

# TRUCK RESTRICTION STUDY

## PHASE II

CALTRANS – DISTRICT 11

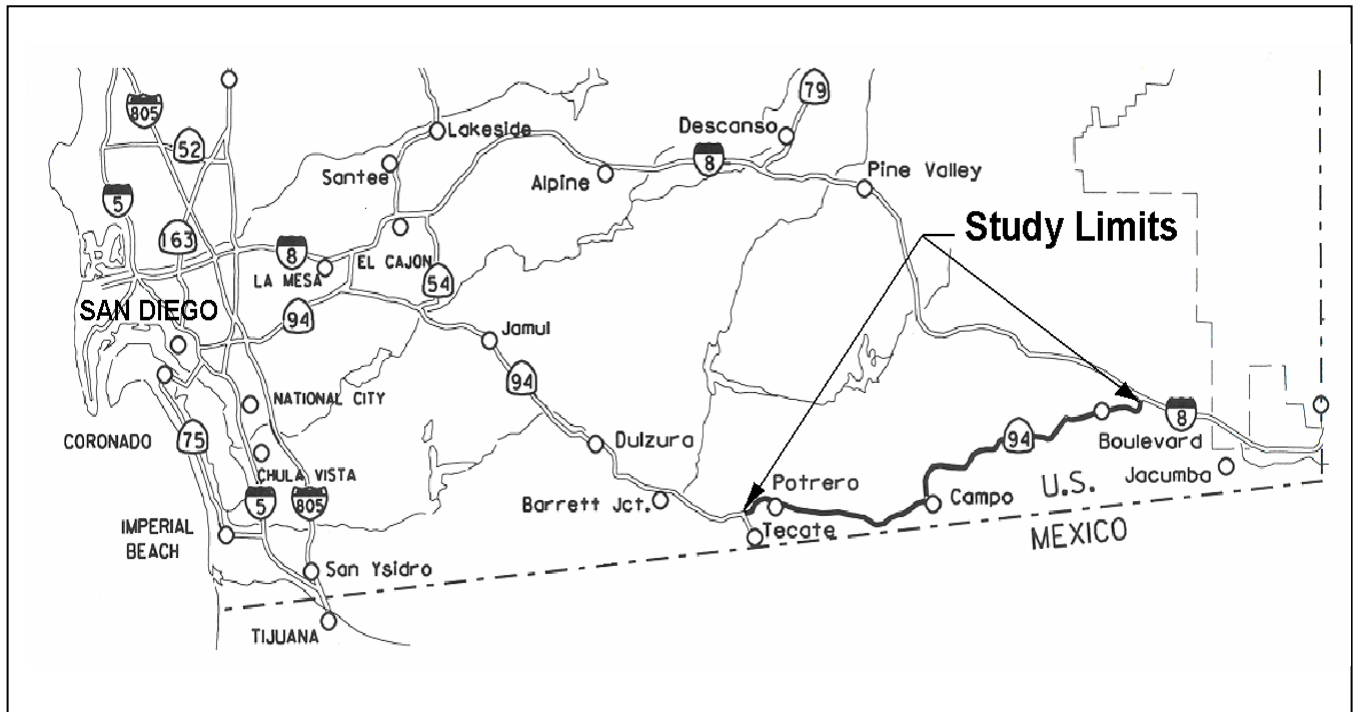
SAN DIEGO COUNTY

STATE ROUTE 94

STATE ROUTE 188 TO INTERSTATE 8

KP 62.6 TO KP 105.3

(PM 38.9 TO PM 65.4)



NOVEMBER 2001

## **INTRODUCTION**

This study provides information for assessing the appropriateness of truck restrictions on a portion of State Route 94 (SR-94) from State Route 188 (SR-188) KP 62.6 (PM 38.9) to Interstate 8 (I-8) KP 105.2 (PM 65.4). This study evaluates the existing highway geometrics related to trucks crossing the centerline (barrier stripe) into the opposing lane or crossing the edge of traveled way and paved shoulder onto the unpaved area in order to negotiate curves on the portion of SR-94 shown in Exhibit 1. This study has two parts: the length of trucks currently using the highway, and the existing nonstandard <sup>1</sup> roadway geometrics including: lane and shoulder widths, horizontal curve radii and curve lengths.

