Caltrans

Route 127
Route Concept Report

California Department of Transportation
District 9
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Abbreviations

Units of Measurement

m.....meter (1 m = 0.3048 feet)
mm.....millimeter
kg.....kilogram (1 kg = 35.3 lbs)
km.....kilometer (1 km = 0.62 mile)
Mha..... million hectares (1 ha = 2.47 acres)
MT.....metric tonne (1MT = 1000 kg = 1.1 ton)
MTHM.....metric tonne heavy metal
KP.....kilometer post
PM.....post mile
mph.....miles per hour

Miscellaneous

ADT.....Average Daily Traffic
AADT.....Average Annual Daily Traffic
BLM..... Bureau of Land Management
Caltrans.....California Department of Transportation
DOE.....U.S. Department of Energy
DVCC.....Death Valley Chamber of Commerce
DVNP.....Death Valley National Park
I.....Interstate
LOS.....Level of Service
NTS..... Nevada Test Site
OCRWM.....Office of Civilian Radioactive Waste Management
RV..... Recreational Vehicle
SHELL.....Subsystem of Highways for the Movement of Extra Legal Permit Loads
SR.....State Route
UTC..... Ultimate Transportation Corridor

STATEMENT OF PLANNING INTENT

This Route Concept Report is a planning document which expresses the California Department of Transportation's (Caltrans) judgment on what the characteristics of the state highway should be to respond to the projected travel demand over a twenty-year planning period. This report contains the Department's goals for the development of State Route 127 within Inyo County in terms of Level of Service (LOS) and broadly identifies the nature and extent of improvements needed to achieve those goals. It is a preliminary step in the planning process which leads to subsequent programming and preparation of the Route Development Plan—a systems analysis that indicates the LOS possible on the route at various funding levels.

Facility information (e.g., roadway widths, number of lanes, etc.) described in this report represents an initial planning approach to scoping candidate improvements. All information in this report is subject to change as conditions change and new information is obtained. Consequently, the nature and size of identified improvements may change through the later stages of project development, with final determinations made at the time of project planning and design.

The draft version of this report was prepared by Environmental Science Associates, Inc., a consultant, with oversight by Caltrans, in cooperation with Inyo County Planning staff. The final report was prepared by Caltrans Planning staff.

ROUTE CONCEPT REPORT
SUMMARY SHEET
State Route 127
09-Iny-127-0.00/79.53 (PM 0.00/49.42)

ROUTE CONCEPT

Shoulder widening, horizontal curve realignments, relocation of several sections of highway, and minor drainage improvements are necessary in order to improve the operational and safety characteristics of State Route 127. District 9's concept for this facility is *Level of Service C.*

CONCEPT RATIONALE

According to Section 307.3 of the 1995 Metric Highway Design Manual, widening paved shoulders is justified as part of roadway Resurfacing, Restoration, and Rehabilitation projects not only by the current traffic volumes but also by the projected and anticipated traffic mix. Realignment of several horizontal curves will enhance the roadway's operational and safety characteristics. Relocation of certain sections of highway will eliminate the potential for flash flood related damage to the facility.

ISSUES OF CONCERN

State Route 127 is under consideration for use as a haul route for truck shipments of radioactive waste to both the proposed radioactive waste repository at Yucca Mountain, Nevada, and the Nevada Test Site. Significant increases in the daily truck traffic on the route are possible.

The combined effect of narrow paved and soft dirt shoulders causes operational and safety concerns with regards to vehicles that are slow moving or are forced to perform emergency maneuvers. The narrow paved shoulders and the relatively high percentage of trucks and recreational vehicles reduce roadway capacity and operational characteristics.

The posted speed limit on SR 127 is 60 mph but numerous horizontal curves on the route have much lower advisory speeds. The advisory speeds for the majority of these curves are between 40 and 50 mph but two such curves, immediately south of Death Valley Junction, are posted at 25 and 35 mph.

Flash floods present recurring problems at numerous locations where the roadway crosses the normally dry Amargosa River. On average such flooding occurs twice a year causing considerable damage to the pavement surface and supporting roadbed, and results in road closures for sustained periods once every two years. **[a]**

Two culvert locations on this route show evidence of significant erosion. These drainage facilities need to be modified in order to eliminate potential damage to the roadway.

PROPOSED IMPROVEMENTS

The District recommends the following roadway improvements, as funding becomes available:

- Widen paved shoulders to 0.6 m minimum between KPs 1.29/9.01 (PM 0.8/5.6), 9.49/22.20 (PM 5.9/13.8), and 60.67/79.53 (PM 37.7/49.4);
- Relocate the highway to the bluff line west of the current alignment between KPs 35.08/37.66 (PM 21.8/23.4) and 46.99/50.85 (PM 29.2/31.6) constructing new roadway with 2.4 m paved shoulders;
- Realign horizontal curves at KPs 22.85, 25.75, 27.20, 28.00, 29.45, 32.51, 55.79, 59.54 and 63.08 (PMs 14.2, 16.0, 16.9, 17.4, 18.3, 20.2, 34.7, 37.0,39.2 and 41.6, respectively) constructing new roadway with 2.4 m paved shoulders; and,
- Improve drainage facilities located near KPs 17.70 and 77.25 (PMs 11.0 and 48.0, respectively).

ROUTE CONCEPT REPORT
State Route 127
09-Iny-127-0.00/79.53 (PM 0.00/49.42)

ROUTE DESCRIPTION

State Route (SR) 127 extends northward from its southern junction with Interstate 15, near Baker, in San Bernardino County, for 66.79 km through Caltrans District 8 to the Inyo County line. From there SR 127 traverses 79.53 km through Caltrans District 9, in Inyo County, to the Nevada State boundary where it is designated Nevada SR 373. SR 127 intersects SR 178 east and west junctions in Shoshone and SR 190 in Death Valley Junction (refer to Exhibits A & B).

State Route 127 is functionally classified as a Minor Arterial, is part of the National Highway System, and is included in the Freeway and Expressway System. It is an eligible highway in the Scenic Highway System although it is not currently designated as a scenic highway. The route is not included in the Subsystem of Highways for the movement of Extra-Legal Permit Loads (SHELL) system; nor does AB 866 [b] or the Federal Highway Administration as a route suitable for larger trucks designate it.

State Route 127 is a rural two-lane conventional highway. In Inyo County, the traveled lanes are each generally 3.6 m wide with about half of the total existing paved shoulders measuring less than 0.6 m in width.

ROUTE SEGMENTATION

State Route 127, in Inyo County, is designated as Segment 1. For planning purposes, however, the route has been divided into the following four sub-segments:

Sub-segment 1: KP 0.00/23.74 (PM 0.00/14.75) Extending from the San Bernardino/Inyo County line to the junction of SR 127 and SR 178 east, in Shoshone.

Sub-segment 2: KP 23.74/26.44 (PM 14.75/16.43) Extending from the junction of SR 127 and SR 178 east, in Shoshone, to the junction of SR 127 and SR 178 west, north of Shoshone.

Sub-segment 3: KP 26.44/67.83 (PM 16.43/42.15) Extending from the junction of SR 127 and SR 178 west, north of Shoshone, to the junction of SR 127 and SR 190 at Death Valley Junction.

Sub-segment 4: KP 67.83/79.53 (PM 42.15/49.42) Extending from Death Valley Junction at the junction of SR 127 and SR 190 to the Nevada State Line.

ROUTE PURPOSE

In 1994, Inyo County and Caltrans conducted a highway travel survey on SR 127 to determine a profile of the highway's users. This survey, hereinafter referred to as the *1994 Travel Survey*, was conducted in two parts. The first part of the study, spanning five consecutive days between the 26th and 29th of March, captured all traffic coming into the system at each of five locations. The second part, conducted on the 16th and 17th of May, captured all north and southbound traffic on SR 127 at each of two locations, one of which was over a 24-hour period. Each vehicle passing a station was stopped, the vehicle type and number of occupants noted, and the drivers asked to respond to a number of questions including purpose for trip and geographic locations of origin and destination. Survey results indicated that about 66 percent of all trips on this route were recreational in nature while only about 20 percent were work and/or business related. The survey revealed that as high as 87 percent of all trips began and ended outside the SR 127 corridor. Since most travelers on this highway are visitors to Death Valley National Park (DVNP), SR 127 has local, regional, and interstate significance.

Of major importance to the long range system planning of SR 127 is the fact that, although neither a designated SHELL highway nor an AB866 truck route, this highway is being considered as a potential designated route for transporting high-level radioactive waste to the proposed nuclear waste repository at Yucca Mountain, Nevada. It is also being considered as a route to transport transuranic materials (protective clothing, etc., with low levels of radioactive contamination) from the Nevada Test Site to the Waste Isolation Pilot Plant located in New Mexico.

