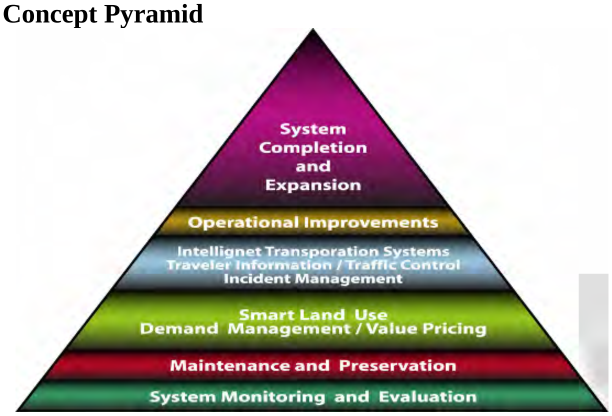
The I-15 corridor for this CSMP is defined as I-15 from State Route 78 (SR-78) to Interstate 8 (I-8), State Route 15 (SR-15) from I-8 to State Route 94 (SR-94), and SR-94 from SR-15 to Interstate 5 (I-5), along with adjacent major parallel arterials and other modal systems (**Figure i**). These limits are the logical termini for this CSMP based on route and traveler characteristics. For discussion purposes, I-15/SR-15 will be identified as I-15 for the rest of this report.

Figure i. Corridor Limits for I-15 Corridor Management Plan

I-15 System Management Plan (SMP)

The I-15 SMP identifies the characteristics of the corridor. This includes but is not limited to demographics, existing corridor facilities, current and future corridor performance, corridor management strategies, and planned improvements to the facility. The development of the I-15 SMP is based on Strategic Growth Planning, the premise that investments in mobility throughout the system yield significant improvements in congestion relief and system management, which focuses on a coordinated and integrated operation of all elements of the transportation system (productivity, mobility, reliability, accessibility, safety, and preservation) with the intention of maximizing performance. The Strategic Growth Concept Pyramid outlines the strategies used to achieve reduced congestion (**Figure ii**); each level of the Pyramid is discussed in the SMP.

Figure ii. Strategic Growth Concept Pyramid



Within the SMP project limits, I-15 is an eight to ten-lane freeway with auxiliary/added lanes at various locations. A reversible High Occupany Vehicle (HOV) lane facility was constructed in the median of I-15 between State Route 163 (SR-163) and State Route 56 (SR-56) and was opened to traffic in October 1988. While there are no continuous arterial routes parallel to I-15, several intermittent arterials provide a north-south alternative to travel in the corridor, including Centre City Parkway, Bear Valley Parkway, Pomerado Road, Black Mountain Road, and Kearny Villa Road.

The I-15 corridor also encompasses alternative modes of transportation, including transit and bikeways. The Metropolitan Transit System (MTS) operates express bus services along the I-15 corridor. Greyhound also provides intercity bus service, with a major stop in Escondido, before continuing north into Riverside County. Currently within the corridor, north-south bicycle travel is primarily on parallel arterials, except for a two-mile stretch on I-15 from Pomerado Road/West Bernardo Drive north across the Lake Hodges Bridge to Via Rancho Parkway, and from Via Rancho Parkway north to Centre City Parkway. There are presently 24 park-and-ride (P&R) lots maintained by Caltrans near or adjacent to I-15, with a total of 1,919 spaces. As of November 2006, 547 vanpools participate in the SANDAG RideLink vanpool program that operates on the I-15 Corridor, of which 236 (43%) commute from Riverside County.

I-15 currently suffers from severe congestion, affecting commuters, businesses, and inter-regional goods movement. Traffic along the corridor is subject to lengthy freeway queues that, on average, add 30 to 45 minutes to a typical weekday commute. Furthermore, due to the lack of continuous arterial parallel routes or high-speed transit service, I-15 traffic is subject to additional delay during rainy conditions, incidents, and special events. Current annual average daily traffic (AADT) along the corridor is 290,000 vehicles per day, and is expected to approach 410,000 vehicles per day by 2030. During peak periods, the traffic mix includes 15-20% carpoolers, and a 60/40 directional split, with traffic demand higher on southbound I-15 in the AM peak period and on northbound I-15 in the PM peak period. Accident data indicates that there are 16 locations on northbound I-15 and 9 locations on southbound I-15 that had accident concentrations between 2001 and 2005. Analyses of accident data suggest that accidents are caused not by deficiencies of the freeway, but by congestion from excessive demand.

Projected population and employment growth in the San Diego region will result in additional travel demand on the I-15 corridor. In particular, growth along the I-15 corridor from Escondido to Riverside County is expected to be higher than the San Diego regional average. The SMP lists SANDAG estimates for 2006 in population and housing, and ethnic composition for cities along the I-15 corridor, excluding unincorporated areas. SANDAG forecasts for 2030 show an increase in population, housing, and employment for these cities.

The I-15 SMP outlines a variety of strategies to maximize mobility, including the region's Regional Transportation Plan (RTP), Regional Comprehensive Plan (RCP), Smart Growth, Intelligent Transportation Systems (ITS), and the I-15 Interregional Partnership (IRP)'s Strategic Plan. Strategic growth forms the basis for the proposed transportation improvements and system management in the I-15 Corridor. This system management approach focuses on a coordinated and integrated operation of all elements of the transportation system to maximize performance (productivity, mobility, reliability, accessibility, safety, and preservation). The transportation network is managed for its highest efficiency, coordinating across all modes, jurisdictions, and functions. Commitments identified in the 2007 RTP and used in the development of future management improvement strategies for the I-15 Corridor include maintaining air quality standards, complying with the principles of environmental justice, and integrating transit/HOV use.

For system monitoring and evaluation, the I-15 SMP utilizes the Freeway Performance Measurement System (PeMS), a traffic data collection, processing, and analysis tool created as a joint effort by Caltrans, the University of California, Berkeley, and the Partnership for Advanced Technology on the Highways (PATH). PeMS extracts information from real-time and historical data and presents this information to assist traffic engineers in assessing the performance of the freeway system. The advantages of PeMS over conventional study approaches are demonstrated from case studies on conducting freeway operational analyses, bottleneck identification, level of service (LOS) determination, assessment of incident impacts, and evaluation of advanced control strategies.

Traffic improvements discussed in the CSMP include various proposed freeway projects, along with the approved I-15 Managed Lanes Project. The entire I-15 Managed Lanes Project, when completed, will provide four managed lanes from SR-163 to SR-78, along with additional general purpose lanes and auxiliary lanes. For construction and funding purposes, the I-15 Managed Lanes Project is divided into three segments: North (from SR-78 to Via Rancho Parkway/Del Lago Blvd), Middle (Via Rancho Parkway/Del Lago Blvd to SR-56), and South

(SR-56 to SR-163). The managed lanes will have five direct access ramp locations (DARs), several intermediate access points (IAPs), and a moveable barrier in the Middle and South segments to allow for two lanes in each direction or three lanes in one direction and one lane in the opposite direction. The managed lanes will also include priority for a Bus Rapid Transit (BRT) system and carpoolers, optimizing people-carrying capacity in the corridor. Additional planned improvements for the corridor include the I-15 Center City Corridor Project between SR-94 and the SR-163 merge, for which HOV lanes are being studied. The project would connect to the proposed I-805 Managed Lanes project, providing a continuous HOV system for regional connectivity. The project also incorporates BRT stations at University Avenue and El Cajon Boulevard, with operations beginning in 2012. The I-15 Center City Corridor Project is currently in the Project Study Report (PSR) phase. Future strategies for arterials to the I-15 include traffic signal priority measures, "queue jumpers" to bypass bottlenecks on local streets, and rail grade separations along the SPRINTER line.

I-15 Managed Lanes Operations (MLOPS) Plan

The MLOPS presents the operational and maintenance strategies for operating the moveable barrier system under various configurations within the managed lanes section of the corridor. This document also identifies the possible operational configurations, operational scenarios and procedures, and resource requirements.

SANDAG, Caltrans, the California Highway Patrol (CHP) and other agencies will be responsible for the operations and maintenance of the I-15 Managed Lanes. Since 1998, SANDAG has operated and managed the I-15 *FasTrak* Program that allows single occupant vehicles (SOVs) to pay a per trip fee to use the two existing reversible HOV Lanes. The FasTrak Program will be expanded to include the managed lanes as each segment becomes operational. Caltrans Traffic Operations and Maintenance Divisions will be actively involved in the day-to-day operations and maintenance of the managed lanes, with 15 personnel and an estimated cost of $2 million for Fiscal Year 2008-09 per the Cooperative Agreement between Caltrans and SANDAG. CHP will provide traffic control assistance and traffic breaks that are required to ensure safe operations during the transition from one managed lanes configuration to another. Cooperative agreements signed by these agencies will formalize agency responsibilities and commitments.

Construction is currently underway on the Middle segment, and is scheduled to be in operation in 2008. To accommodate the Middle segment managed lanes operations in conjunction with the existing reversible HOV lanes operations, traffic guidance devices will be installed on the north (Del Lago Blvd) and south (Sabre Springs Pkwy) ends of the Middle segment. These devices include fixed and moveable barriers, pop-ups, in-pavement lights, gates, variable message signs (VMS), and other appurtenances. Different configurations can be achieved by using two barrier transfer machines (BTMs) to shift the moveable barriers, which will be manufactured by Barrier Systems, Incorporated (BSI). A third BTM machine will be acquired when the entire managed lanes system becomes operational in 2012.

The four managed lanes can be configured to provide two northbound and two southbound lanes (2N+2S), three northbound lanes and one southbound lane (3N+1S), or one northbound lane and three southbound lanes (1N+3S). All four managed lanes could be dedicated to one traffic flow direction (4N+0S or 0N+4S) for extreme conditions or emergencies. Together with the two existing reversible HOV lanes, there are twelve possible combinations of configuring the managed lanes. Four of these combinations, identified as “Standard Daily Operations,” are expected to be used on a regular/daily basis. Operational procedures involved in changing from one configuration to another under the Standard Daily Operations are presented in the Operations Plan. The other eight combinations are identified as “Incident Management,” to be implemented if necessary during emergency or incident situations, and are presented in the TIM Plan. Traffic analysis will indicate the appropriate timing (year, time of year and time of day) for implementing the different configurations. When procedures involve the closing of active managed lanes, CHP traffic breaks are required to allow for pop-up delineators activation and moveable barrier transfer operations within the clear area.

The operation, control, and maintenance of the managed lanes and the existing reversible HOV lanes will require significant increased effort from the Caltrans Maintenance Division and the Traffic Operations Division, as well as the CHP. In addition to the normal roadway maintenance, extra effort will be needed to maintain and operate the managed lanes field elements, the eight miles of movable barrier, the BTMs, and the control system itself. All of those factors are critical to ensuring the integrity of the managed lanes operations, the safety of the traveling public, and the safety of Caltrans Maintenance workers.

I-15 Managed Lanes Traffic Incident Management (TIM) Plan

The TIM Plan defines agency roles, working relationships and responsibilities, along with associated procedures, timeframes, and estimates of staffing and equipment requirements to manage traffic incidents and safely mitigate impacts. This includes, but is not limited to, training requirements, the criteria for barrier transfers during incidents, scene management guidelines, and programmatic recommendations.

A traffic incident is any planned or unplanned event that impacts, or has the strong potential to impact, the flow of traffic, such as severe weather and emergency highway maintenance. Traffic Incident Management is the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration of incidents, and improve the safety of motorists, collision victims, and incident responders. The TIM Plan will outline the critical duties of various agencies including, but not limited to, law enforcement, fire and rescue, emergency medical services (EMS), medical examiners, transportation agencies, towing and recovery service providers, internet service providers (ISPs), and the media. At the time of this writing, specific agency responsibilities in connection with the I-15 managed lanes operations are in the process of being finalized and will be formalized via letters of intent and/or interagency cooperative agreements.

TIM training refers to the interagency, multi-disciplinary training required to enable a high degree of coordination and ensure the efficient use of resources available for managing traffic incidents. As part of the I-15 Managed Lanes Operations and Traffic Incident Management Plan study, high-level training will be conducted for operational personnel and TIM responders, and will focus on the purpose of the two plans and how to use the procedural information contained within them. Based on specific indentified TIM training needs, and the complexity of the I-15 managed lanes operations, an ongoing, multi-agency TIM training program will be established.

In addition to providing extra capacity during peak periods, the I-15 managed lanes are expected to be used to help alleviate incident related congestion in the general purpose lanes. An initial decision tree for barrier transfers during TIM operations was developed to determine whether barrier transfers are cost effective. Factors considered in the decision tree include incident classification, incident duration, number of lanes closed, day of the week, time of day, incident location, and direction of travel. Close coordination between the messages displayed on SANDAG's *FasTrak* variable toll message signs (VTMS) and Caltrans' changeable message signs (CMS) will be required.

The TIM Plan provides guidelines specific to various scene management strategies and tactics, including the National Incident Management System (NIMS) and Incident Command System (ICS), scene management and emergency traffic control, emergency scene access, staging considerations, and emergency vehicle lighting. NIMS is a comprehensive system that is intended to improve response and continuity of operations using the ICS and other standard procedures and preparedness measures. Scene management and emergency traffic control guidelines ensure the safest possible work environment for emergency responders. Emergency scene access guidelines provide alternatives for emergency vehicle access to potential incident sites. Staging considerations guidelines are applied when an incident occurs within an area with limited shoulders or lanes or when multiple agencies respond. Guidelines for emergency vehicle lighting, such as high intensity rotating, flashing, oscillating, or strobe lights, establish good traffic control measures to reduce excessive use of high intensity lighting, especially at night.

The I-15 Managed Lanes TIM Plan acknowledges the benefits of ongoing, sustained TIM programs. Regions that have comprehensive programs have typically experienced significant reductions in travel delay and overall incident duration as well as improvements in the area of responder and motorist safety. The goal of the TIM program is not to create a response, but rather to create a more effective, efficient response for all responding agencies. To establish and sustain the ongoing program, the I-15 Managed Lanes TIM Plan identifies a "champion" agency or individual to lead program development, and to involve, and encourage participation from, all responding agencies/stakeholders. The stakeholders must meet regularly for such actions as confirming goals and objectives, discussing ongoing problem areas and needs, identifying and/or establishing funding sources, and monitoring progress.

I-15 Corridor System Management Plan (CSMP)

The I-15 System Management Plan (SMP), the I-15 Managed Lanes Operations (MLOPS) Plan, and the I-15 Managed Lanes Traffic Incident Management (TIM) Plan together provide a unified concept for managing, operating, improving, and preserving the I-15 corridor across all modes and jurisdictions for the highest productivity, mobility, reliability, accessibility, safety, and preservation outcomes. These three documents form the Corridor System Management Plan (CSMP), creating a tool for effective management and a guide for implementation of system management and performance measurement. The larger purpose of a corridor system management plan is to focus all jurisdictional transportation efforts on the effective and efficient usage of all facilities in the corridor.

I-15
SYSTEM MANAGEMENT PLAN

October 10, 2008

Caltrans

Table of Contents

List of Tables

List of Figures

List of Acronyms

Acronym	Description
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AC	Asphalt Concrete
ADT	Average Daily Traffic
ATIMS	Advanced Transportation Information Management System
ATIS	Advanced Traveler Information System
ATMS	Advanced Transportation Management System
AVL	Automatic Vehicle Locator
AWDT	Average Weekday Daily Traffic
BTM	Barrier Transfer Machine
BRT	Bus Rapid Transit
CAD	Computer Aided Dispatch
CAPM	Capital Preventative Maintenance
CBD	Central Business District
CCTV	Closed Circuit Television
CHP	California Highway Patrol
CMIA	Corridor Mobility Improvement Account
CMS	Changeable Message Sign
CSMP	Corridor System Management Plan
CTC	California Transportation Commission
DAR	Direct Access Ramp
EMS	Emergency Medical Services
F&E	Freeway and Expressway
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicle
I-	Interstate
IAP	Intermediate Access Point
ICES	Intermodal Corridors of Economic Significance
ICMS	Integrated Corridor Management System
ICS	Incident Command System
IMTMS	Intermodal Transportation Management System
IRP	Interregional Partnership
ISP	Internet Service Provider
ITS	Intelligent Transportation System
LED	Light Emitting Diode
LIP	Limited Implementation Plan
LOS	Level of Service
MLOPS	Managed Lanes Operations Plan
MPO	Metropolitan Planning Organization
MSAT	Mobile Source Air Toxics
MTS	Metropolitan Transit System
NAAQS	National Ambient Air Quality Standards

NAFTA	North American Free Trade Agreement
NCTD	North County Transit District
NEPA	National Environmental Policy Act
NIMS	National Incident Management System
P&R	Park and Ride
PA&ED	Project Approval and Environmental Document
PATH	Partnership for Advanced Technology on the Highways
PCC	Portland Cement Concrete
PCS	Pavement Condition Survey
PeMS	Performance Measurement System
PIRS	Project Information Reporting System
$PM_{2.5}$	Particulate Matter with aerodynamic diameter of up to 2.5μm
PM_{10}	Particulate Matter with aerodynamic diameter of up to 10μm
PMS	Pavement Management System
POE	Port of Entry
PSE	Plans, Specifications, and Estimates
PSR	Project Study Report
PY	Personnel Year
RAMS	Regional Arterial Management System
RCP	Regional Comprehensive Plan
REMS	Regional Event Management System
RLCS	Reversible Lane Control System
RMS	Ramp Monitoring Station
RTMS	Regional Transit Management System
RTP	Regional Transportation Plan
RTV	Regional Transit Vision
SANDAG	San Diego Association of Governments
SDRIMS	San Diego Ramp Metering Information System
SGP	Strategic Growth Planning
SHOPP	State Highway Operation Protection Plan
SM	System Management
SMP	System Management Plan
SOV	Single Occupant Vehicle
SR-	State Route
STIP	State Transportation Improvement Program
TDA	Transportation Development Act
TIM	Traffic Incident Management
TMC	Transportation Management Center
TMS	Traffic Monitoring Station
VAR	Value Added Reseller
VMS	Variable Message Sign
VTMS	Variable Toll Message Sign
WAN	Wide Area Network
WRCOG	Western Riverside Council of Governments

1.0 BACKGROUND

1.1 Purpose of Corridor System Management Plans

The purpose of a Corridor System Management Plan (CSMP) is to provide a unified concept for managing, operating, improving, and preserving a corridor across all modes and jurisdictions for the highest productivity, mobility, reliability, accessibility, safety, and preservation outcomes. The CSMP provides a basis for prioritizing improvements and resources. The Corridor System Management Plan focuses the transportation efforts of all jurisdictions on effective and efficient use of the facilities in the corridor. The Plan serves as a tool for effective management and a guide for implementing systems management and performance measures. It integrates operational analysis with traditional system planning based on a foundation of comprehensive performance assessments and evaluation.

1.2 Development of Corridor System Management Plans

CSMPs utilize a multi-disciplinary and multi-functional approach. Information in the CSMP synthesizes information from many functional areas within the District including Planning, Traffic Operations, Maintenance, and Program Management. In addition, jurisdictional agency coordination includes working closely with the San Diego Association of Governments (SANDAG) and appropriate jurisdictions along the CSMP corridor.

The development of the CSMP is based on strategic growth planning (SGP) and system management (SM). This type of planning is performance based and outcome driven. The key premise of SGP is that investments in mobility throughout the system yield significant improvements in congestion relief.

System management is the wave of the future and is being touted at the federal, state, regional and local levels. SM addresses both transportation demand and supply to get the best system performance possible. Ideally, Caltrans and its regional partners would develop a regional system management plan that addresses all components of the Strategic Growth Concept Pyramid for an entire region, comprehensively. However, because SM is new to Caltrans and its regional and local partners, it is prudent to practice SM at the corridor level first.

The Strategic Growth Concept Pyramid outlines the strategies to be used to achieve the outcome of reduced congestion (**Figure 1**). The base of the pyramid is as important as the apex. The foundation of system management is system monitoring and evaluation through comprehensive performance assessment and evaluation. Understanding how a corridor performs and why it performs the way it does is critical to crafting the appropriate strategies. A relatively new measure merits a discussion here since it explains the increased emphasis on operational strategies. This measure is productivity. A critical goal of system management is to “get the most out” of the existing system, or maximize system productivity. One would think that a given freeway is most productive during peak commute times. This is true for freeways not experiencing congestion. However, for California’s urban freeways that have been experiencing growing congestion, the opposite is true. System monitoring and preservation are the foundation upon which the other strategies are built.

This document will discuss each level of the pyramid. System expansion and completion will provide the desired mobility benefits to the extent that investments in and implementation of the strategies below it establish a solid platform. This system management approach focuses on a coordinated and integrated operation of all elements of the transportation system in a way that maximizes performance (productivity, mobility, reliability, accessibility, safety, and preservation). It means managing the State's transportation "plant" for highest efficiency, as in a major factory or manufacturing firm. The entirety of the transportation network is managed for highest efficiency, coordinating across all modes, jurisdictions, and functions, including planning, operations, improvements, and maintenance.

Figure 1. Strategic Growth Concept Pyramid

1.3 Corridor Mobility Improvement Account Program (CMIA)

The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, approved by the voters as Proposition 1B on November 7, 2006, includes a program of funding from $4.5 billion deposited in the Corridor Mobility Improvement Account (CMIA). The funds in the CMIA are available to the California Transportation Commission (CTC), upon appropriation in the annual Budget Act by the Legislature, for allocation for performance improvements on the State highway system or major access routes to the State highway system.

To include a project in the CMIA program, the CTC must find that it improves mobility in a high congestion corridor by improving travel times or reducing the number of daily vehicle hours of delay, improves the connectivity of the State highway system between rural, suburban, and urban areas, or improves the operation or safety of a highway or road segment. The project must also improve access to jobs, housing, markets, and commerce. The project can commence construction no later than December 31, 2012. In selecting projects for funding under the CMIA program, the CTC intends to balance improvements to mobility in highly congested urban corridors, and improvements to mobility and connectivity in interregional State highway corridors.

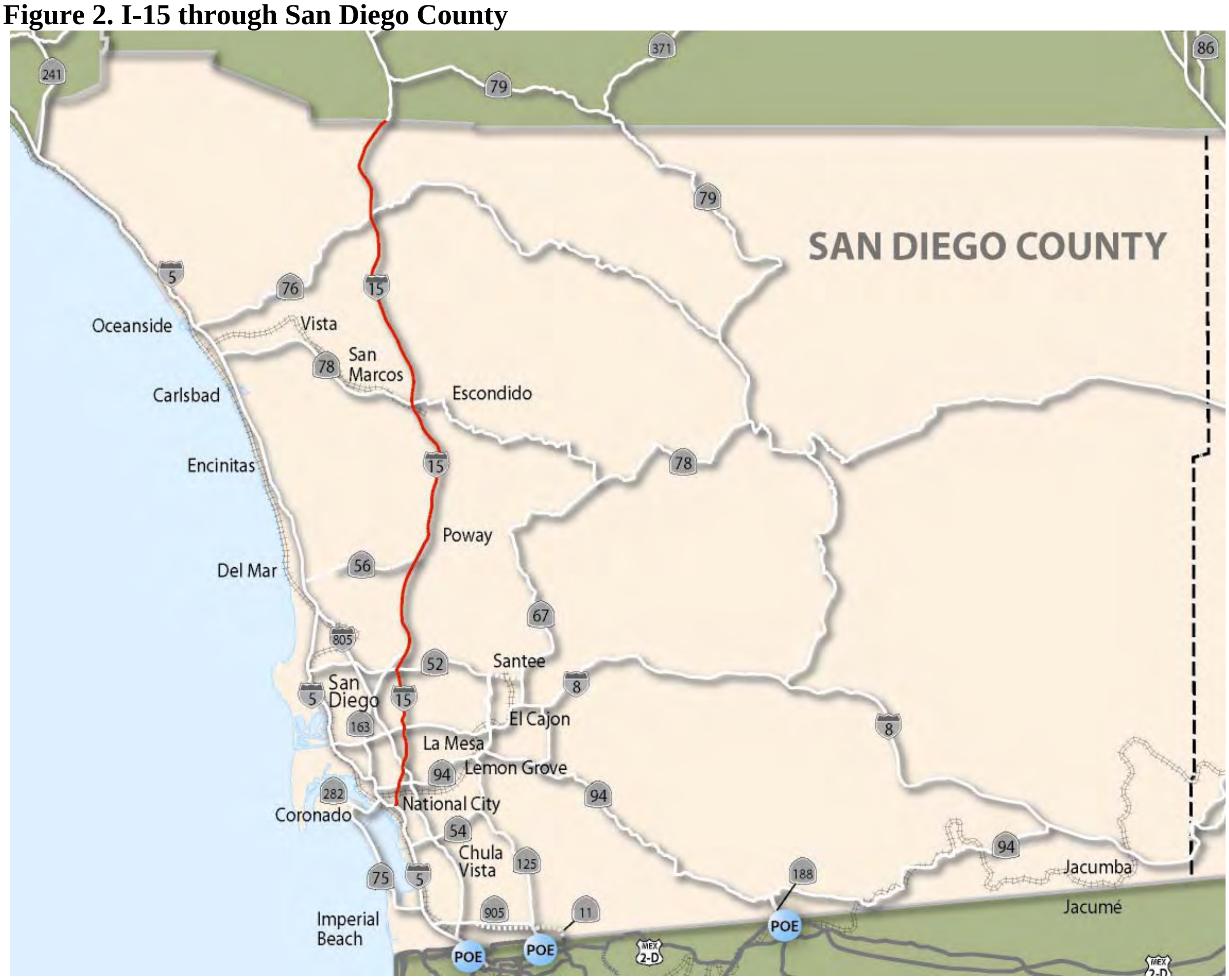
The CTC expects Caltrans and regional agencies to preserve the mobility gains of urban corridor capacity improvements over time and to describe how they intend to do so in project nominations. For urban corridor capacity improvements, the Commission intends to give priority to projects where there is a CSMP in place to preserve corridor mobility or where there is a documented regional and local commitment to the development and effective implementation of a CSMP, which may include the installation of traffic detection equipment, the use of ramp metering, operational improvements, and other traffic management elements as appropriate.

The description and analysis of specific CMIA project proposals is included in the CSMP, however, the primary focus of the CSMP is to provide a comprehensive corridor improvement strategy that will ultimately result in optimized performance of the corridor.

2.0 CORRIDOR IDENTIFICATION / DESCRIPTION

Interstate 15 / State Route 15 (I-15 / SR-15) is a major north-south freeway serving the inland portion of San Diego County. (For discussion purposes, I-15 / SR-15 will be identified as I-15 for the rest of this report.) Interstate 15 is mostly an eight-lane freeway originating at the south junction with Interstate 5 (I-5) near downtown San Diego and continuing north to the Canadian Border. It is the only State highway serving the major growth corridor from metropolitan San Diego to Riverside County (**Figure 2**). Interstate 15 serves interregional travel by linking the metropolitan San Diego area with Mexico to the south, and it also serves intraregional travel between the Cities of National City, San Diego, San Marcos, Poway, and Escondido, and the unincorporated communities of Bonsall, Fallbrook, and Rainbow. Interstate 15 is a heavily utilized commuter route providing access to the growing residential communities of Tierrasanta, Mira Mesa, Scripps Ranch, Rancho Peñasquitos, Sabre Springs, Carmel Mountain Ranch, Poway, Rancho Bernardo, and Escondido. I-15 bisects the Marine Corps Air Station Miramar and links major employment centers located in Kearny Mesa and the Miramar area, as well as providing a connection to the 32nd Street Naval Station. I-15 is also a major truck route for goods movement connecting the U.S.-Mexico border to San Diego County, Riverside County and San Bernardino County, then continuing northeast to Las Vegas.

Figure 2. I-15 through San Diego County



The corridor limits for this CSMP begin at State Route 78 (SR-78) in Escondido in the north, and extend south to State Route 94 (SR-94) in San Diego. The corridor limits continue on SR-94 to the junction with I-5 in downtown San Diego (**Figure 3**). These limits are the logical termini for the I-15 CSMP based on route and traveler characteristics, with the primary destinations being the San Diego central business district (CBD) and Escondido. Annual average daily traffic (AADT) volumes for I-15 north of SR-78 are approximately one-third of the AADT volumes for I-15 south of SR-78; forecasts for 2030 indicate similar ADT volume ratios. Due to this significant change in traffic volumes at this location, SR-78 in Escondido is the northern terminus for this comprehensive CSMP.

Figure 3. Corridor Limits for I-15 Corridor Management Plan

3.0 EXISTING CONDITIONS

3.1 Existing Facility Classifications

Interstate 15 serves a wide range of international, national, and interregional transportation needs. The I-15 corridor is one of Intermodal Corridors of Economic Significance (ICES) network of goods movement facilities for the State of California. The ICES is composed of California's major seaports, airports, and a network of NHS routes and connectors that link these intermodal facilities most directly, conveniently and efficiently in time and distance to intrastate, interstate, and international markets. Interstate 15 was added to the State Highway System in 1931 and to the California Freeway and Expressway (F&E) System in 1959. The route from Interstate 8 (I-8) to the Riverside County line was added to the Interstate Highway System in 1969. From I-5 to I-8, the route was made part of the nonchargeable interstate system in 1984. The entire 54.5 mile length of I-15 in San Diego County is included in the National Highway System (NHS).

3.2 Freeway

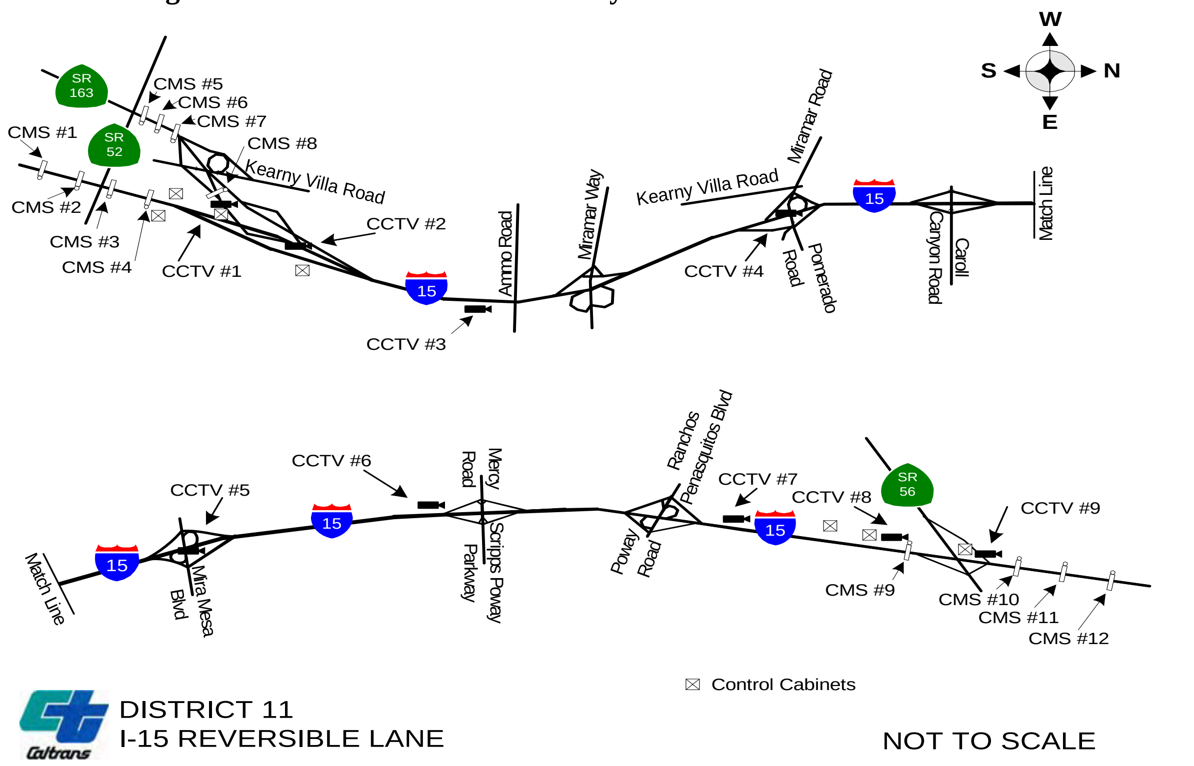
Within the CSMP area, I-15 is an eight to ten-lane freeway with auxiliary lanes at various locations within the project limits. The main lanes are 3.6 meters (12 feet) wide and composed of Portland cement concrete (PCC) pavement. The shoulders are a minimum of 3.0 meters (10 feet) wide and are composed of an asphalt concrete (AC) structural section, except at a few locations that have PCC shoulders.

The freeway median varies from State Route 163 (SR-163) to SR-78, and can be described in three segments:

1) From SR-163 to State Route 56 (SR-56), the median includes an existing reversible HOV lane facility (**Figure 4**), opened to traffic on October 1988. This facility is comprised of two 3.6 meter PCC lanes used by vehicles and a 3.0 meter AC shoulder on each side. A concrete barrier separates the general purpose lane inside shoulder from the reversible HOV lane shoulder on each side, and the minimum median width is about 21 meters (70 feet). The hours of operation for these express lanes originally were three hours for the southbound morning commute and three hours for the northbound evening commute. These weekday operation hours were later extended due to congestion and public demand from approximately 4:30 am to 12:30 pm in the southbound direction and from 1:00 pm to 7:00 pm in the northbound direction. Based on observed weekend traffic, these lanes remain open in the northbound direction from 7:00 pm Friday to 4:30 am Monday. These lanes will continue to operate during the Managed Lanes construction.

In December 2005, the reversible HOV lanes carried about 17,950 average daily trips (ADT) (13,640 HOV and 4,310 *FasTrak*). SANDAG began the *FasTrak* program in 1998 that allows single occupant vehicles (SOVs) to use the reversible HOV lanes for a fee. Currently about 25% of the vehicles on these lanes are *FasTrak* customers. Additionally, the Inland Breeze express bus line currently utilizes the reversible HOV lanes from Rancho Bernardo to downtown San Diego, and is partially funded by revenues from the *FasTrak* program.

Figure 4. Existing I-15 Reversible HOV Lane Facility



2) From SR-56 to Del Lago Blvd., a Managed Lanes facility is currently under construction in the median, to be completed and open to traffic by December 2008. When complete, the facility will consist of four 3.6 meter PCC lanes used by vehicles and a 3.0 meter AC shoulder on each side. A moveable barrier will be utilized between the Managed Lanes to configure the lanes to meet the peak demand (i.e., 3 lanes northbound and 1 lane southbound). A concrete barrier will separate the general purpose lane inside shoulder from the Managed Lane shoulder on each side. The minimum median width is approximately 21 meters (70 feet).

3) From Del Lago Blvd. to SR-78, the median width is approximately 14 meters (46 feet), with oleanders planted from Clarence Lane to SR-78. The existing median will be reconstructed to extend the Managed Lanes facility, changing to four 3.6 meter PCC lanes, two northbound and two southbound separated by a fixed barrier, with 3.0 meter shoulders in each direction. The Managed Lanes facility will be separated from the general purpose lanes by striping. Construction is scheduled to begin in late 2008 or early 2009 and is scheduled to be completed in 2012.

3.3 Congestion

In the early 1990s, I-15 began to experience congestion. ADT on the corridor ranged from 190,000 to 290,000 vehicles with daily commute delays ranging from 30 to 45 minutes. In 1994, I-15 was identified in the Regional Transportation Plan (RTP) as a future congested corridor requiring further study to identify possible solutions. Prior to the current RTP, a project was proposed to add two high occupancy vehicle (HOV) lanes from SR-56 to SR-78. The Regional HOV System Plan also identified this project.

I-15 experiences significant traffic congestion in both the AM (6:00 to 9:00 am) and PM (4:00 to 7:00 pm) peak periods. Of the top 10 congested segments in the AM peak period (**Figure 5**), I-15 southbound from north of SR-78 to Via Rancho Parkway is the fourth most congested segment in the San Diego metropolitan region, with 596 average vehicle hours of delay. I-15 northbound from south of Adams Avenue to Friars Road is the ninth most congested AM peak segment, with 282 average daily vehicle hours of congestion. As of Fall 2007, no segment of I-15 makes the list for the top 10 congested segments for the PM peak period (**Figure 6**), yet I-15 northbound from SR-56 to Bernardo Center Drive and I-15 southbound from SR-163 to Balboa Avenue are known congested segments from previous analysis. Please note that construction disturbed collection of data for the Fall 2007 PM Top 10 Congested Segments map.

Figure 5. Fall 2007 Top 10 AM Congested Segments

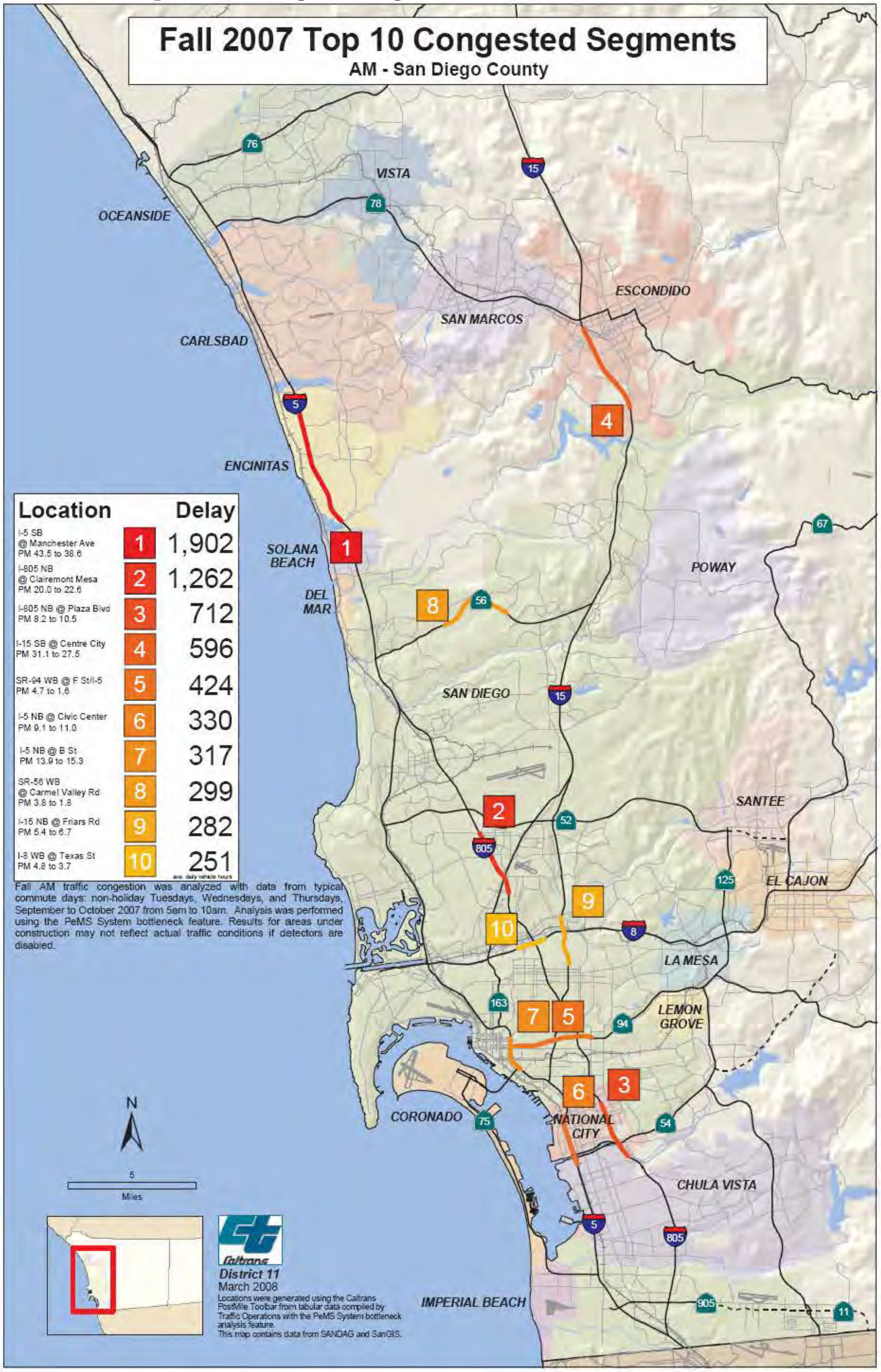
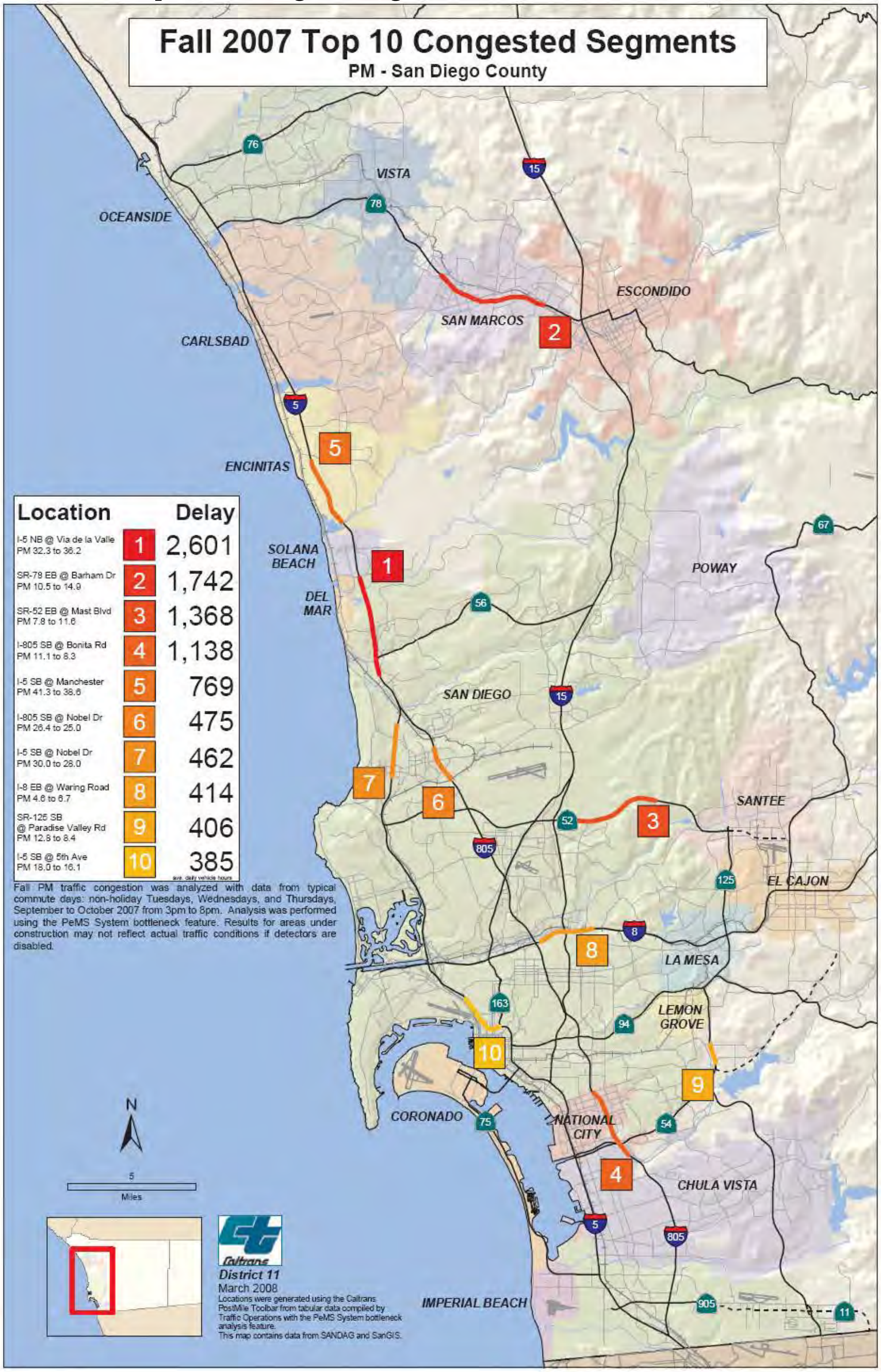


Figure 6. Fall 2007 Top 10 PM Congested Segments



3.4 Existing and Future Traffic

Table 1. I-15 Existing (2006) and Projected (2030) Average Weekday Traffic Volumes (AWDT)

LOCATION	2006 AWDT[1]	2030 AWDT[2]
I-5 to National Ave	118,200	119,400
National Ave to Ocean View Blvd	118,200	119,400
Ocean View Blvd to Imperial Ave	124,000	125,230
Imperial Ave to Market St	124,000	125,230
Market St to SR-94	126,200	136,040
SR-94 to I-805	105,400	132,610
I-805 to Wightman St	167,200	191,420
Wightman St to University Ave	167,200	175,190
University Ave to Orange Ave	164,000	173,150
Orange Ave to El Cajon Blvd	164,000	173,150
El Cajon Blvd to Meade Ave	165,100	198,280
Meade Ave to Adams Ave	165,100	187,820
Adams Ave to I-8	175,700	217,140
I-8 to San Diego Mission Rd	234,300	235,500
San Diego Mission Rd to Friars Rd	234,300	235,500
Friars Rd to Aero Dr	236,400	241,900
Aero Dr to Balboa Ave/Tierrasanta Blvd	204,500	207,820
Balboa Ave/Tierrasanta Blvd to Clairemont Mesa Blvd	186,400	202,400
Clairemont Mesa Blvd to SR-52	176,800	216,200
SR-52 to SR-163	210,900	243,390
SR-163 to Miramar Way	321,600	412,350
Miramar Way to Pomerado Rd	317,300	408,850
Pomerado Rd to Carroll Canyon Rd	299,100	384,470
Carroll Canyon Rd to Mira Mesa Blvd	278,000	379,000
Mira Mesa Blvd to Mercy Rd/Scripps Poway Pkwy	277,600	380,730
Mercy Rd/Scripps Poway Pkwy to Poway Rd	265,900	361,700
Poway Rd to SR-56	236,900	324,190
SR-56 to Carmel Mountain Rd	247,600	365,100
Carmel Mountain Rd to Camino del Norte	240,100	352,220
Camino del Norte to Bernardo Center Dr	239,100	352,490
Bernardo Center Dr to Rancho Bernardo Rd	230,500	310,120
Rancho Bernardo Rd to Pomerado Dr/W Bernardo Dr	223,000	327,600
Pomerado Dr/W Bernardo Dr to Via Rancho Pkwy/Bear Vly	239,100	365,160
Via Rancho Pkwy/Bear Vly to Centre City Pkwy	213,000	346,360
Centre City Pkwy to Gamble Ln/Citracado Pkwy	185,300	304,520
Gamble Ln/Citracado Pkwy to 9th Ave	193,500	302,510
9th Ave to Valley Pkwy	189,400	298,380
Valley Pkwy to SR-78	202,800	289,610
SR-78 to El Norte Pkwy	127,600	216,020
El Norte Pkwy to Centre City Pkwy	113,600	197,460

LOCATION	2006 AWDT[1]	2030 AWDT[2]
Centre City Pkwy to Deer Springs Rd	121,700	207,800
Deer Springs Rd to Gopher Canyon Rd	125,700	221,820
Gopher Canyon Rd to Old Hwy 395	125,900	227,910
Old Hwy 395 to SR-76/Pala Rd	124,800	222,000
SR-76/Pala Rd to Mission Rd	129,500	232,230
Mission Rd to Rainbow Valley Blvd	137,600	254,610
Rainbow Valley Blvd to Riverside Co Line	137,100	254,470

1 Caltrans District 11 Traffic Census Branch AADTs
2 SANDAG Regional Transportation Model, March 2006.

3.5 Goods Movement and Border Activities

The I-15 corridor is significant in providing for the economic vitality of California and the nation as a whole. With the implementation of the North American Free Trade Agreement (NAFTA) in 1992, increased commercial vehicle traffic has impacted the border region's transportation network. The total for all California – Baja California, Mexico import and export trade was approximately $37 billion in 2007, with 98% of this trade transported by trucks. Additionally, it is estimated that 30% to 40% of the goods that move through San Diego County bound to and from Mexico through the Otay Mesa Port of Entry (POE) are transported through the north I-15 corridor. I-15 also serves the rapidly growing truck distribution centers in Riverside and San Bernardino Counties. Total annual northbound and southbound truck crossings at the Otay Mesa POE and the proposed Otay Mesa East POE are projected to increase to approximately 3.6 million by 2030, with the majority of these truck trips utilizing I-15 to head to northern destinations.

Numerous studies have been developed regarding transportation improvements related to the U.S./Mexico border region. A detailed discussion of these studies is beyond the scope of this report; however, District 11 participated in the development of the San Diego Regional Goods Movement Action Plan (GMAP). The GMAP, written by SANDAG as part of their 2007 RTP, outlines criteria to identify and prioritize freight system projects that will provide adequate future capacity and also mitigate congestion. The overall goods movement concern is the increasing amount of congestion due to the economic and population growth in the region and the lack of infrastructure to meet the region's needs. District 11 is also currently developing the California-Baja California Border Master Plan, which has the following goals and objectives:

- Establish a process to institutionalize dialogue among stakeholders in the United States and Mexico,
- Develop criteria to prioritize projects related to POEs and connecting transportation facilities,
- Understand current planning processes for POEs and related transportation facilities,
- Identify POE and transportation infrastructure needs based on regional capacity and existing and future travel demand,
- Integrate federal, state, regional, and local input to develop a list of short-, mid-, and long-term POE and related transportation projects, and

- Incorporate project evaluation criteria into stakeholders' transportation and POE planning documents.

3.6 Non-Motorized Transportation

In 2007, the region expects to spend at least $4 million in Transportation Development Act (TDA) and *TransNet* funds in support of non-motorized facilities. Facilities for non-motorized transportation modes include sidewalks for pedestrians and bikeways for bicycle users. While pedestrians are prohibited from virtually all freeways, bicycles are permitted on the outside shoulders of nearly 25 percent of all freeways located within the State. The legal authority to prohibit bicycle and pedestrian use on freeways and expressways is specified in the California Vehicle Code section 21960. It is estimated that 510,000 bike trips occur in the San Diego region daily.

Currently within the I-15 corridor, north-south bicycle travel is primarily on parallel arterials. An exception is a two-mile stretch on I-15 from Pomerado Road/West Bernardo Drive north across the Lake Hodges Bridge to Via Rancho Parkway, and from Via Rancho Parkway north to Centre City Parkway, where bicyclists are permitted on the outside northbound and southbound shoulders. Bicyclists are not permitted past the gore points at Via Rancho Parkway, and must exit to avoid the short segment of the freeway at the undercrossing. On the arterials, there is an existing Class I bike path along the east side of I-15 from Mira Mesa Boulevard over the Los Peñasquitos Creek Bridge to Poway Road. There is also an existing Class I bike path originating at I-15, traversing east-west along the south side of SR-56, terminating just east of I-5. Types of bicycle facilities are defined as follows:

- Class I Bicycle Path: This bikeway is completely separated from motorized traffic,
- Class II Bicycle Lane: This bikeway is a shoulder of an existing road with a painted stripe and bicycle stencil that delineates the bicycle rider from other highway users, and
- Class III Bicycle Route: This bikeway is a shared facility with other motorized traffic. It is usually used when insufficient shoulder space is available for a bicycle lane.

3.7 Park and Ride

Park-and-ride (P&R) lots encourage and support the use of commuter and express transit bus service. For longer trips, P&Rs provide parking for cars and vanpool vehicles. Some lots furnish bicycle lockers so that bicycle commuters have a place to secure their bicycles. Collectively, P&R lots reduce total vehicle miles traveled (VMT) within the San Diego region.

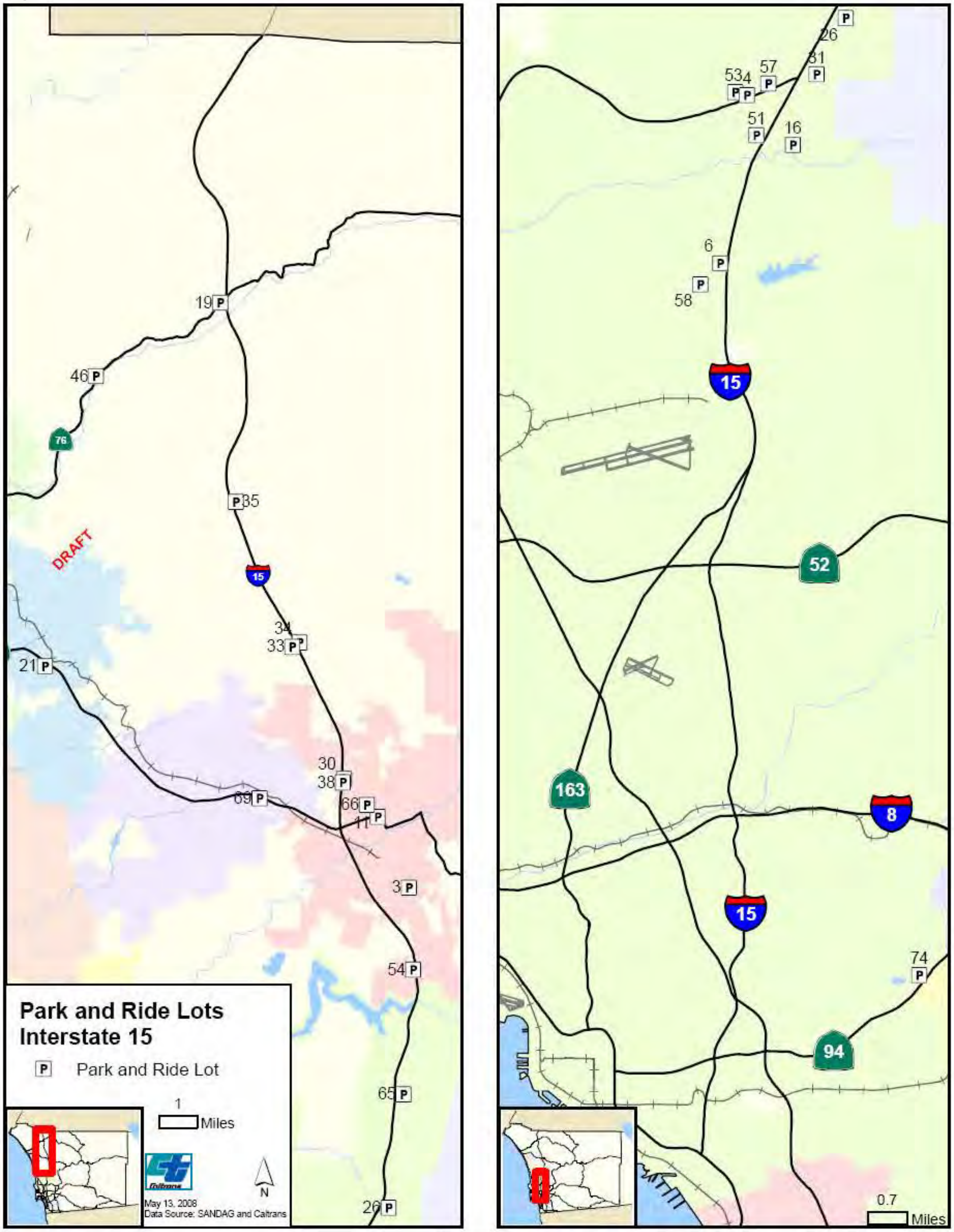
Currently, there are 24 park-and-ride lots maintained by Caltrans near or adjacent to I-15, with a total of 1,919 parking spaces (**Table 2, Figure 7**):

Table 2. Park-and-Ride Lots, I-15 Corridor

LOT #	LOCATION	SPACES
3	Felicita and Escondido	29
4	Carmel Mountain and Freeport	102
6	I-15 and Mira Mesa	176

LOT #	LOCATION	SPACES
11	SR-78 and Broadway	85
16	Poway and Sabre Springs	103
18	Ted Williams and Sabre Springs	108
19	I-15 and SR-76	163
26	Carmel Mountain and Rancho Carmel	125
30	I-15 and El Norte Parkway	41
31	SR-56 and Rancho Carmel	70
33	I-15 and Deer Springs	28
34	I-15 and Mountain Meadows	22
35	I-15 and Gopher Canyon	11
38	Seven Oaks and El Norte Parkway	111
46	SR-76 and Sweetgrass	50
48	Twin Peaks and Budwin	34
51	I-15 and Rancho Peñasquitos	58
53	Carmel Mountain and Paseo Cardiel	88
54	I-15 and Via Rancho Parkway	215
57	Carmel Mountain and Stoney Creek	132
58	Black Mountain and Hillery	44
64	East Valley and Citrus	20
65	I-15 and Rancho Bernardo	15
69	SR-78 at Barham and Woodland Parkway	89

Figure 7. Park-and-Ride Lots, I-15 Corridor



4.0 PURPOSE AND NEED

4.1 Purpose of Projects

The purpose of identifying transportation improvements for I-15 is to accommodate the need for the project with the following objectives:

- Increase capacity to move people and goods,
- Provide cost-effective, convenient, and safe travel choices for regional trips that include transit, carpools, and vanpools, in addition to single occupant vehicles, particularly in those areas where no options currently exist,
- Improve current peak and off peak travel times in mixed-use lanes in the near term and long term taking into account projected growth in population, employment, and travel demand,
- Improve current peak and off peak travel times for goods movement related trips in the near term and long term taking into account projected growth in truck travel and potential diversion to freight rail,
- Provide highway facilities and regional transit services that support transit, carpool, and vanpool travel times to major job centers competitive with driving alone travel times, and
- Achieve an increased transit mode share percentage and an increased carpool mode share percentage for work trips during peak periods.

4.2 Need for Projects

Limited Travel Choices - There are no continuous arterial routes parallel to I-15, and there is a lack of high speed transit service on the corridor. Existing transit routes on local streets operate at or near capacity. These local transit trips are slow and usually require multiple transfers. Because of this, I-15 is subject to additional delays during rainy days, incidents, or special events.

Travel Times and Peak Congestion - Traffic along the I-15 corridor is subject to lengthy freeway queues that, on average, add from 30 to 45 minutes to a typical weekday commute. The current ADT figure along the corridor is 290,000, and the traffic mix includes approximately 15-20% carpoolers during peak periods. By 2030, ADT volumes along the I-15 corridor are expected to approach 410,000. There is also a 60/40 directional split in traffic demand during the peak period, with traffic demand higher on southbound I-15 in the AM peak period than northbound; during the PM peak period, northbound traffic demand is higher than southbound. It is estimated that by 2020, without the I-15 Managed Lanes project, traffic would increase to where there would be heavy congestion in both the peak and reverse peak directions.

Accidents - Accident data based on Table C of the *Traffic Accident Surveillance and Analysis System* indicates that there are 16 locations on northbound I-15 and 9 locations on southbound I-15 that had accident concentrations within the years 2001 through 2005. Analyses of accident data suggest that accidents are not caused by deficiencies of the freeway, but rather by congestion caused by excessive demand. Over 70% of the accidents occurred during the peak hours, and the types of accidents are indicative of congestion. The majority were rear end accidents caused by excessive speed and/or inattention. Other accident types were related to following other vehicles too closely, improper lane changes, and sideswipes that are also related to congestion. There were no other patterns suggesting different causes for these accidents. Accidents are also found to be concentrated in various locations along the corridor; this pattern is indicative of congestion and not freeway deficiencies. Along the corridor, about 33% of northbound lanes and 73% southbound lanes are considered locations of accident concentrations within the years analyzed.

Anticipated Growth - Projected population and employment growth in the San Diego region will result in additional travel demand on the I-15 corridor. By the year 2030, population growth and employment growth in the areas surrounding the I-15 corridor are expected to reach 31% and 25%, respectively. In particular, growth along the I-15 corridor from Escondido to Riverside County is expected to be higher than the San Diego regional average.

Goods Movement - Sustaining effective goods movement is essential for the economic vitality of the region and the State. I-15 is a key north-south goods movement corridor in the San Diego region. Commercial vehicles experience the same congested travel conditions as other motorists. The I-15 corridor will face the challenge of accommodating future goods movement travel as a result of continued implementation of the North American Free Trade Agreement (NAFTA) and anticipated growth in interregional travel between the San Diego region and northern Baja California. Currently, I-15 provides a critical goods movement route to and from the Otay Mesa Port of Entry (POE) and the proposed Otay Mesa East POE to areas north of downtown San Diego, including the rapidly growing truck distribution centers in Riverside and San Bernardino Counties. In 2007, the Otay Mesa POE handled more than $22 billion in crossborder trade, making this commercial crossing the busiest along the California-Baja California border. It is estimated that 30% to 40% of the goods that move through San Diego County bound to and from Mexico through the Otay Mesa POE are transported through the north I-15 corridor.

5.0 CORRIDOR MANAGEMENT STRATEGY

The Corridor Management Strategy for I-15 is comprised of a variety of strategies to maximize mobility. The Strategic Growth Concept Pyramid forms the basis for proposed transportation improvements and system management in the I-15 corridor. Specific corridor management strategies for I-15 include, but are not limited to:

- Adding HOV/Managed Lanes,
- Adding direct access ramps (DARs) and Bus Rapid Transit (BRT) facilities,
- Adding general purpose lanes,
- Adding auxiliary lanes,
- Reconfiguring interchanges,
- Adding intelligent transportation system (ITS) improvements,
- Adding other operational improvements, and
- Maintaining and preserving the existing route.

6.0 THE PYRAMID – SYSTEM MONITORING AND EVALUATION

6.1 Freeway Performance Measurement Project (PeMS)

The Performance Measurement System (PeMS) is used to measure performance in the I-15 corridor. PeMS is a joint effort by Caltrans, the University of California, Berkeley, and PATH, the Partnership for Advanced Technology on the Highways. The software that has been developed in conjunction with this project is a traffic data collection, processing, and analysis tool to assist traffic engineers in assessing the performance of the freeway system. PeMS extracts information from real-time and historical data and presents this information in various forms to assist managers, traffic engineers, planners, freeway users, researchers, and traveler information service providers (value added resellers or VARs).

With PeMS, Caltrans managers can instantaneously obtain a uniform and comprehensive assessment of the performance of the freeways. Traffic engineers can base their operational decisions on knowledge of the current state of the freeway network. Planners can determine whether congestion bottlenecks can be alleviated by improving operations or by minor capital improvements. Traffic control equipment (ramp metering and changeable message signs) can be optimally placed and evaluated. In short, PeMS can serve to guide and assess the deployment of intelligent transportation systems (ITS).

PeMS obtains 30 second loop detector data in real-time from each Caltrans District Transportation Management Center (TMC). The data are transferred through the Caltrans wide area network (WAN) to which all districts are connected. Users can access PeMS over the internet through a web browser. The PeMS software architecture is modular and open. It uses commercial off-the-shelf products for communication and computation. A brief overview of the system components is given below. The 30 second data received by PeMS consist of counts (number of vehicles crossing the loop), and occupancy (the average fraction of time a vehicle is present over the loop). The software processes the data in real-time and performs the following steps:

- Performs diagnostics on the data to determine if the loop detector is faulty,
- Aggregates 30 second values of counts and occupancy to lane-by-lane, 5 minute values,
- Calculates the speed for each lane based on individual g-factors for each loop detector in the system,
- Imputes for any missing data (due to either faulty detectors or a faulty collection system),
- Aggregates the lane-by-lane value of flow, occupancy, and speed across all lanes at each detector station (one station typically serves the detectors in all the lanes at one location),
- Computes performance measures, and
- Aggregates across geographical boundaries.

The advantages of PeMS over conventional study approaches are demonstrated by case studies on conducting freeway operational analyses, bottleneck identification, level of service (LOS) determination, assessment of incident impacts, and evaluation of advanced control strategies.

7.0 THE PYRAMID - MAINTENANCE AND PRESERVATION

7.1 Distressed Lane Miles

The California Department of Transportation (the Department) is responsible for maintaining the State highway system. The State highway system has close to 15,000 centerline miles and over 49,000 lane miles. To effectively manage this pavement, the Department conducts an annual Pavement Condition Survey (PCS). A pavement rater crew conducts visual inspections of the pavement surfaces. In addition, a 'profile' van measures the ride quality via lasers. Using the PCS data, the Pavement Management System (PMS) provides a detailed pavement inventory, identifies project needs, prioritizes pavement distress, and summarizes the condition of the system. One of every four lane miles of California's highways needs repair.

Several key components of maintenance and pavement management are included in the State Highway System Performance Measures, specifically safety, mobility, and stewardship.

The number of distressed lane miles (those with poor structural condition or with poor ride quality) is an important indicator of the State highway system's pavement condition. This indicator is used to prioritize road maintenance and repairs. This gauge of the pavement condition is listed as a stewardship performance measure.

There are several different types of distress classifications. "Major Structural Distress" indicates the pavement has severe cracking and may also have a poor ride. This type of distressed pavement is remedied by rehabilitation or reconstruction projects. "Minor Structural Distress" indicates the pavement has moderate cracking and may have a poor ride. This type of distressed pavement is remedied by capital preventive maintenance (CAPM) or rehabilitation projects. "Poor Ride Quality (Only)" indicates the pavement exhibits few cracks but has a poor ride condition. This pavement type is generally treated with CAPM strategies.

7.2 Pavement Rehabilitation

There are cost savings when the treatment is applied before the pavement deteriorates into a condition warranting a major rehabilitation or reconstruction project. Preventive maintenance treatments keep pavement in good shape and studies show that pavement in good condition costs less to maintain. Corrective maintenance treatments are used to remedy most minor surface problems. These maintenance strategies can extend a pavement's service life by four to seven years depending on the traffic volumes and environmental conditions. Preventive and corrective major maintenance project treatments cost, on average, between $10,000 and $45,000 per lane mile.

A CAPM strategy (pavement grinding or asphalt concrete overlays greater than 1 inch, but less than 2 inches) is typically performed on pavement with minor distress. A moderate cost CAPM project can successfully restore pavement to excellent condition and provide a service life of five to seven years. CAPM projects awarded in the 2003/04 FY averaged $104,000 per lane.

Rehabilitation and reconstruction are the most expensive treatments. They remove and replace the entire pavement structural section rather than just the pavement surface. A roadway that is rehabilitated should provide ten years or more of service life with relatively low maintenance expenditures. The costs for rehabilitation projects, including the upgrade of related facilities, awarded in the 2003/04 FY ranged from $129,000 to $496,000 per lane mile with an average of $256,000 per lane mile. (A summary of the various contracted maintenance and rehabilitation treatments for the past five years is provided in Table C, page 23.).

Long life pavement strategies apply to roadways showing pavement distress in the PMS and with traffic volumes greater than 150,000 average daily traffic vehicles or greater than 15,000 average daily truck vehicles. Some long life strategies include rigid pavement reconstruction, reconstruction of concrete pavement with asphalt concrete, and crack seat and overlay strategies that provide longer life than the current practice. Long life pavement design extends the pavement life to more than thirty five years and reduces traffic interruptions and delays to the traveling public due to highway construction.

There are various segments along the I-15 corridor where the pavement is distressed and in need of rehabilitation. Most of these are located in the South segment of the I-15 Managed Lanes project and will be repaired as part of that project. As a result, there are no major maintenance projects proposed in the I-15 Corridor, and only two projects proposed in the 2007 Ten Year State Highway Operations Protection Plan (SHOPP) (**Table 3**).

Table 3. 2007 Ten Year SHOPP Plan

FISCAL YEAR	POST MILE	LOCATION	IMPROVEMENT DESCRIPTION
2011/2012	0.4 - 4.0	Main St to south of Landis St	Roadway Rehabilitation (PCC grinding)
2015/2016	31.0 - 43.0	SR-78 to Old Hwy 395	Grind PCC pavement, slab replacement

7.3 Other SHOPP Projects

In addition to many pavement rehabilitation projects, the SHOPP program includes other projects to keep the facility and the supporting infrastructure safe and serviceable (**Table 4**).

Table 4. 2004 SHOPP Project List

POST MILE	LOCATION	IMPROVEMENT DESCRIPTION
2.3 - 6.1	North of SR-94 to I-8	Install TMS Field Elements
3.2 - 4.1	Interstate 805 (I-805)	Upgrade planting and irrigation
13.1 - 16.8	Mira Mesa Blvd to north of Mira Mesa Blvd	Landscape mitigation

7.4 Traffic Operations and Maintenance Resourcing

To accommodate peak directional traffic variations, moveable barriers will be installed throughout the entire length of the Middle and South segments on I-15. The moveable barrier system will enable the Managed Lanes to be configured as 2N+2S, 3N+1S, or 1N+3S in response to directional traffic flow and major incidents. The North segment is currently envisioned to have a fixed 2N+2S configuration with permanent barriers.

Access to the Managed Lanes will be provided at the north and south termini of operational Managed Lanes segments, at intermediate access points (IAPs) and at direct access ramps (DARs) connecting the Managed Lanes to BRT stations. The IAPs are at-grade entrances/exits adjacent to the freeway main lanes, similar to carpool lane access. The DARs provide access into the Managed Lanes from grade separated interchanges. These ramps have been located to enhance HOV and BRT access. Seven northbound and six southbound IAPs, as well as five DARs, will be provided under the full implementation of the Managed Lanes system.

The operation, control, and maintenance of the Middle segment, in conjunction with the existing reversible HOV lanes, will require significant increased effort from the Caltrans Maintenance Division and the Traffic Operations Division, as well as the California Highway Patrol (CHP). In addition to the normal roadway maintenance for pavement, structure, landscape, signage, etc., extra effort will be needed to maintain and operate the Managed Lanes field elements (e.g., pop-ups, in-pavement lights, gates, variable message signs (VMS), etc.), the eight miles of movable barrier, the barrier transfer machines, and the control system itself. All of these items are critical to ensuring the integrity of the Managed Lanes operations, the safety of the traveling public, and the safety of Caltrans Maintenance workers. For both Caltrans Maintenance and Traffic Operations staff, as well as CHP personnel, appropriate training will be essential for the successful operation of the new system.

The Caltrans Traffic Operations Division estimated that a total of 5.0 additional personnel years (PYs) will be required for the I-15 Managed Lanes operations, to be divided among the following: TMC – 1.25 PYs; Electrical Systems – 3.5 PYs; and Ramp Metering Systems – 0.25 PY. **Tables 5, 6, and 7** summarize Caltrans Maintenance resource requirements for personnel, facilities, and equipment. **Table 8** summarizes CHP resource requirements.

Table 5. Caltrans Maintenance Program – Resource Requirements (2006 Dollars)

Phase*	Miles of Moveable Barrier	Opening Day	PYs Regular	PYs Overtime	Annual Operating Expense (excl. equipment)	Annual Total
1	5.6	January 2008	16	5	$1.3 M	$2.7 M
2	8	January 2009	21	5	$1.7 M	3.5 M
3	15	January 2013	30	7	$2.4 M	$5.1 M

Table 6. Caltrans Maintenance Program – One Time Facility Costs (2006 Dollars)

Phase*	Temporary Sabre Springs	Modular Escondido	Permanent Lake Hodges	Permanent Escondido
1	$300,000	$500,000		

Phase*	Temporary Sabre Springs	Modular Escondido	Permanent Lake Hodges	Permanent Escondido
2	$50,000 to remove		$2,500,000	
3				$2,000,000

*NOTE: Phase 1 – Middle Segment Interim Opening; Phase 2 – Middle Segment Final Opening; Phase 3 – Integration with North and South Segments.

Table 7. Caltrans Maintenance Program – One Time Equipment Costs (2006 Dollars)

Equipment	Quantity	Cost	Capital Cost
Barrier Transfer Machine @ $1.5M	2		$3,000,000
16 ton tow truck	1	$ 130,000	
2 ton towable forklift	1	$ 66,500	
15 ft cargo body truck	1	$ 75,000	
Solar (trailer) LED CMS + arrow board	1	$ 15,000	
Solar CMS sign + truck	1	$ 66,630	
Cone truck	1	$ 60,000	
½ ton pickup truck w/CMS @ $50,000	2	$ 100,000	
Street sweeper @ $200,000	2	$ 400,000	
Balsi Beam + tractor	1	$ 300,000	
Electrical Hoist	1	$ 75,000	
4 yd w/ CMS and crash cushion	3	$ 300,000	
High Lift Truck	1	$ 100,000	
Snooper Type Truck	1	$ 250,000	
Mechanic’s truck	1	$ 50,000	
Total	**20**	**$1,988,130**	**$3,000,000**

Table 8. CHP Resource Requirements (2006 Dollars)

Operation	Units needed	Hours billed per day	Miles billed per day	Daily cost (hours and miles)	Yearly Cost (hours and miles)	Cost with 10% cushion
2/2 Operations	1	4	75	$311.28	$80,933	$89,026
3/1 Operations	2	8	200	$658.56	$171,226	$188,349
3/1 Operations	3 (2 to run break)	12	300	$978.84	$254,498	$279,947

8.0 THE PYRAMID - SMART LAND USE

8.1 Population and Employment Growth

Projected regional growth will continue to put pressure on the transportation system. SANDAG periodically prepares population and employment growth forecasts for the San Diego region. These forecasts are used as inputs to prepare traffic projections. The SANDAG 2030 forecasts show an increase in population, housing, and employment for all cities along the I-15 corridor (**Table 9**), not including unincorporated areas.

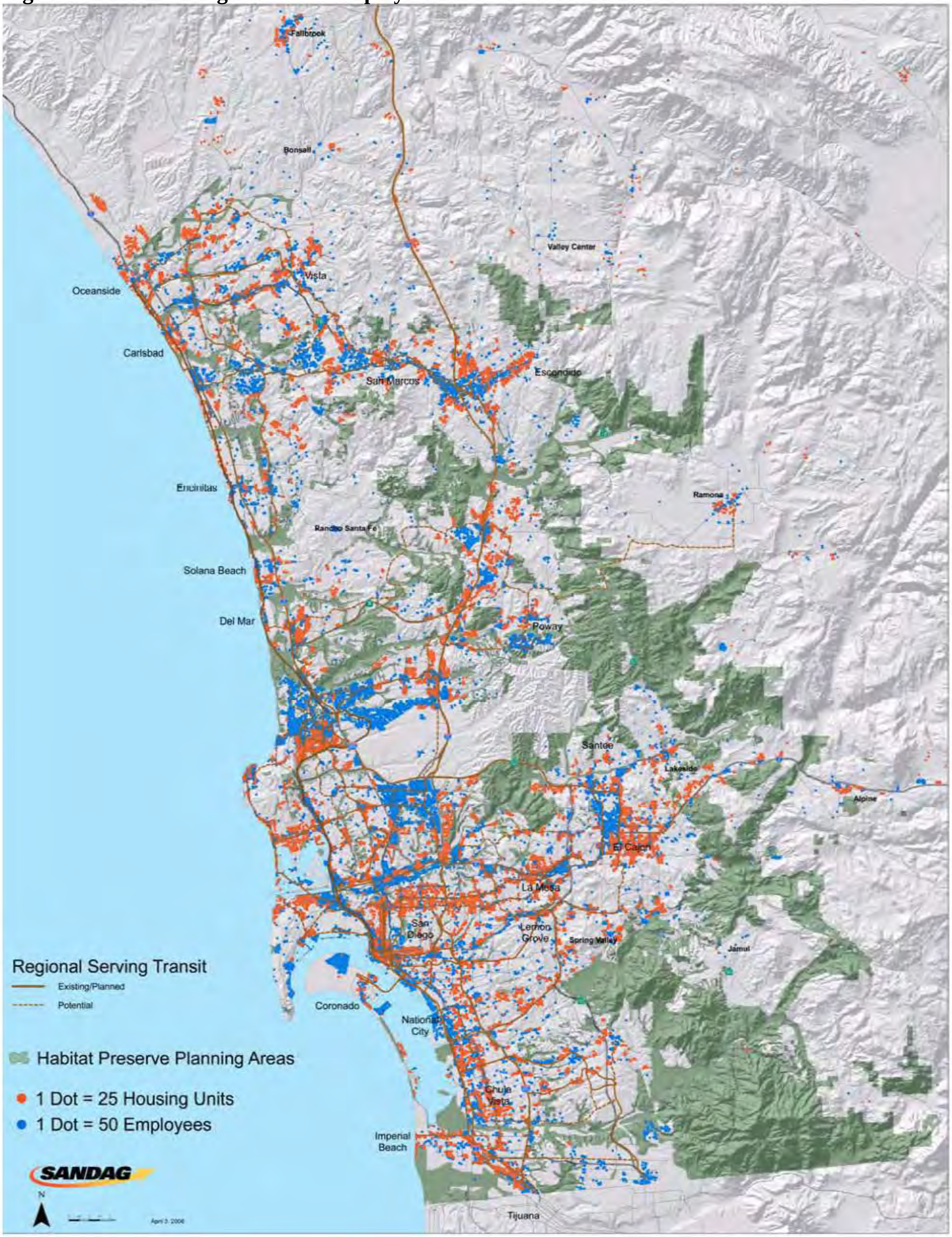
Table 9. 2030 Forecasts for Cities along the I-15 Corridor

CITY		Year 2000	Year 2030	% Change (2000-2030)
San Diego	Total Population	1,223,400	1,656,820	35%
	Housing Units	469,689	604,399	29%
	Civilian Employment	742,904	941,294	27%
Poway	Total Population	48,044	56,078	17%
	Housing Units	15,714	17,244	10%
	Civilian Employment	21,796	35,022	61%
Escondido	Total Population	133,559	163,299	22%
	Housing Units	45,050	51,646	15%
	Civilian Employment	49,716	63,813	28%

This forecast may exceed the development potential of current general and community plans because it incorporates higher densities and more mixed use development opportunities within smart growth areas identified by SANDAG.

Figure 8 shows housing units and employment locations in 2004 in the San Diego region.

Figure 8. 2004 Housing Units and Employment Locations



8.2 2030 Regional Transportation Plan

Several I-15 corridor improvements are already planned and programmed in the *2030 San Diego Regional Transportation Plan: Pathways for the Future* (RTP), SANDAG's full plan update approved in November 2007. This RTP is the blueprint to address the mobility challenges created by the region's growth and contains an integrated set of public policies, strategies, and investments to maintain, manage, and improve the transportation system in the region through the year 2030. The 2030 vision is to develop a flexible transportation system that focuses on moving people and goods. The vision is to provide more convenient, fast, and safe travel choices for public transit, ridesharing, walking, biking, private vehicles, and freight. It commits the region to maintain or improve average travel times and travel speeds, reduce congestion, expand regional transit services, and improve air quality.

Below are the commitments identified in the 2030 RTP and used in the development of future management improvement strategies for the I-15 corridor.

8.2a Air Quality Commitments

Air quality remains an important concern for the region. Federal and State standards are safeguards against the adverse health effects of pollution. The 2030 RTP reaffirms the region's commitment to maintain air quality standards. The integration of smart growth development combined with the investments in public transit, managed/high occupancy vehicle, pedestrian, and bicycle facilities will help lessen dependency on motor vehicle travel, which will, in turn, benefit the region's air quality.

8.2b Environmental Justice

Environmental justice is defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws and policies. SANDAG's plans, projects, and programs comply with the principles of environmental justice and all associated federal and State requirements. Environmental justice encourages better land use decisions, improves access to jobs, helps promote good air quality, and strengthens neighborhoods. It also supports community involvement in regional planning and programming through improved communications and active engagement with the process.

8.2c Integrating Transit and High-Occupancy Vehicle Use

The 2030 RTP envisions vastly improving regional transit service through the implementation of the Regional Transit Vision (RTV), adopted by SANDAG in November 2001. The RTV is a joint effort by SANDAG, MTS, and NCTD to make public transit the first choice for many of our trips. The 2030 RTP recognizes that transit improvements need to be focused in areas with compatible land uses that support an efficient transit system.

8.3 Regional Comprehensive Plan

In order to strengthen the critical linkage between land use and transportation in the San Diego region, the Regional Comprehensive Plan (RCP) was developed by SANDAG in July 2004, in conjunction with a multitude of individuals, stakeholders, planning directors, public works directors, city managers, community-based organizations, elected officials, and representatives from tribal governments, State and federal agencies, neighboring counties, and Mexico.

The RCP is a strategic planning document that serves as the long term planning framework for the San Diego region. It provides a broad context in which local and regional decisions can be made that move the region toward a sustainable future. The RCP utilizes a policy approach that focuses on connecting local and regional transportation and land use plans, and creates incentives that encourage “smart growth” planning and actions. This approach is based upon a planning framework that parallels those used by cities and counties in preparing their general plans, and thereby strengthens the coordination of local and regional plans and programs.

The RCP calls for a preferred planning concept that focuses on:

- Improving connections between land use and transportation plans using smart growth principles,
- Using land use and transportation plans to guide decisions regarding environmental and public facility investments, and
- Emphasizing collaboration and incentives to achieve regional goals and objectives.

The first major emphasis of the RCP is on improving connections between land use and transportation. In this vein, a key recommendation of the RCP is to identify smart growth opportunity areas, areas where compact, mixed use, pedestrian oriented development either exists now, is currently planned, or has the potential for future incorporation into local land use plans. The priority should be on directing transportation facility improvements and other infrastructure resources toward these areas.

The second emphasis is on using land use and transportation to guide other plans. The designation of specific smart growth opportunity areas in the RCP will provide guidance to local governments, property owners, and service providers as to where smart growth development should occur from a regional perspective. It will focus attention on these areas as local jurisdictions update their general plans and redevelopment plans, and as service providers update their facility master plans. Coordinating planning efforts in this manner ensures that public and private investment in local and regional infrastructure is implemented in an efficient and sustainable manner.