## **PURPOSE AND NEED**

This document is Phase II of a two-phase study. The segment of SR-94 from Otay Lakes Road KP 39.7 (PM 24.7) to SR-188 KP 62.6 (PM 38.9) was evaluated in January 1999. SR-188 is a 3.1 km (1.8 mi) segment of highway that connects SR-94 with the international port of entry at Tecate, Mexico. Interstate commerce must also be addressed when truck restrictions are considered. The United States Supreme Court has ruled that truck length can not be restricted unless atypical accident rates have established a substantial impact on safety.

This study is the first step in the consideration of truck restrictions in accordance with section 35401(f) of the California Vehicle Code (Appendix A). Chapter 1378, Statutes of 1986 (SB 2232, McCorquodale) increased the maximum kingpin-to-rear axle (KP-RA) length of tractor-semitrailer combination vehicles from 38 feet to 40 feet. SB 2232 directed the California Department of Transportation (Caltrans), in consultation with the California Highway Patrol (CHP), to determine which State highways could not sustain the operation of tractor-semitrailer combinations of 40-foot KP-RA. The Vehicle Code was amended by Chapter 1021, Statutes of 1988 (SB 2175, McCorquodale) to reflect this change. On May 21, 1998 Bill AB 2253, that proposed that Caltrans be empowered to prohibit trucks to a length less than 38 feet, was defeated in the California State Assembly.

## **BACKGROUND**

SR-94 was adopted into the State Highway System in 1933. Before passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), SR-94 was classified as a rural minor arterial and was part of the Federal Aid Primary System. Then, SR-94 was included as part of the National Highway System in November, 1995. Now the route is classified as a Principal Arterial between downtown San Diego and SR-188, and as a Minor Arterial from SR-188 to I-8.

State Route 94 connects the City of San Diego with smaller east county rural communities and Interstate 8 near the community of Boulevard. It is also the only east/west route on the United States side of the U.S./Mexico international border connecting Tecate, Mexico with San Diego. In addition to local traffic, it serves both interregional and international travel in the area.

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<sup>1</sup> Does not meet the minimum standards in the Highway Design Manual, Section 307.3 and Design Information Bulletin Number 79.

## EXISTING FACILITY

Within the study area, Route 94 is a two-lane conventional rural highway constructed of asphalt concrete. Within the surveyed sections of the study area, the pavement width varies from 6.8 m (22 ft) to 8.2 m (27 ft). The right of way width is 12.2 m (40 ft) from KP 62.6 (PM 38.9) to KP 84.5 (PM 52.5) and 15.2 m (50 ft) wide from KP 84.5 (PM 52.5) to KP 105.2 (PM 65.4).

In accordance with the *Truck Kingpin to Rear Axle Length State Highway System Evaluation Report* dated December 1989, the section of SR-94 from Otay Lakes Road, KP 39.7 (PM 24.7), to Tierra Del Sol Road, KP 101.7 (PM 63.2), has been identified as geometrically inadequate for use by truck tractor-semitrailer combinations exceeding a 9.14 m (30 ft) kingpin to rear axle (KP-RA) length (Exhibit 4a). This section of SR-94 traverses mountainous terrain, and is shown on the *Truck Networks on California State Highways Map* as a route not advised for tractor-semi trucks with kingpin to rear axle lengths greater than the posted value of 9.14 m (30 ft) (KP-RA Advisory).