Information provided by the Death Valley Chamber of Commerce, in Shoshone, indicates that as high as 25 percent of the trucks currently traveling SR 127 are hauling hazardous waste to the Nevada Test Site near Mercury, Nevada and to the U.S. Ecology commercial hazardous waste disposal facility near Beatty, Nevada. **[a]**

ROUTE CONCEPT

State Route 127 currently provides a theoretical *LOS A*; however, reduced advisory speeds through numerous horizontal curves and regulatory speed limits through Shoshone limit the Level of Service to much lower than *A* in spot locations. Since the traffic volume on SR 127 is so low, and locations with reduced operating speeds somewhat isolated, *LOS A* conditions prevail along most of the overall route segment.

The District's concept Level of Service is *C* for all four sub-segments of the route. With a projected one percent annual growth rate in daily traffic over the next 20 years, better than *LOS C* conditions should be maintained along the entire route segment. District 9 will determine if physical and/or operational improvements are necessary to restore the roadway to the concept Level of Service if conditions along SR 127 deteriorate beyond this level. Table 1 summarizes the current and concept Levels of Service and facility types for the four sub-segments of SR 127.

Table 1: Level of Service and Facility Type for State Route 127, in Inyo County

Route	Location	Current		Concept	
Sub-segment	KP (PM)	LOS	Facility	LOS	Facility
1,2,3,4	0.00/79.53 (0.00/49.42)	A \1\	2C \2\	C	2C

\1 Indicates a theoretical *LOS A* over the majority of the route segment
\2 Indicates a two-lane, conventional highway

CONCEPT RATIONALE

Due to low traffic volumes and District 9's priorities, the primary concept for SR 127 is to keep the road open and in safe operating condition. Since this is a minor arterial/low volume route it has been assigned a Maintenance Service Level rating of 3. Caltrans may determine that this route should be upgraded to a higher Maintenance Level of Service should the traffic conditions of SR 127 change considerably.

Even though this facility is currently Maintenance Service Level 3, widening paved shoulders is justified not only by the current traffic volume but also by the projected and anticipated traffic mix. Realigning several horizontal curves will increase the operating speeds while enhancing the roadway's operational and safety characteristics. Relocating specific sections of highway will eliminate the expenses and traveler inconvenience and hazards due to flash flood related damage and road closures. Improving certain drainage systems will lessen the likelihood that future storm runoff will damage and/or close the roadway.

ROUTE ANALYSIS

Land Use

The region through which SR 127 passes is characterized as a rural, sparsely populated area. The Death Valley Chamber of Commerce estimates that the current population east of DVNP within Inyo County is only about 450 people—a density of less than one person per square mile. **[c]** Data provided in 1990 by the Inyo County Planning Department indicate that the population density of a five-mile bandwidth along SR 127 is about 1.3 persons per square mile. The 1990 Federal Census indicated that the entire region sustained only about 840 people, most of whom were listed as residents of Furnace Creek, within DVNP. Shoshone sustains a population of about 150 people. There are some 225 people residing in the Tecopa/Tecopa Hot Springs area located a few miles east of SR 127. **[d]**

State Route 127 is located along the eastern boundary of DVNP. In late 1994, Congress passed the Desert Protection Act, SB 21, which expanded the size of Death Valley National Monument by 0.48 Mha and reclassified it as a National Park. The Act transferred ownership and management responsibility from the Bureau of Land Management (BLM) to the National Park Service and moved the eastern Park boundary right up to the highway right of way. Given the highway's

close proximity to the Park and its predominant use by recreational travelers, it can be stated that SR 127 supports the region's economic viability.

Some 5.06 Mha of land in the California Desert Conservation Areas surrounding DVNP are administered by BLM. Included in this vast area are the Ibex Hills Wilderness, located between Shoshone and DVNP, and a large area in Nevada, adjacent to Inyo County. BLM manages these lands for grazing, mining, and recreation according to the multiple use/sustained yield philosophy.

Mining was a traditional economic mainstay for this region until the late 1980s when several mines cut back or eliminated operations entirely because of environmental constraints. Due largely to the decline of mining activity, population and economic activity have dwindled. Regional unemployment has been high over the past five to seven years. According to the 1990 Federal Census, available through the Department of Finance, response to *Journey to Work* indicates very limited employment opportunities. The Federal Census indicated that more than 60 percent of those responding to the *Mode to Work* question either worked at home or were close enough to walk to their place of employment. Travel time to place of employment was found to be ten minutes or less for over 80 percent of the population and fifteen minutes or less for over 90 percent. **[d]**

The State Department of Finance forecasts negligible economic growth for this region due to its isolation, primarily public lands ownership, and DVNP's strict environmental regulations. **[e]**

Existing Facilities

Type of Facility
State Route 127 in Inyo County is a rural, two-lane, conventional highway.

Pavement Width (Traveled Way)
The average total width of traveled way on SR 127, in Inyo County, is about 7.3 m, with some notable exceptions. Between KPs 64.73 and 67.59 (PM 40.0/42.0), a relatively straight section with few sight distance restrictions, the traveled way is as narrow as 7.07 m. The traveled way measures about 7.16 m through Death Valley Junction and is as narrow as 6.71 m near the SR 178-East junction, although the lanes widen to 8.53 m in the intersection.

Pavement Condition (Traveled Way)
A Pavement Deflection Study conducted on this route by Caltrans staff in May 1995, revealed that the average evaluated (80th percentile) deflection levels, measured at 1.6 km intervals, exceeded tolerable levels over much of the highway's length. The study reported that roadway conditions exhibited varying degrees of transverse, lateral, and alligator cracking throughout. During the field inspection of pavement conditions, the most deteriorated pavement conditions were observed between KPs 54.72 and 59.54 (PM 34.0/37.0), with slightly better conditions continuing northward to KP 74.03 (PM 46.0). Also noted was that chip seals had been applied to most areas with cracking. The roadway through Death Valley Junction exhibits substantial cracking but has received no such treatment. Although pavement conditions between KPs 74.02 and 79.53 (PM 46.0/49.42) also show signs of transverse and lateral cracking, the roadway is generally in better condition than the segment to the immediate south. The District's *Pavement History and Plan* indicates that there has been no overlay work performed on the segment between KPs 55.52 and 79.53 (PM 34.5/49.42) since 1980, nor have chip seals been placed since 1985. **[f]**

Pavement Width (Shoulder)
About 51 percent of the existing paved shoulders are less than 0.6 m wide and overall average only about 0.4 m in width. Refer to Exhibit C for a schematic drawing and to Table 2 for a summary of paved shoulder widths along the highway. The width of unpaved shoulders is as much as, and at times exceeds 2.44 m, but these generally consist of loosely compacted dirt, crushed stone, or gravel. Cracking and failure at the edge of pavement is prevalent along the roadway without paved shoulders. This condition was observed at KPs 8.85, 17.70, and 55.52 (PMs 5.5, 11.0, and 34.5, respectively) and is likely to exist at other locations. **[f]**

Table 2: Paved Shoulder Widths on State Route 127, in Inyo County

Width (m)	0	0.30	0.6	1.2	2.4
Length (km)	21.24	19.31	37.66	1.45	0.16
Percentage of Segment	27	24	47	2	NA

Right of Way (Existing)
Much of the property on either side of SR 127 is publicly owned. The highway right of way, both owned in fee by Caltrans and with prescriptive rights, varies in width between 30.5 and 122 m over the course of the entire route segment.

Terrain
SR 127 traverses the scenic, desolate, relatively flat desert terrain of the Amargosa River Valley, at elevations ranging from 396 to 701 m above sea level. The highway profile grades throughout the segment are generally less than 3 percent. Table 3 presents a summary of average profile grades for the route segment.

Table 3: Average Profile Grades on State Route 127, in Inyo County

Grade Percentage	Less than 3	Between 3 & 6	Greater than 6
Percentage of Segment	98	1	1

Sight distance restrictions along the route are relatively few but numerous horizontal curves have posted advisory speeds ranging between 25 and 50 mph. The percentage of the segment with sight restrictions is only about 12 percent.

Interchanges, Signals and Changeable Message Signs
There are no existing or planned grade-separated interchanges, traffic signal-controlled or four-way stop controlled intersections, or changeable message signs on SR 127, in Inyo County.

Parallel and Alternate Facilities
There are two alternate paved facilities for local travel along this segment of SR 127, both of which add considerable time for the motorist intending to travel SR 127. State Route 178 West intersects SR 127 north of Shoshone and ultimately connects with SR 190 in Furnace Creek. SR 178 east may be traveled to Pahrump to connect with State line Road and ultimately intersect SR 127 near Death Valley Junction.

Bicycles
Bicycle travel is allowed on SR 127 but there are no facilities such as designated bicycle route signing, striped bike lanes, separate paths, or designated rest/parking stops. The total length of SR 127 with paved shoulders that could reasonably accommodate bicycles is negligible. Organized special events do attract cyclists to the area during the year, but are only occasional in nature.