The RCP includes a number of “strategic initiatives,” that are priority actions to be undertaken by various groups to implement the recommendations in the adopted plan. The strategic initiatives are organized into manageable units of work and prioritized by timeframe, helping ensure implementation. Several “early action” strategic initiatives were underway prior to adoption of the RCP in July 2004, or are currently being developed or implemented. These initiatives include:

- Development of a regional funding program for the 2030 RTP (*TransNet*),
- Evaluation of the use of transportation impact funding,
- Adoption of the updated Regional Housing Needs Assessment,

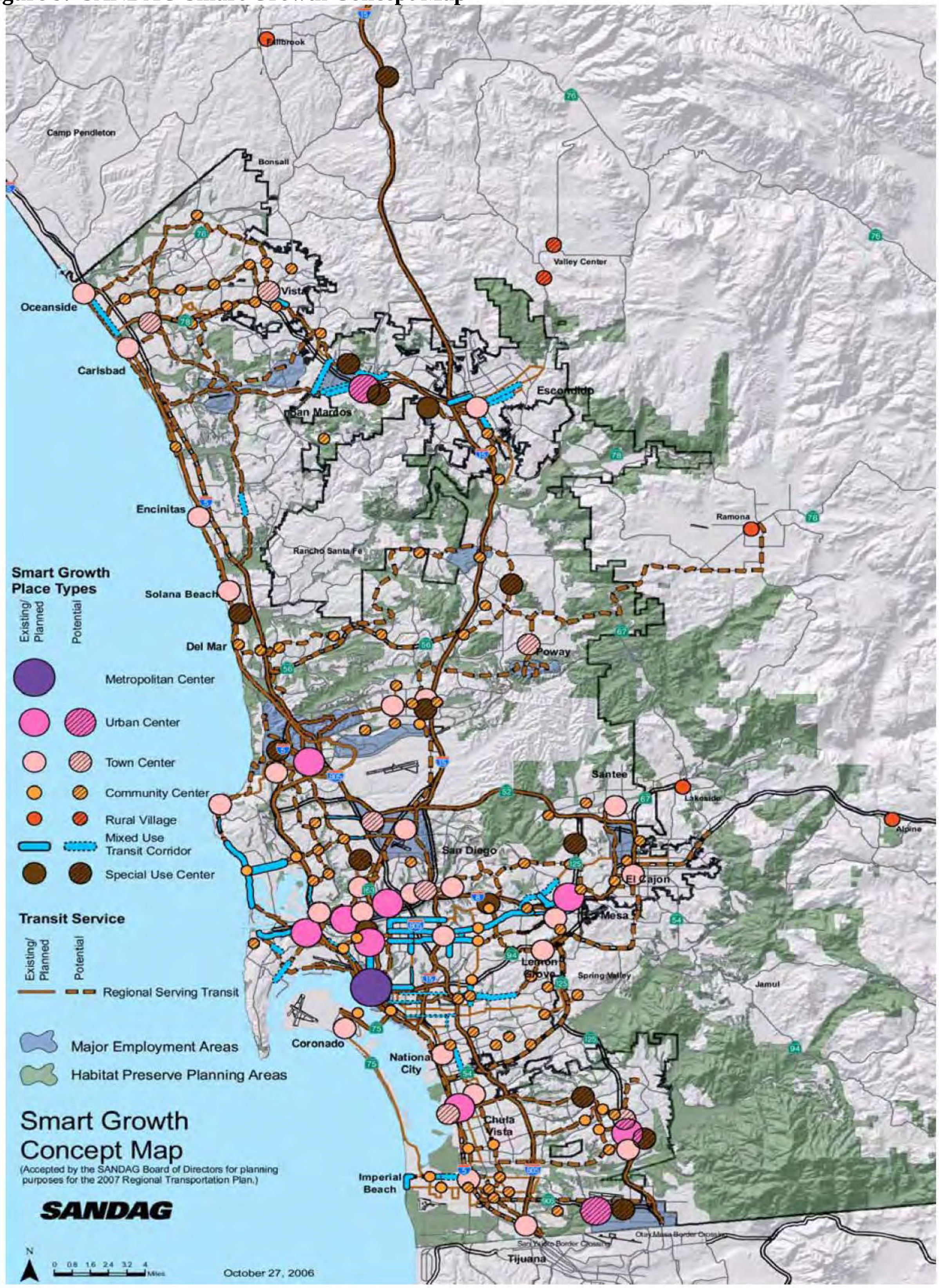
- Development of a regional habitat funding program, and
- Preparation of a smart growth concept map.

8.4 Smart Growth

Improvement strategies for the I-15 Corridor are consistent with the RTP's vision to accommodate "smart growth." Smart growth considers the interrelationships between population growth, land use, and the environment by emphasizing compact, efficient, and environmentally sensitive development. Proposed improvements connect housing with jobs, services, and transportation and focus future growth away from rural areas. The I-15 Corridor is experiencing some of the region's highest growth and is expected to continue to do so. Integrating smart growth concepts into future I-15 Corridor improvement strategies promotes an intelligent transportation system that provides travelers with seamless and convenient shifts between freeway, arterial, and transit modes. This will, in turn, enhance mobility for people, goods, and services, and improve connectivity, safety, environmental compatibility, and accessibility to reach destination points in a reliable and timely manner. This planning approach is visualized in the SANDAG Smart Growth Concept Map (**Figure 9**).

The concept map is a key ingredient for successfully implementing the RCP, as it identifies locations within the region that can support smart growth and transportation investments. This map serves as the foundation for refining the regional transit network and identifying other transportation needs in the development of the 2030 RTP and other plans. It also will be used to determine eligibility to participate in the Smart Growth Incentive Program. The concept map contains almost 200 smart growth areas, with 40 percent identified as existing or planned areas, and 60 percent as potential areas. Because land use authority rests with the cities and county, each jurisdiction is responsible for making recommendations for future amendments to the map as their general plans are updated.

Figure 9. SANDAG Smart Growth Concept Map



Smart growth is not a "one size fits all" approach. What makes sense in one community may not be appropriate in another. For example, smart growth in the large metropolitan center of downtown San Diego or a lively urban center in University City looks and feels different from a town center in Escondido or a community center in Imperial Beach. The following defines the types of smart growth areas that are featured on the map:

Metropolitan Center
- The region's primary business, civic, commercial, and cultural center
- Mid- and high-rise residential, office, and commercial buildings
- Very high levels of employment
- Draws from throughout the region and from beyond the region's borders
- Served by numerous transportation services
- Example: Downtown San Diego

Urban Center
- Subregional business, civic, commercial, and cultural centers
- Mid- and high-rise residential, office, and commercial buildings
- Medium to high levels of employment
- Draws from throughout the region, with many from the immediate area
- Served by transit lines and local bus services
- Examples: University City, Uptown/ Hillcrest, Chula Vista Urban Core

Town Center
- Suburban downtowns within the region
- Low- and mid-rise residential, office, and commercial buildings
- Some employment
- Draws from the immediate area
- Served by corridor/regional transit lines and local services or shuttle services
- Examples: Downtowns of La Mesa, Oceanside, National City, Encinitas

Community Center
- Areas with housing within walking/biking distance of transit stations
- Low- to mid-rise residential, office, and commercial buildings
- Draws from nearby communities and neighborhoods
- Served by local high frequency transit
- Examples: Imperial Beach 9th and Palm, Otay Ranch Heritage Village

Rural Village
- Distinct communities within the unincorporated areas of San Diego County
- Low-rise employment and residential buildings
- Draws from nearby rural areas
- Concentrated local road network within the village, with possible local transit
- Examples: Alpine, Fallbrook

Mixed Use Transit Corridor
- Areas with concentrated residential and mixed use development along a linear transit corridor
- Variety of low-, mid- and high-rise buildings, with employment, commercial, and retail businesses
- Draws from nearby communities

- Examples: University Avenue and El Cajon Blvd. in San Diego, Mission Road in Escondido, La Mesa Blvd. in La Mesa, South Santa Fe Ave. in Vista

Special Use Center

- Employment areas consisting primarily of medical or educational facilities
- Variety of low-, mid- and high-rise buildings
- Dominated by one non-residential land use (e.g., medical or educational)
- Draws from throughout the region or immediate subregion
- Examples: SDSU, Sharp Memorial Hospital, Cal State San Marcos, UCSD

Figure 10 shows specific smart growth areas and place types in relation to the I-15 corridor, while **Table 10** shows the existing/planned and potential smart growth areas adjacent to the I-15 corridor.

Figure 10-1. Smart Growth Concept Map, North County

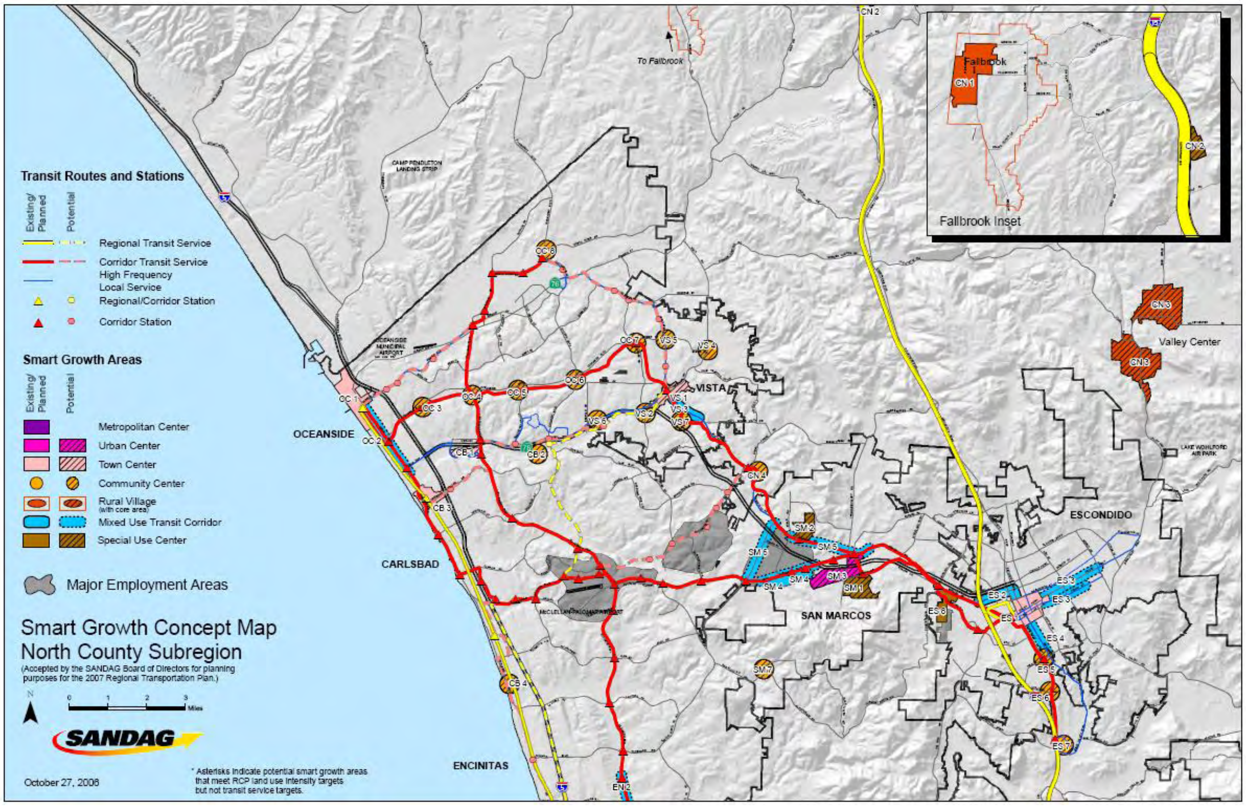


Figure 10-2. Smart Growth Concept Map, North City

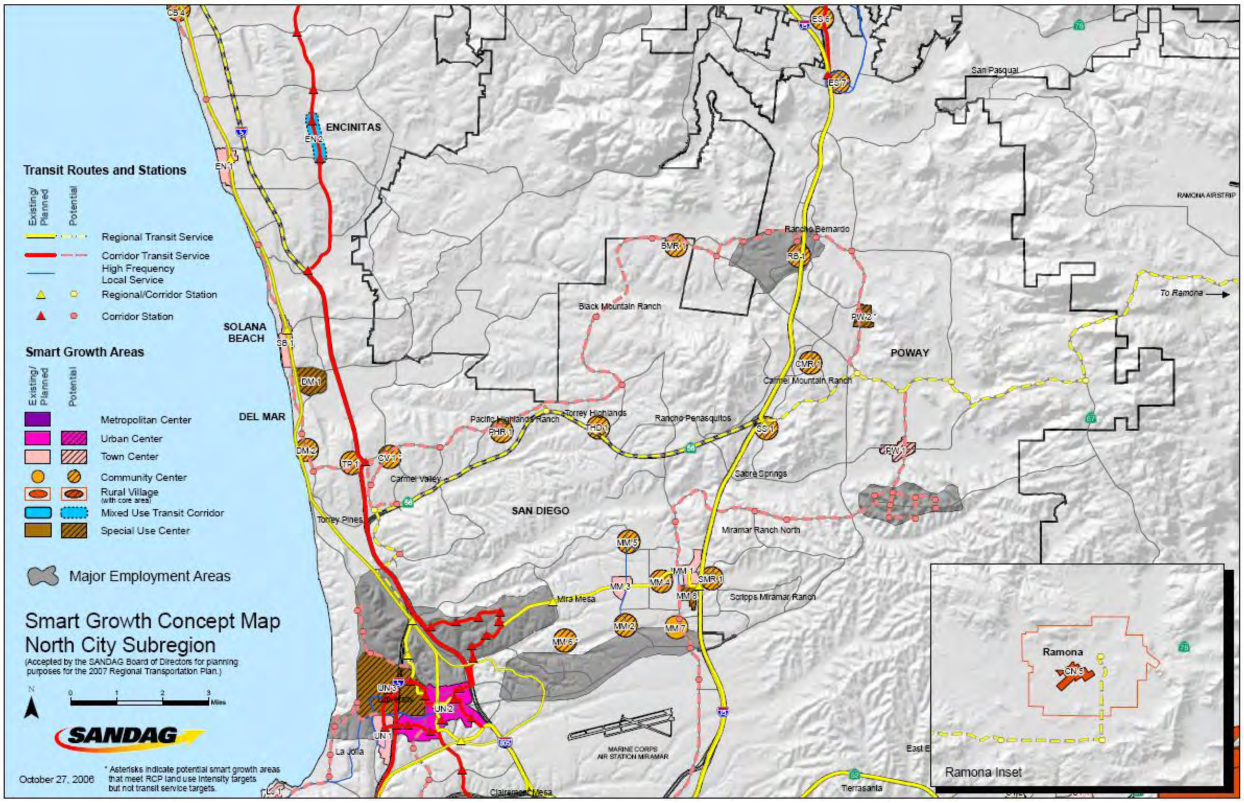


Figure 10-3. Smart Growth Concept Map, Mid-City

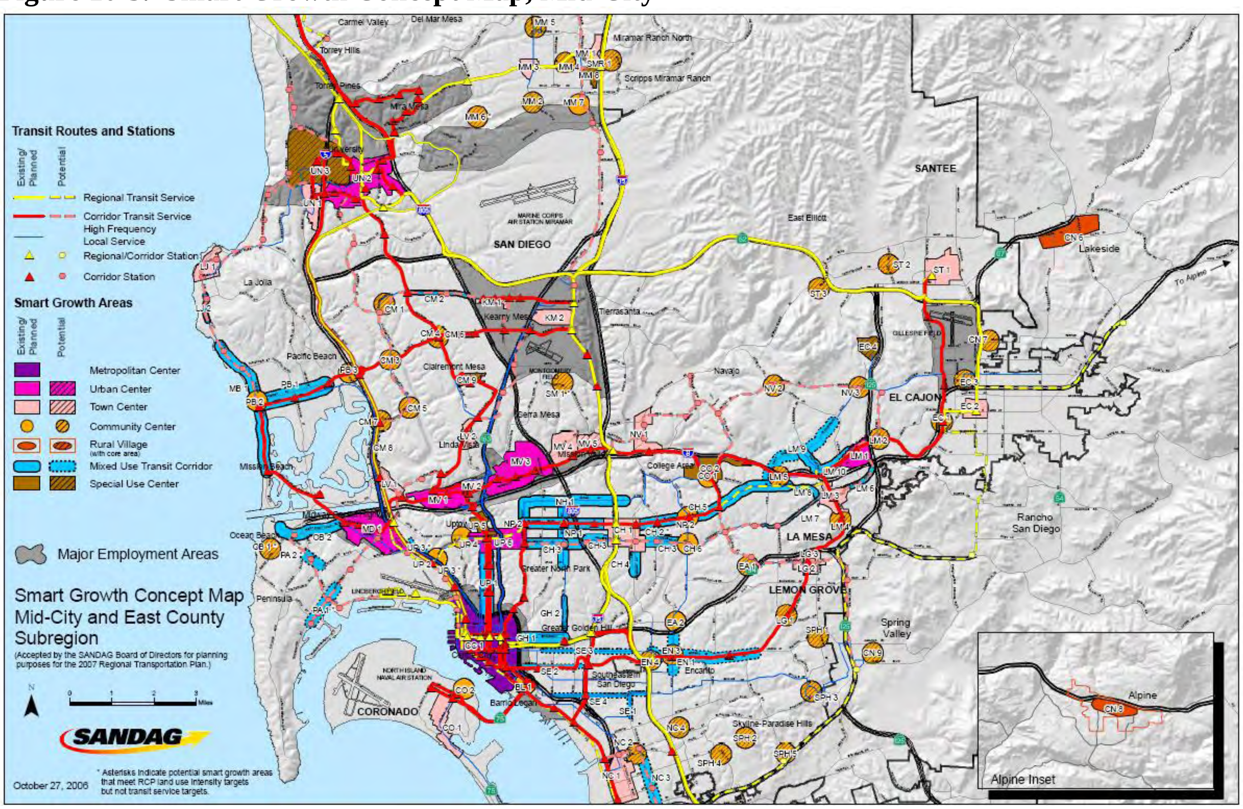


Table 10. Regional Comprehensive Plan Smart Growth Areas – I-15 Corridor

Place Type	Identifier	Location	Status
Special Use Center	CN-2	Campus Park Quadrant	Potential
Town Center	ES-1	Downtown Specific Plan / Mercado Area Plan	Existing/Planned
Mixed-Use Transit Corridor	ES-2	Mission Road	Existing/Planned
Mixed-Use Transit Corridor	ES-3	East Valley Pkwy	Potential
Mixed-Use Transit Corridor	ES-4	South Escondido Blvd	Potential
Community Center	ES-5	Felicita Ave and Centre City Pkwy	Potential
Community Center	ES-6	Citracado Pkwy and Centre City Pkwy	Potential
Community Center	ES-7	North County Fair	Potential
Special Use Center	ES-8	Nordahl Sprinter Station	Existing/Planned
Special Use Center	PW-2	Pomerado Hospital	Potential
Community Center	SD-RB-1	Rancho Bernardo BRT – I-15 and West Bernardo Dr	Potential
Community Center	SD-CMR-1	Carmel Mountain Ranch Rd and Highland Ranch Rd	Potential
Community Center	SD-SS-1	Evening Creek North Dr and Sabre Springs Pkwy	Potential
Community Center	SD-SMR-1	Scripps Ranch Blvd, from Mira Mesa Blvd to Hilbert St	Potential
Town Center	SD-MM-1	Westview Pkwy and Mira Mesa Blvd	Existing/Planned
Community Center	SD-MM-2	Camino Ruiz, future Carroll Canyon Rd alignment	Potential
Town Center	SD-MM-3	Mira Mesa Blvd, from Reagan Rd to Camino Ruiz	Existing/Planned
Community Center	SD-MM-4	Mira Mesa Blvd, from Greenford Dr to Marbury Ave	Potential
Community Center	SD-MM-5	Camino Ruiz and Zapata Ave	Potential
Community Center	SD-MM-7	Kearny Villa Rd and Carroll Canyon Rd	Existing/Planned
Special Use Center	SD-MM-8	Miramar College	Potential
Town Center	SD-KM-2	Lightwave Ave, Tech Way, Kearny Villa Rd, Ruffin Rd	Existing/Planned
Community Center	SD-SM-1	Gramercy Dr, Ruffin Rd, Village Glen Dr, Glencolum Dr	Potential
Town Center	SD-MV-4	I-805, San Diego River, Mission Valley community boundary	Existing/Planned
Town Center	SD-MV-5	Qualcomm Stadium	Potential
Town Center	SD-NV-1	I-8, Friars Rd, San Diego River, Mission Gorge Rd	Existing/Planned

Place Type	Identifier	Location	Status
Mixed-Use Transit Corridor	SD-NH-1	Adams Ave, from Park Blvd to Edgeware Rd	Existing/Planned
Mixed-Use Transit Corridor	SD-NP-1	30th St, from Adams Ave to Upas St	Existing/Planned
Town Center	SD-CH-1	Meade Ave, Wightman St, 40th St	Existing/Planned
Mixed-Use Transit Corridor	SD-CH-2	Euclid Ave, from El Cajon Blvd to University Ave	Potential
Mixed-Use Transit Corridor	SD-CH-3	University Ave, from Park Blvd to 54th St	Existing/Planned
Mixed-Use Transit Corridor	SD-CH-4	43rd St/Fairmont Ave, from Thorn St to Wightman St	Existing/Planned
Mixed-Use Transit Corridor	SD-GH-1	Broadway, from I-5 to Fern St	Existing/Planned
Mixed-Use Transit Corridor	SD-GH-2	Fern St, from A St to Juniper St	Existing/Planned
Mixed-Use Transit Corridor	SD-SE-2	Imperial Ave, from I-5 to I-15	Potential
Mixed-Use Transit Corridor	SD-SE-3	Market St, from 26th St to I-805	Potential
Mixed-Use Transit Corridor	SD-SE-4	National Ave, from I-5 to 43rd St; Logan Ave, from S 43rd St to S 45th St	Potential

CN = County of San Diego
ES = Escondido
PW = Poway
SD = San Diego

8.5 I-15 Interregional Partnership

The I-15 Interregional Partnership (IRP) is a voluntary partnership between SANDAG and the Western Riverside Council of Governments (WRCOG) to work together to address the planning issues of mutual concern related to economic development, housing, and transportation. The I-15 IRP was formed in 2001 to address the challenges of serious imbalances in jobs and housing growth across the two Counties. The primary goal is to foster more sustainable land use patterns by providing employment closer to where people live in the housing rich areas of West Riverside County and more affordable housing closer to employment in job rich areas in the San Diego region. The overall intent is to reduce the number of work related vehicle trips and the amount of commuter miles traveled on I-15.

Working through a committee structure, the I-15 IRP will identify and prioritize issues related to the jobs/housing balance, recommend strategies and model approaches to address the issues, and promote adoption of its recommendations into existing jurisdictional and agency plans and programs. The partnership's efforts are funded through an Interregional Partnership (IRP) Grant from the State, which is designed to address the impacts of substantial jobs/housing imbalances. The distribution and monitoring of the grant are under the direction of the State Department of Housing and Community Development.

In September 2007, Caltrans awarded SANDAG a $450,000 grant for Phase III of the I-15 IRP to develop an I-15 Strategic Plan, which will focus on implementation of economic development, transportation, and housing strategies in the short term (between now and 2020). The Strategic

Plan will also consider early action projects regarding transit and low cost traffic flow improvements. This phase should be completed by the end of the 2008/09 fiscal year.

9.0 THE PYRAMID - INTELLIGENT TRANSPORTATION SYSTEMS

An intelligent transportation system (ITS) is defined as electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system. In simple terms, it is primarily any electronic transportation system that communicates to the traveler, providing transportation safety and efficiency. It is a key component of the strategic growth pyramid of system management and can yield significant improvements in congestion relief.

ITS follows a logical process of data collection, processing, and acting on the processed information. Examples of ITS components are traffic signals, surveillance cameras, changeable message signs, ramp meters, weigh-in-motion devices, roadway service patrols, and transportation management centers. An ITS provides centralized control from traffic or transit management centers of many of its components, traveler information broadcast systems, traffic signal priority for emergency or transit vehicles, ITS data archive management, and vehicle safety warning systems.

An ITS project is any project that, in whole or in part, funds the deployment of ITS components and/or systems that provide or significantly contribute to one or more ITS user services as defined in the National ITS Architecture (NA). An example of a relatively small ITS project would be the installation of traffic signal hardware (traffic controller, detectors, etc) at an intersection. An example of a relatively large ITS project is the installation of a network of traffic signals that is controlled from a traffic management center. A traditional highway project which has an ITS element, such as a traffic signal or a ramp meter, meets the definition of an ITS project.

9.1 Transportation Management Center (TMC)

The San Diego Transportation Management Center (TMC), operational since November 1996, has staff from the Caltrans Traffic Operations Division, Caltrans Maintenance Division, and CHP Communications working together in a communication and command center. The TMC provides the communications, surveillance, and computer infrastructure necessary for coordinated transportation management on State highways during normal commute periods, as well as for special events, and major incidents. In the event of an emergency, the TMC becomes a command center for directing relief throughout the region. The TMC is designed with the latest technologies to survive earthquakes, power outages, and communications disruptions. As fiber optics, video, and interactive electronic and computer systems are integrated into the TMC in the coming years, and more agencies tie into the systems, it will provide increased value for safety on I-15.

The Operations Branch of the TMC is charged with providing real time traffic management activities on all State highways including monitoring of traffic conditions and initiating effective responses to help mitigate traffic impacts arising from incidents, emergencies, events, and other unusual occurrences.

The TMC Operations branch utilizes the following elements:

- Cellular 911 call takers,
- Call box call takers for critical incidents,
- Monitor roadway speeds via loop/radar detectors,
- CHP Dispatch using computer aided dispatch (CAD) to assign officers and Freeway Service Patrol trucks,
- Caltrans Traffic Operations Communications,
- Caltrans Maintenance Dispatch,
- Caltrans Construction Communications,
- Real time incident detection, verification, and coordination of response,
- Graphic display of real time traffic flow data,
- Monitoring incident locations and status and relaying this information to the public,
- Providing timely and accurate traffic information for public broadcast to the motoring public and commercial vehicles,
- Manage freeway volumes for free flow by controlling and monitoring ramp meter operations to regulate entrance ramp volumes,
- Control and operation of the I-15 Reversible HOV/Express Lanes,
- Changeable Message Signs (CMS) and Highway Advisory Radio (HAR),
- Recommending detours and alternate routes,
- Closed Circuit Television (CCTV),
- Automatic Vehicle Locator (AVL) (navigational tracking devices),
- Operating existing I-15 Reversible Express Lanes,
- Collecting and processing traffic data generated by freeway monitoring systems,
- Work with other transportation providers to obtain real time information for transportation management coordination, and
- Functional test bed support facility for ongoing and future new technology.

The TMC Operations Branch currently operates twenty four hours a day, Sunday thru Friday evening, and relies on call-outs on weekends. With the opening of the I-15 Managed Lanes Middle segment, it is expected that the branch will need to shift from a 24/5 schedule to a 24/7 schedule. The expansion to a 24/7 schedule at the TMC is also warranted due to increased maintenance and construction occurring at nights and on weekends as well as general increases in traffic and incidents.

9.2 Ramp Metering

Ramp metering has proven to be an effective traffic operations tool to maximize the efficiency of a corridor. The primary objective of metering is to reduce congestion and the overall travel time of the total traffic stream on both freeway and nearby surface streets. Ramp metering reduces congestion by maintaining more consistent freeway throughput, and utilizing the capacity of the freeway corridor more efficiently, providing incentives for increased use of carpools, vanpools, and public transit by including preferential lanes which offer time savings to high occupancy vehicles at ramp meters.

Secondary benefits include the reduction of congestion related accidents and air pollution. Ramp meters operate most effectively when upstream mainline traffic is controlled. This control can be accomplished by installing additional ramp meters, metering freeway to freeway connectors, or mainline control. These procedures focus on the implementation of ramp metering systems through a coordinated effort involving Caltrans planners, designers, operations personnel, local agency staff, the California Highway Patrol, and the public.

Currently, all ramps are metered in the peak direction, northbound in the PM (**Table 11-1**) and southbound in the AM (**Table 11-2**). In the reverse peak direction, no metering is used with the exception of the ramps at Miramar Road, Carroll Canyon Road, Mira Mesa Boulevard, Scripps Poway Parkway, and Poway Road in the southbound direction during the PM peak period. This segment is congested in both the AM and PM peak periods.

Table 11-1. I-15 Existing Northbound Ramp Meter Locations

Post Mile	SDRIMS No.	Lanes	Location	Metering Period
4.640	261	2	University Ave	AM
5.020	262	3	El Cajon Blvd	AM
5.610	263	2	Adams Ave	AM
6.200	222	2	Fairmount Ave	AM
7.015	141	3	Friars Rd	AM / PM
8.318	210	2	Aero Dr	PM
9.175	143	1	EB Balboa Ave	PM
9.372	142	1	WB Tierrasanta Blvd	PM
9.962	144	2	SEG Clairemont Mesa	PM
13.446	145	1	Miramar Way	PM
14.245	96	2	EB Miramar Rd	PM
14.429	96	1	WB Pomerado Rd	PM
15.146	86	2	Carroll Canyon Rd	PM
15.891	74	2	EB Mira Mesa Blvd	PM
15.930	124	2	WB Mira Mesa Blvd	PM
17.464	245	3	Mercy Rd	PM
18.127	172	1	EB Poway Rd	PM
19.450	352	2	EB SR-56	PM
19.670	173	2	Ted Williams Pkwy	PM
20.726	174	3	Carmel Mountain Rd	PM
22.069	175	2	Camino del Norte	PM
23.058	178	2	Bernardo Center Dr	PM
23.639	176	2	EB Rancho Bernardo	PM
23.869	177	2	WB Rancho Bernardo	PM
25.991	159	2	Pomerado/Highland	PM
26.895	303	2	Via Rancho Pkwy	PM
28.888	304	1	Citracado Pkwy	PM
30.222	305	2	Auto Park Way/9th	PM
30.790	306	2	Valley Pkwy	PM

Table 11-2. I-15 Existing Southbound Ramp Meter Locations

Post Mile	SDRIMS No.	Lanes	Location	Metering Period
4.630	264	2	University Ave	PM
5.010	265	2	El Cajon Blvd	PM
5.600	266	2	Adams Ave	PM
6.650	386	1	Friars Rd	PM
6.823	140	1	WB Friars Rd	PM
7.535	244	2	Murphy Canyon Rd	PM
8.205	101	3	Aero Dr	PM
9.101	139	3	EB Balboa Ave	PM
9.301	138	2	WB Balboa Ave	PM
9.843	137	3	Clairemont Mesa Blvd	PM
13.103	183	2	Miramar Way	AM
14.353	120	2	EB Miramar Rd	AM / PM
14.358	121	2	WB Pomerado Rd	AM / PM
14.881	135	2	Carroll Canyon Rd	AM / PM
15.765	119	3	EB Mira Mesa Blvd	AM / PM
15.987	118	2	WB Mira Mesa Blvd	AM / PM
17.144	92	3	Mercy Rd	AM / PM
18.243	116	2	EB Rancho Peñasquitos	AM / PM
18.245	117	2	WB Rancho Peñasquitos	AM / PM
18.787	81	2	Ted Williams Pkwy	AM / PM
20.434	80	3	Carmel Mountain Rd	AM / PM
21.825	79	3	Camino del Norte	AM
22.806	136	1	Bernardo Center Dr	AM
23.755	147	2	EB Rancho Bernardo	AM
23.758	146	2	WB Rancho Bernardo	AM
25.854	148	1	Pomerado/Highland	AM
26.785	149	3	Via Rancho Pkwy	AM
27.455	150	3	Centre City Pkwy	AM
28.631	134	2	Citracado Pkwy	AM
29.969	157	2	9th Ave	AM
30.685	156	1	Valley Pkwy	AM
32.663	155	2	El Norte Pkwy	AM

The Ramp Metering Operations Branch of the Caltrans Traffic Operations Division is involved with operating, maintaining, and updating the District's San Diego Ramp Metering Information System (SDRIMS), ATMS, Real Time Traffic Website Map, and the Reversible Lane Control System (RLCS). The staff in this branch is also involved in the review, testing, and approval of new technology (communications, hardware, firmware, and software) available for traffic system information, such as the software upgrade for the RLCS, which will be expanded for control of the Managed Lanes field elements. This means that new safety rules will have to be incorporated in the RLCS control system and the graphical user interface and its corresponding mapping system will need to be upgraded to incorporate Managed Lanes field element controls.

Sufficient staff must be trained and available to maintain and troubleshoot any system (software and hardware) problems with the extended RLCS control system.

9.3 Traffic Monitoring Stations (TMS)

Traffic monitoring stations (TMS) are electronic data acquisition systems used to collect and communicate real time traffic volume and occupancy data along segments of freeways (and in some cases, speeds). TMS functionality is also part of the SDRIMS. While ramp monitoring stations (RMS) are not counted as TMS for inventorying purposes, it *is* typical for both sets of functionality to be supported by a single controller software package for RMS. TMS systems have been implemented using various types of detection technology, such as inductive loop detectors, magnetic detectors, side fire microwave radar sensors, and video detectors.

TMS systems have been installed at numerous locations on Caltrans freeways, although not all freeway segments currently have coverage. TMS and associated detectors are generally installed every half mile to one mile along a freeway. Detectors are used to continuously and automatically monitor the flow of traffic. The data are reported to the Transportation Management Center (TMC) every 30 seconds. When included as part of the Freeway Performance Measurement Project (PeMS), which is discussed in detail in a previous section, TMS data is a valuable tool that can determine levels of congestion, speed, flow, delay, travel time, bottlenecks, and other performance measures.

Table 12-1 shows existing traffic monitoring station locations on I-15. **Table 12-2** shows planned traffic monitoring station locations on I-15; additional locations may be added based on potential CMIA funding.

Table 12-1. I-15 Existing Traffic Monitoring Station Locations

Post Mile	SDRIMS No.	Direction	Location
1.452	3047[1]	NB	S/O Imperial Ave (radar)
1.453	4047[1]	SB	S/O Imperial Ave (radar)
2.197	449	SB	SR-94 WB
4.202	3048[1]	NB	S/O University Ave (radar)
4.203	4048[1]	SB	S/O University Ave (radar)
4.627	264	SB	University Ave
4.668	261	NB	University Ave
4.999	265	SB	El Cajon Blvd
5.050	262	NB	El Cajon Blvd
5.507	266	SB	Adams Ave
5.600	263	NB	Adams Ave
6.650	386	SB	Friars Rd
6.779	140	SB	Friars Rd to I-8
6.820	222	NB	Fairmount Ave
6.822	492	NB	I-8 WB
6.960	141	NB	Friars Rd
7.569	355	NB	N/O Friars Rd
7.670	244	SB	Murphy Canyon Rd

Post Mile	SDRIMS No.	Direction	Location
7.861	11408	SB	S/O Aero Dr
7.862	11409	NB	S/O Aero Dr
8.328	210	NB	Aero Dr
8.335	101	SB	Aero Dr
8.662	11412	SB	S/O Balboa Ave
8.663	11413	NB	S/O Balboa Ave
9.175	143	NB	Balboa Ave EB
9.193	139	SB	Balboa Ave EB
9.195	138	SB	Balboa Ave WB
9.372	142	NB	Balboa Ave WB
9.566	11505	SB	S/O Clairemont Mesa Blvd
9.567	11506	NB	S/O Clairemont Mesa Blvd
9.951	137	SB	Clairemont Mesa Blvd
9.962	144	NB	Clairemont Mesa Blvd
9.964	465	NB	State Route 52 (SR-52)
10.632	11509	SB	N/O SR-52
10.633	11510	NB	N/O SR-52
10.840	3044[1]	NB	N/O SR-52 (radar)
10.840	4044[1]	SB	N/O SR-52 (radar)
11.079	11511	SB	S/O HOV lanes
11.080	11512	NB	S/O HOV lanes
11.201	486	SB	SR-163 SB from HOV
12.070	3020[1]	NB	N/O SR-163 Merge/Split (radar)
12.070	4020[1]	SB	N/O SR-163 Merge/Split (radar)
12.464	11803	NB	N/O SR-163 Merge/Split
12.465	11804	SB	N/O SR-163 Merge/Split
13.200	3021[1]	SB	S/O Miramar Way (radar)
13.266	145	NB	Miramar Way
13.268	367	N/S	HOV @ Miramar Way
13.444	183	SB	Miramar Way
13.779	11808	SB	S/O Miramar Rd
13.781	11809	NB	S/O Miramar Rd
14.286	96	NB	Miramar Rd/Pomerado Rd
14.353	120	SB	Miramar Rd
14.355	121	SB	Pomerado Rd
14.981	94	SB	Carroll Canyon Rd
14.982	95	N/S	HOV @ Carroll Canyon Rd
14.991	135	SB	Carroll Canyon Rd
15.006	86	NB	Carroll Canyon Rd
15.380	11908	SB	N/O Carroll Canyon Rd
15.382	11909	NB	N/O Carroll Canyon Rd
15.920	74	NB	Mira Mesa Blvd EB
15.930	124	NB	Mira Mesa Blvd WB
15.959	119	SB	Mira Mesa Blvd EB

Post Mile	SDRIMS No.	Direction	Location
15.963	118	SB	Mira Mesa Blvd WB
16.551	12002	NB	S/O Mercy Rd (radar)
16.552	12001	SB	S/O Mercy Rd
17.241	92	SB	Mercy Rd
17.272	245	NB	Mercy Rd
18.142	172	NB	Poway Rd/Rancho Peñasquitos Blvd
18.243	116	SB	Rancho Peñasquitos Blvd
18.245	117	SB	Poway Rd
18.247	480	N/S	HOV @ Poway Rd
18.990	327	NB	S/O Ted Williams Pkwy
19.020	81	SB	SR-56/Ted Williams Pkwy
19.021	432	SB	HOV entrance
19.446	352	NB	SR-56 EB
19.514	173	NB	Ted Williams Pkwy
20.491	80	SB	Carmel Mountain Rd
20.584	174	NB	Carmel Mountain Rd
21.825	79	SB	Camino del Norte
21.930	175	NB	Camino del Norte
22.935	136	SB	Bernardo Center Dr
23.000	178	NB	Bernardo Center Dr
23.688	176	NB	Rancho Bernardo Rd EB
23.755	147	SB	Rancho Bernardo Rd EB
23.757	146	SB	Rancho Bernardo Rd WB
23.794	177	NB	Rancho Bernardo Rd WB
25.937	148	SB	Pomerado Rd/W Bernardo Dr
26.012	159	NB	Pomerado Rd/W Bernardo Dr
26.880	303	NB	Via Rancho Pkwy
27.010	149	SB	Via Rancho Pkwy
27.840	150	SB	Centre City Pkwy
27.950	3022[1]	NB	S/O Citracado Pkwy (radar)
28.774	304	NB	Citracado Pkwy
28.940	134	SB	Felicita Rd/Citracado Pkwy
29.969	157	SB	Auto Park Way/9th Ave
30.212	305	NB	Auto Park Way/9th Ave
30.697	156	SB	Valley Pkwy
30.718	306	NB	Valley Pkwy
32.850	155	SB	El Norte Pkwy
34.272	3049[1]	NB	N/O N Centre City Pkwy (radar)
34.273	4049[1]	SB	N/O N Centre City Pkwy (radar)

1. Privately owned thru a public/private partnership with Mobility Technologies (Traffic.com) and temporary in nature until Caltrans stations are installed.

Table 12-2. I-15 Planned Traffic Monitoring Station Locations

Post Mile	Direction	Location

Post Mile	Direction	Location
1.80	NB	Market St
2.60	SB	S/O SR-94
2.60	NB	N/O SR-94/Logan Ave
2.68	NB	S/O I-805 (radar)
3.40	SB	N/O I-805
17.75	SB	S/O Poway Rd
19.76	SB	N/O Ted Williams Pkwy
20.10	NB	S/O Carmel Mountain Rd
20.36	NB	N/O Carmel Mountain Rd
21.16	SB	S/O Camino del Norte
22.33	SB	N/O Camino del Norte
24.60	NB	N/O Duenda Bridge
25.20	SB	N/O Rancho Bernardo
25.31	NB	
27.75	NB	Clarence UP
28.16	SB	
29.32	SB	N/O Felicita Rd
29.49	NB	S/O 9th Ave

9.4 Changeable Message Signs (CMS)

Changeable message signs (CMSs) are traffic management electronic messaging devices that are installed along the freeway prior to major traveler "decision points" such as freeway-to-freeway interchanges or freeway splits. The primary purpose of a CMS is to inform the traveling public of traffic conditions ahead. The CMS helps the driver in choosing an alternate route thus reducing the amount of travel delay in the event of an accident or incident. This helps to make the existing freeway system more efficient while providing additional motorist safety. CMSs can also show expected travel times from the CMS to a location or community ahead. CMSs also carry broadcasted AMBER alerts, an early warning system to help find abducted children.

These signs are a matrix of either incandescent light bulbs, light emitting diodes (LEDs), flip disks, or LED enhanced flip disks. The majority of the installations utilize a Caltrans standard CMS design. A central software application located at the TMC is used to control the CMS. Depending on the installation, signs communicate to the TMC using leased dedicated or dial-up phone lines, or State owned hardwire connections such as fiber optics.

Table 13-1 shows existing changeable message sign locations on I-15, while **Table 13-2** shows planned/proposed changeable message sign locations on I-15.

Table 13-1. I-15 Existing Changeable Message Sign Locations

Post Mile	CMS No.	Direction	Location
2.680	15	NB	N/O SR-94
10.627	HOV 1	NB	S/O SR-52
10.874	HOV 2	NB	S/O SR-52
11.252	HOV 3	NB	N/O SR-52

Post Mile	CMS No.	Direction	Location
11.508	HOV 4	NB	N/O SR-52
13.569	7	SB	Miramar Way
19.101	HOV 9	SB	S/O Ted Williams Pkwy
19.319	HOV 10	SB	Ted Williams Pkwy OC
19.903	HOV 11	SB	S/O Carmel Mountain Rd
21.134	HOV 12	SB	Camino del Norte
32.832	22	SB	El Norte Pkwy

Table 13-2. I-15 Planned Changeable Message Sign Locations

Post Mile	CMS No.	Direction	Location
17.311	TBD	NB	N/O Mercy Rd

9.5 Closed Circuit Television Cameras (CCTV)

Closed circuit television (CCTV) cameras are electronic video devices that are installed along the freeway to visually identify the nature of an incident after it has been detected by the system or reported to the transportation management center. CCTV cameras reduce the time that the TMC operators require to verify an incident and best determine the type of response needed. CCTV cameras can also be used during incident management to assist TMC operators to monitor congestion queuing development and to verify the conditions of freeway segments that are being ramp metered. TMC operators can deploy more advisories during incident management through the use of changeable message signs, highway advisory radio or other media to alert approaching traffic and avoid possible secondary accidents or to assist dispatch traffic management teams in the field.

CCTV cameras with pan and tilt units have a zoom range of approximately 0.5 mile in each direction. A wide variety of communication solutions are utilized for the video infrastructure, including fiber optic or DSL. In general, the control of the cameras is at the TMC where all the video is received and available for monitoring. Depending on the architecture of each District's video network, some larger districts may use communication hubs to collect all the video and then transmit those being selected to the TMC for operational use. CCTV cameras as part of a traffic surveillance system will minimize the time required to restore the freeway to full capacity, thus reducing congestion resulting from delay and secondary incidents on the system.

The District 11 TMC Field Elements Plan from September 2000 recommended installation of an additional 336 CCTV cameras on most urbanized freeways in District 11. **Table 14** shows existing closed circuit television camera locations on I-15; there are currently no planned closed circuit television camera locations on I-15.

Table 14. I-15 Existing Closed Circuit Television Camera Locations

Post Mile	ID No.	Direction	Location
4.045	52	SB	N/O I-805 OFR
4.629	53	SB	S/O University Ave
5.001	54	SB	S/O El Cajon Blvd OC
5.509	55	SB	S/O Adams Ave OC

Post Mile	ID No.	Direction	Location
6.165	56	SB	S/O I-8 UC
7.309	64	SB	SR-52
8.252	61	SB	S/O Aero Dr
12.650	38	NB	S/O Ammo Rd
13.316	39	NB	S/O Miramar Way OC
14.330	40	SB	S/O Miramar Rd OC
15.930	41	SB	S/O Mira Mesa Blvd UC
16.590	42	SB	S/O Mercy Rd.
18.108	43	SB	S/O Rancho Peñasquitos Blvd
19.000	44	NB	North End HOV Entrance/Exit
19.510	45	NB	S/O Ted Williams Pkwy OC

9.6 Highway Advisory Radio (HAR)

Highway advisory radio (HAR) is a low power (10 watt) FCC licensed non-commercial radio station operated by Caltrans. Its purpose is to transmit localized traffic and road information to the motorists on the State highway system. Broadcasting of traffic and road conditions is typically transmitted via AM (amplitude modulation) or FM (frequency modulation) radio transmitters. The coverage area is a two to three mile radius from the transmitter.

The HAR stations are installed along the State highways upstream of major traveler "decision points" such as freeway-to-freeway interchanges or freeway splits. They provide the traveling motorist with real time traffic conditions; thus, allowing the driver to choose an alternate route if available. The HAR provides additional details that cannot be provided elsewhere once the public is using the State highway system. The HAR, for example, can advise about road closures due to adverse weather conditions (i.e. fog, ice, and snow), long term incidents or construction projects. The motoring public can receive alternate route information due to these construction or maintenance activities. By informing the motorist of long term traffic conditions, the HAR helps the driver choose an alternate route thus reducing the amount of travel delay. This helps the TMC manage the existing freeway system more efficiently while providing additional safety to the motoring public.

There are no existing HAR locations on I-15, however, the HAR located on SR-78 at Centre City Parkway (Call Sign WNSB 426) has a range that covers much of the northern portion of I-15 around Escondido. There are no planned HAR locations for I-15.

9.7 Integrated Corridor Management System (ICMS)

The San Diego Association of Governments (SANDAG) has completed a project that is the foundation of center-to-center transportation information exchange throughout the San Diego region. The Interstate 15 Integrated Corridor Management System (ICMS) consists of two major subsystems: the existing Intermodal Transportation Management System (IMTMS) and a future Decision Support System (DSS). The IMTMS acts as an intelligent data router between source legacy modal management systems and a variety of users including the regional 511 system and IMTMS participating agencies. The DSS will support the manual, semi-automatic, and/or automatic generation of modal action plans in response to one or more stimuli from the participating systems. For example, a major arterial event may require a response from not only the local traffic signal control system, but also from the freeway management, transit management, and traveler information management systems.

Several existing and planned regional systems will be interfaced to the ICMS. Some of these will be upgrades to the IMTMS, some will be new systems. **Figure 11** shows the ICMS and the systems to which it will be connected. These systems are shown in **Table 15** with the owning agency.

Figure 11. ICMS Context Diagram – Baseline Operations

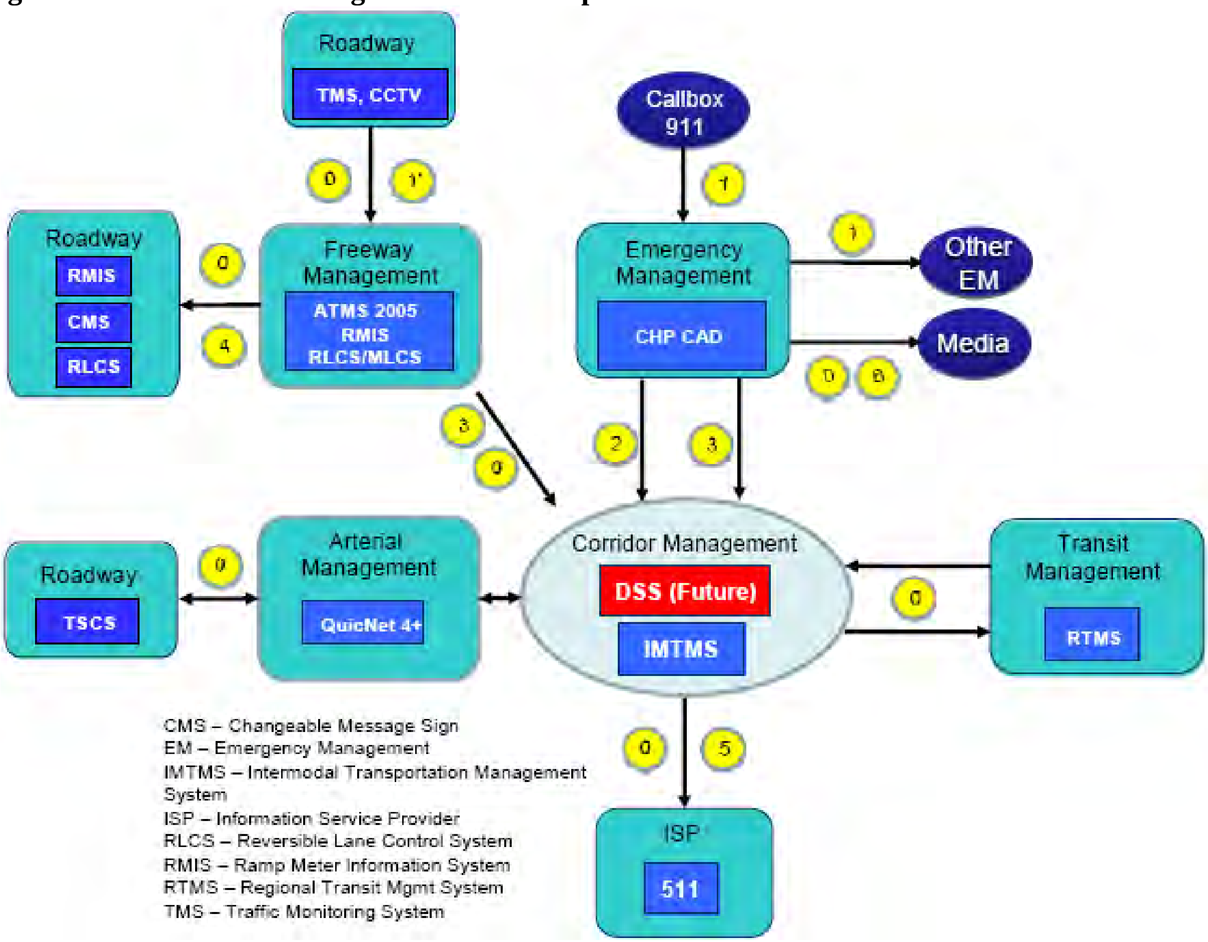


Table 15. ICMS Interfacing Systems and Owner Agencies

Existing or Planned System	Owning Agency
Advanced Transportation Management System (ATMS 2005)	Caltrans District 11
Reversible [Managed] Lanes Control System (MLCS)	Caltrans District 11
Ramp Meter Information System (RMIS)	Caltrans District 11
Lane Closure System (CMS)	Caltrans District 11

Existing or Planned System	Owning Agency
Regional Transit Management System (RTMS)	SANDAG (MTS and NCTD are system operators)
Regional Arterial Management System (RAMS)	SANDAG (local agencies are system operators)
Regional Event Management System (REMS)	CHP (in future, other public safety agencies will be included)
Advanced Transportation Information Management System (ATIMS, or 511)	SANDAG
Parking Management System	SANDAG
Congestion Pricing System	SANDAG

9.8 Intermodal Transportation Management System (IMTMS)

IMTMS Project Description

The Intermodal Transportation Management System (IMTMS) project links the region's four primary transportation agency systems together through a regional open systems network. This physical IMTMS network is accessible to all participating agencies in San Diego County. Regional transportation data is then made available to the 511 ATIS project for traveler information purposes. The IMTMS project utilizes web services technology, the latest Transportation Management Data Dictionary (TMDD) and National Transportation Communications for ITS Protocols (NTCIP) standards, and Extensible Markup Language (XML) interfacing which allows for the regional exchange of data over the network.

The connected IMTMS systems are comprised of:

- Caltrans District 11 (San Diego County) Advanced Traffic Management System (ATMS) for freeway management,
- Regional Transit Management System (RTMS) managing information from fixed route bus transit services,
- Regional Arterial Management System (RAMS) for local agency traffic signal coordination and freeway/arterial coordination,
- CHP Computer Aided Dispatch (CAD) for incident management, and
- Regional 511/Advanced Traveler Information Management System (ATIMS) for the dissemination of transportation-related information on all modes to information system providers (ISP) and the general public.

Results

The evolution of the IMTMS project has allowed the region's real time data to be viewed and accessed in a standard web browser as well as available online to other external agencies and systems via a standard, easy-to-use XML data format. The IMTMS project is producing a framework to support center-to-center operations that will allow other regional agencies a systematic process to connect to the network to receive or provide data. SANDAG is comprised of over 20 local and regional agencies in the San Diego area that plan to connect to the network for regional transportation purposes.

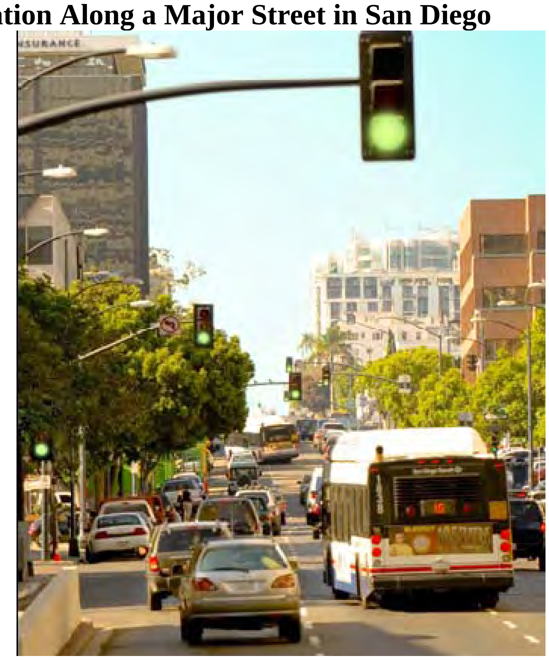
Future

The IMTMS will further compliment the regional utility of the IMTMS by connecting with "first responder" projects here in San Diego. This will enable not only multi-jurisdictional data sharing of traffic and transit information, but also enable multi-discipline (eg. fire, police, and EM services) access to supplemental 'real time' dispatch and operational decision support. Again, this exchange will be delivered based on the latest technology driven standards most appropriate to the exchange of information between IMTMS and these "first responder" networks.

9.9 Regional Arterial Management System (RAMS)

SANDAG is deploying the Regional Arterial Management System (RAMS) to enhance inter-jurisdictional coordination of traffic signals along major streets/arterial corridors throughout the San Diego region (**Figure 12**). The RAMS project provides the ability to view other agencies' traffic signal timing plans and coordinates these timing plans across jurisdictions. It will allow for the management of regional arterial traffic and will coordinate freeway/arterial interchanges. RAMS will allow jurisdictions to develop, propose, and implement traffic signal timing plans spanning multiple jurisdictions for day-to-day operations, planned special events, and emergency conditions.

Figure 12. Signal Coordination Along a Major Street in San Diego



RAMS will eventually be meshed into the IMTMS. IMTMS will link systems, such as RAMS, through a regional network, built on National standards to provide a comprehensive Regional Transportation Management System. The Regional IMTMS Network is under development and will communicate between local operations centers, and serves as the cornerstone data collection and formatting system that will:

- Coordinate transportation operations,

- Provide safety agencies access to critical transportation systems, and
- Supply transportation data to the San Diego Region's 511 Advanced Traveler Information System (ATIS).

Due to front loaded delays in the project execution, this project is currently moving into a limited implementation phase (LIP). The LIP will encompass nine major arterials with focal points around common highway intersections. The City of San Diego, the City of Chula Vista and Caltrans will jointly operate the LIP in parallel with the full regional deployment of the RAMS Tier 1 project. Completion of the rollout to the full operational environment is planned for December 2007 in various cities in the region, including Escondido and Poway, and the County of San Diego.

Benefits of this program include reduction of traffic congestion and improved air quality, enhanced emergency response, and improved event management.

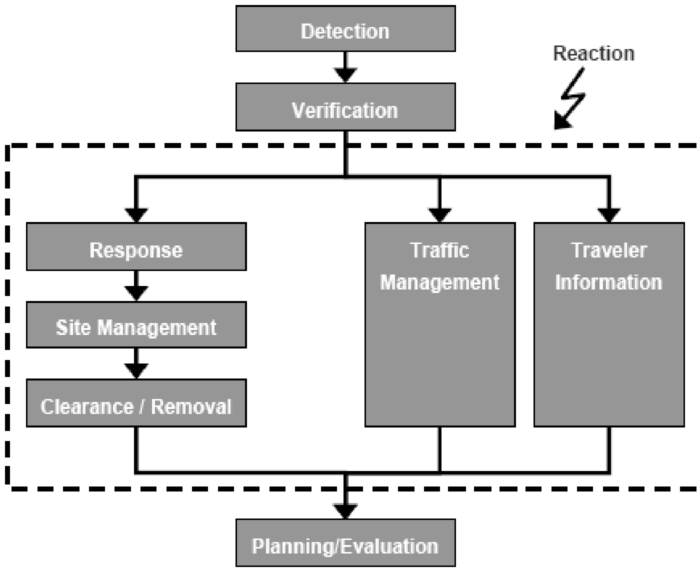
9.10 Traffic Incident Management

A traffic incident is any unplanned or planned event that impacts, or has the strong potential to impact, the flow of traffic. Examples range from vehicles stalled on the highway shoulder to major crashes. Severe weather, emergency highway maintenance activities, and other unplanned events may also be characterized as traffic incidents if they impact traffic flow. In the case of the I-15 Managed Lanes, and its strong dependence on technology (e.g., CMS) and field devices for operations (e.g., barrier transfer machine), the failure of one or several system components could also be considered a traffic incident.

Traffic incident impacts are significant and far reaching. In San Diego and most other major metropolitan areas, it is estimated that between 50% and 60% of all delays are attributable to traffic incidents. The delays, secondary incidents, and resulting congestion further lead to missed shipment deadlines, losses in productivity, wasted fuel, and an overall degradation in the quality of life for system users. However, possibly the most compelling impact of traffic incidents involve a reduction in safety for both motorists and those responding to these highway emergencies.

Traffic incident management (TIM) is defined as the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration of incidents, and improve the safety of motorists, crash victims, and incident responders. TIM is a process (**Figure 13**) that provides a coordinated approach to managing highway incidents and is a highly specialized field that involves developing and maintaining working relationships with a wide variety of stakeholders and emergency responders.

Figure 13. TIM Process Diagram



The greatest benefits of effective TIM strategies are achieved through the reduction of incident duration. Reducing incident duration is typically fostered by reducing incident detection and verification times, initiating an expedient and appropriate response, and clearing the incident as quickly as possible. Quantifiable benefits generally associated with an effective TIM Program include increased survival rates of crash victims, improved safety of responders and motorists, and reduced delays. Qualitative benefits often include improved public perception of agency operations, improved quality of life, and improved coordination and cooperation of response agencies.

10.0 THE PYRAMID – OPERATIONAL IMPROVEMENTS

The goal is to maintain current travel times in 2030. In addition, the length of LOS F lanes is to be maintained or reduced. The Managed Lanes will facilitate travel times for transit service and carpools. **Table 16** and **Figure 14** show significant improvement in 2030 Levels of Service (LOS) for I-15, resulting from the improvements contained within the RTP. The challenge is to secure the necessary additional federal and State revenues to supplement the local sales tax funds (*TransNet*) already earmarked for operational improvements in this corridor.

Table 16. 2030 RTP Improvements Evaluation on I-15 Deficient Segments

Location / Limits	**Length (miles)**	**Existing 2005 LOS**	**Future LOS with RTP Improvements**		
			2010 LOS	**2020 LOS**	**2030 LOS**
I-5 to Imperial Ave	0.95	F	D	A-C	A-C
Imperial Ave to SR-94	0.74	F	D	A-C	A-C
I-8 to Balboa Ave	2.97	F	E	F	E
SR-163 to Miramar Rd	2.17	F	E	E	E
Miramar Rd to Bernardo Center Dr	9.29	F	E	E	E
Bernardo Center Dr to Centre City Pkwy	4.63	F	E	E	E
Centre City Pkwy to SR-78	3.87	F	F*	D	D

* With completion of I-15 Managed Lanes by 2012

Figure 14-1. Congestion Management Plan – 2006 LOS

Figure 14-2. Congestion Management Plan – 2030 LOS

10.1 Freeway Improvements

Proposed operational improvements for the I-15 CMP include various freeway projects including the already approved I-15 Managed Lanes project. Proposed freeway projects are shown below in **Table 17**.

Table 17. I-15 Recommended Major Freeway Improvements

Post Mile	Location	Improvement Description[1]
0.0 – 2.2	I-5 to SR-94	Add 2 Main Lanes and 2 HOV Lanes
2.2 – 12.1	SR-94 to SR-163	Add 2 HOV Lanes
12.1 – 19.4	SR-163 to SR-56	Add 2 Main Lanes and 2 Managed Lanes[2]
19.4 – 27.6	SR-56 to Centre City Pkwy	Add 2 Main Lanes and 4 Managed Lanes[2]
27.6 – 31.5	Centre City Pkwy to SR-78	Add 4 Managed Lanes
31.5 – 54.3	SR-78 to Riverside Co. Line	Add 4 Toll Lanes

1 All improvements included in TransNet2, except toll lanes from SR-78 to Riverside Co. line
2 Managed Lanes with Movable Barrier

HOV connectors allow for continuous movement for carpools and regional BRT on the HOV network from freeway to freeway. HOV connectors should be provided at the following locations on I-15:

- I-805 North to North and South to South,
- SR-94 East to North and South to West,
- SR-52 West to North and South to East,
- SR-163 North to North and South to South,
- SR-56 East to North and South to West, and
- SR-78 East to South and North to West.

Freeway connectors should be provided at the following location on I-15:

- SR-56 North to West.

10.1a I-15 Managed Lanes Project

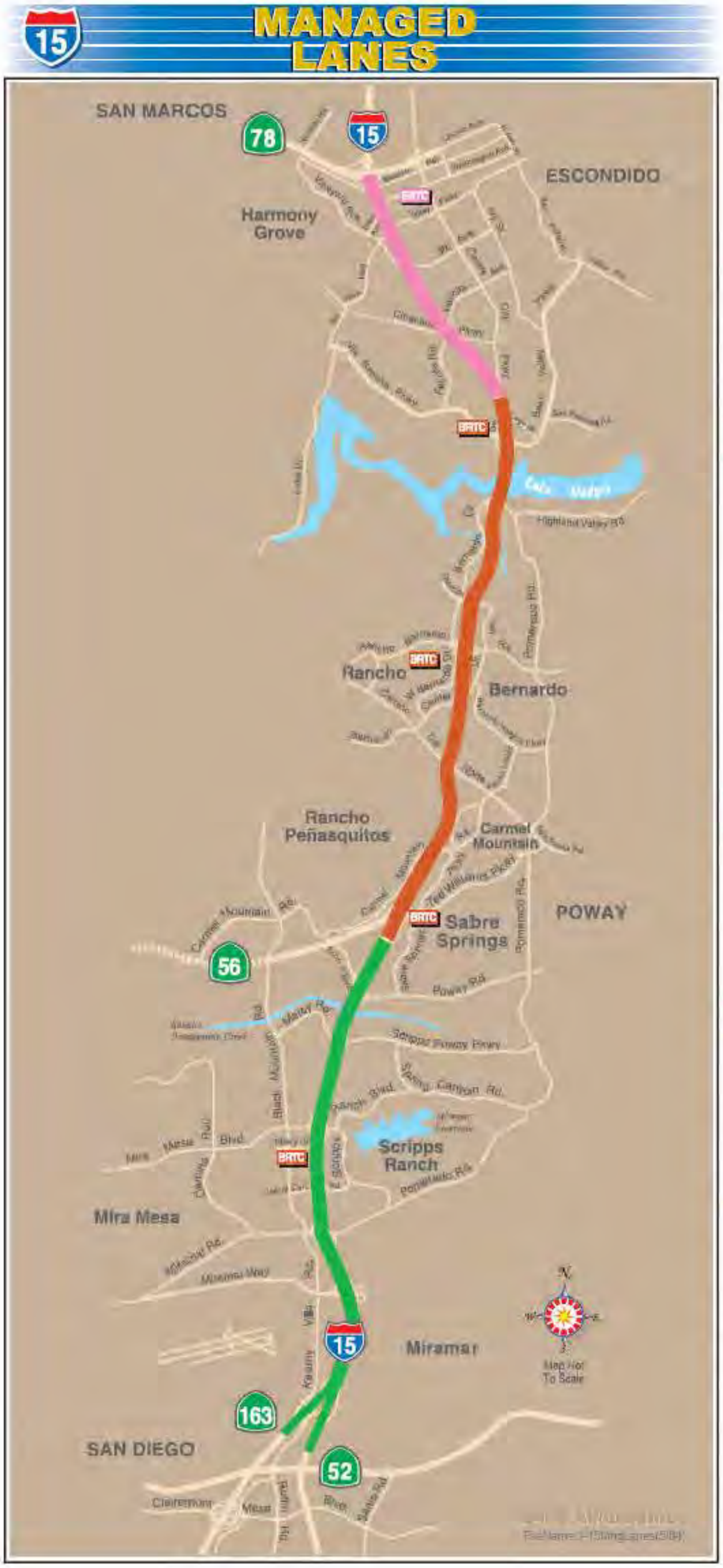
Managed Lanes are defined as lanes or a system of lanes designed and operated to provide unimpeded, high speed, efficient travel during periods when the remainder of the freeway is congested. Techniques for managing lanes include altering lane configurations using a moveable barrier, limiting eligibility, controlling access, pricing, and having reversible lanes. The proposal is to operate a "freeway within a freeway" for HOV and transit users in the 35-mile project report area with the latest technologies that would maintain proper flow rates, sense problems, make adjustments at necessary locations, and keep travelers informed of their choices.

The Managed Lanes are being constructed mostly within the existing freeway median, though some outside widening is required. The concept is to allow entry and exit openings every two- to three-mile intervals along the managed lanes, with preference given to high occupancy vehicles, such as buses and carpools. SANDAG's I-15 *FasTrak* Program, which allows single occupant vehicles (SOV) to access HOV lanes for a fee, will be expanded to include the Managed Lanes as each segment becomes operational. As the managed lanes reach capacity, sensors would close off SOV access by relaying pre-programmed information to changeable message signs. In the future, the message could be relayed directly to approaching vehicles.

Currently planned with the I-15 Managed Lanes project are five BRT stations, accessible to I-15 by DARs. Three of these BRT stations are under construction in the Middle segment at South Escondido (Del Lago Blvd), Rancho Bernardo, and Sabre Springs (**Figure 15**). The other two Managed Lanes BRT stations will serve Escondido in the North segment and Mira Mesa in the South segment. Mid-City San Diego will be served by BRT with stations at El Cajon Boulevard and University Avenue. The Managed Lanes BRT stations will provide parking for transit users and carpoolers that will be connected to the managed lanes by DARs, allowing buses and HOVs to quickly bypass freeway on-ramps. The BRT service would be part of a region-wide BRT system that would connect North County cities to major regional employment centers throughout San Diego.

Within the I-15 Managed Lanes project, there is an additional Class I bike path under construction west of I-15 over Lake Hodges, which is partially funded through Caltrans. Other identified bikeway improvement needs include restoring the connection between Adams Avenue and Camino del Rio South, improving connections to the SR-56/Ted Williams Parkway bikeway, and providing safety improvements along Kearny Villa Road. In addition, several of the BRT stations of the Managed Lanes project are being designed to improve bike and pedestrian movement. Most buses in the I-15 corridor have bike racks for passengers.

Figure 15. I-15 Managed Lanes Segments



District 11

N C T D

SANDAG

MTS Metropolitan Transit System

LEGEND

(Million$)

Segment	*Description*	*Cost*	*Funding*	*Constr.*
North Freeway	Centre City Pkwy to SR-78	$251	TRANSNET CMAQ RSTP SHOPP	2008-2011
Middle Freeway	SR-56 to Centre City Pkwy	$428	TRANSNET TCRP STIP-IIP STIP-RIP SHOPP RSTP CMAQ GARVEE-RIP GARVEE-IIP DEMO COOP	2003-2008
South Freeway	SR-163 to SR-56	$467	TRANSNET CMAQ CMIA	2008-2012
Transit	Escondido to Downtown	$122	TRANSNET TCRP CMAQ Federal Bus	2008-2012

NOTES

1. Project Report approved 2-13-03
2. Mitigated Negative Declaration (MND) & Finding of No Significatn Impact (FONSI) approved 3-27-03
3. North projects total includes a direct access ramp at Hale Avenue.
4. South project total includes a direct access ramp in Mira Mesa.

June 2007

Figure 16. Middle Segment Intermediate Access Points and Direct Access Ramps

Figure 17-1. I-15 Managed Lanes - Lane Configuration Summary (1 of 4)

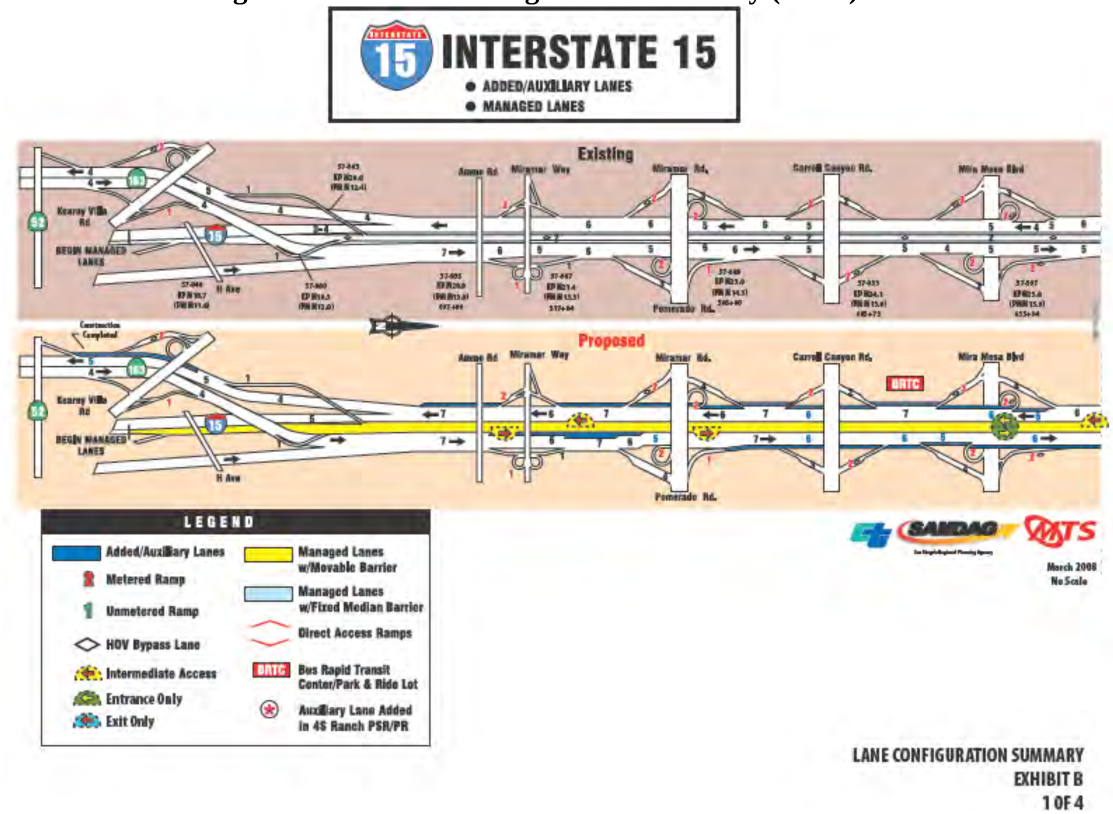


Figure 17-2. I-15 Managed Lanes – Lane Configuration Summary (2 of 4)

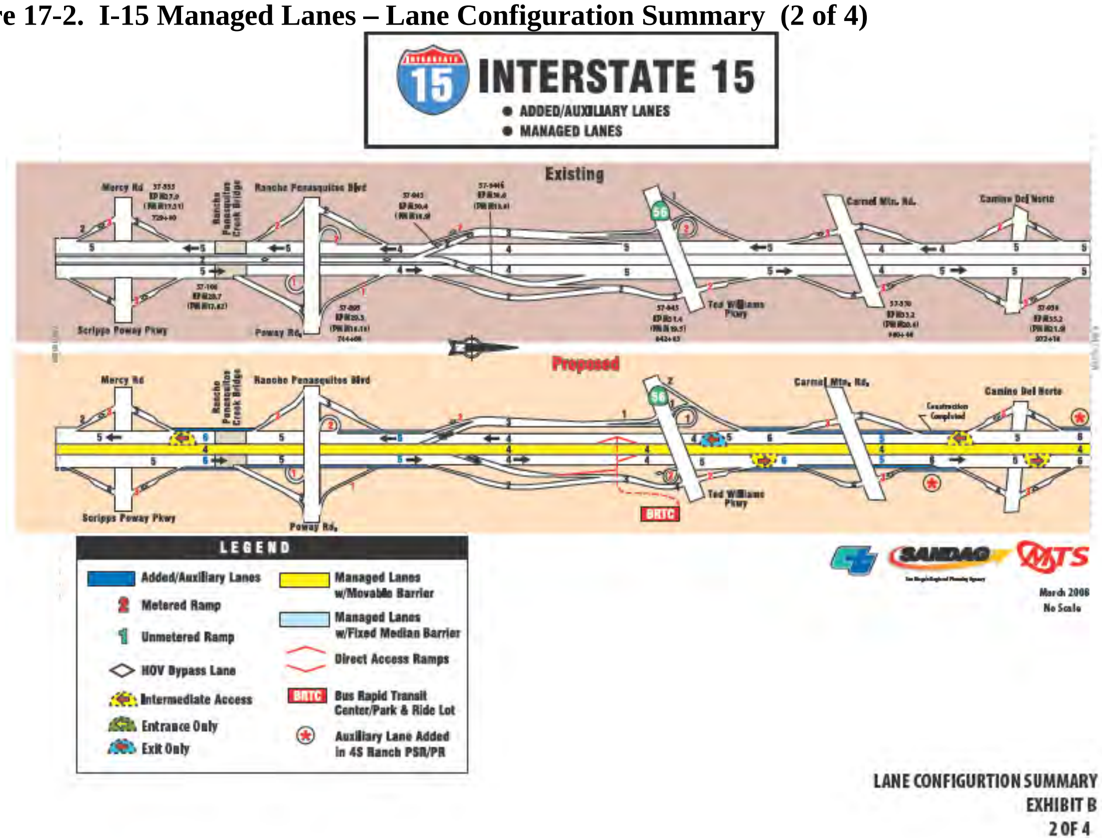


Figure 17-3. I-15 Managed Lanes – Lane Configuration Summary (3 of 4)

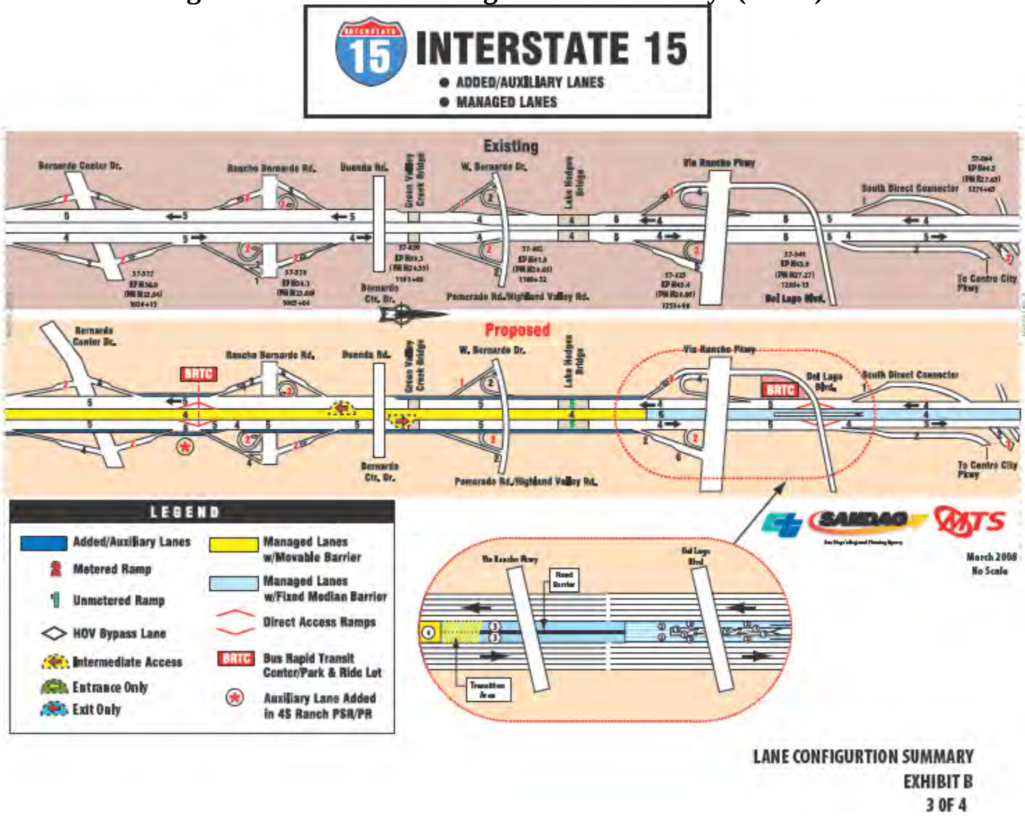
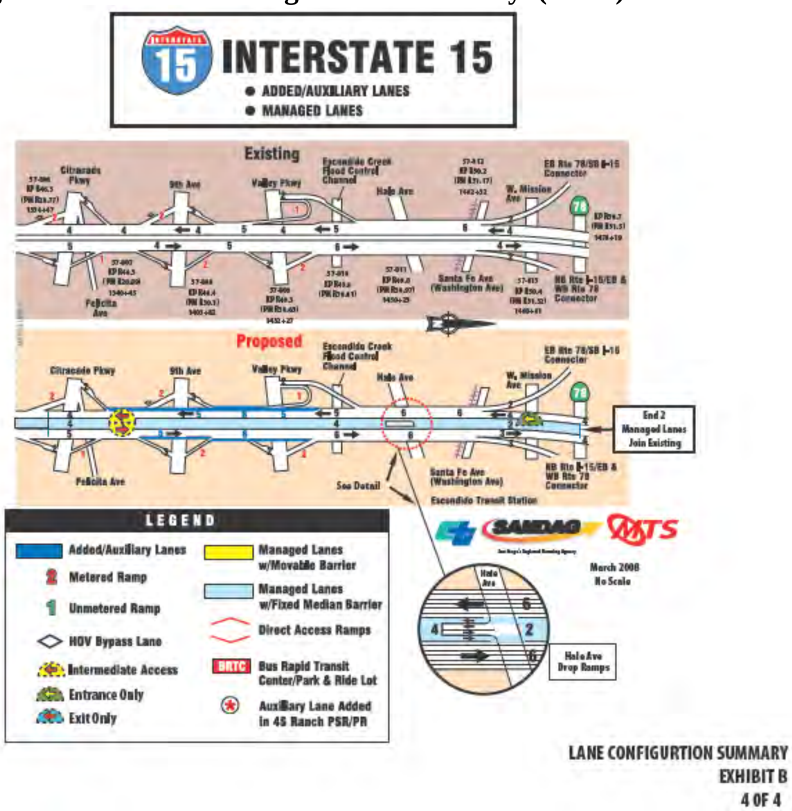


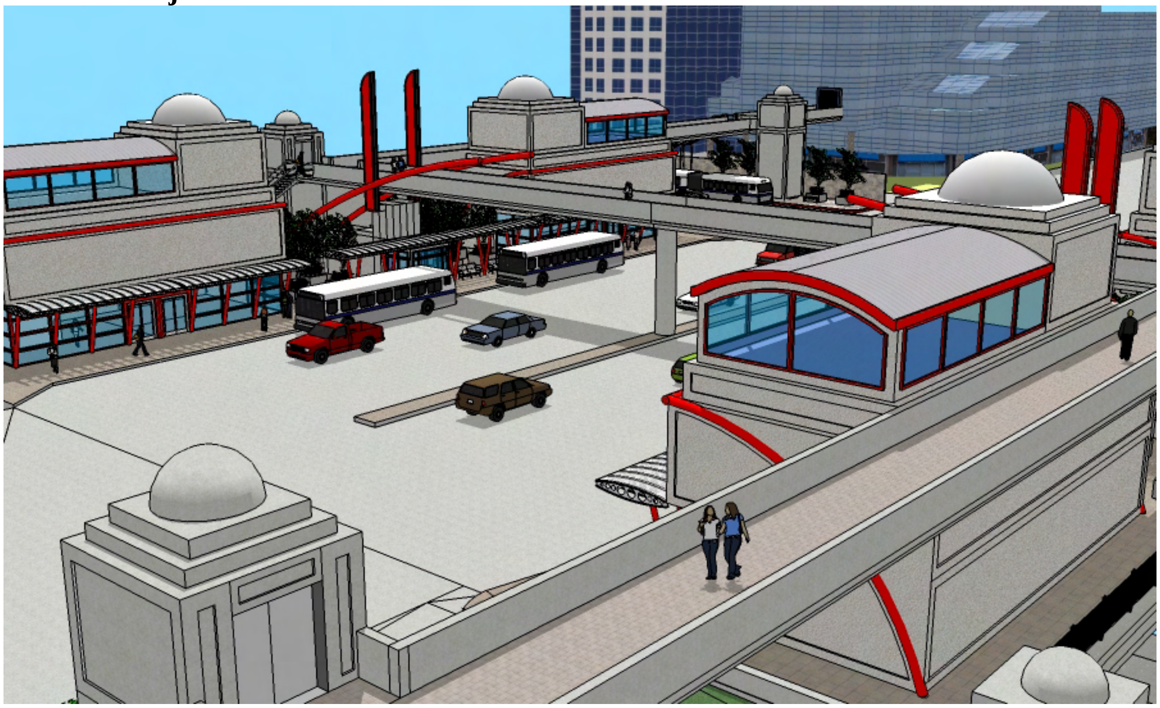
Figure 17-4. I-15 Managed Lanes – Lane Configuration Summary (4 of 4)



10.1b I-15 Center City Corridor Project

The I-15 Center City Corridor Project examines adding HOV lanes on I-15 between the SR-94 and the SR-163. The project also incorporates transit facilities that utilize BRT services planned to begin operations in 2012. The BRT stations will be located at University Avenue and El Cajon Boulevard (**Figure 18**), with potential stations in Mission Valley and at Balboa Avenue. In addition, the project includes HOV to HOV direct connectors at SR-94 and I-805. With I-15 connecting to I-805, where a managed lanes project is currently being planned, a continuous HOV system will provide regional connectivity. The I-15 Center City Corridor Project is currently in the poject study report (PSR) phase.

