INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC DEPLOYMENT PLAN FOR THE LAS VEGAS VALLEY

User Service Plan

prepared for

Nevada Department of Transportation
Regional Transportation Commission of Clark County, NV

by

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1 . Introduction

1.1 Overview

This report represents the Intelligent Transportation System (ITS) User Service Plan for the Las Vegas Metropolitan area. It presents a description of each of the Federal Highway Administration's (FHWA) thirty ITS user services and the methodology used to identify specific transportation needs in the Las Vegas Valley which may be addressed by the user services. The user services are then mapped against the needs of the region for evaluating the relative priorities of each user service. This report summarizes the efforts of Tasks 1 to 4 in the workscope:

Task 1: Inventory of ITS User Services
Task 2: Establish Performance Criteria
Task 3: Overview of Las Vegas Valley Transportation System
Task 4: Evaluate ITS User Services

1.2 ITS Strategic Deployment Planning Process

The Intelligent Transportation Systems Strategic Deployment Plan (SDP) for the Las Vegas Valley is a project to define priorities for application of Intelligent Transportation Systems. "Intelligent Transportation Systems" is a collective term for measures involving the real-time management of transportation facilities and services, usually involving the use of electronic equipment for collecting, processing, reacting to, or disseminating dynamic information.

The ITS Strategic Deployment Plan focuses on both institutional issues and technological opportunities. It will blend analysis of end user needs, appropriate technologies, and the desires and capabilities of the region's institutions, to identify the appropriate uses of ITS in the Las Vegas Valley. The product of this project is an action plan to build ITS infrastructure and to cultivate partnerships for deployment. Building a successful institutional "framework" is as critical as the technology elements for the ultimate success of ITS deployment.

The Strategic Deployment Planning Process for the Las Vegas Valley has three central goals, each with several objectives which are consistent with FHWA guidelines for conducting these studies throughout the United States. These goals and objectives are identified on the following pages:

Goal 1: The planning process is to be broadly inclusive, reaching out to transportation stakeholders from all sectors and interests, and providing educational information as well as opportunities for input.

Objectives:

- Educate regional stakeholders on ITS by providing information on Intelligent Transportation technologies and services.
- Solicit a wide assortment of ideas and concepts for ITS implementation.
- Enable participants to gain ownership of the Strategic Deployment Plan.

Goal 2: The Deployment Plan process develops a consensus on an action plan for ITS implementation which supports regional multi-modal transportation planning goals and objectives.

Objectives:

- Identify and evaluate technology and deployment options for ITS.
- Support Regional Transportation Plan and regional goals for improving mobility, promoting equity, enhancing sensitivity to the environment, supporting economic vitality and supporting community vitality.
- Gather broad-based support around a plan for short, medium and long-range ITS projects in the region.