Aviation
There are no regularly scheduled passenger- or freight-air services in this region. Aviation facilities near SR 127 are limited to small airfields located in Amargosa, Shoshone, Stove Pipe Wells, and Furnace Creek. Short runways able to accommodate only small aircraft characterize these landing strips. The nearest major commercial air passenger terminal is McCarran Airport in Las Vegas, Nevada, approximately 145 km from Shoshone.

Rail
There is no passenger or freight rail service along the SR 127 corridor. The long-abandoned Tonopah/Tidewater Railroad parallels much of SR 127 through Inyo County. This rail line, defunct since the early 1900's, once operated between Ludlow, California and Goldfield, Nevada. The right of way once occupied by the rail line currently belongs to BLM and the State of California Lands Commission. Although remnants of the original elevated railroad foundation berm still exist, all track and related facilities have been removed.

Roadside Rests
There are no designated rest stop facilities along the four sub-segments of SR 127. Shoshone and Death Valley Junction provide the only convenient roadside areas offering traveler services. Shoshone, 45.1 km from Death Valley Junction and 48.3 km from Pahrump, Nevada, has a general store, gas station, and parking area. Death Valley Junction, 48.3 km from

Furnace Creek, in DVNP, and 37.0 km from Amargosa Valley, Nevada, offers only the Amargosa Hotel in the way of services.

Agriculture Inspection Station

Since SR 127 is not a significant haul-route for agribusiness, there is no California Department of Food and Agriculture Inspection Station near the California/Nevada State boundary.

TRAFFIC DATA

Accident Rates

The accident rates on SR 127 summarized in Table 4 are based on three years of accidents reported between January 1, 1994 and December 31, 1996. Most of the accidents reported during this time period were "run-off-road" incidents and all occurred when the posted speed limit was 55 mph. Since accidents do not become a critical concern until the actual rate is one and a half times the statewide average rate for the type of facility, none of the four sub-segments present an unusual potential for accidents.

Table 4: Three-Year Accident Rate Summary for State Route 127, in Inyo County (based on TASAS data available in District 9 Traffic Department)

Sub-segment		1	2	3	4
Accident	Actual	0.93	1.25	0.69	0.47
Rates	Average	1.20	1.70	1.87	1.55
F+I \1\	Actual	0.67	1.25	0.20	0.47
Rates	Average	0.65	0.90	0.99	0.82

\1\ Fatalities & Injuries

Traffic Volume

Machine vehicle counts were collected and used to determine the type distribution (i.e., trucks, RVs, buses, passenger vehicles) and volume of vehicles traveling on SR 127. The District 9 Traffic Department gathered this data (hereinafter referred to as *1995 Machine Counts* [g]) continuously between mid-December 1994 and the end of December 1995 at a station located south of SR 178 East in Sub-segment 1. Figure 1 illustrates the relative distribution of vehicles determined by this study.

Figure 1: Vehicle Mix of All Traffic Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study)

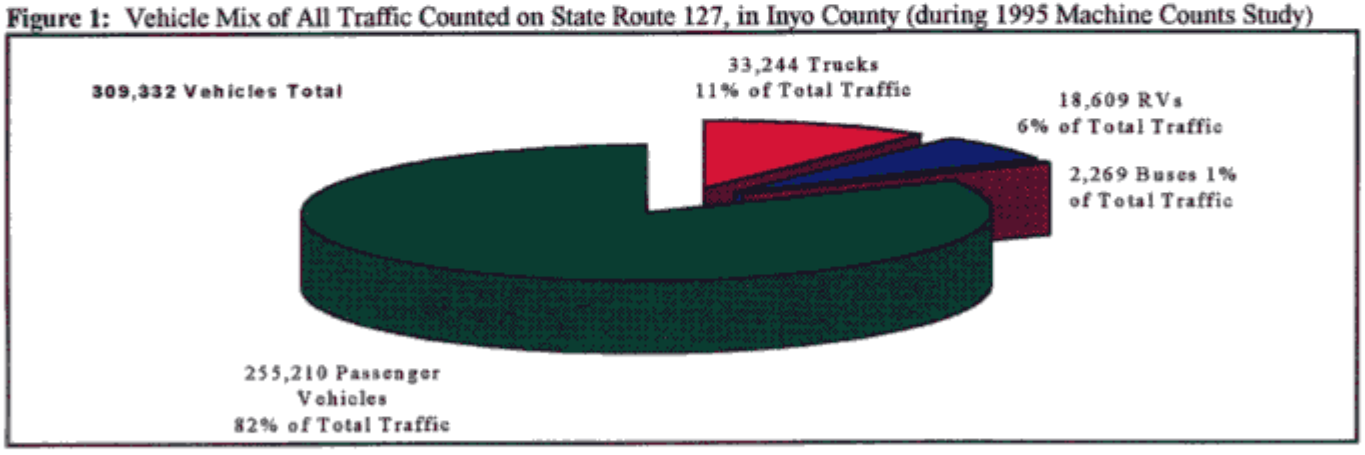


Figure 2 illustrates the monthly distribution of the traffic, which traveled over the count station during the 1995 Machine Counts study period.

Figure 2: Monthly Distribution of All Vehicles (by Type) Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study).

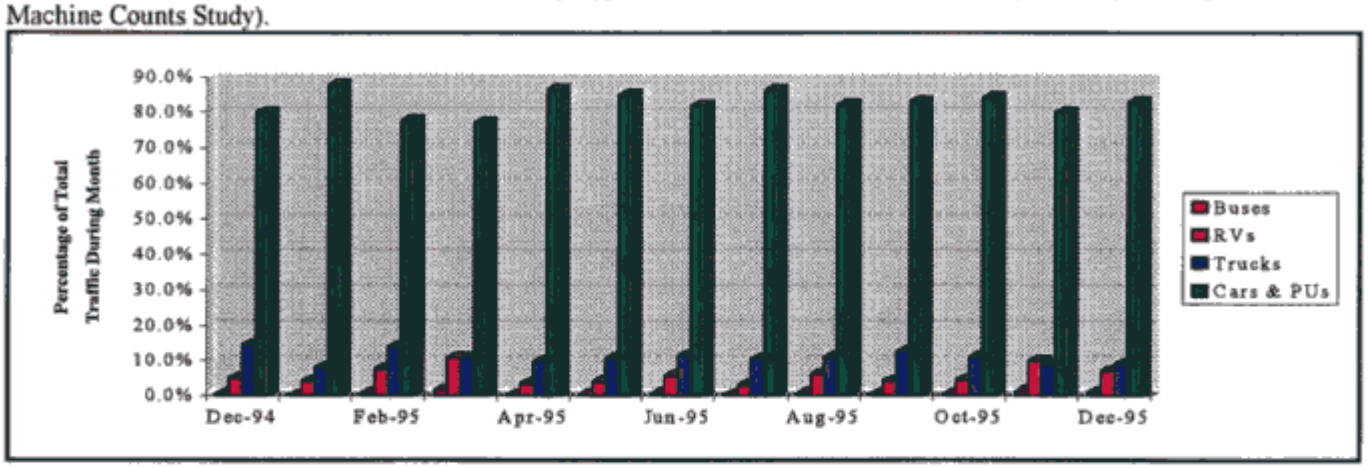
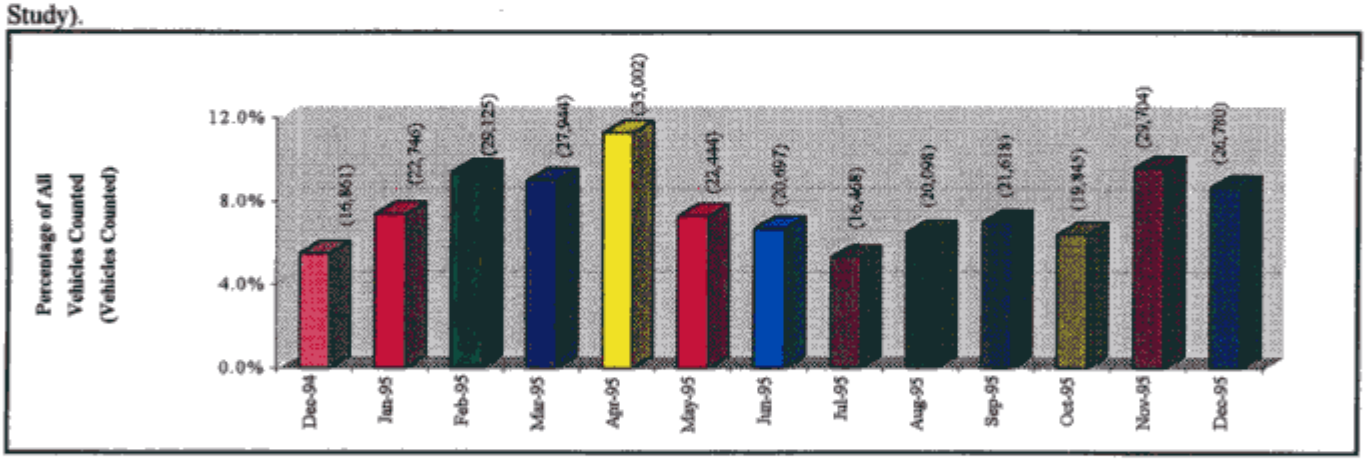


Figure 3 presents the monthly distribution of all vehicles (all types of vehicles combined) counted during the study. The monthly counts ranged from a low of 16,468, in July, to a high of 35,002 vehicles in April and averaged about 23,800 vehicles per month.