Figure 18. El Cajon Blvd BRT Station Simulation



10.2 Transit Improvements

The Metropolitan Transit System (MTS) operates express bus services along the I-15 corridor. Current transit service operating on I-15 includes MTS Routes 20, 210, 320, 810, 820, 850, 860, and 960. Greyhound also provides intercity bus service with a major stop in Escondido before continuing north into Riverside County. Proposed improvements to the San Diego region's transit system include increased bus services and construction of BRT facilities, such as DARs (**Figure 19**). Due to the significance of the I-15 Corridor to mobility in the region, several of the proposed transit improvements are on I-15 (**Table 18**).

Figure 19. 2030 Transit Network – Major Capital Projects

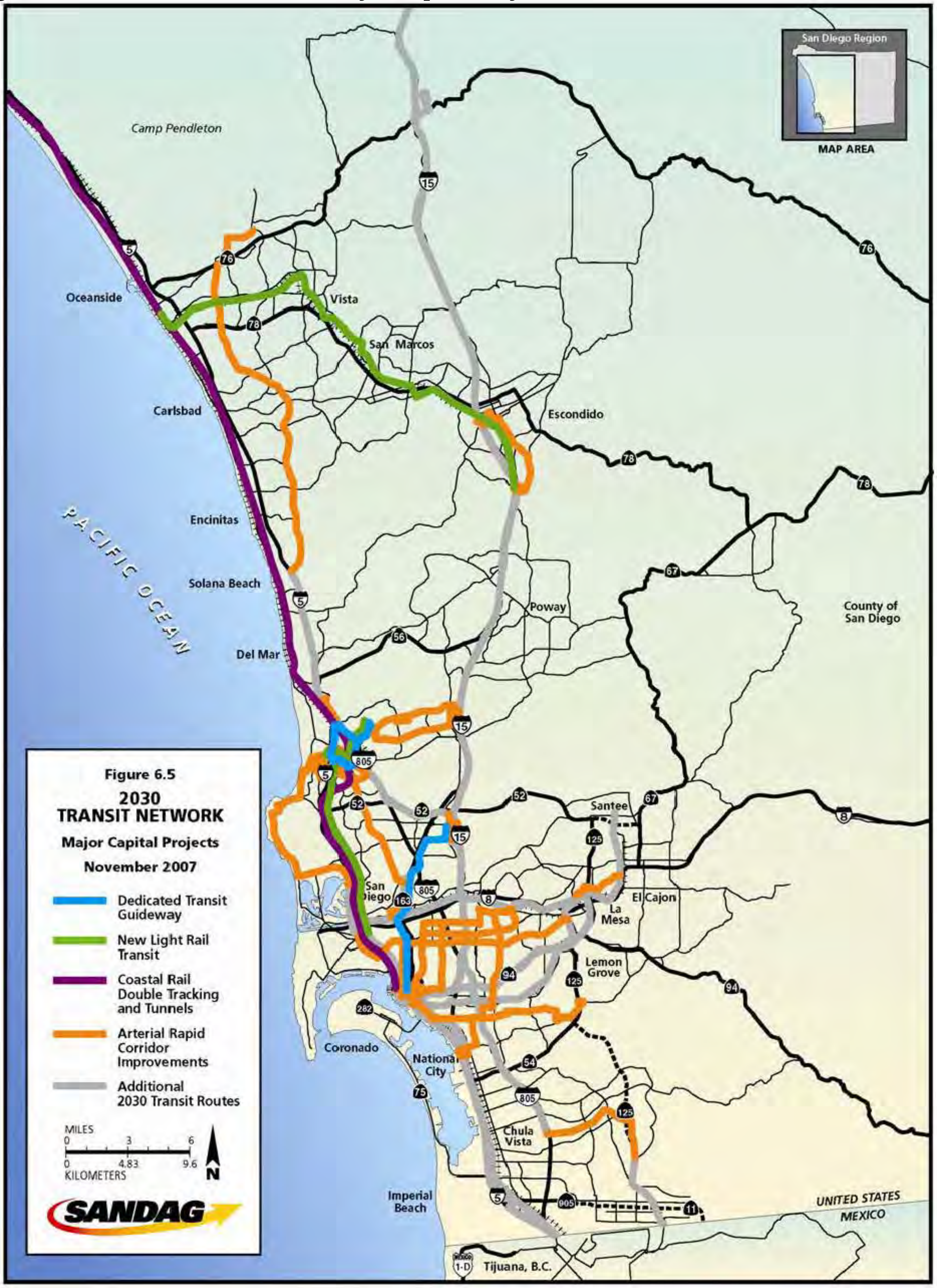


Table 18. Proposed Transit Improvements for I-15 CSMP

YEAR BUILT BY	ROUTE	DESCRIPTION	PEAK HEADWAY (Minutes)	OFF-PEAK HEADWAY (Minutes)
2010	350	Escondido Rapid	10	10
2020	470	Riverside Cty to Sorrento Mesa via Mira Mesa Blvd. (via Carroll Canyon Rd. after 2020)[1]	10-30	15-60
2020	610	Escondido to Centre City via I-15/SR-94	10	15
2020	680	Otay Mesa to Sorrento Mesa via I-805/I-15	10	15
2030	210	Mira Mesa to Centre City via I-15/SR 94	10	15

[1] Peak headways at 10 minutes to Escondido and 30 minutes to Riverside County; off peak headways at 30 minutes to Escondido and 60 minutes to Riverside County.

The current corridor local and commute express buses use the I-15/SR-163 alignment to reach San Diego. The corridor local route takes two hours to travel from end to end and is most valuable to passengers making short journeys and those reliant on transit. The commute express services are characterized by moderate ridership; only one service runs more frequently than every half hour. The best areas for riders to board the buses on these routes are the Park and Ride lots closest to the I-15 Corridor, as there is limited walk-up usage.

The two reverse commute services have few passengers on the north I-15 Corridor and are proposed for discontinuance. Two of the commuter express routes are proposed to be merged for the same reason.

The two cross-regional services currently end at University City, but are planned to extend to the University of California San Diego (UCSD) Campus. One of these services will also be expanded to all day service. The community services at Poway and Mira Mesa are proposed to be simplified. These changes are part of the MTS Comprehensive Operational Analysis Project and should help prepare the corridor for BRT in 2012.

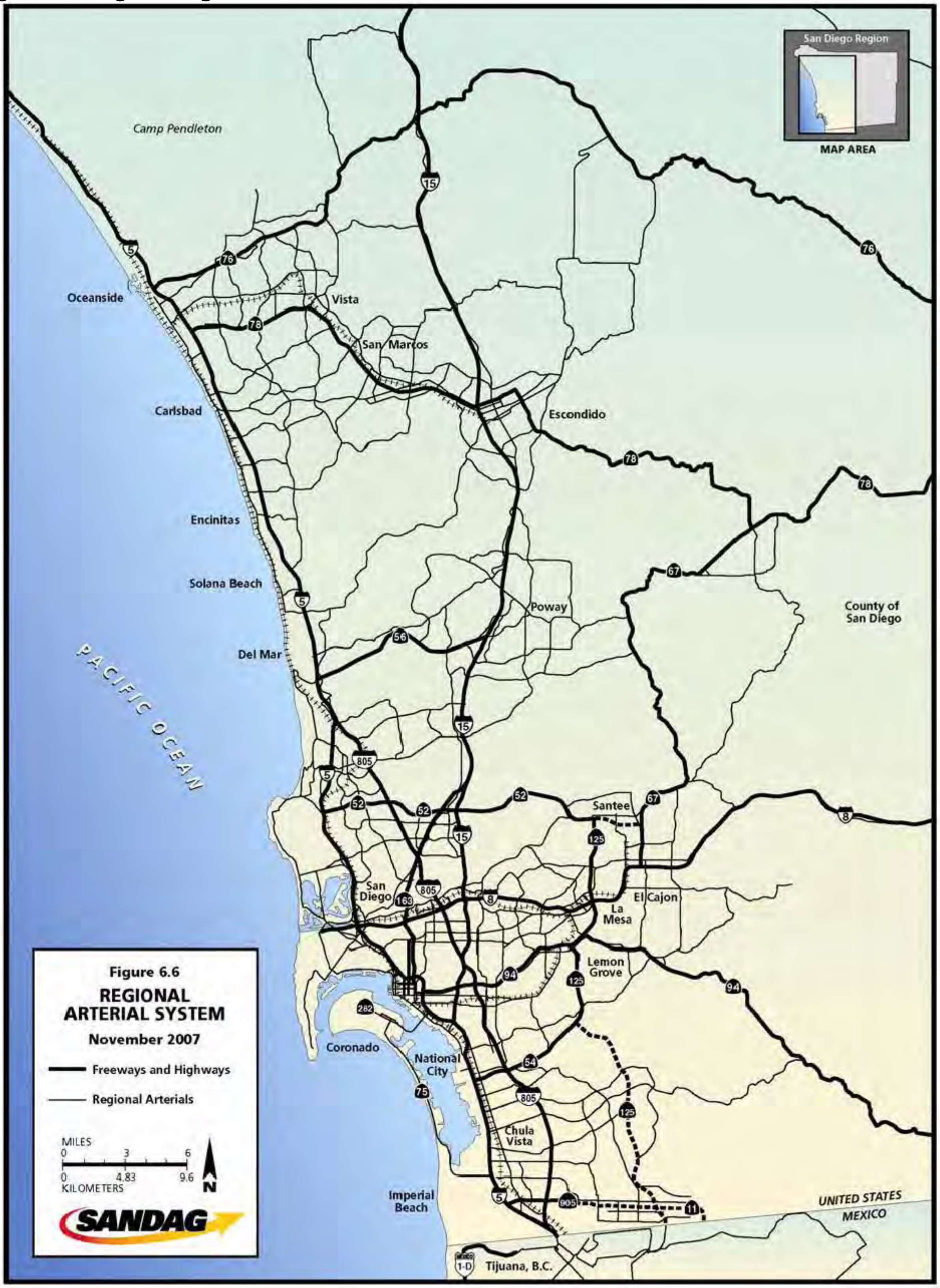
The San Diego region has developed a Regional Transit Vision, which envisions many more trips to be made on the transit system, and allows for more express and direct types of service. The I-15 Managed Lanes project accommodates a BRT system that includes five DARs from the Managed Lanes to BRT stations placed in communities near the freeway (**Figure 20**). The I-15 Managed Lanes project is a prototype project for this Regional Transit Vision.

Figure 20. Rancho Bernardo BRT Station Photo Simulation

10.3 Arterial System

The 2030 RTP includes funds to enhance the arterial component of the Regionally Significant Transportation Network. These arterials provide a critical link to the highway network and serve as alternative routes to the highways (**Figure 21**). Future strategies for arterials to the I-15 include traffic signal priority measures (priority for transit by extending the green phase of the traffic light), "queue jumpers" to bypass bottlenecks on local streets, and rail grade separations along the SPRINTER line. Management systems would integrate arterial operations with other transportation modes.

Figure 21. Regional Significant Arterial Network



10.4 Additional Operational Improvements

There are many types of improvements planned for I-15, both highway and transit related. Improvements are from the 2006 State Transportation Improvement Program (STIP), the 2006 State Highway Operation and Protection Plan (SHOPP), the District 11 Project Information Reporting System (PIRS), the District 11 2007 Ten Year SHOPP Needs Plan, the most recent Status of Projects, and the District 11 Planning Division (**Tables 19 and 20**).

Table 19. 2006 STIP, 2006 SHOPP and PIRS Projects for I-15

POST MILE	LOCATION	IMPROVEMENT DESCRIPTION	SOURCE/ PHASE
0.0 – 4.7	Various	Storm Water Mitigation	PIRS/PA&ED
0.4 – 4.0	Main St to 0.4 mi south of Landis St	Pavement Rehabilitation	PIRS/PSR
0.5 – 4.4	0.3 mi north of National Ave to 0.1 mi south of Wightman St	PCC Slab Replacement	PIRS/PSE
1.6 – 2.2	0.2 mi south of Market St to SR-94	Construct Murals	PIRS/PSE
1.8 – 12.6	Market St to 0.7 mi south of Miramar Way	Add General Purpose Lanes and 2 HOV/Managed Lanes (1 in each direction)	PIRS/PSR
3.2 – 4.1	0.2 mi south to 0.7 mi north of I-805	Planting and Irrigation Update	2006 SHOPP, PIRS/PSE
4.4 – 4.8	Landis St to Polk-Orange Ave Tunnel	Pedestrian/Bike Facilities and Landscaping	PIRS/PA&ED
4.4 – 9.6	Landis St to Camino del Rio South	Construct Class 1 Bike Path	PIRS/PA&ED
5.6 – 6.1	Adams Ave to I-8	Provide Noise Abatement	PIRS/PSE
10.4 – 19.5	0.1 mi south of SR-52 to SR-56	Construct Managed Lanes – South Segment	2006 STIP, PIRS/PSE
11.2 – 11.6	0.6 mi north of SR-52 to 0.2 mi north of H Ave	Storm Water Mitigation	PIRS/PSE
12.4 – 14.1	0.6 mi south of Ammo Rd to 0.2 mi south of Pomerado Rd	Construct Median Barrier	PIRS/PSE
13.2 – 16.8	0.1 mi south of Miramar Way to 0.5 mi north of Mira Mesa Blvd	Landscaping Mitigation	2006 SHOPP, PIRS/PSE
14.8 – 16.3	0.1 mi south of Carroll Canyon Rd to 0.4 mi north of Mira Mesa Blvd	Construct Managed Lanes – South Segment	2006 STIP, PIRS/PA&ED
17.3 – 19.1	0.5 mi south of Los Peñasquitos Creek Bridge to 0.4 mi south of SR-56	Construct Southbound Auxiliary Lane	PIRS/PSR

POST MILE	LOCATION	IMPROVEMENT DESCRIPTION	SOURCE/ PHASE
18.8 – 21.9	0.7 mi south of SR-56 to Camino del Norte	Required Mitigation Planting	PIRS/PSE
21.4 – 24.2	0.5 mi south of Camino del Norte to 0.5 mi north of Rancho Bernardo Rd	Construct Freeway and Interchange Improvements	PIRS/PSE
21.9 – 23.9	Camino del Norte to 0.2 mi north of Rancho Bernardo Rd	Required Mitigation Planting	PIRS/PSE
23.9 – 26.2	0.2 mi north of Rancho Bernardo Rd to Lake Hodges Bridge	Required Mitigation Planting	PIRS/PSE
26.0 – 26.7	Pomerado Rd to 0.2 mi south of Via Rancho Pkwy	Bicycle and Pedestrian Bridge	PIRS/PSE
26.1 – 31.8	0.1 mi north of Pomerado Rd/Highland Valley Rd to 0.3 mi north of SR-78	Construct Managed Lanes – North Segment	2006 STIP, PIRS/PSE
26.1 – 31.5	0.1 mi south of Lake Hodges Bridge to SR-78	Required Mitigation Planting	PIRS/PSE
29.1 – 30.8	0.3 mi north of Citracado Pkwy to 0.2 mi north of Valley Pkwy	Construct Lane Additions (North and southbound)	2006 SHOPP, PIRS/PA&ED
51.3 – 54.4	0.3 mi north of Mission Rd to 0.3 mi north of Rainbow Valley Blvd	Strom Water Mitigation	PIRS/PA&ED
51.4 – 54.3	0.4 mi north of Mission Rd to 0.2 mi north of Rainbow Valley Blvd	Construct Infiltration Devices and Bioswales	2006 SHOPP

PSR = Project Study Report
PSE = Plans, Specifications, and Estimates
PA&ED = Project Approval and Environmental Document

Table 20. 2007 Ten Year SHOPP Needs Plan Projects for I-15

POST MILE	LOCATION	IMPROVEMENT DESCRIPTION	CATEGORY/FISCAL YEAR
0.4 – 4.0	Main St to 0.4 mi south of Landis St	Rehabilitate Roadway (PCC pavement grinding)	Roadway Preservation 2011/12
17.8	Los Peñasquitos Creek	Strengthen Bridge	Bridge Preservation 2010/11
31.0 – 43.0	SR-78 to Old Hwy 395	Rehabilitate Roadway (PCC pavement grinding, slab replacement, ramp rehabilitation)	Roadway Preservation 2015/16

POST MILE	LOCATION	IMPROVEMENT DESCRIPTION	CATEGORY/FISCAL YEAR
Various	Various	Upgrade Metal Barrier to Concrete	Collision Reduction 2011/12
Various	Various	Repair/Replace Culverts	Roadway Preservation 2009/10
Various	Various	Install Changeable Message Signs	Mobility 2015/16
Various	Various	Bridge Rail Upgrade, Rehabilitation and Seismic Retrofitting	Bridge Preservation 2010/11, 2015/16

11.0 THE PYRAMID – SYSTEM COMPLETION AND EXPANSION

11.1 *TransNet* Sales Tax for Transportation

Since 1988, *TransNet*, the half-cent sales tax collected in San Diego County for local transportation projects has been instrumental in expanding the transportation system, reducing traffic congestion, and bringing critical transit projects to life.

In November 2004, 67 percent of voters approved a 40 year extension of *TransNet*, which will generate an additional $14 billion for public transit, highway, and local street and road improvements. SANDAG leverages these funds with State and federal resources to improve the region's transportation infrastructure and tackle growing traffic congestion.

During the life of this 40 year extension, major highway projects along Interstates 5, 8, 15, and 805 as well as along State Routes 52, 54, 56, 67, 76, 78, 94, 125, and 905 will receive funding. *TransNet* also will support a robust public transit system. An $850 million environmental mitigation program and a $280 million smart growth incentive program make *TransNet* a truly comprehensive funding mechanism.

Partnering with Caltrans, MTS, and NCTD, SANDAG is advancing several projects. Through the aggressive early action program, a variety of high priority transportation projects have been accelerated to keep San Diego moving. The I-15 Managed Lanes and the BRT service from Escondido to downtown San Diego are part of the Early Action Program (**Figure 22**).

In the ballot measure, a total of $1.4 billion was allocated for various projects in the I-15 CSMP, such as managed lanes, BRT facilities, and HOV-to-HOV connectors. These costs reflect total costs in 2002 dollars, with *TransNet* funds providing 50% of the project costs and the other 50% coming from federal, State, or other sources.

Figure 22. TransNet Early Action Projects

12.0 ENVIRONMENTAL IMPACTS

With the Managed Lanes Project, there would be minimal to no impacts on land use, social and economic conditions, relocation and property acquisition, air quality, historic and archaeological preservation, joint development, wildlife, floodplains, water quality, and hazardous waste.

With the Managed Lanes Project, the following environmental issues would be raised:

12.1 Pedestrian and Bicycle Facilities

At Lake Hodges, both temporary and permanent construction impacts would occur. Replacement of the bridge may result in temporary trail closures to allow equipment movement across the trail and during bridge demolition and reconstruction. A five day closure of this trail would be required during construction. Detours would be required during construction on the bike path located on the east side of I-15 between Erma Road and Scripps Ranch Boulevard. This bike path will remain open during construction. On SR-56 near the I-15 interchange, the existing bike path will be temporarily closed during construction, however, bikes will be permitted to share the traffic lanes. At the Escondido flood control channel undercrossing, the bike and pedestrian path will be maintained during construction.

12.2 Sensitive Noise Receptors

Noise modeling showed that 204 of 384 modeled noise sensitive receivers would approach or exceed the noise abatement criteria as defined in the Caltrans Noise Protocol. Of these sites, eight locations are considered severely impacted and at several receptors abatement is not reasonable. Within the corridor, six noise barriers are considered reasonable, and feasible to construct.

12.3 Air Quality

The Clean Air Act is the comprehensive federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U. S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

As the implementation of the project would involve expenditure of federal funds, it will be necessary to demonstrate project conformance with the State Implementation Plan. The purpose of the Implementation Plan is to attain and maintain the National Ambient Air Quality Standards. Concerning Mobile Source Air Toxics (MSAT), when a NEPA document is required, a determination must be made as to whether the project will meaningfully increase emissions. If so, a qualitative analysis is required. If the project will add substantial capacity to the route and create traffic volumes with an Average Annual Daily Traffic (AADT) projected to be in the range of 140,000 to 150,000 or greater, by the design year, a quantitative analysis is required.

Interstate 15 is located in the San Diego Air Basin. Federal and State standards have been met for lead, nitrogen dioxide, sulfur dioxide, and for inhalable particulates labeled PM_{10} and $PM_{2.5}$.

The San Diego Air Basin is in a federal "maintenance" status with regards to carbon monoxide, and in a non-attainment status for the ozone eight hour standard.

12.4 Water and Wetlands

Both permanent and temporary impacts would occur to wetlands and waters of the U.S. at the five jurisdictional locations in the I-15 corridor. The proposed project would result in approximately 0.16 hectare (1.04 acres) of permanent impacts to wetlands and 0.60 hectare (1.48 acres) of permanent impacts to USACOE jurisdictional wetlands, 0.54 hectare (1.3 acre) of permanent impacts to DFG jurisdictional wetlands, and 0.42 hectare (1.04 acres) of permanent impacts to waters of the United States. A total of 0.64 hectare (1.6 acres) of temporary impacts to USACOE jurisdictional wetlands, 2.1 hectares (5.1 acres) of temporary impacts to DFG jurisdictional areas, and 1.97 hectares (4.9 acres) of temporary impacts to waters of the United States. Since no individual permanent wetland impact exceed the threshold for an individual permit under Section 404 of the Clean Water Act, nationwide permits will be obtained for the proposed work.

12.5 Growth

The project is only one part of the necessary infrastructure required to efficiently support planned and approved growth. The Managed Lanes Project is not expected to induce unplanned growth, as all areas within the corridor have adopted local plans.

12.6 Threatened and Endangered Species

A total of 17.48 hectares (43.2 acres) of coastal sage scrub (CSS) habitat and 15 territories (11 pair, 4 single) of coastal California gnatcatchers would be impacted. This would be a direct loss of habitat likely used by gnatcatchers for breeding, foraging, and shelter.

12.7 Visual

With the proposed project, the suburban and semi-rural character of the I-15 corridor would become noticeably more urban. Generally, this change would affect freeway users more than it would those who view the freeway from adjacent communities. Views from the freeway would be diminished in quality by the increase in size and scale of the freeway. In addition, views to the freeway would also be adversely affected at right-of-way edges and community entrances. Overall changes in character are considered low to moderately high.

12.8 Construction

Noise produced by construction equipment during the proposed project would occur with varying intensities and duration during the eight basic phases of construction. These construction phases would take place over an estimated 13 year period. Because of the different phases of construction, no single location would experience a long term period of construction noise.

During construction, it is proposed to keep the same number of freeway lanes open during heavy demand times. This would be accomplished through the use of temporary concrete barriers and reduced shoulder and/or lane widths. Traffic would be shifted towards the median so outside widening could be completed. Once the outside widening is completed, traffic would be shifted to the outside so construction within the median could occur.

Freeway lanes would be subject to closure during off peak times. Complete freeway closures would generally be scheduled on weekdays between 11:00 pm and 5:00 am and on weekends between 3:00 am and 10:00 am. Freeway detours would be required for night time bridge work and where ramps and bridges are closed.

With the no build alternative, there would be no impacts to sensitive resources. However, runoff from the Lake Hodges Bridge would remain untreated, and existing noise impacts to residents would be unabated.

12.9 Permits and Approvals

The proposed projects will affect waters of the U.S. and waters of the State within project limits. Impacts to "waters" will be identified, and appropriate mitigation will be proposed, in the environmental document. Offsite mitigation will be required. **Table 21** shows the required permits and approvals.

Table 21. Required Approvals for I-15 Managed Lanes

AGENCY	APPROVAL REQUIRED
U.S. Fish and Wildlife Service	Consultation pursuant to Section 7 of the Endangered Species Act (completed)
U.S. Army Corps of Engineers	Nationwide Permit per Section 404 of the Clean Water Act
Regional Water Quality Control Board	Statewide NPDES permit per Section 402 of the Clean Water Act
	Water Quality Certification per Section 401 of the Clean Water Act
CA Department of Fish and Game	1601 Streambed Alteration Agreement per Section 1601 of the CA Fish and Game Code
City of San Diego	Freeway Agreement for DAR
City of Escondido	

12.10 Right of Way

Additional right-of-way will be required for temporary construction easements, grading and drainage easements, retaining wall footing easements, soil-nail and tieback easements, and for noise barriers. A soil-nail easement may be required at Kit Parson Park in Escondido.

Right-of-way associated with the proposed BRT stations at Mira Mesa, Sabre Springs, and Rancho Bernardo will be acquired by SANDAG/MTS as a separate project.

13.0 CORRIDOR MANAGEMENT AGREEMENTS WITH STAKEHOLDERS

The I-15 Corridor will be managed cooperatively through on-going partnerships between Caltrans, SANDAG, MTS, NCTD, CHP, and the Cities of San Diego, Poway, and Escondido.

Cooperative agreements will formalize agency responsibilities and commitments. Two cooperative agreements will be required, one between SANDAG and Caltrans, and one between Caltrans and CHP. The agreements will detail specific operational roles, responsibilities, and requirements for normal as well as incident conditions.

Safety is the highest priority for both motorists and managed lanes operators. Performing traffic breaks required for operations is inherently a dangerous activity. The following needs have been identified to maximize safety:

- Adequate personnel,
- Proper equipment,
- Identification of optimal times for traffic breaks, and
- Thorough understanding of operations by all appropriate parties.

Provisions for enforcement are needed, particularly at entry and exit points. Dedicated resources and specialized equipment to facilitate enforcement should be considered. Clarification of SANDAG reimbursement to CHP for enforcement expenses is also required.

APPENDIX

Aside from the System Management Plan, the I-15 Corridor System Management Plan consists of two other documents:

- The I-15 Managed Lanes Operations (MLOPS) Plan, and
- The I-15 Managed Lanes Traffic Incident Management (TIM) Plan.

The latter two documents were approved by the California Transportation Commission (CTC) in April 2007, allowing the I-15 Middle Segment project to move forward.

I-15 MANAGED LANES OPERATIONS PLAN

October 10, 2006

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Table of Contents

List of Tables

List of Figures

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EXECUTIVE SUMMARY

This document presents the Operations Plan for the I-15 Managed Lanes segments of I-15 in San Diego, California. Managed Lanes are an innovative concept for "managing" traffic service to accommodate peak directional flows. The I-15 Managed Lanes Project will "manage" four lanes in the median to provide a high level of traffic service to users of both the Managed Lanes and the general use/mixed-use lanes. These Managed Lanes will have multiple access points and will operate 24 hours a day, 7 days a week (24/7). The four lanes could be configured to handle typical off-peak conditions where traffic flow is approximately equal in both directions by providing two northbound lanes and two southbound lanes (2N+2S), the morning commute peak period demand with predominant southbound traffic flow by providing one northbound lane and three southbound lanes (1N+3S), or the afternoon peak period demand with predominant northbound traffic flow by providing three northbound lanes and one southbound lane (3N+1S). The Managed Lanes can also be configured outside these daily regular schedule/configurations in response to emergencies or traffic incident situations.

The Operations Plan is one in a series of Technical Memoranda developed as part of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study jointly commissioned by SANDAG and Caltrans. The Technical Memoranda for this study include:

- **Study Goals, Objectives and High-Level Needs -** documents study goals/objectives and summarizes initial high-level needs as provided by the project Stakeholders.
- **Background Information and Best Practices** – synthesizes information from other agencies using moveable barriers and identifies best practices for the San Diego region.
- **Traffic Analysis** – identifies the appropriate timing (year, time of year, and time of day) for implementing various possible Managed Lanes configurations.
- **Operations Plan** (this document) – identifies operational and maintenance strategies for operating the moveable barrier system under various configurations.
- **Traffic Incident Management Plan** – defines agency roles, working relationships and responsibilities along with associated procedures, timeframes, estimates of staffing and equipment requirements to manage traffic incidents and safely mitigate impacts.
- **Intelligent Transportation System (ITS) Strategies Integration –** provides recommendations for integrating the Operations and Traffic Incident Management Plans into existing/on-going regional ITS strategies.

The Operations Plan chapters are presented in Summary and Details format to accommodate a wide range of potential users, including stakeholders, top and middle level management, and field/operations staff. It is recommended that a Field Operations Manual be developed specifically for field and operations staff who will be involved in the day-to-day operations and maintenance of the Managed Lanes.

ES.1 Overview

For construction and funding purposes, the I-15 Managed Lanes project is divided into three segments as shown in **Figure ES-1**.

Figure ES-1. I-15 Managed Lanes Project

- **Middle Segment** – identified as top priority. The Middle Segment is under construction and is estimated to be operational in 2008. This segment will be operated in conjunction with the existing two-lane Reversible HOV operations to the south.
- **North Segment** - estimated to be operational in 2011.
- **South Segment** - estimated to be operational in 2012.

To accommodate peak directional traffic variations, moveable barriers will be installed throughout the entire length of the Middle and South Segments. The moveable barrier system will enable the Managed Lanes to be configured as 2N+2S, 3N+1S or 1N+3S in response to directional traffic flow and major incidents. The North Segment is currently envisioned to have fixed 2N+2S configuration with permanent barriers.

Access to the Managed Lanes will be provided at the north and south termini of operational Managed Lanes segments, at Intermediate Access Points (IAP) and at Direct Access Ramps (DAR) connecting the Managed Lanes to Bus Rapid Transit Centers (BRTC). IAPs are at-grade entrances/exits adjacent to the freeway main lanes, similar to carpool lane access. DARs provide access into the Managed Lanes from grade-separated interchanges. These have been located to enhance HOV and BRT access. Seven (7) northbound and six (6) southbound IAPs as well as five (5) DARs will be provided under the full implementation of the Managed Lanes.

ES.2 Organization and Responsibilities

SANDAG, Caltrans, CHP and other agencies will be responsible for the operations and maintenance of the I-15 Managed Lanes. SANDAG currently operates and manages the I-15 FasTrak Program that allows solo drivers to pay a per trip fee to use the existing Reversible HOV Lanes / Express Lanes. The I-15 FasTrak Program will be expanded to include the Managed Lanes as each segment becomes operational. Different branches of Caltrans, including Traffic Operations/TMC and Maintenance, will be actively involved in the day-to-day operations and maintenance of the Managed Lanes. CHP will provide traffic control assistance during traffic breaks that are required to ensure safe operations during the transition from one Managed Lanes configuration to another. Cooperative agreements between and among these agencies will formalize the agency responsibilities and commitments.

ES.3 Physical and Traffic Guidance Elements

To accommodate the Middle Segment Managed Lanes operations in conjunction with the existing Reversible HOV Lanes operations, physical traffic guidance devices will be installed on the north (Del Lago) and south (Sabre Springs) ends of the Middle Segment to ensure the safe and efficient transition between the four Managed Lanes and two Reversible HOV Lanes. These devices include fixed and moveable barriers, pop-ups, in-pavement lights, gates, Variable Message Signs (VMS) and other appurtenances.

Different configurations can be achieved by moving the moveable barriers using Barrier Transfer Machines (BTM). Both moveable barriers and BTMs will be manufactured by Barrier Systems, Incorporated (BSI). Two BTM machines will initially be acquired in 2007. A third BTM machine is planned to be acquired when the entire Managed Lanes becomes operational in 2012. The BTM machines will be stored initially at a temporary storage facility located under the Sabre Springs DAR. A permanent storage facility is planned to be constructed at Lake Hodges in 2008 and another permanent maintenance facility at Escondido in 2012.

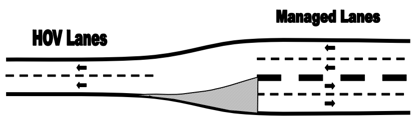
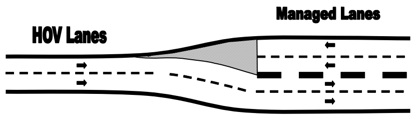
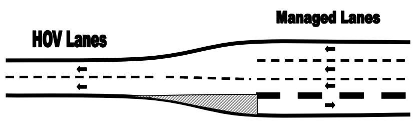
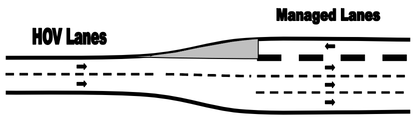
During Middle Segment operations, moveable barriers will consist of a short 480-foot section located at the south end (Sabre Springs), and a long 7.5-mile section covering the entire length of the Middle Segment. When all segments become operational, the South and Middle Segments will have one long continuous stretch of moveable barriers, while the North Segment will have fixed barriers. Once the Middle and South Segments are open, the pop-ups and in-pavement lights at the south end (Sabre Springs) of the Middle Segment will not be required and will be eliminated.

ES.4 Operational Configurations

The four Managed Lanes can be configured to provide two northbound and two southbound lanes (2N+2S), three northbound and one southbound lane (3N+1S), or one northbound and three southbound lanes (1N+3S). In extreme conditions or emergencies, all four Managed Lanes could be dedicated to one traffic flow direction (4N+0S or 0N+4S). The Traffic Analysis will indicate the appropriate timing (year, time of year and time of day) for implementing the different configurations. The Traffic Incident Management Plan will indicate the appropriate configuration to use during emergency or incident situations.

During Middle Segment operations, the four Managed Lanes will be operated in conjunction with the existing two-lane Reversible HOV facility to the south. The Reversible HOV facility is currently operated in the southbound direction during the morning commute peak period, and in the northbound direction at other times of the day and on weekends. Four combinations of Managed Lanes and HOV Lanes configurations, shown in **Figure ES-2**, have been identified for implementation on a regular/daily basis (hereinafter referred to as “standard daily operations”). Other combinations could be implemented if necessary during emergency or incident situations.

Figure ES-2. Managed Lanes Standard Daily Configurations

2N + 2S (AM)	
2N + 2S (PM)	
1N + 3S (AM)	
3N + 1S (PM)	

Note: the letter "N" means "Northbound," the letter "S" means "Southbound," and the numbers indicate the number of lanes in that direction. For example, 2N+2S means two northbound lanes and two southbound lanes, and 3N+1S means three northbound lanes and one southbound lane. 2N+2S (AM) refers to 2N+2S configuration for the Managed Lanes with the HOV Lanes in the southbound direction during the AM commute hours, while 2N+2S (PM) refers to the same general configuration on the Managed Lanes with the HOV Lanes in the northbound direction during the PM commute hours.

ES.5 Operational Scenarios and Procedures

Table ES-1 shows the twelve possible combinations of configuring the four Managed Lanes and the two Reversible HOV Lanes. Four of these combinations, identified as "Standard Daily Operations," are expected to be used on a regular/daily basis. The other combinations, identified as "Incident Management," will be related to incident management scenarios. Operational procedures involved in changing from one configuration to another under Standard Daily Operations are presented in this document. Procedures associated with Incident Management configurations will be presented in the Traffic Incident Management Plan.

When procedures involve closing of active Managed Lanes, CHP traffic breaks are required to effect a safe and efficient transition from one configuration to another. A traffic break involves CHP patrol vehicles traveling at 35 mph to slow down Managed Lanes traffic following behind, but allows vehicles ahead to travel at higher speeds to clear the Managed Lanes. This in turn would allow moveable barrier transfer operations within the clear area. When barrier transfer operations are completed and appropriate traffic guidance elements (pop-ups, in-pavement lights, VMS) are in place, CHP will exit the Managed Lanes to allow traffic to resume normal freeway speeds.

Table ES-1. Operational Scenarios between Managed Lanes (ML) and Reversible HOV Lanes (RL)

ML	RL	→	ML	RL	Type
		Change To	2N+2S (PM)	2N	Standard Daily Operations
2N+2S (AM)	2S	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management

		Change To	2N+2S (AM)	2S	Standard Daily Operations
2N+2S (PM)	2N	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management
		Change To	1N+3S (AM)	2S	Standard Daily Operations
3N+1S (PM)	2N	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Standard Daily Operations
1N+3S (AM)	2S	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management

ES.6 Manpower and Equipment Requirements

The operation, control and maintenance of the Middle Segment Managed Lanes in conjunction with the existing Reversible HOV Lanes will require significant increased effort from Caltrans Maintenance Division and Traffic Operations Division, as well as the CHP. In addition to the normal roadway maintenance for pavement, structure, landscape, signage, etc., extra effort will be needed to maintain and operate the Managed Lanes field elements (e.g., pop-ups, in-pavement lights, gates, variable message signs (VMS), etc.), the 8 miles of movable barrier, the barrier transfer machines and the control system itself – all critical to ensuring the integrity of the Managed Lanes operations, the safety of the traveling public, and the safety of Caltrans Maintenance workers. For both Caltrans Maintenance and Traffic Operations staff as well as CHP personnel, appropriate training will be essential for successful operation of the new system.

Caltrans Traffic Operations estimated a total of 5.0 additional PYs for the I-15 Managed Lanes operations, to be divided among the following: TMC – 1.25 PYs; Electrical Systems – 3.5 PYs; and, Ramp Metering/Systems – 0.25 PY. **Tables ES-2** to **ES-4** summarize Caltrans Maintenance resource, facility and equipment requirements. **Table ES-5** summarizes CHP resource requirements.

Table ES-2. Caltrans Maintenance Program – Resource Requirements (2006 Dollars)

Phase*	Miles of Moveable Barrier	Opening Day	PYs Regular	PYs Overtime	Annual Operating Expense (excluding equipment)	Annual Total
1	5.6	January 2008	16	5	$ 1.3 M	$ 2.7 M
2	8	January 2009	21	5	$ 1.7 M	$ 3.5 M
3	15	January 2013	30	7	$ 2.4 M	$ 5.1 M

Table ES-3. Caltrans Maintenance Program - One-Time Facility Costs (2006 Dollars)

Phase*	Temporary Sabre Springs	Modular Escondido	Permanent Lake Hodges	Permanent Escondido
1	$ 300,000	$ 500,000		

2	$ 50,000 to remove		$ 2,500,000	
3				$ 2,000,000

*NOTE: Phase 1 – Middle Segment Interim Opening; Phase 2 – Middle Segment Final Opening; Phase 3 – Integration with North and South Segments.

Table ES-4. Caltrans Maintenance Program - One-Time Equipment Costs (2006 Dollars)

Equipment	Quantity	Cost	Capital Cost
Barrier Transfer Machine @ $1.5M	2		$3,000,000
16-ton tow truck	1	$ 130,000	
2-ton towable forklift	1	$ 66,500	
15-ft cargo body truck	1	$ 75,000	
Solar (trailer) LED CMS + arrow board	1	$ 15,000	
Solar CMS sign + truck	1	$ 66,630	
Cone truck	1	$ 60,000	
½-ton pickup truck w/CMS @ $50,000	2	$ 100,000	
Street sweeper @ $200,000	2	$ 400,000	
Balsi Beam + tractor	1	$ 300,000	
Electrical Hoist	1	$ 75,000	
4-yd w/ CMS and crash cushion	3	$ 300,000	
High Lift Truck	1	$ 100,000	
Snooper Type Truck	1	$ 250,000	
Mechanic's truck	1	$ 50,000	
Total	**20**	**$ 1,988,130**	**$3,000,000**

Table ES-5. CHP Resource Requirements (2006 Dollars)

Operation	Number units needed	Number of hours billed per day	Number of miles billed per day	Cost per day (hours and miles)	Cost per year (hours and miles)	Cost with 10% cushion
2/2 Operations	1	4	75	$311.28	$80,933	$89,026
3/1 Operations	2	8	200	$658.56	$171,226	$188,349
3/1 Operations	3 units (2 to run break)	12	300	$978.84	$254,498	$279,947

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1.0 INTRODUCTION

The Operations Plan provides the basic traffic operations procedures and guidelines for the Middle Segment opening (2007/2008) of the I-15 Managed Lanes in coordination with the existing I-15 Reversible High Occupancy Vehicle (HOV) Lanes. This is considered an interim step prior to the completion of the full Managed Lanes including the South and North Segments. As with any new implementation of an innovative traffic operations concept such as the Managed Lanes, the Operations Plan will allow Transportation Management Center (TMC) operators, maintenance staff, and California Highway Patrol (CHP) to modify the procedures as appropriate to adjust to the flow of traffic and the conditions encountered in the field. They will be able to refine the procedures based on their observations of what works best.

The Operations Plan discusses activities anticipated during standard daily operations of the Managed Lanes. Operations during major incidents or emergencies are covered under a separate document (Traffic Incident Management Plan).

It is anticipated that the Managed Lanes will operate twenty four hours, seven days a week (24/7), requiring additional staffing in the field, at Caltrans TMC, and with CHP when they are required for traffic breaks or enforcement. A summary of these activities and the need for additional personnel and equipment are discussed in this Operations Plan.

1.1 Organization of the Operations Plan

The Operations Plan discusses various aspects of the Managed Lanes operations. Each aspect is presented in two levels of detail – Summary and Details – to accommodate the needs of different agencies and individuals who are expected to use this Operations Plan. The Appendices provides supplementary information regarding the components of the Managed Lanes system.

- Executive Summary
- Section 1 – Introduction
- Section 2 – Background
- Section 3 – Organization and Coordination – Summary
- Section 4 – Organization and Coordination – Details
- Section 5 – Physical and Traffic Guidance Elements – Summary
- Section 6 – Physical and Traffic Guidance Elements – Details
- Section 7 – Operational Configurations – Summary
- Section 8 – Operational Configurations – Details
- Section 9 – Operational Scenarios –Summary
- Section 10 – Operational Scenarios – Details
- Section 11 – Manpower and Equipment Requirements – Summary
- Section 12 – Manpower and Equipment Requirements – Details
- Section 13 – Other Topics

1.2 Relationship of the Operations Plan to Other Technical Memoranda

The Operations Plan is one in a series of Technical Memoranda developed as part of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study jointly commissioned by SANDAG and Caltrans. The Technical Memoranda series include:

- **Study Goals, Objectives and High-Level Needs** – identifies study goals, objectives and needs that serve as the basis for development of subsequent study tasks.
- **Background Information and Best Practices** – synthesizes information from other agencies using moveable barriers and identifies best practices for the San Diego region.
- **Traffic Analysis** – identifies the appropriate timing (year, time of year, and time of day) for implementing various possible Managed Lanes configurations.
- **Operations Plan** (this report) – identifies operational and maintenance strategies for operating the moveable barrier system under various configurations.
- **Traffic Incident Management Plan** – defines agency roles, working relationship and responsibilities along with associated procedures, timeframes and estimates of staffing requirements to handle traffic incident situations.
- **ITS Strategies Recommendations** – provides recommendations for integrating the Operations Plan and Traffic Incident Management Plan into ongoing Intelligent Transportation Systems strategies/plans.

It is recommended that a **Field Operations Manual** be developed specifically for field and operations staff who will be involved in the day-to-day operations and maintenance of the Managed Lanes.

1.3 Intended Users of the Operations Plan

The primary users of this Operations Plan are the staff from SANDAG, Caltrans and CHP who will be directly involved in the day-to-day operations of the Managed Lanes, particularly in changing the Managed Lanes configuration to accommodate the directional variation in I-15 traffic during the regular/daily AM and PM peak periods.

Other users include top-level management / decision makers / stakeholders as well as mid-level management who need to make informed decisions about the Managed Lanes implementation and operations.

1.4 How to Use the Operations Plan

As discussed previously in Section 1.1, the Operations Plan is organized by presenting various aspects of the Managed Lanes operations in different levels of detail, from high level summary overviews, to detailed step-by-step operational sequences, to more detailed specifications contained in the Appendices.

Table 1-1 shows the recommended reading paths for different users. The Executive Summary and Introduction provides an overview of the Operations Plan and are recommended to be read by all users. Top level decision makers and stakeholders wishing more information may want to read the "Summary" sections for an overview of the specific topic. All "Summary" sections are recommended "Must Read" for mid-level management and Field/TMC personnel. Mid-level management may also need to read the "Details" section of topics related to their work. The "Details" sections were written primarily for Field/TMC personnel who will be involved in day-to-day operations.

Table 1-1. Operations Plan Reading Guide

Section	Title	Decision Makers and Stakeholders	Mid-Level Management	Field/TMC Personnel
	Executive Summary			
1	Introduction			
2	Background			
3	Organization and Responsibilities – Summary			
4	Organization and Responsibilities – Details			
5	Physical and Traffic Guidance Elements – Summary			
6	Physical and Traffic Guidance Elements – Details			
7	Operational Configurations – Summary			
8	Operational Configurations – Details			
9	Operational Scenarios and Procedures–Summary			
10	Operational Scenarios and Procedures – Details			
11	Manpower and Equipment Requirements – Summary			
12	Manpower and Equipment Requirements – Details			
13	Other Topics			
	Appendices			

Legend:

	Must Read
	Background Information
	Optional Reading

1.5 Updating the Operations Plan

1.5.1 Responsibility for Maintaining and Updating the Operations Plan

It is recognized that the I-15 ML Operations Plan will require updating occasionally as operational conditions and organization policies change. It is recommended that the responsibility for updating the operations plan be assigned to the Traffic Operations Division, specifically the TMC Branch with support from the Electrical and Systems Branches, and the Maintenance Division. Others to be included are SANDAG and the CHP, if needed.

1.5.2 Procedure for Updating the Operations Plan

The following is a recommended set of procedures for updating the Operations Plan:

- Identify part of the plan requiring update.
- Request TMC Branch to initiate Operations Plan Update Meeting.
- TMC Branch contacts all other parties and arranges a meeting to discuss proposed update.
- TMC Branch documents meeting and consensus to update.

- TMC Branch informs Executive Staff of consensus to update, and solicits concurrence with proposed update.
- TMC Branch develops draft Operations Plan update and circulates to all parties for review and comment.
- TMC Branch incorporates review comments and reconciles discrepancies.
- TMC Branch forwards updated Operations Plan to all parties .

1.6 Sources of Materials

This Operations Plan used materials from the following related I-15 Managed Lanes reports prepared by Caltrans Staff and others:

- Caltrans District 11 Traffic Operations – Advanced Transportation Systems Engineering Branch, *Operations/Resource Requirements Report for I-15 Managed Lanes Middle Segment Opening*, July 2006.

- Caltrans District 11 Maintenance Staff, *Maintenance Operations on I-15 Managed Lanes Facility Opening Spring 2007*, May 2006.

- Caltrans District 11 Maintenance Staff, *Draft 2006/07 Budget Change Proposal – Managed Traffic Lanes*, December 2005.

- Caltrans District 11, *I-15 Managed Lanes Middle Segment Barrier Transfer Machine and Traffic Elements Information*, no date.

- Caltrans District 11, *Interstate 15 Draft Project Report*, October 2002.

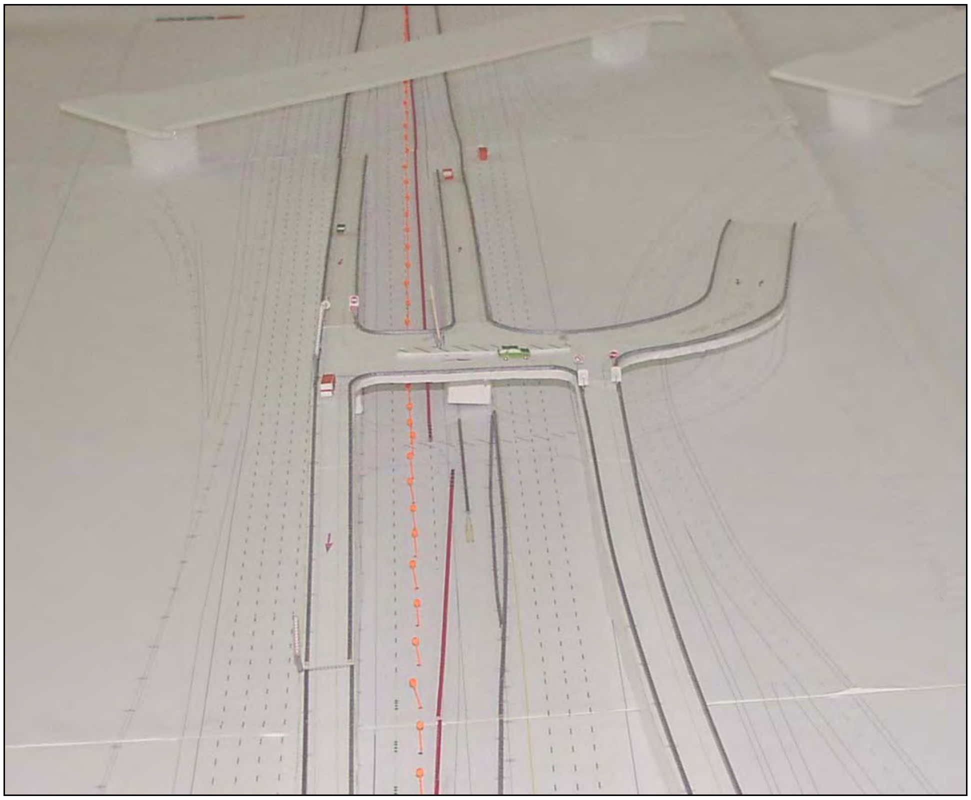
- Barrier Systems Inc., various *Technical Briefs* regarding moveable barriers, Barrier Transfer Machines, and related topics.

1.7 3-D Model

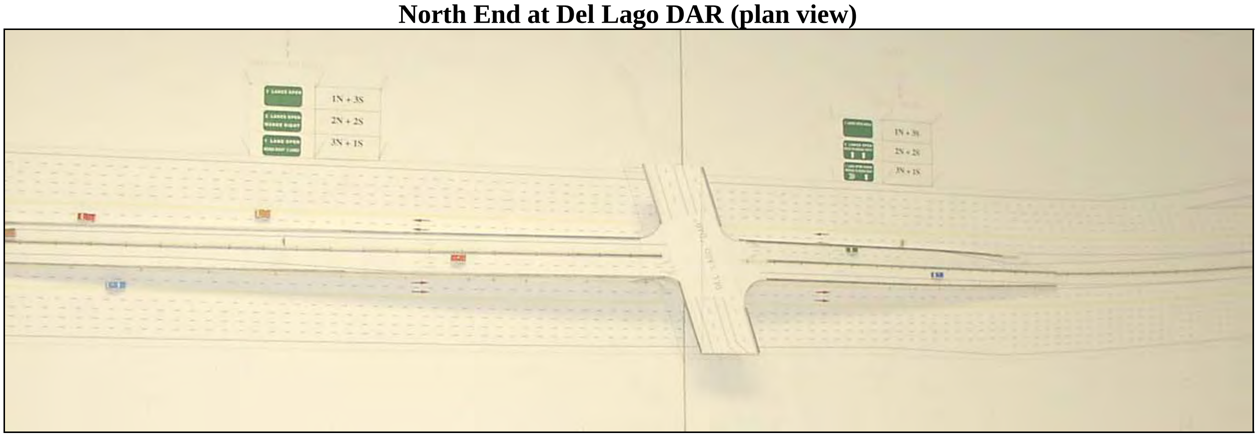
To facilitate the visualization and analysis of the operational scenarios, Caltrans District 11 Advanced Transportation Systems Engineering Branch of Traffic Operations developed a 3-dimensional scale model that depicts various Managed Lanes configurations (**Figure 1-1**). A 3-D computer animation is envisioned to be developed for use in training as well as public information.

Figure 1-1. Caltrans Managed Lanes 3-D Scale Model Photos

South End at Sabre Springs DAR (looking north)



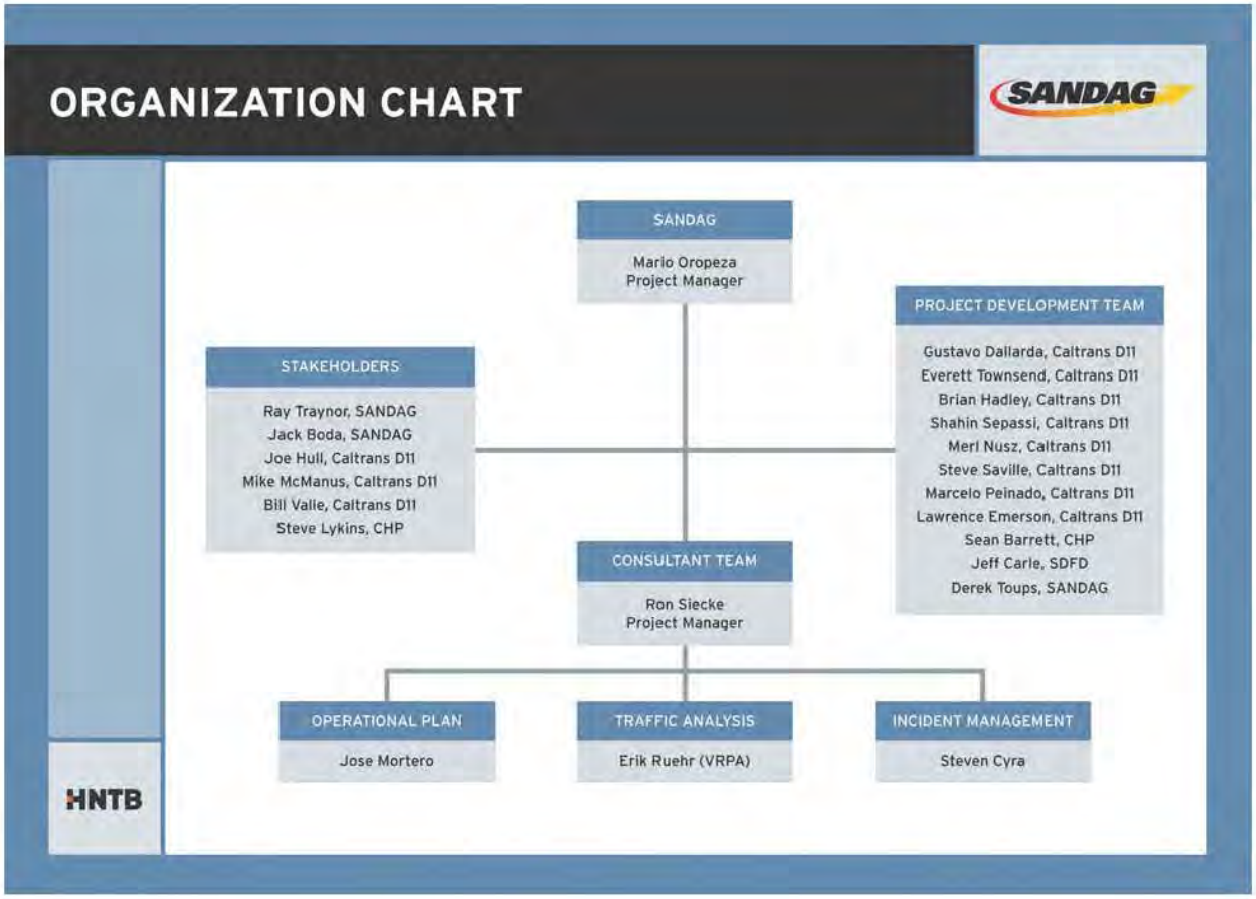
North End at Del Lago DAR (plan view)



1.8 Acknowledgments

This document was prepared with valuable inputs and comments from various agencies and individuals, particularly the representatives of Stakeholder agencies and the members of the Project Development Team (PDT), as shown in the project organizational chart in **Figure 1-3**. Other individuals not included in the chart also provided invaluable insights and materials during the various workshops conducted as part of the study.

Figure 1-3. Project Organization Chart


ORGANIZATION CHART
SANDAG
SANDAG
Mario Oropeza
Project Manager
PROJECT DEVELOPMENT TEAM
Gustavo Dallarda, Caltrans D11
Everett Townsend, Caltrans D11
Brian Hadley, Caltrans D11
Shahin Sepassi, Caltrans D11
Meri Nusz, Caltrans D11
Steve Saville, Caltrans D11
Marcelo Peinado, Caltrans D11
Lawrence Emerson, Caltrans D11
Sean Barrett, CHP
Jeff Carle, SDFD
Derek Toups, SANDAG
STAKEHOLDERS
Ray Traynor, SANDAG
Jack Boda, SANDAG
Joe Hull, Caltrans D11
Mike McManus, Caltrans D11
Bill Valle, Caltrans D11
Steve Lykins, CHP
CONSULTANT TEAM
Ron Siecke
Project Manager
OPERATIONAL PLAN
Jose Mortero
TRAFFIC ANALYSIS
Erik Ruehr (VRPA)
INCIDENT MANAGEMENT
Steven Cyra
HNTB

2.0 BACKGROUND

2.1 Managed Lanes Concept and Vision

The I-15 Managed Lanes Project (**Figure 2-1**) introduces an innovative concept for "managing" traffic service to accommodate peak directional flows, and incorporates a reliable Bus Rapid Transit (BRT) System. This system provides incentives for carpooling, and additional opportunities for single occupant vehicles that will help reduce congestion on general purpose lanes.

Figure 2-1. The I-15 Managed Lanes Project

The improvements to I-15 are consistent with the region's desire to accommodate "smart growth." The "smart growth" strategy emphasizes compact, efficient, and environmentally sensitive development. It focuses future growth away from rural areas and connects housing with jobs, services, and transportation. The I-15 corridor is experiencing some of the region's greatest growth and is expected to continue to do so.

2.1.1 Managed Lanes

The I-15 Managed Lanes Project has several components that make the project challenging. The ability to "manage" capacity (by using a moveable barrier system) and the ability to "manage" the type of traffic users on the facility (buses, carpools and as capacity allows, single occupant vehicles) have never been accomplished before in California. The current FasTrak program administered by the San Diego Association of Governments (SANDAG) has been successful in "managing" the types of traffic users on the existing reversible lanes without degrading the level of service for all users.

The I-15 Managed Lanes Project will "manage" four lanes in the median to provide a high level of traffic service to users of both the Managed Lanes and the general purpose / mixed-use lanes. These Managed Lanes will have multiple access points and will operate 24 hours per day, 7 days a week (24/7). The lanes could be configured to handle typical off-peak conditions where traffic flow is approximately equal in both directions by providing two northbound lanes and two southbound lanes (2N+2S), the morning peak period demand with predominant southbound traffic flow by providing one northbound lane and three southbound lanes (1N+3S), or the afternoon peak period demand with predominant northbound traffic flow by providing three northbound lanes and one southbound lane (3N+1S). In extreme cases during severe traffic incidents or emergencies, the Managed Lanes could be configured for all lanes to operate in one direction only (4N+0S or 0N+4S).

2.1.2 Bus Rapid Transit Centers (BRTC) and Direct Access Ramps (DAR)

The region has also developed a Regional Transit Vision, which envisions many more trips to be made on the transit system and allows for more express and direct types of service. The I-15 Managed Lanes Project accommodates a BRT System that includes five direct access ramps (DAR) from the Managed Lanes to bus rapid transit centers (BRTC) placed in communities near the freeway (see sample photo simulation in **Figure 2-3**). The I-15 Managed Lanes Project is a prototype project for this Regional Transit Vision.

Figure 2-3. Proposed Rancho Bernardo BRTC and DAR

2.2 Managed Lanes Project History

In the early 1990's, I-15 began to experience congestion. Now, I-15 has severe congestion problems affecting commuters, businesses, and regional goods movers. In 1999, the Average Daily Traffic (ADT) on the corridor at various locations ranged from 190,000 to 290,000 vehicles per day, with daily commute delays ranging from 30 to 45 minutes. In addition, due to a lack of adjacent parallel routes, I-15 is subject to additional delays during rainy days, incidents, or special events. By the year 2020, volumes are expected to approach 380,000 ADT, with commute delays ranging from 80 to 90 minutes within the project limits. Additional queues would extend far outside the project limits if no transportation improvements were implemented.

The I-15 corridor was identified in the San Diego Association of Government (SANDAG) 1994 Regional Transportation Plan (RTP) as a future congested corridor that needed further study to identify possible solutions. Prior to the current RTP, the I-15 project was described in the plan as "add 2 HOV lanes"(one in each direction) from SR-56 to SR-78. The Regional HOV System Plan has also identified this project.

The Metropolitan Transit Development Board (MTDB) began its I-15 corridor study in 1995 to look at transit, highway, and regional arterial improvements that might be required. In November 1998, MTDB issued a final Phase 2 Report for the North I-15 Corridor. This study met the requirements for a Major Investment Study as SANDAG, North County Transit District (NCTD), Caltrans and MTDB worked cooperatively to identify, develop and analyze alternatives. In addition to the agencies, the public and community groups had many opportunities to participate.

The Phase 2 Report recommended HOV/ Managed Lanes in the median of I-15 with a High-Speed Bus Rapid Transit System. It did not recommend any corridors on new alignment for transit or highways.

Caltrans approved a Project Study Report (PSR) in September 1998 that followed closely the alternatives developed in the North I-15, Phase 2 Report mentioned above. The development of the Project Report (PR) and environmental studies began immediately after the PSR was approved. The PR was completed and approved in February 2003. A Mitigated Negative Declaration (MND) and Finding of No Significant Impact (FONSI) were approved in March 2003. The Middle Segment is currently under construction and is expected to open in 2007/2008.

2.3 Existing Facility

I-15 extends from I-5 in southern San Diego County near the Mexican border to the Canadian border. Within the Managed Lanes project area, I-15 is an eight- to ten-lane freeway with auxiliary/added lanes at various locations within the project limits. I-15 lies within the Cities of San Diego and Escondido and bisects a military base, the Marine Corps Air Station - Miramar. It was constructed in the late 1970's and early 1980's. The main lanes are 3.6 meters (12 feet) wide and composed of Portland Cement Concrete (PCC) pavement. The shoulders are a minimum of 3.0 meters (10 feet) and composed of an Asphalt Concrete (AC) structural section.

The median varies but can be described in three segments. 1) From SR-163 to SR-56, the median includes an existing Reversible HOV Lane Facility. This facility is comprised of two 3.6-meter PCC lanes used by vehicles and a 3.0-meter AC shoulder on each side. A concrete barrier separates the main lane inside shoulder from the Reversible HOV lane shoulder on each side. Therefore, the minimum median width is about 21 meters. 2) From SR-56 to Duenda Road Overcrossing, the median is mostly unpaved. The northbound and southbound roadways often have independent profiles thereby creating a median slope. The minimum median width is about 21 meters (70 feet). 3) From Duenda Road Overcrossing to SR-78, the median width is about 14 meters (46 feet). Oleanders are planted in the median between Del Lago Boulevard Overcrossing and SR-78.

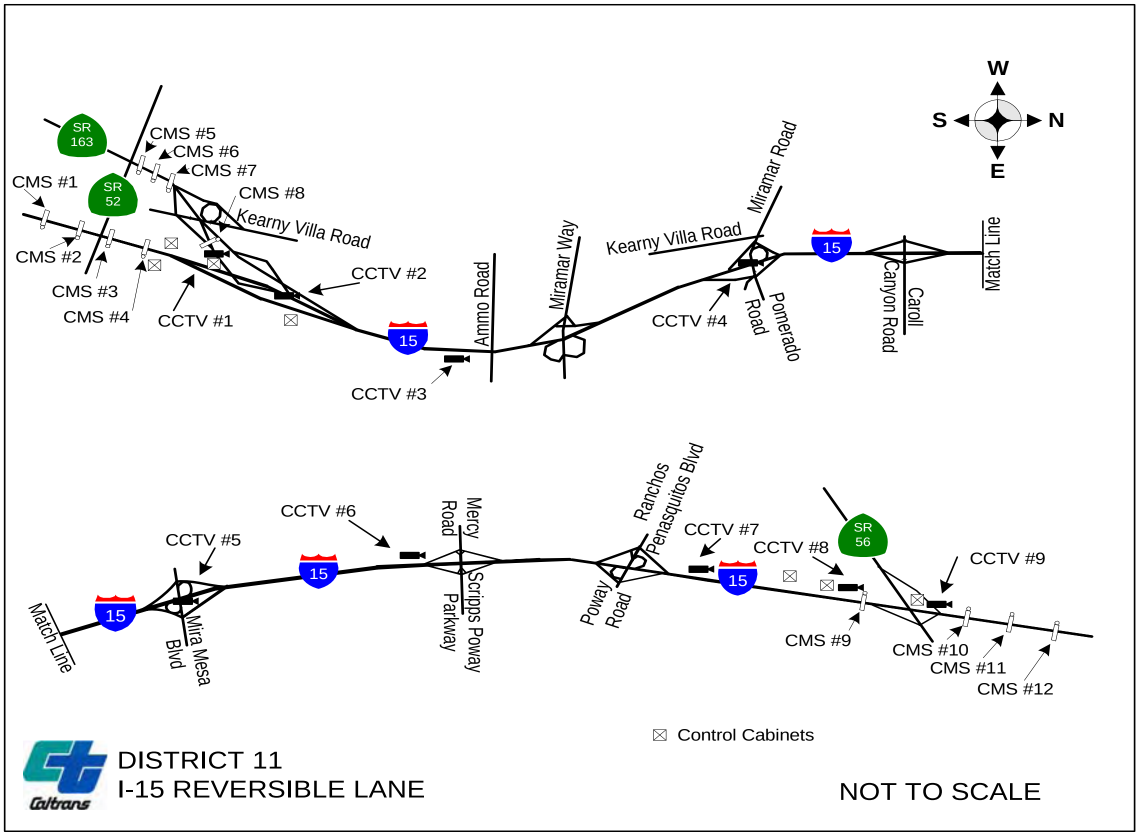
The Reversible HOV Lane Facility (**Figure 2-5**) was constructed in the median of I-15 between SR-163 and SR-56 and was opened to traffic on October 20, 1988. The Reversible HOV Lane Facility is separated from the main general purpose lanes by median barriers. The Reversible HOV Lanes now carry about 17,950 ADT (13,640 HOV and 4,310 FasTrak) in December 2005. The hours of operation for these express lanes originally extend only about 3 hours for the southbound morning commute and about 3 hours for the northbound evening commute. These daily Monday-Friday operation hours were later extended due to congestion and public demand to approximately 5:45 a.m. to 11:00 a.m. in the southbound direction and 12:00 p.m. to 7:00 p.m. in the northbound direction.

Several years later after extending the morning and evening hours, opening of the Reversible HOV Lanes on weekends was considered as well. Because the directional split of traffic demand on weekends was not significantly different, and to save operational cost of opening and closing both direction on Saturdays and Sundays, the Reversible HOV Lanes were tested and left open in the southbound direction on weekends for approximately three months and then in the northbound direction for three months. Based on the observed results, it was decided to leave the

Reversible HOV Lanes open in the northbound direction for the weekend (Friday evening through Sunday evening) and go back to the daily reversal on Monday morning, starting with the southbound morning commute.

SANDAG began the FasTrak program in 1998 that allows single occupant vehicles (SOVs) to use the Reversible HOV Lanes for a fee. Currently about 25% of the vehicles on these lanes are Fastrak customers.

Figure 2-5. Existing I-15 Reversible HOV Lane Facility



2.4 Managed Lanes Segments

For construction and funding purposes, the entire length of the I-15 Managed Lanes is divided into three segments, as shown in **Figure 2-7**.

2.4.1 Middle Segment

The Middle Segment, in the Cities of San Diego and Escondido, begins 1.0 km south of SR-56 to 0.4 km north of Del Lago Boulevard/North County Fair overcrossing. This segment is the first priority and is currently under construction.

2.4.2 South Segment

The South Segment, in the City of San Diego, begins 2.4 km south of SR-163 to 0.2 km south of SR-56. This segment will include the construction of the SB on-ramp from the Saber Springs DAR and the Hillery Drive DAR. The schedule depends on funding availability; however, construction is expected to start between 2008 and 2010.

2.4.3 North Segment

The North Segment, in the City of Escondido, begins at Del Lago Boulevard to 0.5 km north of SR-78. This segment will include the construction of the Del Lago Boulevard / North County Fair DAR northern ramps and the Hale Avenue DAR. The schedule depends on funding availability; however, construction is expected to start between 2008 and 2010.

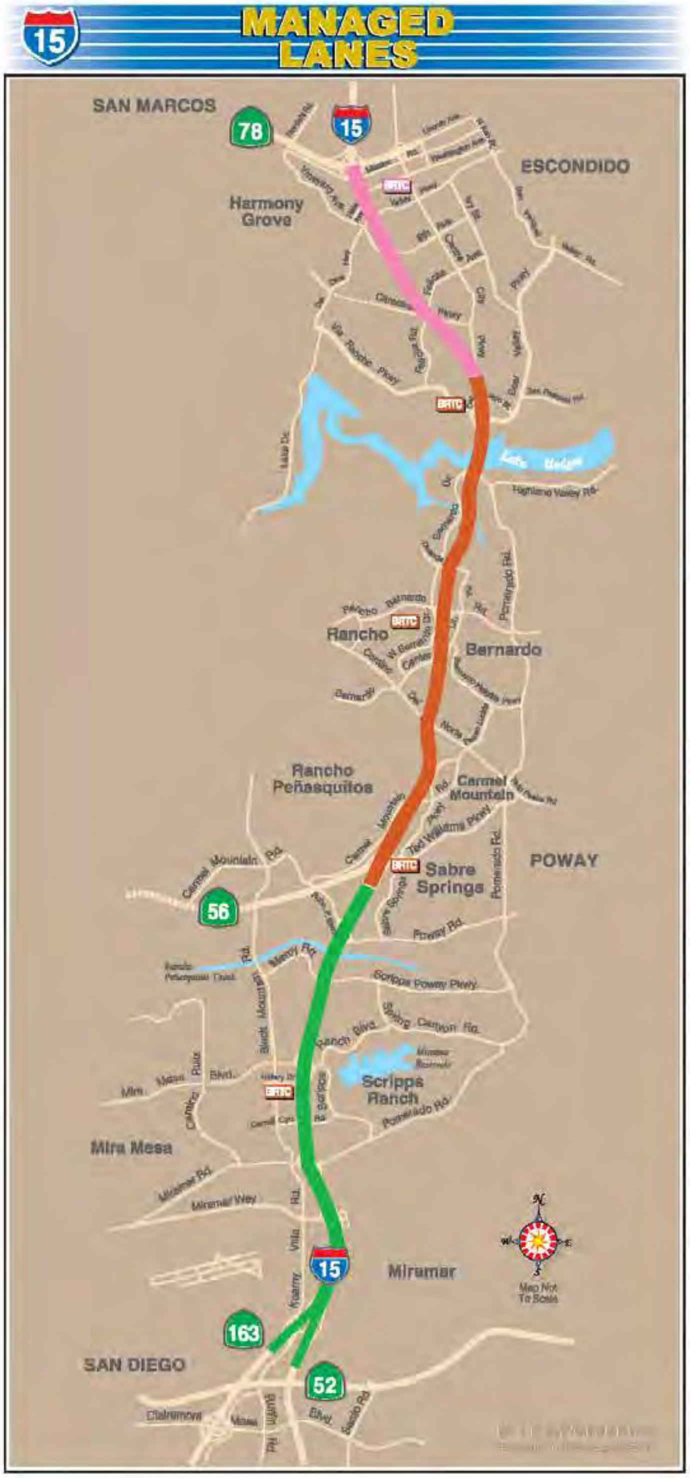
2.5 Managed Lanes Access Points

Two types of access into and out of the Managed Lanes will be provided - Intermediate Access Points (IAP) and Direct Access Ramps (DAR).

2.5.1 Intermediate Access Points

Intermediate Access Points (IAP) are at-grade entrances/exits adjacent to the freeway main lanes (similar to carpool lane access). Traffic will exit the Managed Lanes and enter a weaving lane of approximately 300 to 600 meters in length, depending on traffic volumes. Managed Lanes traffic will then weave into the number 1 (leftmost) freeway main lane. Traffic entering the Managed Lanes will weave into the weaving lane from the leftmost freeway main lane and then weave into the Managed Lanes. There are three (3) northbound and two (2) southbound IAPs for the Middle Segment, as shown in **Figure 2-9**. When all Managed Lanes segments become operational, seven (7) northbound and six (6) southbound IAPs will be available, as shown in **Figure 2-12**.

Figure 2-7. I-15 Managed Lanes Segments



District 11

NCTD

MTS Metropolitan Transit System

LEGEND

(Million$)

Segment	*Description*	*Cost*	*Funding*	*Constr.*
North Freeway	Centre City Pkwy to SR-78	$188	$30	2008-2011
Middle Freeway	SR-56 to Centre City Pkwy	$427	TRANSNET TCRP STIP-IIP STIP-RIP SHOPP RSTP CMAQ GARVEE-RIP GARVEE-IIP DEMO	2003-2007/2008
South Freeway	SR-163 to SR-56	$346	$62	2008-2012
Transit	Escondido to Downtown	$161	$118	2007-2012

NOTES

1. Project Report approved 2-13-03
2. Mitigated Negative Declaration (MND) & Finding of No Significatn Impact (FONSI) approved 3-27-03
3. Transit includes direct access ramps for north and south segments.

January 2006

Figure 2-9. Middle Segment Intermediate Access Points and Direct Access Ramps

Figure 2-12. I-15 Managed Lanes – Lane Configuration Summary

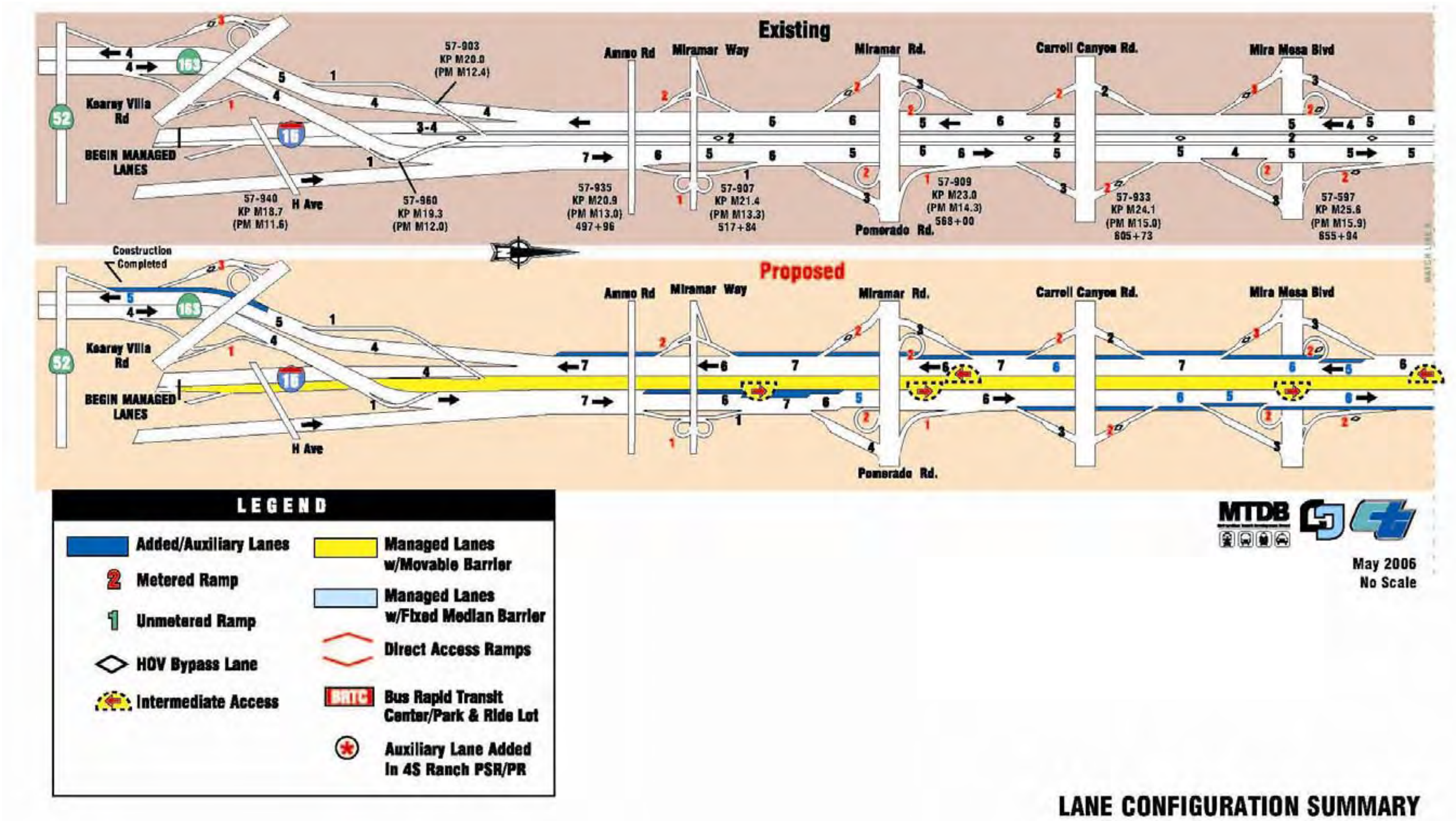


Figure 2-6 . I-15 Managed Lanes – Lane Configuration Summary (2 of 4)

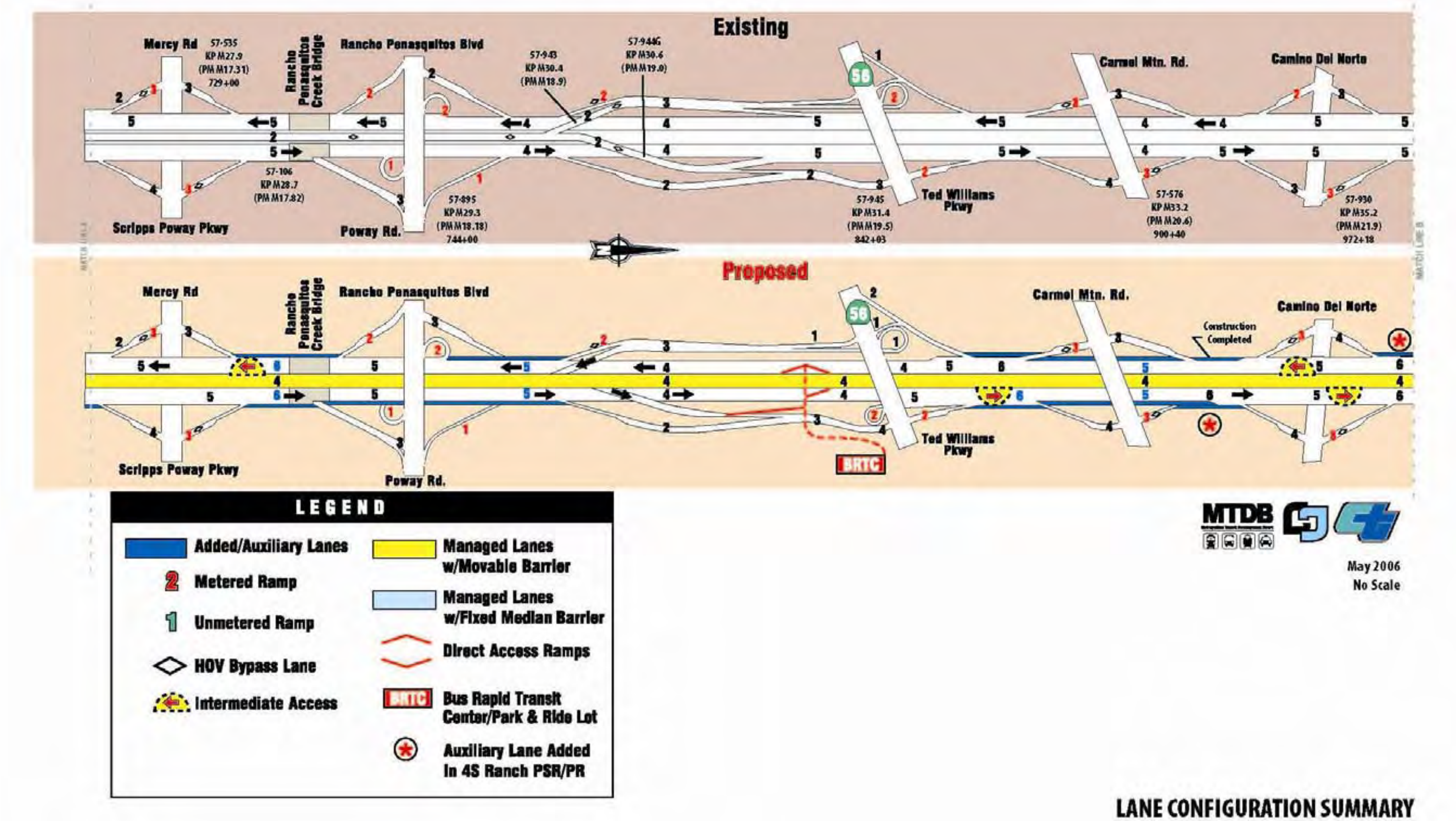


Figure 2-6 . I-15 Managed Lanes – Lane Configuration Summary (3 of 4)

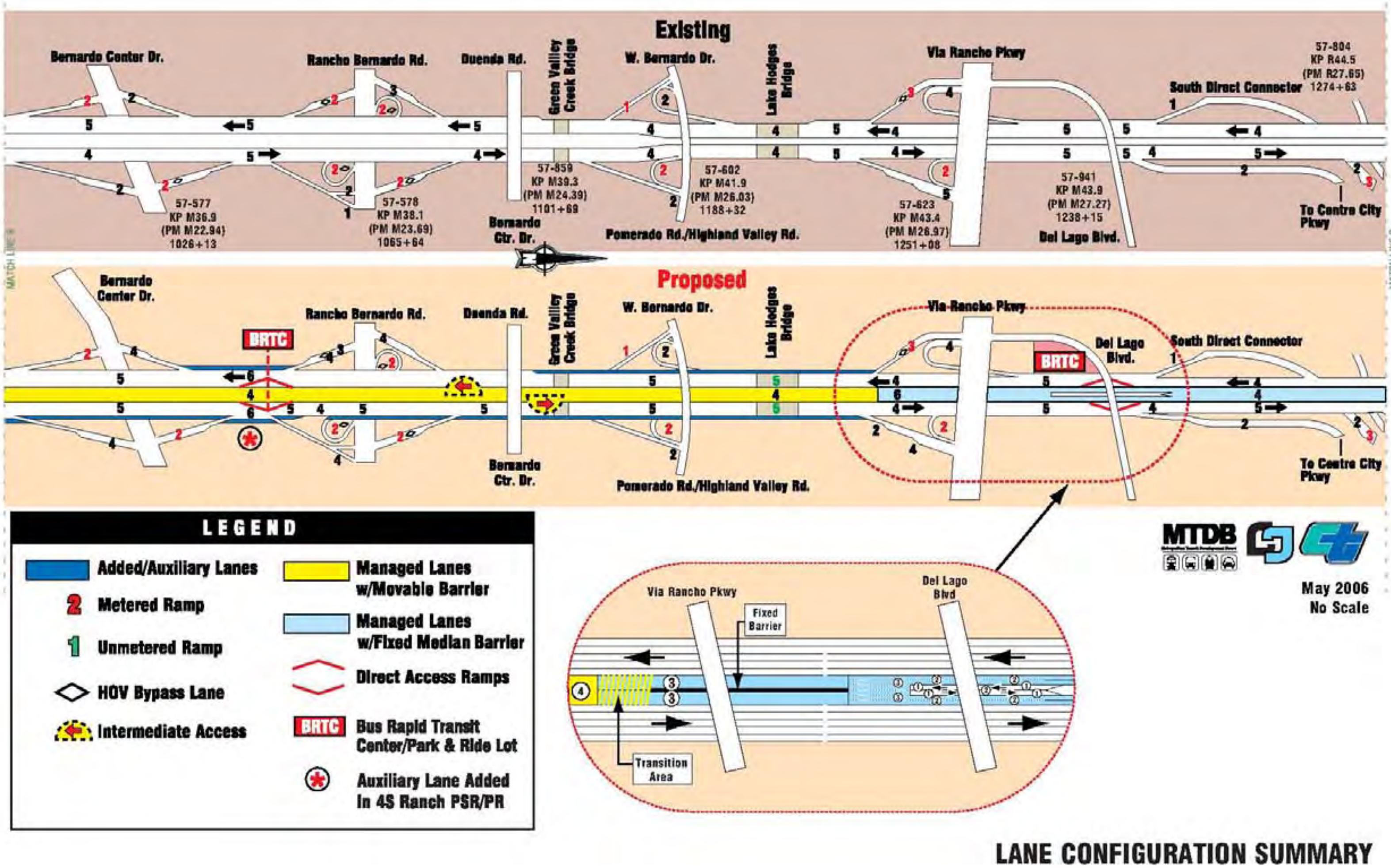
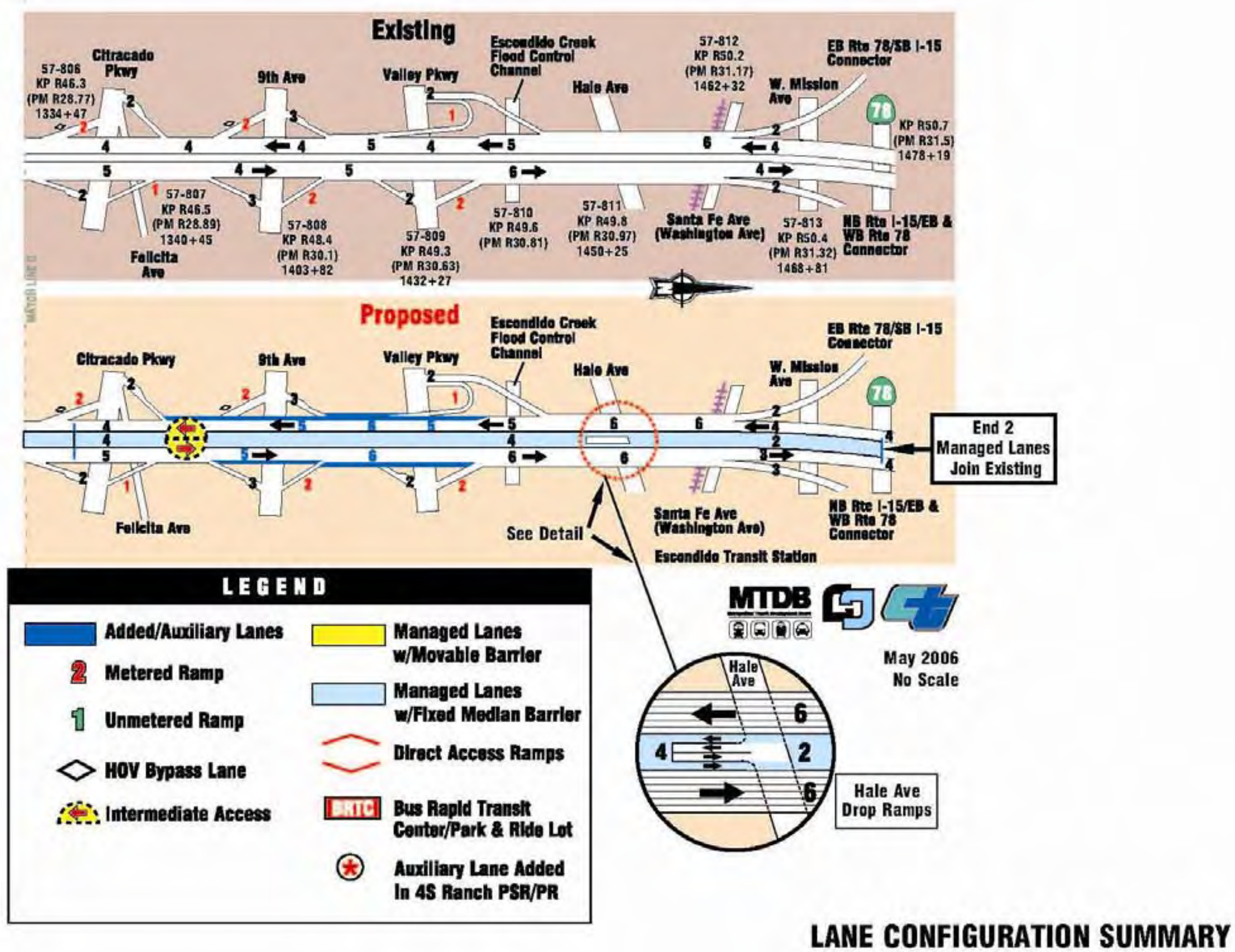


Figure 2-6 . I-15 Managed Lanes – Lane Configuration Summary (4 of 4)



2.5.2 Direct Access Ramps (DAR)

The other type of access is a Direct Access Ramp (DAR) to/from the Managed Lanes from a grade-separated interchange. These have been located to enhance HOV and Bus Rapid Transit (BRT) access. The DARs are required to implement the BRT System and will encourage carpool usage. There are three (3) DARs planned to serve the three Bus Rapid Transit Centers (BRTC) envisioned when the Middle Segment becomes operational:

- Sabre Springs DAR / BRTC
- Rancho Bernardo DAR / BRTC (see **Figure 2-13** for a simulated photo)
- Del Lago DAR / BRTC

The full implementation of the BRT System will include the following additional DARs/BRTCs:

- Escondido DAR / BRTC
- Mira Mesa DAR / BRTC

Figure 2-13. Rancho Bernardo BRTC and DAR (Simulated Photo)

2.6 Managed Lanes Cross Section

The typical cross section for the Managed Lanes will include standard PCC lanes and PCC shoulders (some exceptions to match existing AC shoulders). The Managed Lanes will be separated from the general use freeway lanes by fixed barriers. This will aid in the ability to manage the lanes, increase driver comfort, reduce the violation rate, and allow a protected location for the many hardware features (video cameras, electronic toll readers, changeable message signs, etc.) required which can be mounted on the concrete barrier. **Figure 2-15** and **Figure 2-17** illustrate the Managed Lanes cross sections under the 2N+2S and 3N+1S configurations.