Caltrans conducted a field evaluation in February 1998. The vehicle used was a truck tractor-semitrailer with a 14.63 m (48 ft) trailer and the KP-RA length set to 12.19 m (40 ft). The truck was driven along SR-94 in both directions from Otay Lakes Road, KP 39.8 (PM 24.7), to Live Oak Springs Road, KP 98.2 (PM 61.0). The truck was video taped to document where the tires crossed the centerline stripe and/or went off the edge of pavement. This occurred at areas with nonstandard horizontal curves (radius between 76-92 m (250-300 ft)) and narrow shoulders. The locations of these areas within the study limits are shown on Exhibit 2 and listed in the following table:

<b>LOCATIONS OF NONSTANDARD GEOMETRICS</b>					
Between SR-188 and Interstate 8					
<b>Loc.</b>	<b>Kilometer Post</b>	<b>Post Mile</b>	<b>Kilometer Post</b>	<b>Post Mile</b>	<b>Reason for Concern</b>
	<b>East Bound</b>		<b>West Bound</b>		
I	62.7 – 63.1	39.0 – 39.2	62.7 – 63.1	39.0 – 39.2	Curve / Cliff
J	67.3 – 67.4	41.8 – 41.9	67.38	41.87	Curve / Tree WB
K	76.2 – 76.9	47.5 – 47.8	76.6	47.6	Rock face / Tree WB
L	79.0 – 79.2	49.1 – 49.2	79.1	49.15	Rock face / Creek / Tree WB
M	79.3 – 79.6	49.3 – 49.5	79.58	49.45	Rock face / Creek / Tree WB
N	81.71	50.77	81.6 – 81.8	50.7 – 50.8	Pole EB / Blind Curve
O	83.14	51.66	82.9 – 83.2	51.5 – 51.7	Tree EB / Curves
P	84.54	52.53	84.3 – 84.7	52.4 – 52.6	Pole EB / Curves
Q	91.6 – 91.9	56.9 – 57.1	91.6 – 92.2	56.9 – 57.3	Curves / Rock face
R	92.7 – 93.0	57.6 – 57.8	92.7 – 93.0	57.6 – 57.8	Curve
S	93.3 – 93.7	58.0 – 58.2	93.62	58.17	Curves / Tree WB
T	96.1 – 96.6	59.7 – 60.0	96.1 – 96.4	59.7 – 59.9	Winding road / Rock face
U	96.6 – 96.9	60.0 – 60.2	96.6 – 96.9	60.0 – 60.2	Curve / Rock face
V	97.33	60.48	97.3 – 97.5	60.4 – 60.6	Tree EB / Cut face / Ravine
W	98.00, 98.15	60.90, 60.99	97.8 – 98.3	60.8 – 61.1	Trees EB / Reversing curves

It should be noted that San Diego County Highway S1, Buckman Springs Road, is a route used by some vehicles heading eastbound to I-8 going from Tecate, and westbound vehicles from I-8 going to Tecate. There have been proposals by some officials and citizen groups to add highway signs to direct trucks to use this route. However, due to a lack of public consensus, this signing revision is not advocated by this study. Additionally, the revision does not meet the purpose and need of this study which is to analyze traffic operations on SR-94.

## TRAFFIC

### Traffic Volumes and Operating Conditions

ROUTE 94 SEGMENT	YEAR	ADT	LEVEL OF SERVICE
SR-188 to Buckman Sprgs. Rd. KP 62.6 – 83.9 (PM 38.9 – 52.2)	2000	1,750	C
	2020	7,000	E
Buckman Sprgs. Rd. to I-8 KP 83.9 – 105.2 (PM 52.2 – 65.4)	2000	1,100	B
	2020	5,000	E

The 2000 truck traffic was approximately 6% of the Average Daily Traffic (ADT).