Figure 3: Monthly Distribution of All Vehicles Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study).



Transit Services

There are two public transit routes that service the communities of Tecopa and Shoshone to Victorville and Pahrump. The weekly Tecopa-Pahrump route utilizes Route 178 and provides dial-a-ride pickup service in the communities of Tecopa and Shoshone. The trips generated on this route are for basic medical services and basic life necessities (i.e., groceries).

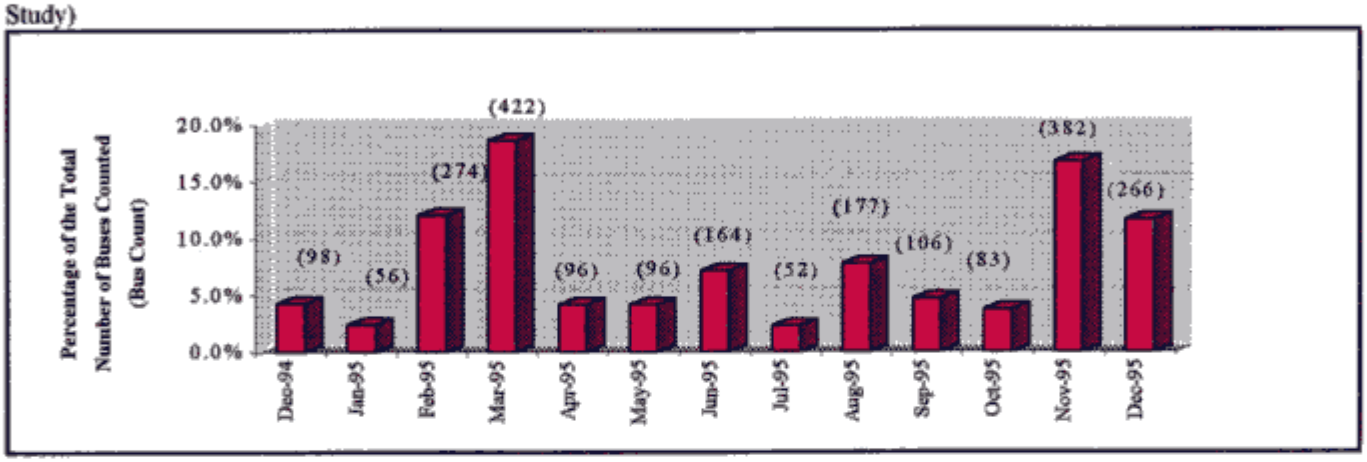
The monthly Tecopa-Victorville route utilizes SR 127 and I-15 as a link to services and to intermodal connections that are not readily available by the Tecopa-Pahrump route. In 1995, the Inyo County Local Transportation Commission established a pilot project to provide transit services for the Tecopa and Shoshone areas to the City of Victorville. With good coordination by the local program administrator, high ridership numbers, and surpassing the farebox return established by the Inyo County Local Transportation Commission this route became permanent in 1996. The Tecopa-Victorville route also interfaces with other transit providers within the cities of Barstow and Victorville upon request. The trips generated on this route are for activities such as shopping, medical appointments, and entertainment.

Buses

SR 127 is used by school buses to transport high school-age students to Pahrump, Nevada. Charter buses also frequent DVNP during the peak tourism months.

Figure 4 shows the monthly distribution of buses relative to the total number of buses counted during the 1995 Machine Count study. Bus volumes accounted for between 0.2 and 1.5 percent of the total traffic counted on SR. These figures are in fair agreement with the 1994 Travel Survey which reported the number of buses at anywhere from one to two percent of the total traffic observed (see Table 5). Bus traffic peaked at 422 vehicles in March, dropped to a low of 52 in July, and averaged about 182 buses per month.

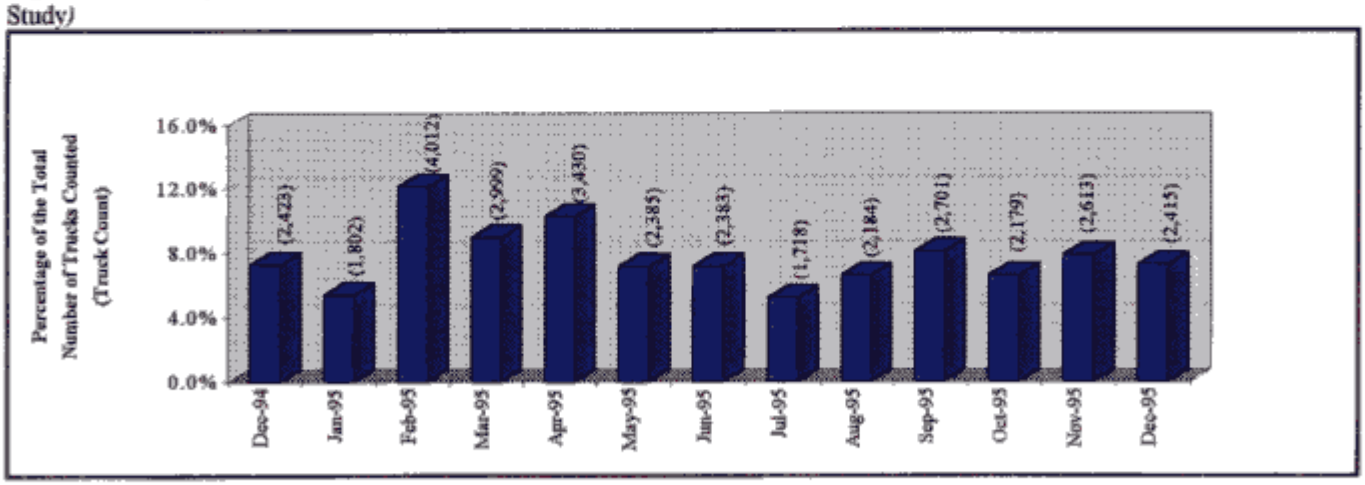
Figure 4: Monthly Distribution of All Buses Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study)



Trucks

Figure 5 shows the monthly distribution of trucks relative to the total number of trucks counted. Trucks (excluding RVs and pickups) accounted for between 8 and 14 percent of the total traffic counted on SR 127. These statistics agree closely with the 1994 Travel Survey which reported the number of trucks at between 9 and 15 percent of the total traffic observed (see Table 5). The 1995 Machine Count Study revealed that truck traffic ranged from a high of 4,012 vehicles in February, to a low of 1,718 in July, and averaged about 2,660 per month.

Figure 5: Monthly Distribution of All Trucks Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study)



Information provided by the Death Valley Chamber of Commerce suggests that the volume of truck traffic has remained relatively constant since the mid 1980s despite widespread mine closures since that time. A Chamber of Commerce representative suggested that this may be attributable to the noticeable increase in the transport of hazardous wastes along the route. [a]

Recreational Vehicles

Figure 6 shows the monthly distribution of RVs relative to the total number of RVs counted during the 1995 Machine Count study. Recreational vehicles comprised between 3 and 11 percent of the total traffic counted on SR 127. These RV counts agree fairly well with the 1994 Travel Survey which reported a range of between 3 and 12 percent of the total traffic observed (see Table 5). The RV traffic peaked in March with 3,016 RVs, dropped to as low as 493 in July, and averaged about 1,490 RVs per month.