2.7 Middle Segment Phases

The Middle Segment implementation is divided into three phases:

- Phase 1 – Middle Segment Interim Opening in 2007
- Phase 2 – Middle Segment Final Opening in 2008
- Phase 3 – Integration with the North and South Segments in 2012.

2.7.1 Phase 1 – Middle Segment Interim Opening in 2007

In Phase 1, the southern section of the Middle Segment from Sabre Springs DAR to Rancho Bernardo will become operational for a distance of approximately 5.6 miles. Phase 1 also provides a temporary BTM storage facility at Sabre Springs DAR, and a modular facility at Escondido.

During Phase 1, the Managed Lanes will operate under the 2N+2S configuration, while the Reversible HOV Lanes continue to operate in the SB direction during the AM commute period and in the NB direction during the PM commute period. During this phase, the operational sequence in changing from the 2N+2S (AM) to the 2N+2S (PM) configuration and vice versa will be tested, implemented, and fine-tuned to ensure a safe, smooth and coordinated transition.

2.7.2 Phase 2 – Middle Segment Final Opening in 2008

In Phase 2, the northern section of the Middle Segment from Rancho Bernardo to Del Lago DAR will become operational for a distance of approximately 8 miles. Phase 2 also provides a new BTM storage facility at Lake Hodges.

During Phase 2, the Managed Lanes may be deployed to provide other operating configurations in addition to the 2N+2S configuration to be implemented in Phase 1. Additional configurations include 1N+3S which will most likely be used during the AM peak hours, and 3N+1S which will most likely be used during the PM peak hours. The Traffic Analysis will indicate what configuration (2N+2S, 3N+1S or 1N+3S) would be most appropriate for each hour of the day.

Figure 2-15. Managed Lanes Cross Section - 2N+2S Configuration

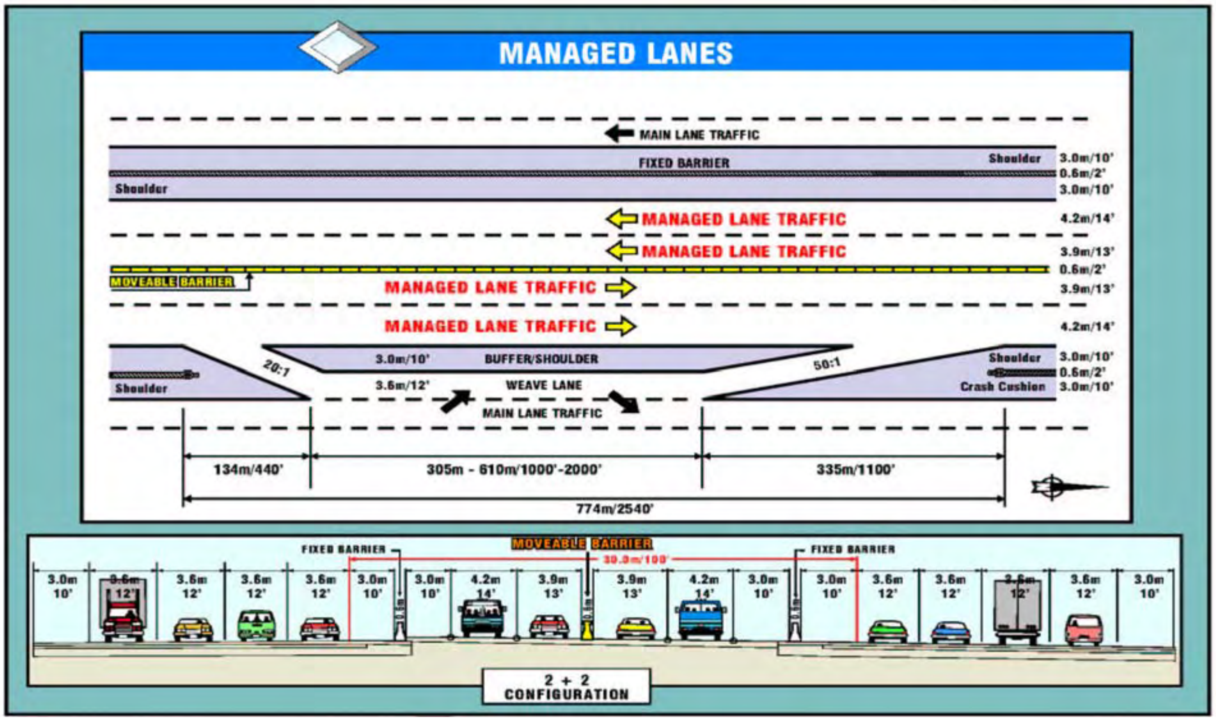
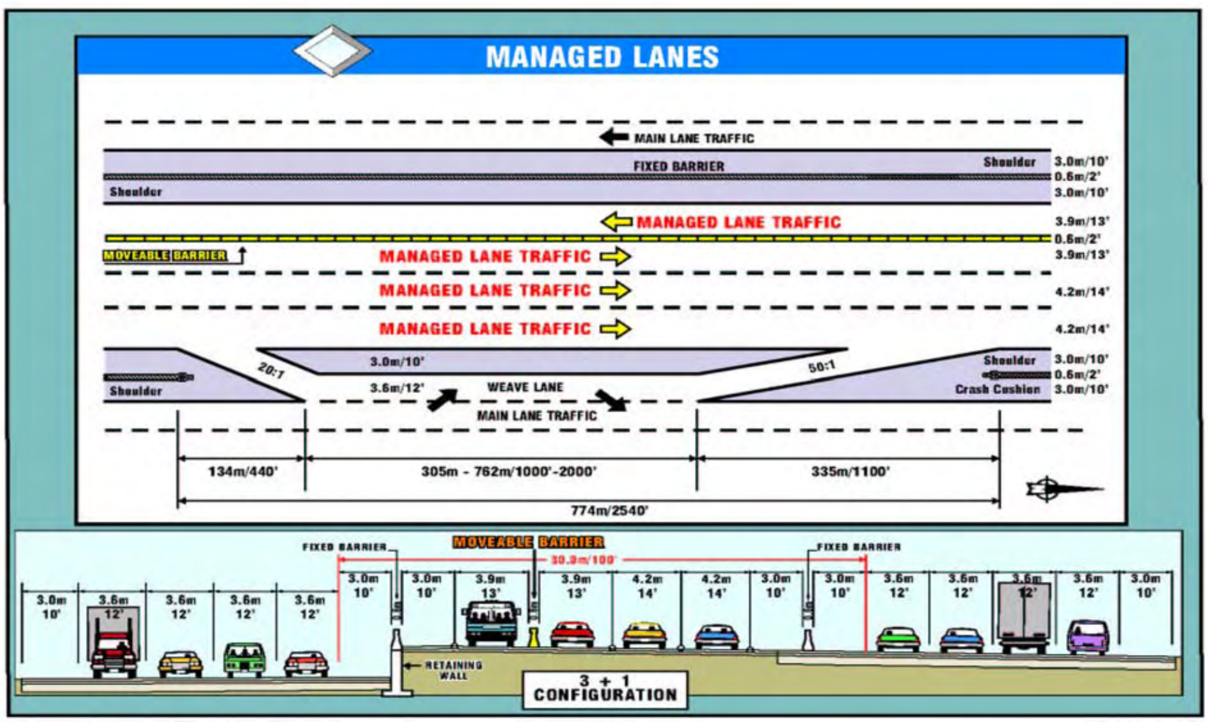


Figure 2-17. Managed Lanes Cross Section - 3N+1S Configuration



2.7.3 Phase 3 – Integration with North and South Segments in 2012

In Phase 3, the 2-lane Reversible HOV facility in the South Segment will be converted into 4 Managed Lanes. This will allow a more simplified interface between the Middle and South Segments that will eliminate the need for pop-ups and in-pavement lights to be installed in the earlier phases at the South End. Phase 3 will also provide a permanent maintenance station at Escondido.

3.0 ORGANIZATION AND RESPONSIBILITIES – SUMMARY

Primary agencies involved in the Managed Lanes operations include:

- SANDAG
- Caltrans
- CHP

Specific agency responsibilities in connection with Managed Lanes operations will be formalized via Letters of Intent / Interagency Cooperative Agreements which are currently being drafted.

3.1 San Diego Association of Governments (SANDAG)

The San Diego Association of Governments (SANDAG) is the designated Metropolitan Planning Organization (MPO) for the San Diego Region. SANDAG currently operates and manages the I-15 FasTrak Program that allows solo drivers to pay a per trip fee to use the existing Reversible HOV Lanes. Carpoolers use the Reversible HOV Lanes for free. Representatives from Caltrans, the Metropolitan Transit System, the California Highway Patrol, and SANDAG work together on this innovative commute solution. The program provides a faster commute for solo drivers, and the funding also provides express buses along I-15.

3.2 California Department of Transportation (Caltrans)

3.2.1 TMC Operations Branch

The TMC Operations Branch is charged with providing real-time traffic management activities on all State highways including monitoring of traffic conditions and initiating effective responses to help mitigate traffic impacts arising from incidents, emergencies, events, and other unusual occurrences. TMC Branch activities include monitoring roadway speeds via loop detectors, monitoring the CHP Computer Aided Dispatch system, verifying with Closed Circuit Television Cameras (CCTV), providing traveler information with the activation of Changeable Message Signs (CMS) and Highway Advisory Radios (HAR), coordination of mobile CMS sign trucks, Portable CMS, recommending detours and alternate routes, operating the existing I-15 Reversible Express Lanes, and providing Executive staff notifications and updates.

The branch currently operates twenty-four hours a day, Sunday thru Friday evening, and relies on call-outs on weekends. With the opening of the I-15 ML Middle Segment, it is expected that the TMC Operations branch will need to shift from a 24/5 schedule to a 24/7 schedule with the Managed Lanes operations. The expansion to a 24/7 schedule at the TMC is also warranted due to increased maintenance and construction occurring at nights and weekends as well as general increase in traffic and incidents. See Section 3.4 for additional information on the TMC.

3.2.2 Traffic Operations, Electrical Systems Branch

The Traffic Operations, Electrical Systems Branch is charged with developing and maintaining various electrical and communication systems within the District. These include traffic signals, Changeable Message Signs, CCTV System, TMC Display System, Traffic Operations System Network (TOSNET), fiber optic network, and existing Reversible Lane Control System. This branch is involved with the upgrade effort of the existing Reversible Lanes Control System that is also envisioned to be expanded for control of the Managed Lanes field elements. Once the fiber system network is extended north along the Managed Lanes corridor, the Electrical Systems Branch will have an additional 8 miles of fiber network and field elements to maintain. Proper care and effort will be needed to ensure the integrity of the Managed Lanes operations. The communication medium to communicate with all the field elements will be part of the TOSNET. Sufficient staff must be trained and available to maintain and troubleshoot any problems with the extended communications and control system out in the field.

3.2.3 Traffic Operations, Ramp Metering/System Branch

The Traffic Operations, Ramp Metering/Systems Branch is involved with maintaining and updating systems such as the District Ramp Metering System, Advance Transportation Management System (ATMS), Traffic Website Map, and the Reversible Lane Control System (RLCS). The staff in this branch is also involved in the review, testing, and eventual maintenance of the software upgrade for the RLCS, which is expected to be expanded for control of the Managed Lanes field elements as well. This means that new safety rules will have to be incorporated in the RLCS control system and the graphical user interface and its corresponding mapping system will need to be upgraded to incorporate Managed Lanes field element controls. Sufficient staff must be trained and available to maintain and troubleshoot any system (software and hardware) problems with the extended RLCS control system.

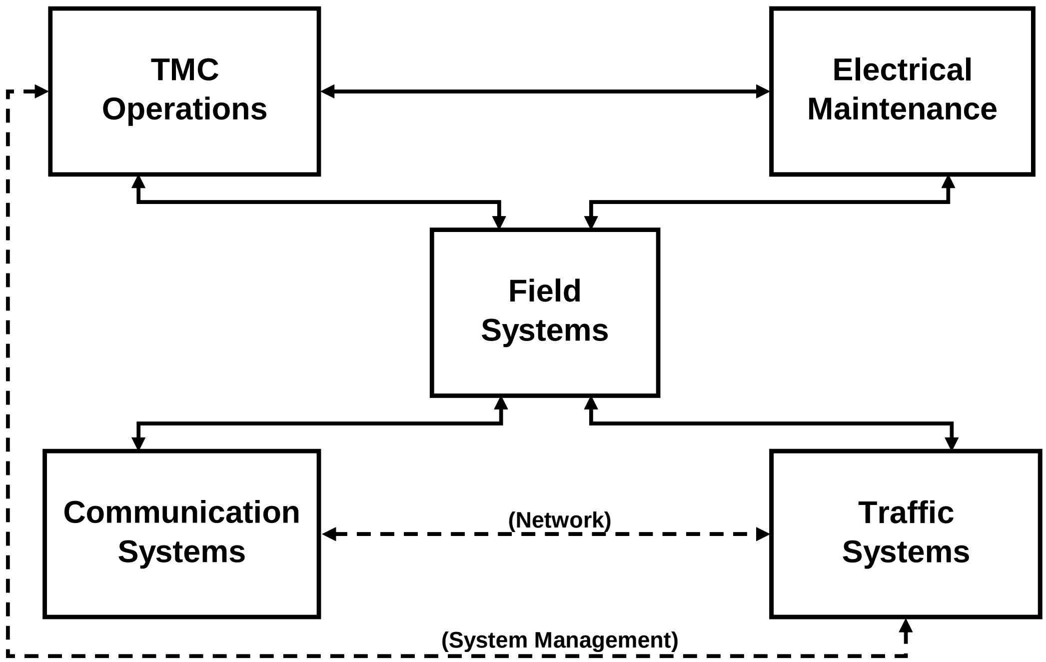
Figure 3-1 shows the interaction between various Caltrans Traffic Operations branches involved in Managed Lanes operations.

3.2.4 Maintenance Division

The Maintenance Division consists of approximately 400 qualified men and women who are responsible for maintaining more than 1000 centerline miles of highways and freeways in San Diego and Imperial Counties. Significant extra effort by the Maintenance Division will be needed to:

- Maintain the new Managed Lanes field elements (pop-ups, in-pavement lights, gates, VMS, cabinets, and possibly wireless equipment),
- Maintain the 8 miles of movable barriers (reactive tension type),
- Maintain and operate the barrier transfer machines, and

Figure 3-1. Interaction between Team Members for Managed Lanes Operations



- Actively participate in the regular operational sequences described in this report involving traffic breaks, coordination/communication with TMC Operators for sequencing field elements, operating the barrier transfer machines and moving the barriers.

These activities will be in addition to the normal roadway maintenance for pavement, structure, landscape, signage, etc.

Maintenance will provide the front line staff for maintaining the Managed Lanes field elements and will work closely with Traffic Operations, Electrical Systems Branch to investigate the cause and to fix any malfunctions of the field elements.

Highway maintenance equipment operators will drive multipurpose ½-ton trucks with changeable message signs, larger trucks with attenuator, and the barrier transfer machines during the operational sequence. They will communicate and coordinate closely with the TMC Operations staff.

To handle the envisioned 24/7 operations for the Managed Lanes corridor will require operations/maintenance crews working staggered shifts as well as electricians to maintain and repair electrical devices. A dedicated, trained corridor team with supervisor and lead workers for the highway maintenance equipment operator crews is recommended to ensure efficient, smooth and safe operations on the Managed Lanes for the traveling public.

3.2.5 Support from HQ Equipment Shop Service Center

Separate from the district staffing mentioned above for Traffic Operations and Maintenance, additional equipment mechanic support is needed for the maintenance of the initial two Barrier Transfer Machines (BTMs). This would include an Equipment Mechanic, a Mechanics Truck and repair/replacement parts inventory for the BTMs.

3.3 California Highway Patrol (CHP)

The California Highway Patrol (CHP) will conduct traffic breaks necessary to effect a safe and efficient transition between Managed Lanes configurations. The CHP will continue to perform designated functions during traffic incidents.

3.4 San Diego Transportation Management Center (TMC)

The San Diego Transportation Management Center (TMC), operational since November 1996, integrates Caltrans Traffic Operations, Caltrans Maintenance, and CHP Communications in a unified, co-located communication and command center. The TMC provides the communications, surveillance and computer infrastructure necessary for coordinated transportation management on State Highways during normal commute periods, as well as special events, and major incidents. The TMC is planned with the future in mind. Beyond immediately improving the safety and efficiency of the transportation system, in an emergency, the TMC becomes a command center for directing relief throughout the region. The TMC is designed with the latest technologies to survive earthquakes, power outages and communications disruptions. With secure communications and focused, prepared responses, the TMC becomes a valuable asset for the survival and recovery of our community. As fiber optics, video and interactive electronic and computer systems are integrated into the TMC in the coming years, and more agencies tie into the systems, it will prove its value for our safety, security and survival.

The TMC utilizes the following elements:

- Cellular 911 call takers
- Call Box call takers for critical incidents
- CHP Dispatch using Computer Aided Dispatch (CAD) - to assign Officers & Freeway Service Patrol trucks
- Caltrans Traffic Operations Communications
- Caltrans Maintenance Dispatch
- Caltrans Construction Communications
- Real time incident detection, verification, and coordination of response
- Graphic display of real time traffic flow data
- Monitoring incident locations and status and relaying this information to the public
- Providing timely and accurate traffic information for public broadcast to the motoring public and commercial vehicles
- Manage freeway volumes for free flow by controlling monitoring ramp meter operations to regulate entrance ramp volumes
- Control and operation of the I-15 Reversible HOV/Express Lanes

- Changeable Message Signs (CMS) and Highway Advisory Radio (HAR)
- Closed Circuit Television (CCTV)
- Automatic Vehicle Locator (AVL) (navigational tracking devices)
- Collection and processing traffic data generated by freeway monitoring systems
- Work with other transportation providers to obtain real-time information for transportation management coordination
- Functional test bed support facility for ongoing and future new technology.

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4.0 ORGANIZATION AND RESPONSIBILITIES – DETAILS

(FORTHCOMING – Pending availability of Letters of Intent / Cooperative Agreements)

4.1 Organizational Charts

4.2 Contact List

4.3 Letters of Intent - Cooperative Agreements

4.4 Responsibility Matrix

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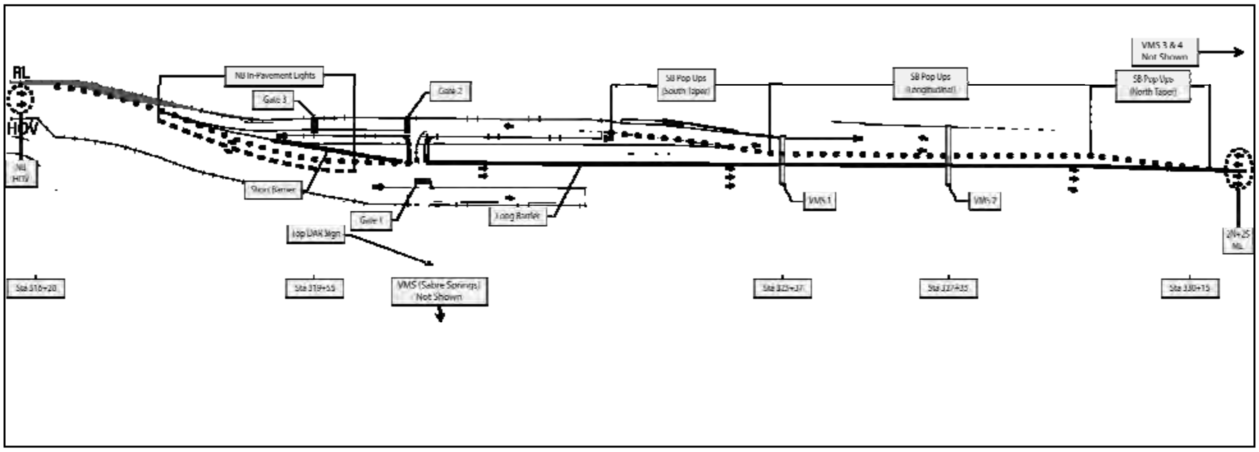
5.0 PHYSICAL AND TRAFFIC GUIDANCE ELEMENTS – SUMMARY

To ensure smooth and safe operations of the Managed Lanes both during its operations under one configuration as well as during the transition from one configuration to another, a number of new technologies and devices will be used. **Figure 5-1** shows the relative location of some of these devices for one particular configuration on the South End of the Middle Segment in the vicinity of the Sabre Springs DAR. Different configurations may have common and separate sets of elements.

Figure 5-1. Location of Physical and Traffic Guidance Elements

2N+2S (AM) Configuration – South End



5.1 Fixed Barriers

Fixed barriers will separate the Managed Lanes from the freeway mainline / general purpose lanes. These are concrete barriers (type 60 series) that are fixed in place.

5.2 Moveable Barriers

Moveable barriers will separate the traffic flow in opposite directions within the Managed Lanes. The position of the moveable barriers can be changed using Barrier Transfer Machines (BTM) to provide the desired lane configuration (2N+2S, 1N+3S or 3N+1S). The I-15 Managed Lanes Project will use the Concrete Reactive Tension System – Quickchange Moveable Barriers (QMB) manufactured by Barrier Systems, Inc. (BSI). Detailed specifications of the Quickchange Moveable Barriers are included in the **Appendix**.

The Middle Segment will have two sections of moveable barriers – a 479-foot Short Barrier section, and a 7.5-mile Long Barrier Section.

The Short Barrier is located at the south end of the Middle Segment in the vicinity of the Sabre Springs DAR (see **Figure 5-1** above), where the interface between the Reversible HOV Lanes and the Middle Segment Managed Lanes occur. The Short Barrier has a total length of 479 feet (146 m) and is located between Station 319+20 and Station 320+66. The Short Barrier provides the safety element at the transition between the Managed Lanes and the HOV Lanes by preventing errant vehicles from crossing over to the opposite direction.

The Long Barrier defines the operational configuration of the Middle Segment Managed Lanes. It has a total length of 7.5 miles (12 km) and stretches between Station 320+85 on the south end in the vicinity of Sabre Springs DAR, and Station 441+80 on the north end of the Middle Segment in the vicinity of the Del Lago DAR.

5.3 Barrier Transfer Machines

The configuration of the moveable barriers can be changed using specially designed vehicles known as Barrier Transfer Machines (BTM), also manufactured by BSI. Two (2) BTMs will be used during Phase 1 of the Middle Segment implementation. A third BTM machine will be added in Phase 2. Detailed specifications of the BTMs are included in the **Appendix**.

BTM Dimensions (Approximate)

- Length: 46 feet
- Height: 12 feet
- Width: 10 feet

When loaded, the BTM can travel at speeds between 5 mph and 10 mph. When unloaded, BTM can travel at top speed of 20 mph. For operational planning purposes, a speed of 5 mph was assumed.

The BTM will pick up the barriers 4 inches from the ground. The BTM can move the barriers for a lateral distance between 8 feet 6 inches and 14 feet. The BTM operates by guide wire. The BTM can be operated from either end, having cabs at both ends which enable the machine to move forwards or backwards. The minimum service life of a BTM is 10 years, with required maintenance and inspection every year.

5.4 BTM Maintenance, Storage and Repair Facilities

When the BTMs are not in use, they will be stored initially underneath the Sabre Springs DAR. This area will be enclosed by concrete barriers on the east and west sides, and chain link fence on the north and south sides. This area is approximately 77 m (252 ft) long. The clear width at the narrowest point (due to bridge columns) is approximately 4.5 m (14.8 ft). Caltrans identified the need for constructing a temporary facility during the initial phase of the Middle Segment operations, and a permanent facility towards the completion of the total project in 2012.

5.5 Pop-Ups

Pop-ups are electronically controlled devices installed underneath the pavement with orange-colored cylinders that can be raised or lowered to direct traffic to appropriate lanes (see **Figure 5-3**). Pop-ups are used to mark the edge of the travelway. Different sets of pop-ups are used to delineate the desired configuration.

Table 5-1 shows the different sets of pop-ups, relative locations, and number of pop-ups. As shown, some pop-ups are shared between different configurations.

Table 5-1. Number and Location of Pop-Ups

SCENARIO	North End	North Taper	Longitudinal	South Taper	Long South Taper	Short Barrier	
	STA 439+90 To STA 444+21 431m (1414 ft) SB	STA 329+10 To STA 333+15 405m (1329 ft) SB	STA 325+10 To STA 329+10 400 m (1312 ft) SB	STA 323+10 To STA 325+10 200 m (656 ft) SB	STA 320+66 To STA 325+20 454 m (1490 ft) SB	STA 317+70 To STA 320+66 296 m (1300 ft) SB	STA 316+10 To STA 320+66 456 m (1500 ft) NB
2N+2S (PM)	47	31	30	36			34
2N+2S (AM)	(47)					23	
3N+1S (PM)	77 (47)			(32)			(34)
1N+3S (AM)	3				30	(23)	
TOTAL	**80**	**31**	**30**	**36**	**30**	**23**	**34**

Note: Numbers in parenthesis ( ) indicate shared use between scenarios.

Figure 5-3. Photos of Pop-Ups

5.6 In-Pavement Lights

In-Pavement Lights are devices installed on the pavement that emit light which can be seen from one traffic direction only (see **Figure 5-5**). They are used to operate similar to inner lane markings in areas where painted lane markings cannot be used because of changing lane configurations. **Table 5-3** shows the number of and length of In-Pavement Lights used under each configuration.

5.7 Gates

Gates are used to either block or allow traffic particularly at DAR ramps. **Figure 5-7** shows a typical gate. A total of three (3) gates will be used at the Sabre Springs DAR.

Figure 5-5. In-Pavement Lights

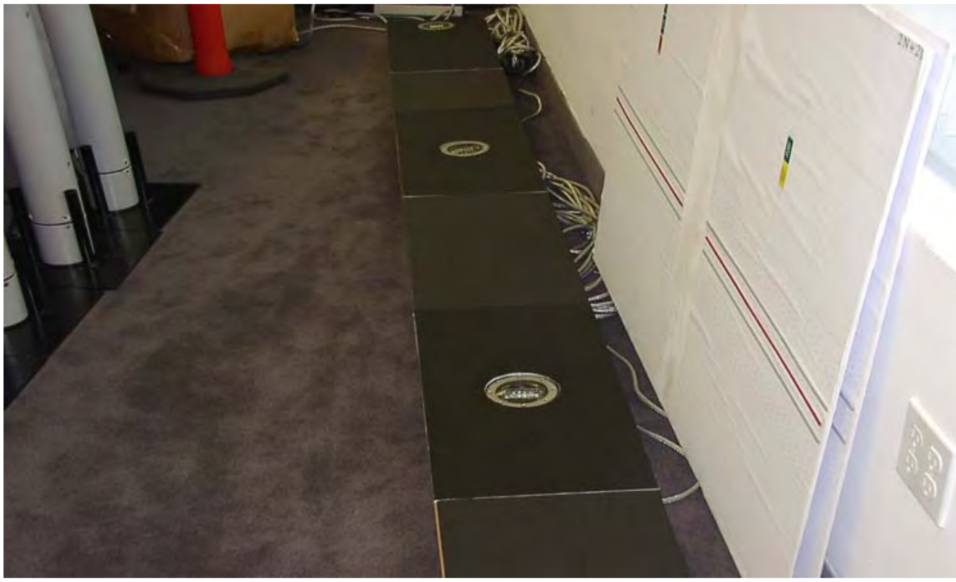


Table 5-3. In-Pavement Lights

CONFIGURATION	North End	South End
2N+2S (PM)	0	68
2N+2S (AM)	0	56
3N+1S (PM)	48	(68)
1N+3S (AM)	152	(56)
TOTAL	**200**	**124**

Note: Numbers in parenthesis ( ) indicate shared use between scenarios.

Figure 5-7. Photo of Typical Gate

5.8 Variable Message Signs

In addition to permanent traffic signs, Variable Message Signs (VMS) will be used to alert motorists using the Managed Lanes of the changing lane configuration ahead. **Table 5-5** shows the location of the VMS. A total of eight (8) VMS will be used in the Middle Segment. Five (5) VMS will be located at the South End in the vicinity of Sabre Springs DAR, and three (3) VMS will be located at the North End in the vicinity of the Del Lago DAR. **Figure 5-9** shows the layout of Variable Message Signs under various configurations. Variable Message Signs consists of panels that can be rotated to show two or three different messages (compared to Changeable Message Signs – see below – that can show several different messages).

Table 5-5. Location of Variable Message Signs

VMS	Location	Station
VMS 1	South End	325+37
VMS 2		327+35
VMS 3		337+00
VMS 4		341+95
VMS (SS)		Bottom of Sabre Springs DAR
VMS 5	North End	442+00
VMS 6		446+35
VMS 7		450+78

5.9 Other Appurtenances

- CCTV Cameras
- Control Cabinets

(Information to follow)

Figure 5-9. Variable Message Signs - South End

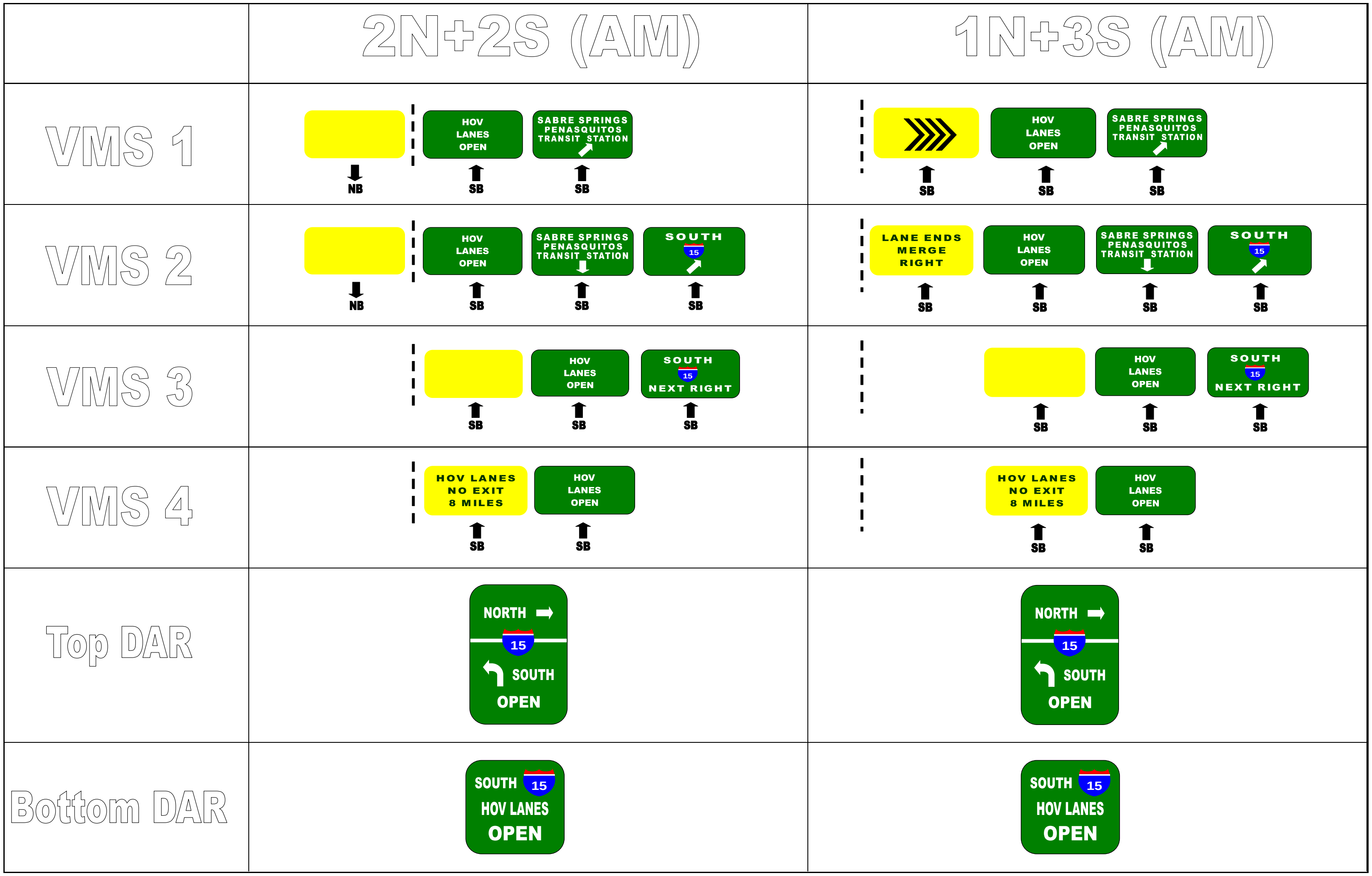
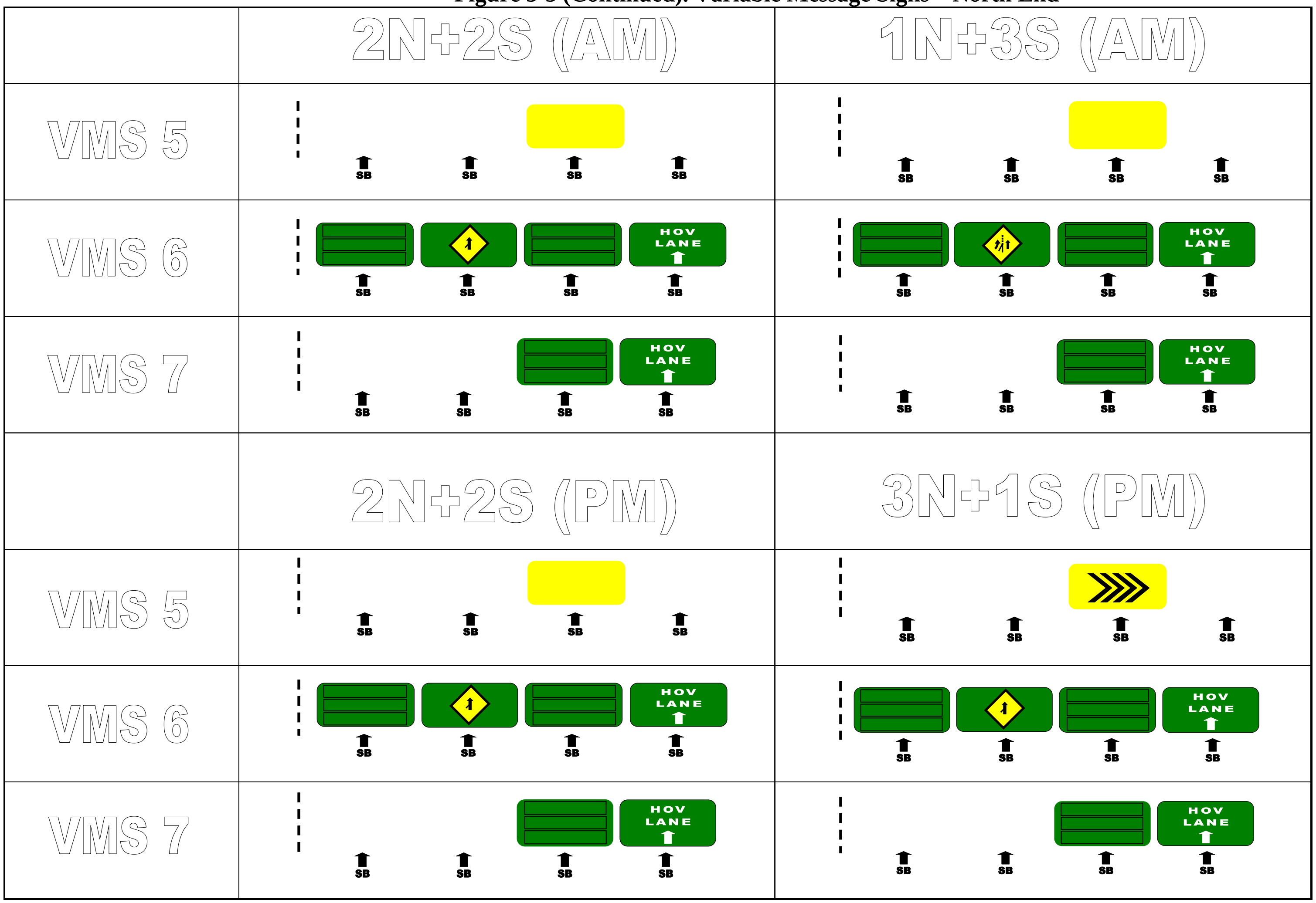


Figure 5-5 (Continued). Variable Message Signs – South End

	2N+2S (PM)	3N+1S (PM)
VMS 1	NB; HOV LANES CLOSED SB; SABRE SPRINGS PENASQUITOS TRANSIT STATION ONLY SB	NB; HOV LANES CLOSED NB; SABRE SPRINGS PENASQUITOS TRANSIT STATION ONLY SB
VMS 2	NB; HOV LANES CLOSED SB; SABRE SPRINGS PENASQUITOS TRANSIT STATION ONLY SB; SOUTH 15 SB	NB; NB; SABRE SPRINGS PENASQUITOS TRANSIT STATION ONLY SB; SOUTH 15 SB
VMS 3	SB; HOV LANES CLOSED SB; SOUTH 15 NEXT RIGHT SB	NB; HOV LANES CLOSED SB; SOUTH 15 NEXT RIGHT SB
VMS 4	LANE ENDS MERGE RIGHT SB; HOV LANES CLOSED SB	NB; HOV LANES CLOSED SB
Top DAR	NORTH 15 SOUTH CLOSED	NORTH 15 SOUTH CLOSED
Bottom DAR	SOUTH 15 HOV LANES CLOSED	SOUTH 15 HOV LANES CLOSED

Figure 5-5 (Continued). Variable Message Signs – North End



6.0 PHYSICAL AND TRAFFIC GUIDANCE ELEMENTS – DETAILS

6.1 Moveable Barriers

The barriers manufactured by BSI are trademarked as Quickchange Moveable Barriers (QMB). The old type of moveable barriers used on the Coronado Bridge are called Standard Barriers. The barriers are hinged together, but the hinges allow up to ½ inch of movement. The cumulative effect of small movements at the hinges could result in significant longitudinal float (migration). In turn, migration creates the potential for high tension and/or compression, wheel and receiver wear, and increased vibration.

To overcome the disadvantages posed by the Standard Barriers, BSI developed the Reactive Tension System type of moveable barriers. These barriers are held rigidly by a pin in metal-to-metal contact which significantly reduces migration and allows more precise barrier-to-barrier spacing. The reduced migration results in minimized vibration and enhances longevity of the conveyor system. To accommodate the need for expansion and/or contraction, Variable Length Barriers are placed at intermediate locations.

BSI has two types of Reactive Tension System barriers – the Concrete Reactive Tension System QMB (to be used in the I-15 Managed Lanes), and the Steel Reactive Tension System QMB. Detailed specifications of these barriers are found in the **Appendices**.

6.2 Barrier Transfer Machines

The Barrier Transfer Machines (BTMs) are high-maintenance units. They consume fuel at the rate of approximately five gallons per mile. Their optimal cruising speed is five to seven mph. BTMs are not designed for driving at prevailing speeds for long distances. District 11 experience with this equipment on the Coronado Bay Bridge has shown that two units would be required at the outset of Managed Lanes operation to provide system redundancy. A third unit will be required in a subsequent budget year, 20010/11, to be deployed for the project's 17-mile completed construction timeline.

6.2.1 BTM Specifications

Discussion between Caltrans and BSI resulted in a draft specifications for the Managed Lanes BTM machines - see **Appendix**: "I-15 Barrier Transfer Machine Specification Considerations." Detailed specifications of Barrier Transfer Machines are included in the **Appendix**.

6.2.2 BTM Operating Costs

BTM operating costs are grouped into two main areas: Parts and Labor costs to operate and maintain the system.

Parts include both consumable and replacement parts. Consumable parts include fuel, oil, filters, conveyor wheels, hubs, bearings, tires, breaks, hoses and belts. Replacement parts include engine and axle rebuilds, hydraulic valves and fittings, ground drive and other motors, pumps, auto capstan and auto guidance components, rubber isolation mounts, other electrical and hydraulic parts and repainting of the machine. **Appendix** (BSI, Technical Brief TB 011228 Rev. 3, "Permanent Machine Operating Costs") identifies the spare parts list recommended by BSI for BTM machines.

BSI estimated the parts operating cost for the Middle Segment Managed Lanes to be approximately $64 per operating hour for consumable parts, and $37 per hour for replacement parts, for a total of $101 per operating hour.

BTM labor costs depend on the following considerations:

- It requires 2 operators to run the machine.
- The machine can drive at 5-10 mph depending on the type of barrier installed. Standard barrier can be transferred at the rate of one mile every 12 minutes, and Reactive Tension Barriers can be transferred at the rate to one mile every 6 minutes.
- Normal maintenance can be performed by the operators before or after the barrier transfer.
- Heavy or specialty repair may require help from the manufacturer or a trained heavy equipment mechanic or a trained subcontractor.

6.2.3 BTM Autoguidance System

Appendix: BSI Technical Brief TB 940721 Rev. 3, "Barrier Transfer Machine Autoguidance System Wire and Loops"

Appendix: BSI Technical Brief TB 951130-Rev. 2, "Installation of Autoguidance Wire and Related Equipment"

6.3 BTM Maintenance, Storage and Repair Facilities

Some BTM users have provided permanent storage facility to house their BTM equipment for the following reasons:

- It provides a centralized location for storage of spare parts, fluid/fuel, tools, and other items needed for BTM operations and maintenance.
- It provides protection against weather and vandalism.
- It maintains visual aesthetics by keeping BTMs out of sight when not in use.
- It minimizes potential spectator traffic that could be attracted by the size and probably color of the BTMs.

Table 6-1 shows features of some BTM storage facilities in the country.

Table 6-1. BTM Storage Facilities

Location / Machine Size	Barn Size	Remarks
Midtown Tunnel Viaduct, NY 9.5 ft x 56 ft 2.89m x 17.1m	Holds one BTM 30 ft x 70 ft 9.2m x 21.3m	High crime area. Quonset type building used for parts and tools storage. Located under bridge.
Hawaii H-1, HI 12 ft x 66 ft 3.7m x 20.2 m	Holds two BTMs 30 ft x 160 ft 9.2m x 48.8m	Very large concrete tilt up with water and power. Located in median.
Gowanus Expressway, NY 12 ft x 66 ft 3.7m x 20.2m	No garage BTM stored on an off-ramp	
Dallas I-30 East, TX 12 ft x 66 ft 3.7m x 20.2 m	Two garages each 80 ft x 30 ft 9.2m x 24.4m	Facility has parts and repair plus outside storage for spare barriers. Agency also uses addition onto one building for HOV staff. Both garages located in center median.

Source: BSI Technical Brief TB 050501 Rev. 0, "BTM Storage Facilities"

Caltrans identified the need for constructing a temporary facility during the initial phase of the Middle Segment operations, and a permanent facility towards the completion of the total project in 2012.

The first necessity is a temporary maintenance/service facility, with a fueling station on a close and easily accessible leased property location. This station will provide covered structure/service building with capability to provide against weather and vandalism for the barrier transfer machines. Water hydrants will also be installed to serve the street sweepers, which will frequently clear the Managed Lanes and shoulders of debris that could hinder efficient barrier transfer and emergency parking.

Prior to completion of the total project in 2012, the second necessity is a permanent stand-alone maintenance/repair facility appropriately staffed to provide full maintenance/service by Division of Maintenance/Equipment personnel. This station will serve the Managed Lanes as the central field operational facility for the total 17-mile project. It will provide garage capability for the BTMs in order to provide against vandalism and weather, fueling capability, office, crew room, and a lockable storage for the materials inventory needed to maintain the entire Managed Lanes system.

6.4 Pop-Ups

(Additional information to follow.)

6.5 In-Pavement Lights

(Additional information to follow.)

6.6 Gates

(Additional information to follow.)

6.7 Variable Message Signs

(Additional information to follow.)

6.8 Other Appurtenances

(Additional information to follow.)

7.0 OPERATIONAL CONFIGURATIONS - SUMMARY

When the Middle Segment of the Managed Lanes Project opens in 2007/2008, it will consist of improved northbound and southbound main lanes and four new Managed Lanes in the median. The existing two-lane Reversible HOV Facility will still be in place until the South Segment of the Managed Lanes is completed in 2012. To handle this interim condition, where four Managed Lanes in the Middle Segment connect to only two HOV lanes that change directions during the AM and PM commute periods, required a careful review of the possible operational combinations, and the proper planning and sequencing for the standard operations selected.

The term "configuration" is used in the Operations Plan to refer to a specific arrangement of lanes (northbound or southbound), pop-ups (up or down), in-pavement lights (on or off), gates (open or closed), VMS and other appurtenances. When the Managed Lanes operate at one particular "configuration," the specific arrangement of lanes and various field elements remains fixed. Chapters 7 and 8 describe the different Managed Lanes operational "configurations."

The term "scenario" is used in the Operations Plan to refer to a change from one configuration to another. The scenarios involve a sequence of procedures required to make the transition. Chapters 9 and 10 describe the different Managed Lanes operational "scenarios."

7.1 Existing Reversible HOV Lane Configuration

The existing two-lane Reversible HOV facility is currently operated in the southbound direction during the morning commute period, and in the northbound direction during the afternoon commute period. Below is a summary of the current normal operating times for this facility:

<u>Monday – Friday (Normal Operations)</u>

05:35 am	Open to southbound traffic
11:00 am	Start reversal of lanes to northbound (NB) traffic (takes about 45 minutes to an hour)
07:00 pm	Closed at night except on Friday (left open NB for the weekend)

<u>Friday Night and Weekend</u> – Open to NB traffic

7.2 Middle Segment Operations with Existing Reversible HOV Lanes

Table 7-1 shows the ten possible combinations of configuring the four Managed Lanes and the two Reversible HOV Lanes. Four of these combinations, identified as "Standard Daily Operations," are expected to be used on a regular/daily basis (see **Figure 7-1**). The other combinations, identified as "Incident Management," will be related to incident management scenarios and will be discussed in the Traffic Incident Management Plan.

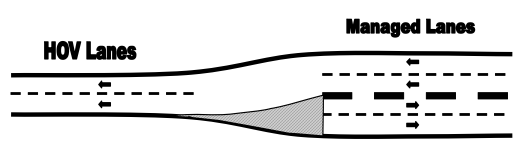
Table 7-1. Possible Combinations for Configuring the Managed Lanes and Reversible HOV Lanes

Managed Lanes	Reversible HOV Lanes	Type
0N+4S	2N	Incident Management
	2S	Incident Management
1N+3S	2N	Incident Management
	2S	Standard Daily Operations
2N+2S	2N	Standard Daily Operations
	2S	Standard Daily Operations
3N+1S	2N	Standard Daily Operations
	2S	Incident Management
4N+0S	2N	Incident Management
	2S	Incident Management

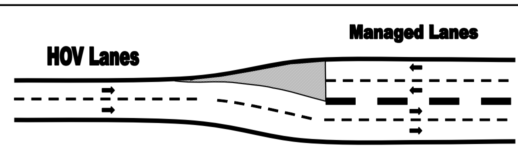
Note: *the letter "N" means "Northbound," the letter "S" means "Southbound," and the numbers indicate the number of lanes in that direction. For example, 2N+2S means two northbound lanes and two southbound lanes, and 3N+1S means three northbound lanes and one southbound lane.*

Figure 7-1. Standard Daily Operations Configurations

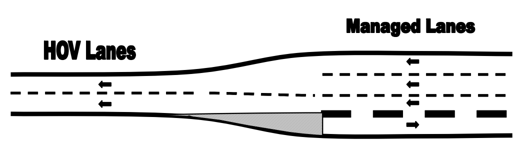
2N + 2S (AM)



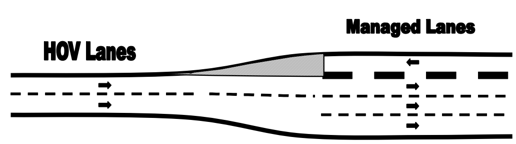
2N + 2S (PM)



1N + 3S (AM)



3N + 1S (PM)

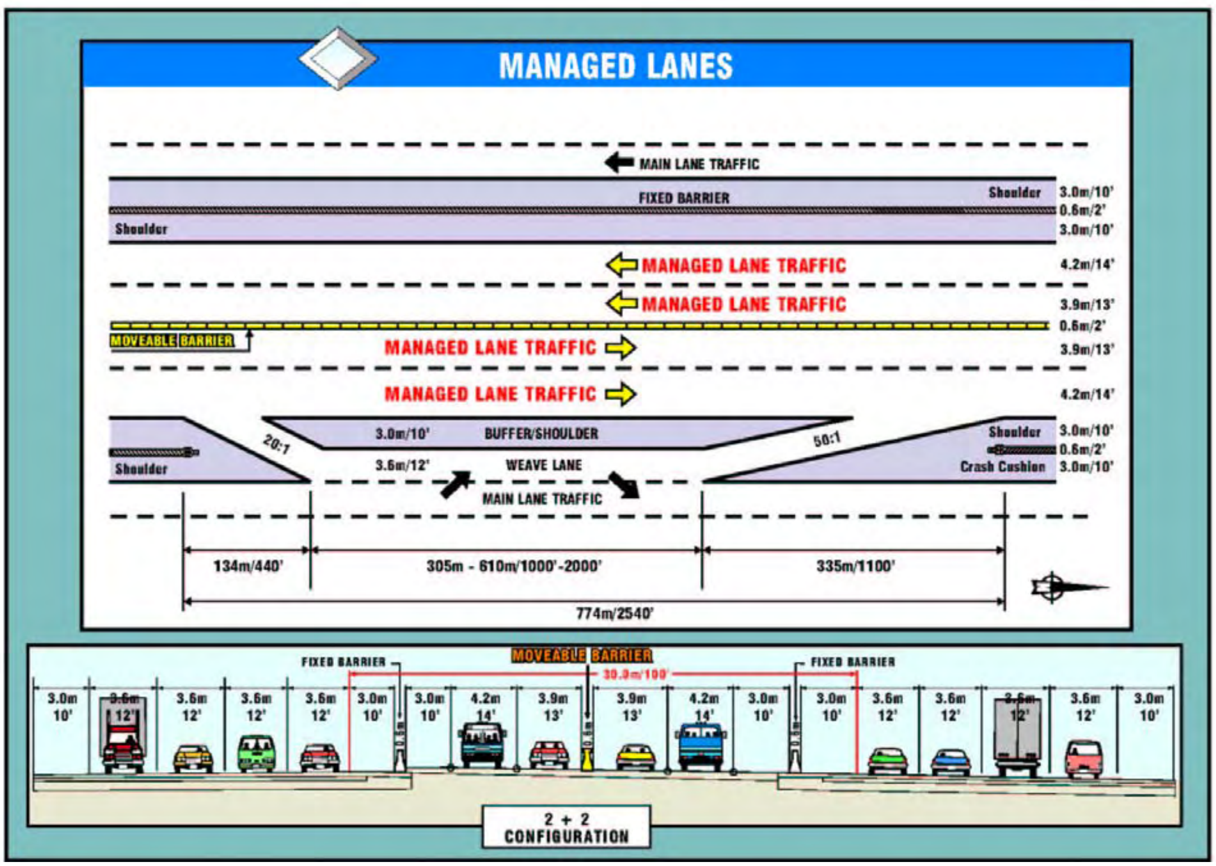


7.3 Phase 1 – Middle Segment Interim Opening in 2007

During Phase 1, the Managed Lanes will initially be configured as 2N+2S while the operations involved in changing the configurations at the South End to accommodate the Reversible HOV Lanes are tested and refined.

- **2N+2S (AM)** – the Managed Lanes operate with 2 northbound lanes and 2 southbound lanes while the 2 HOV Lanes operate in the **southbound** direction.
- **2N+2S (PM)** – the Managed Lanes operate with 2 northbound lanes and 2 southbound lanes while the 2 HOV Lanes operate in the **northbound** direction.

Figure 7-3. 2N+2S Configuration

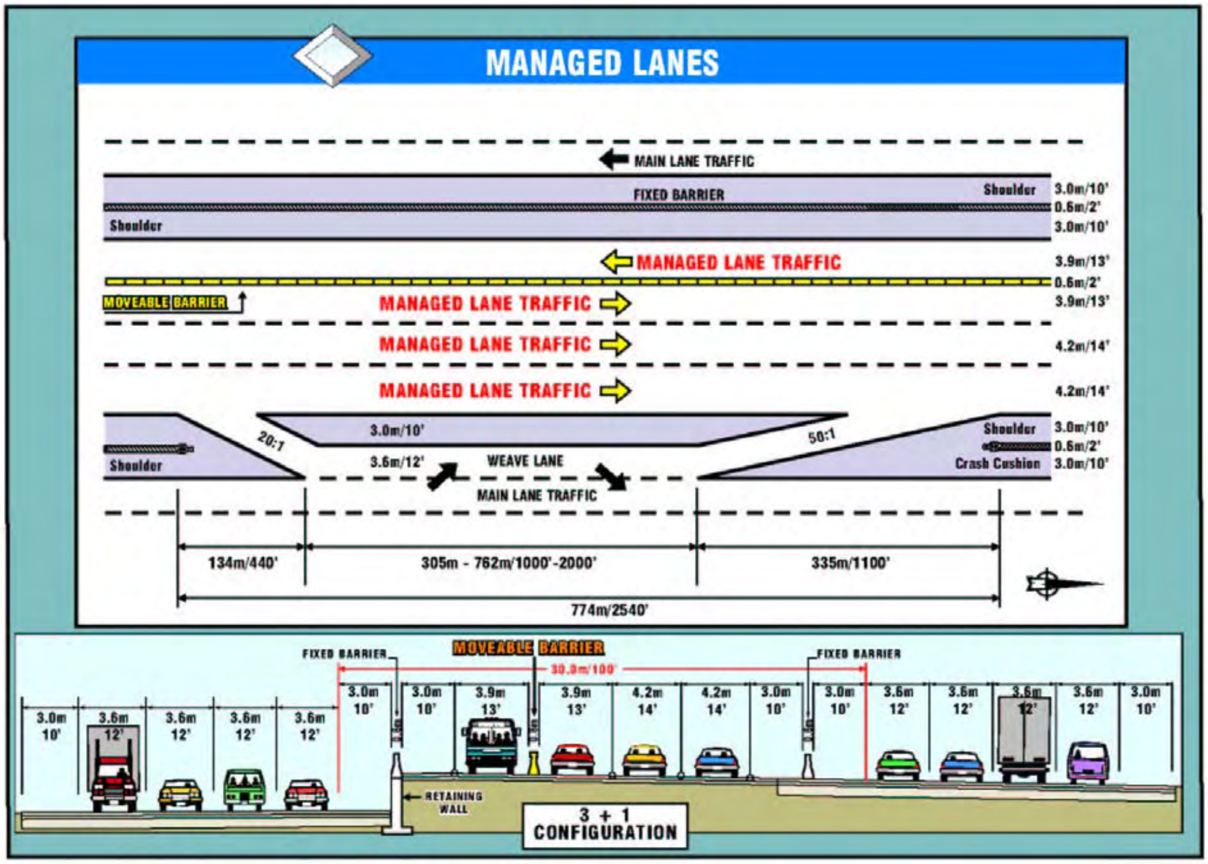


7.4 Phase 2 – Middle Segment Final Opening in 2008

During Phase 2, other standard configurations identified below can be tested and refined. The Traffic Analysis will indicate the appropriate timing of using the other standard configurations.

- **1N+3S (AM)** – the Managed Lanes operate with 1 northbound lane and 3 southbound lanes while the 2 HOV Lanes operate in the **southbound** direction.
- **3N+1S (PM)** – the Managed Lanes operated with 3 northbound lanes and 1 southbound lanes while the 2 HOV Lanes operate in the **northbound** direction (see **Figure 7-5**).

Figure 7-5. 3N+1S Configuration



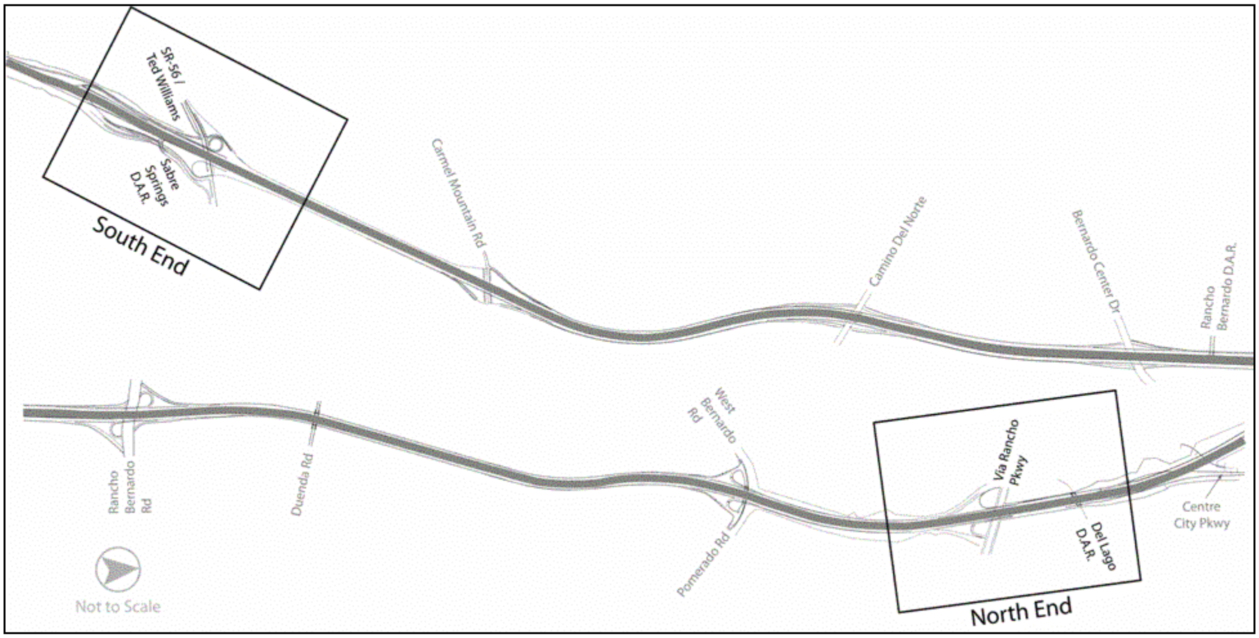
7.5 Phase 3 – Middle Segment Integration with North and South Segments in 2012

The completion of the South Segment will greatly simplify the operations at the South End of the Middle Segment. As a result, many of the traffic guidance devices (pop-ups, in-pavement lights, etc.) at the South End will no longer be needed.

8.0 OPERATIONAL CONFIGURATIONS – DETAILS

This section describes the standard daily operational configurations at the South End (Sabre Springs DAR) and the North End (Del Lago DAR) of the Middle Segment (see **Figure 8-1**). (The incident management configurations will be discussed in the Traffic Incident Management Plan). Most of the traffic guidance elements and activities associated with changing the Managed Lanes configuration are concentrated at these ends. To facilitate understanding the different configurations, as well as the sequence of activities associated with each operational scenario, schematic diagrams representing the South and North Ends were developed and used in this Operations Plan, as exemplified by Figure 8-5 and Figure 8-6. These diagrams were based on actual CAD drawings, but were compressed along the horizontal axis to show as much detail as necessary. The South End diagram covers a distance of approximately 0.9 mile, while the North End covers a distance of approximately 0.7 mile.

Figure 8-1. Location Map - South End and North End



8.1 2N+2S (AM)

8.1.1 2N+2S (AM) Traffic Flow

In this configuration, the Managed Lanes operate with 2 northbound lanes and 2 southbound lanes while the 2 HOV Lanes operate in the **southbound** direction.

South End (Sabre Springs)

Figure 8-5 shows the 2N+2S (AM) configuration at the South End (Sabre Springs) together with the flow of traffic. As shown, the Managed Lanes are configured as 2N+2S to the north of the Sabre Springs DAR. In the southbound direction, Managed Lanes traffic can continue southbound to the HOV Lanes. Southbound ML traffic can exit the Managed Lanes to join the southbound I-5 general purpose lanes after VMS 2. Southbound Managed Lanes traffic continuing past VMS 1 can exit the Managed Lanes via the Sabre Springs DAR southbound off-ramp. Traffic from the Sabre Springs DAR can access the southbound HOV Lanes via the Sabre Springs DAR southbound on-ramp which is open in this configuration.

In the northbound direction, the Sabre Springs DAR northbound on-ramp provides the first opportunity for traffic to enter the northbound Managed Lanes under this configuration.

North End (Via Rancho Parkway / Del Lago)

Figure 8-6 shows the 2N+2S configuration at the North End (Via Rancho Parkway / Del Lago DAR) together with the flow of traffic. The configuration is the same for both the AM and PM peak periods. In the southbound direction, traffic from Del Lago DAR on-ramp merges with the southbound Managed Lanes in the vicinity of the Via Rancho Parkway overcrossing. The DAR on-ramp is transitioned into the Managed Lanes by two banks of pop-ups.

In the northbound direction, the Managed Lanes operate with two lanes northbound until the end of the Long Barrier. Past the end of the Long Barrier, an inner lane is added for the Del Lago DAR northbound off-ramp.

Figure 8-5. 2N+2S (AM) Configuration - South End

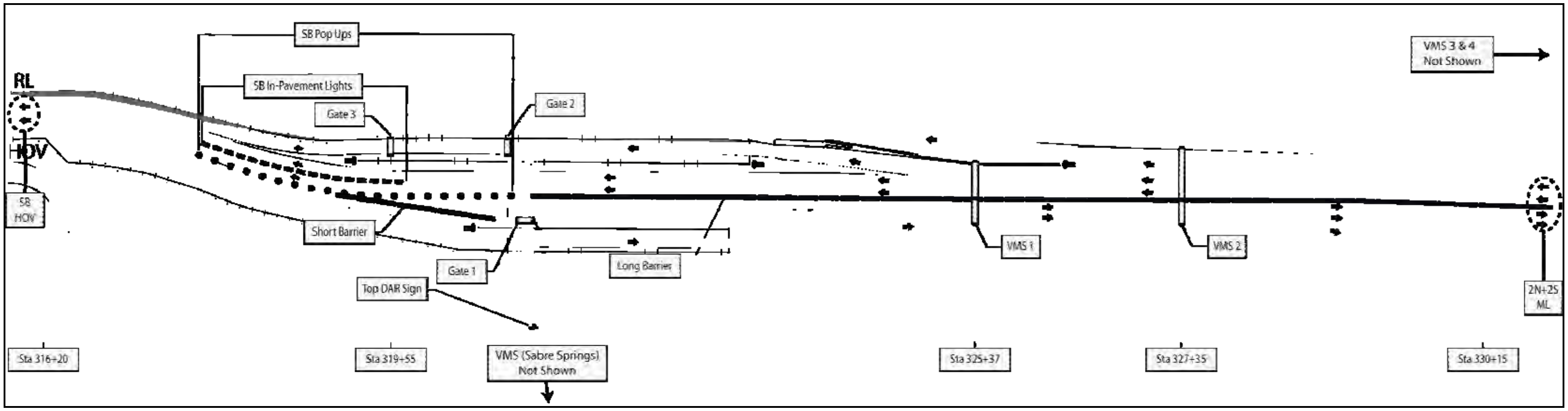
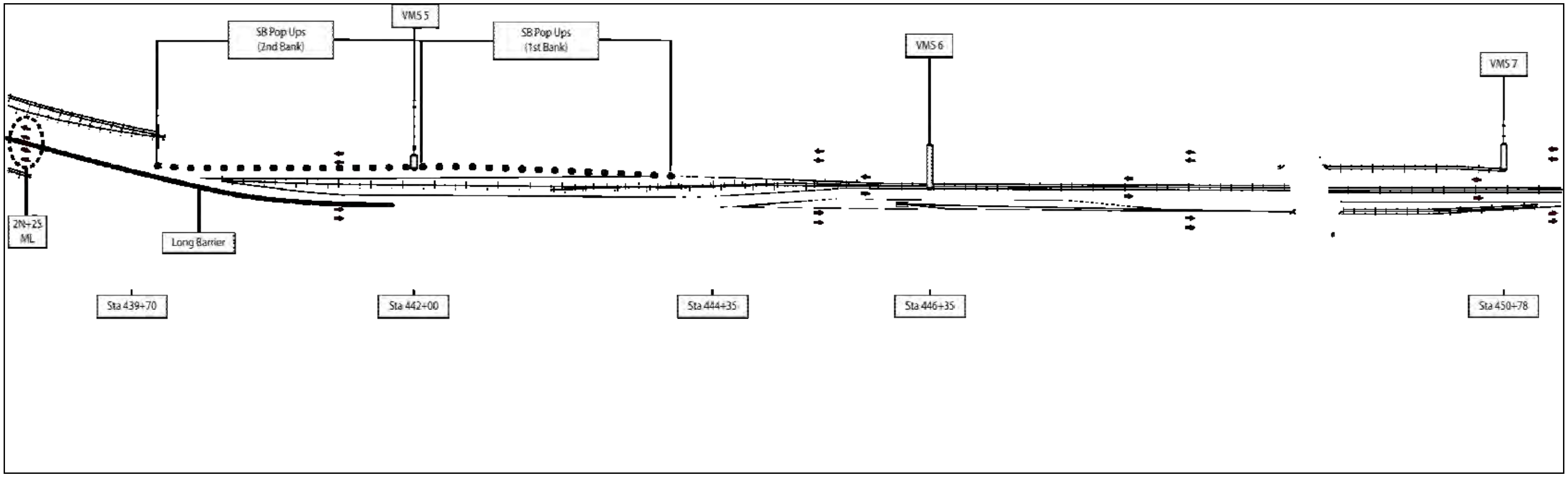


Figure 8-6. 2N+2S (AM) Configuration - North End



8.1.2 2N+2S (AM) Configuration

To maintain the traffic flow described above under the 2N+2S (AM) configuration, the following elements are put in place:

- The long barrier is positioned such that it divides the Managed Lanes into 2 northbound and 2 southbound lanes.

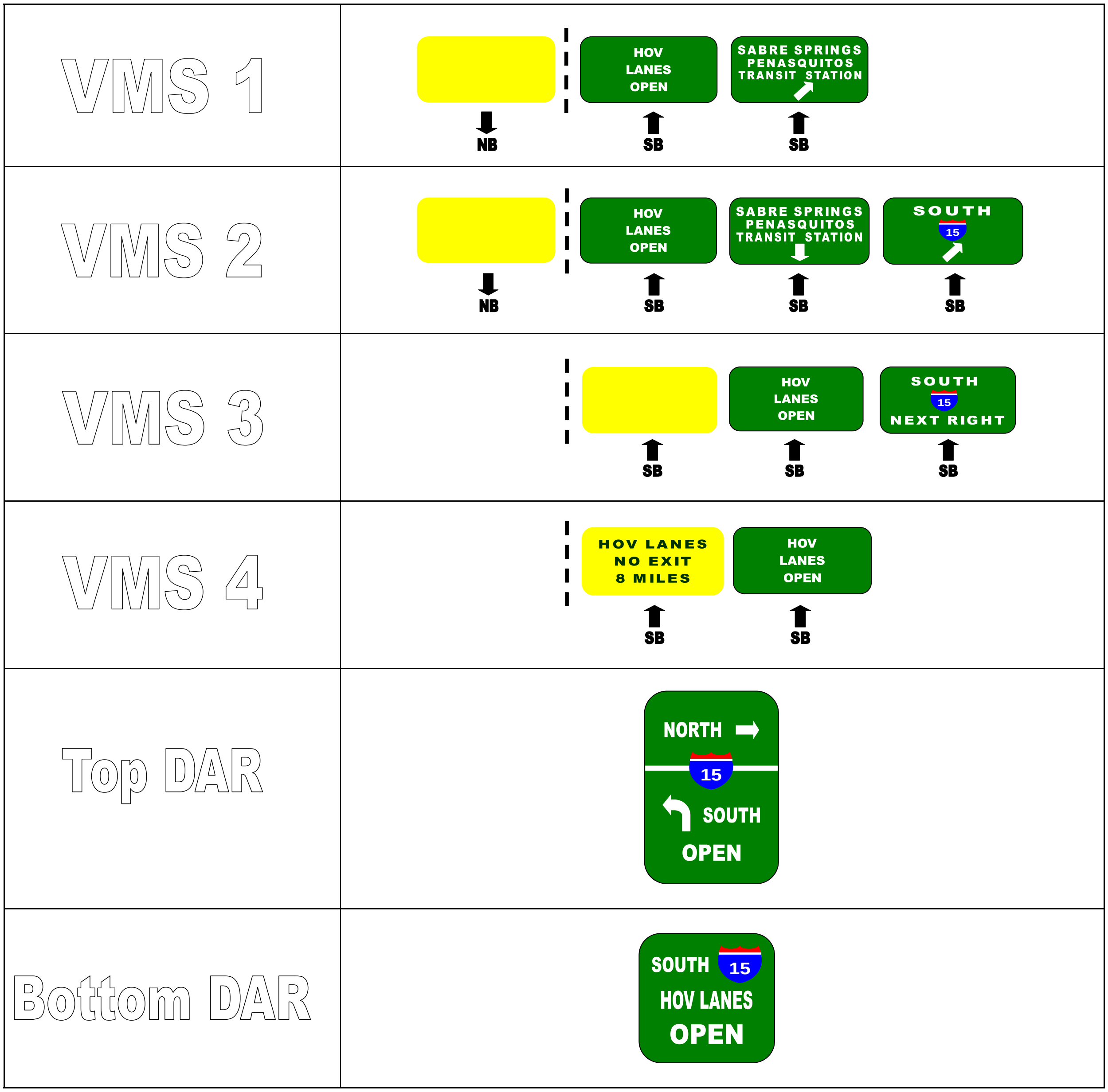
South End (Sabre Springs)

- The southbound pop-ups in the vicinity of the short barrier are raised.
- The northbound pop-ups used in the 2N+2S (PM) configuration in the vicinity of the short barrier are lowered.
- The southbound north taper, longitudinal and south taper pop-ups used in the 2N+2S (PM) configuration north of the DAR are lowered.
- The southbound long south taper pop-ups used in the 1S+3N (AM) configuration in the vicinity of the short barrier are lowered.
- The southbound in-pavement lights in the vicinity of the short barrier are turned on.
- The northbound in-pavement lights used in the 2N+2S (PM) configuration in the vicinity of the short barrier are turned off.
- The short barrier is positioned behind (east side of) the southbound pop-ups.
- The gates on Sabre Springs DAR are all open.
- The VMS signs indicate that the HOV Lanes are open in the southbound direction (**Figure 8-9**).

North End (Via Rancho Parkway / Del Lago)

- The southbound pop-ups (1st and 2nd banks) used in the 2N+2S configuration are raised.
- The southbound pop-ups (3rd bank) used in the 1N+3S configuration are lowered.
- The southbound pop-ups (1st and 2nd banks) used in the 3N+1S configuration are lowered.
- The southbound in-pavement lights (1st and 2nd banks) used in the 1N+3S configuration are off.
- The northbound in-pavement lights used in the 3N+1S configuration are off.
- VMS signs indicate 2 southbound HOV Lanes are open (**Figure 8-11**).

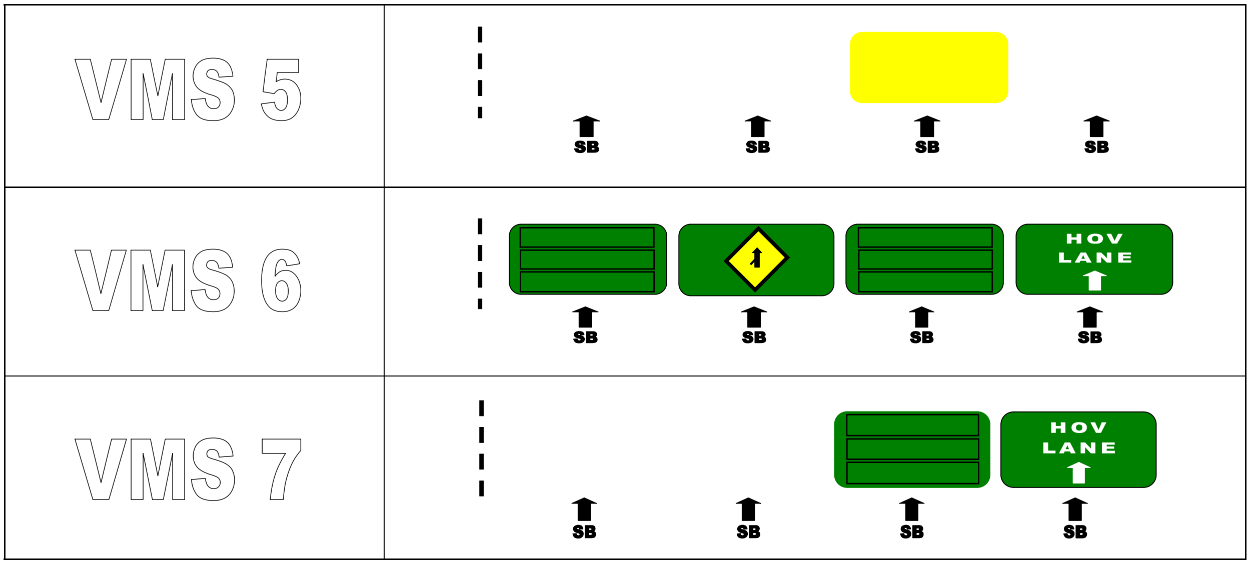
Figure 8-9. 2N+2S (AM) Variable Message Signs – South End



8.1.3 2N+2S (AM) Schedule of Operation

The 2N+2S (AM) configuration is expected to be operational during the AM peak hours when southbound traffic is predominant. The Traffic Analysis task that is part of this study will indicate the appropriate schedule for implementing this configuration.