### Accident History

The accident history data from the Traffic Accident Surveillance & Analysis System (TASAS) Report for the period of December 31, 1997 through December 31, 2000<sup>2</sup> indicate the following accident rates:

ROUTE 94 SEGMENT	Total Accidents (ACC)	ACTUAL Accident Rates (ACC/MVM)				STATEWIDE AVERAGE <sup>3</sup> (ACC/MVM)			
		F	F+I	PDO	Total	F	F+I	PDO	Total
SR-188 to Buckman S.R. KP 62.6 – 83.9 (PM 38.9 – 52.2)	54	0.042	1.22	1.05	2.27	0.037	0.85	0.87	1.72
Buckman S.R. to I-8 KP 83.9 – 105.2 (PM 52.2 – 65.4)	38	0.000	0.73	1.41	2.14	0.035	0.77	0.82	1.59

ACC = Accidents

MVM = Million Vehicle Mile

F = Fatality Rate (# Fatal Accidents)/MVM

I = Injury Rate (# Injury Accidents)/MVM

PDO = Property Damage Only Rate (# PDO Accidents)/MVM

Total = Total Rate (# Fatal + # Injury + # PDO Accidents)/MVM

<sup>2</sup> Accident reports processed after the date of the TASAS request (07-31-01) are not included in this total.

<sup>3</sup> Statewide average for similar facilities.

Since trucks comprise 6% of the average daily traffic, over the three years approximately 6 truck related accidents would be anticipated. The TASAS report listed 9 accidents involving trucks for the three-year time period and post mile limits shown above. Two conclusions may be drawn from this; either truck restrictions are necessary, or SR-94 is in need of operational improvements to facilitate trucks without restriction.

#### California Highway Patrol (CHP)

The CHP has responsibility for the traffic law enforcement activities on Route 94. Since 1991 the CHP has enhanced truck inspection activities and, in response to community concerns, they have stepped up their surveillance and enforcement along the route.

### **VEHICLE CODE RESTRICTIONS ON TRUCK LENGTH**

The California Vehicle Code (CVC) Section 35000, Division 15 governs vehicle width, length, height, weight, and load limits. These sections define, where federal law has not preempted, the California legal truck that must be allowed to operate on every state highway and local street or road. The general rule and the more important exemptions and conditions of the codes relating to truck length are summarized below. The CVC should be consulted for further details, and other exceptions and conditions not listed here. The current CVC uses English units; therefore no Metric equivalent units are shown in the following summary and excerpts.

#### General Rule

CVC Section 35400 provides, as a general rule, that no vehicle shall exceed a KP-RA length of 40 feet. However numerous exceptions to this rule are listed in the section.

CVC Section 35401(a) provides that no combination of vehicles shall exceed a total length of 65 feet.

CVC Section 35401(b) states that for a truck tractor, semitrailer, and trailer combination, the total length shall not exceed 75 feet if the length of neither the semitrailers nor the trailer in the combination of vehicles exceed 28 feet 6 inches.

#### Exceptions and Conditions

CVC Section 35400(b)(4) states that the limitation of 40 feet does not apply to a truck-semitrailer combination if the distance from the kingpin to the rearmost axle does not exceed 40 feet for semitrailers having two or more axles, or 38 feet for one axle.

CVC Section 35401(f) permits Caltrans to restrict the kingpin to rear axle length of semitrailers to not less than 38 feet. The basis for this is safety. The general rule is 40 feet. This section is also the basis for the maximum kingpin to rear axle KP-RA advisory signing on designated state highways.

CVC Section 35401.5 incorporates the National Network requirements into California law and allows longer vehicles to operate on the National System of Interstate and Defense Highways and terminal access routes. The federal regulations state that the length of the

semitrailer in exclusive combination with a truck tractor does not exceed 48 feet. However, a semitrailer not more than 53 feet in length may be reconfigured with two or more rear axles and still meet the KP-RA limitation of 40 feet.

## **EVALUATION CRITERIA**

The basic criteria for mainline evaluation is that trucks must be able to stay on the paved width available (lane width plus paved shoulder in their direction of traffic). Offtracking computer software, highway as-built plans, aerial photographs, survey data, field reviews, video taping, and engineering judgement are used in evaluating the highway geometrics for truck access and use.