Figure 6: Monthly Distribution of All RVs Counted on State Route 127, in Inyo County (during 1995 Machine Counts Study)

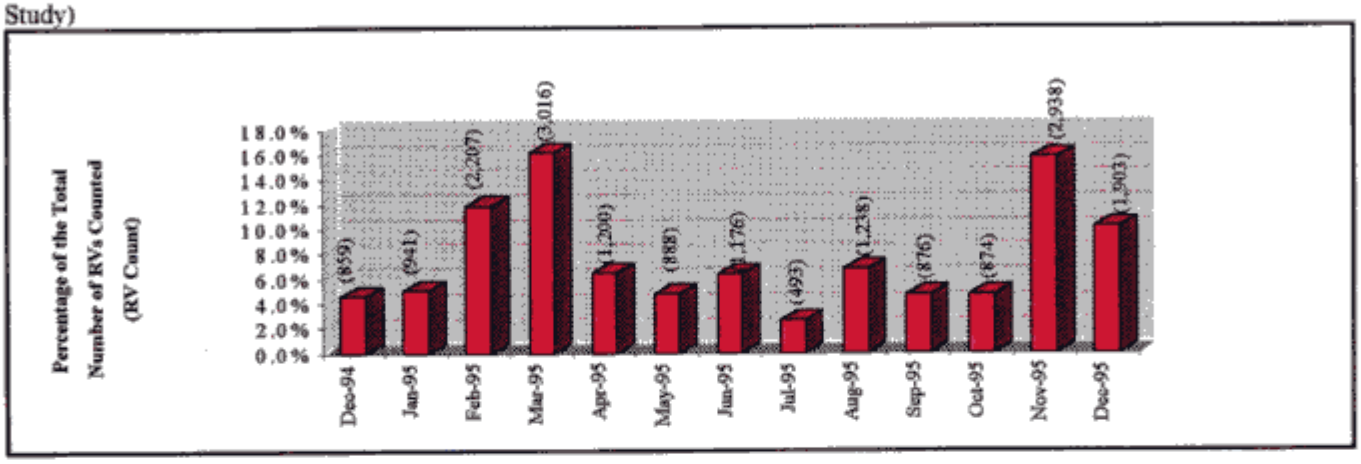


Table 5: Distribution of Buses, Trucks, and RVs Observed on State Route 127, in Inyo County (during 1994 Travel Survey)

	Observed Percentage of Total Traffic			
Sub-segment Number	1	2	3	4
Buses	1-2	1-2	1	2
Trucks	9-11	9-11	11-15	12-13
RVs	4-12	4-12	3-11	3-7

PRESENT AND FUTURE OPERATING CONDITIONS

Current and future operating conditions, such as Level of Service and the Volume-to-Capacity (V/C) ratios, were derived using the methodology outlined in the 1985 Highway Capacity Manual. \h\ In general, Level of Services range between *A* and *F*, with *A* representing ideal, free-flowing conditions and *F*—slow, stop-and-go movement resulting in jammed conditions with extensive delay and congestion.

Table 6 summarizes present and future operating conditions for SR 127. The figures reported for years 2005 and 2015 were calculated with a one percent annual growth rate assuming no improvements will have been made to the system. Each sub-segment of SR 127 currently operates at *LOS A*. During the next twenty-year forecast period Sub-segment 1 will decline to an *LOS B* while the remaining sub-segments will continue to operate at an *LOS A*. These high levels of service are primarily due to the low base and forecast year traffic volumes, the flat terrain, and the unencumbered sight distance along most of the route which results in a low percentage of passing restrictions. The actual spot-Level of Service is as low as *E* in numerous isolated locations due to reduced operating speeds at certain horizontal curves and through the town of Shoshone.

CONDITIONS COVERED BY THE STIP

The improvements proposed in this Route Concept Report for the concept facility are intended to address operational concerns and maintainability of the facility. There are no capital improvement projects programmed for SR 127 in the adopted 1996 State Transportation Improvement Program (STIP) or 1998 Proposed STIP.

Table 6: Present and Future Operating Conditions on State Route 127, in Inyo County

Sub-segment		1	2	3	4
Length (km)		23.80	2.64	41.39	11.70
Location	KP	0.00/23.80	23.80/26.44	26.44/67.83	67.83/79.53
	PM	0.00/14.79	14.79/16.43	16.43/42.15	42.15/49.42
AADT \1\	1995	900	400	300	600
	2005	990	440	330	660
	2015	1098	488	366	732
Year 1996	LOS	A	A	A	A
	V/C	0.06	0.03	0.02	0.03
Year 2005	LOS	A	A	A	A
	D/C	0.07	0.03	0.02	0.04
Year 2015	LOS	B	A	A	A
	D/C	0.08	0.03	0.02	0.04

\1\ AADT denotes the weighted annual average daily traffic, taken from 1996 Highway Inventory Data

PRESENT AND FUTURE CONCERNS

All four sub-segments of SR 127 will probably continue to operate at a high Level of Service over the next twenty years. In the future, if this route is designated as a route used to haul high-level radioactive wastes to Yucca Mountain, and because of the probable cumulative impacts of increased truck traffic on the facility, further improvements not currently included in the District's route concept, i.e., changes to the structural section, capacity, roadway cross-section (shoulder widths), and/or alignment, may become necessary for all four sub-segments. The combined effects of roadway topography, alignment, and the fairly high volumes of truck and RVs could cause delays and possible platooning on all four sub-segments. The recommended shoulder widening, curve realignments, and highway relocations would be necessary in order to accommodate a significant increase in truck traffic due to highway shipments of high-level radioactive wastes.

Sub-segment 1

The operational-related concerns of this sub-segment are suggested by a comparison of the actual-to-average accident rates to those of Sub-segments 3 and 4. Nearly all of the accidents that occurred during the previously noted accident history were "run-off-the-road" type and all occurred in the areas with narrow paved shoulders. Widening the narrow paved shoulders between KPs 1.29 and 10.30 (PM 0.8/6.4) and between KPs 10.78 and 23.17 (PM 6.7/14.4) would improve the operational conditions, especially where joint use by bicyclists is concerned. The horizontal curve at KP 22.85 (PM 14.2) has a reduced advisory operating speed.

Sub-segment 2

The horizontal curve at about KP 25.75 (PM 16.0) is actually a broken back curve with a reduced advisory speed. The geometrics of this combination of curves, if improved, would enhance the roadway operational characteristics. The actual fatality and injury accident rate was slightly higher than the average rate. The single reported accident occurred at the north end of this curve. It should be noted that the cause of the accident was speeding and defective vehicle or equipment leading to overturning.

Sub-segment 3

Deteriorated pavement conditions along specific sections of this sub-segment may warrant resurfacing. The worst pavement conditions exist between KPs 55.52 and 59.54 (PM 34.5/37.0) but pavement conditions between KPs 59.54 and 74.03 (PM 37.0/46.0) are also deteriorating and may require pavement maintenance.

Portions of this sub-segment between KPs 35.08 and 37.66 (PM 21.8/23.4), and between KPs 46.99 and 50.85 (PM 29.2/31.6) cross the normally dry Amargosa Riverbed. Even with drainage systems in generally good condition, certain locations are vulnerable to severe flooding which occasionally results in extended roadway closure and considerable damage to the paved surface, roadbed, and embankment.

Widening the paved shoulders between KPs 60.67 and 67.83 (PM 37.7/42.15) would improve the operational conditions on this sub-segment.

Realigning the horizontal curves at KPs 27.20, 28.00, 29.45, 32.51, 55.79, 59.54, and 63.08 (PMs 16.9, 17.4, 18.3, 20.2, 34.7, 37.0, and 39.2, respectively), which all have reduced advisory speeds, would enhance the operational characteristics within this sub-segment.

The horizontal curves immediately south of Death Valley Junction, at KPs 41.6 and 41.7 (PM 25.8 and 25.9), are highly restrictive, short radius curves that slow traffic to 35 and 25 mph. Realigning these curves would significantly improve the operational characteristics of this sub-segment.

Sub-segment 4
Even though the actual accident rate on this sub-segment is considerably lower than the statewide average for this type of facility, the overall narrow width of paved shoulders between KP 67.83 and 79.50 (PM 42.15/49.4) does reduce the operational conditions.

In the future, roadway maintenance along much of this sub-segment may be necessary due to the substantial transverse, lateral, and alligator cracking present in the pavement.

IMPROVEMENTS TO ACHIEVE CONCEPT PLAN

The recommended improvements shown below are conceptual in nature and meet the requirements of a Maintenance Level 3 roadway; they will not increase traffic capacity but will enhance the operational characteristics and minimize the periodic maintenance requirements. Identification of precise locations, alignment, cross-section designs, right-of-way requirements, and construction costs will require further analysis as part of the project study and design process.

Sub-segment 1:
- Widen paved shoulders between KPs 1.29 and 10.30 (PM 0.8/6.4) and between KPs 10.78 and 23.17 (PM 6.7/14.4) to a minimum of 0.6 m
- Realign horizontal curve at KP 12.87 (PM 8.0), construct 2.4 m paved shoulders
- Repair erosion damage at culvert near KP 17.70 (PM 11.0)

Sub-segment 2:
- Realign broken-back horizontal curve at KP 25.75 (PM 16.0), construct 2.4 m paved shoulders
- Improve angle of intersection with old State Highway at KP 24.94 (PM 15.5) to 90 degrees

Sub-segment 3:
- Overlay with asphalt concrete between KPs 55.52 and 59.54 (PM 34.5/37.0) and in Death Valley Junction
- Widen paved shoulders between KPs 60.67 and 67.83 (PM 37.7/42.15) to a minimum of 0.6 m
- Relocate the route to follow the bluff line to the west of the current alignment between KPs 35.08 and 37.66 (PM 21.8/23.4), and between KPs 46.99 and 50.85 (PM 29.2/31.6), construct 2.4 m shoulders
- Realign horizontal curves at KPs 27.20, 28.00, 29.45, 32.51, 55.79, 59.54, and 63.08 (PMs 16.9, 17.4, 18.3, 20.2, 34.7, 37.0, and 39.2, respectively), construct 2.4 m shoulders