Figure 8-11. 2N+2S (AM) Variable Message Signs - North End



8.2 2N+2S (PM)

8.2.1 2N+2S (PM) Traffic Flow

In this configuration, the Managed Lanes operate with 2 northbound lanes and 2 southbound lanes while the 2 HOV Lanes operate in the **northbound** direction.

South End (Sabre Springs)

Figure 8-14 shows the 2N+2S (PM) configuration on the South End (Sabre Springs) together with the flow of traffic.

Southbound Managed Lanes traffic is directed to exit the Managed Lanes and merge with southbound I-15 mainline after VMS 2 or exit via and Sabre Springs DAR southbound off-ramp after VMS 1.

Northbound HOV Lane traffic is directed by pop-ups and in-pavement lights to the northbound side of the Managed Lanes.

Traffic from Sabre Springs DAR can access the northbound Managed Lanes. However, the southbound on-ramp from Sabre Springs DAR is closed under this configuration.

North End (Via Rancho Parkway / Del Lago)

Figure 8-15 shows the 2N+2S (PM) configuration on the North End (Via Rancho Parkway / Del Lago DAR) together with the flow of traffic. The configuration on the North End is the same as in the 2N+2S (AM) configuration. In the southbound direction, traffic from Del Lago DAR on-ramp merges with the southbound Managed Lanes in the vicinity of the Via Rancho Parkway overcrossing. The DAR on-ramp is transitioned into the Managed Lanes by two banks of pop-ups.

In the northbound direction, the Managed Lanes operate with two lanes northbound until the end of the long barrier. Past the end of the long barrier, an inner lane is added for the Del Lago DAR northbound off-ramp.

Figure 8-14. 2N+2S (PM) Configuration - South End

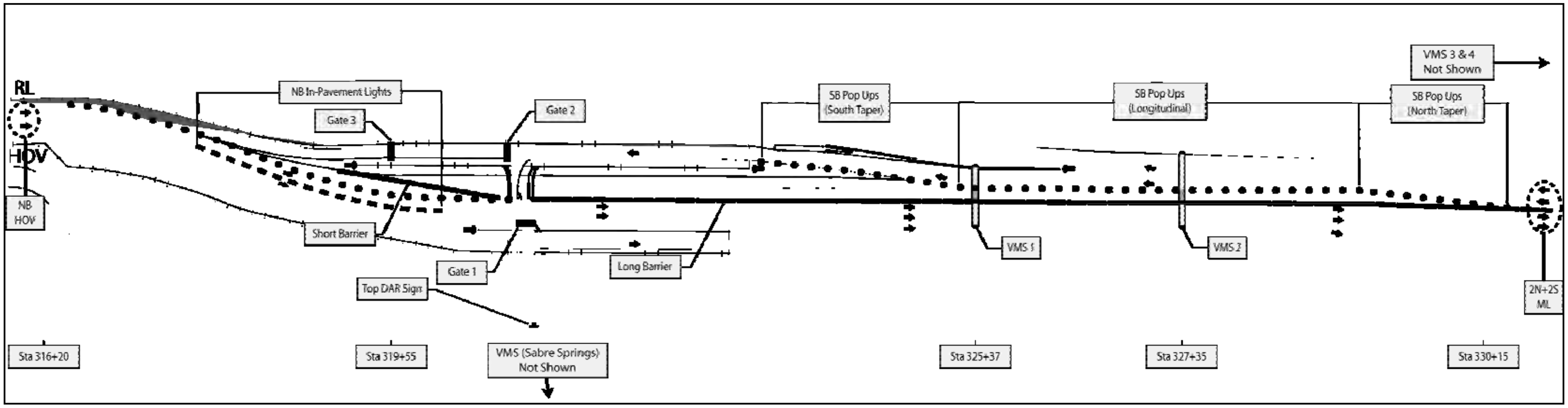
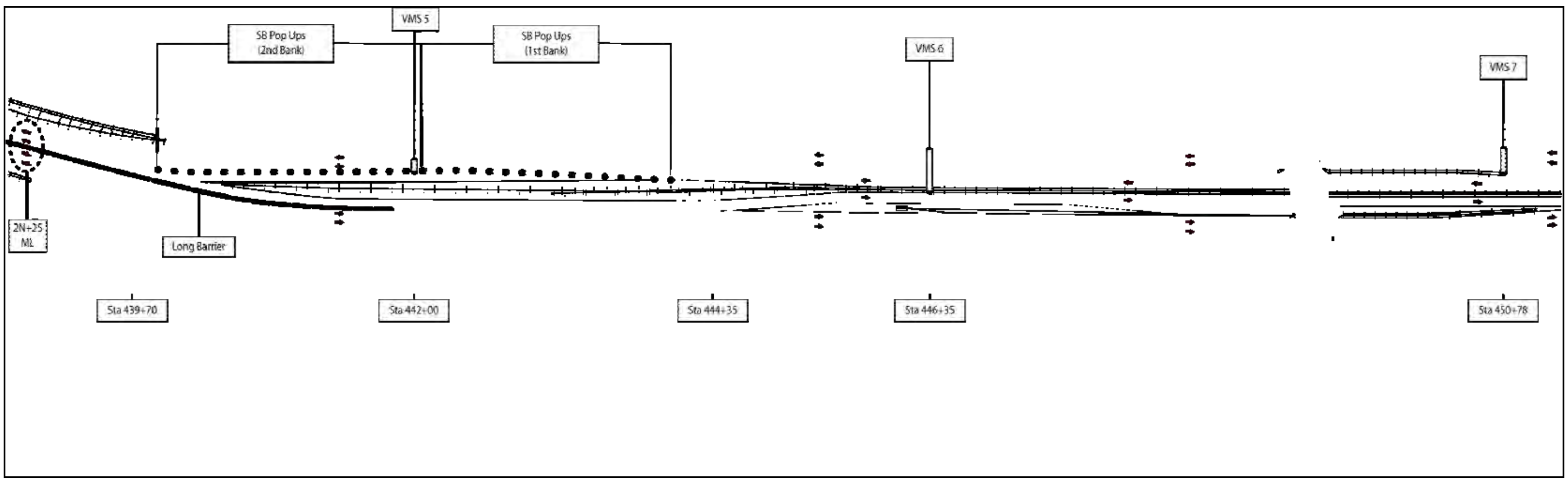


Figure 8-15. 2N+2S (PM) Configuration - North End



8.2.2 2N+2S (PM) Configuration

To maintain the traffic flow described above under the 2N+2S (PM) configuration, the following elements are put in place:

- The long barrier is positioned such that it divides the Managed Lanes into 2 northbound and 2 southbound lanes.

South End (Sabre Springs)

- The southbound pop-ups used in the 2N+2S (AM) configuration in the vicinity of the short barrier are lowered.
- The northbound pop-ups in the vicinity of the short barrier are raised.
- The southbound north taper, longitudinal and south taper pop-ups north of the DAR are raised.
- The southbound long south taper pop-ups used in the 1S+3N (AM) configuration in the vicinity of the short barrier are lowered.
- The southbound in-pavement lights used in the 2N+2S (AM) configuration in the vicinity of the short barrier are turned off.
- The northbound in-pavement lights in the vicinity of the short barrier are turned off.
- The short barrier is positioned behind (west side of) the northbound pop-ups.
- The Barrier Transfer Machine is positioned behind the short barrier.
- The gates on Sabre Springs DAR are all closed.
- The VMS signs indicate that the HOV Lanes are closed in the southbound direction, as shown in **Figure 8-18**.

North End (Via Rancho Parkway / Del Lago)

The configuration at the North End is the same as for the 2N+2S (AM) configuration:

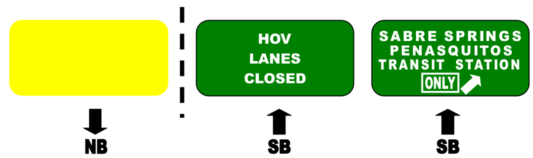
- The southbound pop-ups (1^{st} and 2^{nd} banks) used in the 2N+2S configuration are raised.
- The southbound pop-ups (3^{rd} bank) used in the 1N+3S configuration are lowered.
- The southbound pop-ups (1^{st} and 2^{nd} banks) used in the 3N+1S configuration are lowered.
- The southbound in-pavement lights (1^{st} and 2^{nd} banks) used in the 1N+3S configuration are off.
- The northbound in-pavement lights used in the 3N+1S configuration are off.
- VMS signs indicate 2 southbound HOV Lanes are open, as shown in **Figure 8-20**.

8.2.3 2N+2S (PM) Schedule of Operation

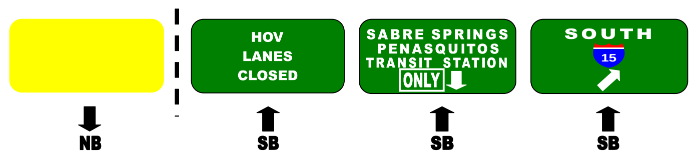
The 2N+2S (PM) configuration is expected to be operational during the PM peak hours when northbound traffic is predominant. The Traffic Analysis task that is part of this study will indicate the appropriate schedule for implementing this configuration.

Figure 8-18. 2N+2S (PM) Variable Message Signs - South End

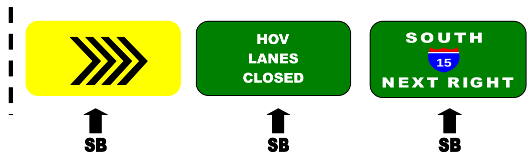
VMS 1



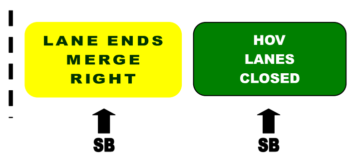
VMS 2



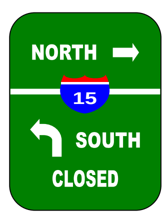
VMS 3



VMS 4

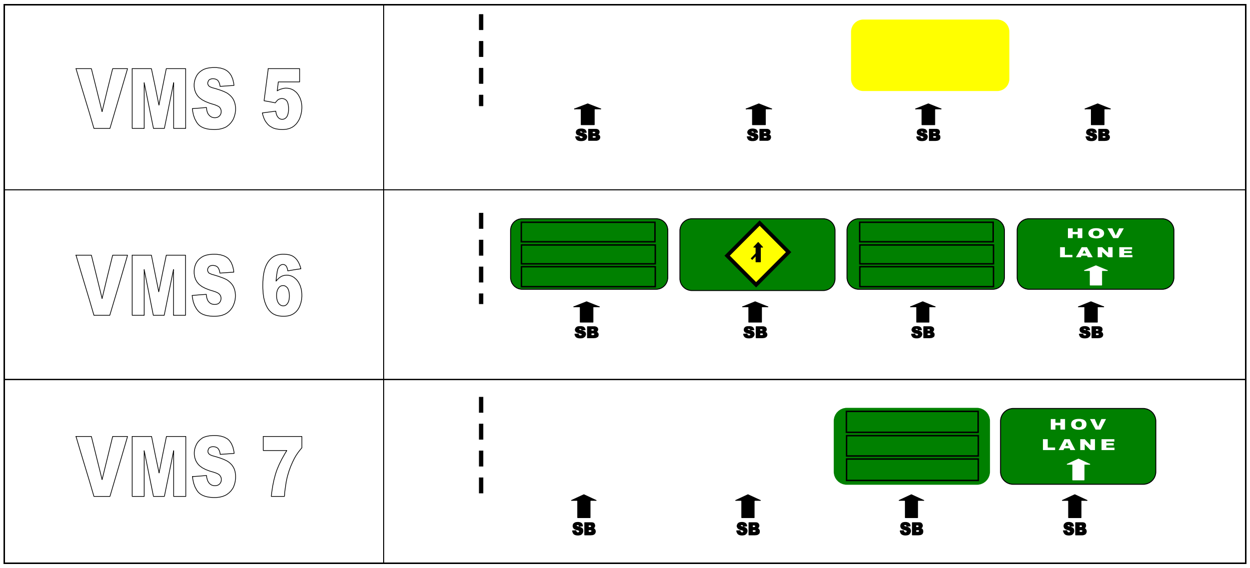


Top DAR



Bottom DAR

Figure 8-20. 2N+2S (PM) Variable Message Signs - North End



8.3 1N+3S (AM)

8.3.1 1N+3S (AM) Traffic Flow

In this configuration, the Managed Lanes operate with 1 northbound lane and 3 southbound lanes while the 2 HOV Lanes operate in the **southbound** direction.

South End (Sabre Springs)

Figure 8-23 shows the 1N+3S (AM) configuration on the South End (Sabre Springs) together with the flow of traffic.

North of Sabre Springs DAR, southbound Managed Lanes traffic uses 3 lanes. Beyond VMS 2, southbound Managed Lanes traffic can exit the Managed Lanes and join the southbound I-15 mainline. Beyond VMS 1, the outer southbound Managed Lane peels off onto the southbound Sabre Springs DAR off-ramp. The 3 southbound Managed Lanes are transitioned to 2 lanes by pop-ups prior to connecting to the southbound HOV Lanes.

Traffic from Sabre Springs DAR can access the southbound HOV Lanes via the southbound Sabre Springs DAR on-ramp which is open in this configuration. The Sabre Springs DAR northbound on-ramp provides the first opportunity for northbound traffic to enter the signle northbound Managed Lanes.

The northbound direction of the Managed Lanes between the HOV Lanes and merge with the Sabre Springs DAR northbound on-ramp is unused in this configuration.

North End (Via Rancho Parkway / Del Lago)

Figure 8-24 shows the 1N+3S (AM) configuration on the North End (Via Rancho Parkway / Del Lago DAR) together with the flow of traffic. In the southbound direction,

Managed Lanes traffic use two lanes north of Via Rancho Parkway overcrossing. South of Via Rancho Parkway, traffic from Del Lago DAR on-ramp merges with the southbound Managed Lanes, and the Del Lago DAR on-ramp transitions to an add-lane to form 3 southbound Managed Lanes.

In the northbound direction, the Managed Lanes operate with one lane northbound until the end of the long barrier. Past the end of the long barrier, three lanes become available for the northbound traffic, with the innermost lane becoming the Del Lago DAR northbound off-ramp, and the two outer lanes continuing beyond the Del Lago DAR.

Figure 8-23. 1N+3S (AM) Configuration - South End

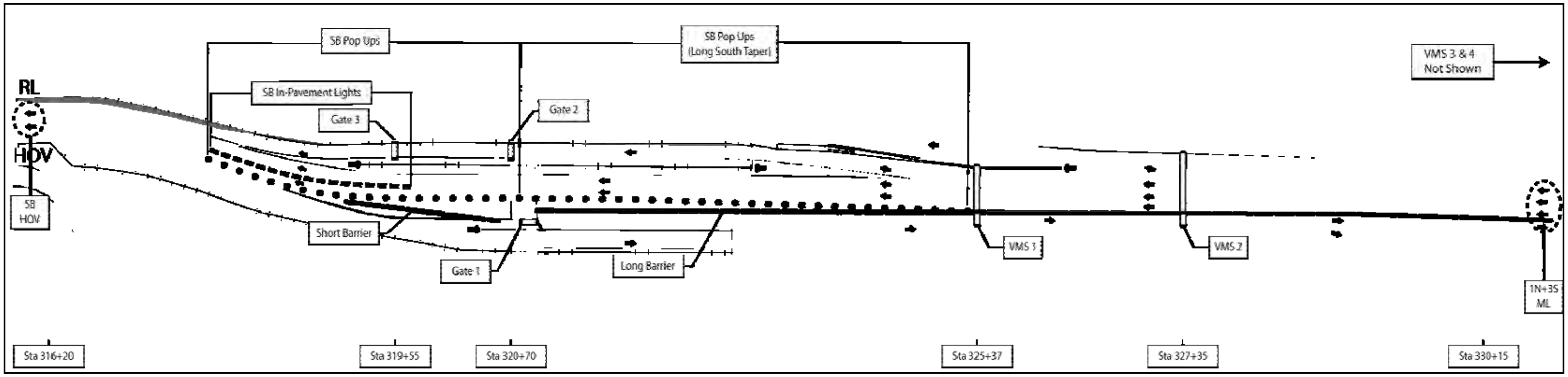
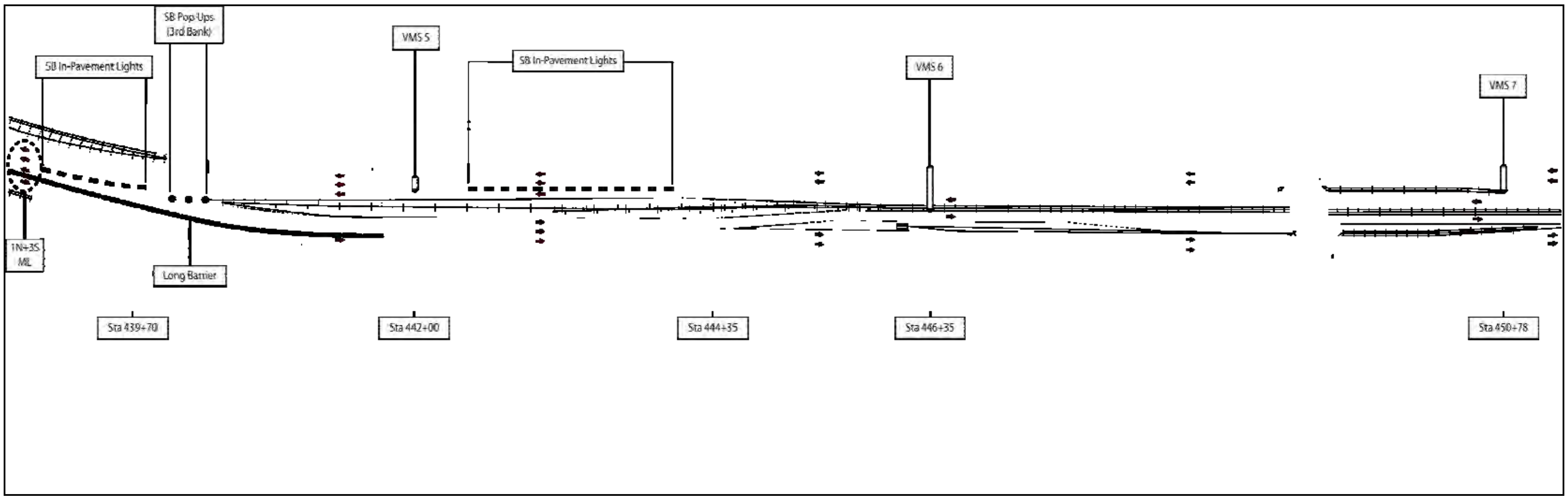


Figure 8-24. 1N+3S (AM) Configuration - North End



1N+3S (AM) Configuration

To maintain the traffic flow described above under the 1N+3S (AM) configuration, the following elements are put in place:

- The long barrier is positioned such that it divides the Managed Lanes into 1 northbound and 3 southbound lanes.

South End (Sabre Springs)

The southbound pop-ups in the vicinity of the short barrier are raised.

- The northbound pop-ups used in the 2N+2S (PM) configuration in the vicinity of the short barrier are lowered.
- The southbound north taper, longitudinal and south taper pop-ups used in the 2N+2S (PM) configuration north of the DAR are lowered.
- The southbound long south taper pop-ups north of the DAR are raised.
- The southbound in-pavement lights in the vicinity of the short barrier are turned on.
- The northbound in-pavement lights used in the 2N+2S (PM) configuration in the vicinity of the short barrier are turned off.
- The short barrier is positioned behind (east side of) the southbound pop-ups.
- The Barrier Transfer Machine is positioned behind the short barrier.
- The gates on Sabre Springs DAR are all open.
- The VMS signs indicate that the HOV Lanes are open in the southbound direction, as shown in **Figure 8-26**.

North End (Via Rancho Parkway / Del Lago)

- The southbound pop-ups (1st and 2nd banks) used in the 2N+2S configuration are lowered.
- The southbound pop-ups (3rd bank) used in the 1N+3S configuration are raised.
- The southbound pop-ups (1st and 2nd banks) used in the 3N+1S configuration are lowered.
- The southbound in-pavement lights (1st and 2nd banks) used in the 1N+3S configuration are on.
- The northbound in-pavement lights used in the 3N+1S configuration are off.
- VMS signs indicate 3 southbound HOV Lanes are open, as shown in **Figure 8-28**.

8.3.3 1N+3S (AM) Schedule of Operation

The 1N+3S (AM) configuration is expected to be operational during the AM peak hours when southbound traffic is predominant. The Traffic Analysis task that is part of this study will indicate the appropriate schedule for implementing this configuration.

Figure 8-26. 1N+3S (AM) Variable Message Signs - South End

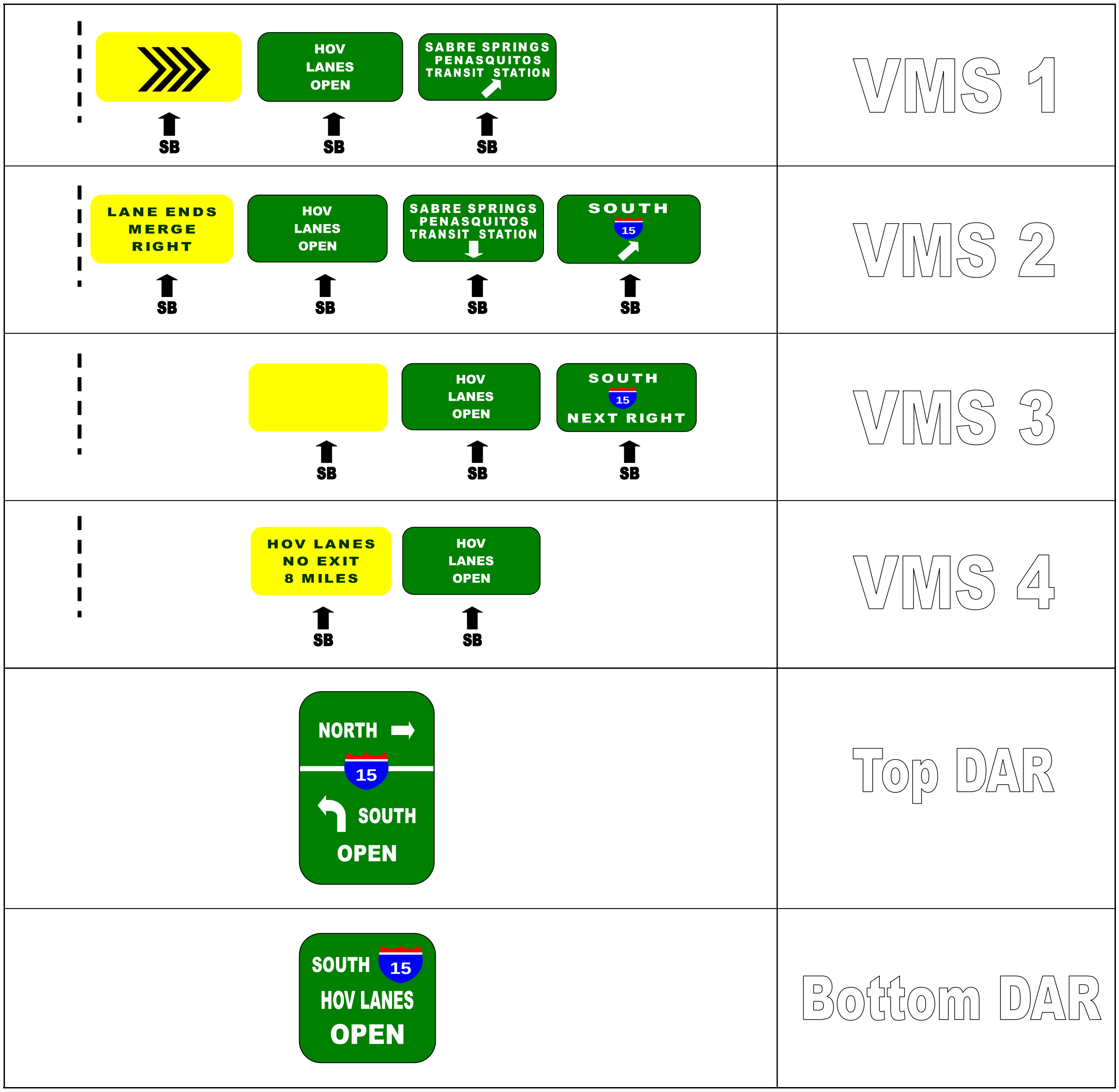
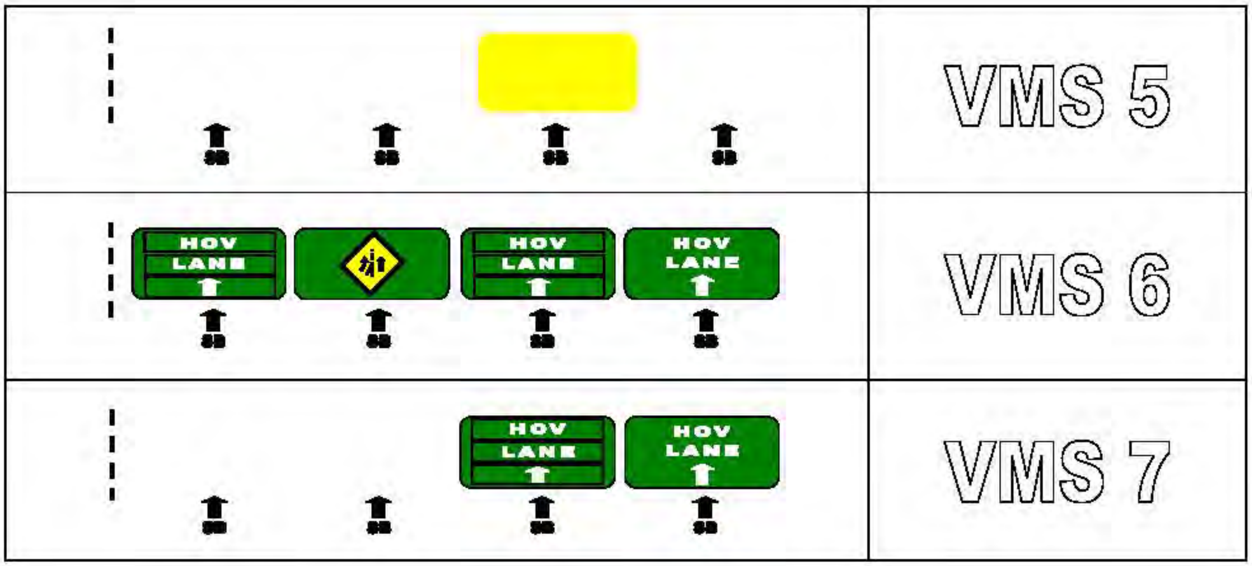


Figure 8-28. 1N+3S (AM) Variable Message Signs - North End



8.4 3N+1S (PM)

8.4.1 3N+1S (PM) Traffic Flow

In this configuration, the Managed Lanes operate with 3 northbound lanes and 1 southbound lane while the 2 HOV Lanes operate in the **northbound** direction.

South End (Sabre Springs)

Figure 8-31 shows the 3N+1S (PM) configuration on the South End (Sabre Springs) together with the flow of traffic.

Southbound Managed Lanes traffic is directed to exit the Managed Lanes and merge with southbound I-15 mainline after VMS 2 or exit via and Sabre Springs DAR southbound off-ramp after VMS 1.

Northbound HOV Lane traffic is directed by pop-ups and in-pavement lights to the northbound side of the Managed Lanes.

Traffic from Sabre Springs DAR can access the northbound Managed Lanes. However, the southbound on-ramp from Sabre Springs DAR is closed under this configuration.

North End (Via Rancho Parkway / Del Lago)

Figure 8-32 shows the 3N+1S (PM) configuration on the North End (Via Rancho Parkway / Del Lago DAR) together with the flow of traffic. In the southbound direction, Managed Lanes traffic use two lanes north of Via Rancho Parkway overcrossing. South of Via Rancho Parkway, traffic from Del Lago DAR on-ramp merges with the southbound Managed Lanes. Beyond VMS 1, the 2 southbound Managed Lanes are transitioned into one lane using pop-ups.

In the northbound direction, the Managed Lanes operate with 3 lanes northbound until the Via Rancho Parkway overcrossing. Past the overcrossing, the innermost lane becomes the Del Lago DAR northbound off-ramp, and the two outer lanes continue beyond the Del Lago DAR.

Figure 8-31. 3N+1S (PM) Configuration - South End

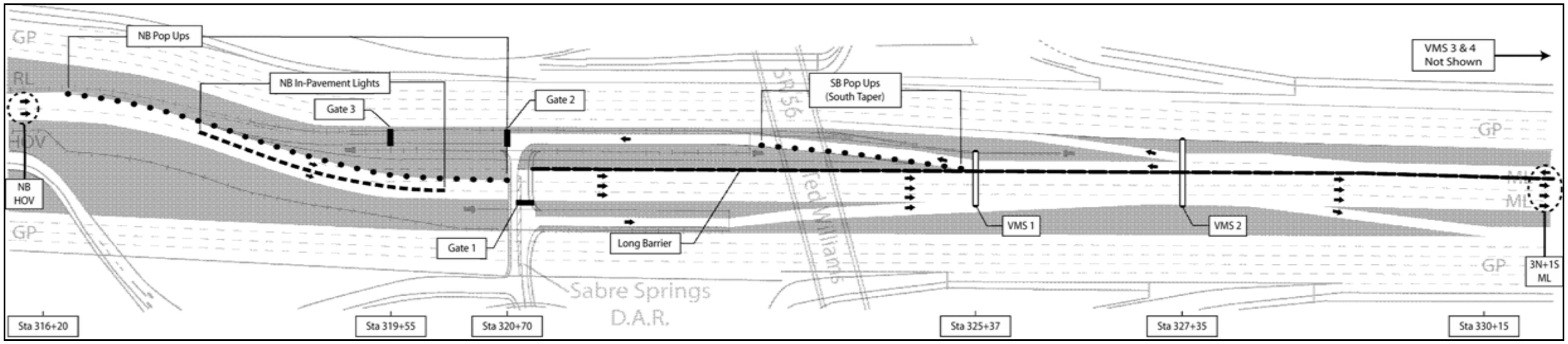
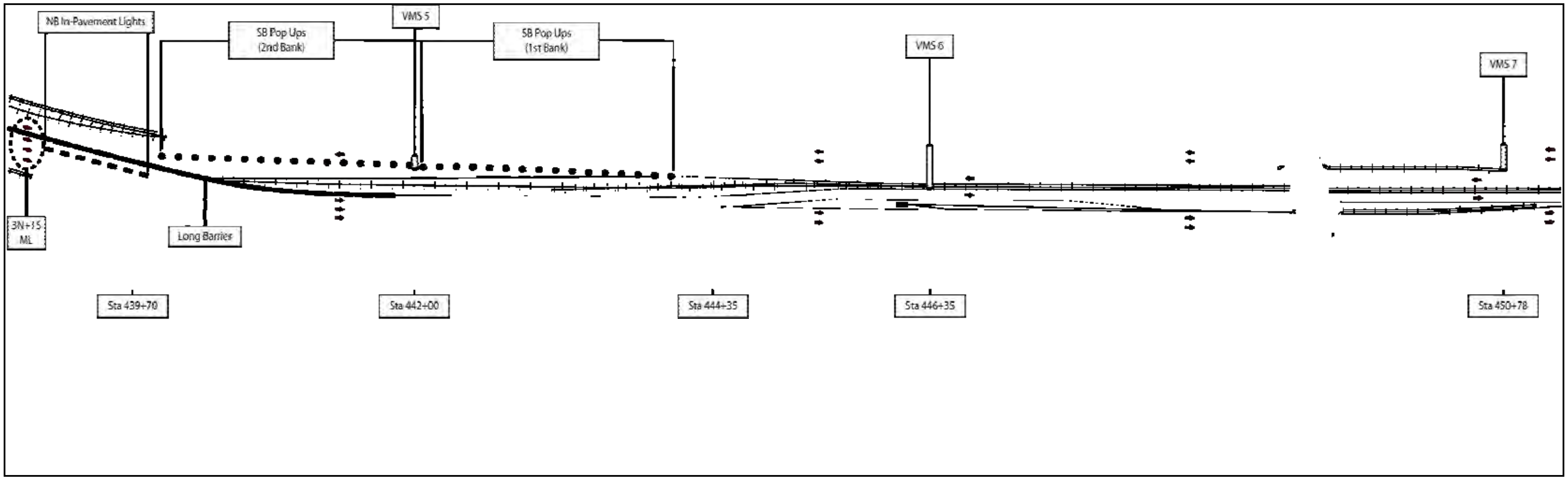


Figure 8-32. 3N+1S (PM) Configuration - North End



3N+1S (PM) Configuration

To maintain the traffic flow described above under the 3N+1S (PM) configuration, the following elements are put in place:

- The long barrier is positioned such that it divides the Managed Lanes into 3 northbound and 1 southbound lanes.

South End (Sabre Springs)

- The southbound pop-ups used in the 2N+2S (AM) configuration in the vicinity of the short barrier are lowered.
- The northbound pop-ups in the vicinity of the short barrier are raised.
- The southbound north taper and longitudinal pop-ups north of the DAR used in the 2N+2S (PM) configuration are lowered, while the south taper pop-ups are raised.
- The southbound long south taper pop-ups used in the 1S+3N (AM) configuration in the vicinity of the short barrier are lowered.
- The southbound in-pavement lights used in the 2N+2S (AM) configuration in the vicinity of the short barrier are turned off.
- The northbound in-pavement lights in the vicinity of the short barrier are turned on.
- The short barrier is positioned behind (west side of) the northbound pop-ups.
- The Barrier Transfer Machine is positioned behind the short barrier.
- The gates on Sabre Springs DAR are all closed.
- The VMS signs indicate that the HOV Lanes are closed in the southbound direction, as shown in **Figure 8-34**.

North End (Via Rancho Parkway / Del Lago)

- The southbound pop-ups (1st and 2nd banks) used in the 2N+2S configuration are lowered.
- The southbound pop-ups (3rd bank) used in the 1N+3S configuration are lowered.
- The southbound pop-ups (1st and 2nd banks) used in the 3N+1S configuration are raised.
- The southbound in-pavement lights (1st and 2nd banks) used in the 1N+3S configuration are off.
- The northbound in-pavement lights used in the 3N+1S configuration are on.
- VMS signs indicate 1 southbound HOV Lane is open, as shown in **Figure 8-36**.

8.4.3 3N+1S (PM) Schedule of Operation

The 3N+1S (PM) configuration is expected to be operational during the PM peak hours when northbound traffic is predominant. The Traffic Analysis task that is part of this study will indicate the appropriate schedule for implementing this configuration.

Figure 8-34. 3N+1S (PM) Variable Message Signs - South End

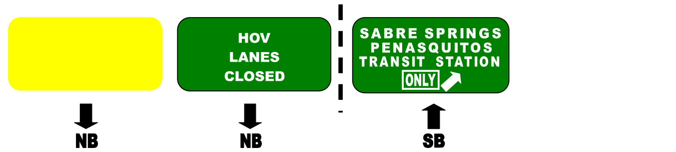
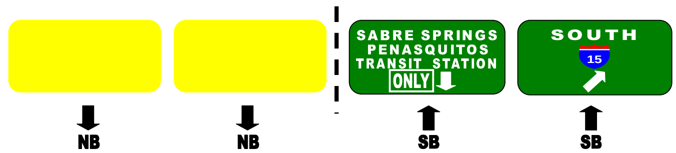
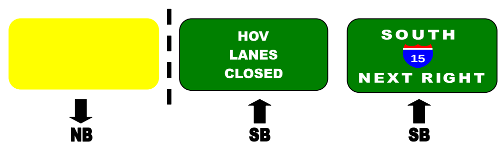
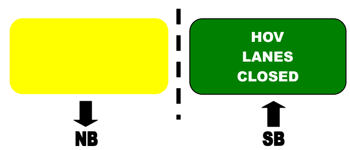
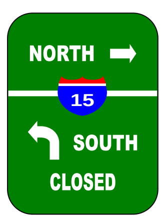
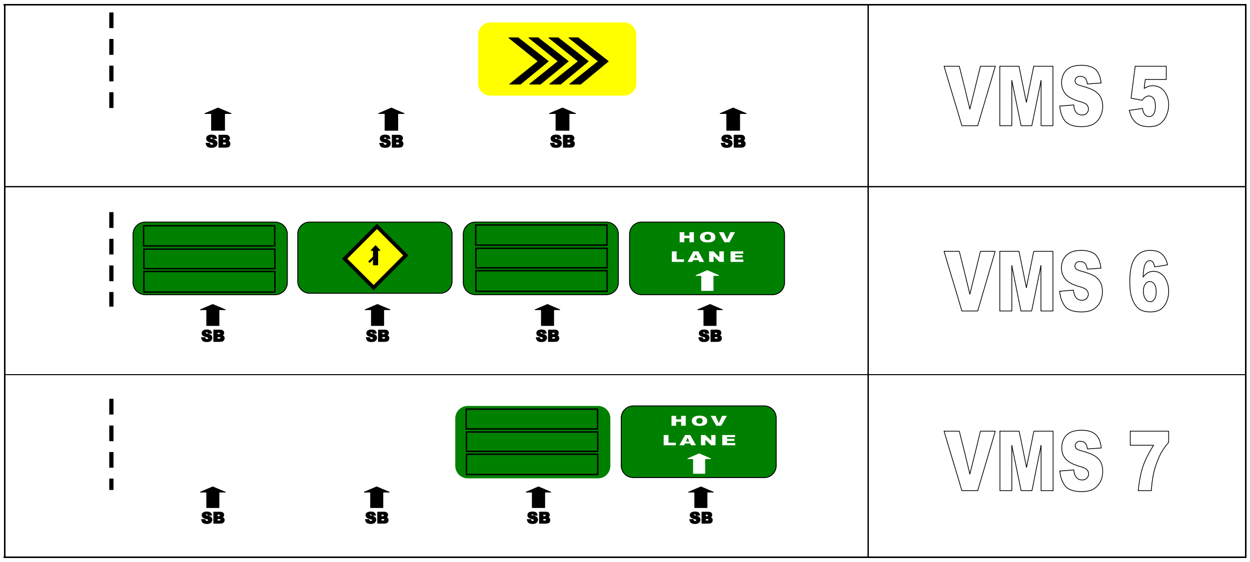
	VMS 1
	VMS 2
	VMS 3
	VMS 4
	Top DAR
	Bottom DAR

Figure 8-36. 3N+1S (PM) Variable Message Signs - North End



8.5 Summary

Table 8-1 identifies the various traffic guidance devices and their status under the four standard daily configurations.

Table 8-1. Summary of Standard Daily Configurations

	2N+2S (AM)	2N+2S (PM)	1N+3S (AM)	3N+1S (PM)
SOUTH END (Sabre Springs)				
POP-UPS				
SB North Taper (D) (STA 329 + 10 to STA 333 + 15)	Down	Up	Down	Down
SB Longitudinal (E) (STA 325 + 10 to STA 329 + 10)	Down	Up	Down	Down
SB South Taper (F) (STA 323 + 10 to STA 325 + 10)	Down	Up	Down	Up
SB Long South Taper (G) (STA 320 + 66 to STA 325 + 20)	Down	Down	Up	Down
SB Short Barrier (H) (STA 317 + 70 to STA 320 + 66)	Up	Down	Up	Down
NB Short Barrier (I) (STA 316 + 10 to STA 320 + 66)	Down	Up	Down	Up
IN-PAVEMENT LIGHTS				
NB Short Barrier (STA 317 + 70 to STA 320 + 20)	Off	On	Off	On
SB Short Barrier (STA 317 + 70 to STA 319 + 75)	On	Off	On	Off
GATES				
Gate 1 (Top of DAR) (STA 320 + 85)	Open	Closed	Open	Closed
Gate 2 (SB On-ramp Top) (STA 320 + 70)	Open	Closed	Open	Closed
Gate 3 (SB On-ramp Bottom) (STA 319 + 55)	Open	Closed	Open	Closed
NORTH END (Via Rancho/Del Lago)				
POP-UPS				
SB 1st Bank (A)* (STA 442 + 10 to STA 444 + 21)	Up	Up	Down	Up
SB 2nd Bank (B1) (STA 439 + 90 to STA 442 + 10)	Up	UP	Down	Down
SB 2nd Bank (B2) (STA 439 + 90 to STA 442 + 10)	Down	Down	Down	Up
SB 3rd Bank (C) (STA 439 + 90 to STA 440 + 30)	Down	Down	Up	Down
IN-PAVEMENT LIGHTS				
NB (STA 438 + 85 to STA 439 + 70)	Off	Off	Off	On
SB (A) (STA 438 + 85 to STA 439 + 70)	Off	Off	On	Off
SB (B) (STA 442 + 30 to STA 444 + 20)	Off	Off	On	Off

* Note: Letters in parentheses correspond to designations in Caltrans original drawings retained here for compatibility.

9.0 OPERATIONAL SCENARIOS AND PROCEDURES – SUMMARY

Table 9-1 shows the twelve possible combinations of configuring the four Managed Lanes and the two Reversible HOV Lanes. Four of these combinations, identified as "Standard Daily Operations," are expected to be used on a regular/daily basis. The other combinations, identified as "Incident Management," will be related to incident management scenarios and are discussed in the Traffic Incident Management Plan.

Table 9-1. Operational Scenarios between Managed Lanes (ML) and Reversible HOV Lanes (RL)

ML	RL	→	ML	RL	Type
		Change To	2N+2S (PM)	2N	Standard Daily Operations
2N+2S (AM)	2S	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Standard Daily Operations
2N+2S (PM)	2N	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management
		Change To	1N+3S (AM)	2S	Standard Daily Operations
3N+1S (PM)	2N	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Standard Daily Operations
1N+3S (AM)	2S	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management

Note: the letter "N" means "Northbound," the letter "S" means "Southbound," and the numbers indicate the number of lanes in that direction. For example, 2N+2S means two northbound lanes and two southbound lanes, and 3N+1S means three northbound lanes and one southbound lane. 2N+2S (AM) refers to 2N+2S configuration for the Managed Lanes with the HOV Lanes in the southbound direction during the AM commute hours, while 2N+2S (PM) refers to the same general configuration on the Managed Lanes with the HOV Lanes in the northbound direction during the PM commute hours.

9.1 From 2N+2S (PM) To 2N+2S (AM)

Overview

This scenario will change the Managed Lanes configuration at the **South End** from **Figure 9-1** to **Figure 9-2.** The configuration at the **North End** will remain the same at 2N+2S as shown in **Figure 9-3**.

When to make the transition?

The change from Northbound to Southbound lane configuration is planned to start at around 10:30 PM. Times for opening and closing may vary based on traffic volumes and/or to allow for most efficient use of staffing and turnaround squad, at the discretion of the TMC Operations Chief and Maintenance Area Supervisor.

Who are involved?

No CHP Traffic Break is required as live lanes are being opened SB, not closed.

During these operations, Caltrans Maintenance Staff are in the field coordinating with the TMC Operations Staff for the transition. In addition to working on the NB closure of the Reversible HOV Lanes, they transport and drop off the Barrier Transfer Machine (BTM) Equipment Operators, provide protection against errant drivers with strategically parked attenuated trucks, and communicate with TMC Operations Staff for proper timing to raise the gates, raise/lower the pop-ups, turn the in-pavement lights on/off, and change the VMS. TMC Operations Staff will have primary control over traffic guidance elements (pop-ups, in-pavement lights, gates, VMS); BTM driver will have secondary control, while tertiary control will be provided via field controller cabinets. Chapters 3 and 4 describe agency responsibilities and interactions.

How will the transition be accomplished?

To change from the 2N+2S (PM) to the 2N+2S (AM) configuration, activities occur only at the South End of the Middle Segment at Sabre Springs:

South End (Sabre Springs)

1. Existing Reversible HOV Lanes are closed northbound (NB) and opened southbound (SB).
2. At Sabre Springs, Managed Lanes NB Pop-ups are lowered and NB In-pavement Lights are turned off.

Figure 9-1. Initial Configuration: 2N+2S (PM) – South End

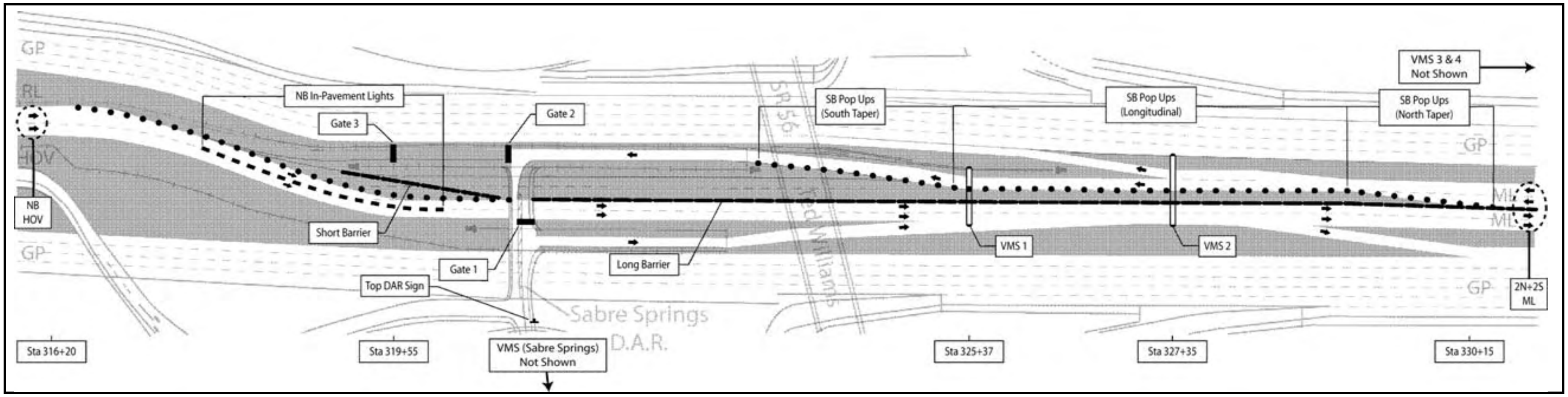


Figure 9-2. Final Configuration: 2N+2S (AM) – South End

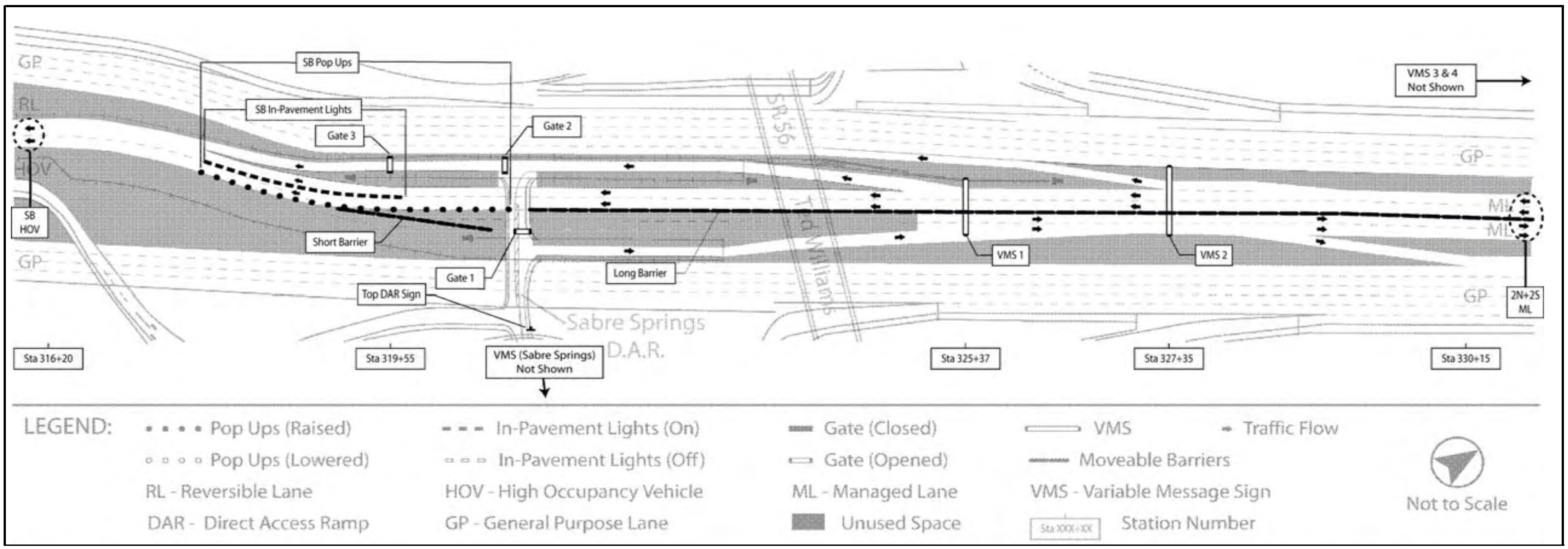
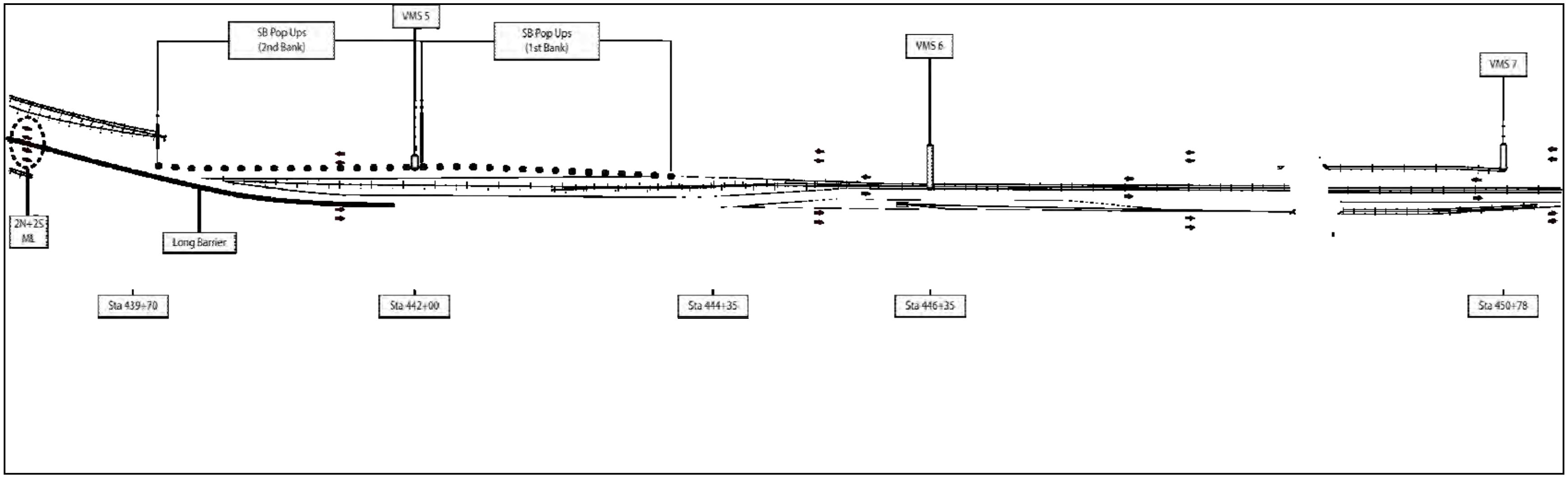


Figure 9-3. 2N+2S (AM) and (PM) – North End

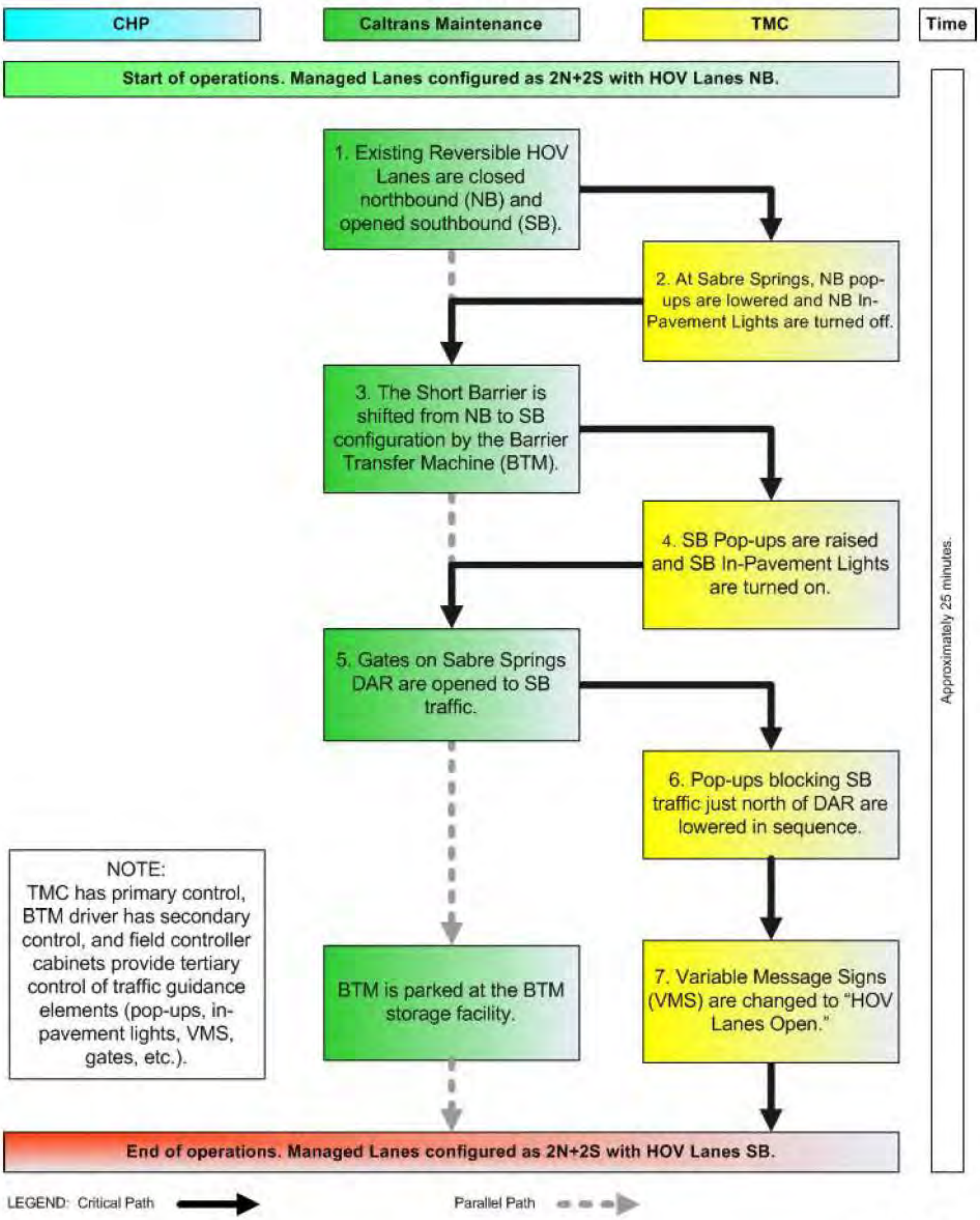


<u>**South End (Sabre Springs) Activities Continued:**</u>

3. The Short Barrier is shifted from NB to SB configuration with Barrier Transfer Machine (BTM).
4. SB Pop-ups under Sabre Springs DAR are raised and SB In-pavement Lights are turned on.
5. Gates on Sabre Springs DAR are opened to SB traffic.
6. Pop-ups blocking SB traffic just north of DAR are lowered in sequence.
7. Variable Message Signs (VMS) are changed to “HOV Lanes Open” to southbound traffic.

SEQUENCE OF OPERATIONS TO PREPARE FOR THE MORNING COMMUTE CHANGE FROM 2N+2S (PM – HOV NB) TO 2N+2S (AM – HOV SB)

SUMMARY



9.2 From 2N+2S (AM) To 2N+2S (PM)

Overview

This scenario will change the Managed Lanes configuration at the **South End** from **Figure 9-4** to **Figure 9-5.** The configuration at the **North End** will remain the same at 2N+2S as shown in **Figure 9-6**.

When to make the transition?

The change from Southbound to Northbound lane configuration is planned to start at around 10:30 AM. Times for opening and closing may vary based on traffic volumes and/or to allow for most efficient use of staffing and turnaround squad, at the discretion of the TMC Operations Chief and Maintenance Area Supervisor.

Who are involved?

A CHP Traffic Break is required for the closing of the southbound Managed Lanes into the Reversible HOV Lanes when switching to northbound operations for the evening commute. Assumptions for the Traffic Break: CHP Patrol Car travels at 35 mph, Caltrans Maintenance Truck travels ahead of the CHP car at 45 mph, Attenuator Truck travels ahead of Maintenance Truck at 55 mph, behind the Public Vehicles traveling at freeway speeds of 55 mph or greater.

During these operations, Caltrans Maintenance Staff are in the field coordinating with the CHP for the Traffic Break and with the TMC Operations Staff for the transition. In addition to working on the SB closure of the Reversible HOV Lanes, they transport and drop off the Barrier Transfer Machine (BTM) Equipment Operators, provide protection against errant drivers with strategically parked attenuated trucks, and communicate with TMC Operations Staff for proper timing to change the VMS messages, close the gates, and change the configuration of the pop-ups and in-pavement lights. TMC Operations Staff will have primary control over traffic guidance elements (pop-ups, in-pavement lights, gates, VMS); BTM driver will have secondary control, while tertiary control will be provided via field controller cabinets. Chapters 3 and 4 describe agency responsibilities and interactions.

How will the transition be accomplished?

To change from the 2N+2S (AM) to the 2N+2S (PM) configuration, a CHP Traffic Break is required north of Sabre Springs to close the live SB traffic going into the Reversible HOV Lanes.

The major activities to prepare for the evening traffic occur only at the South End.

Figure 9-4. Initial Configuration: 2N+2S (AM) - South End

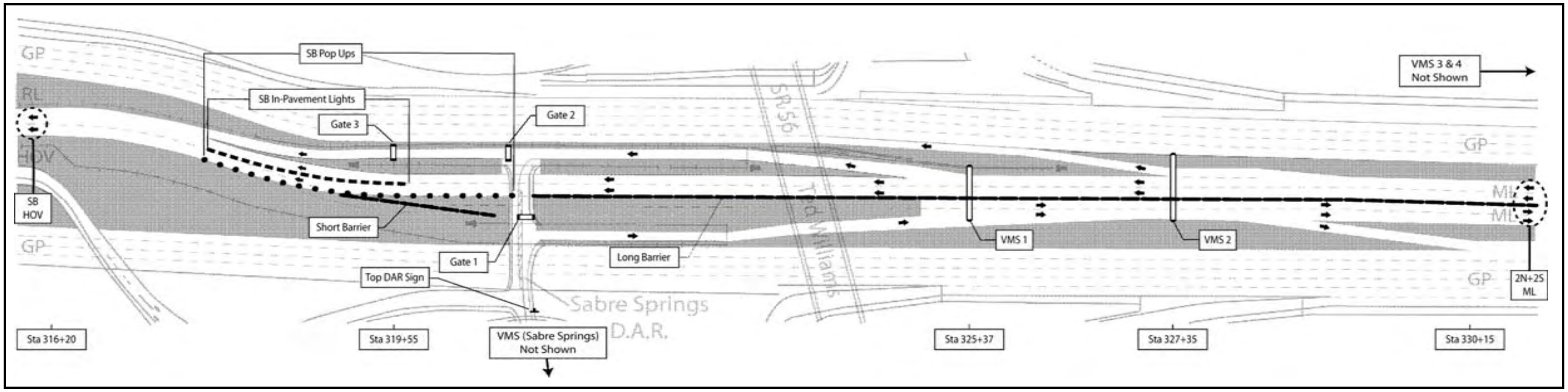


Figure 9-5. Final Configuration: 2N+2S (PM) - South End

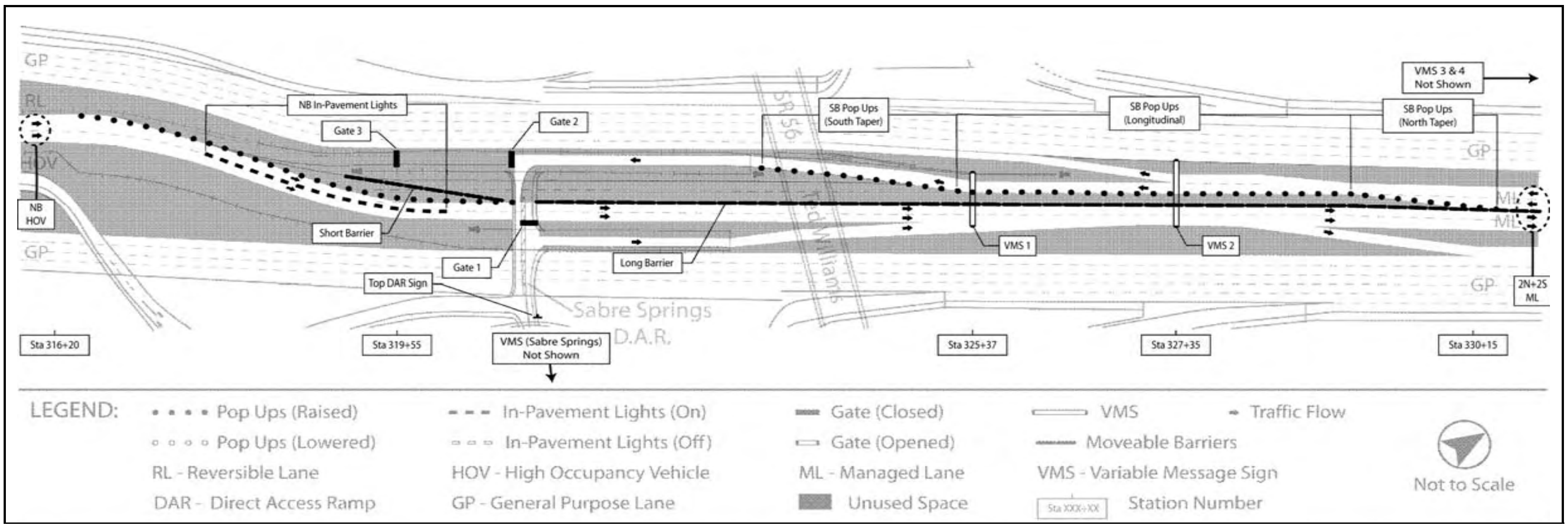
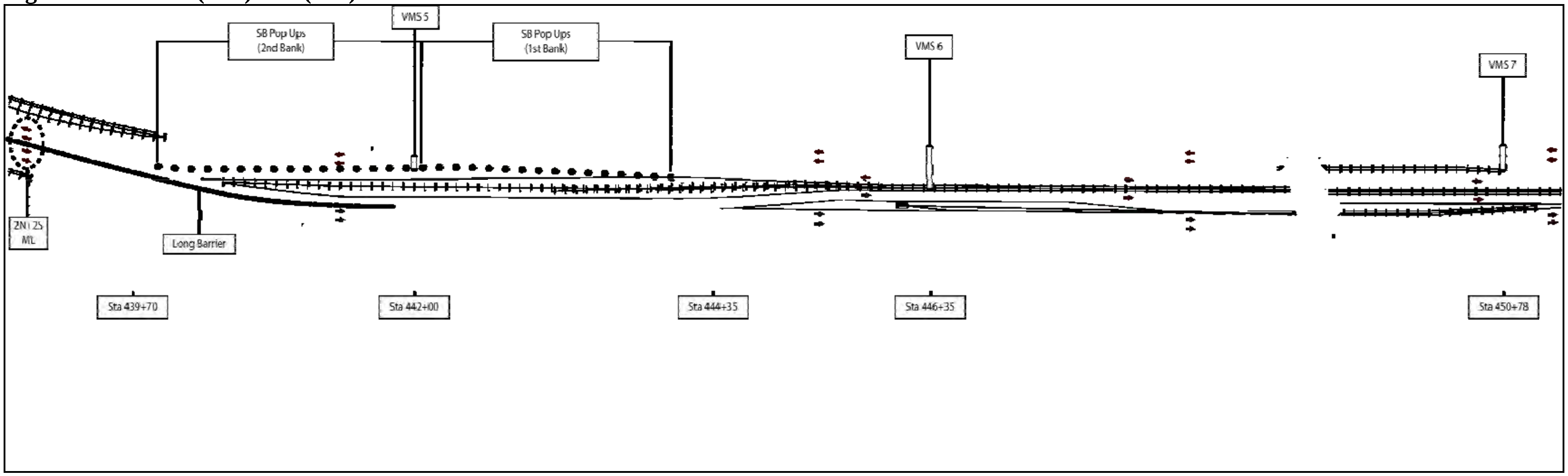


Figure 9-6. 2N+2S (AM) and (PM) - North End

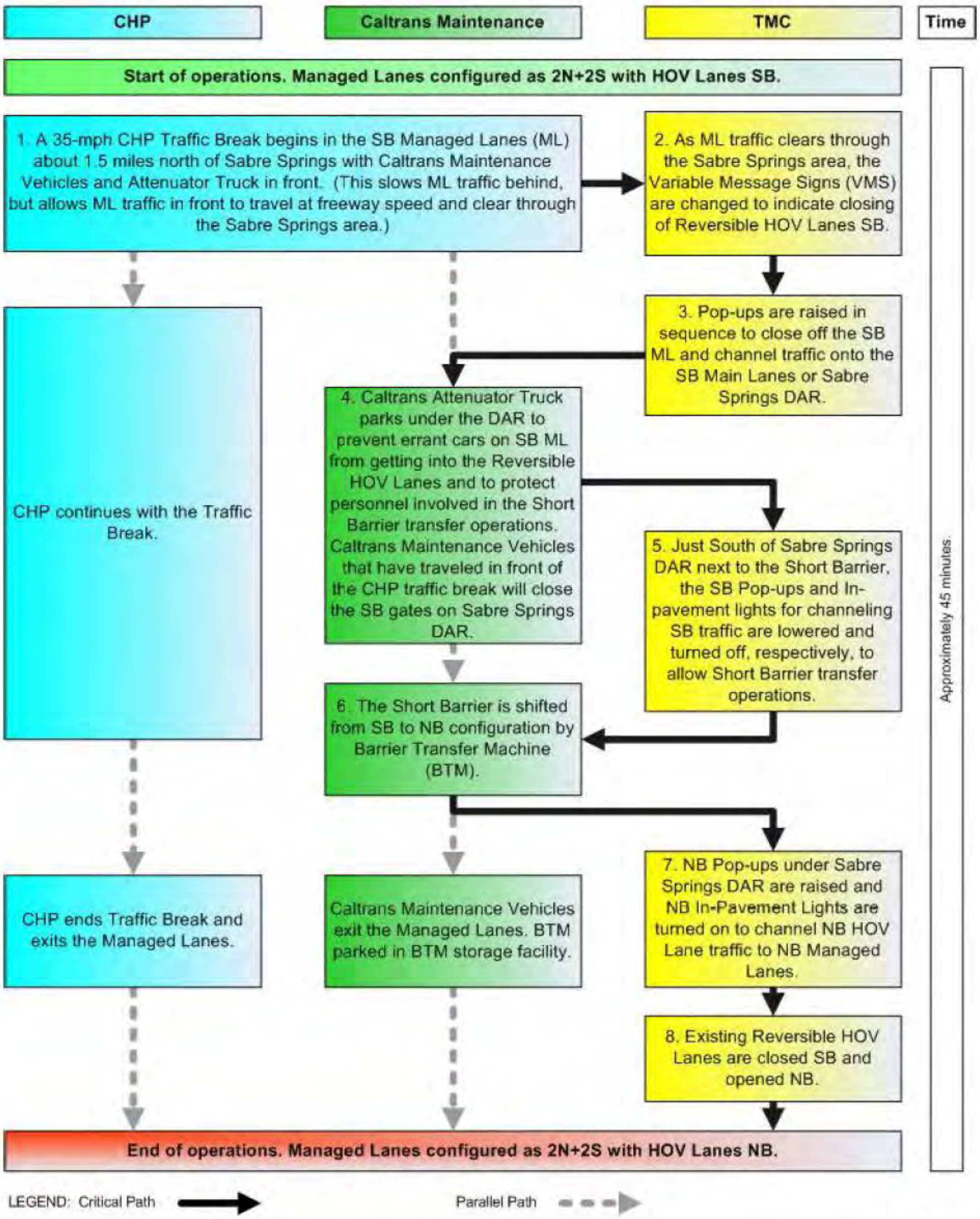


South End (Sabre Springs)

1. A 35-mph CHP Traffic Break begins about 1.5 miles north of Sabre Springs in the SB ML with Caltrans Maintenance Vehicles and Attenuator Truck in front. (This slows vehicles behind, but allows traffic in front to travel at freeway speed and clear through the Sabre Springs area.)
2. As public vehicles clear through the Sabre Springs area, the VMS are changed to indicate closing of Reversible HOV Lanes SB.
3. Pop-ups are raised in sequence to close off the SB ML traffic and channel this traffic onto the SB Main Lanes or onto Sabre Springs DAR.
4. Caltrans Attenuator Truck parks under the DAR to prevent errant cars on SB Managed Lanes from getting into the Reversible HOV Lanes and to protect personnel involved in the Short Barrier transfer operations. Caltrans Maintenance Vehicles that have traveled in front of the CHP traffic break will close the SB gates on Sabre Springs DAR.
5. Just south of Sabre Springs DAR next to the Short Barrier, Pop-ups and In-pavement lights for channeling SB traffic are lowered and turned off, respectively.
6. The Short Barrier is shifted from SB to NB configuration by Barrier Transfer Machine (BTM).
7. NB Pop-ups under Sabre Springs DAR are raised and NB In-pavement Lights are turned on.
8. Existing Reversible HOV Lanes are closed SB and opened NB.

SEQUENCE OF OPERATIONS TO PREPARE FOR THE EVENING COMMUTE CHANGE FROM 2N+2S (AM – HOV SB) TO 2N+2S (PM – HOV NB)

SUMMARY



9.3 From 3N+1S (PM) To 1N+3S (AM)

Overview

This scenario will change the Managed Lanes configuration at the **South End** from **Figure 9-7** to **Figure 9-8.** The configuration at the **North End** will also change from **Figure 9-9** to **Figure 9-10**.

When to make the transition?

The change from Northbound to Southbound lane configuration is planned to occur between 7:00 PM to 10:30 PM. Start times are earlier than the 2N+2S operations due to additional time needed to transfer the long movable barriers by the BTMs, reconfigure field elements at each end, and to execute CHP Traffic Breaks when reducing the number of southbound lanes at Del Lago/Via Rancho Parkway or when closing the southbound Managed Lanes flowing into the Reversible HOV Lanes.

The Traffic Analysis will indicate the appropriate timing for using the 1N+3S (AM) versus the 2N+2S (AM) configurations.

Who are involved?

No CHP Traffic Break is required as live lanes are being opened SB, not closed.

During these operations, Caltrans Maintenance Staff are in the field coordinating with the TMC Operations Staff for the transition. In addition to working on the NB closure of the Reversible HOV Lanes, they transport and drop off the Barrier Transfer Machine (BTM) Equipment Operators, provide protection against errant drivers with strategically parked attenuated trucks, and communicate with TMC Operations Staff for proper timing to raise the gates, raise/lower the pop-ups, turn the in-pavement lights on/off, and change the VMS. TMC Operations Staff will have primary control over traffic guidance elements (pop-ups, in-pavement lights, gates, VMS); BTM driver will have secondary control, while tertiary control will be provided via field controller cabinets. Chapters 3 and 4 describe agency responsibilities and interactions.

How will the transition be accomplished?

To change from the 3N+1S to the 1N+3S configuration, activities start at the South End of the Middle Segment at Sabre Springs and move to the North End at Del Lago/Via Rancho Parkway. (The existing Reversible HOV Lanes are first closed northbound.)

Figure 9-7. Initial Configuration: 3N+1S (PM) - South End

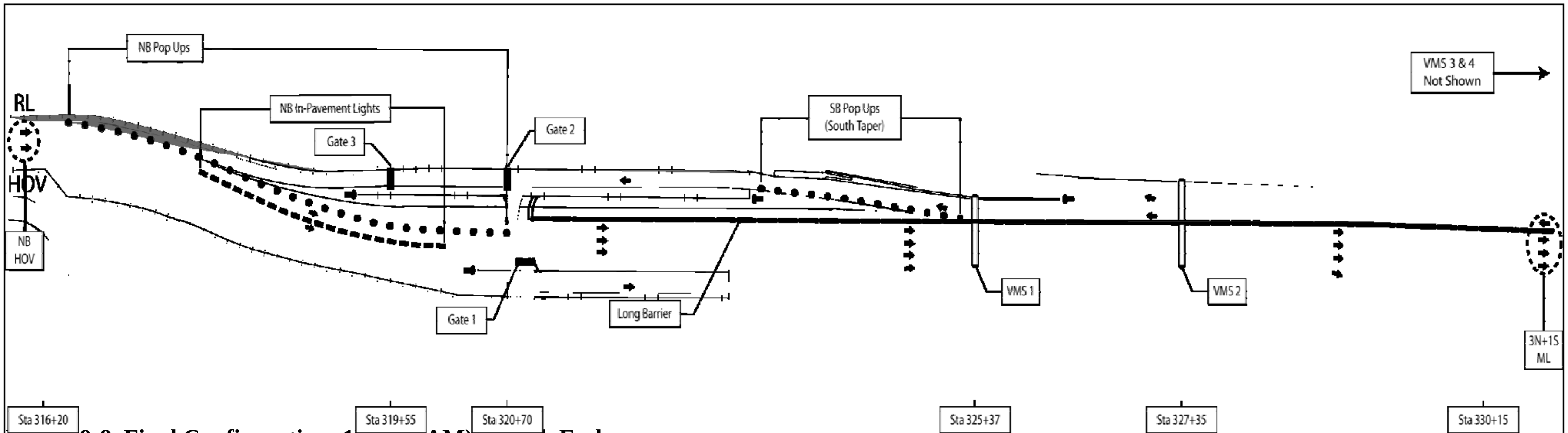


Figure 9-8. Final Configuration: 1N+3S (AM) - South End

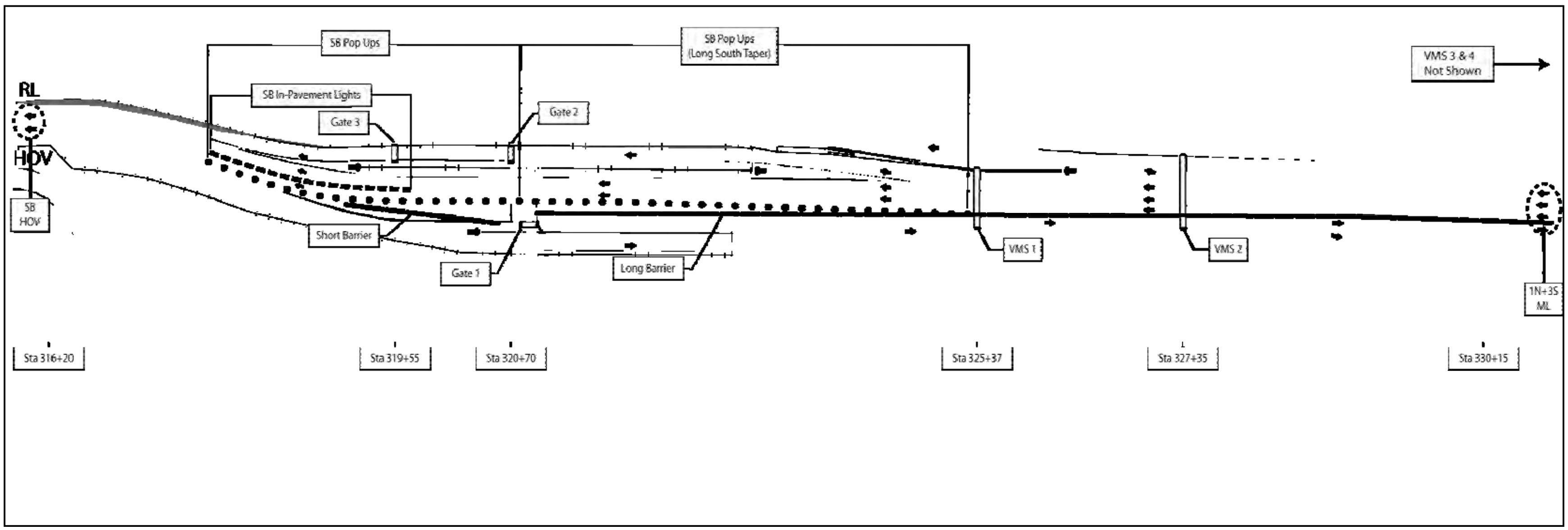


Figure 9-9. Initial Configuration: 3N+1S (PM) - North End

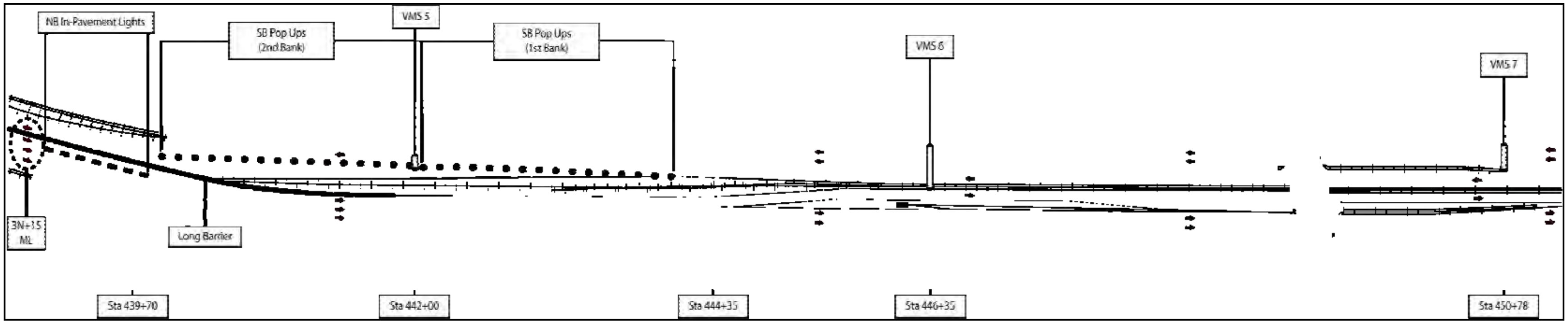
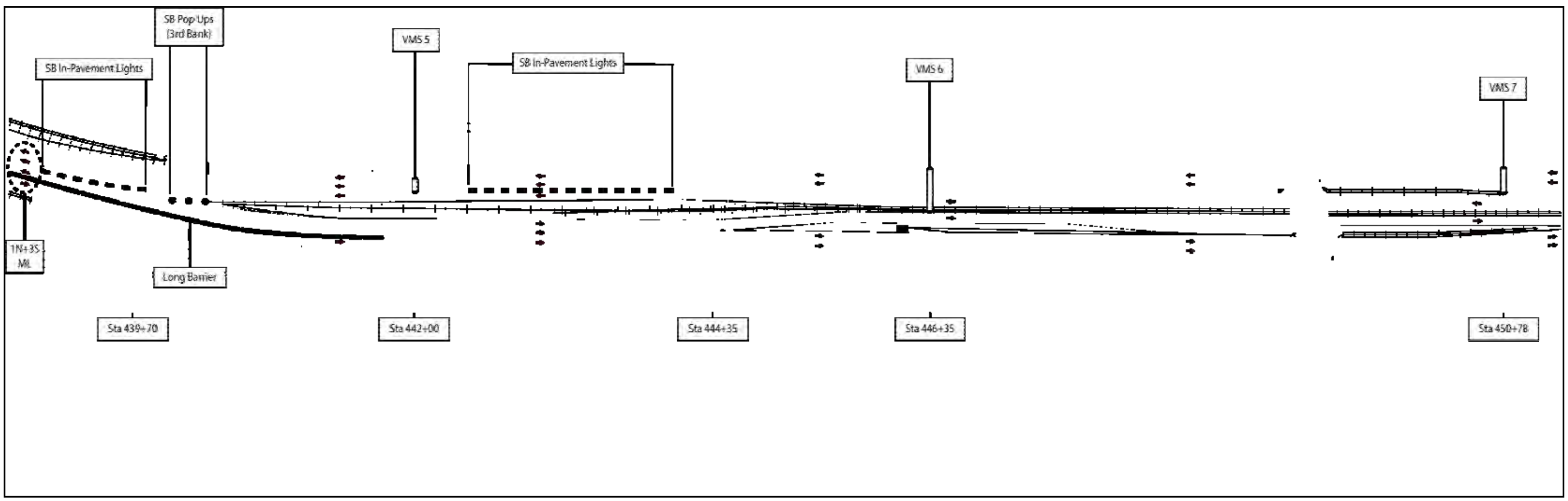


Figure 9-10. Final Configuration: 1N+3S (AM) - North End



South End (Sabre Springs)

1. Existing HOV Lanes are first closed NB and opened SB.
2. NB Pop-ups and In-pavement lights at the Short Barrier are lowered/turned off, respectively.
3. The Short Barrier is transferred from NB to SB configuration with one BTM.
4. SB Pop-ups and In-Pavement Lights at the Short Barrier are raised/turned on, respectively.
5. DAR Gates are opened for SB traffic; Sabre Springs VMS display "SB HOV Open".
6. Two BTMs start driving north, transferring the Long Barrier one lane each.
7. BTMs make a temporary stop and tapered pop-ups just north of the DAR blocking SB traffic are lowered in sequence. SB traffic may now access the HOV lanes.
8. Variable Message Signs (VMS) facing the SB traffic are changed to "SB HOV Open."
9. BTMs continue north toward Via Rancho Parkway/Del Lago, transferring the Long Barrier to the 1N+3S configuration.

North End (Via Rancho Parkway / Del Lago)

1. Two barrier transfer machines (BTMs) start from the south end at Sabre Springs Direct Access Ramp (DAR) and move north one after the other transferring the reactive tension movable barriers one lane (4.2 meter/14 feet) each for a total of two lanes (8.5 meter/28 feet). The barrier movement is from left to right (west to east).