### Offtracking

The definition of offtracking as described in the *Highway Design Manual*:

“Any vehicle whether car, bus, truck, or combination tractor semi-trailer traveling around a circular curve will sweep a wider path than the width of the vehicle. The steering axle, controlled by the driver, can generally follow a circular curve, but the following axles (or trailers) will swing inward toward the center of the curve sweeping a wide path defined by the wheel tracks of the outside front wheel and the inside rear wheel. The difference between the swept width and the vehicle width is referred to as offtracking.”

### Computer Model – AutoTURN<sup>®</sup>

AutoTURN<sup>®</sup> is a computer aided design (CAD) based program that simulates low speed turning maneuvers for highway vehicles and aircraft. This program calculates the location and orientation of the vehicle as it is steered along a pre-defined path and can be used to determine vehicle tire tracking and swept paths. The path is that of the center of the vehicle steering axle, and is drawn in the CAD environment. AutoTURN<sup>®</sup> comes with complete sets of standard vehicles including the Caltrans Standard Vehicles, as defined in the *Highway Design Manual Figure 404.2* (The California Design Vehicle is shown in Exhibit 4b). This program was used to evaluate the extent of offtracking for trucks with the specific KP-RA length of 12.19 m (40 ft), negotiating specific turns along SR-94 within the study limits. These computer simulation runs were able to show how much roadway width was needed for this size of truck to negotiate the highway at the identified curve locations without crossing the centerline, and was used in determining the roadway widening and realignment for Alternative 2.

## **ALTERNATIVES**

### Alternative 1 – No Action / No Restriction / Maintain Advisory Signs

The purpose and need of this study was to determine if trucks should be restricted on this segment of SR-94. A restriction in truck length would increase the number of trucks using the road, which is not an operational improvement. So, the current truck traffic will still be allowed (keep the existing 9.1 m (30 ft) advisory signs in place) with a high level of surveillance by the CHP.

This alternative would maintain the existing 9.14 m (30 ft) KP-RA advisory signs on SR-94. This alternative does not address the problem with the existing nonstandard roadway

geometrics, and would only be effective if the trucks using the route were restricted to the maximum advised length. With this alternative, as the traffic volume increases, so could the potential for truck and automobile accidents if the same types of trucks (longer than the advised maximum) continue using this route.

#### Alternative 2 – Minimal Widening, Realignment and/or Restriping

This alternative proposes to revise the existing roadway geometrics to enable the trucks to physically stay on the pavement and not cross centerline. Locations M, N & P only require relocating the centerline, while the rest of them require wider pavement. Any roadway widening to a width less than standard will require design exceptions. For environmental reasons, the width of the roadway would be increased only as much as necessary to make it possible for the trucks to stay in their lane, plus provide a 0.6 m (2.0 ft) shoulder. On average, the widening would need to be about 0.8 m (2.6 ft) in the vicinity of the subject curves. About one-third of the locations require additional right of way. The existing right of way is 12.2 m (40 ft) wide to the West of Location P and 15.2 m (50 ft) wide to the East.

#### Alternative 3 - Realignment and Widening to Minimum Standards (9.6 m wide)

This alternative proposes to revise the existing roadway to standard geometrics as outlined in Section 307 of the Highway Design Manual and the Design Information Bulletin Number 79 – Geometric Design Criteria for Resurfacing Restoration and Rehabilitation Projects (RRR). RRR design criteria apply to bridge and pavement projects on two-lane conventional highways for certain operational improvements and safety funded nonfreeway projects. These criteria apply to geometric design features such as lane and shoulder widths, horizontal and vertical alignment, cross slope, superelevation, side slope and clear recovery zone. The RRR criteria were used in the preliminary engineering to upgrade the areas where trucks were offtracking. To reduce environmental impacts, the preliminary engineering for these locations minimized the proposed cut areas by using retaining walls.