Sub-segment 4:
- Widen paved shoulders between KPs 67.83 and 79.53 (PM 42.15/49.42) to a minimum of 0.6 m
- Improve drainage characteristics of system at KP 77.25 (PM 48.0) to reduce erosion problems

Pavement Deflection Study Summary

The following is a summary of roadway surface rehabilitation strategies recommended in the *Pavement Deflection Study.* **[f]** In several areas, rehabilitation is recommended due to the extent and frequency of load-induced alligator cracking, even though the average evaluated deflection level is below the tolerable level. These recommendations are designed to provide an additional ten years of service life for the roadway while minimizing maintenance costs. These strategies are based on the traffic/design scenarios designated by the varying traffic index (TI) value shown below:

TI 7.5: Continuation of existing truck volume and percentage of ADT

TI 8.5: A doubling of existing truck volume and percentage of ADT, including shipments of radioactive materials to Yucca Mountain, weighing up to 36,288 kg

TI 9.5: Overload trucks specially designed to haul high-weight, multi-purpose canisters of radioactive materials to Yucca Mountain, weighing upwards of 113,400 kg are present on roadway

Alternative 1:
Locate specific areas of severe pavement failure—identified by rutting greater than 15 mm, and/or loose or spalling pavement—and cold plane the existing surface to a depth of 30 mm. Dig out and repair areas of localized failure, seal cracks wider than 5 mm, then place a dense graded asphalt concrete [to the depths shown in Table 7] for reflection crack retardation or for structural adequacy.

Alternative 2:
All rehabilitation strategy for this alternative is the same as Alternative 1 except that asphalt rubber hot mix-gap graded overlay [to the depths shown in Table 7] is recommended in lieu of dense graded asphalt concrete.

Table 7: Asphalt Concrete Overlay Depth Recommendations (from Pavement Deflection Study)

KP Limits	PM Limits	Alternate 1 Dense Graded AC (mm)			Alternate 2 Asphalt Rubber Hot Mix Gap Graded (mm)		
		Traffic Index			Traffic Index		
		7.5	8.5	9.5	7.5	8.5	9.5
0.00/11.27	0.0/7.0	45	45	45	30	30	30
11.27/14.48	7.0/9.0	120	165	180	60	45\2\	60\1\
14.48/16.90	9.0/10.5	60	90	120	45	45	60
16.90/22.53	10.5/14.0	105	150	165	45	45\1\	45\2\
22.53/27.36	14.0/17.0	180	210	225	60\1\	60\3\	60\4\
27.36/41.84	17.0/26.0	45	60	60	30	30	45
41.84/53.11	26.0/33.0	45	45	45	30	30	30
53.11/67.59	33.0/42.0	45	90	120	30	45	60
67.59/71.61	42.0/44.5	150	195	210	45\1\	60\2\	60\3\
71.61/79.50	44.5/49.4	105	150	165	45	45\1\	45\2\

\1\ Place dense graded asphalt concrete (DGAC) 45 mm thick prior to placing asphalt rubber hot mix-gap graded (ARHM-GG)

\2\ Place DGAC 60 mm thick prior to placing ARHM-GG

\3\ Place DGAC 75 mm thick prior to placing ARHM-GG

\4\ Place DGAC 90 mm thick prior to placing ARHM-GG

TRANSIT/HIGH OCCUPANCY VEHICLE CONSIDERATIONS

Transit or high occupancy vehicle measures will not contribute to the route concept; the identified shortcomings are limited to issues related to operations, safety, and maintainability.

THE ULTIMATE TRANSPORTATION CORRIDOR

With the exception of paved shoulders, it is unlikely that the SR 127 would have to be widened beyond its current condition within the 20-year study time frame for the following reasons: the Inyo County General Plan does not anticipate substantial economic development within the corridor; virtually all land along the route is publicly-owned inhibiting commercial development; the low base-year traffic volumes would have to grow enormously to justify an expansion of the facility for increased capacity; and, the State of California forecasts low growth in both local and regional traffic volumes.

The Ultimate Transportation Corridor (UTC) should incorporate the improvements recommended herein to achieve the concept plan of improving the operational and safety characteristics. In the next 20 to 50 years, recreational opportunities could expand in or near the study corridor and DVNP. If past trends continue, metropolitan Las Vegas and southern

California will experience growth, and consequently the travel demand in this corridor may eventually exceed that of a two-lane facility. Initial measures aimed at increasing capacity would include installation of left turn and acceleration lanes and appropriate forms of traffic controls at existing or future intersections. It is conceivable that in the next half century, expansion of this facility to four lanes could be required to accommodate an increased demand.

Effects of Nuclear Waste Shipments on the UTC Requirements [i]

In the foreseeable future, the roadway cross section and Maintenance Service Level may be dictated by the need to accommodate truck shipments of radioactive waste to and from the proposed repository at Yucca Mountain, Nevada and the Nevada Test Site (NTS).

The U.S. Department of Energy, Office of Civilian Radioactive Waste Management (DOE-OCRWM) plans to transport radioactive waste and spent nuclear fuel using the General Atomics GA-4/9 canister system on legal-weight truck-trailer combinations weighing less than 36.3 MT. With specially designed, light-weight transport-trailers to haul them, these legal-weight, semi-trailers would be 18.29 m long and 2.44 m wide. The allowable canister size constraint limits legal-weight trucks to carrying total payloads of about 24.6 MT with each shipment's total payload consisting of approximately 2 metric tonnes of heavy metal, MTHM (uranium, plutonium, etc.).

The DOE-OCRWM has developed a series of access options to Yucca Mountain and NTS that include truck access via SR 127/Nevada SR 373. This corridor is an integral part of two (of the three) candidate routes under consideration. Shipments of high-level radioactive waste along this corridor may pass to Yucca Mountain and the NTS, via I-15, in the quantities dictated by two shipment scenarios—*primarily long-distance rail* and *highway only*.

In the *primarily long distance rail shipment* scenario, the majority of waste would be transported over long distance railways. DOE estimated that legal-weight trucks would transport the balance of material—anywhere from 2,000 to 7,000 MTHM—over a 35 year acceptance period. This amount constitutes anywhere from 4 to 11 percent of the total amount that Yucca Mountain could ultimately accept. At about 2 metric tonnes heavy metal per legal-weight truck shipment, nearly 3,500 truck shipments in all might be necessary, an average of about 8 shipments per month.

In the *highway shipment only* scenario the DOE assumed no rail or intermodal access to Yucca Mountain. Consequently, the SR 127/373 corridor would conceivably accommodate the highway transport of about 45,414 MTHM of radioactive waste. This would result in about 22,707 shipments using GA-4/9 canisters, an average of 54 shipments per month.

According to one source, "the largest number of shipments to or from a single site would occur at NTS...A combined total of more than 295,000 truck shipments or more than 106,000 rail shipments of waste could occur at NTS, or about 118 truck shipments or 42 rail shipments per day (assuming receipt of shipments during 250 days per year)." **[j]** This estimate of truck traffic would result in a range of from 13% to 40% increase in the overall average daily traffic.

When considering the current condition of the highway, i.e., capacity, typically narrow paved shoulders, the presence of numerous restrictive horizontal curves, and the existing alignment through the occasionally flooded Amargosa river, as well as the current fairly high volume of truck traffic, the potential frequency of shipments raises numerous maintenance, operational, and safety related concerns.

Given the conditions on SR 127 where many of the existing paved shoulders are narrower than the stated minimum width, and the projected increased truck traffic, Caltrans' metric design guidelines require 1.2 m paved shoulders on the right side of vehicle lanes as part of roadway Resurfacing, Restoration, and Rehabilitation projects. This being the case, the recommended minimum shoulder width would double from 0.6 to 1.2 m. Truck volumes could also possibly warrant installation of passing lanes in some locations. The cumulative impacts of truck shipments of radioactive waste to Yucca Mountain and NTS could also affect Caltrans' designated Maintenance Service Level and the District's plans for pavement overlay and repair strategies as well as the roadway structural section, cross sectional and alignment design.

LONG RANGE OPERATIONS PLAN COORDINATION

The District works cooperatively with local, regional, and other state agencies in developing route concept plans. Route Concept Reports are circulated internally within Caltrans and externally to interested agencies. Departments, agencies,

entities, and individuals are consulted, their input solicited, and, if appropriate, incorporated during the draft review stage. The Route Concept Report is compatible with relevant goals and programs of the District's Long Range Operations Plan and the District System Management Plan. **[k]** These include such elements as motorist information services (i.e. message signs), ongoing surveillance and traffic data collection programs, truck census programs, highway operational elements and improvements, and incidence response actions.