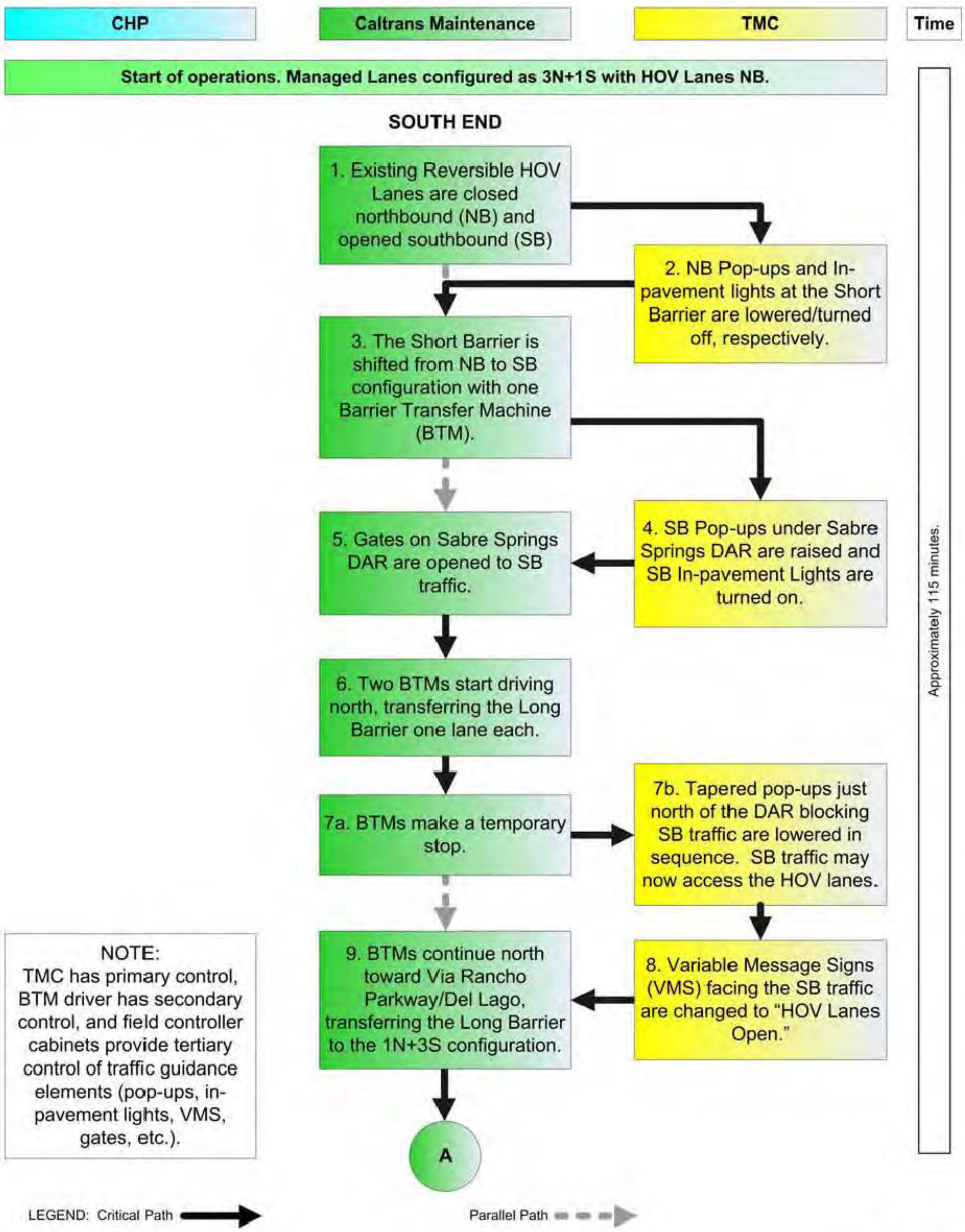
2. When the BTMs reach the first set of in-pavement lights and pop-ups, just south of Via Rancho Parkway, the delineation will change. The in-pavement light will be turned off for the northbound lanes and turned on for the southbound lanes. The pop-ups for the 3N + 1S setup will be lowered, allowing both vehicles/traffic from the DAR onramp and the two other southbound HOV lanes to flow south through three lanes.

3. The southbound VMS are changed (immediately following the delineation change) to reflect the new configuration with three lanes flowing south.

4. At the end of this sequence, the two BTMs may be maneuvered and parked between the movable barrier and the median barrier, or the machines may be driven off up the DAR to the Del Lago permanent storage/maintenance facility, expected to be completed a year or two after the opening.

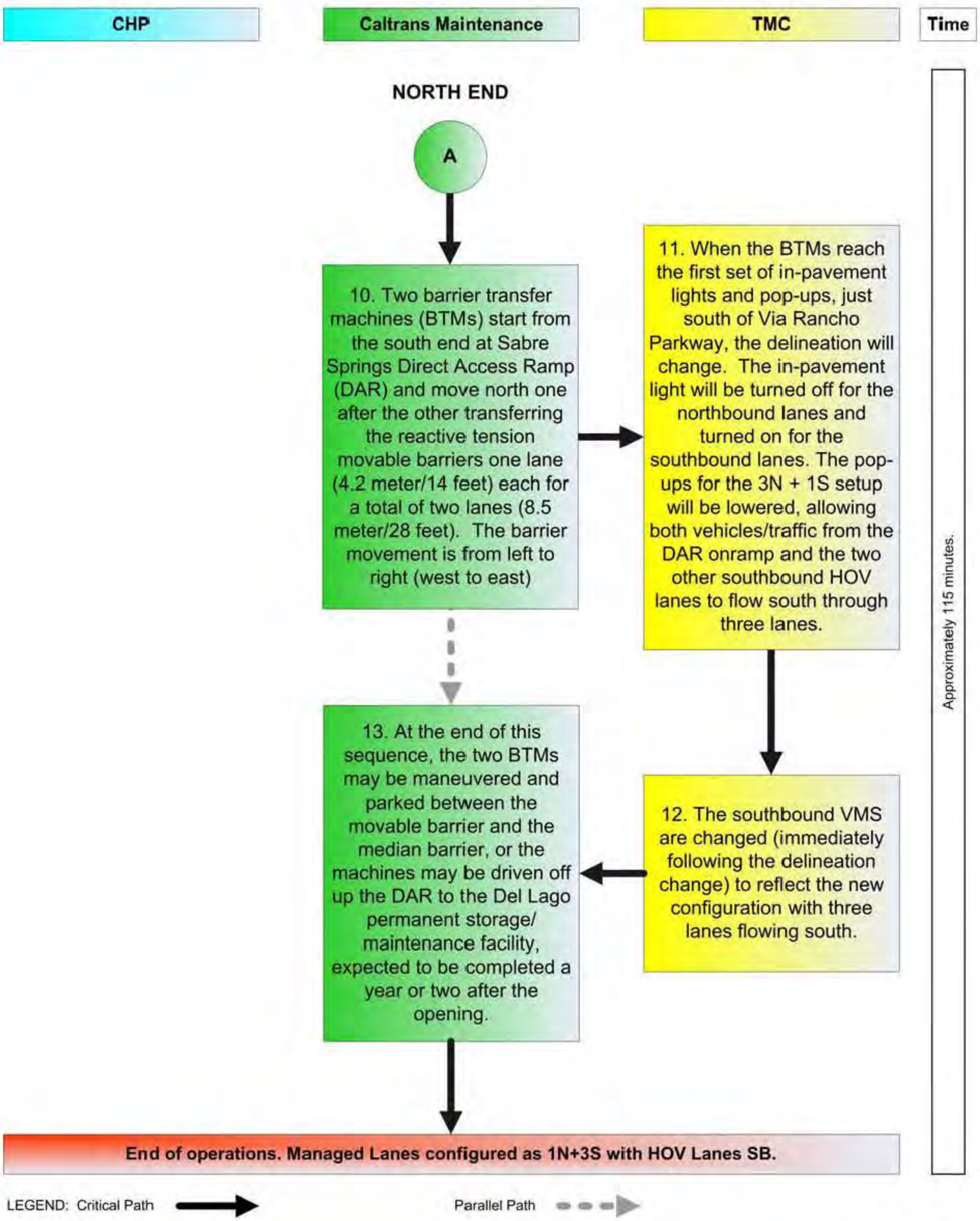
SEQUENCE OF OPERATIONS TO PREPARE FOR THE MORNING COMMUTE CHANGE FROM 3N+1S (PM – HOV NB) TO 1N+3S (AM – HOV SB)

SUMMARY



SEQUENCE OF OPERATIONS TO PREPARE FOR THE MORNING COMMUTE CHANGE FROM 3N+1S (PM – HOV NB) TO 1N+3S (AM – HOV SB)

SUMMARY (Continued)



9.4 From 1N+3S (AM) To 3N+1S (PM)

Overview

This scenario will change the Managed Lanes configuration at the **South End** from **Figure 9-11** to **Figure 9-12.** The configuration at the **North End** will also change from **Figure 9-13** to **Figure 9-14**.

When to make the transition?

The change from Northbound to Southbound lane configuration is planned to occur between 7:00 PM to 10:30 PM. Start times are earlier than the 2N+2S operations due to additional time needed to transfer the long movable barriers by the BTMs, reconfigure field elements at each end, and to execute CHP Traffic Breaks when reducing the number of southbound lanes at Del Lago/Via Rancho Parkway or when closing the southbound Managed Lanes flowing into the Reversible HOV Lanes.

The Traffic Analysis will indicate the appropriate timing for making this transition.

Who are involved?

A CHP Traffic Break is required as live lanes SB are being closed.

During these operations, Caltrans Maintenance Staff are in the field coordinating with the CHP for the Traffic Break and with the TMC Operations Staff for the transition. In addition to working on the SB closure of the Reversible HOV Lanes, they transport and drop off the Barrier Transfer Machine (BTM) Equipment Operators, provide protection against errant drivers with strategically parked attenuated trucks, and communicate with TMC Operations Staff for proper timing to change the VMS messages, close the gates, and change the configuration of the pop-ups and in-pavement lights. TMC Operations Staff will have primary control over traffic guidance elements (pop-ups, in-pavement lights, gates, VMS); BTM driver will have secondary control, while tertiary control will be provided via field controller cabinets. Chapters 3 and 4 describe agency responsibilities and interactions.

How will the transition be accomplished?

To change from the 1N+3S to the 3N+1S configuration, activities start at the North End of the Middle Segment at Del Lago/Via Rancho Parkway and move to the South End at Sabre Springs.

Figure 9-11. Initial Configuration: 1N+3S (AM) - South End

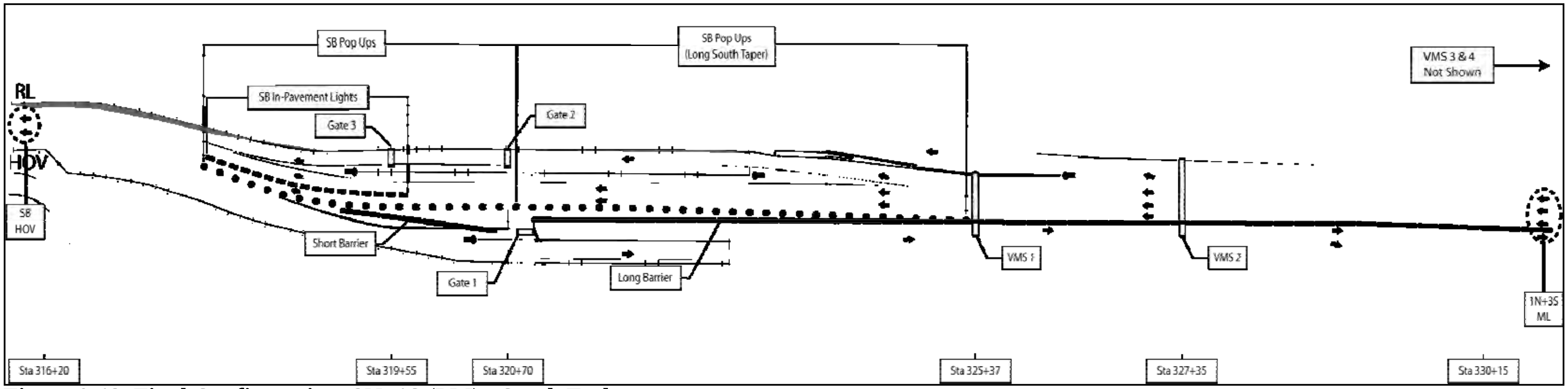


Figure 9-12. Final Configuration: 3N+1S (PM) - South End

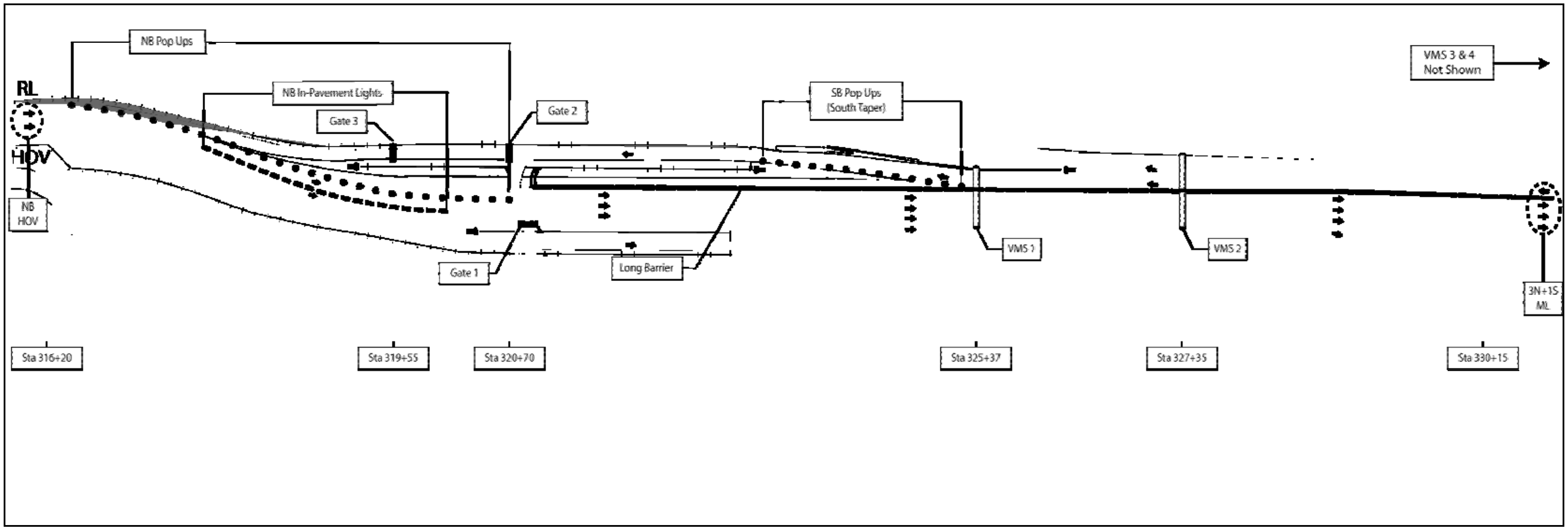


Figure 9-13. Initial Configuration: 1N+3S (AM) - North End

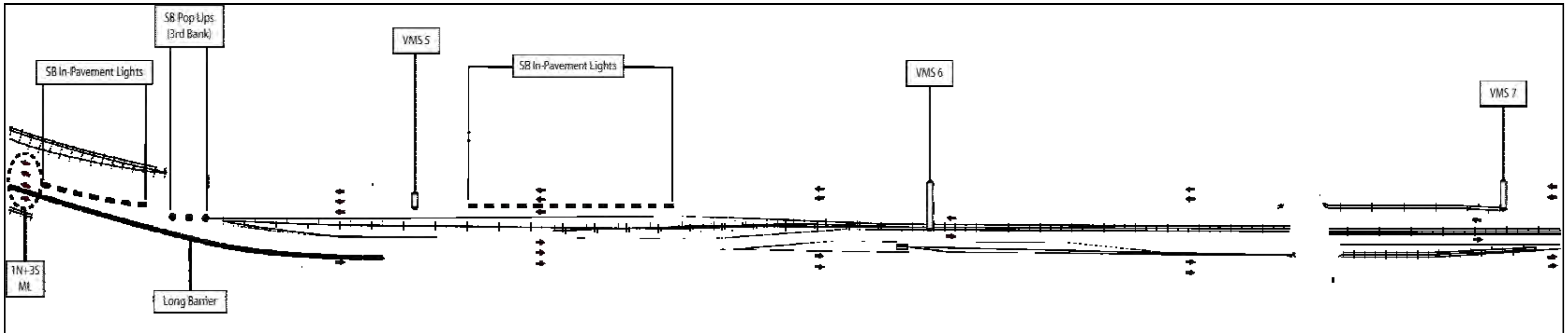
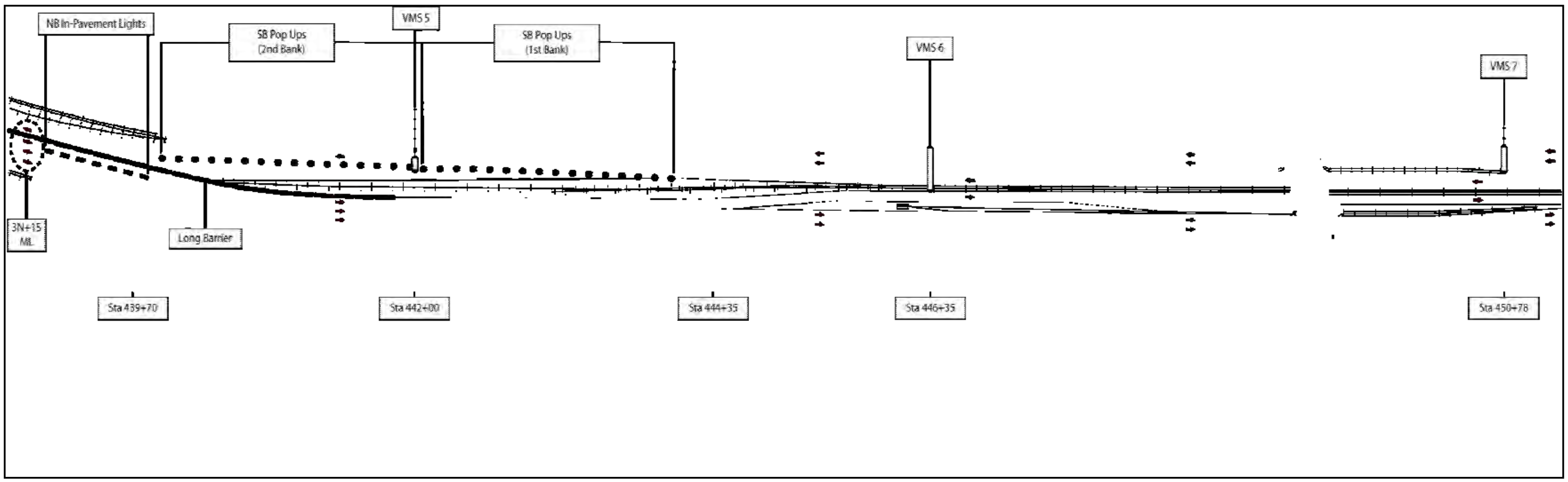


Figure 9- al Configuration: 3N PM) - North End



North End (Via Rancho Parkway / Del Lago)

The major activities to prepare for the evening northbound traffic at the north end of the Managed Lanes:

1. A 35 mph CHP Traffic Break begins north of the Del Lago DAR on the two SB Managed Lanes to allow vehicles to clear out so that pop-ups can be raised safely. Another CHP vehicle will be positioned at the entrance to the Del Lago DAR SB onramp to block access to the Managed Lanes. Caltrans Maintenance vehicles will also be stationed at the traffic break area (or travel just in front of the traffic break) to confirm with TMC Operations Staff when vehicular traffic has cleared.
2. The southbound Variable Message Signs (VMSs) are changed to indicate one lane SB ahead and traffic needs to merge right for the new configuration of one SB lane.
3. Once the area has been cleared, the pop-ups for the 3N+1S configuration will be raised and the southbound in-pavement lights near the DAR and just south of the pop-ups are turned off. This will channel the vehicles traveling from the DAR and one southbound HOV lane to merge into a single southbound lane.
4. Starting at the north end near Via Rancho Parkway and heading south to Sabre Springs, two (BTMs) transfer the Long Barrier one lane (4.2 meter/14 feet) each, a total of two lanes (8.5 meter/28 feet), from left to right (east to west). The northbound in-pavement lights are turned on immediately before or after the BTMs move past the lights.

South End (Sabre Springs)

Once the BTMs approach the South End of the Middle Segment at Sabre Springs, the major activities to prepare for the evening northbound traffic at the South End are similar to the 2N+2S configuration, except that there is only one SB lane to close:

1. A 35-mph CHP Traffic Break begins about 1.5 miles north of Sabre Springs in the SB lanes with Caltrans Maintenance Vehicles and Attenuator Truck in front. (This slows vehicles behind, but allows public vehicles in front to travel at freeway speed and clear through the Sabre Springs area.)
2. As vehicles clear through the Sabre Springs area, the variable message signs (VMS) are changed to indicate closing of Reversible HOV Lanes SB.
3. Pop-ups are raised in sequence to close off the SB HOV traffic and channel traffic onto the SB Main Lanes or Sabre Spring DAR.
4. Caltrans Maintenance Vehicles and Attenuator Truck have traveled in front of the CHP Traffic Break, closed the SB Gates on Sabre Spring DAR, and parked in position to prevent errant drivers from driving through the pop-ups during the Short Barrier transfer operation.
5. Just South of Sabre Springs DAR next to the Short Barrier, Pop-ups are lowered and In-pavement lights are turned off for channeling SB traffic.
6. The Short Barrier is shifted from SB to NB configuration by one Barrier Transfer Machine (BTM).

7. NB Pop-ups under Sabre Springs DAR are raised and NB In-pavement Lights are turned on.
8. Existing Reversible HOV Lanes are closed SB and opened NB.
9. At the end of this sequence, the two BTMs may be maneuvered and parked under the Sabre Springs DAR in the temporary storage area.

SEQUENCE OF OPERATIONS TO PREPARE FOR THE EVENING COMMUTE CHANGE FROM 1N+3S (AM – HOV SB) TO 3N+1S (PM – HOV NB)

SUMMARY

CHP	Caltrans Maintenance	TMC	Time

Start of operations. Managed Lanes configured as 1N+3S with HOV Lanes SB.

NORTH END

1. A 35 mph CHP Traffic Break begins north of the Del Lago DAR on the two SB Managed Lanes to allow vehicles to clear out so that pop-ups can be raised safely. Another CHP vehicle will be positioned at the entrance to the Del Lago DAR SB onramp to block access to the Managed Lanes. Caltrans Maintenance vehicles will also be stationed at the traffic break area (or travel just in front of the traffic break) to confirm with TMC Operations Staff when vehicular traffic has cleared.

2. The southbound Variable Message Signs (VMSs) are changed to indicate one lane SB ahead and traffic needs to merge right for the new configuration of one SB lane.

3. Once the area has been cleared, the pop-ups for the 3N+1S configuration will be raised and the southbound in-pavement lights near the DAR and just south of the pop-ups are turned off. This will channel the vehicles traveling from the DAR and one southbound HOV lane to merge into a single southbound lane.

4. Starting at the north end near Via Rancho Parkway and heading south to Sabre Springs, two (BTMs) transfer the reactive tension movable barriers one lane (4.2 meter/14 feet) each, a total of two lanes (8.5 meter/28 feet), from left to right (east to west). The northbound in-pavement lights are turned on immediately before or after the BTMs move past the lights.

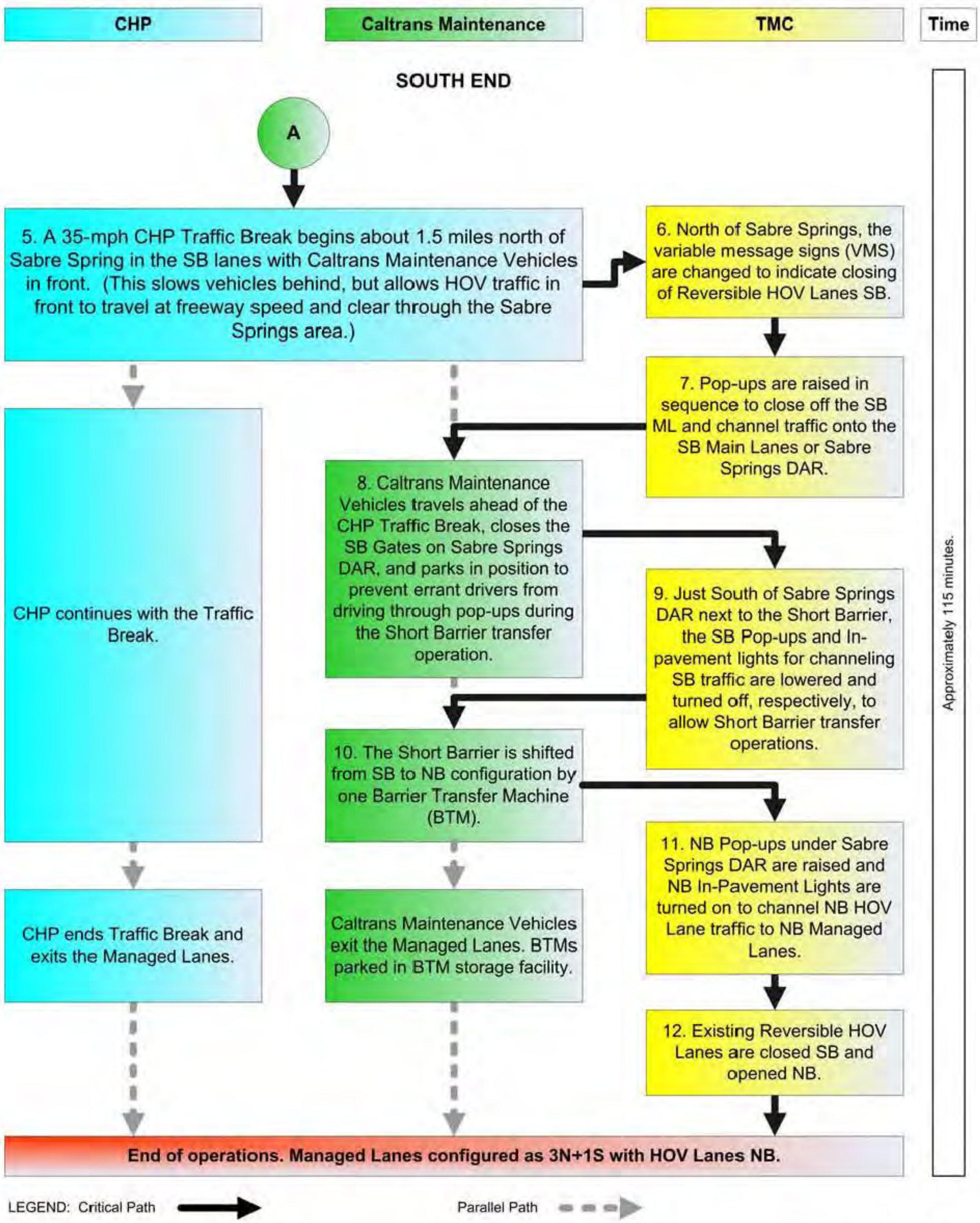
A

Approximately 115 minutes.

LEGEND: Critical Path → Parallel Path

SEQUENCE OF OPERATIONS TO PREPARE FOR THE EVENING COMMUTE CHANGE FROM 1N+3S (AM – HOV SB) TO 3N+1S (PM – HOV NB)

SUMMARY (Continued)



10.0 OPERATIONAL SCENARIOS AND PROCEDURES - DETAILS

10.1 Existing Reversible HOV Lane Operations

Table 10-1 shows the detailed sequence of activities associated with the existing Reversible HOV Lane operations.

Table 10-1. Sequence of Activities - Existing Reverible HOV Lane Operations

I. MORNING OPENING OF SB HOV

ON MONDAY MORNINGS, REMEMBER TO REMOVE BARRICADES AS FOLLOWS:

- IF HOV LANES WERE OPEN IN SB DIRECTION OVER THE WEEKEND – REMOVE BARRICADES FROM LOCATION 1 AND LOCATION 2 ENTRANCES.
- IF HOV LANES WERE OPEN IN NB DIRECTION OVER THE WEEKEND – REMOVE BARRICADES FROM LOCATION 5 ENTRANCE.
- IF HOV LANES WERE CLOSED OVER THE WEEKEND – REMOVE BARRICADES FROM LOCATION 1, 2 AND 5 ENTRANCES

1. Verify that CMS's 1-4 read "EXPRESS LANES CLOSED."
2. Report to Location 1 (south end of HOV on NB 15) at **0500** and radio the TMC with the unit number and 10-97. Switch to auxiliary radio beat.
3. While TMC closes gate (Gate 1) at Location 1, verify that Gate 1 is closed and radio back to TMC about the status of Gate 1. If Gate 1 does not close, inform TMC and perform manual closure.
4. Inform TMC about driving to Location 2 (south end of HOV on NB 163) and 10-97 when at Location 2.
5. Verify that CMS's 5-8 read "EXPRESS LANES CLOSED."
6. While TMC closes gate (Gate 2) at Location 2, verify that Gate 2 is closed and radio back to TMC about the status of Gate 2. If Gate 2 does not close, perform manual closure and inform TMC.
7. Inform TMC about NB sweep while driving to Location 4 (Wrong Way at the north end of HOV on SB 15) and 10-97 when at Location 4.
8. While TMC opens wrong way pop-ups at Location 4, verify that all pop-ups are open (down) and radio back to TMC about the status of pop-ups. If some pop-ups are not down, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
9. Inform TMC about driving to Location 5 (north end entrance to HOV on SB 15) and 10-97 when at Location 5.
10. At **0535**, while TMC opens entrance (pop-ups) at Location 5, verify that all pop-ups are open (down) and radio back to the TMC about the status of the Location 5 entrance. If some pop-ups are not down, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
11. Verify that Draw Lights at Location 5 are ON.
12. Inform TMC about driving north of CMS 12 to verify status of CMS's 12-9.
13. While TMC opens CMS's 12-9, drive along and verify that the CMS's are operational and read: "EXPRESS LANES OPEN." Report back to TMC with the status of CMS's 9-12.
14. Report 10-98 to TMC.

SB HOV LANES ARE OPEN

II. MID-DAY REVERSAL OF HOVs FROM SB TO NB

ON MONDAY MID-DAYS, REMEMBER TO CHECK IF THE BARRICADES ARE REMOVED AS FOLLOWS:

- IF HOV LANES WERE OPEN IN SB DIRECTION OVER THE WEEKEND – REMOVE BARRICADES FROM LOCATION 1 AND LOCATION 2 ENTRANCES
- IF HOV LANES WERE OPEN IN NB DIRECTION OVER THE WEEKEND – THE BARRICADES AT LOCATION 5 ENTRANCE SHOULD HAVE BEEN REMOVED IN THE MORNING
- IF HOV LANES WERE CLOSED OVER THE WEEKEND – REMOVE BARRICADES AT LOCATION 1 AND LOCATION 2 ENTRANCES

CLOSING OF SB HOV

1. Report to location north of CMS 12 (north end of HOV on SB 15) at **1100** and radio the TMC with the unit number and 10-97. Switch to auxiliary radio beat.
2. While TMC closes CMS's 12-9, drive along and verify that CMS's 12-9 are closed and read: "EXPRESS LANES CLOSED MERGE LEFT." Report to TMC the status of CMS's 9-12.
3. Report to TMC when at Location 5 Entrance (north end of HOV on SB 15).
4. While TMC closes entrance (pop-ups) at Location 5, verify that all pop-ups are up and that entrance is closed and radio back to TMC about the status of Location 5 entrance. If some pop-ups are not up, inform TMC and place orange cones over the faulty pop-ups.
5. Verify that Draw Lights at Location 5 are OFF.
6. Drive to Location 4 (Wrong Way at the north end of HOV on SB 15) and radio to TMC with 10-97.
7. While TMC closes wrong way pop-ups at Location 4, verify that all pop-ups are up (closed) and radio back to TMC about the status of wrong way at Location 4. If some pop-ups are not up, inform TMC and place orange cones over faulty pop-ups.
8. Verify that Wrong Way Light at Location 4 is ON.
9. While TMC closes the gate (Gate 5) at Location 5, verify that the gate is closed and radio back to TMC with the status of Gate 5. If Gate 5 does not close, inform TMC and perform manual closure.
10. Inform TMC about driving to Location 1 and 10-97 when at Location 1.
11. While TMC opens the gate (Gate 1) at Location 1, verify that Gate 1 is open and radio back to TMC with the status of Gate 1. If Gate 1 does not open, inform TMC and open the gate manually.
12. Inform TMC about driving to Location 2 and 10-97 when at Location 2.
13. While TMC opens the gate (Gate 2) at Location 2, verify that Gate 2 is open and radio back to TMC with the status of Gate 2. If Gate 2 does not open, inform TMC and open the gate manually.

SB HOV IS CLOSED

OPENING OF NB HOV

1. Drive to Location 3 (south end of HOV on NB 163) and 10-97 when at Location 3.
2. While TMC opens Wrong Way at Location 3, verify that all pop-ups are open (down) and radio back to TMC with the status of wrong ways at Location 3. If some pop-ups are up, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.

3. Verify that Wrong Way Light at Location 3 is ON.
4. Inform TMC about driving to Location 1 (south end of HOV on NB 15) and 10-97 when at Location 1.
5. While TMC opens Wrong Way at Location 1, verify that all pop-ups are open (down) and radio back to TMC with the status of wrong ways at Location 1. If some pop-ups are up, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
6. While TMC opens the entrance at Location 1, verify that all pop-ups are open (down) and radio back to TMC with the status of the entrance at Location 1. If some pop-ups are up, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
7. Verify that Draw Light at Location 1 is ON.
8. Inform TMC about driving to just south of CMS 1 and 10-97 when at CMS 1.
9. While TMC opens CMS's 4-1, drive along and verify that CMS's are open and read: "EXPRESS LANES OPEN." Report to TMC the status of CMS's 1-4.
10. Inform TMC about driving to Location 2 (south end of HOV on NB 163) and 10-97 when at Location 2.
11. While TMC opens entrance at Location 2, verify that all pop-ups are open (down) and radio back to TMC with the status of the entrance at Location 2. If some pop-ups are up, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
12. Verify that Draw Lights at Location 2 are ON.
13. Inform TMC about driving to just south of CMS 5 and 10-97 when at CMS 5.
14. While TMC opens CMS's 8-5, drive along and verify that CMS's are open and read: "EXPRESS LANES OPEN." Report back to TMC the status of CMS's 5-8
15. Report 10-98.

NB HOVs ARE OPEN

III. EVENING CLOSURE OF NB HOV

1. Report to location south of CMS 1 (south end of HOV on NB 15) at 1900 and radio the TMC with the unit number and 10-97. Switch to auxiliary radio beat.
2. While TMC closes CMS's 1-4, drive along and verify that CMS's 1-4 are closed and read: "EXPRESS LANES CLOSED." Report back to TMC the status of CMS's 1-4.
3. Arrive at Location 1 (south end of HOV on NB 15).
4. While TMC closes the entrance at Location 1, verify that all pop-ups are up (closed) and radio back to TMC with the status of the entrance at Location 1. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
5. Verify that Draw Lights at Location 1 are OFF.
6. While TMC closes Wrong Way at Location 1, verify that all pop-ups are up (closed) and radio back to TMC with the status of wrong ways at Location 1. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
7. Inform TMC about driving to location south of CMS 5 and 10-97 when at that location.
8. While TMC closes CMS's 5-8, drive along and verify that CMS's 5-8 are closed and read: "EXPRESS LANES CLOSED." Report back to TMC the status of CMS's 5-8.
9. Arrive at Location 2 (south end of HV on NB 163).
10. While TMC closes the entrance at Location 2, verify that all pop-ups are up (closed) and radio back to TMC with the status of the entrance at Location 2. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
11. Verify that Draw Lights at Location 2 are OFF.
12. Inform TMC about driving to Location 3 (Wrong Way at the south end of HOV on NB 163).

13. While TMC closes Wrong Way at Location 3, verify that all pop-ups are up (closed) and radio back to TMC with the status of wrong ways at Location 3. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
14. Verify that Wrong Way Light at Location 3 is OFF.
15. Sweep to Location 4 and verify that wrong way light at Location 4 (Wrong Way at the north end of HOV on SB 15) is OFF.
16. Arrive at Location 5 (north end of HOV on SB 15).
17. While TMC opens the gate (Gate 5) at Location 5, verify that Gate 5 is open and radio back to TMC with the status of Gate 5. If the gate does not open, inform TMC and open the gate manually.
18. Verify that CMS's 9-12 read "EXPRESS LANES CLOSED."
19. Report 10-98.

NB HOV LANES CLOSED

ON FRIDAY NIGHTS, PLACE BARRICADES DEPENDING ON THE WEEKEND OPERATION OF HOV LANES AS FOLLOWS:

- IF HOV LANES ARE TO BE OPEN IN NB DIRECTION – PLACE BARRICADES AT LOCATION 5 ENTRANCE
- IF HOV LANES ARE TO BE OPEN IN SB DIRECTION – PLACE BARRICADES AT LOCATION 1 AND LOCATION 2 ENTRANCES
- IF HOV LANES ARE TO BE CLOSED OVER THE WEEKEND – PLACE BARRICADES AT LOCATION 1, 2 AND 5 ENTRANCES

IV. MORNING REVERSAL OF HOV FROM NB TO SB

CLOSING OF NB HOV

1. Report to location south of CMS 1 (south end of HOV on NB 15) at **0430** and radio the TMC with the unit number and 10-97. Switch to auxiliary radio beat.
2. While TMC closes CMS's 1-4, drive along and verify that CMS's 1-4 are closed and read: "EXPRESS LANES CLOSED." Report back to TMC the status of CMS's 1-4.
3. Arrive at Location 1 (south end of HOV on NB 15).
4. While TMC closes the entrance at Location 1, verify that all pop-ups are up (closed) and radio back to TMC with the status of the entrance at Location 1. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
5. Verify that Draw Lights at Location 1 are OFF.
6. While TMC closes Wrong Way at Location 1, verify that all pop-ups are up (closed) and radio back to TMC with the status of wrong ways at Location 1. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
7. Inform TMC about driving to location south of CMS 5 and 10-97 when at that location.
8. While TMC closes CMS's 5-8, drive along and verify that CMS's 5-8 are closed and read: "EXPRESS LANES CLOSED." Report back to TMC the status of CMS's 5-8.
9. Arrive at Location 2 (south end of HV on NB 163).
10. While TMC closes the entrance at Location 2, verify that all pop-ups are up (closed) and radio back to TMC with the status of the entrance at Location 2. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
11. Verify that Draw Lights at Location 2 are OFF.
12. Inform TMC about driving to Location 3 (Wrong Way at the south end of HOV on NB 163).

13. While TMC closes Wrong Way at Location 3, verify that all pop-ups are up (closed) and radio back to TMC with the status of wrong ways at Location 3. If some pop-ups are down, inform TMC and place orange cones over faulty pop-ups.
14. Verify that Wrong Way Light at Location 3 is OFF.
15. Sweep to Location 4 and verify that wrong way light at Location 4 (Wrong Way at the north end of HOV on SB 15) is OFF.
16. Arrive at Location 5 (north end of HOV on SB 15).
17. While TMC opens the gate (Gate 5) at Location 5, verify that Gate 5 is open and radio back to TMC with the status of Gate 5. If the gate does not open, inform TMC and open the gate manually.
18. Verify that CMS's 9-12 read "EXPRESS LANES CLOSED."
19. Report 10-98.

HOV LANES CLOSED

OPENING OF SB HOV

1. Verify that CMS's 1-4 read "EXPRESS LANES CLOSED."
2. Report to Location 1 (south end of HOV on NB 15) AT 0500 and radio the TMC with the unit number and 10-97. Switch to auxiliary radio beat. (See Attachment A, HOV Map)
3. While TMC closes gate (Gate 1) at Location 1, verify that Gate 1 is closed and radio back to TMC about the status of Gate 1. If Gate 1 does not close, inform TMC and perform manual closure. (see Attachment B, Manual Operation Guide)
4. Inform TMC about driving to Location 2 (south end of HOV on NB 163) and 10-97 when at Location 2.
5. Verify that CMS's 5-8 read "EXPRESS LANES CLOSED."
6. While TMC closes gate (Gate 2) at Location 2, verify that Gate 2 is closed and radio back to TMC about the status of Gate 2. If Gate 2 does not close, perform manual closure and inform TMC.
7. Inform TMC about NB sweep while driving to Location 4 (Wrong Way at the north end of HOV on SB 15) and 10-97 when at Location 4.
8. While TMC opens wrong way pop-ups at Location 4, verify that all pop-ups are open (down) and radio back to TMC about the status of pop-ups. If some pop-ups are not down, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
9. Inform TMC about driving to Location 5 (north end entrance to HOV on SB 15) and 10-97 when at Location 5.
10. At **0535**, while TMC opens entrance (pop-ups) at Location 5, verify that all pop-ups are open (down) and radio back to the TMC about the status of the Location 5 entrance. If some pop-ups are not down, inform TMC and manually lower pop-ups. TMC to request Maintenance assistance, if needed.
11. Verify that Draw Lights at Location 5 are ON.
12. Inform TMC about driving north of CMS 12 to verify status of CMS's 12-9.
13. While TMC opens CMS's 12-9, drive along and verify that the CMS's are operational and read: "EXPRESS LANES OPEN." Report back to TMC with the status of CMS's 9-12.
14. Report 10-98 to TMC.

SB HOV LANES ARE OPEN

Source: TMC
Note: The attachments referred to in Table 10-1 are available at the TMC.

10.2 From 2N+2S (PM) To 2N+2S (AM)

To change from the 2N+2S (PM) to the 2N+2S (AM) configuration, activities occur only at the South End of the Middle Segment at Sabre Springs, as shown in:

Table 10-3. Sequence of Activities - From 2N+2S (PM) to 2N+2S (AM)

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10.3 From 2N+2S (AM) To 2N+2S (PM)

To change from the 2N+2S (AM) to the 2N+2S (PM) configuration, a CHP Traffic Break is required north of Sabre Springs to close the live SB traffic going into the Reversible HOV Lanes, as shown in:

Table 10-5. Sequence of Activities - From 2N+2S (AM) to 2N+2S (PM)

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10.4 From 3N+1S (PM) To 1N+3S (AM)

To change from the 3N+1S to the 1N+3S configuration, activities start at the South End of the Middle Segment at Sabre Springs and move to the North End at Del Lago/Via Rancho Parkway (the existing Reversible HOV Lanes are first closed northbound) as shown in:

Table 10-7. Sequence of Activities - From 3N+1S (PM) to 1N+3S (AM)

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10.5 From 1N+3S (AM) To 3N+1S (PM)

To change from the 1N+3S to the 3N+1S configuration, activities start at the North End of the Middle Segment at Del Lago/Via Rancho Parkway and move to the South End at Sabre Springs, as shown in:

Table 10-9. Sequence of Activities - From 1N+3S (AM) to 3N+1S (PM)

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11.0 MANPOWER AND EQUIPMENT REQUIREMENTS – SUMMARY

The operation, control and maintenance of the Middle Segment Managed Lanes in conjunction with the existing Reversible HOV Lanes will require significant increased effort from Caltrans Maintenance Division and Traffic Operations Division, as well as from the California Highway Patrol. In addition to the normally required roadway maintenance for pavement, structure, landscape, signage, etc., extra effort will be needed to maintain and operate the Managed Lanes field elements (e.g., pop-ups, in-pavement lights, gates, variable message signs (VMS), etc.), the 8 miles of movable barrier, the barrier transfer machines and the control system itself – all critical to ensuring the integrity of the Managed Lanes operations, the safety of the traveling public, and the safety of Caltrans Maintenance workers.

For the Traffic Operations Division the additional effort will mainly involve staff from three branches currently located at the district TMC. The three traffic operations branches are TMC Operations, Electrical Systems, and Ramp Metering/Systems Branch. For the Maintenance Division this will involve dedicated crews (day and night) to operate and maintain the managed lane corridor. The CHP will need to allocate manpower and vehicle resources to conduct traffic breaks on a regular basis. A brief summary of the additional activities for these staff is outlined below.

For both Caltrans Maintenance and Traffic Operations staff as well as CHP personnel, appropriate training will be essential for successful operation of the new system.

11.1 Caltrans Traffic Operations Division

Traffic Operations estimated a total of 5.0 PYs would be required to accommodate the Managed Lanes operations. This requirement would be distributed among the different branches as discussed below.

11.1.1 TMC Operations Branch

Currently the TMC Operations branch maintains staff twenty four hours a day, Sunday through Friday evening. Once the Middle Segment opens (2007/2008), it is expected that the TMC Operations branch will need to shift from a 24/5 schedule to a 24/7 schedule. The expansion to a 24/7 schedule at the TMC is also warranted due to increased maintenance and construction occurring at nights and weekends as well as general increase in traffic and incidents. It is anticipated that 1.25 PY will be required to cover the extra hours of operation.

11.1.2 Traffic Operations, Electrical Systems Branch

The Traffic Operations, Electrical System Branch is involved with the upgrade effort of the existing reversible lanes control system that is also envisioned to be expanded for control of the Managed Lanes field elements. Once the fiber system network is extended north along the Managed Lanes corridor, the Electrical Systems Branch will have an additional 8 miles of fiber network and field elements to maintain. Proper care and effort will be needed to ensure the integrity of the Managed Lanes operations. The communication medium to communicate with all the field elements will be part of the TOSNET. Sufficient staff must be trained and available to maintain and troubleshoot any problems with the extended communications and control system out in the field. It is anticipated that 3.5 PYs will be required to cover the additional field elements, communication links, and extra hours of operation. (See Chapter 12 for justification).

11.1.3 Traffic Operations, Ramp Metering/System Branch

The Traffic Operations, Ramp Metering/Systems Branch is involved in the review, testing, and eventual maintenance of the software upgrade for the RLCS, which is expected to be expanded for control of the Managed Lanes field elements as well. This means that new safety rules will have to be incorporated in the RLCS control system and the graphical user interface and its corresponding mapping system will need to be upgraded to incorporate Managed Lanes field element controls. Sufficient staff must be trained and available to maintain and troubleshoot any system (software and hardware) problems with the extended RLCS control system. It is anticipated that 0.25 PY will be required to cover the extra hours of operation

11.2 Caltrans Maintenance Division

Significant extra effort by maintenance will be needed to:

a) Maintain the new Managed Lanes field elements (pop-ups, in-pavement lights, gates, VMS, cabinets, and possibly wireless equipment),
b) Maintain the 8 miles of movable barrier (reactive tension type),
c) Maintain and operate the barrier transfer machines, and
d) Actively participate in the regular operational sequences described in this report involving traffic breaks, coordination/communication with TMC Operators for sequencing field elements, operating the barrier transfer machines and moving the barriers.

These activities will be in addition to the normally required roadway maintenance for pavement, structure, landscape, signage, etc.

Maintenance will provide the front line staff for maintaining the Managed Lanes field elements and will work closely with Traffic Operations, Electrical Systems Branch to investigate the cause and to fix any malfunctions of the field elements.

Highway maintenance equipment operators will drive multipurpose ½ ton trucks with changeable message signs, larger trucks with attenuator, and the barrier transfer machines during the operational sequence. They will communicate and coordinate closely with the TMC Operations staff.

To handle the envisioned 24/7 operations for the Managed Lanes corridor will require operations/maintenance crews working staggered shifts as well as electricians to maintain and repair electrical devices. A dedicated, trained corridor team with supervisor and lead workers for the highway maintenance equipment operator crews is recommended to ensure efficient, smooth and safe operations on the Managed Lanes for the traveling public.

Table 11-1, **Table 11-3**, and **Table 11-5** summarize Caltrans Maintenance Program resource, facility and equipment requirements to support Managed Lanes operations. Details are included in Chapter 12.

Table 11-1. Caltrans Maintenance Program – Resource Requirements (2006 Dollars)

Phase*	Miles of Moveable Barrier	Opening Day	PYs Regular	PYs Overtime	Annual Operating Expense (excl. equipment)	Annual Total
1	5.6	January 2008	16	5	$ 1.3 M	$ 2.7 M
2	8	January 2009	21	5	$ 1.7 M	$ 3.5 M
3	15	January 2013	30	7	$ 2.4 M	$ 5.1 M
Current Maintenance Program Budget for San Diego and Imperial County			406	12	$ 25.0 M	$ 51.7 M

Table 11-3. Caltrans Maintenance Program - One-Time Facility Costs (2006 Dollars)

Phase*	Temporary Sabre Springs	Modular Escondido	Permanent Lake Hodges	Permanent Escondido
1	$ 300,000	$ 500,000		
2	$ 50,000 to remove		$ 2,500,000	
3				$ 2,000,000

*NOTE: Phase 1 – Middle Segment Interim Opening; Phase 2 – Middle Segment Final Opening; Phase 3 – Integration with North and South Segments.

Table 11-5. Caltrans Maintenance Program - One-Time Equipment Costs (2006 Dollars)

Equipment	Quantity	Cost	Capital Cost
Barrier Transfer Machine @ $1.5M	2		$3,000,000
16-ton tow truck	1	$ 130,000	
2-ton towable forklift	1	$ 66,500	
15-ft cargo body truck	1	$ 75,000	
Solar (trailer) LED CMS + arrow board	1	$ 15,000	
Solar CMS sign + truck	1	$ 66,630	
Cone truck	1	$ 60,000	
½-ton pickup truck w/CMS @ $50,000	2	$ 100,000	
Street sweeper @ $200,000	2	$ 400,000	
Balsi Beam + tractor	1	$ 300,000	
Electrical Hoist	1	$ 75,000	
4-yd w/ CMS and crash cushion	3	$ 300,000	
High Lift Truck	1	$ 100,000	
Snooper Type Truck	1	$ 250,000	
Mechanic's truck	1	$ 50,000	
Total	**20**	**$ 1,988,130**	**$3,000,000**

The next chapter provides further details on additional level of maintenance staff, additional equipment, and equipment service facilities expected to be needed for the Managed Lanes maintenance effort.

11.3 Support from HQ Equipment Shop Service Center

Separate from the district staffing mentioned above for Traffic Operations and Maintenance, additional equipment mechanic support is needed for the maintenance of the initial two Barrier Transfer Machines (BTMs). This would include an Equipment Mechanic, a Mechanics Truck and repair/replacement parts inventory for the BTMs.

11.4 Additional Considerations

A recommendation was made by D11 Maintenance Staff to add pop-ups at the other ingress/access locations along the facility, and gates at the DARs. It was determined that adding these to the facility would improve the safety of the maintenance/operation of the facility, and it may reduce the operating cost by eliminating the CHP Traffic Breaks.

A similar recommendation was also made by the TMC Branch to add pop-ups at ingress and egress access points to expedite closures when incidents develop, either within the Managed Lanes or the general purpose lanes, to control traffic movement. The recommendation also included the addition of Variable Message Signs to communicate to motorists the status of ingress/egress points associated with incients. This recommendation is expected to be further explored in collaboration with SANDAG as part of an overall Traffic Incident Management Plan.

11.5 California Highway Patrol (CHP)

The CHP estimated the cost associated with the traffic breaks as shown in **Table 11-7**.

Table 11-7. CHP Traffic Break Cost Estimate

Operation	Number units needed	Number of hours billed per day	Number of miles billed per day	Cost per day (hours and miles)	Cost per year (hours and miles)	Cost with 10% cushion.
2/2 Operations	1	4	75	$311.28	$80,933	$89,026
3/1 Operations	2	8	200	$658.56	$171,226	$188,349
3/1 Operations	3 units (2 to run break)	12	300	$978.84	$254,498	$279,947

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12.0 MANPOWER AND EQUIPMENT REQUIREMENTS – DETAIL

12.1 Caltrans Maintenance Division

Table 12-1 presents Caltrans Maintenance Division estimates of manpower requirement for Phases 1 and 2 of the Middle Segment implementation. Detailed worksheets are included in the **Appendix**.

12.2 Caltrans Traffic Operations

12.2.1 Weekend Coverage

The TMC Branch operations should be expanded from twenty-four hours a day, Sunday thru Friday evenings to include Saturday and Sunday to assist with real-time traffic management activities within the I-15 ML corridor and with growing travel demand within the San Diego region. The addition of three Transportation Engineering Technicians (TETs) will improve regional transportation coverage, and expedite incident detection, notification, and response.

12.2.2 Electrical Systems Branch PY Justification

As discussed in Chapter 11, the Electrical Systems Branch anticipates that 3.5 PYs will be required to cover the additional field elements, communication links, and extra hours of operation. **Table 12-2** presents a detailed breakdown of the PY estimate.

12.3 Caltrans Equipment Program

The Heavy Equipment Mechanic (HEM) will perform on site mechanical repair and preventative maintenance support for the two (2) Barrier Transfer Machines (BTM) & other motorized equipment assigned to the facility. The BTM's are highly specialized machines with sophisticated control and propulsion systems. Their reliable operation is integral to the proper function of the Managed Lanes facility; therefore it is imperative that onsite mechanical support be available throughout the operating period.

Table 12-1. Caltrans Maintenance Division Resource Requirements

Phase 1 – Middle Segment Interim Opening

Classification	Employee Executing Traffic Control Process "Title"	Equipment	## of EE's	Employee's time Executing Traffic Control Sequence - PYS	Typical Activities of Executing The Traffic Control Sequence
CMS	Supervision - Day shift	p/u	1	0.51	Planning monthly & daily activities with resources allocated. Adjusting schedules for absentee's and training. Safety inspections. Safety program oversight.
CMS	Supervision - Night shift	p/u	1	0.51	
CHML	Crew lead - Day shift	p/u	1	0.51	Lead crew and operate key equipment during the traffic control process. Provide direct operation guidance. Oversee crew during supervisor absence.
CHML	Crew lead - Day shift	p/u	1	0.51	
CEO 2	Barrier Driver	BTM	2	1.01	Employee operates BTM. Two required per machine.
CEO 2	Shadow driver	4-yds/tmcc	2	1.01	Employee shadows the operation of vehicles
CEO 2	CMS trucks	p/u	2	1.01	Employee shadows the operation of vehicles and displays appropriate advance warning of moveable barrier operations.
CEO 2	Sweeping corridor	sweeper	2	1.01	Employee sweeps during the sequence operation to remove debris from moveable barrier
CEO 1	HOV Vehicle removal	p/u / tow trk	2	1.01	Employee drives through existing HOV and managed lane corridor removing vehicles and/or large debris
CE 2	Elec repairs-Day Shift	Lift truck	2	1.01	Employee monitors and troubleshoots any electrical assets while executing traffic control sequence
Phase 1 Executing Traffic Control Sequence Employee Total			16	8.11	

Table 12-1 (Continued)
Phase 1 – Middle Segment Interim Opening

Classification	Employee Managed Lane Corridor Maintenance Activity "Title"	Equipment	## of EE's	Managed Lane Corridor Maintenance Activities - PYS	Various Maintenance Operations to be performed within the Managed Lane Corridor from Rte 52 to Del Lago.
CMS	Supervision - Day shift	p/u	1	0.49	Inspect, plan, schedule, oversight of daily work. Incident Response. Document expenditures through IMMS, Provide training.
CMS	Supervision - Night shift	p/u	1	0.49	
CHML	Crew lead - Day shift	p/u	1	0.49	Support field crews with direction through proper COSP's. Incident Response. Provide training, Fill in for Supervisor.
CHML	Crew lead - Night shift	p/u	1	0.49	
CEO 2	Barrier Driver	BTM	2	0.98	Incident Response, BTM Maintenance, repair barrier segments, hinge replacement, gate maintenance, signs, guardrail, attenuator, storm water BMP's,
CEO 2	Shadow driver	4-yds/tmcc	2	0.98	
CEO 2	CMS trucks	p/u	2	0.98	
CEO 2	Sweeping corridor	sweeper	2	0.98	Incident Response. Sweep entire Managed Lanes Corridor from SR-78 to SR-52. Maintain sweepers.
CEO 1	Remove vehicles/large debris	p/u / tow trk	2	0.98	Incident Response, Tow vehicles from corridor, Remove large debris
CE 2	Elec repairs-Day Shift	Lift truck	2	0.98	Incident Response to damaged electrical assets, Repair & Replace In-pavement lights, VMS, CCTV, Signals/Lights, Loops, pop-ups,
Maintenance Corridor Operations Employee Total			16	7.81	
PHASE 1 ALL MANAGED LANE ACTIVITIES PY TOTAL				15.92	
	Equipment Program				
HEM	Mechanic		1		
	Traffic Operations Program				
TET	Traffic - TMC Operators		3		
EE classification assignments based on SPB Job descriptions/duties					
Supervisor/Lead workers provide crew guidance & oversight					
Equipment Operators assigned to appropriate equipment types					
Electricians provide control systems repair support					
Mechanics provide specialized equipment repair & Prev. Mtce support					

Table 12-1 (Continued)
Phase 2 – Middle Segment Interim Opening

Classification	Employee Executing Traffic Control Process "Title"	Equipment	## of EE's	Employee's time Executing Traffic Control Sequence - PYS	Typical Activities of Executing The Traffic Control Sequence
CMS	Supervision - Day shift	p/u	1	0.49	Planning monthly & daily activities with resources allocated. Adjusting schedules for absentee's and training. Safety inspections. Safety program oversight.
CMS	Supervision - Night shift	p/u	1	0.49	
CHML	Crew lead - Day shift	p/u	1	0.49	Lead crew and operate key equipment during the traffic control process. Provide direct operation guidance. Oversee crew during supervisor absence.
CHML	Crew lead - Day shift	p/u	1	0.49	
CEO 2	Barrier Driver	BTM	4	1.95	Employee operates BTM. Two required per machine.
CEO 2	Shadow driver	4-yds/tmcc	4	1.95	Employee shadows the operation of vehicles
CEO 2	CMS trucks	p/u	4	1.95	Employee shadows the operation of vehicles and displays appropriate advance warning of moveable barrier operations.
CEO 2	Sweeping corridor	sweeper	2	0.98	Employee sweeps during the sequence operation to remove debris from moveable barrier
CEO 1	HOV Vehicle removal	p/u / tow trk	2	0.98	Employee drives through existing HOV and managed lane corridor removing vehicles and/or large debris
CE 2	Elec repairs-Day Shift	Lift truck	2	0.98	Employee monitors and troubleshoots any electrical assets while executing traffic control sequence
Phase 2 Executing Traffic Control Sequence Employee Total			22	10.75	

Table 12-1 (Continued)
Phase 2 – Middle Segment Interim Opening

Classification	Employee Managed Lane Corridor Maintenance Activity "Title"	Equipment	## of EE's	Managed Lane Corridor Maintenance Activities - PYS	Various Maintenance Operations to be performed within the Managed Lane Corridor from Rte 52 to Del Lago.
CMS	Supervision - Day shift	p/u	1	0.45	Inspect, plan, schedule, oversight of daily work. Incident Response. Document expenditures through IMMS, Provide training.
CMS	Supervision - Night shift	p/u	1	0.45	
CHML	Crew lead - Day shift	p/u	1	0.45	Support field crews with direction through proper COSP's. Incident Response. Provide training, Fill in for Supervisor.
CHML	Crew lead - Night shift	p/u	1	0.45	
CEO 2	Barrier Driver	BTM	4	1.79	Incident Response, BTM Maintenance, repair barrier segments, hinge replacement, gate maintenance, signs, guardrail, attenuator, storm water BMP's,
CEO 2	Shadow driver	4-yds/tmcc	4	1.79	
CEO 2	CMS trucks	p/u	4	1.79	
CEO 2	Sweeping corridor	sweeper	2	0.90	Incident Response. Sweep entire Managed Lanes Corridor from SR-78 to SR-52. Maintain sweepers.
CEO 1	Remove vehicles/large debri	p/u / tow trk	2	0.90	Incident Response, Tow vehicles from corridor, Remove large debris
CE 2	Elec repairs-Day Shift	Lift truck	2	0.90	Incident Response to damaged electrical assets, Repair & Replace In-pavement lights, VMS, CCTV, Signals/Lights, Loops, pop-ups,
Maintenance Corridor Operations Employee Total			22	9.85	
PHASE 2 ALL MANAGED LANE ACTIVITIES PY TOTAL				20.60	
	Equipment Program				
HEM	Mechanic		1		
	Traffic Operations Program				
TET	Traffic - TMC Operators		3		

EE classification assignments based on SPB Job descriptions/duties
Supervisor/Lead workers provide crew guidance & oversight
Equipment Operators assigned to appropriate equipment types
Electricians provide control systems repair support
Mechanics provide specialized equipment repair & Prev. Mtce support

Table 12-2. Electrical Systems Branch PY Justification

Summary Of PYs Needed for Electrical Systems	PY
Field Systems	2
Communications Systems	1.5
Total	**3.5**

Additional P.Y. Justification for Field Systems

Field Element Support	Existing I-15 RLCS	Proposed I-15 Managed Lanes	Total	% Increase
Gates	3	3	6	**50.0%**
Controllers	8	84	92	**91.3%**
Pop-ups (Bank)	31	44	75	**58.7%**
In Pavement Lights	0	114	114	**100.0%**
Comm. using Optics for BTM (access point)	0	25	25	**100.0%**
CMS	12	5	17	**29.4%**
VMS	0	7	7	**100.0%**
CCTV Cameras	0	10	10	**100.0%**
Total Number of Additional Field Elements		**292**	**Average Increase**	**78.7%**
Number of PYs	1	2	**3**	

Field Systems PY Request Breakdown	PY
Maintenance Support	
System Testing & Advanced Troubleshooting	0.5
System Documentation	0.2
System Inventory & Device Tracking	0.1
Assistance in Parts Procurement	0.2
Training in repair & System Diagnostics	0.15
System Support	
Configure Replacement Parts as needed	0.1
Monitor Devices & Measure System Performance	0.2
Provide functioning Simulator for System Validation	0.2
Respond to TMC Operators Requests as Needed	0.15
Use SNMP to Manage and Detect Early Sys Problems	0.2
Total PY for Maintenance & Systems Support	**2**

Table 12-1 (Continued)

Additional P.Y. Justification for Communication Systems

Communications Provided	Existing I-15 RLCS	Proposed I-15 Managed Lanes	Total	% Increase
CCTV	10	12	22	**54.5%**
CMS	0	2	2	**100.0%**
RMS	0	16	16	**100.0%**
Signals	0	14	14	**100.0%**
TMS	0	35	35	**100.0%**
RLCS/ML Systems	4	160	164	**97.6%**
Total Number of Additional Communication Links		**239**	**Average Increase**	**69.0%**
Number of PYs	0	1.5	**1.5**	

Communication Systems PY Request Breakdown	PY
Network Administration	
Network Operations/Maintenance	0.3
Network Management Systems	0.1
Network Security Management	0.1
Network Device Configuration	0.1
Field Operations	
Configure/Install Cameras, Encoders, Media Converters and SIOU	0.4
Maintenance of the Communication Equipment/ IP Interfaces in HUB/ Controller Cabinets	0.2
Troubleshoot Camera+ Encoders+ Media Converters Using Central Control System and Network Tools	0.2
Maintain Fiber Network & Splice/ Connection Drawings	0.1
Total PY for Network Admin and Field Operations	**1.5**

12.4 California Highway Patrol (CHP)

The CHP estimated the cost associated with the traffic breaks as shown in **Table 12-3**.

Table 12-3. CHP Traffic Break Cost Estimate (2006 Dollars)

Operation	Number units needed	Number of hours billed per day	Number of miles billed per day	Cost per day (hours and miles)	Cost per year (hours and miles)	Cost with 10% cushion.
2/2 Operations	1	4	75	$311.28	$80,933	$89,026
3/1 Operations	2	8	200	$658.56	$171,226	$188,349
3/1 Operations	3 units (2 to run break)	12	300	$978.84	$254,498	$279,947

The specific rates for personnel and mileage reimbursable contracts are listed below. The cost differences between a patrol car officer and a motor officer have been averaged in the chart above since these personnel are equally available during the morning and afternoon work shifts. Also averaged is the mileage cost differences between a patrol car and a motorcycle. It should be noted that patrol cars may provide a more reliable tool for traffic breaks due to inclement weather; however, motorcycles are equally capable of conducting the full range of duties identified on the I-15 ML.

Furthermore, the above chart estimates are based on published reimbursable rates as of 9/1/2005, and are amended periodically based upon current, negotiated pay and benefit rates. Cost estimates are based on a five day a week operation 260 days a year. Changes in operations or variances in operation plans will affect cost estimates.

Finally, the mileage and hour estimates are based on a minimum 4 hour reimbursement deployment according to a negotiated Union Contract agreement. Additionally, due to the potential of extended work shifts due to traffic accidents or mechanical issues related to the I-15 ML a cost plus 10% estimate is provided for your benefit.

Rates

Officer Rate Per Hour	$ 63.18
Motor Officer Rate per hour	$ 65.45
Patrol Car Mileage	$ 0.52
Motorcycle Mileage	$ 0.91

Additional Rate Information

A car officer would cost $291.72 for a four hour deployment with 75 miles per day. A motor officer would cost $329.43 for a four hour deployment with 75 miles per day.

13.0 OTHER TOPICS

13.1 Operations Plan Prioritization and Timeline

Table 13-1 summarizes in the form of a worksheet the results of a Stakeholder workshop conducted on August 3, 2006. The worksheet listed potential solutions/strategies to previously identified Operations Plan needs, and identified priorities and timelines.

Table 13-1. Operations Plan Prioritization and Timeline

Category	Need	Solution / Strategy	Prioritization (C, I, E)	Timeline
Hours of Operation	Middle Segment Interim 2007 a) Establish am and pm peak time-of-day for 2N+2S operation	EXISTING reversible hours. Tweak hours upon opening.	**C**	6 MO
	b) Establish criteria for moving barriers for incident management	Placeholder.		
	c) Establish time-of-day for 3N+1S and 1N+3S operation TIME FRAME, YEAR, ETC.	See 8/3 traffic analysis.	**C**	12 MO
	d) Establish time-of-day for set-up/traffic breaks	NB to SB (for am ML) 2100 - 2300 hrs SB to NB (for pm ML) 0900 - 1100 hrs Review needs for 2009 2+2 to 3+1 transition (N and S). Make sure to coordinate with CHP shift changes. PM TB not needed.	**C**	6 MO
	e) Establish preferred time-of-day for maintenance activities	Most likely off-peak and night.	**I**	DONE
	f) Establish requirements for TMC hours of operation	Consider Increase from 24/5 to 24/7 operation	**I**	12 MO
	g) (Repeat for Middle Segment Final 2008)			
	h) (Repeat for North and South Segment Integration 2012)			
Procedures	Middle Segment Interim 2007 a) Confirm/finalize 2N+2S (am) sequencing analysis			
	b) Confirm/finalize 2N+2S (pm) sequencing analysis			
	c) Confirm/finalize 1N+3S (am) sequencing analysis			
	d) Confirm/finalize 3N+1S (pm) sequencing analysis			
	e) Document step-by-step procedures	- Prepare field operations manual	**C**	12 MO DRAFT
	f) Document step-by-step barrier response maintenance procedures	- Prepare field maintenance manual		
	g) Document step-by-step ML enforcement procedures	Enforcement to be handled separately (separate from TB)		
	h) (Repeat for Middle Segment Final 2008)			
	i) (Repeat for North and South Segment Integration 2012)			

Table 13-2. Operations Plan Prioritization and Timeline (2 of 3)

Category	Need	Solution / Strategy	Prioritization (C, I, E)	Timeline
Staffing	Middle Segment Interim 2007 (need for additional staffing for:)			
	a) Caltrans Maintenance	- Maintenance Supervisor	C	18 MO
		- Maintenance Lead Worker	C	18 MO
		- Caltrans Equip Operator II (BTM)	C	18 MO
		- Caltrans Equip Operator I	C	18 MO
		- Maintenance OT	C	18 MO
	b) Caltrans TMC Operations Branch	- TMC Operators (for 24/7 operations)	I	12 MO
		- TMC Operators OT	I	12 MO
	c) Caltrans Traffic Ops, Electrical Systems Branch	- Caltrans Electrician II	C	18 MO
		- Caltrans Electrician I	C	18 MO
		- Electrician OT	C	18 MO
		- Electrical Engineers	C	18 MO
	d) Caltrans Traffic Ops, Ramp Metering/System Branch	- Transportation Engineering Technicians (TET)	C	18 MO
		- Electrical Engineers	C	18 MO
	e) California Highway Patrol (CHP)	- CHP OT	C	6 MO
		- Dedicated add'l CHP	I	18 MO
	f) Caltrans HQ Equipment Shop Service Center	- Caltrans Heavy Equipment Mechanic	C	18 MO
		- Mechanic OT	C	18 MO
Equipment and Materials	a) Barrier transfer	- Barrier Transfer Machine (BTM)	C	PO CUT?
		- Temporary BTM facility	C	3 MO
		- Permanent BTM facility	E	2009
		- Repair/replacement parts inventory	I	2 MO
		- Mechanic's truck	C	2 MO
		- BTM operations other (SEE MERL'S LIST)	C	2 MO
	b) Safety and traffic control	- Pop-ups (ingress/egress) at access points	E	TBD
		- Gates (at DARs)	C	TBD
		- In-pavement lighting	E	TBD
		- VMS (PENDING FURTHER SIGNING DISCUSSIONS)		TBD
		- Portable CMS (trailer)	E	
		- Field device communication and redundancy AND COSTS	C	12 MO
		- Traffic cones		
		- Worker clothing and safety equipment		
		- Spare devices and maintenance parts	C	3 MO

Table 13-3. Operations Plan Prioritization and Timeline (3 of 3)

Category	Need	Solution / Strategy	Prioritization (C, I, E)	Timeline
Equipment and Materials (Continued)	c) Maintenance vehicles, equipment, and materials	- 16-ton tow truck	**C**	2 MO
		- 2-ton towable fork lift	**C**	2 MO
		- 15-ft cargo body truck	**C**	2 MO
		- Truck w/solar CMS	**C**	2 MO
		- Cone truck	**C**	2 MO
		- 1/2-ton pick-up truck w/CMS	**C**	2 MO
		- Street sweeper	**C**	2 MO
		- Balsi Beam + tractor	**C**	2 MO
		- 5-yd (trucks) w/CMS and Crash Cushion	**C**	2 MO
		- High lift truck	**C**	2 MO
		- Snooper-type truck	**C**	2 MO
		- Electrical hoist	**C**	2 MO
		- Vehicle maintenance and operations	**C**	2 MO
	d) CHP vehicles, equipment, and materials	Address add'l resources needed for start-up. May decrease over time.	**E**	TBD
	e) Supplemental (voice) communications devices	- Cellular telephones	**C**	1 MO
		- 800 MHz base	**C**	3 MO
		- 800 MHz mobile	**C**	3 MO
		- 800 MHz hand-held	**C**	3 MO
		- licenses as well	**C**	6 MO
Training and Awareness	a) TOSNET troubleshooting, repair, and maintenance		**C**	1-3 MO
	b) Extended (e.g. ML safety rules, GUI, etc.) RLCS software and hardware (for ML) troubleshooting and maintenance		**C**	1-3 MO
	c) BTM operation and maintenance		**C**	1-3 MO
	d) Field device operation and maintenance		**C**	1-3 MO
	e) ML operations procedural training (Automated and Manual)	- "Classroom" training (HNTB scope task 7)	**C**	3 MO
		- Field test (ADDRESS BURN-IN ACCEPTANCE TESTS OF EQUIP)	**I**	6 MO
		- Table Top Ex	**I**	9 MO
		- Simulation video	**E**	TBD

I-15 MANAGED LANES

TRAFFIC INCIDENT MANAGEMENT (TIM) PLAN

January 12, 2007

Table of Contents

List of Tables

List of Figures

List of Acronyms

AAA	American Automobile Association
ATMS	Advanced Traffic Management System
BRT	Bus Rapid Transit
BRTC	Bus Rapid Transit Centers
CAD	Computer Aided Dispatch
CCTV	Closed Circuit Television
CHP	California Highway Patrol
CMS	Changeable Message Sign
CSC	Customer Service Center
DAR	Direct Access Ramp
DOT	Department of Transportation
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
ERG2004	2004 Emergency Response Guidebook
FHWA	Federal Highway Administration
FSP	Freeway Service Patrol
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HIRT	Hazardous Materials Incident Response Team
HOV	High Occupancy Vehicle
HSPD-5	Homeland Security Presidential Directive-5
IAP	Intermediate Access Points
ICS	Incident Command System
IMTMS	Inter-Modal Transportation Management System
IRT	Incident Response Team
ISP	Information Service Provider
MAIT	Multidisciplinary Accident Investigation Team
ME	Medical Examiners
MIRT	Major Incident Response Team
ML	Managed Lanes
MOU	Memorandum of Understanding
MUTCD	Manual on Uniform Traffic Control Devices
NHI	National Highway Institute
NIMS	National Incident Management System
NRP	National Response Play
PDT	Project Development Team
PRT	Primary Response Team
RISC	Roadway Incident Scene Clearance
SANDAG	San Diego Association of Governments
TIM	Traffic Incident Management
TMC	Traffic Management Center
TRAA	Towing and Recovery Association of America
VTMS	Variable Toll Message Signs

EXECUTIVE SUMMARY

The I-15 Managed Lanes Traffic Incident Management (TIM) Plan supplements the Operations Plan by providing guidelines and information specific to managing incidents and emergencies in the Middle Segment opening (2007/2008) of the I-15 Managed Lanes in coordination with the existing I-15 Reversible High Occupancy Vehicle (HOV) Lanes. The Middle Segment opening is considered an interim step prior to the completion of the full Managed Lanes including the South and North Segments. As with any new implementation of an innovative traffic operations concept such as the Managed Lanes, the TIM Plan will serve as a basis for any needed fine-tuning modifications necessary based on actual field observations and traffic incident experiences. It is expected that this TIM Plan, with refinements, will also be used for future segment openings.

Traffic incidents and other emergencies can occur at any time, impacting either/both the I-15 Managed Lanes and/or General Purpose Lanes. The purpose of the TIM Plan is to provide responders such as Caltrans Maintenance, the Traffic Management Center (TMC), the California Highway Patrol (CHP), Fire, and other public safety agencies with supplemental guidelines and other information to assist them in managing incidents in this unique segment of I-15 in San Diego County. The TIM Plan is NOT intended to replace any Standard Operating Procedures currently used by any responding agency.

The TIM Plan is one in a series of Technical Memoranda developed as part of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study jointly commissioned by San Diego Association of Governments (SANDAG) and Caltrans. The primary users of the TIM Plan are the staff from SANDAG, Caltrans, CHP, and other public safety agencies who will be directly involved in managing incidents on this segment of I-15. Other users include top-level management/decision makers/stakeholders as well as mid-level management who need to make informed decisions about the Managed Lanes implementation and operations, including traffic incident management.

Both the TIM and Operations Plans will be supplemented by a pending **Field Operations Manual** that will be developed specifically for field and operations staff and incident responders who will be involved in the day-to-day operations, maintenance of the Managed Lanes, and traffic incident management.

ES.1 Managed Lanes Overview

For construction and funding purposes, the I-15 Managed Lanes project is divided into three segments as shown in **Figure ES-1**.

Figure ES-1. I-15 Managed Lanes Project

Middle Segment – identified as top priority. The Middle Segment is under construction and is estimated to be operational in 2008. This segment will be operated in conjunction with the existing two-lane Reversible HOV operations to the south.

North Segment - estimated to be operational in 2011.

South Segment - estimated to be operational in 2012.

To accommodate peak directional traffic variations, moveable barriers will be installed throughout the entire length of the Middle and South Segments. The moveable barrier system will enable the Managed Lanes to be configured as 2N+2S, 3N+1S or 1N+3S in response to directional traffic flow and major incidents. The North Segment is currently envisioned to have fixed 2N+2S configuration with permanent barriers.

Access to the Managed Lanes will be provided at the north and south termini of operational Managed Lanes segments, at Intermediate Access Points (IAP) and at Direct Access Ramps (DAR) connecting the Managed Lanes to Bus Rapid Transit Centers (BRTC). IAPs are at-grade entrances/exits adjacent to the freeway main lanes, similar to carpool lane access. DARs provide access into the Managed Lanes from grade-separated interchanges. These have been located to enhance HOV and BRT access. Seven (7) northbound and six (6) southbound IAPs as well as five (5) DARs will be provided under the full implementation of the Managed Lanes.

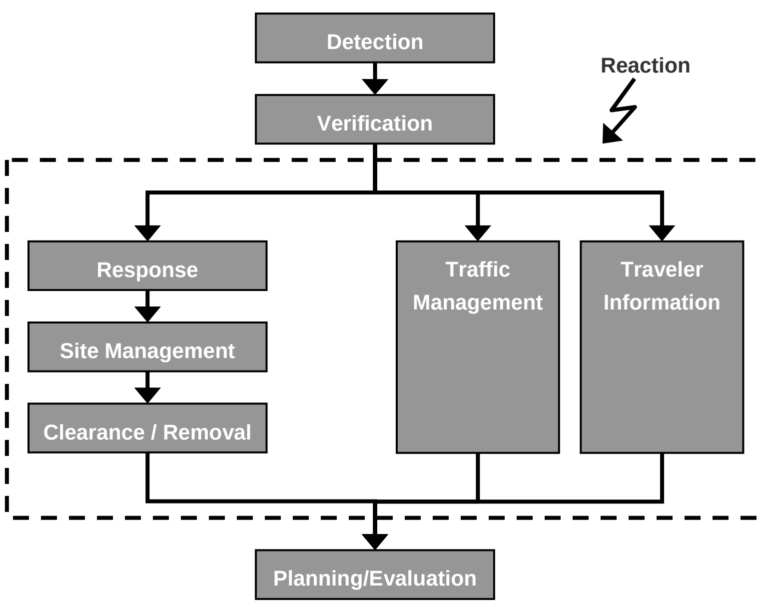
ES.2 Traffic Incident Management Defined and Benefits

A *traffic* incident is any unplanned or planned event that impacts, or has the strong potential to impact the flow of *traffic*. Examples range from vehicles stalled on the highway shoulder to major collisions. Severe weather, emergency highway maintenance activities, and other unplanned events may also be characterized as traffic incidents if they impact traffic flow. In the case of the I-15 Managed Lanes, and its strong dependence on technology (e.g., Changeable Message Signs) and field devices for operations (e.g., Barrier Transfer Machine), the failure of one or several system components could also be considered a traffic incident.

Traffic incident impacts are significant and far-reaching. In San Diego and most other major metropolitan areas, it is estimated that between 50% and 60% of all delay is attributable to traffic incidents. The delay, secondary incidents, and resulting congestion further lead to missed shipment deadlines, losses in productivity, wasted fuel, and an overall degradation in the quality of life for system users. However, possibly the most compelling impacts of traffic incidents involve reductions in safety for both motorists and those responding to these highway emergencies.

Traffic Incident Management (TIM) is defined as the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration of incidents, and improve the safety of motorists, collision victims, and incident responders. TIM is a process **(Figure ES-2)** that provides a coordinated approach to managing highway incidents and is a highly specialized field that involves developing and maintaining working relationships with a wide variety of stakeholders and emergency responders.

Figure ES-2. TIM Process Diagram



The greatest benefits of effective TIM strategies are achieved through the reduction of incident duration. Reducing incident duration is typically fostered by: reducing incident detection and verification time; initiating an expedient and appropriate response; and, clearing the incident as quickly as possible. Quantifiable benefits generally associated with an effective TIM Program include increased survival rates of collision victims, improved safety of responders and motorists, and reduced delay. Qualitative benefits often include improved public perception of agency operations, improved quality of life, and improved coordination and cooperation of response agencies.

ES.3 Traffic Incident Classifications, Types and Examples

Incident classification systems provide common terminology for referencing/discussing incidents and are often utilized to simplify and guide consistent responses. Caltrans and the CHP currently use a simple classification system that defines incidents as either "Minor" or "Major" based on the anticipated incident duration. Additionally, the day of the week and time of day when an incident occurs is also considered when determining its impact to the system. Minor incidents are categorized as incidents that are typically one-hour or less in duration and include: disabled vehicles in a travel lane or on the shoulder; minor collisions; roadway debris; minor roadway maintenance work; and, enforcement activities. Major incidents are categorized as incidents that are typically an hour or more in duration. Major incident examples include: overturned trucks/trailers; rollover or multi-vehicle collisions; chain reaction collisions; commercial carrier collisions; collisions that require a coroner and/or Multidisciplinary Accident Investigation Team (MAIT) response (e.g., Fatalities); and, incidents involving advanced, prolonged environmental clean-up (e.g., Hazardous Materials – HAZMAT). Regional emergencies such as wildfires, earthquakes, and/or acts of terrorism can also be classified as major incidents.

ES.4 Identified TIM Issues and Needs

TIM is not necessarily a new concept to the San Diego region. SANDAG, Caltrans, CHP and others have been aggressively managing traffic incidents for many years. However, due to the operational complexity of the I-15 Managed Lanes, a heightened awareness of the criticality of TIM is warranted to ensure safe and efficient operations for both the managed and general purpose lanes.

The process of identifying specific TIM issues and needs was a focus of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study. A number of different mechanisms were used to discuss TIM issues and needs. These included Stakeholder workshops, traffic incident scenario-based table-top exercises, and Project Development Team (PDT) discussion. A brief overview of identified TIM issues and needs according to TIM process phases is provided in **Table ES-1** below.