RRR criteria states those roadbed widths less than the “Roadbed Minimum” must be widened to the “Roadbed Desirable Minimum”. These values are dependent upon the current traffic (1,750 ADT). At the time of this report, the corresponding minimum value is 8.4 m (27.6 ft) and the desirable minimum is 9.6 m (31.5 ft). All of the locations have pavement widths less than 8.4 m, so the widening needs to be to the full 9.6 m. Location Q still needs 10.4 m (34.1 ft) and all but locations O, P, S & W may require additional right of way.

#### Alternative 4 - Realignment and Widening to Current Caltrans Standards (12 m wide)

This alternative also proposes to revise the existing roadway to standard geometrics for Resurfacing Restoration and Rehabilitation Projects (RRR). This alternative addresses the need to use a higher, future ADT value, which should be obtained at the time the project report is written. The current projection for traffic in 2020 (up to 8,000 ADT) corresponds to a minimum value of 9.6 m (31.5 ft) and desirable minimum of 12.0 m (39.4 ft). All of the study locations require additional right of way for this alternative.

## LOCATION DESCRIPTIONS

### Location I – KP 62.7 – KP 63.1 (PM 39.0 – PM 39.2)

This location is immediately east of the SR-188 intersection and this curved portion of the roadway clings to a very steep hillside. A rock cliff and a steep drop off in this location will make any improvement expensive.

### Location J – KP 67.3 – KP 67.4 (PM 41.8 – PM 41.9)

### Location O – KP 82.9 – KP 83.2 (PM 51.5 – PM 51.7)

### Location V – KP 97.3 – KP 97.5 (PM 60.4 – PM 60.5)

### Location W – KP 97.8 – KP 98.3 (PM 60.8 – PM 61.1)

These locations have existing oak trees or bushes adjacent to the roadway, on both sides in some cases. In all cases, any roadway improvement exceeding the minimum (Alt. 2), removal of oak trees or bushes will be necessary. Also, due to the terrain in these locations, retaining walls and/or roadside cuts will be necessary to make Alt. 3 or 4 improvements.

### Location K – KP 76.2 – KP 76.9 (PM 47.5 – PM 47.8)

### Location L – KP 79.0 – KP 79.2 (PM 49.1 – PM 49.2)

### Location M – KP 79.3 – KP 79.6 (PM 49.3 – PM 49.5)

These locations have rock outcroppings on the eastbound side of the roadway and oak trees, bushes and a creek on the westbound side. Only Alt. 2 improvement would save the trees and would not entirely eliminate the need to cut into the rock face. Alt. 3 and 4 improvements will necessitate retaining wall construction employing methods to avoid debris from entering any ESA adjacent to the stream.

### Location N – KP 81.6 – KP 81.8 (PM 50.7 – PM 50.8)

### Location P – KP 84.3 – KP 84.7 (PM 52.4 – PM 52.6)

### Location S – KP 93.3 – KP 93.7 (PM 58.0 – PM 58.2)

These locations are only similar to each other in the respect that corrections to alignment are needed to correct non-standard sight distance and/or irregular superelevation cross slopes. Two utility poles will need to be relocated for Alternative 4. Otherwise, the environmental impacts are not as extreme as other locations.

### Location Q – KP 91.6 – KP 92.2 (PM 56.9 – PM 57.3)

### Location R – KP 92.7 – KP 93.0 (PM 57.6 – PM 57.8)

### Location T – KP 96.1 – KP 96.6 (PM 59.7 – PM 60.0)

### Location U – KP 96.6 – KP 96.9 (PM 60.0 – PM 60.2)

These locations have reversing curves, some on mountainous grade. Straightening and widening the roadway will require cuts into the rock face, localized boulder removal and some loss of oak bushes. The curve radii range from 38 m to 60 m along this section of SR-94 and include many of the accident sites.

A table comparing alternatives 2, 3 and 4 is shown in Exhibit 3. Also, see Exhibit 5 for aerial photographs of the area.