San Bernardino County's General Plan states that it (the County) will "strive to achieve *LOS C* on all highways," with the concept for SR 127 as a two-lane facility with *LOS C* requiring maintenance only. **[l]** The Inyo County General Plan states that "all two-lane state highways with average daily traffic counts between 1,500 and 3,000 shall generally have an eight-foot shoulder." The portion of SR 127 in Inyo County has not yet achieved this traffic volume threshold and as such, 2.4 m shoulders are not mandated.
This Route Concept Report may be updated as needed to reflect new information and changing priorities, particularly as needs related to facilitating material shipments to Yucca Mountain become more definite. In the event that SR 127 is selected as a haul route, considerable capital improvements would be necessary to safely accommodate shipments of high-level radioactive waste, regardless of the transport scenario implemented. Caltrans' District 9 would request DOE to fund the necessary facility improvements as mitigation of impacts to the transportation system.

District 9 has worked in cooperation and coordination with the Inyo County Planning Department and its Yucca Mountain Repository Assessment Office that is responsible for monitoring ongoing site characterization tasks for the proposed high-level radioactive waste repository at Yucca Mountain. The forecasted travel demand and facility requirements are consistent with the most recent Inyo County General Plan Land Use designations, Regional Development Plans, demographic forecasts, and the Regional Transportation Plan.

ENVIRONMENTAL CONSIDERATIONS

The segment of SR 127 in Inyo County passes through the Amargosa River Valley. This is a low elevation region of the Mojave Desert in the transition between Great Basin Desert and the Sonoran Desert that contains some special status plant and animal species.

The desert marshes present in this region support vegetation such as tule (*Scirpus acutus*), cattail (*Typha* sp.), willows (*Salix exigua, S. gooddinggii, S. lasiolepis, and S. laevigata*), and an occasional mesquite thicket (*Prosopis pubescens and P. juliflora*). **[m,n]** The small playas of alkaline soil found along the riverbed support wormwood (*Iva acerosa*), white rabbit brush (*Chrysothamnus albidus*), Amargosa nitrophila (*Nitrophila mohavensis*), and alkali sacaton (*Sporobolus airoides*). **[n]** A population of Tecopa bird's-beak (*Cordylanthus tecopensis*), a federal candidate (C2) plant species, is reported to exist in an alkali flat located approximately 3 miles south of Shoshone, along the Amargosa River.

The Amargosa vole (*Microtus californicus scirpensis*), a federal and state listed endangered species, inhabits the saline and alkaline tule wetlands found in the bed of the Amargosa River. The endemic Amargosa naucorid bug (*Pelocoris shoshone*), a federal candidate (C2) for listing as endangered is also present in these areas. A man-made spring and drainage canal near Shoshone supports a population of Shoshone pupfish, a federal candidate (C2) for listing as endangered. **[n]** . The vermilion flycatcher (*Pyrocephalus rubinus*), yellow warbler (*Dendroica petchia brewsteri*) and yellow-breasted chat (*Icteria virens*), all California Species of Concern, are among the several species of birds known to inhabit the tule environment.

The Amargosa River cuts through the lower elevations of alluvial fans formed at the base of the bordering desert mountain ranges. These alluvial fans and level plains are covered with creosote bush scrub (*Larrea tridentata*) and in places hop-sage (Grayia spinosa) or desert holly (Atriplex hymenolytra) dominates the scrub. In the dry river bed washes, burro weed (*Ambrosia dumosa*) is a common co-dominant species with creosote bush.

More than thirteen species of amphibians and reptiles are common to the sandy, rocky alluvial fans **[o]** two of which have special status: the chuckwalla (*Sauromalus obesus*), a federal candidate (C2) for listing as endangered; and the Mojave fringe-toed lizard (*Uma scoparia*), a California Species of Concern. **[p]** The desert tortoise (*Xerobates [Gopherus] agassizi*, a federal and state listed threatened species, also inhabits the area.

REFERENCES

a 8/31/95 and 1/31/97 conversations with Ms. Martha Watkins, Death Valley Chamber of Commerce

b California State Assembly Bill (AB) 866 designates

c Ms. Martha Watkins, op. cit.

d Department of Commerce, Bureau of Census, 1990 Census of Population and Housing, STF-1, Data for Inyo County, California

e 1993 Population Projection Series, California Department of Finance, Demographic Research Unit

f *AC Pavement Deflection Study Report*, and *Pavement History and Plan for State Route 127*, Caltrans District 9, May 1995.

g Caltrans Machine Traffic Counts from between December 1994 and 1995 (available in District 9 Traffic and Planning Departments)

h *Highway Capacity Manual*, Chapter 8 (Rural Highways)

i *Nevada Potential Repository Preliminary Transportation Strategy, Study 1*, U.S. Department of Energy Office of Civilian Radioactive Waste Management, TRW Environmental Systems, Inc., 1995

j *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, U.S. Department of Energy, Office of Environmental Management, DOE/EIS-0200-F, Summary, May 1997

k *District 9 Long Range Operation Plan - First Update*, 1988

l *General Plan*, San Bernardino County, Environmental Public Works Agency, Department of Land Management, Office of Planning, 1990

m Jaeger, E. C., 1975. *A Naturalist's Death Valley,* 5th Edition, Inland Printing, Inc., San Bernardino, CA

n California Natural Diversity Data Base, 1995. California Natural Diversity Data Base search report for the Ibex Pass, Shoshone, East of Deadman Pass, Eagle Mt., West of Eagle Mt., Death Valley Junction, and Franklin Well 7.5 minute quad sheets, Sacramento, CA

o Stebbins, R.C., 1985. *A Field Guide to Western Reptiles and Amphibians*, Houghton Mifflin Company, Boston, MA, 236 pp.