Table ES-1. Identified TIM Issues and Needs

TIM Process Phase	Identified TIM Issues/Needs
Detection and Verification	Leverage roadway Closed Circuit Television (CCTV) cameras and share images with emergency responders. Consider I-15 section/location markings on poles to enable motorists to accurately identify their location.
Response	Consider strategies and tactics for emergency access to the incident scene and acknowledge response times for all responders. Consider development of Incident Response Teams dedicated to I-15, including pre-positioned and/or on-site resources. Consider expanding Traffic Management Center (TMC) hours of operation to 24/7. An interim TMC operations solution would be to provide appropriate control of ITS field elements with remote access and operational tracking.
Site Management	The Incident Command System (ICS) is currently used extensively during incident situations and needs to be incorporated into TIM procedural strategies and training.
Clearance and Removal	TIM Plan strategies need to consider the existing Caltrans and CHP 90 minute incident response/clearance performance measure. Heavy-duty recovery equipment such as a rotator crane is needed to facilitate clearance of incidents involving large vehicles. The role of Freeway Service Patrol (FSP) during managed lanes operations needs to be clarified and a policy change may be required to expand FSP hours of operation and to allow FSP to respond to incidents that occur within the managed lanes. Consider enacting hold harmless legislation to protect responder liability when facilitating quick clearance. Also, consideration should be given to implementing/expanding quick clearance towing policies and/or incentives.
Traveler Information	Due to the heavy reliance on the Caltrans District 11 TMC for real-time traveler information, an expansion from the existing hours of operation to 24 hour/7 days should be considered (see *Response*). Correspondingly, Changeable Message Signs (CMS) will be used extensively and should be implemented at all Managed Lanes entry points as well as other locations. Message coordination is required between Caltrans TMC and SANDAG's FasTrak Customer Service Center (CSC). Supplemental changeable message boards mounted on trucks/trailers may also be considered.
Traffic Management	Throughout the study process, it was recognized that the public is fully expecting barrier transfer (i.e. adding an additional lane) during incident situations. The TIM plan needs to address under which conditions the barrier is to be transferred. As an additional proactive traffic management strategy, formal emergency alternate route plans should also be developed with acknowledgement that law enforcement personnel may be required to successfully manage diversion traffic on these emergency routes.
Planning and Evaluation	There is a need to conduct formal TIM training in the form of "table-top" and field exercises to test strategies and facilitate inter-agency coordination. Also, a need exists to regularly debrief incidents and discuss TIM issues especially after Managed Lanes are opened. Finally, an Emergency Response Callout List with names, contact details for all involved in incident response is needed to enhance communications.
General	Due to the Managed Lanes strong reliance on technology and field devices for safe and efficient operations, spare parts availability and emergency maintenance of system components needs to be given a high priority. Additionally, there is a need to document existing systems and provide a high-level overview of how they interact and are integrated.

ES.5 TIM Solutions, Strategies, and Planning-Level Cost Estimates

To address identified issues and needs, a TIM "Toolbox" was developed. The toolbox, summarized in **Table ES-2** below, presents potential I-15 Managed Lanes TIM solutions, strategies, and planning-level cost estimates and is organized according to the phases of the TIM process. In developing potential solutions and strategies, "best practices" from other areas of the country as well as the San Diego region were considered. Also included is a recommended timeline for implementation.

Table ES-2. Summary of TIM Solutions, Strategies, and Planning-Level Cost Estimates

Phase	Tool/Strategy	Recommendation	Planning Level Cost Estimates	Timeline (Implemented By)
Detection / Verification	Closed Circuit Television (CCTV) Cameras	Identify additional CCTV locations necessary to provide full coverage of the ML and ensure that provisions are in place for installing CCTV in these locations.	Approximately $50,000 per additional CCTV camera location	Minimum of 3 months prior to the opening of the ML
	CCTV Video Sharing	Continue to develop and implement the regional Inter-Modal Transportation Management System (IMTMS) to achieve video sharing.	Requires further investigation and preliminary design	Minimum of 3 months prior to the opening of the ML
	Computer-Aided Dispatch (CAD) Linkages	Continue integration of CHP's CAD data into the new ATMS recognizing that the ability of the system to track and easily report on performance measures such as response time and incident duration is important.	N/A	Opening of the ML
	Incident Detection Algorithms	Improve existing incident detection algorithms and integrate back into daily TMC operations.	Approximately $160,000	Minimum of 3 months prior to the opening of the ML
Response	Emergency Response Callout List / Resource List	Develop a comprehensive communication/resource plan. *Component of proposed I-15 ML Field Operations Manual*	*Included in I-15 ML Field Operations Manual cost estimate*	Minimum of 3 months prior to the opening of the ML
	Freeway Service Patrol (FSP)	1.) Extend FSP coverage to include the ML facility. 2.) Review existing hours of operation and ensure coverage needs of the ML are met.	Requires further investigation	Opening of the ML
	Incident Response Teams (IRTs)	Implement an I-15 Managed Lanes IRT with personnel dedicated to TIM.	Approximately $620,000	Minimum of 3 months prior to the opening of the ML
	Pre-positioned TIM Equipment	Identify locations for and construct TIM storage sites along the I-15 Managed Lanes corridor.	$25,000 - $50,000 per location	Minimum of 3 months prior to the opening of the ML

Phase	Tool/Strategy	Recommendation	Planning Level Cost Estimates	Timeline (Implemented By)
Response	Operations and TIM Field Manual	Develop an I-15 Managed Lanes Field Operations Manual that provides guidelines and procedures related to both operations and TIM for field personnel that will be working/responding within the I-15 corridor.	$100,000	Minimum of 3 months prior to the opening of the ML
	Incident Classification Consistency/Awareness	Ensure regional awareness of existing Caltrans/CHP incident classification system among all responders. *Component of proposed I-15 ML Field Operations Manual*	N/A	Minimum of 3 months prior to the opening of the ML
	Staging Guidelines	Develop staging guidelines that identify minimum requirements for staging locations. *Component of proposed I-15 ML Field Operations Manual*	*Included in I-15 ML Field Operations Manual cost estimate*	Minimum of 3 months prior to the opening of the ML
	Responder Safety Tactics			
	1. Vehicle Markings	Add reflective markings to all emergency/maintenance vehicles anticipated to be used in or near moving traffic.	$1,000 - $3,000 per vehicle	Minimum of 3 months prior to the opening of the ML
	2. High-Visibility Garments	Require, and enforce, that all incident responders wear high-visibility garments when responding to incidents in or near moving traffic.	$100 - $1,000 per responder	Minimum of 1 month prior to the opening of the ML
	3. Emergency-Vehicle Lighting Policies	Develop guidelines/policy for use of emergency-vehicle lighting at incident scenes. *Component of proposed I-15 ML Field Operations Manual*	*Included in I-15 ML Field Operations Manual cost estimate*	Minimum of 3 months prior to the opening of the ML
Site Management	National Incident Management System (NIMS) / Incident Command System (ICS)	To satisfy HSPD-5 requirements, all first responders should take, at a minimum, IS-700 and ICS-100.	Nominal (Training courses available online)	Minimum of 3 months prior to the opening of the ML
	"Move Over" Legislation	Promote public awareness of the new law and identify strategies to monitor the impact of the law on driver behavior.	Requires further investigation	Minimum of 3 months prior to the opening of the M

Phase	Tool/Strategy	Recommendation	Planning Level Cost Estimates	Timeline (Implemented By)
Clearance / Removal	"Open Roads" Policies	1.) Increase awareness of existing "Open Roads" policy to all responding agencies and obtain buy-in. 2.) Identify method for tracking clearance times and develop consistent format for reporting.	*Component of formal TIM Program*	Opening of the ML
	Quick Clearance / Hold Harmless Legislation	Initiate efforts to enact Quick Clearance and Hold Harmless legislation.	N/A	6 months after opening of the ML
	Heavy-Duty Recovery Program	Develop and implement an incentive based heavy-duty recovery program for the I-15 Managed Lanes corridor.	Requires further investigation	Minimum of 1 month prior to the opening of the ML
	Collision Investigation/ Reconstruction Technologies	Continuously monitor and evaluate feasibility of using new collision reconstruction tools and technology with the goal of decreasing on scene time for data collection.	Variable depending on technology	On-going
	Medical Examiner Agreements / MOU	At a minimum increase awareness of incident clearance goal and improve coordination efforts with Medical Examiners in the San Diego Region.	N/A	1 year after opening of the ML
Traffic Management	Barrier Transfer	The criteria for barrier transfer during incidents should be revised as the operational characteristics of the I-15 Managed Lanes change. *Component of proposed I-15 ML Field Operations Manual*	Requires further investigation	On-going
	Formal Emergency Alternate Route Plans	Develop formal alternate route plan(s) that consider the use of non-I-15 roadways for emergencies.	\$50,000 - \$100,000	1 year after opening of the ML
	Emergency Alternate Route Infrastructure and Operations Deployment	If a formal emergency alternate route plan is developed, pursue traffic management improvements on designated routes.	Highly variable	1 year after opening of the ML
	Advanced Notification	Identify advanced notification as an IRT responsibility.	*Included in IRT cost estimate*	Minimum of 3 months prior to the opening of the ML

Phase	Tool/Strategy	Recommendation	Planning Level Cost Estimates	Timeline (Implemented By)
Traveler Information	Traffic Management Centers (TMCs)	Expand Caltrans District 11 TMC operations 24/7.	Approximately $300,000	Minimum of 3 months prior to the opening of the ML
	Changeable Message Signs (CMS)	1.) Identify all critical decision points along the ML, and ensure that provisions for CMS in these locations are made. 2.) Develop a CMS/VTMS Operations Policy between Caltrans and SANDAG outlining necessary coordination between FasTrak and the District 11 TMC.	Requires further investigation and preliminary design	Minimum of 3 months prior to the opening of the ML
	Highway Advisory Radio (HAR)	Restore HAR functionality and integrate back into daily TMC operations.	Approximately $210,000	Minimum of 3 months prior to the opening of the ML
	511	Utilize 511 system to provide incident information, including alternate route information if applicable	On-going initiative	Anticipated to be in place by end of 2006
	Media - Traffic Reports	Continue coordination efforts between the media and the Caltrans District 11 TMC.	*Component of formal TIM Program*	Opening of the ML
Planning / Evaluation	Formal TIM Program	Establish a formal TIM Program for the San Diego region.	$250,000 - $500,000 (Consultant support per year)	Minimum of 3 months prior to the opening of the ML
	TIM Training Program	Establish a formal, on-going, multi-agency TIM Training Program.	*Component of formal TIM Program*	Minimum of 3 months prior to the opening of the ML
	Incident Debriefings	Develop standard guidelines/policies for multi-agency incident debriefings.	*Component of formal TIM Program*	Opening of the ML
General	Spare Parts and Emergency Maintenance	Ensure emergency maintenance/repair provisions be in place for critical equipment and field devices, along with provisions for an adequate supply of spare parts.	Requires further investigation	Minimum of 3 months prior to the opening of the ML

Phase	Tool/Strategy	Recommendation	Planning Level Cost Estimates	Timeline (Implemented By)
General	I-15 Managed Lanes Systems Documentation	Prepare and distribute Systems Documentation for use as a ready-reference to those agencies responsible for I-15 Managed Lanes operations and TIM.	Requires further investigation	Minimum of 3 months prior to the opening of the ML

ES.6 Stakeholder Agency Roles and Responsibilities

The phases or activities that make up the TIM process require the skills and expertise of a number of different agencies from diverse disciplines. For effective TIM to occur, a mutual understanding of the roles that each agency plays is very important. At the time of this writing, specific agency responsibilities in connection with the I-15 Managed Lanes operations are in the process of being finalized and will be formalized via Letters of Intent/Interagency Cooperative Agreements.

Brief summaries of typical agency roles and responsibilities involved in and/or responsible for TIM are described below. They are not necessarily assumed to be representative of Caltrans, CHP, SANDAG or other traffic incident responders in the San Diego region. Nor are they intended to be recommendations. The descriptions below are merely an illustration of how these agencies and service providers are typically involved in the TIM process.

Law Enforcement – is often first on-scene and typically provide a variety of duties including first aid, emergency traffic control, incident command, and collision reconstruction.

Fire and Rescue – is primarily responsible for emergency medical care, fire suppression, extrication, and HAZMAT response and containment.

Emergency Medical Services (EMS) – Often combined with the fire department as in San Diego, EMS is responsible for providing advanced emergency medical care, transportation of the injured to hospitals and trauma centers, and removal of medical waste from the incident scene.

Coroners and Medical Examiners - play a role in TIM when the traffic incident involves a fatality. In San Diego, as mandated by State Law, the County Department of the Medical Examiner must certify the cause and manner of death for all incidents/accidents in the region, including traffic fatalities.

Transportation Agencies – typically assist with incident detection and verification, initiate and monitor traffic management strategies, provide emergency traffic control, disseminate traveler information, and respond to needed infrastructure repairs. Oftentimes the transportation agencies play a lead role in organizing and sustaining formal TIM programs.

Towing and Recovery Service Providers – are critical to the overall TIM process and are responsible for the safe and efficient removal of wrecked or disabled vehicles, and debris from the incident scene.

Information Service Providers (ISPs) and the Media - are commercial/private entities that collect traffic data, often from existing DOT sources, and disseminate information to both motorists and other media outlets.

ES.7 Training Requirements

TIM training refers to the interagency, multi-disciplinary training required to enable a high degree of coordination and ensure the efficient use of resources available for managing traffic incidents. The overall goal of TIM training is to initiate a common, coordinated response to traffic incidents that builds partnerships, enhances safety for emergency personnel, reduces secondary collisions, and improves the efficiency of the transportation system. Multi-agency training is essential to responder safety as well as to maintaining and improving overall TIM quality. Irregardless of roles, it is extremely important that all responding agencies be involved in joint TIM training.

Training, like other aspects of TIM programs, typically varies significantly from region to region. Many programs customize training for incident responders, managers, and policy-makers. In any case, training may include any combination of field drills, table-top exercises, and/or classroom lectures and discussion. As part of the I-15 Managed Lanes Operations and Traffic Incident Management Plan study, some training will be conducted for operational personnel and TIM responders. This high-level training will focus on the purpose of the two plans and how to use the procedural information contained within them. Based on specific TIM training needs identified throughout the course of the study, and the complexity of the I-15 managed lanes operations, it is highly recommended that an on-going, multi-agency TIM training program be established.

The importance of proper TIM training for responders cannot be underestimated in the litigious nature of our society today. More and more agencies are being forced to assume at least some liability for failing to provide training for personnel who manage emergency situations, especially in cases where it can be proven that proper training could have prevented injuries or damages.

ES.8 Criteria for Barrier Transfer During Incidents

In addition to providing additional capacity during peak periods, the public is expecting that the I-15 Managed Lanes will be used to help alleviate incident related congestion that occurs when an incident happens in the general purpose lanes. However, barrier transfer is not a cost effective solution for incidents with durations anticipated to be less than the time required to transfer the barrier. In order to address this issue, an initial decision tree for barrier transfer during TIM operations was developed. Factors considered in the decision tree include incident classification, incident duration, number of lanes closed, day of the week, time of day, incident location, and direction of travel.

There are three possible ending points to the decision tree: "No Action," "Open the Managed Lanes or HOV Lanes (depending on incident location) to all traffic," or "Move the HOV barrier wall." The decision tree was developed under the assumption that the Managed Lanes will be operating in the 2N+2S standard daily configuration until 2012. Thus, transfer of the barrier was limited to the south end of the project where changing the direction of the travel in the existing HOV lanes may be necessary. It is important to note, however, that after the interim middle segment opening, Caltrans will have the ability to transfer the barrier in the middle segment. Therefore, if a major incident was anticipated to block one direction of travel for a significant amount of time (e.g., 6 hours or more) consideration may be given to transferring the barrier to a non-standard 3N+1S or 1N+3S configuration.

If the decision is made to open the Managed Lanes to all traffic or to transfer the HOV barrier wall, close coordination between Caltrans and SANDAG's FasTrak office will be required. In order for either solution to be effective the rate information (or absence of toll rates) displayed on SANDAG's Variable Toll Message Signs (VTMS) and the messages displayed on Caltrans CMS must be coordinated.

It is important to note that the decision tree was developed as a guidance tool. As each incident is different, it is likely that incident specific circumstances may outweigh the guidance provided in the decision tree. In addition, it is anticipated that the decision tree will be revised on an on-going basis based on experience and to accommodate changes in operational characteristics as they occur.

ES.9 Scene Management Guidelines

The I-15 Managed Lanes TIM Plan provides guidelines specific to various scene management strategies and tactics as summarized below.

National Incident Management System (NIMS) and Incident Command System (ICS) - NIMS is a comprehensive system that is intended to improve response and continuity of operations through the use of the Incident Command System (ICS) and other standard procedures and preparedness measures. NIMS also promotes the development of cross-jurisdictional, statewide and interstate regional mechanisms for coordinating incident management and obtaining support during large-scale or complex incidents.

Scene Management and Emergency Traffic Control - All personnel required to work at emergency scenes along or within close proximity to roadways should be aware of the dangers associated with working in live traffic. Emergency responders are often too busy or concerned with caring for others to be concerned for their own safety. However, emergency responders can take several actions to provide the safest possible work environment and should use whatever means necessary, within reason, to do so. Conversely, responders must also be aware that closing more lanes of traffic than necessary for scene protection significantly increases the likelihood of secondary incidents occurring upstream of the primary emergency and can prolong the overall duration of the incident.

Emergency Scene Access - Emergency scene access guidelines provide alternatives for emergency vehicle access to potential incident sites. Generally the Incident Commander or an on-scene responder will determine the best available route to a scene. Scene access guidelines for I-15 Managed Lanes considers three alternatives:

Alternative 1 – Upstream of Incident, Flow with Traffic;
Alternative 2 – Upstream of Incident, on Adjacent Facility (e.g., either general purpose lanes or managed lanes depending on incident location);
Alternative 3 – Downstream of Incident, Opposite Direction.

Staging Considerations - When incidents require response from multiple agencies and a large number of responding vehicles or when an incident occurs within an area with limited shoulders or lanes, it may be appropriate to implement staging areas removed from, but in close proximity to the immediate scene.

Guidelines for Emergency-Vehicle Lighting - At an incident scene, emergency-vehicle lighting (such as high-intensity rotating, flashing, oscillating, or strobe lights) is used to enhance the safety of response personnel and incident victims. However, excessive use of flashing lights can create unnecessary delay and confusion for motorists passing the scene, especially at night. The use of emergency-vehicle lighting can be reduced if good traffic control has been established at the incident scene. Chapter 6I of the Manual on Uniform Traffic Control Devices (MUTCD) recommends that public safety agencies examine their policies on the use of emergency-vehicle lighting, especially after a traffic incident scene is secured, with the intent of reducing the use of this lighting as much as possible while not endangering those at the scene. Furthermore, vehicle headlights not needed for illumination, or to provide notice to other road users of the incident response vehicle being in an unexpected location, should be turned off at night.

ES.10 Emergency Alternate Route Considerations

A high-level definition of an emergency alternate route is a roadway or series of roadways that provide additional capacity to service primary route (e.g., I-15) traffic. The term “emergency” implies that the route is to be used for additional primary route capacity only under emergency conditions (i.e. major traffic incidents), not as a general, everyday “by-pass”. Emergency alternate routes can be both regional and local in nature. In the case of the I-15 Managed Lanes segment in San Diego, a regional emergency alternate route might be I-5/I-805. An example of a localized emergency alternate route could be Pomerado Road to the east of I-15. The Managed Lanes themselves may also be used as an emergency alternate under certain conditions. In all situations, the location and expected duration of the incident, extent of congestion resulting from the emergency, and the distance traveled from the primary facility must be factored into the decision as to which emergency alternate route to use. Additionally, real-time, accurate traveler information is critical. Motorists must be sufficiently warned of the emergency alternate route so that they can make informed decisions both in advance and during their trips. Often an activity of formal TIM programs, advance planning and preparation of emergency alternate route plans enhances the on-scene traffic management capability of interagency incident responders. Proper emergency alternate route planning has a significant effect on improving the safety and efficiency of roadway operations under traffic incident conditions without undue impact on the surrounding community.

ES.11 Hazardous Materials (HAZMAT) Considerations

Effective first response to traffic incidents involving hazardous materials (HAZMAT) is critical to minimizing the impacts of the emergency in terms of public and responder safety, environmental degradation, and clean-up costs. Well-defined agency HAZMAT response policies and procedures and corresponding training allow first responders to accurately identify the hazardous material and direct further response. For example, Caltrans Maintenance Policy Directive Number 0601 identifies roles and responsibilities for spill clean-up, ensures HAZMAT contractors comply with State and Federal regulations for removing hazardous materials, expedites contractor payment, and describes recovery of incident expenditures from the responsible party. Most common (and small quantity) engine fluid spills (oil, diesel fuel, gasoline, anti-freeze, etc.) can be contained and cleaned up without calling hazardous materials contractors. Quick cleanup and removal of these types of spills can greatly reduce incident duration.

Many materials transported via highways are particularly hazardous in any quantity, and should be approached with extreme caution. The 2004 Emergency Response Guidebook (ERG2004) developed jointly by the USDOT and other similar North American entities, is a primary guide to aid first responders in quickly identifying the specific or generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident. The guide should be used by TIM responders such as fire fighters, law enforcement, DOTs, and other public safety personnel who may be the first to arrive at the scene of a traffic incident involving dangerous goods.

ES.12 TIM Programmatic Recommendations

The I-15 Managed Lanes TIM Plan references the benefits of on-going, sustained TIM programs. Those regions that have comprehensive programs have typically experienced significant reductions in travel delay and overall incident duration as well as improvements in the area of responder and motorist safety. Furthermore, TIM programs have served to greatly enhance transportation-public safety partnerships and relationships.

It should be recognized that even in areas without formal TIM programs, agencies still must perform some type of incident response. In other words, someone responds to traffic incidents that occur. Thus, the goal of a TIM program is not to create a response, but rather to create a more effective, efficient response for *all* responding agencies. This distinction is very important. Incident response in and of itself, does not entail the same degree of coordination, planning, and conscious effort required for TIM to be effective.

At a minimum, the following activities are recommended in establishing and sustaining an on- going TIM program:

- Identify a "champion" agency or individual to lead program development.
- Involve and encourage participation from all responding agencies/stakeholders.
- Meet regularly to:
    - Confirm and reinforce goals and objectives.
    - Discuss on-going problem areas and needs.
    - Collaborate in the development of solutions, strategies, and enhancements.
    - Conduct incident after-action reviews and debriefings.
    - Monitor training needs.
    - Establish, reinforce, and renew relationships with responders.

- Identify and/or establish funding source(s).
- Oversee solution, strategy, and enhancement implementation.
- Monitor progress, evaluate strategies, and identify benefits.
- Conduct TIM benefits outreach and "in-reach".

1.0 INTRODUCTION AND PURPOSE

The Traffic Incident Management (TIM) Plan supplements the Operations Plan by providing guidelines and information specific to managing incidents and emergencies in the Middle Segment opening (2007/2008) of the I-15 Managed Lanes in coordination with the existing I-15 Reversible High Occupancy Vehicle (HOV) Lanes. The Middle Segment opening is considered an interim step prior to the completion of the full Managed Lanes including the South and North Segments. As with any new implementation of an innovative traffic operations concept such as the Managed Lanes, the TIM Plan will serve as a basis for any needed fine-tuning modifications necessary based on actual field observations and traffic incident experiences. It is expected that this TIM Plan, with refinements, will be also be used for future segment openings.

Traffic incidents and other emergencies can occur at any time impacting either/both the I-15 Managed and/or General Purpose Lanes. The purpose of the TIM Plan is to provide responders such as Caltrans Maintenance, the Traffic Management Center (TMC), the California Highway Patrol (CHP), Fire, and other public safety agencies with supplemental guidelines and other information to assist them in managing incidents in this unique segment of I-15 in San Diego County. The TIM Plan is NOT intended to replace any Standard Operating Procedures currently used by any responding agency.

1.1 Organization of the Traffic Incident Management (TIM) Plan

The TIM Plan is organized around the following topics and sections.

Executive Summary
Section 1 – Introduction and Purpose
Section 2 – I-15 Managed Lanes Project Background
Section 3 – Traffic Incident Management Defined and Benefits
Section 4 – Incident Classifications, Types and Examples
Section 5 – Identified TIM Issues and Needs
Section 6 – TIM Solutions, Strategies, and Planning-Level Cost Estimates
Section 7 – Stakeholder Agency Roles and Responsibilities
Section 8 – Training Requirements
Section 9 – Criteria for Barrier Transfer during Incidents
Section 10 – Scene Management Guidelines
Section 11 – Emergency Alternate Route Considerations
Section 12 – Hazardous Materials (HAZMAT) Considerations
Section 13 – TIM Programmatic Recommendations

1.2 Relationship of the TIM Plan to Other Technical Memoranda

The TIM Plan is one in a series of Technical Memoranda developed as part of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study jointly commissioned by the San Diego Association of Governments (SANDAG) and Caltrans. The Technical Memoranda series include:

- **Study Goals, Objectives and High-Level Needs** – identifies study goals, objectives and needs that serve as the basis for development of subsequent study tasks.
- **Background Information and Best Practices** – synthesizes information from other agencies using moveable barriers and identifies best practices for the San Diego region.
- **Traffic Analysis** – identifies the appropriate timing (year, time of year, and time of day) for implementing various possible Managed Lanes configurations.
- **Operations Plan** – identifies operational and maintenance strategies for operating the moveable barrier system under various configurations.
- **Traffic Incident Management (TIM) Plan** (this document) – defines what TIM is and why it is critical to successful Managed Lanes operations. Provides TIM solution and strategy recommendations along with planning-level cost estimates for implementation.
- **ITS Strategies Recommendations** – provides recommendations for integrating the Operations Plan and Traffic Incident Management Plan into ongoing Intelligent Transportation Systems strategies/plans.

It is recommended that a **Field Operations Manual** be developed specifically for field and operations staff and incident responders who will be involved in the day-to-day operations, maintenance of the Managed Lanes, and traffic incident management.

1.3 Intended Users of the TIM Plan

The primary users of this TIM Plan are the staff from SANDAG, Caltrans, CHP, and other public safety agencies who will be directly involved in managing incidents on this segment of I-15.

Other users include top-level management/decision makers/stakeholders as well as mid-level management who need to make informed decisions about the Managed Lanes implementation and operations, including traffic incident management.

1.4 How to Use the TIM Plan

As described above, the TIM Plan is organized by presenting various components of traffic incident management. Some components of the plan may be more relevant to field personnel, while other components to management and other decision makers. **Table 1-1** shows the recommended reading paths for different users. The Executive Summary and Introduction and Purpose sections provide an overview of the TIM Plan and are recommended to be read by all users.

Table 1-1. TIM Plan Reading Guide

Section	Title	Decision Makers and Stakeholders	Mid-Level Management	Field/TMC Personnel
	Executive Summary			
1	Introduction and Purpose			
2	I-15 Managed Lanes Project Background			
3	Traffic Incident Management Defined and Benefits			
4	Incident Classifications, Types and Examples			
5	Identified TIM Issues and Needs			
6	TIM Solutions, Strategies, and Planning-Level Costs			
7	Stakeholder Agency Roles and Responsibilities			
8	Training Requirements			
9	Criteria for Barrier Transfer During Incidents			
10	Scene Management Guidelines			
11	Emergency Alternate Route Considerations			
12	Hazardous Materials (HAZMAT) Considerations			
13	TIM Programmatic Recommendations			
	Appendices			

Legend:

Must Read
Background Information
Optional Reading

1.5 Updating the TIM Plan

1.5.1 Responsibility for Maintaining and Updating the TIM Plan

It is recognized that the I-15 Managed Lanes TIM Plan will require periodic updating as operational conditions and organization policies change. It is recommended that the responsibility for updating the TIM Plan be assigned to the Caltrans Traffic Operations Division, specifically the TMC Branch with support from the Electrical and Systems Branches, the Maintenance Division, and CHP. SANDAG as well as other incident responders and public safety agencies may also provide updates to the TIM Plan as required.

1.5.2 Procedure for Updating the TIM Plan

The following is a recommended set of procedures for updating the TIM Plan:

- Identify part of the plan requiring update.
- Request TMC Branch to initiate TIM Plan Update Meeting.

- TMC Branch contacts all other parties and arranges a meeting to discuss proposed update.
- TMC Branch documents meeting and consensus to update.
- TMC Branch informs Executive Staff of consensus to update, and solicits concurrence with proposed update.
- TMC Branch develops draft TIM Plan update materials and circulates to all parties for review and comment.
- TMC Branch incorporates review comments and reconciles discrepancies.
- TMC Branch forwards updated TIM Plan to all parties.

1.6 Sources of Materials

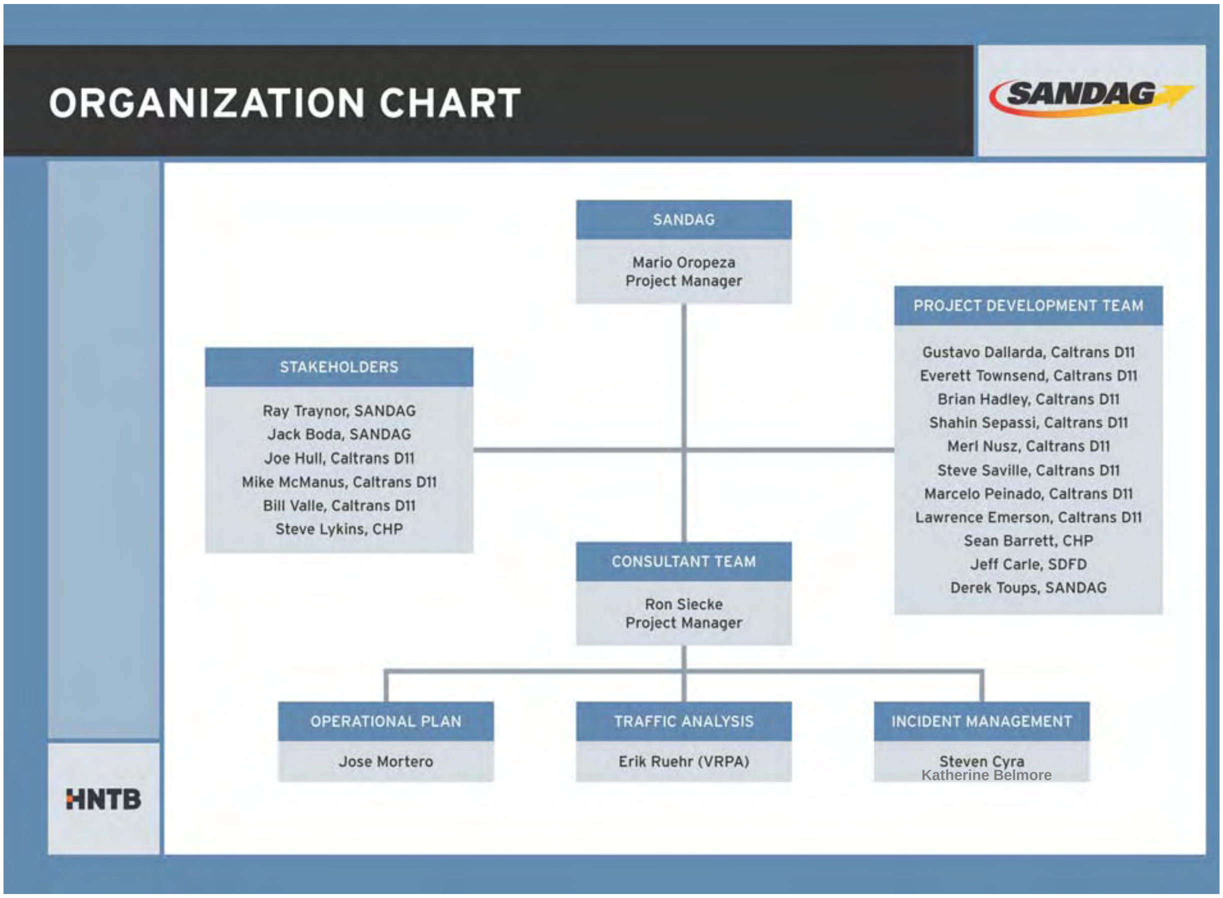
This TIM Plan used materials from the following related I-15 Managed Lanes reports and other documents as specified:

- Caltrans District 11 Traffic Operations – Advanced Transportation Systems Engineering Branch, *Operations/Resource Requirements Report for I-15 Managed Lanes Middle Segment Opening*, July 2006.
- USDOT FHWA, *Traffic Incident Management Handbook*, November 2000.
- Caltrans, *California Manual on Uniform Traffic Control Devices for Streets and Highways (FHWA's MUTCD 2003 Edition, as amended for use in California)*, September 26, 2006.

1.7 Acknowledgments

This document was prepared with valuable inputs and comments from various agencies and individuals, particularly the representatives of Stakeholder agencies and the members of the Project Development Team (PDT), as shown in the project organizational chart in **Figure 1-1Figure 1-1. Project Organization** Chart
. Other individuals not included in the chart also provided invaluable insights and materials during the various workshops conducted as part of the study.

Figure 1-1. Project Organization Chart



2.0 I-15 MANAGED LANES PROJECT BACKGROUND

The following section provides an abbreviated background of the I-15 Managed Lanes project. Refer to the project's Operations Plan for full description of the overall project and its history. For consistency purposes and in order to provide the users of the TIM Plan with a better understanding of the project's existing and proposed lane configurations and cross-sections, summary diagrams are included in Section 2.0 of the Operations Plan.

2.1 Managed Lanes Concept and Vision

The I-15 Managed Lanes Project (**Figure 2-1**) introduces an innovative concept for "managing" traffic service to accommodate peak directional flows, and incorporates a reliable Bus Rapid Transit (BRT) System. This system provides incentives for carpooling, and additional opportunities for single occupant vehicles that will help reduce congestion on general purpose lanes.

Figure 2-1. The I-15 Managed Lanes Project

The improvements to I-15 are consistent with the region's desire to accommodate "smart growth." The "smart growth" strategy emphasizes compact, efficient, and environmentally sensitive development. It focuses future growth away from rural areas and connects housing with jobs, services, and transportation. The I-15 corridor is experiencing some of the region's greatest growth and is expected to continue to do so.

2.1.1 Managed Lanes

The I-15 Managed Lanes Project has several components that make the project challenging. The ability to "manage" capacity (by using a moveable barrier system) and the ability to "manage" the type of traffic users on the facility (buses, carpools and as capacity allows, single occupant vehicles) have never been accomplished before in California. The current FasTrak value pricing program administered by SANDAG has been successful in using value pricing to "manage" traffic demand and maximize person-throughput on the existing reversible lanes on I-15 while ensuring a minimum level of service "C" is maintained on the facility at all times.

The I-15 Managed Lanes Project will "manage" four lanes in the median to provide a high level of traffic service to users of both the Managed Lanes and the general purpose/mixed-use lanes. These Managed Lanes will have multiple access points and will operate 24 hours per day, 7 days a week (24/7). The lanes could be configured to handle typical off-peak conditions where traffic flow is approximately equal in both directions by providing two northbound lanes and two southbound lanes (2N+2S), the morning peak period demand with predominant southbound traffic flow by providing one northbound lane and three southbound lanes (1N+3S), or the afternoon peak period demand with predominant northbound traffic flow by providing three northbound lanes and one southbound lane (3N+1S). In extreme cases during severe traffic incidents or emergencies, the Managed Lanes could be configured for all lanes to operate in one direction only (4N+0S or 0N+4S).

2.1.2 Bus Rapid Transit Centers (BRTC) and Direct Access Ramps (DAR)

The region has also developed a Regional Transit Vision, which envisions many more trips to be made on the transit system and allows for more express and direct types of service. The I-15 Managed Lanes Project accommodates a BRT System that includes five direct access ramps (DAR) from the Managed Lanes to bus rapid transit centers (BRTC) placed in communities near the freeway (see sample photo simulation in **Figure 2-2**). The I-15 Managed Lanes Project is a prototype project for this Regional Transit Vision.

Figure 2-2. Proposed Rancho Bernardo BRTC and DAR

3.0 TRAFFIC INCIDENT MANAGEMENT DEFINED AND BENEFITS

3.1 Traffic Incidents

Broadly defined, an incident is something that occurs in connection with something else. An incident can mean different things to different people, so it's especially important to define what is meant by a *traffic* incident. For purposes of this Plan, a *traffic* incident is defined as any non-recurring event that reduces roadway capacity or abnormally increases demand. Examples range from vehicles stalled on the highway shoulder to major collisions. Severe weather, emergency highway maintenance activities, and other unplanned events may also be characterized as traffic incidents if they impact traffic flow. In the case of the I-15 Managed Lanes, and its strong dependence on technology and field devices for operations, the failure of one or several system components could also be considered a traffic incident. Examples include breakdown of the Barrier Transfer Machine, failure of communications to Changeable Message Signs (CMS), and power outages to one or more components. Planned events such as roadway construction and special events (e.g., sporting events, festivals, etc.) fall under this definition of incidents since they too cause traffic impacts. In other words, a *traffic* incident is any unplanned or planned event that impacts, or has the strong potential to impact the flow of *traffic*.

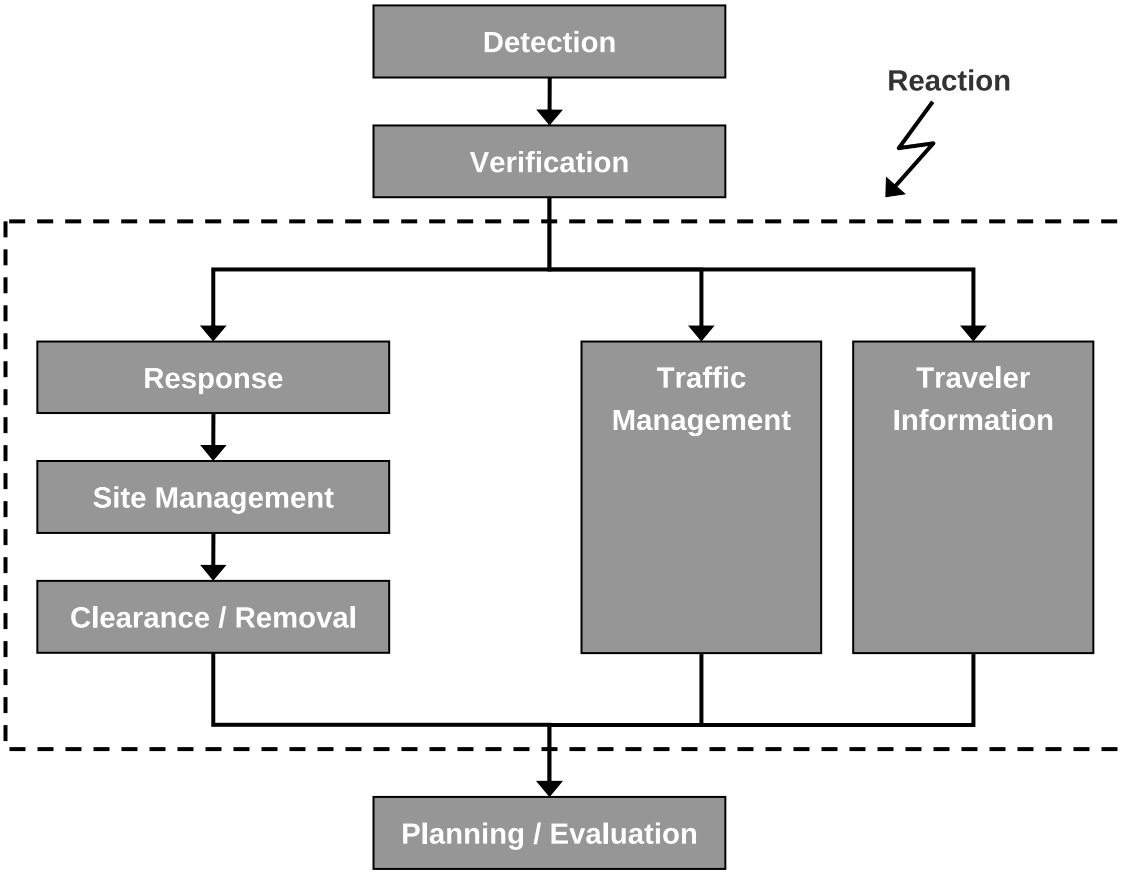
Traffic incident impacts are significant and far-reaching. In San Diego and most other major metropolitan areas, it is estimated that between 50% and 60% of all delay is attributable to traffic incidents. The delay, secondary incidents, and resulting congestion further lead to missed shipment deadlines, losses in productivity, wasted fuel, and an overall degradation in the quality of life for system users. However, possibly the most compelling impacts of traffic incidents involve reductions in safety for both motorists and those responding to these highway emergencies. In fact, statistics show that nearly half of all law enforcement officer fatalities in the line of duty occur in traffic.

3.2 Traffic Incident Management (TIM)

Traffic Incident Management (TIM) is defined as the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration of incidents, and improve the safety of motorists, collision victims, and incident responders. TIM provides a coordinated approach to managing highway incidents and is a highly specialized field that involves developing and maintaining working relationships with a wide variety of stakeholders and emergency responders. It requires being able to speak a "common language" void of technical jargon often used in the transportation profession. Effective TIM is about doing what's best for the area or region and providing tools and tactics to responders to help them with their jobs of clearing incidents, improving safety and restoring traffic flow.

TIM can also be described as a process as presented in **Figure 3-1**. The TIM process is further broken down into the following different phases or activities:

Figure 3-1. TIM Process Diagram



3.2.1 Detection

Traffic incident detection is the process that brings an incident to the attention of the agency or agencies responsible for maintaining traffic flow and safe operations on the facility. Incident victims are most vulnerable from the time the incident occurs until the first responder arrives. Traffic flow is also likely to be most disrupted at this time. The more quickly an incident is detected, the more quickly the appropriate response can be dispatched. Quick response minimizes the exposure of those involved in the incident, speeds the implementation of traffic control, reduces the duration of the traffic flow, and minimizes overall incident impact. Detecting traffic incidents quickly and accurately is critical.

3.2.2 Verification

Verification of a traffic incident encompasses confirming that an incident has occurred, determining the exact location and direction of travel, and obtaining and assessing as many details about the incident as possible.

3.2.3 Response

Responding to a traffic incident involves deployment of the appropriate personnel, equipment, communication links, motorist information, and traffic management as soon as it is confirmed that an incident has occurred. Appropriate response requires understanding the incident's nature, scope, as well as understanding the steps and resources necessary to clear it and restore normal operating conditions. Depending on the situation, those agencies that respond to a traffic incident may include fire, emergency medical services and transport, law enforcement/site investigation, transportation, towing and recovery, and HAZMAT clean-up.

3.2.4 Site Management

Site management is the process of accurately assessing traffic incidents, properly establishing priorities, notifying and coordinating with the appropriate agencies and organizations, and maintaining clear communications with each responder. The National Incident Management System (NIMS) and Incident Command System (ICS) are often used as a structure for site management. Ensuring the safety of response personnel, incident victims, and other motorists is the foremost objective of site management. To be effective, responders and commanders at the incident site require accurate information about the incident's current status, overall progress toward clearance, and the equipment needed to complete the process. Effective site management requires continual assessment of the situation, the needs of the responders, and an understanding and respect for the priorities of other responders while working together cooperatively and productively. Regular planning, training, and communications with other responders produce the best results. Those managing the incident site must also have enough authority to determine courses of action, commit agency or other resources, and otherwise do their jobs without having to wait for guidance or approval from superiors who are not on site.

3.2.5 Clearance and Removal

Clearance involves the process of removing vehicles, wreckage, debris, spilled material, and other items from the roadway so that capacity can be returned to normal levels. Traffic incident clearance and removal objectives include: restoration of the roadway to its pre-incident capacity as quickly and safely as possible; minimizing motorists delays; facilitating effective use of all available clearance resources; enhancing the safety of responders and motorists; and, protecting the roadway system and private property from unnecessary damage during the removal process. Clearance and removal is often the most critical step in managing major traffic incidents due to the time requirements to remove obstructions and restore traffic flow.

3.2.6 Traveler Information

Dissemination of traveler information is one of the primary services provided by today's Transportation Management/Operations Centers. Public-private partnerships have allowed media outlets to use DOT generated real-time video feeds, traffic flows, incident information, construction information, and special event traffic data. Live video feeds are routinely used for radio and television traffic reports. Other traditional methods commonly used to disseminate traveler information include Changeable Message Signs (CMS), Highway Advisory Radio (HAR), 511 telephone call-in systems, and the internet. Even after an incident is cleared it is important to continue to provide traveler information until traffic flow returns to normal conditions. In some cases, depending on the severity of the traffic incident and the time that it occurs, traveler information may need to be provided for several hours.

3.2.7 Traffic Management

Traffic management is the application of traffic control measures at the incident site and on facilities affected by the incident, including emergency alternate routes. The overall goal is a balance between minimizing traffic disruption while maintaining a safe workplace for responders. Traffic control measures can be categorized into those that are intended to improve traffic flow past the immediate incident scene and those that are intended to improve traffic flow on emergency alternate routes. Techniques to improve flow past the incident include:

- Establishing traffic control at the scene;
- Managing the roadway space (opening and closing lanes, blocking only the portion of the incident scene that is needed for safety, staging and parking emergency vehicles and equipment to minimize impact on traffic flow);
- Deploying appropriate personnel to assist in managing traffic (e.g., CHP, Freeway Service Patrols, Caltrans, and local police); and,
- In the case of the I-15 Managed Lanes Project, opening the managed lanes to all traffic or in extreme cases transferring the barrier to add capacity.

With few exceptions, traffic control is not the primary concern of most emergency responders. A common result is that motorists who are unfamiliar with an area are diverted and left to find their own way past the incident scene. Without proper control, traffic is often unnecessarily delayed, and along with that delay come costs in terms of lost time, wasted fuel, and degradation of air quality. When traffic is unnecessarily delayed, there is an increased likelihood of generating secondary collisions, which significantly impacts the safety of other motorists and emergency responders. Actions by the responders when they reach the scene, both in regard to the incident itself and to traffic affected by the incident, has a tremendous bearing on the safe and successful resolution of the roadway emergency.

3.2.8 Planning and Evaluation

TIM is a critical operations function of a number of different agencies and disciplines, including Caltrans, SANDAG, CHP, and other public safety organizations. Typically these agencies have various agreements or memorandums of understanding (MOUs) for TIM activities, such as the case with Caltrans and CHP. Since TIM involves coordinating the operations of these agencies to respond to traffic incidents, TIM can pose a significant institutional and management challenge. The human and technological resources of these agencies have to be mobilized and leveraged collectively within a relatively short period of time in response to the emergency. Interagency relationships have to be developed and sustained to ensure high operational efficiency at the incident scene, but they also need to be maintained outside the emergency environment as well. Technology can help with many of the TIM process activities, but technology alone cannot guarantee that the partners will be able to work well together when significant differences in ideology and approaches exist between them.

TIM success will come only with careful planning, execution, and evaluation. TIM planning must occur from both a "big picture" perspective as well as from the site or corridor specific perspective as in the case of I-15 in San Diego. From a high-level, strategic perspective, planning for TIM involves all partner agencies and stakeholders agreeing on common objectives and approaches to deal with traffic incidents. In the case of specific sites or corridors, TIM planning requires additional detail and should include:

- Identification and participation of all responding agencies/stakeholders;
- Clarification of goals and objectives;
- Identification of problems and needs;
- Development of alternative solutions and strategies;
- Securing and/or confirming funding;
- Deployment; and,
- Evaluation.

3.3 Benefits of Traffic Incident Management

The greatest benefits of effective TIM strategies are achieved through the reduction of incident duration. Reducing incident duration is typically fostered by:

- Reducing incident detection and verification time;
- Initiating an expedient and appropriate response; and,
- Clearing the incident as quickly as possible.

Substantial reductions in response and clearance of incidents can be achieved through the implementation of policies and procedures that are understood and agreed upon by all incident responders. The resulting TIM benefits can be characterized as both quantitative and qualitative.

To date, there has been little in the way of consistent standards for evaluating the quantifiable benefits of TIM. In part, this results from the relatively diverse structure and operations of incident management strategies and programs. Each program is developed to meet the unique identified needs of the given region. TIM strategies and programs are also generally developed to fit within the existing institutional framework. In addition, baseline data against which to measure a new program's benefits (e.g., incident response times) are rarely available. In any case, quantifiable benefits generally associated with an effective TIM include:

- Increased survival rates of collision victims;
- Reduced delay;
- Improved response time;
- Improved air quality;
- Reduced occurrence of secondary incidents; and,
- Improved safety of responders, collision victims and other motorists.

Just as with quantifiable benefits, no consistent standards typically exist for evaluating TIM from a qualitative perspective. Qualitative TIM benefits generally include:

- Improved public perception of agency operations;
- Reduced driver frustration;
- Improved quality of life; and,
- Improved coordination and cooperation of response agencies.

Identifying and documenting examples of qualitative benefits is in the large part difficult because few if any studies on these benefits have been conducted. TIM qualitative benefits are generally derived through the operating agencies' interaction and communication with partner agencies and the traveling public. Qualitative benefits are, however, important because they can provide a basis to justify additional funding for TIM programs. One qualitative benefit that is particularly hard to measure is the increased efficiency of agency operations through the coordinated use of resources and personnel and the elimination of duplicated efforts.

4.0 TRAFFIC INCIDENT CLASSIFICATIONS, TYPES AND EXAMPLES

Incident classification systems provide common terminology for referencing/discussing incidents and are often utilized to simplify and guide consistent responses. Caltrans and the CHP currently use a simple classification system that defines incidents as either "Minor" or "Major" based on the anticipated incident duration. In addition, the day of the week and time of day that an incident occurs need to be considered when determining its impact to the system (see Section 9).

Minor incidents are categorized as incidents that are typically one-hour or less in duration. Minor incident examples include:

- Disabled vehicles in a travel lane or on the shoulder;
- Minor collisions;
- Roadway debris;
- Minor roadway maintenance work;
- Enforcement activities.

Major incidents are categorized as incidents that are typically an hour or more in duration. Major incident examples include:

- Overturned trucks/trailers;
- Rollover or multi-vehicle collisions;
- Chain reaction collisions;
- Commercial carrier collisions;
- Collisions that require a significant medical response, a coroner response and/or a Multidisciplinary Accident Investigation Team (MAIT) response (e.g., Fatalities);
- Incidents involving advanced prolonged environmental clean-up (e.g., Hazardous Materials – HAZMAT).

Regional emergencies such as wildfires, earthquakes, and/or acts of terrorism can also be classified as major incidents.

5.0 IDENTIFIED TIM ISSUES AND NEEDS

TIM is not necessarily a new concept to the San Diego region. SANDAG, Caltrans, CHP and others have been aggressively managing traffic incidents for many years. The establishment of the Freeway Service Patrols (FSP) in 1993, the 1996 opening of the Caltrans District 11 Transportation Management Center (TMC), and the District 11 Major Incident Response Team (MIRT) are just a few of the relatively recent examples of this. However, due to the operational complexity of the I-15 Managed Lanes, a heightened awareness of the criticality of TIM is warranted to ensure safe and efficient operations for both the managed and general purpose lanes.

The process of identifying specific TIM issues and needs was a focus of the I-15 Managed Lanes Operations and Traffic Incident Management Plans Study jointly commissioned by SANDAG and Caltrans. A number of different mechanisms were used to discuss TIM issues and needs. These included Stakeholder workshops, traffic incident scenario-based table-top exercises, and Project Development Team (PDT) discussion. The TIM issues and needs identified throughout the course of the study are summarized below. They are documented according to the phases of the TIM process described in Section 3.0. Detection and Verification have been combined for simplicity and one additional category was added for general, non-process specific TIM issues.

5.1 Detection and Verification

a. A need exists for sharing roadway CCTV images with fire departments and other emergency responders to provide them with real-time information to help tailor their response.

b. A CCTV coverage map needs to be prepared for the I-15 Managed Lanes corridor, specifically noting coverage gaps, if any.

c. The public's ability to accurately identify their location is very important. As an interim solution to the emerging E9-1-1 technologies, section/location markings on poles should be considered.

5.2 Response

a. The day of the week and time of day that an incident occurs needs to be considered when determining the appropriate response and its impact to the system.

b. TIM Plan strategies and tactics need to consider fire and other public safety responder access to the incident scene. Varying roadway elevations is a concern. Currently incident responders do not use the existing HOV lanes due to the risk of being trapped. This policy is expected to remain in-place. It is imperative that public safety agencies receive accurate information about the incident and the best available response route so that efficiency can be achieved.

c. Typically, Caltrans maintenance staff is required to "drop everything" and leave their "normal" job/maintenance activities to respond to incidents. This oftentimes leads to increased response times depending and where the forces are with respect to the incident.

d. Consider development of Incident Response Teams (IRTs) dedicated to I-15, including pre-positioned and/or on-site resources. Dedicated IRTs will provide enhanced response time from Caltrans maintenance, especially on weekends when the majority of forces are not on duty.

e. Consider expanding TMC hours of operation to 24/7. As an interim solution, providing appropriate control of ITS field elements (e.g., CMS, CCTV, etc.) with remote access (VPN/remote commands) and operational tracking (i.e. log the person making a command, time, location, etc. of commands) should be considered.

f. Pre-positioned equipment for incident scene traffic management and control should be considered, especially for closing managed lanes entry points.

5.3 Site Management

a. The Incident Command System (ICS) is currently utilized extensively and needs to be considered when developing procedural TIM strategies and training.

5.4 Clearance and Removal

a. TIM Plan strategies and tactics need to consider the Caltrans and CHP 90 minute incident response/clearance performance measure (reference Caltrans May 30, 2003 memorandum).

b. For incidents involving trucks/trailers with spilled or partially spilled loads, carrier personnel is required to off-load their cargo, however, in the interest of time and in an effort to reduce traveler delay, Caltrans maintenance staff typically helps with off-loading the cargo (with the proper approvals).

c. For incidents involving multiple injuries/fatalities, CHP responds with its Multidisciplinary Accident Investigation Team (MAIT). MAIT response time can be lengthy due to the distance required for the team to travel.

d. Heavy-duty recovery equipment such as a rotator crane is needed to facilitate clearance of incidents involving large vehicles.

e. The role of Freeway Service Patrol (FSP) during managed lanes operations needs to be clarified and a policy change may be required to expand FSP hours of operation and to allow FSP to respond to incidents that occur within the managed lanes.

f. Consider enacting hold harmless legislation to protect responder liability when facilitating quick clearance. Those involved with the FSP program may be in the best position to initiate this activity.

g. Consider implementing/expanding quick clearance towing policies and/or incentives.

5.5 Traveler Information

a. Due to the heavy reliance on the Caltrans District 11 TMC for real-time traveler information, an expansion from the existing hours of operation to 24 hour/7 day should be considered (see *Response, Item e*).

b. Changeable Message Signs (CMS) will be used extensively to provide traveler information and will be critical to effective Managed Lanes operations. As such, the following should be considered:

- Use of both existing and planned CMS.
- CMSs are needed at all Managed Lanes entry points as well as other possible locations.
- SANDAG will have additional Variable Toll Message Signs (VTMS) near all entrances to the Managed Lanes for the purpose of displaying the "current" toll rate to FasTrak motorists.
- Additional coordination is required between Caltrans TMC and SANDAG's FasTrak Customer Service Center (CSC) specifically for toll system shutdowns and signage notification to I-15 corridor motorists. Need clear-cut procedures and understanding of decision making process and delegation of authority/responsibility of actions for updating message sets displayed on CMS and VTMS signs.

c. Trucks with changeable message sign boards may be needed to supplement permanent CMSs.

d. Make traffic reporters more aware of incident information sources, such as the CHP's incident webpage or the CHP media officer's live on-air traffic reports.

5.6 Traffic Management

a. The public is fully expecting barrier transfer (i.e. adding an additional lane) during incident situations. The TIM plan needs to address under which conditions the barrier is to be transferred.

b. Develop formal emergency alternate route plans as a proactive traffic management strategy.

c. Additional CHP, Sheriff, and local law enforcement personnel may be required to successfully manage diversion traffic on emergency alternate routes.

5.7 Planning and Evaluation

a. There is a need to conduct formal TIM training "table-top" and field exercises to test strategies and facilitate inter-agency coordination.

b. Need to regularly debrief incidents and discuss TIM issues especially after Managed Lanes are opened.

c. An Emergency Response callout list with names, contact details for all involved in incident response is needed to enhance communications.

5.8 General

a. Due to the Managed Lanes strong reliance on technology and field devices for safe and efficient operations, spare parts availability and emergency maintenance of system components needs to be given a high priority.

b. Need to document existing systems and provide a high-level overview of how they interact and are integrated.

c. An I-15 Managed Lanes Operations Field Manual is needed to summarize and simplify components of the Operations and TIM Plans for use in the field by operations and emergency response personnel.

6.0 TIM SOLUTIONS, STRATEGIES, AND PLANNING-LEVEL COST ESTIMATES

In order to address the issues and needs identified in Section 5.0, a TIM "Toolbox" was developed. The toolbox outlines potential TIM solutions and strategies and is organized according to the phases of the TIM process described in Section 3.0. The following section expands on the toolbox concept and provides a detailed overview of each solution/strategy. Also included is a discussion of "best practices" from around the country and a summary of related initiatives in the San Diego region. For each solution/strategy a recommendation is provided along with a timeline for implementation and a planning-level cost estimate where appropriate. Note that the planning-level cost estimates do not include expected costs for on-going operations and maintenance. Depending on complexity and technology of deployed solutions and strategies, annual operations and maintenance costs are typically estimated to be between 5% and 15% of deployment costs.

6.1 Detection/Verification

6.1.1 Closed Circuit Television (CCTV) Cameras

CCTV cameras are strategically located along the highway system for the purpose of monitoring traffic flow. CCTV cameras are a main component of most freeway traffic management systems and are generally monitored by TMC operators. CCTV allow operators to visually verify incident locations, monitor response and clearance activities as well as traffic queues. Most CCTV systems are comprised of multiple cameras and TMC operators are not able to monitor all cameras at all times, thus CCTV are more effective at verifying incidents than at detecting them.

There are currently 10 CCTV cameras located within the I-15 Managed Lanes project boundary, the majority of which are located at the southern end. The CCTV are monitored by the Caltrans District 11 TMC. Additional CCTV are being installed as part of the Managed Lanes project. Ideally, the CCTV system should provide full coverage of the Managed Lanes. A CCTV coverage map is currently being developed by Caltrans to identify any potential coverage gaps within the Managed Lanes.

Recommendation: Identify additional CCTV locations necessary to provide full coverage of the Managed Lanes and ensure that provisions are in place for installing CCTV in these locations.

Cost Estimate: Approximately $50,000 per additional CCTV camera location.

Timeline: Cameras should be fully operational and integrated into the existing Caltrans District 11 TMC a minimum of 3 months prior to the opening of the Managed Lanes.

6.1.2 CCTV Video Sharing

In order to facilitate verification and response activities, some TMC have started providing other responding agencies access to their CCTV video. Video sharing provides responding agencies the ability to verify incident details so they can ensure they are dispatching the proper response. Video sharing can be accomplished via the internet or, if available, using direct connections (wire or wireless) between agencies.

Recommendation: Continue to develop and implement the regional Inter-Modal Transportation Management System (IMTMS) to achieve video sharing.

Cost Estimate: Requires further investigation and preliminary design.

Timeline: System should be fully operational a minimum of 3 months prior to the opening of the Managed Lanes.

6.1.3 Computer-Aided Dispatch (CAD) Linkages

CAD linkages provide a direct link between a law enforcement agency's CAD system and a TMC's freeway management system. CAD linkages provide TMC's "instant" notification of traffic related incidents reported to law enforcement. CAD data can be filtered to limit information sharing to traffic related incidents only.

The Wisconsin DOT's (WisDOT) Statewide Traffic Operations Center (STOC) currently has a link between their Advanced Traffic Management System (ATMS) and the Milwaukee County Sheriff's Office's CAD. The STOC utilizes InterCAD software to import CAD data into their ATMS. The software provides a one-way connection and the STOC does not have direct access to the Sheriff's CAD, nor do they send information back to the Sheriff. The CAD data is filtered and information sharing is restricted to traffic related incidents.

The Caltrans District 11 TMC is a collocated facility that houses both TMC operators and CHP dispatchers. TMC operators have access to the CHP's CAD and have the ability to make updates or add notes. However, the TMC operators also track incident response activities in a separate incident activities log. Caltrans is currently in the process of obtaining an ATMS that would store information in a database format and provide a much improved recording system for capturing incident response activities. The new ATMS should provide Caltrans the ability to utilize response activity data for performance measures, including incident duration, which is a critical measure for many solutions/strategies discussed below.

Recommendation: Continue integration of CHP's CAD data into the new ATMS recognizing that the ability of the system to track and easily report on performance measures such as response time and incident duration is important.

Cost Estimate: N/A (Integrate into existing effort.)

Timeline: Implement mechanisms for performance measure reporting by opening of the Managed Lanes.

6.1.4 Incident Detection Algorithms

Incident detection algorithms utilize traffic surveillance data (i.e. volumes, speeds, occupancy) collected by field devices. Various incident detection algorithms have been developed to allow TMC computer systems to alert operators to the possibility of an incident on the highway system. TMC operators can then use other equipment, such as CCTV if available, to verify that an incident has occurred. Use of algorithms is limited to areas of the system for which traffic data is available. Multiple types of incident detection algorithms, including comparative, statistical, time-series/smoothing and modeling exist. The performance of algorithms is typically measured in three ways: (1) the percentage of incidents detected, (2) the time required to detect an incident, and (3) the percentage of "false alarms." Generally there is a trade off between two of these measures.

The Caltrans District 11 TMC has the ability to, but is not currently utilizing incident detection algorithms. In order for the algorithms to be effective and correctly generate alerts, dedicated staff time is needed to study and "fine-tune" the system. The TMC does not currently have resources available for this effort.

Recommendation: Improve existing incident detection algorithms and integrate back into daily TMC operations.

Cost Estimate: Approximately $160,000 for one additional full-time staff member.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.2 Response

6.2.1 Emergency Response Callout List / Resource List

Emergency response callout lists, and/or communication plans, provide key agency contacts on a city/county/regional basis. Plans can include general roles and responsibilities for each agency, communication flow diagrams, contact information (including names, positions, phone/cell/pager numbers, etc.), and/or media contact guidelines. Similarly emergency response resource lists specify who (personnel) and what (equipment) are available to assist with TIM when an emergency occurs on the system. Emergency response callout and resources lists are distributed to all responsible agencies and can be used by dispatchers/operators to ensure the most efficient and effective resources are dispatched for TIM.

An emergency response callout list currently exists for the San Diego region, but it is limited to Caltrans information.

Recommendation: Develop a comprehensive communication/resource plan that, at a minimum, includes SANDAG/FasTrak, Caltrans, the CHP, FSP, local law enforcement, fire and rescue and EMS. The final product should be a component of the proposed I-15 Managed Lanes Field Operations Manual.

Cost Estimate: Included in I-15 Managed Lanes Field Operations Manual cost estimate.

Timeline: Develop a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.2 Freeway Service Patrol (FSP)

FSPs utilize roaming vehicles to patrol congested and/or high incident sections of the roadway in order to quickly detect and respond to incidents. The main objectives of a FSP are to quickly detect incidents, minimize incident duration, rapidly restore freeway capacity and reduce secondary collision and responder safety risks. The operational characteristics of FSPs, such as hours of operation, coverage area, vehicle type and equipment, services, and training vary greatly from program to program.

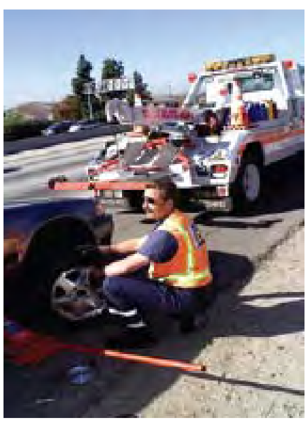


Figure 6-1. San Diego FSP

The San Diego Regional FSP program is a cooperative effort between Caltrans, SANDAG, and the CHP. SANDAG contracts with local towing vendors to operate a fleet of 25 tow trucks and seven light-duty pickup trucks to patrol approximately 225 miles of San Diego freeways. The FSP operates during weekday peak periods from 5:30 to 9:30 a.m. and 3:00 to 7:00 p.m., excluding holidays. The FSP does not patrol within the barrier wall of the existing reversible HOV lanes; however, FSP will respond to incidents in the existing HOV facility when situations warrant. Dedicated FSP coverage of the Managed Lanes is anticipated as additional funding for FSP becomes available to the region.

In today's tight fiscal climate, another FSP model worth mentioning is the State Farm Safety Patrol in Florida. The Safety Patrol is the result of a partnership between State Farm Insurance and the Florida Turnpike Enterprise (FTE). The Safety Patrol is comprised of 14 vehicles that patrol Florida's Turnpike and Sawgrass Expressway from 6:00 am - 10:00 pm, 365 days a year. State Farm spokesman Chris Neal is quoted as saying that "If we can prevent even a few accidents, a few claims that we normally would've had, it (the Safety Patrol) will easily pay for itself." State Farm's initial contribution to the program was $850,000.

The State Farm Safety Patrol is an excellent example of the potential for public/private partnerships in this area. During the course of this study, it has been stated that toll revenue from the Managed Lanes is not anticipated to cover all costs associated with operations and maintenance of the facility. Partnerships or sponsorships, which would not be limited to FSP, should be considered as an alternative for generating funding.

The Safety Patrol model also highlights an emerging trend to replace the word "service" with "safety" as in Freeway Safety Patrol. This change reinforces that one main intent of a FSP is to increase safety on the highway system, not to serve as an alternative to programs such as the American Automobile Association (AAA). This is especially applicable to programs that are able to provide assistance with traffic control at incident scenes. Making this simple change can clarify the purpose of a FSP to decision makers, which can be very important when budget decisions are being made.

Recommendation: Provisions need to be made to extend FSP coverage to include the Managed Lanes facility. In addition, the existing hours of operation should be reviewed to ensure that they cover the needs of the Managed Lanes operation. Finally, possible opportunities for public/private partnerships should be identified and investigated.

Cost Estimate: Requires further investigation.

Timeline: Implement at opening of the Managed Lanes.

Other Considerations: Consider renaming the San Diego Regional Freeway Service Patrol to Freeway Safety Patrol to more accurately reflect the mission of the patrol. Ideally, this change would be made on a statewide basis.

6.2.3 Incident Response Teams (IRTs)

An IRT is a specially trained team dedicated to responding to and clearing roadway incidents. IRTs can be interdisciplinary teams, or comprised of personnel from a single agency. IRT members are generally authorized to determine a course of action, deploy additional personnel, and commit their agency's resources if required. Equipment for use by IRTs may be stored in dedicated vehicles or housed at central locations for quick deployment.

The Washington State DOT (WSDOT) has deployed a roving IRT program to help alleviate congestion on Washington State highways. The IRT is comprised of a group of specially trained WSDOT maintenance employees that, in addition to being on-call 24/7 for response, provide a roving service during the peak periods. When responding to a major incident, the IRT priorities are to first, coordinate with the Washington State Patrol (WSP) and other emergency responders, second, provide traffic control for a safe incident zone, and third, provide incident and traffic condition information to the TMC with periodic updates. The roving IRT service is in addition to the state's FSP program, which includes WSP Cadet Service Patrols, contracted Registered Tow Truck Operator (RTTO) Service Patrols, and Motorist Assistance Vans.

The Caltrans District 11 Maintenance division currently has a Major Incident Response Team (MIRT). The Primary Response Team (PRT) of the MIRT is comprised of a group of landscape maintenance supervisors. The landscape supervisors were selected because they generally have the most flexibility within their existing job duties and thus have the ability to respond to an incident at a moment's notice. Typically, two PRT members will respond to the incident location, assess the situation and, in coordination with the CHP, implement the appropriate response. The secondary response team consists of mobile message units that are delegated to maintenance field personnel. The secondary response team responds as directed by the PRT and is able to assist with tasks such as performing advance-warning activities, assisting with lane closures and completing temporary safety repairs.

Although landscape supervisors can have flexibility within their job duties, inefficiency exists when they are forced to abandon their primary responsibility (landscaping) to respond to an incident. Utilizing a dedicated IRT would improve overall incident response resulting in improved safety and decreased traveler delay.

Recommendation: Implement an I-15 Managed Lanes IRT with personnel dedicated to TIM. Each IRT should have three members and a dedicated response vehicle. Two IRTs should be assigned to the I-15 Managed Lanes segment and provisions should be made to have the IRTs available 24/7. Consideration should also be given to having the IRTs provide a roving service during the peak periods.

Cost Estimate: Approximately $620,000 for two IRTs with three members, assuming $100,000 per vehicle and $60,000 - $80,000 annual cost per IRT member.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.4 Pre-positioned TIM Equipment

Storing equipment required for incident response near high incident locations instead of one central location can reduce the time needed to respond to an incident. Stored equipment may include trailers containing traffic control equipment (signs, cones, flags, etc.) specifically reserved for TIM. Field personnel should be consulted as to which materials and equipment they need and thought must be given to determine what resources would be most feasible to be kept at these sites. The storage sites must be secure to ensure that resources are available when needed. In addition, agreements should be established between responding agencies regarding material and equipment use.

The Tennessee DOT (TDOT) has utilized pre-positioned TIM equipment to help reduce response times in rural areas of the state. The "Ready Response" trailers are strategically located along Tennessee's highway system to facilitate quick deployment of traffic control during major incidents. The trailers are equipped with traffic control devices such as signs, cones, and barricades.

Figure 6-2. TDOT "Ready Response" Trailer

When an incident occurs in the San Diego region, CHP personnel are generally the first to arrive and are subsequently responsible for traffic control. However, due to the size of their vehicles, they have limited ability to carry traffic control devices with them. Pre-positioned TIM equipment would allow CHP to more efficiently control traffic during incidents.

Recommendation: Identify locations for and construct TIM storage sites along the I-15 Managed Lanes corridor.

Cost Estimate: $25,000-$50,000 per location depending on storage facility type utilized and the number of traffic control devices available.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.5 Operations and TIM Field Manual

Supplemental to formal training, agencies often provide responders with written field manuals. Field manuals provide responders with the "nuts and bolts" information they need to do their job in what are often hard and demanding conditions.

Development of an I-15 Managed Lanes Field Operations Manual is currently pending. Considerations for an I-15 Managed Lanes Field Operations Manual are discussed in more detail in Section 8.0.

Recommendation: Develop an I-15 Managed Lanes Field Operations Manual that provides guidelines and procedures related to both operations and TIM for field personnel that will be working/responding within the I-15 corridor.

Cost Estimate: $100,000

Timeline: Complete a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.6 Incident Classification Consistency/Awareness

Incident classification systems provide a common reference for discussing incidents and are often utilized to simplify and guide consistent responses. While regional consistency across disciplines is preferable, at a minimum, response agencies should take steps to ensure that other agencies are aware of and understand existing incident classification schemes.

Caltrans and the CHP currently use a simple classification system that defines incidents as either "Minor" or "Major." This incident classification system is discussed in further detail in Section 4.0 of this document.

Recommendation: Efforts should be made to ensure regional awareness of the existing Caltrans/CHP incident classification system among all responders. The incident classification system should also be included in the proposed I-15 Managed Lanes Field Operations Manual and integrated into training activities.

Cost Estimate: N/A

Timeline: Complete outreach efforts a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.7 Staging Guidelines

When incidents require response from multiple agencies and a large number of responding vehicles or when an incident occurs within an area with limited shoulders or lanes, it may be appropriate to implement staging areas removed from, but in close proximity to the immediate scene. Staging policies identify minimum requirements for staging locations and can set guidelines for reducing the number of on-scene response vehicles.

Recommendation: Develop staging guidelines that identify minimum requirements for staging locations. Staging guidelines should be included in the proposed I-15 Managed Lanes Field Operations Manual.

Cost Estimate: Included in I-15 Managed Lanes Field Operations Manual cost estimate.

Timeline: Develop a minimum of 3 months prior to the opening of the Managed Lanes.

6.2.8 Responder Safety Tactics

1. **Vehicle Markings**

   Vehicle markings increase response vehicle visibility to passing motorists and improve the safety of the incident scene and the responders working within the scene.

   Recommendation: Add reflective markings to all emergency/maintenance vehicles anticipated to be used in or near moving traffic. It is recognized that vehicle consistency is desired throughout the state and therefore would likely require corresponding statewide policy changes.

   Cost Estimate: $1,000 - $3,000 per vehicle

   Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

2. **High-Visibility Garments**

   High-visibility garments (currently Type 2 vests) are required to be worn by all incident responders working at an incident scene. The vests increase their visibility to motorists and improve responder safety.

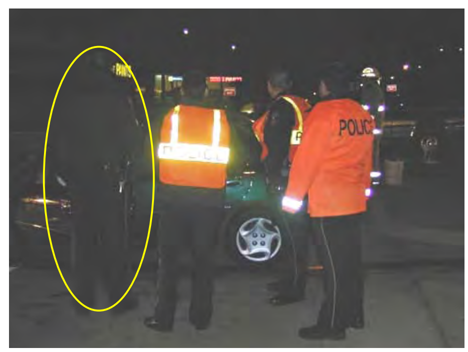
   

   Figure 6-3. Responder Visibility

   Recommendation: Require, and enforce, that all incident responders wear high-visibility garments when responding to incidents in or near moving traffic.

   Cost Estimate: $100 - $1000 per responder (depending on type of garment worn by responder).

   Timeline: Implement a minimum of 1 month prior to the opening of the Managed Lanes.

3. **Emergency-Vehicle Lighting Policies**

   At an incident scene, emergency-vehicle lighting is used to enhance the safety of response personnel and incident victims. However, excessive use of overhead flashers can create unnecessary delay and confusion for motorist passing the scene, especially at night. Furthermore, emergency-vehicle lighting provides warning only and is not an effective method of providing traffic control. Chapter 6I of the Manual on Uniform Traffic Control (MUTCD) recommends that public safety agencies examine their policies on the use of emergency-vehicle lighting, especially after the incident is secured, with the intent of reducing the use of this lighting as much as possible while not endangering those at the scene. Emergency-vehicle lighting is discussed in further detail in Section 10.5.

Recommendation: Develop guidelines/policy for use of emergency-vehicle lighting at incident scenes. Lighting guidelines should be included in the proposed I-15 Managed Lanes Field Operations Manual.

Cost Estimate: Included in I-15 Managed Lanes Field Operations Manual cost estimate.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.3 Site Management

6.3.1 National Incident Management System (NIMS)/ Incident Command System (ICS)

The National Incident Management System (NIMS) is a comprehensive system that is intended to improve response and continuity of operations through the use of the Incident Command System (ICS) and other standard procedures and preparedness measures. NIMS also promotes the development of cross-jurisdictional, statewide and interstate regional mechanisms for coordinating incident management and obtaining support during large-scale or complex incidents. The adoption of NIMS by all Federal, state and local jurisdictions was required by Homeland Security Presidential Directive-5 "Management of Domestic Incidents" (HSPD-5.) HSPD-5 includes a number of training requirements for first responders, supervisors, middle management, and command and general staff.

The HSPD-5 training requirements are outlined in detail in Section 10.0.

Recommendation: To satisfy HSPD-5 requirements, all first responders, including personnel such as FSP drivers, Caltrans maintenance staff, and TMC operators, should take, at a minimum, IS-700 and ICS-100. In addition, NIMS/ICS should be included as part of a comprehensive TIM training program.

Cost Estimate: Should be nominal due to the fact that these courses are available online.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.3.2 "Move Over" Legislation

In response to the growing number of public safety and roadway maintenance workers being struck while working on the side of the highway, over three dozen states have passed “Move Over” legislation. In general, "Move Over" laws require motorists to move over one lane if an emergency, maintenance, or construction vehicle with flashing lights is parked on the shoulder of the highway. If the passing driver is unable to safely change lanes, they are required to slow down below the posted speed limit.

A “Move Over” bill cleared the California Legislature in 2005, but it was subsequently vetoed by the Governor. In 2006, the bill was introduced again and passed. It is anticipated that the law will go into effect in July of 2007.

Recommendation: Promote public awareness of the new law and identify strategies to monitor the impact of the law on driver behavior.

Cost Estimate: Requires further investigation.

Timeline: Implement 3 months prior to the opening of the Managed Lanes.

6.4 Clearance and Removal

6.4.1 "Open Roads" Policies

"Open Roads" policies are generally multi-agency polices that set goals for quickly clearing traffic incidents. Many "Open Roads" policies have a goal of clearing all highway incidents within 90 minutes.

Caltrans, with support from the CHP, established a 90 minute goal for clearing the highway after notification of an incident. Caltrans emphasized that this goal, while not attainable in every case, may be possible for even large incidents with a focused and well-executed response.

Recommendation: Increase awareness of existing “Open Roads” policy to all responding agencies and obtain buy-in. In addition, identify method for tracking clearance times and develop consistent format for reporting.

Cost Estimate: N/A - Component of a formal TIM Program.

Timeline: Implement at opening of Managed Lanes.

6.4.2 Quick Clearance Legislation / Hold Harmless Legislation

Quick Clearance legislation is designed to quickly move vehicles involved in minor collisions out of travel lanes. Removing these vehicles from travel lanes as quickly as possible reduces delays and improves the safety of those involved in the collision. In general, Quick Clearance legislation instructs drivers to remove disabled or wrecked vehicles from travel lanes when it is safe to do so and if there are no injuries; and/or grants authority to remove disabled or wrecked vehicles from the travel lanes if the driver is not present and/or willing.

Closely related to Quick Clearance legislation, Hold Harmless laws grants incident responders immunity from civil liability when participating in quick clearance activities, such as removing vehicles and/or cargo involved in a traffic incident that is blocking travel lanes. Hold Harmless legislation can facilitate quick clearance initiatives such as the heavy-duty recovery program discussed below.

The Statewide Freeway Service Patrol Oversight committee was identified by the PDT as the appropriate group to move forward with discussing efforts to enact Quick Clearance and Hold Harmless legislation. There are currently quick clearance pilots underway in the Alameda corridor and in the Bay area.

Recommendation: Initiate efforts to enact Quick Clearance and Hold Harmless legislation.

Cost Estimate: N/A

Timeline: Implement 6 months after opening of the Managed Lanes.

6.4.3 Heavy-Duty Recovery Program

Heavy-duty recovery operations for incidents involving large trucks and spilled loads require specialized equipment and skilled operators to quickly clear the highway when an incident occurs. Traditionally recovery service providers have been paid on an hourly basis, which provides little motivation for the quick clearance of incident scenes. An incentive based heavy-duty recovery program can significantly reduce the time it takes to clear major highway incidents.

In an effort to support Florida's "Open Roads" Policy, the Florida Turnpike Enterprise (FTE) implemented an innovative clearance strategy referred to as the Roadway Incident Scene Clearance (RISC) program. The RISC utilizes incentive based contracts to facilitate the quick removal of major incidents that require heavy-duty towing and recovery services. The FTE has contracted with four towing organizations to provide RISC coverage on 75 percent of the turnpike system. The contractors are required to respond to

FTE service requests with 15 minutes of initial contact and must arrive at the incident site within 60 minutes of the initial contact. The contractors are required to respond with one 50-ton hydraulic, extendable boom, ultra heavy-duty wrecker, one 40-ton capacity rotator type heavy duty recovery wrecker, and one recovery support vehicle. If the contractor is able to respond within 60 minutes and clear the incident within 90 minutes after given notice to proceed, they will receive a $2,500 bonus. If the contractor is not successful in clearing the incident after 3 hours, they will be assessed a $10/per minute fine.

In order to ensure that contractors are not sacrificing safety to achieve clearance goals, contracts should include safety requirements and corresponding penalties for non-compliance.

Recommendation: Develop and implement an incentive based heavy-duty recovery program for the I-15 Managed Lanes corridor.

Cost Estimate: Requires further investigation.

Timeline: Implement a minimum of 1 month prior to the opening of the Managed Lanes.

6.4.4 Collision Investigation/Reconstruction Technologies

Major collisions typically must be treated as crime scenes and subsequently require evidence collection, which may include detailed measurements of skid marks, scrapes or gouges in the pavement, final vehicle position, etc. In-depth collision investigations are generally required for incidents during which a collision victim sustains life-threatening or fatal injuries, or when a collision is believed to be the result of criminal activity.

The Multidisciplinary Accident Investigation Team (MAIT) Program was established by the CHP in 1979. The objective of the program is to provide CHP with the means to conduct in-depth investigations and analyses of major traffic incidents. Each MAIT consists of investigators with specialized training in traffic collision reconstruction, traffic engineering, automotive engineering and vehicle dynamics. There are currently eight teams based in CHP Division offices around California. A ninth team, located in the Border Division, is anticipated to be added in early 2007.

MAIT investigation times have a direct impact on incident duration since the nature of most MAIT investigations require that scene clearance cannot begin until the investigation is complete.

One collision reconstruction tool intended to minimize the on-scene time required for law enforcement collision investigations is photogrammetry. Photogrammetry uses digital pictures and specialized software to create accurate 3D measurements and object models. After photographs are taken in the field, the collision scene can be cleared and law enforcement officials can perform reconstruction calculations and drawings in the safe confines of their office utilizing photogrammetry software.

Photogrammetry has been integrated into state police collision reconstruction programs in a number of states including Oregon, Florida, Kansas, Minnesota, and New Hampshire. Since May 2005, the Washington County Sheriff's Department in Wisconsin has used photogrammetry in the investigation of numerous collisions. This has enabled substantial reductions in "on-scene" time, with 50% reductions common. In addition, some agencies have been able to use Photogrammetry to reconstruct historical collisions from file photographs.

Photogrammetry can be used as a primary method for collision reconstruction or it can be used as a supplement to other collision reconstruction tools such as Total Station. Utilizing photogrammetry, even as a supplement, can eliminate the need to revisit incident scenes to obtain missed measurements.

Total Stations have also proven to be an effective tool for collision investigation. In recent years, a new generation of Reflectorless Total Stations has emerged. In general, Reflectorless Total Stations provide optical communications for radio-free operation, an instant lock/remote location system and reflectorless distance measurements. These features allow for Total Station measurements to be taken by a single individual if necessary and have been shown to reduce the on scene time required for data collection during collision investigations.