## **SUMMARY**

This report concludes that State Route 94, from State Route 188 to Interstate 8, has nonstandard sections of roadway that inhibit the ability of truck tractor-semitrailers with KP-RA length over 9.1 m (30 ft) to negotiate the highway without crossing the centerline or going off the existing edge of pavement.

To address this issue, four alternatives have been discussed:

- 1) Continue to allow trucks up to KP-RA length of 12.19 m (40 ft) and keep the existing 9.1 m (30 ft) advisory signs in place (maintain status quo) since the legislation was defeated that proposed that Caltrans be empowered to prohibit trucks to a length less than 38 feet,
- 2) Revise the roadway geometrics by realigning the nonstandard curves and widening the traveled way to accommodate the length of truck that is legally allowed [12.2 m (40 ft)], but design exceptions would be required,
- 3) Revise the roadway, bringing it up to minimum standard width of 9.6 m (31.5 ft), based on the current ADT, and
- 4) Revise the roadway, bringing it up to minimum standard width of 12.0 m (39.4 ft), based on a future project year ADT.

Further studies are required to address the environmental issues and processes related to Alternatives 2 through 4. These studies should be consistent with the other projects currently being developed for the Route 94 corridor. Also, the amount of cut can be reduced through further refined design, but, in-depth geotechnical studies are required for more detailed engineering. The type of rock and soil will dictate the best engineering strategy to use for each location. Impacts to the community character and resources of the area are a major issue with local communities. Controversy may arise even with minor impacts.

## **RECOMMENDATIONS**

It is recommended that future activities related to the segment of SR-94 evaluated in this study be classified as immediate, intermediate and future goals. The purpose and need of this study was to determine if trucks should be restricted on this segment of SR-94. A restriction in truck length would increase the number of trucks using the road, which is not an operational improvement. So, as an immediate goal, the current truck traffic will still be allowed (keep the existing 9.1 m (30 ft) advisory signs in place) with a high level of surveillance by the CHP.

The recommended intermediate goal is to implement a combination of Alternatives 2, 3 and 4 within Locations I through W that can be accomplished within the confines of the Categorical Exemption/Categorical Exclusion environmental process. Each location should be evaluated to determine which Alternative is best suited for that location. The level of improvement selected for each location would be the least environmentally damaging practical alternative (LEDPA), as determined by Caltrans environmental staff.

The recommended future goal is to diligently pursue the appropriate environmental document for projects that would further improve locations I through W not addressed in the intermediate goal. These locations may require an EIS/EIR document to determine the full impact and assure all environmental issues are addressed.

## REFERENCES

- 1) "Truck Restrictions, Overview of Existing Authority and Procedures Pertaining to Truck Restrictions", Caltrans, February 1994 Draft
- 2) "State of California 2001 Vehicle Code Through the 2000 Legislative Session"
- 3) "Highway Design Manual" Fifth Edition, Caltrans, January 1999
- 4) "Route Concept Report State Route 94", Caltrans, January 1991
- 5) "Rural Highway 94 - Corridor Study", SANDAG, January 2001
- 6) "State Route 94 Passing Lanes San Diego County, Negative Declaration Finding of No Significant Impact", Caltrans, May 1998
- 7) "Technical Report State Route 94 Corridor, Tecate Port of Entry: Trade and Truck Traffic", SANDAG, July 9, 1997
- 8) "Rural Highway 94 Corridor Study Technical Advisory Committee Data", SANDAG, February 2000
- 9) Map titled "Truck Networks on California State Highways", Caltrans, January 1998
- 10) "Truck Kingpin to Rear Axle Length State Highway System Evaluation Report", Caltrans, December 1989
- 11) "Truck Networks and Offtracking Analysis", Caltrans, September 1994
- 12) "AutoTURN<sup>®</sup> Version 3.0 User's Guide, Revised August 1997
- 13) "Truck Restriction Study, SR-94 from Otay Lakes Road to SR-188", Caltrans, January 1999