p California Department of Fish and Game. Special Animal List, August 1994

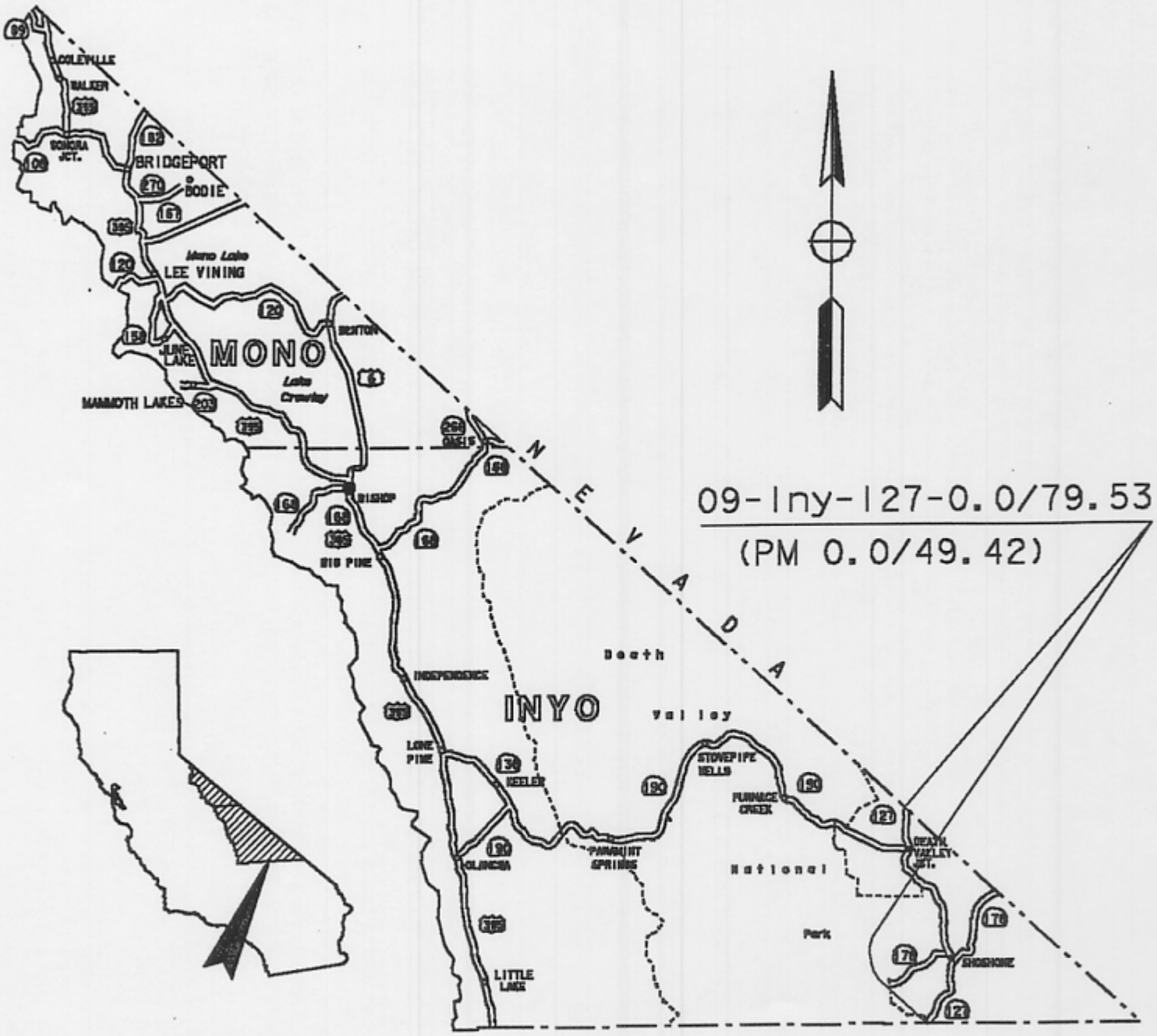


EXHIBIT A
VICINITY MAP

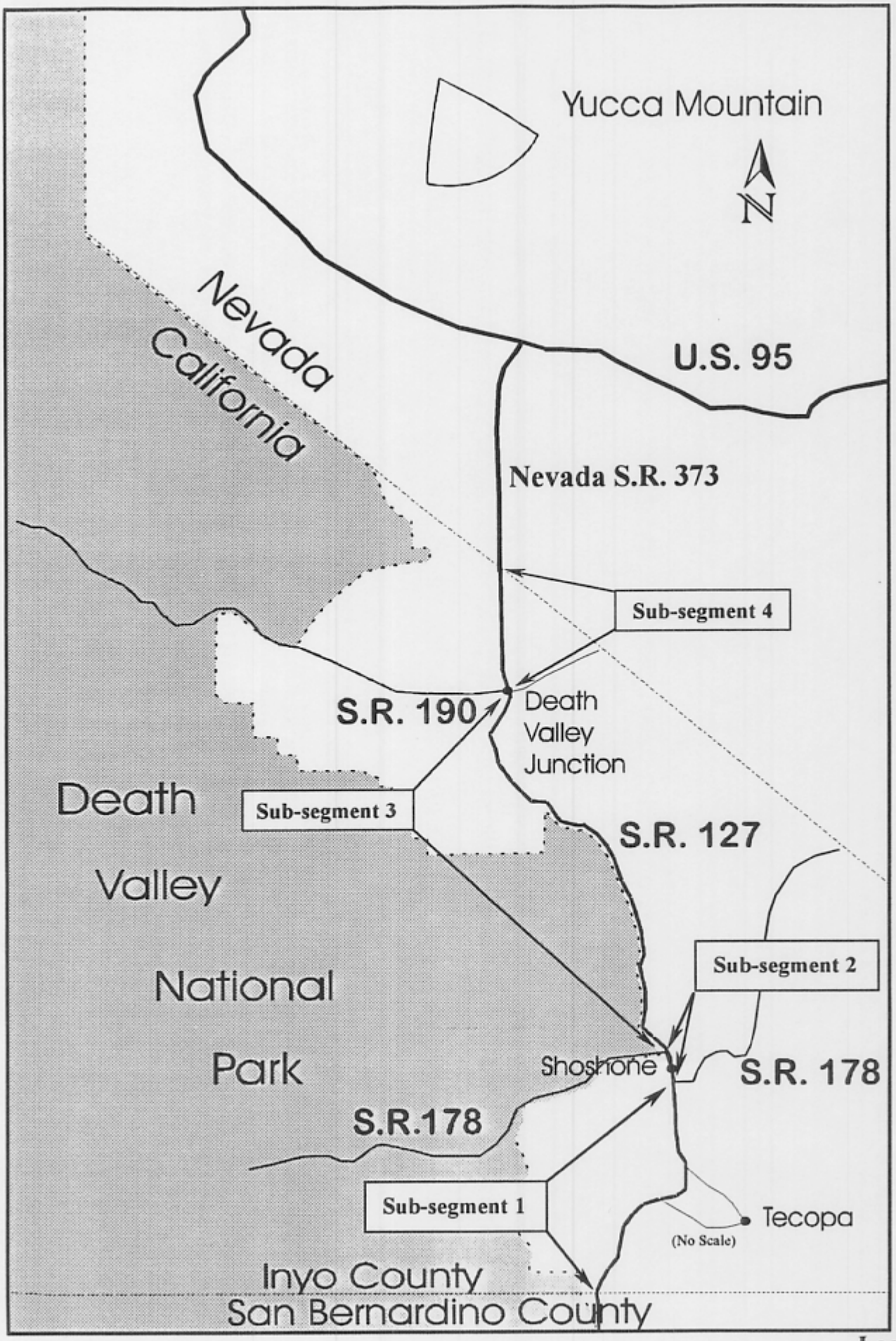
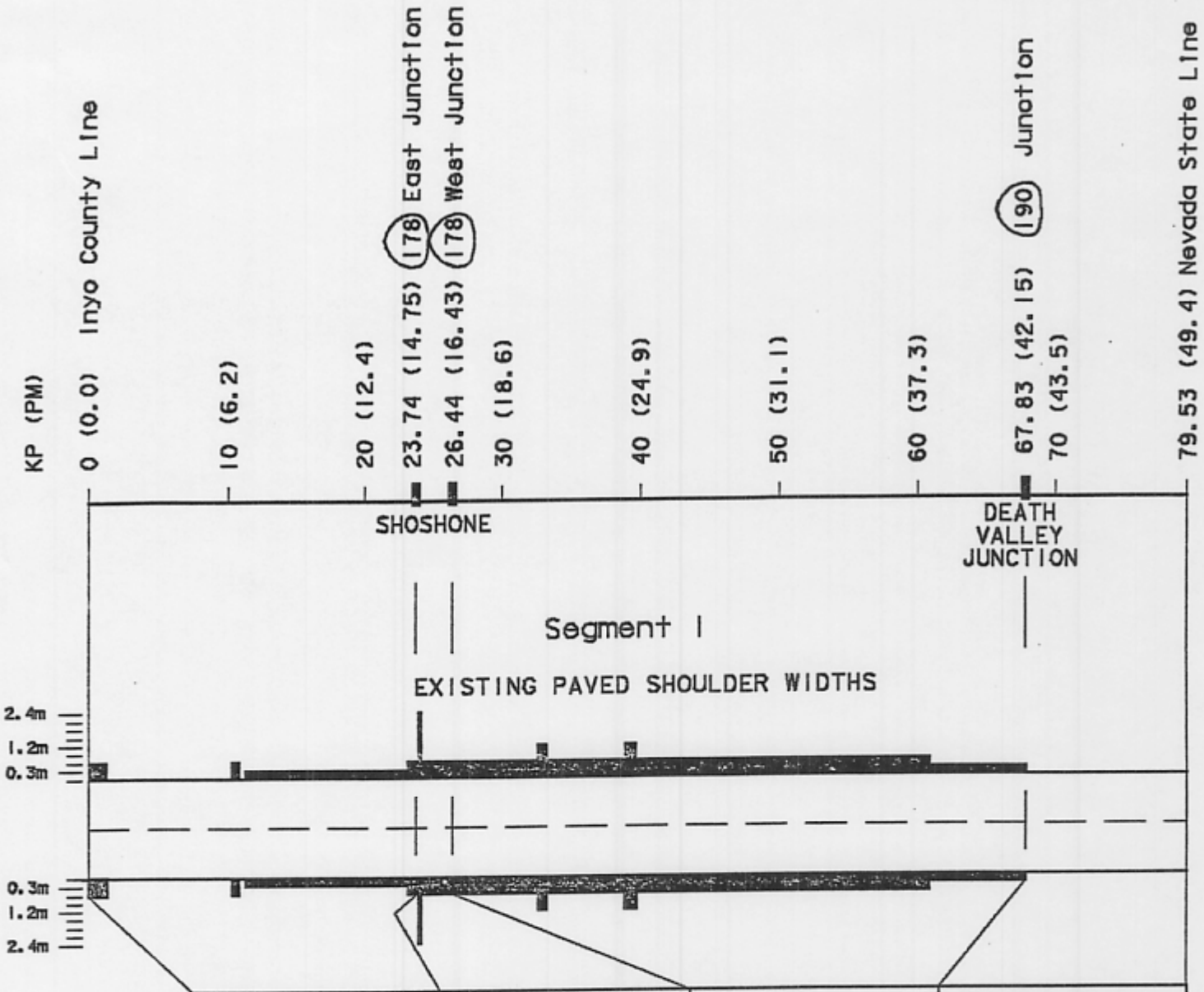


Exhibit B
Location Map



		Sub-segment 1	Sub-segment 2	Sub-segment 3	Sub-segment 4
KP Location		0.0/23.80	23.80/26.44	26.44/67.83	67.83/79.53
PM Location		0.0/14.79	14.79/16.43	16.43/42.15	42.15/49.42
1995	AADT	900	400	300	600
	LOS	A	A	A	A
	V/C	0.06	0.03	0.02	0.03
2005	AADT	990	440	330	660
	LOS	A	A	A	A
	D/C	0.07	0.03	0.02	0.04
2015	AADT	1098	488	366	732
	LOS	B	A	A	A
	D/C	0.08	0.03	0.02	0.04

EXHIBIT C

SUB-SEGMENTS SCHEMATIC

09-INY-127-0.0/79.53 (0.0/49.42)