Recommendation: Continuously monitor and evaluate feasibility of using new collision reconstruction tools and technology with the goal of decreasing on scene time for data collection.

Cost Estimate: Variable depending on technology. Typical per unit costs for photogrammetry, including 1 software license and 1 digital camera, range from $3,000-$5,000. Total Stations typically cost $10,000-$20,000 each. These cost estimates do not include training costs.

Timeline: On-going

6.4.5 Medical Examiner Agreements/Memorandum of Understanding (MOU)

Medical Examiners (ME) play a role in TIM when the incident involves a fatality. In a traffic incident/fatality, it is not uncommon for both the ME response and investigation to take an extended amount of time. Regions with formal TIM programs often work with MEs to identify opportunities to increase efficiencies in their activities. Additionally, in the San Diego region it has been noted that there is a shortage of personnel responsible for removal of deceased victims.

Thurston County, located in Washington State, has developed a Coroner Agreement that allows for the removal of vehicles from an incident scene with the deceased inside for off-site extrication. The purpose of the agreement is to maintain the privacy and dignity of the victim, as well as provide a safer environment for responders to perform the extrication.

Recommendation: At a minimum increase awareness of incident clearance goal and improve coordination efforts with Medical Examiners in the San Diego Region.

Cost Estimate: N/A

Timeline: Implement 1 year after opening of the Managed Lanes.

6.5 Traffic Management

6.5.1 Barrier Transfer

If an incident occurs on the mainline and blocks travel lanes, the barrier in the I-15 Managed Lanes facility can be moved to provide additional capacity and help alleviate incident related congestion. However, barrier transfer takes time and barrier transfer is not a cost effective solution for incidents with durations anticipated to be less than the time required for barrier transfer. In order to address this issue, an initial decision tree for barrier transfer during TIM operations has been developed and is included in Section 9.0.

Recommendation: The criteria for barrier transfer during incidents should be revised as the operational characteristics of the I-15 Managed Lanes change. The criteria should be a component of the proposed I-15 Managed Lanes Field Operations Manual.

Cost Estimate: Requires further investigation.

Timeline: On-going

6.5.2 Formal Emergency Alternate Route Plans

An emergency alternate route is a roadway or series of roadways that provide additional capacity to service primary route (e.g., I-15) traffic. The term "emergency" implies that the route is to be used for additional primary route capacity only under emergency conditions (i.e. major traffic incidents), not as a general, everyday "by-pass". Often an activity of formal TIM programs, advance planning and preparation of emergency alternate route plans enhances the on-scene traffic management capability of interagency incident responders. Proper emergency alternate route planning has a significant effect on improving the safety and efficiency of freeway operations under traffic incident conditions without undue impact on the surrounding community. Refer to Section 11 for additional details relating to this strategy.

Recommendation: It is recognized that under some traffic incident conditions, the managed lanes themselves may serve as an emergency alternate to the I-15 corridor general purpose lanes. However, based on the additional needs identified throughout the study, it remains a recommendation to develop formal alternate route plan(s) that consider the use of non-I-15 roadways for emergencies. A three-step approach should be utilized:

1. Emergency Alternate Route Selection;
2. Emergency Alternate Route Plan Development; and
3. Traffic Management Planning, Design, and Implementation.

The resultant Emergency Alternate Route Plans should be documented in a "user friendly" format for use by responders responsible for traffic management associated with TIM.

Cost Estimate: $50,000 to $100,000 depending on the complexity and amount of detail that requires documentation. (This cost does not include the design and implementation of any recommended infrastructure or operational improvements to the emergency alternates themselves accounted for under a separate strategy.)

Timeline: Develop 6 months to 1 year after opening of the Managed Lanes.

6.5.3 Emergency Alternate Route Infrastructure and Operations Deployment

In most cases, the designated emergency alternate route(s) will require some additional traffic management improvements for them to be effective as viable emergency alternates. This strategy involves planning, design and implementation of improvements such as:

- Spot capacity improvements;
- Traffic signal system enhancements including equipment and emergency timing plans;
- Guide signing (static); and
- Changeable message signing (CMS).

Recommendation: It is strongly recommended that this strategy be pursued if a formal emergency alternate route plan is developed. Doing so will ensure the proper degree of operational efficiency on the routes.

Cost Estimate: Highly variable and will depend on the inventory of traffic management needs once the emergency alternate route(s) have been identified. From a budgetary standpoint, it may be beneficial to reserve up to $1M for these types of improvements.

Timeline: Implement 6 months to 1 year after opening of the Managed Lanes.

6.5.4 Advanced Notification

Advanced notification is a key component of traffic management and when done properly, can greatly reduces the risk of secondary incidents, help to reduce motorist delay, and promote the use of alternate routes. Advance notification utilizes traffic control measures in advance of the incident scene to inform, prepare, and guide approaching motorists.

It is reasonable to expect that advanced notification responsibilities would be a function of the previously recommended IRT.

Recommendation: Identify advanced notification as an IRT responsibility.

Cost Estimate: Included in IRT cost estimate.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.6 Traveler Information

6.6.1 Traffic Management Centers (TMCs)

TMCs typically serve as the hubs for Intelligent Transportation Systems (ITS) and traffic control systems. TMCs provide a central location for rapid detection, coordination, and implementation of traffic management strategies to address incidents and other unusual activities. The traffic information collected for, analyzed by, and disseminated from TMCs is key to effective TIM. TMCs are able to support detection and verification, response, site management, traffic management, and clearance, in addition to their core mission of providing traveler information.

The Caltrans District 11 TMC currently houses Caltrans Traffic Operations, Caltrans Maintenance, and CHP Communications in a unified, collocated communication and command center. Once the I-15 Managed Lanes are open the TMC will be responsible for monitoring the system and dispatching maintenance/MIRT when incidents occur.

Recommendation: Expand Caltrans District 11 TMC operations 24/7.

Cost Estimate: Approximately $300,000 for three additional staff members

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.6.2 Changeable Message Signs (CMS)

CMS are permanent overhead signs, generally located at key decision points on a highway system. CMSs provide dynamic (changeable) messages that can be used to warn drivers of congestion ahead, provide incident location and duration information, and provide emergency alternate route information. CMS can also utilized to provide travel times.

As mentioned in Section 5.5, in addition to Caltrans controlled CMS signs in the Managed Lanes, SANDAG will have Variable Toll Message Signs (VTMS) near all entrances for the purpose of displaying the "current" toll rate to FasTrak motorists. Additionally, SANDAG plans to display travel times for the Managed Lanes on the VTMS signs. In order to ensure a clear and consistent message set is provided to the motoring public during I-15 corridor incidents, Caltrans and SANDAG should develop clear-cut procedures and a decision-making process must be published in the I-15 Managed Lanes Field Operations Manual that identifies how the TMC and SANDAG's FasTrak CSC will coordinate the updates to the VTMS signs. While it is planned that this interface will be manual, at least initially, consideration should be made to determine the scope and cost to develop a software interface for initiating incident-related sign message set changes. However, since the VTMS signs will not display text messages, there is no requirement for Caltrans to push messages to SANDAG's CSC for display on the VTMS signs. Rather, VTMS signs will simply "go dark" or could display a null value (e.g., $0.00) as there is limited character width for longer messages.

Recommendation: Identify all critical decision points along the Managed Lanes, including all entrance and exit locations, and ensure that provisions for CMS in these locations are made. Develop a CMS/VTMS Operations Policy between Caltrans and SANDAG outlining necessary coordination between FasTrak and the District 11 TMC, including development of agreed-upon message sets, delegation of authority and responsibility for implementing incident-related sign changes, policies for which situations dictate implementing a sign change, and procedures for how to implement the change, e.g., guidelines for TIM operations and pre-planned closure/alternate route message plans.

Cost Estimate: Requires further investigation and preliminary design. New full-matrix LED CMS with structure can cost up to $150,000.

Timeline: CMS should be fully operational and integrated into the existing Caltrans District 11 TMC a minimum of 3 months prior to the opening of Managed Lanes.

6.6.3 Highway Advisory Radio (HAR)

HAR provides drivers information via their vehicles' AM radio receivers. Drivers receive notification to tune to the HAR frequency upstream of the transmitter. HAR and CMS provide travelers a similar service, but HAR has the ability to communicate longer, more complex messages.

A HAR system is available at the northern end of the I-15 Managed Lanes project area, but the system is not currently functional. If the system was functional and/or expanded, it would provide the Caltrans District 11 TMC a secondary method for distributing traveler information in the project area.

Recommendation: Restore HAR functionality and integrate back into daily TMC operations.

Cost Estimate: Approximately $210,000 for three additional HAR locations

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.6.4 511

Similar to dialing 911 for emergencies, 511 is a free public telephone (and web) service that provides real-time information on traffic conditions and incidents 24/7. In May of 2006 there were twenty-eight 511 systems active in 24 states. 511 can also be augmented with Web sites that vary from location to location but generally include information such as travel information, maps, traffic cameras, travel times, and some systems are equipped to provide e-mail alerts.

The 511 system for the San Diego region is anticipated to be in place by the end of 2006.

Recommendation: Utilize 511 system to provide incident information, including alternate route information if applicable.

Cost Estimate: N/A (On-going initiative)

Timeline: Anticipated to be functional by the end of 2006.

6.6.5 Media - Traffic Reports

The media, which includes radio, television, and newspapers, can play a key role in the TIM process by providing information about traffic incidents to the traveling public. However, the information provided must be timely and accurate to be of any value.

Many TIM programs include the media as part of their committee structure so that these points can be discussed and enhanced.

The role of the media is discussed in further detail in Section 7.7.

Recommendation: Continue coordination efforts between the media and the Caltrans District 11 TMC.

Cost Estimate: N/A - Component of a formal TIM Program.

Timeline: Implement at opening of the Managed Lanes.

6.7 Planning and Evaluation

6.7.1 Formal TIM Program

Effective TIM requires broad cooperation among transportation and public safety agencies, including law enforcement, fire, EMS, towing and recovery, emergency management planners and many others. On-going TIM Programs include a multi-agency, multi-discipline stakeholder group that is continuously evaluating and implementing strategies to improve incident management in their area. It is important to note that even in areas without formal TIM programs, when an incident occurs someone responds. Thus, the goal of a TIM program is not to create a response, but rather to create a more effective, efficient response for all responding agencies.

The greatest benefits of an effective TIM program are attained through the reduction of incident duration. By implementing policies and procedures that are understood and agreed upon by all TIM stakeholders, substantial reductions in incident response and clearance times can be achieved.

TIM Programmatic recommendations are discussed in further detail in section 14.1.

Recommendation: Establish a formal TIM Program for the San Diego region.

Cost Estimate: Consultant supported programs typically cost $250,000 - $500,000 per year.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.7.2 TIM Training Program

The overall goal of a TIM training program is to initiate a common, coordinated response to traffic incidents. In order to enable a high degree of coordination and ensure the efficient use of resources available for managing traffic incidents, training programs must be interagency and multi-disciplinary. A successful TIM training program builds partnerships, enhances safety for emergency personnel, reduces secondary collisions, and improves the efficiency of the transportation system. Training programs may include any combination of field drills; table-top exercises; and classroom lectures and discussion.

As part of the I-15 Managed Lanes Operations and Traffic Incident Management Plan study, some training will be conducted for operational personnel and TIM responders. This high-level training will focus on the purpose of the two plans and how to use the procedural information contained within them. However, based on the specific TIM training needs identified throughout the course of the study, and the complexity of the I-15 Managed Lanes operations, an on-going, multi-agency TIM training program should be established.

Training requirements are discussed in further detail in Section 8.0.

Recommendation: Establish a formal, on-going, multi-agency TIM Training Program.

Cost Estimate: N/A - Component of a formal TIM Program.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.7.3 Incident Debriefings

The purpose of an incident debriefing is to evaluate the decisions made and actions taken during an incident and to identify any opportunities for improvement. Effective debriefings provide a forum in which conflicts and inefficiencies are identified and steps are taken to resolve or eliminate them. Debriefings can also be helpful in developing and maintaining lines of communications and relationships among responders and it is essential that incident debriefings be multi-agency and multi-disciplined. In addition, in order to be effective, debriefings should take place as soon as possible after an incident.

Incident debriefings are discussed in further detail in Section 14.2.

Recommendation: Develop standard guidelines/policies for multi-agency incident debriefings.

Cost Estimate: N/A - Component of a formal TIM Program.

Timeline: Implement at opening of the Managed Lanes.

6.8 General

6.8.1 Spare Parts and Emergency Maintenance

Within the Managed Lanes there is a strong reliance on technology, equipment, and field devices for safe and efficient operations. Traffic flow through the I-15 corridor could be significantly impacted by a component and/or system failure or malfunction. Once a failure is detected, it will be imperative to quickly respond to the failure with emergency repairs and spare parts as required.

Recommendation: While not specifically a TIM strategy, failure of certain pieces of equipment and systems could adversely impact safe and efficient management of incidents. Therefore, it is recommended that emergency maintenance/repair provisions be in place for critical equipment and field devices (e.g. Barrier Transfer Machine, pop-ups, CMS, etc.). Along with emergency maintenance there needs to be provisions for an adequate supply of spare parts.

Cost Estimate: Requires further investigation.

Timeline: Implement a minimum of 3 months prior to the opening of the Managed Lanes.

6.8.2 I-15 Managed Lanes Systems Documentation

Successful operation of the Managed Lanes requires the use and coordination of several agencies and systems including the Caltrans District 11 TMC ATMS, SANDAG's FasTrak CSC, and CHP. Documentation is needed to facilitate mutual inter-agency understanding of these systems and how they interact and are integrated.

Recommendation: Prepare and distribute Systems Documentation for use as a ready-reference to those agencies responsible for I-15 managed lanes operations and TIM.

Cost Estimate: Requires further investigation.

Timeline: Develop a minimum of 3 months prior to the opening of the Managed Lanes.

7.0 STAKEHOLDER AGENCY ROLES AND RESPONSIBILITIES

The phases or activities that make up the TIM process described in Section 3.0 require the skills and expertise of a number of different agencies from diverse disciplines. For effective TIM to occur, a mutual understanding of the roles that each agency plays is very important. Specific agency responsibilities in connection with Managed Lanes operations are in the process of being finalized and will be formalized via Letters of Intent/Interagency Cooperative Agreements currently being drafted. The agency responsibilities as they relate to both operations and TIM should be further documented in the pending I-15 Managed Lanes Operations Field Manual.

Typical agency roles and responsibilities involved in and/or responsible for TIM are described below. They are not necessarily assumed to be representative of Caltrans, CHP, SANDAG or other traffic incident responders in the San Diego region. Nor are they intended to be recommendations. The descriptions below are merely an illustration of how these agencies and service providers are typically involved in the TIM process.

7.1 Law Enforcement

Law enforcement agencies from the state, county, and local levels are critical to effective TIM and are many times first responders to the incident scene. In the case of I-15 in San Diego, CHP is often the primary law enforcement responder with other sheriff, police participation dictated by the jurisdiction in which the incident occurs. Typical incident management roles and responsibilities assumed by law enforcement include:

- Assist in traffic incident detection/verification;
- Secure the incident scene;
- Assist disabled motorists;
- Provide emergency medical aid until help arrives;
- Provide emergency traffic control;
- Serve as incident commander in accordance with California law;
- Safeguard personal property; and
- Supervise scene clearance.

Many law enforcement agencies also provide traffic incident specialty services in the area of collision investigation/reconstruction. In California, CHP's Multidisciplinary Accident Investigation Team (MAIT) Program was established in 1979 to conduct more intensive causal collision and injury investigations. The objective of the MAIT Program is to provide CHP with the means to conduct in-depth investigations and analyses of major traffic collisions in San Diego and throughout the state. Investigations include the reconstruction of a traffic incident and a study of the factors that may have contributed to the incident.

7.2 Fire and Rescue

Fire and rescue services are provided by local fire departments with jurisdiction over a particular segment of roadway. Surrounding fire departments may also respond through mutual aid agreements. In most jurisdictions, the fire department is the primary emergency response agency for hazardous materials spills and serves as the liaison to private contractors who may be hired by public safety or transportation agencies to support clean-up and disposal of toxic or hazardous materials. For example, the San Diego Fire-Rescue Department Hazardous Materials Incident Response Team (HIRT) is a highly trained group of firefighters who protect lives and property from incidents involving hazardous materials such as chemical explosions and spills. Additional TIM-focused roles and responsibilities typically assumed by fire departments include:

- Protect the incident scene;
- Provide emergency medical care;
- Provide limited traffic control until police or DOT arrival;
- Provide emergency HAZMAT response and containment;
- Fire suppression;
- Collision victim rescue and extrication from wrecked vehicles;
- Rescue collision victims from contaminated environments;
- Arrange transportation for the injured;
- Serve as incident commander in accordance with California law; and
- Assist in incident clearance.

Fire departments usually operate under a highly organized team structure with the close supervision of a commanding officer. Recognizing that traffic incidents often involve multiple jurisdictions with multi-agency involvement, Fire and Rescue agencies often promote the Unified Command Structure for TIM. Unified command allows agencies with different legal, geographic, and functional authorities and responsibilities to work together effectively without affecting individual agency authority, responsibility, or accountability. Implementing unified command also helps avoid disagreements at incident scenes that can become a distraction and impair coordination in the field.

7.3 Emergency Medical Services (EMS)

EMS is responsible for triage, treatment, and transport of collision victims. This emergency service may also be combined with the fire department as is the case in San Diego where a paramedic/firefighter is located in each of the City's fire stations. With fire stations strategically placed throughout the region, a paramedic along with three firefighter/Emergency Medical Technicians (EMTs) can arrive on the scene of an emergency more quickly. The paramedic/firefighter is then reinforced by a paramedic ambulance carrying an additional paramedic and an EMT. In other areas, private companies are contracted to provide these services to local jurisdictions. In response to an incident, EMS typically provide the following TIM support:

- Provide advanced emergency medical care;
- Provide transportation for injured to hospitals, trauma centers;
- Coordinate med-evacuation with fire, law enforcement;
- Serve as incident commander for medical emergencies; and
- Remove medical waste from the incident scene.

For TIM, EMS personnel operate under a defined set of priorities. Their focus is patient care, collision victim rescue, and safety of their personnel. Liability is oftentimes a primary concern of EMS operators. Even if a vehicle involved in a traffic incident has little or no damage, when an occupant complains of possible injury, EMS policy may dictate that the victim be stabilized or immobilized and carefully removed from the vehicle. Understandably, this activity can take a significant amount of time. Therefore incident clearance times may be minimized if the circumstances are clear as to when more extreme extrication measures are necessary.

7.4 Coroners and Medical Examiners

Coroners and Medical Examiners (ME) play a role in TIM when the traffic incident involves a fatality. In San Diego, as mandated by State Law, the County Department of the Medical Examiner must certify the cause and manner of death for all incidents/accidents in the region, including traffic fatalities. When a traffic incident involves a fatality, it is not uncommon for both the ME response and investigation to take an extended amount of time. Many regions with formal TIM programs are working with MEs to identify efficiencies in their activities.

7.5 Transportation Agencies

The transportation-based agencies typically involved in TIM include State DOTs (e.g., Caltrans) and county/local-level highway or public works departments. Regional and metropolitan planning organizations (e.g., SANDAG) while not strictly focused on transportation, also typically fall in this category. Generally speaking, in addition to being incident responders, transportation agencies are often responsible for the overall planning and implementation of TIM Programs. Many times their response is through traffic/transportation management/operations centers (e.g., Caltrans District 11 TMC), as well as through the management and operations of freeway service patrols (e.g., San Diego region FSP). Typical TIM operational responsibilities assumed by transportation agencies, TOCs/TMCs, and freeway service patrols include:

- Assist in incident detection and verification;
- Initiate traffic management strategies on incident impacted facilities;
- Protect the incident scene;
- Provide emergency traffic control;
- Assist motorists with disabled vehicles;
- Provide traveler information;
- Respond to infrastructure repair needs;
- Establish and operate alternate routes; and
- Serve as incident commander for clearance and repair functions.

Through formal TIM programs, some DOTs have forged active partnerships with traditional response and public safety agencies. DOT's can provide considerable technological resources and innovative approaches to TIM. Some of the more successful TIM programs have resulted from proactive DOT leadership that fosters cooperation and coordination from the executive, decision-making level on down to field operations. Establishing trust, open communications, and relationships with the many and varied responding agencies is the only way to resolve TIM issues before they get in the way of effective field operations. The open forum and dialogue offered by a formal DOT-led TIM program enables further program development without directly challenging traditional agency roles and responsibilities.

I-15 in San Diego is somewhat unique in that two separate transportation agencies effectively manage traffic on the facility (Caltrans-general purpose lanes and SANDAG-FasTrak managed lanes). Thus, close coordination between the two agencies is critical for successful traffic management operations and TIM. In order to effectively monitor and control traffic on the planned I-15 managed lanes, Caltrans District 11 TMC Operators must have the ability to view "real time" congestion data for all lanes and segments of the facility. To collect congestion data, vehicle detectors will be utilized by Caltrans at strategic locations along the managed lanes and adjacent general purpose lanes. Inductive loop detectors on the managed lanes will collect and report vehicle location, speed, and volume to the TMC for all lanes and segments in both directions. By comparing congestion data from general purpose lanes with the data for the ML, Caltrans TMC operators can observe the performance of the I-15 corridor freeway system and make effective traffic management decisions. These systems will be furnished and maintained by Caltrans and the I-15 managed lanes system will use this data for its dynamic pricing algorithm.

SANDAG and Caltrans will need to coordinate the appropriate response to any traffic incident in the I-15 corridor that will affect I-15 managed lanes operations. As appropriate, close coordination is needed to ensure that messages displayed on SANDAG's FasTrak Variable Toll Message Signs (VTMS) and Caltrans CMS signs are consistent and updated in a timely manner (refer to Sections 5.5 and 6.6.2 for information on policies pertaining to CMS and VTMS sign control).

7.6 Towing and Recovery Service Providers

Towing and recovery service providers are critical to the overall TIM process. They are responsible for the safe and efficient removal of wrecked or disabled vehicles, and debris from the incident scene. Typical towing and recovery responsibilities include:

- Remove vehicles from incident scene;
- Protect victims' property and vehicles;
- Remove debris from the roadway;
- Provide transportation for uninjured vehicle occupants; and
- Serve as incident commander for recovery operations.

While towing and recovery companies remain integral to the TIM process, they face a number of challenges and are sometimes not properly recognized as emergency responders because they are not public agencies. Through the efforts of organizations like the Towing and Recovery Association of America (TRAA), their roles, responsibilities, and the emphasis on maintaining two-way communication during incident situations is being clarified and enhanced through a variety of guidance documents, training and education.

7.7 Information Service Providers (ISPs) and the Media

Information service providers are commercial/private entities that collect traffic data, often from existing DOT sources, and disseminate information to both motorists and the media. The media includes radio, television, and newspapers. The media may also collect traffic data either from other sources (e.g., ISPs, DOTs) or their own methods (e.g., airborne reporters, private CCTV cameras). They in-turn broadcast the traveler information via their respective medias. Each can play a key role in the TIM process by providing information about traffic incident(s) to the traveling public. However, the information provided must be timely and accurate to be of value. Many TIM programs include ISPs and the media as part of their committee structure so that these points can be discussed and enhanced. Typical media roles and responsibilities for TIM include:

- Report traffic incidents;
- Broadcast information on delays;
- Provide alternate route information;
- Update incident status frequently; and
- Provide video or photography services.

The media and ISPs in-turn may work together or independently to provide traveler information through mechanisms such as:

- Broadcast radio, television;
- Satellite radio, cable television;
- Newspapers (for planned incidents such as construction or special events);
- Telephone call-in systems;
- E-mail services;
- Pager services; and
- Internet web-sites.

8.0 TRAINING REQUIREMENTS

TIM requires interagency, multi-disciplinary training to enable a high degree of coordination and ensure the efficient use of resources available for managing traffic incidents. The overall goal of TIM training is to initiate a common, coordinated response to traffic incidents that builds partnerships, enhances safety for emergency personnel, reduces secondary collisions, and improves the efficiency of the transportation system. Multi-agency training is essential to responder safety as well as to maintaining and improving overall TIM quality. Irregardless of roles, it is extremely important that all responding agencies be involved in joint TIM training.

Training, like other aspects of TIM programs, typically varies significantly from region to region. Many programs customize training for incident responders, managers, and policy-makers. In any case, training may include any combination of field drills, table-top exercises, and/or classroom lectures and discussion. As part of the I-15 Managed Lanes Operations and Traffic Incident Management Plan study, some training will be conducted for operational personnel and TIM responders. This high-level training will focus on the purpose of the two plans and how to use the procedural information contained within them. Based on specific TIM training needs identified throughout the course of the study, and the complexity of the I-15 managed lanes operations, it is highly recommended that an on-going, multi-agency TIM training program be established with the following objectives:

- Understand TIM phases, activities, tools and techniques.
- Understand the roles and responsibilities of each responder.
- Foster improved interagency communication and cooperation.
- Identify opportunities to improve the efficiency of TIM operational activities.
- Emphasize maintenance of a safe environment for responders, collision victims, and other motorists.
- Identify and discuss TIM policies and regulations.
- Ensure mutual understanding of the relevant command system (e.g., NIMS/ICS).
- Review procedural information and equipment use.
- Conduct of traffic incident after-action reviews and debriefs.

Based on the objectives described above, and depending on training needs specific to each individual/responder, formal I-15 Managed Lanes TIM training could include elements such as:

- CPR;
- Basic First Aid;
- Radio communication;
- Traffic control strategies, including use of the moveable barrier during incidents and use of Emergency Alternate Routes;
- I-15 managed lanes system components;
- Public relations;
- National Incident Management System (NIMS)/Incident Command System (ICS);
- Basic HAZMAT identification training;
- Removal of disabled vehicles;
- Response vehicle equipment use policies and procedures; and

- Fatal or felony accident procedures.

One opportunity for formal TIM training is available from the National Highway Institute (NHI) of the Federal Highway Administration (FHWA). The "Workshop on Traffic Incident Management" (Course Number 133048) is recommended for any location regardless of the state-of-the-practice in effective management of traffic incidents. Participants typically include mid-level management and on-scene supervisory level persons from law enforcement, fire and rescue, emergency communications, transportation, towing and recovery, traffic reporting media, and other agencies or companies involved in TIM.

Formal TIM training programs/courses provide the knowledge and skill base that responders need to perform their jobs effectively. To supplement this training, many agencies provide responders with written (or electronic) field manuals. Field manuals, like other aspects of TIM programs, must be tailored to the specific needs of the corridor or region and available resources. Field manuals provide responders with the "nuts and bolts" information they need, including contact lists, to do their job in what are often harsh and demanding conditions. An Operations Field Manual is pending development as part of the I-15 managed lanes project. TIM-related elements of this manual are expected to include:

- Detailed responder roles, responsibilities, and jurisdictions;
- Responder contact list;
- TIM resource list;
- Criteria for managed lanes barrier transfer during incidents and response considerations by time-of-day and type of incident;
- Incident detection/verification guidelines;
- Scene management guidelines;
- Emergency alternate route considerations;
- HAZMAT guidelines;
- CMS sign message sets for various incident and non-incident conditions; and
- Traveler information guidelines, including protocols and actors for FasTrak VTMS sign coordination.

The importance of proper TIM training for responders cannot be underestimated in the litigious nature of our society today. More and more agencies are being forced to assume at least some liability for failing to provide training for personnel who manage emergency situations, especially in cases where it can be proven that proper training could have prevented injuries or damages.

9.0 BARRIER TRANSFER DURING INCIDENTS

Table 9-1 shows the twelve possible combinations of configuring the four Managed Lanes and the two Reversible HOV Lanes. Four of these combinations, identified as "Standard Daily Operations," are expected to be used on a regular/daily basis. The other combinations, identified as "Incident Management," will be used for incident management during non-standard scenarios.

Table 9-1. Operational Scenarios between Managed Lanes (ML) and Reversible HOV Lanes (RL)

ML	RL	→	ML	RL	Type
		Change To	2N+2S (PM)	2N	Standard Daily Operations
2N+2S (AM)	2S	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Standard Daily Operations
2N+2S (PM)	2N	Change To	1N+3S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Incident Management
		Change To	1N+3S (AM)	2S	Standard Daily Operations
3N+1S (PM)	2N	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management
		Change To	3N+1S (PM)	2N	Standard Daily Operations
1N+3S (AM)	2S	Change To	2N+2S (PM)	2N	Incident Management
		Change To	2N+2S (AM)	2S	Incident Management

Note: the letter "N" means "Northbound," the letter "S" means "Southbound," and the numbers indicate the number of lanes in that direction. For example, 2N+2S means two northbound lanes and two southbound lanes, and 3N+1S means three northbound lanes and one southbound lane. 2N+2S (AM) refers to 2N+2S configuration for the Managed Lanes with the HOV Lanes in the southbound direction during the AM commute hours, while 2N+2S (PM) refers to the same general configuration on the Managed Lanes with the HOV Lanes in the northbound direction during the PM commute hours.

It should be noted that changing the direction of the HOV lanes from northbound to southbound during the PM commute hours or changing them from southbound to northbound during the AM commute hours is also a viable traffic management strategy during incident conditions.

9.1 Barrier Transfer When an Incident Occurs in the General Purpose Lanes

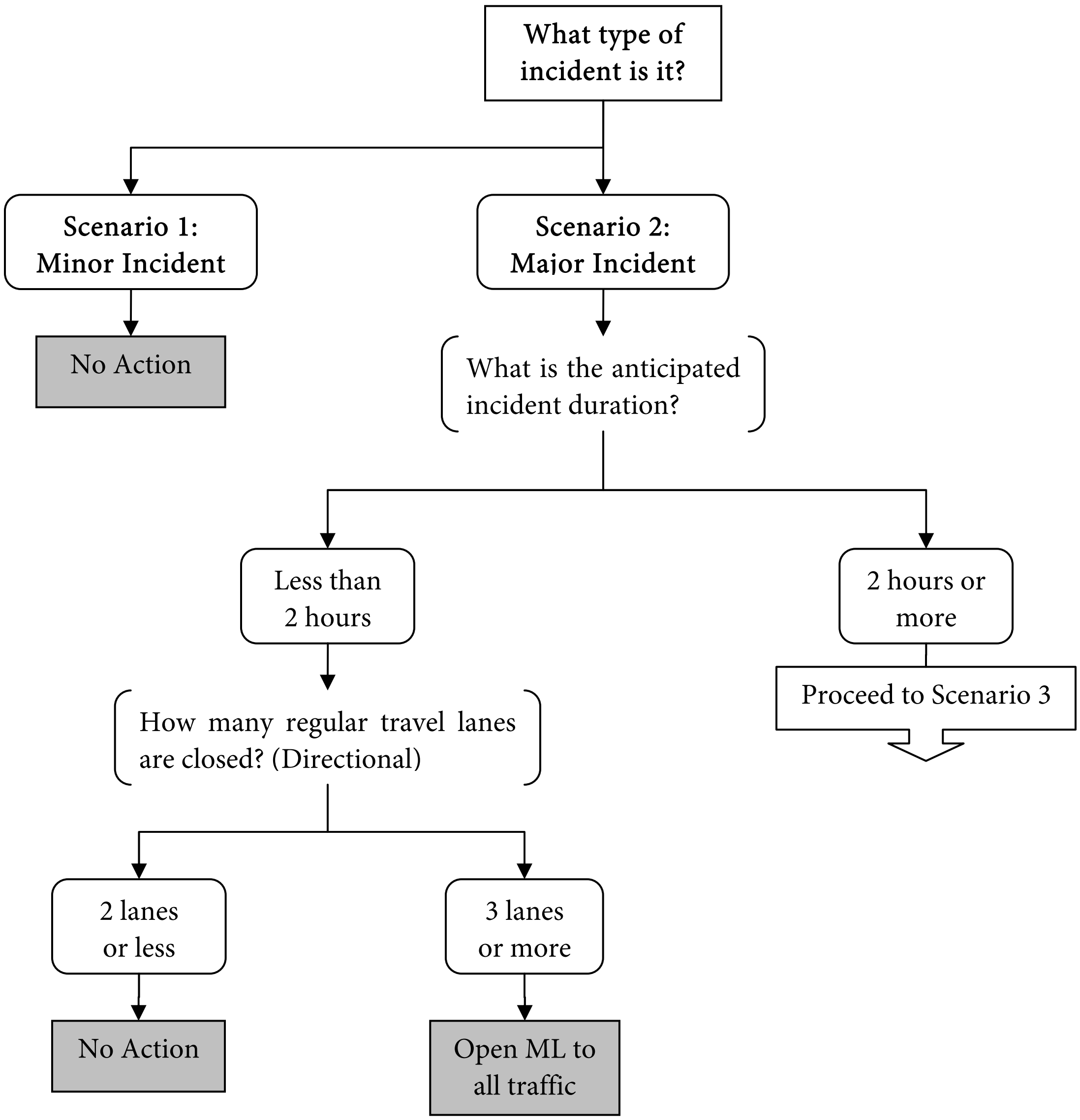
In addition to providing additional capacity during peak periods, the public is expecting that the I-15 Managed Lanes will be used to help alleviate incident related congestion that occurs when an incident happens in the general purpose lanes. However, barrier transfer is not a cost effective solution for incidents with durations anticipated to be less than the time required to transfer the barrier. In order to address this issue, an initial decision tree for barrier transfer during TIM operations was developed. Factors considered in the decision tree include incident classification, incident duration, number of lanes closed, day of the week, time of day, incident location and direction of travel. The development of the decision tree was also based on feedback received during a workshop held with I-15 stakeholders from San Diego. During this workshop various incident scenarios (presented in Appendix A) were "exercised" by participants so that consensus could be reached on the most appropriate response given the circumstances of the incident and the intended operations of the managed lane segments.

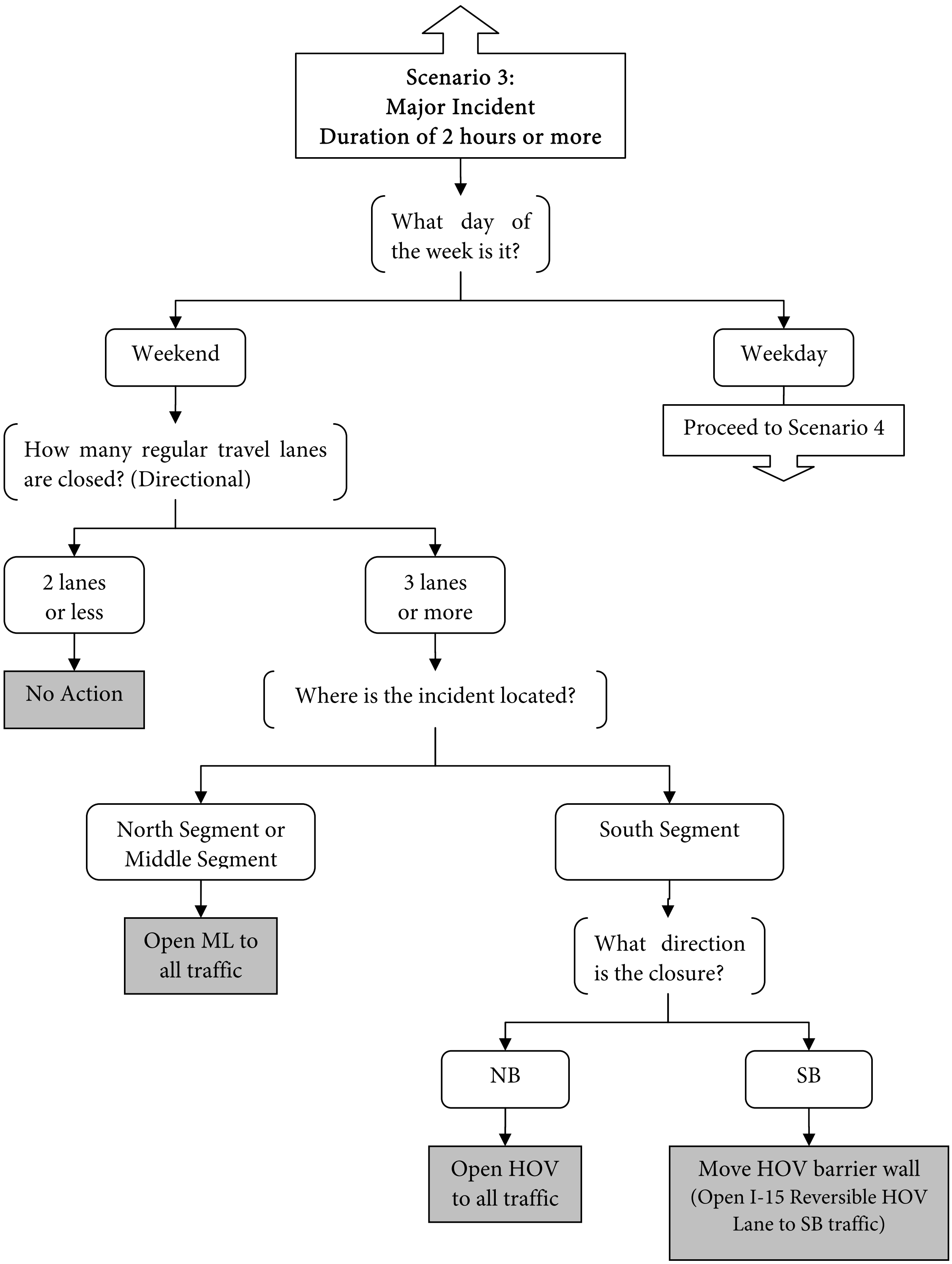
There are three possible ending points to the decision tree: "No Action," "Open the Managed Lanes or HOV Lanes (depending on incident location) to all traffic," or "Move the HOV barrier wall." The decision tree was developed under the assumption that the Managed Lanes will be operating in the 2N+2S standard daily configuration until 2012. Thus, transfer of the barrier was limited to the south end of the project where changing the direction of the travel in the existing HOV lanes may be necessary. It is important to note, however, that after the interim middle segment opening, Caltrans will have the ability to transfer the barrier in the middle segment. Therefore, if a major incident was anticipated to block one direction of travel for a significant amount of time (e.g., 6 hours or more) consideration may be given to transferring the barrier to a non-standard 3N+1S or 1N+3S configuration.

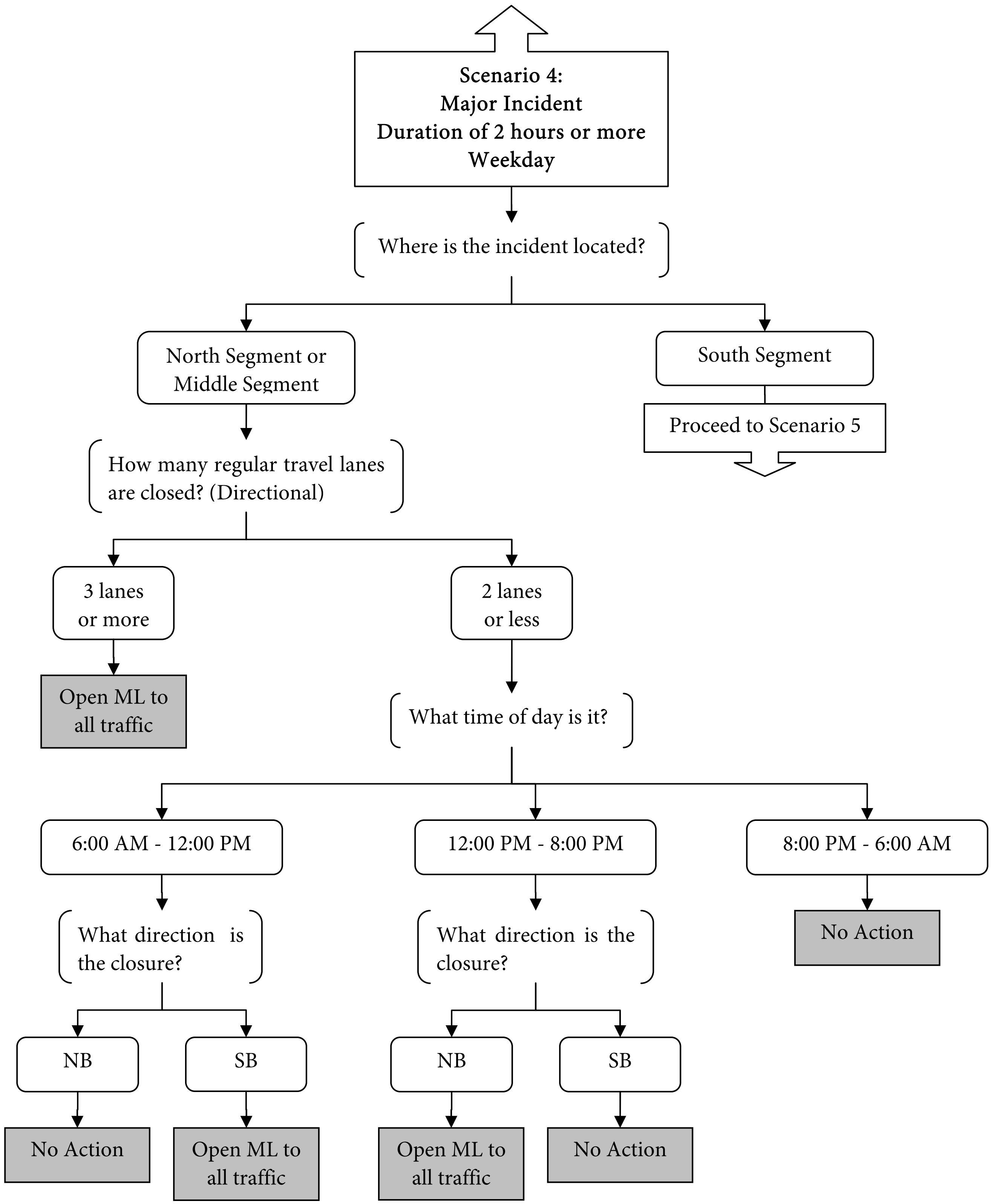
If the decision is made to open the Managed Lanes to all traffic or to transfer the HOV barrier wall, close coordination between Caltrans and SANDAG/FasTrak will be required. In order for either solution to be effective the messages displayed on the Variable Toll Message Signs (VTMS) and the messages displayed on Caltrans CMS must be coordinated.

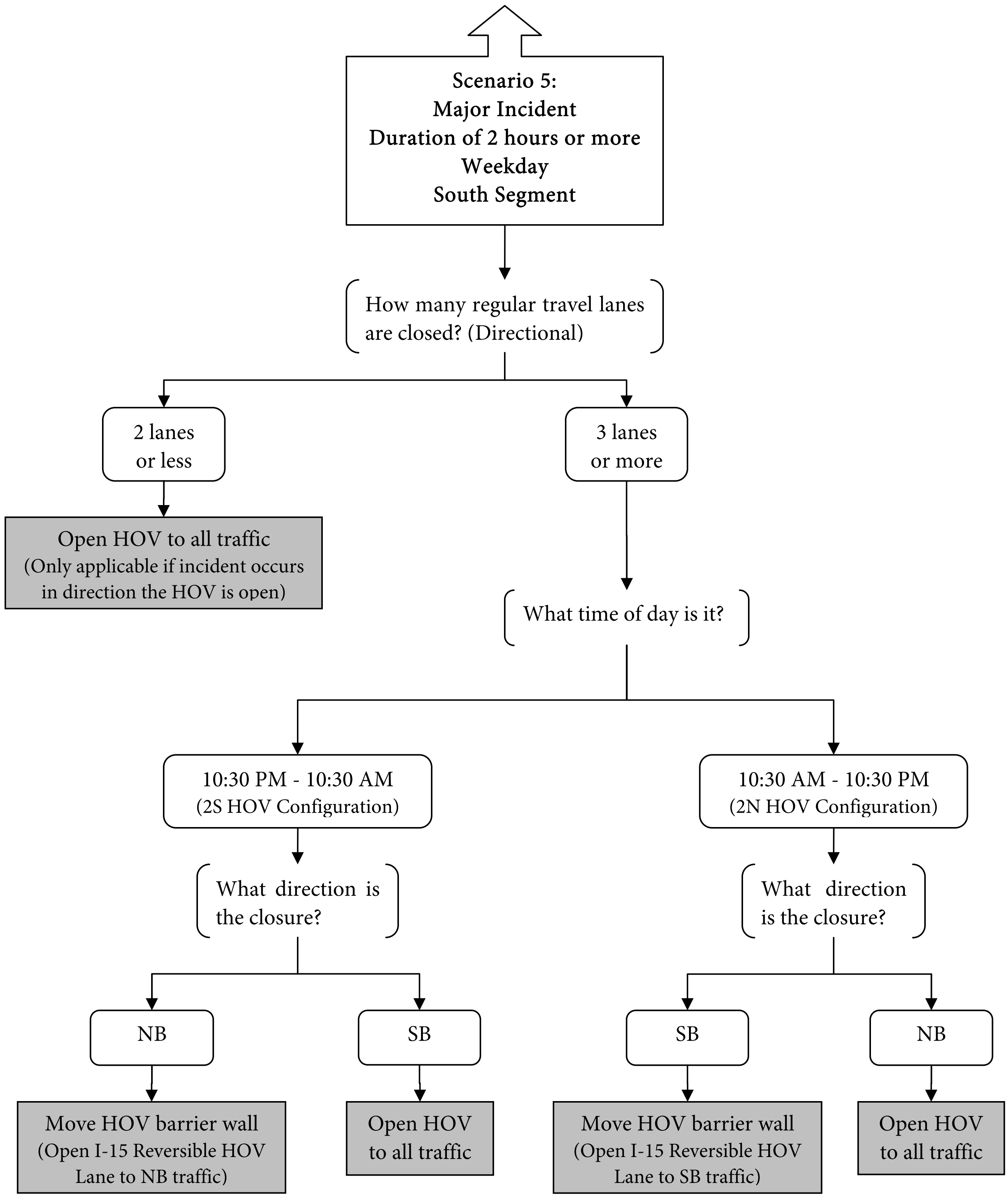
It is important to note that the decision tree was developed as a guidance tool. As each incident is different, it is likely that incident specific circumstances may outweigh the guidance provided in the decision tree. In addition, it is anticipated that the decision tree will be revised on an on-going basis based on experience and to accommodate changes in operational characteristics as they occur.

Figure 9-1. Decision Tree for Barrier Transfer
When an Incident Occurs Within the General Purpose Lanes




Scenario 3:
Major Incident
Duration of 2 hours or more
What day of the week is it?
Weekend
Weekday
Proceed to Scenario 4
How many regular travel lanes are closed? (Directional)
2 lanes or less
3 lanes or more
No Action
Where is the incident located?
North Segment or Middle Segment
South Segment
Open ML to all traffic
What direction is the closure?
NB
SB
Open HOV to all traffic
Move HOV barrier wall
(Open I-15 Reversible HOV Lane to SB traffic)


Scenario 4:
Major Incident
Duration of 2 hours or more
Weekday
Where is the incident located?
North Segment or Middle Segment
South Segment
Proceed to Scenario 5
How many regular travel lanes are closed? (Directional)
3 lanes or more
2 lanes or less
Open ML to all traffic
What time of day is it?
6:00 AM - 12:00 PM
12:00 PM - 8:00 PM
8:00 PM - 6:00 AM
What direction is the closure?
What direction is the closure?
No Action
NB
SB
NB
SB
No Action
Open ML to all traffic
Open ML to all traffic
No Action


Scenario 5:
Major Incident
Duration of 2 hours or more
Weekday
South Segment
How many regular travel lanes are closed? (Directional)
2 lanes or less
Open HOV to all traffic
(Only applicable if incident occurs in direction the HOV is open)
3 lanes or more
What time of day is it?
10:30 PM - 10:30 AM
(2S HOV Configuration)
What direction is the closure?
NB
Move HOV barrier wall
(Open I-15 Reversible HOV Lane to NB traffic)
SB
Open HOV to all traffic
10:30 AM - 10:30 PM
(2N HOV Configuration)
What direction is the closure?
SB
Move HOV barrier wall
(Open I-15 Reversible HOV Lane to SB traffic)
NB
Open HOV to all traffic

9.2 Barrier Transfer When an Incident Occurs Within the Managed Lanes

Due to space requirements for the operation of the barrier transfer machine, barrier transfer when an incident occurs within the Managed Lanes will not be possible. Moving the barrier transfer machine through an incident scene would introduce an additional hazard to those working in the scene and the machine would not be allowed to travel through a scene requiring a formal investigation.

9.3 Considerations for Returning to Standard Daily Operations

Once the impact of a major incident has started to dissipate, consideration must be given to returning the Managed Lanes to standard daily operations. Some of the factors that should be considered when determining what steps to take after the incident has been cleared are as follows:

- Can the barrier be left in its current position until the next regularly scheduled transfer? (i.e., it is 1:00 AM and the barrier is in the correct position to accommodate AM peak period traffic)
- What time of day is it? - Is transferring the barrier necessary to accommodate peak period travel or conversely would transferring the barrier be disruptive to traffic flow.

These and other considerations will be further investigated and documented as part of the procedural development of the I-15 Managed Lanes Field Operations Manual.

10.0 SCENE MANAGEMENT GUIDELINES

10.1 National Incident Management System (NIMS) and Incident Command System (ICS) Overview

The National Incident Management System (NIMS) is a comprehensive system that is intended to improve response and continuity of operations through the use of the Incident Command System (ICS) and other standard procedures and preparedness measures. NIMS also promotes the development of cross-jurisdictional, statewide and interstate regional mechanisms for coordinating incident management and obtaining support during large-scale or complex incidents. It is critically important that all agencies and jurisdictions comply with the NIMS because the challenges faced in dealing with a large-scale state or national incidents are far greater than the capabilities of any one agency or jurisdiction. NIMS provides the structure for all agencies to work together for mutual support.

Homeland Security Presidential Directive-5 "Management of Domestic Incidents" (HSPD-5) requires the adoption of NIMS by all Federal departments and agencies. The directive also requires that Federal preparedness assistance funding for all states and local jurisdictions be dependent on NIMS compliance. In FY 2005 and 2006, states self-certified that they were making a "good faith" effort to implement NIMS. The self-certification compliance process is being changed to specific performance-based metrics for FY 2007 (October 1, 2006 – September 30, 2007), which will be monitored for compliance by the Department of Homeland Security. Following is a summary of the training requirements outlined for FY 2007:

IS-700 NIMS: An Introduction

A web-based awareness level course that explains NIMS components, concepts and principles. The course can be found at: http://training.fema.gov/emiweb/IS/is700.asp.

Completion of IS-700 is required for:

- Entry level first responders and disaster workers;
- First line supervisors;
- Middle management; and
- Command and general staff.

IS-800 National Response Plan (NRP): An Introduction

A web-based awareness level course that introduces the key elements of the National Response Plan so that its implementation can be supported at all levels of government. The course can be found at: http://www.training.fema.gov/emiweb/IS/is800a.asp.

Completion of IS-800 is required for:

- Emergency management personnel in middle management; and
- Emergency management personnel in command and general staff.

ICS-100: Introduction to ICS

The course explains the purpose of ICS, basic features, incident commander and command staff functions, facilities, the concept of Unified Command, and common responsibilities. The course can be found at: http://www.usfa.fema.gov/training/nfa/independent/.

Completion of ICS-100 is required for:

- Entry level first responders and disaster workers;
- First line supervisors;
- Middle management; and
- Command and general staff.

ICS-200 Basic ICS

The course builds on ICS-100 and describes leadership and management principles including chain of command and formal communication relationships, delegation of authority and management by objectives, functional areas and positions, briefings, organizational objectives, and transfer of command. The course can be found at: http://www.usfa.fema.gov/training/nfa/independent/.

Completion of ICS-200 is required for:

- First line supervisors;
- Middle management; and
- Command and general staff.

Note: The training requirements outlined above are categorized as essential to successful NIMS implementation. Completion of ICS-300 by middle management, and command and general staff; and completion of ICS-400 by command and general staff will be also required for FY 2007, but completion is categorized as supporting successful NIMS implementation.

Based on the training requirements outlined above all first responders, including personnel such as FSP drivers, Caltrans maintenance staff, and TMC operators will be required to take, at a minimum, IS-700 and ICS-100.

10.2 Scene Management and Emergency Traffic Control

All personnel required to work at emergency scenes along or within close proximity to roadways should be aware of the dangers associated with working in live traffic. Emergency responders are often too busy or concerned with caring for others to be concerned for their own safety. However, emergency responders can take several actions to provide the safest possible work environment and should use whatever means necessary, within reason, to do so. Conversely, responders must also be aware that closing more lanes of traffic than necessary for scene protection significantly increases the likelihood of secondary incidents occurring upstream of the primary emergency and can prolong the overall duration of the incident.

Following is an example of scene management and emergency traffic control guidelines developed for emergency responders.

Emergency responders should follow these steps when arriving at an incident:

a. Establish and use the incident command system on every incident. Command must account for all personnel working at the incident scene.

b. Develop an escape plan:

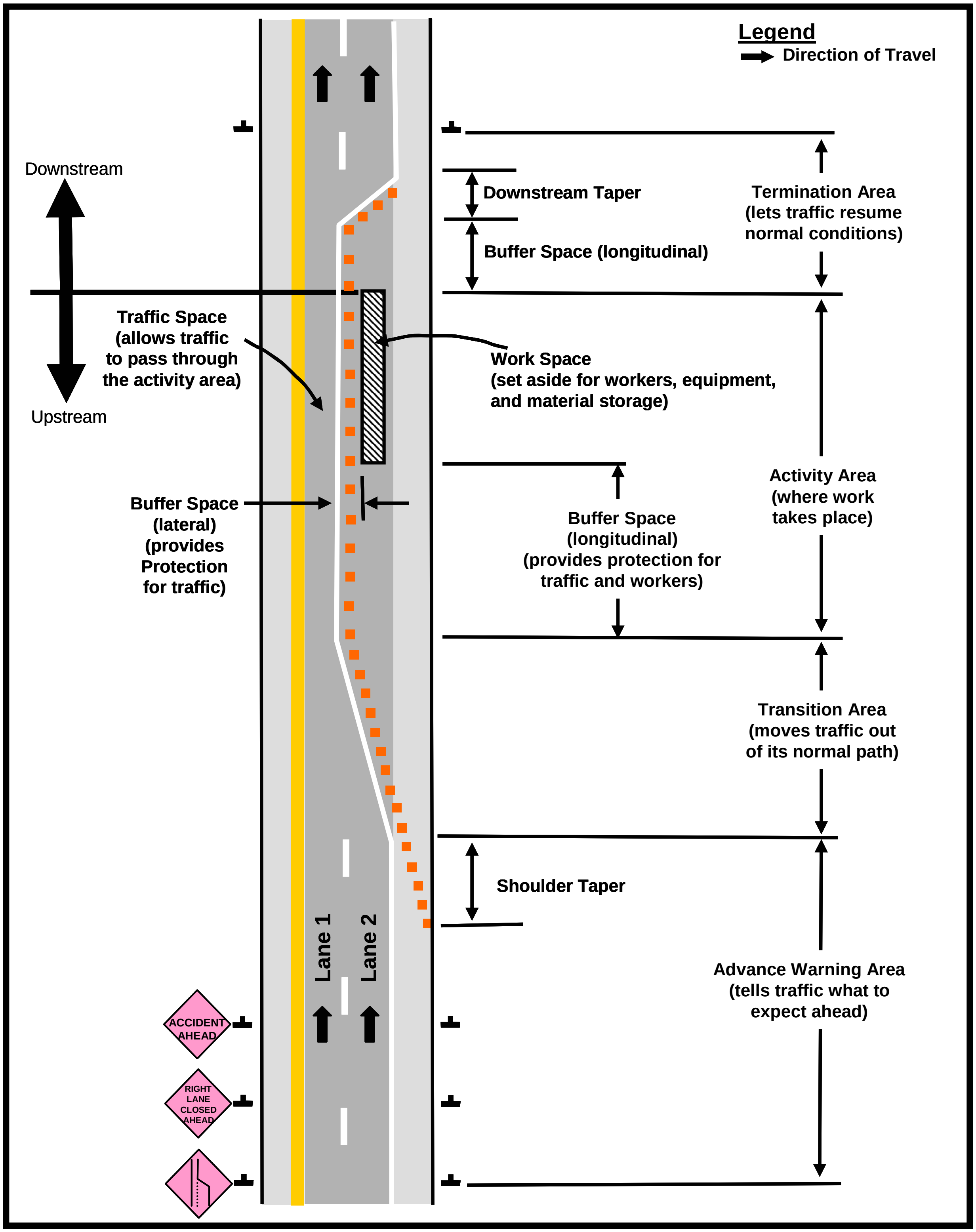
   - Personnel should always maintain awareness of other traffic and develop an escape plan to a safe area in the event of a secondary collision.
   - Personnel should avoid or at least be aware of situations in which there is no avenue of escape to a safe area away from traffic.

c. Wear reflective clothing on roadway scenes at all times. The Manual on Uniform Traffic Control Devices (MUTCD) states that all workers shall wear bright, highly visible clothing when working in or near moving traffic.

d. Develop a safe work area. Personnel must be aware of the five components of a traffic incident scene. All five components must be established as soon as possible at all incident scenes. These components are (see Figure 10-1):

   1. Advance warning area;
   2. Transition area;
   3. Buffer space;
   4. Work Space; and
   5. Termination area.

Figure 10-1. Typical Traffic Incident Scene Components



10.3 Emergency Scene Access

Emergency scene access guidelines provide alternatives for emergency vehicle access to potential incident sites. Generally the Incident Commander or an on-scene responder will determine the best available route to a scene. However, due to the unique nature of the Managed Lanes, scene access guidelines would serve as a useful tool for all emergency responders prior to the establishment of incident command. Following is an example of scene access guidelines, which considered three alternatives for scene access (the guidelines were slightly adapted to reflect the configuration of the Managed Lanes):

1. **Alternative 1 – Upstream of Incident, Flow with Traffic**
   - Most appropriate for minor incidents blocking only the shoulder or one lane of traffic.
   - Requires emergency vehicles to "compete" with other existing traffic.
   - Requires traffic to continue flowing past the incident or for traffic to move over to a shoulder for an emergency vehicle to pass.
   - If all lanes of traffic are blocked at the incident scene, traffic is not flowing, and no emergency shoulders are available, this alternative is not advised.
   - In the Managed Lane, there will be two lanes in each direction with limited shoulders, thus if two lanes are blocked, the entire mainline is likely blocked and traffic will not flow.

2. **Alternative 2 – Upstream of Incident, Adjacent Facility** (i.e., Travel in mainline if incident is in Managed Lanes and vice versa)
   - Most appropriate when an incident is in the mainline left lane or in the median shoulder or in the Managed Lanes and a quicker response is possible from the adjacent facility than flowing through traffic.
   - This response is not advised for an incident in the right shoulder or in the right lanes of the mainline as this would result in the response requiring the blockage of the Managed Lanes.
   - This response is not possible for tow trucks when removal is required.
   - Traffic in the adjacent facility will likely still be moving when an incident occurs, however, some slowing of traffic may occur due to gapers block.
   - This scenario will more directly impact both facilities if the emergency vehicles park near the scene.

3. **Alternative 3 – Downstream of Incident, Opposite Direction**
   - Most appropriate for a major incident blocking all lanes of traffic.
   - Requires closing the freeway to allow emergency vehicles to flow counter to the traffic direction (i.e., opposite direction).
   - May require closure of downstream ramps or interstate to interstate ramps.
   - Requires confirmation that all traffic is clear before emergency vehicles can use this alternative.

- Is not advised for minor incidents or incidents blocking only one lane of traffic, as it requires the blocking of the entire freeway.
- Blocking of the freeway will require the implementation of the emergency alternate routes.

10.4 Staging Considerations

When incidents require response from multiple agencies and a large number of responding vehicles or when an incident occurs within an area with limited shoulders or lanes, it may be appropriate to implement staging areas removed from, but in close proximity to the immediate scene. In an effort to enhance response operations, staging areas can be predetermined and documented. Furthermore, it is preferable that staging areas for both response apparatus and for the media are identified. Ideally, apparatus staging areas should be on a flat, hard surface with adequate space and easy access to the highway. Media staging areas can be smaller and should be removed from the apparatus staging area to minimize conflicts. The media is more likely to respond to the staging area if a designated spokesperson is available to provide information and there is an opportunity for camera shots of the scene.

10.5 Guidelines for Emergency-Vehicle Lighting

At an incident scene, emergency-vehicle lighting (such as high-intensity rotating, flashing, oscillating, or strobe lights) is used to enhance the safety of response personnel and incident victims. However, excessive use of flashing lights can create unnecessary delay and confusion for motorists passing the scene, especially at night. The use of emergency-vehicle lighting can be reduced if good traffic control has been established at the incident scene. Chapter 6I of the Manual on Uniform Traffic Control Devices (MUTCD) recommends that public safety agencies examine their policies on the use of emergency-vehicle lighting, especially after a traffic incident scene is secured, with the intent of reducing the use of this lighting as much as possible while not endangering those at the scene. Furthermore, vehicle headlights not needed for illumination, or to provide notice to other road users of the incident response vehicle being in an unexpected location, should be turned off at night.

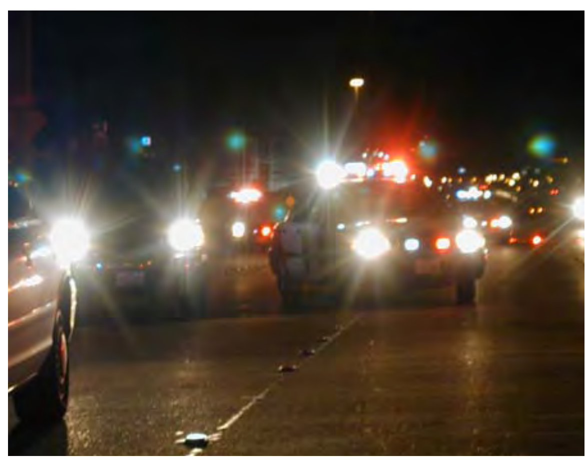


Figure 10-2. Emergency-Vehicle Lighting

Following is a basic example of guidelines developed for use of emergency-vehicle lighting:

a. *Keep flashing lights on*:

- While traveling cautiously through stopped traffic at the incident scene.
- When traveling to an incident on the shoulder.
- When an agency needs to work through traffic to remove blocking, disabled vehicles.
- When incident vehicles are blocking the highway lanes; or incident vehicles are on the shoulder and traffic is passing by at a high speed.
- At night, flashing lights are still recommended for use on the shoulder, even when traffic is not congested, to warn vehicles that may be illegally traveling on the shoulder.

b. *Turn flashing lights off*:

- After employing the overhead lights to stop violators or protect accident scenes etc., and once vehicles are out of the traveled portions of the road, turn off overhead lights and turn on yellow flashers to alleviate "rubber-necking" by passing motorists.
- When multiple response vehicles are lined up, turn off overhead flashers on all vehicles except the rear and front vehicle.

11.0 EMERGENCY ALTERNATE ROUTE CONSIDERATIONS

11.1 Overview

An emergency alternate route is a roadway or series of roadways that provide additional capacity to service primary route (e.g., I-15) traffic. The term "emergency" implies that the route is to be used for additional primary route capacity only under emergency conditions (i.e. major traffic incidents), not as a general, everyday "by-pass". Emergency alternate route plans serve to address the following TIM-related issues:

- Contingency planning for future traffic incidents at locations with a high occurrence of collisions.
- Major catastrophes closing a key component of a region's highway infrastructure (e.g., high-capacity bridge, freeway-to-freeway ramp, etc.). Major catastrophes include natural disasters, infrastructure failures, or acts of violence or terrorism.
- Planned construction and maintenance activities.
- Future planned special events.

The benefits of deploying emergency alternate route plans include decreases in:

- Secondary incidents;
- Vehicle fuel consumption;
- Vehicle emissions;
- Response time to traffic incidents and other emergencies;
- Motorist stress levels;
- Aggressive driving behavior;
- Impact on the movement of freight in the region; and
- Impact on the regional economy.

Emergency alternate routes can be both regional and local in nature. In the case of the I-15 Managed Lanes segment in San Diego, a regional emergency alternate route might be I-5/I-805. An example of a localized emergency alternate route could be Pomerado Road to the east of I-15. The Managed Lanes themselves may also be used as an emergency alternate under certain conditions as described previously in Section 9.0 of this plan. In all situations, the location and expected duration of the incident, extent of congestion resulting from the emergency, and the distance traveled from the primary facility must be factored into the decision as to which emergency alternate route to use. Additionally, real-time, accurate traveler information is critical. Motorists must be sufficiently warned of the emergency alternate route so that they can make informed decisions both in advance and during their trips.

11.2 Planning and Development Approach

Often an activity of formal TIM programs, advance planning and preparation of emergency alternate route plans enhances the on-scene traffic management capability of interagency incident responders. Proper emergency alternate route planning has a significant effect on improving the safety and efficiency of roadway operations under traffic incident conditions without undue impact on the surrounding community. Emergency alternate route planning typically involves a transportation agency assuming a lead role with support and/or plan review solicited from affected stakeholders, such as local/municipal traffic engineers and public safety agencies. The plans must include guidance to response personnel on when and how to deploy an emergency alternate route and notify affected motorists.

A number of different criteria and guidelines are typically utilized in selecting emergency alternate routes. Likewise, the plans themselves can contain different information and are usually customized depending on the specific needs of the area or region. Generally speaking, the approach for preparing emergency alternate route plans involves three phases:

1. **Emergency Alternate Route Selection**

   This phase includes choosing candidate emergency alternate routes and evaluating each to determine the optimal choice(s). In a high-level preliminary view of the I-15 corridor, there appear to be very few local alternatives. However, the two described below should be further considered:

   - Pomerado Road (including I-15 interchange roadways of: Scripps Poway Parkway; Poway Road; Ted Williams Freeway/SR56; Camino Del Norte; Rancho Bernardo Road).
   - Black Mountain/Kearny Villa Road (including I-15 interchange roadways of: Ted Williams Freeway/SR56; Rancho Penasquitos Boulevard; Mercy Road; Mira Mesa Boulevard; Miramar Road; Miramar Way).

   In addition, once the Black Mountain Ranch development is complete, Carmel Valley Road and Bernardo Drive may also be available for use as alternate routes.

   Figure 11-1 provides an overview of a high-level analysis of possible emergency alternate routes for the I-15 corridor.

   The evaluation of any potential emergency alternate route should at a minimum consider the roadway's capacity, traffic signals, 4-way stops, school zones, neighborhoods, weight restrictions, signing, and distance traveled away from the primary facility.

2. **Emergency Alternate Route Plan Development**

   In this phase, the actual plan development is initiated and should include field visits to the routes, coordination with local agencies, and documenting/displaying the appropriate route information in a format suitable for use in the field by those responsible for deployment.

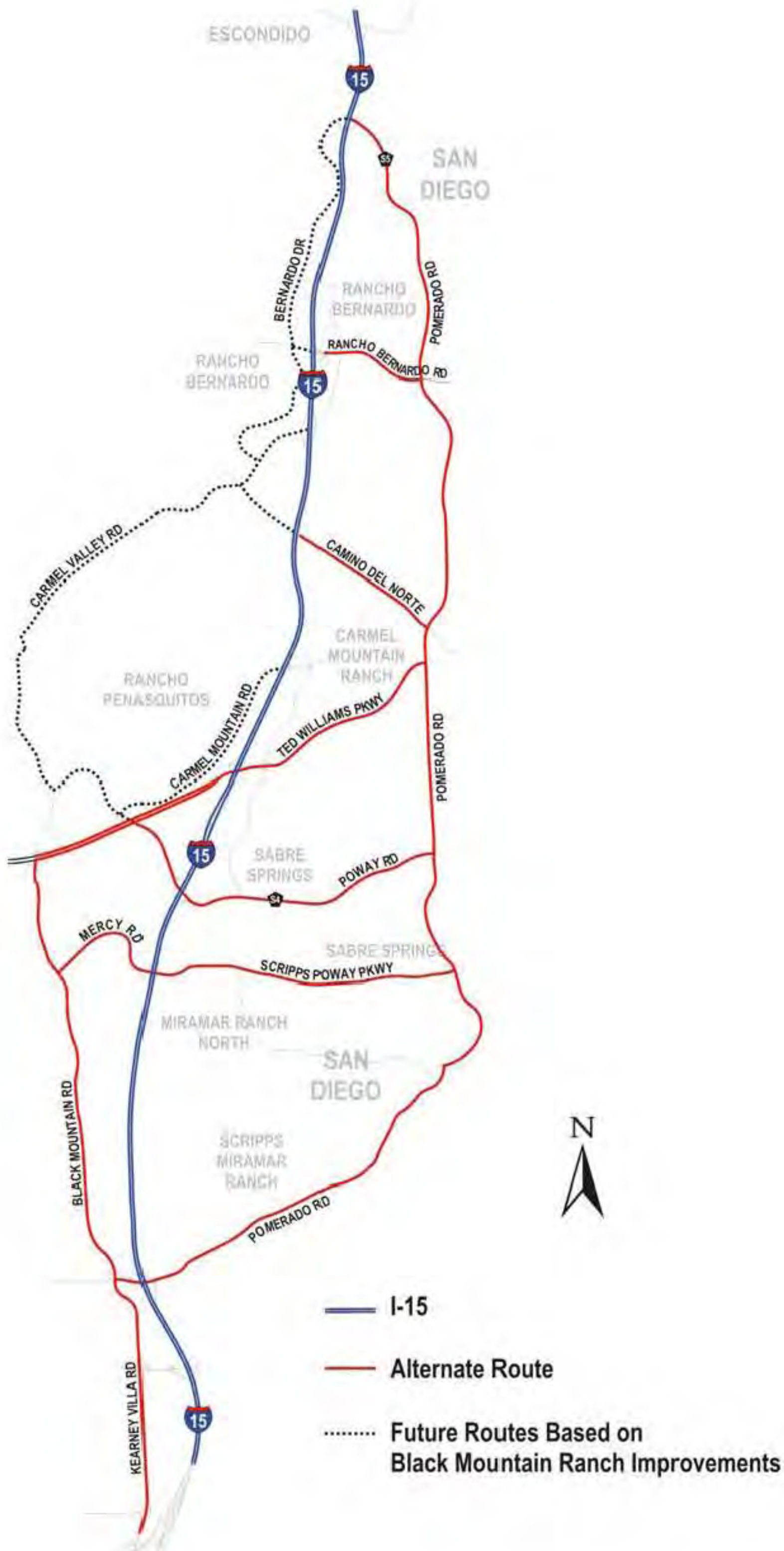
3. **Traffic Management Planning, Design, and Implementation**

   In most cases, the designated route(s) will require some additional traffic management improvements for them to be viable as emergency alternates. In the third phase, these improvements are planned, designed (if required), and implemented. Traffic management improvements can include:

- Spot capacity improvements;
- Traffic signal system enhancements including equipment and emergency timing plans;
- Guide signing (static); and
- Changeable message signing (CMS).

Lastly, similar to other strategies and tools to mitigate the impacts of traffic incidents, the effectiveness of Emergency Alternate Routes should routinely be reviewed and fine-tuned as required.

Figure 11-1. High-Level Analysis of Possible Emergency Alternate Routes for the I-15 Corridor



12.0 HAZARDOUS MATERIALS (HAZMAT) CONSIDERATIONS

Effective first response to traffic incidents involving hazardous materials (HAZMAT) is critical to minimizing the impacts of the emergency in terms of public and responder safety, environmental degradation, and clean-up costs. Well-defined agency HAZMAT response policies and procedures and corresponding training allow first responders to accurately identify the hazardous material and direct further response. For example, Caltrans Maintenance Policy Directive Number 0601 identifies roles and responsibilities for spill clean-up, ensures HAZMAT contractors comply with State and Federal regulations for removing hazardous materials, expedites contractor payment, and describes recovery of incident expenditures from the responsible party. Most common (and small quantity) engine fluid spills (oil, diesel fuel, gasoline, anti-freeze, etc.) can be contained and cleaned up without calling hazardous materials contractors. Quick cleanup and removal of these types of spills can greatly reduce incident duration.

12.1 The 2004 Emergency Response Guidebook (ERG2004)

Many materials transported via highways are particularly hazardous in any quantity, and should be approached with extreme caution. The 2004 Emergency Response Guidebook (ERG2004) developed jointly by the USDOT and other similar North American entities, is a primary guide to aid first responders in quickly identifying the specific or generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident. The guide should be used by TIM responders such as fire fighters, law enforcement, DOTs, and other public safety personnel who may be the first to arrive at the scene of a traffic incident involving dangerous goods. The guidebook assists responders in making initial decisions upon arriving at the scene of a traffic incident involving dangerous materials. It should not be considered a substitute for emergency response training, knowledge or sound judgment. ERG2004 does not address all possible circumstances associated with HAZMAT incidents occurring on a highway. First responders at the scene of a HAZMAT incident should seek additional specific information about any material in question as soon as possible. It is strongly recommended that TIM responders become familiar with ERG2004 before needing to use it in a traffic emergency.

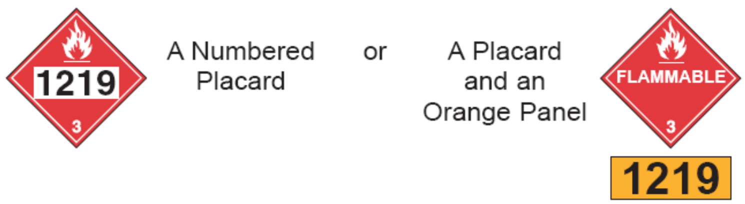
12.2 Basic I-15 Managed Lanes HAZMAT Response Guidelines

1. Resist rushing in! Stay clear of all spills, vapors, fumes, and smoke. Do not assume that odorless vapors or fumes are harmless!
2. Identify the material by finding any one of the following:
   - The 4-digit ID number on a placard or orange panel;
   - The 4-digit ID number on a shipping document or package; and
   - The name of the material on a shipping document, placard, or package.
3. Look up the material's 4-digit guide number in either:
   - The ERG2004 ID number index (yellow-bordered pages); and

- The name of material index (blue-bordered pages).

EXAMPLE OF PLACARD AND PANEL WITH ID NUMBER

The 4-digit ID Number may be shown on the diamond-shaped placard or on an adjacent orange panel displayed on the ends and sides of a cargo tank, vehicle or rail car.



Source: 2004 Emergency Response Guidebook

4. Follow the ERG2004 manual's instructions paying particular attention to materials with warning designations.
5. Obtain necessary help by contacting the San Diego Fire Department, Caltrans District Hazmat Manager, or other specialty trained HAZMAT responders.
6. DO NOT approach the material until it is known EXACTLY what it is and if it's safe. Do not help others until all hazards are known. Only when it is safe, approach upwind with caution.

13.0 TIM PROGRAMMATIC RECOMMENDATIONS

13.1 TIM Programmatic Recommendations

Throughout this plan, there has have been a number of references to TIM programs and their benefits. Typically, those regions that have comprehensive, sustained, programs have experienced significant reductions in travel delay and overall incident duration as well as improvements in the area of responder and motorist safety. Furthermore, TIM programs have served to greatly enhance transportation-public safety partnerships and relationships.

It should be recognized that even in areas without formal TIM programs, agencies still must perform some type of incident response. In other words, someone responds to incidents that occur. Thus, the goal of a TIM program is not to create a response, but rather to create a more effective, efficient response for all responding agencies. This distinction is very important. Incident response in and of itself, does not entail the same degree of coordination, planning, and conscious effort required for TIM to be effective.

At a minimum, the following activities are recommended in establishing and sustaining an on-going TIM program:

a. Identify a "champion" agency or individual to lead program development.

b. Involve and encourage participation from all responding agencies/stakeholders.

c. Meet regularly to:

   - Confirm and reinforce goals and objectives.
   - Discuss on-going problem areas and needs.
   - Collaborate in the development of solutions, strategies, and enhancements.
   - Conduct incident after-action reviews and debriefings (see below).
   - Monitor training needs.
   - Establish, reinforce, and renew relationships with responders.

d. Identify and/or establish funding source(s).

e. Oversee solution, strategy, and enhancement implementation.

f. Monitor progress, evaluate strategies (see below), and identify benefits.

g. Conduct TIM benefits outreach and "in-reach".

13.2 Evaluation Guidelines

The routine monitoring and evaluation of TIM activities, solutions, and strategies is important to assessing the program's overall success in achieving its goals and objectives. One method for evaluation includes incident after-action reviews or debriefs. The purpose of debriefing traffic incidents is to evaluate the decisions made and actions taken during the incident and to identify any opportunities for improvement. The debriefing should be held to constructively critique the decisions made and actions taken at an incident to determine if future responses need to be improved or if additional resources or procedures are needed. All collision reports and other emergency agency reports should be obtained prior to the scheduled debriefing. It is important to emphasize that no "finger pointing" is allowed or tolerated in these sessions. Specific points of discussion should include, but are not limited to, 1) were proper TIM guidelines and practices followed; 2) were the actions and decisions made effective; 3) what were the limiting factors in carrying out the proper guidelines (e.g., lack of training, extenuating circumstances, lack of resources, communication problems, etc.); and 4) what changes are needed to improve the procedures. The agency serving as Incident Command for the incident should conduct the meeting within one to two weeks of the incident and request through the TIM program a notification of all affected agencies prior to the meeting. Documentation of the debriefing in minutes or report format should be provided to all TIM program members and appropriate follow-up pursued.

A more formal evaluation of a given TIM strategy may be required for assessing cost/benefit and/or if federal funding was used for deployment. The structure and formality of the evaluation process used will depend on the complexity and available data to base the evaluation on. In any case, the evaluation process and criteria should be rooted in the TIM program's goals and objectives.

APPENDIX A

I-15 MANAGED LANES
TIM WORKSHOP
INCIDENT SCENARIOS [1]

[1] The content of this Appendix was used as a handout for discussion during the TIM Workshop on September 14, 2006.

I-15 Managed Lanes Operations and Incident Management Plans Study

Traffic Incident Management (TIM) Workshop Scenarios

September 14, 2006

Scenario 1 – Stalled Vehicle

Day/Date: Tuesday, April 28, 2009

Time: 7:20am

ML Configuration: 3S+1N

Description:

A motorist using a cell phone calls 911 to report a small truck is blocking a lane of traffic. The 911 call taker at the TMC asks the motorist where the blockage is located. He replies that he is driving towards Escondido and he had to drive on the shoulder around the truck since it is the only lane in that direction. He is not from the area and does not know exactly where it is but he remembers driving past "Bernardo Parkway or something".

Scenario 2 – Struck Barrier and Gravel Spill

Day/Date: Sunday, February 22, 2009

Time: 2:00am

ML Configuration: 2S+2N

Description:

CHP reports that the ML Barrier SB near Mira Mesa Blvd. has been struck, is significantly out of alignment, and looks to be damaged. The barrier was likely struck by a gravel truck since there is gravel spilled in the SB ML travel lanes. There are currently no vehicles involved except for motorists slowing or swerving to drive through or around the spilled gravel. The heavy rain the area continues to experience likely contributed to the incident.

Scenario 3 – Rear-End Collision, Fire, and Fatality

Day/Date: Friday, May 22, 2009

Time: 4:10pm

ML Configuration: 1S+3N

Description:

Multiple cellular 911 calls are reporting a passenger car has rear-ended a tanker truck at a high-rate of speed and is wedged underneath the trailer. The incident is NB I-15 approximately ½ mile north of the Poway Rd./R. Penasquitos Blvd. interchange in the number 1 lane. CHP rolls up and confirms the incident/location and reports that the passenger vehicle is burning. It does not appear that any passengers in the car have escaped and thus are unconfirmed fatalities. The tanker driver however is conscience and is sitting on the pavement in front of his vehicle with what appears to be a head injury. CHP also reports thick black smoke and some of the flames are blowing into at least 2 of the NB managed lanes and requests the managed lanes be closed. The wind is 15 mph from the east. From a distance CHP can read the number 3346 from the tanker's placard and after consulting his HAZMAT Emergency Guidebook determines that the tanker contains Phenoxy a flammable, toxic liquid herbicide. Due to the upcoming Memorial Day weekend, traffic is extremely heavy in both directions on I-15 making response and access to the scene difficult.

Scenario 3a – Escalation of Scenario 3

Day/Date: Friday, May 22, 2009

Time: 4:25pm

ML Configuration: 1S+3N

Description:

CHP can not approach the burning car due to the intense flames. Knowing that the tanker's contents are highly flammable and toxic, on-scene CHP relocates the tanker driver upwind and establishes an initial 150 foot perimeter around the incident scene except for the nearby managed lanes where traffic remains and is moving very slowly due to the flames/smoke and gawkers. The only first responders currently at the scene are CHP and FSP. Both are working to establish the perimeter and assisting with traffic control. Dispatch reports that Fire Department ETA is 5-10 minutes. Suddenly, the tanker explodes and in doing so, falls on its side, burning.

Scenario 4 – Mass Evacuation

Day/Date: Monday, September 14, 2009

Time: 1:30pm

ML Configuration: 2S+2N

Description:

A suspected act of terrorism in downtown San Diego has necessitated an evacuation order for all businesses and residents within a 5 mile radius of downtown. Congestion is extensive on all outbound freeways including I-15.

Scenario 5 – Post Incident Public Complaints

Day/Date: Wednesday, January 21, 2009

Time: 10:30am

ML Configuration: 2S+2N

Description:

Approximately one-month after opening the middle section of I-15 managed lanes project, a major incident occurs SB I-15 during the morning peak that severely impacts traffic for approximately 2 hours. Due to a variety of reasons, the morning peak managed lane configuration was 2S+2N and remained that way during the incident. Motorists on SB I-15 were delayed up to 3 hours due to the incident. Public complaints began pouring in demanding an answer why the barrier wasn't moved to provide additional inbound lanes. Also, being a slow news day, all the major media networks picked up the story.