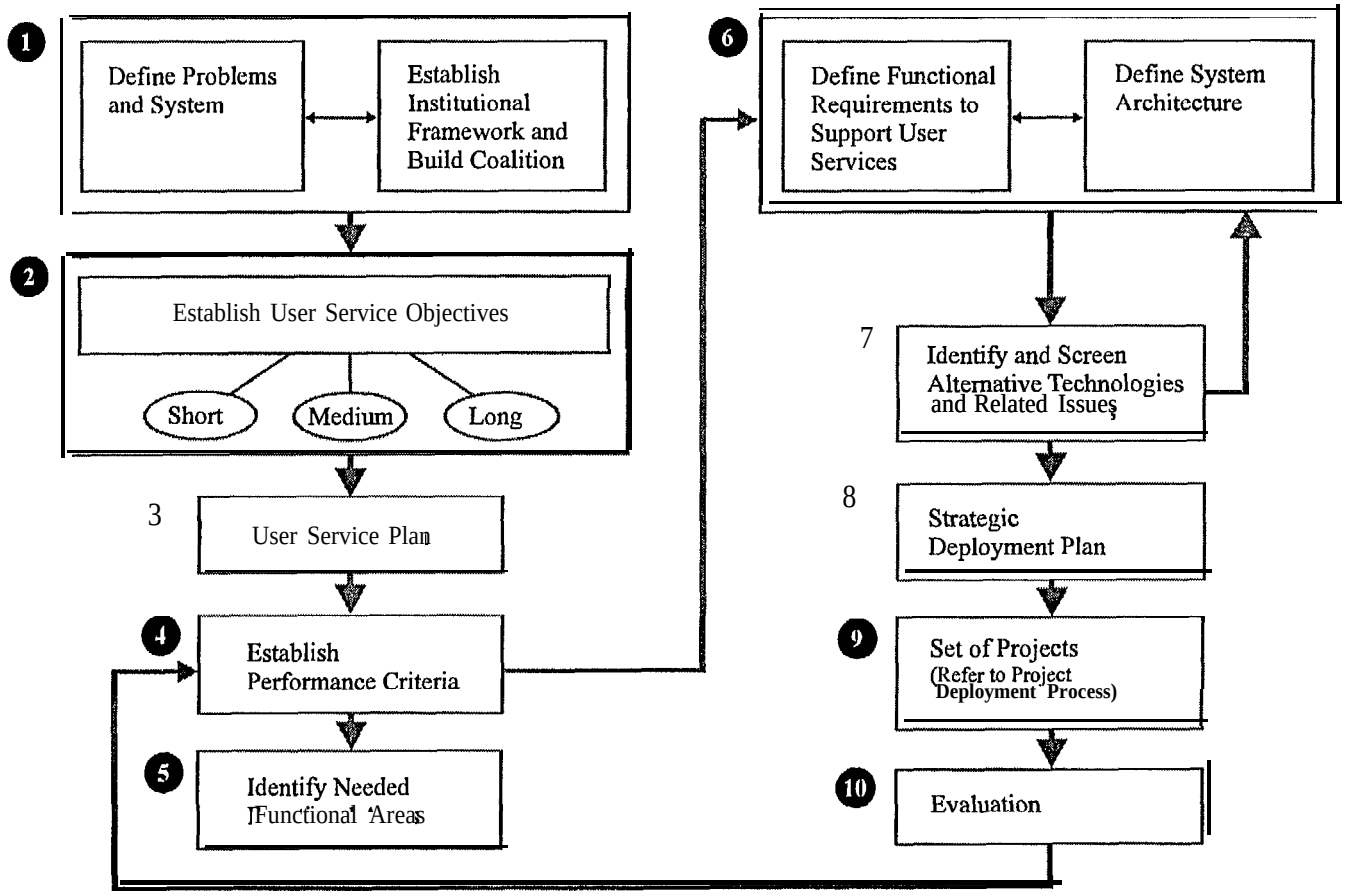
Goal 3: The planning process builds partnerships to foster ITS deployment.

Objectives:

- Enable establishment of public/public partnerships for specific ITS projects.
- Enable establishment of public/private partnerships to permit innovative joint arrangements for ITS deployment.
- Enable establishment of private/private partnerships to tailor technologies to the Las Vegas area.

Figure 1-1 illustrates the ITS Planning Process.

Figure 1-1: ITS Planning Process



1.3 Existing Transportation Needs

The guiding principal of ITS planning is that it must be based on the local needs. Approximately 130 different transportation needs are identified in this report. These needs were identified from three areas:

- Existing Conditions Assessment
- Agency Stakeholder Meetings
- Steering Committee Evaluation

Each of these areas is described in more detail in the following sections of this report.

2. Description of ITS User Services

2.1 Overview

ITS planning starts with the development of "user services." The users include travelers of any mode, operators of transportation management centers, transit operators, the Metropolitan Planning Organization (MPO), commercial vehicle operators, state and local governments, and other transportation providers or service providers.

2.2 User Service Descriptions

The concept of user services is to ensure that ITS planning is based on needs of services and not based on needs of technology. User services share common characteristics, such as:

- **Composed of Multiple Technological Elements**
  A single user service will usually depend upon several technologies such as advanced communications, mapping and surveillance.

- **Building Blocks**
  Once the basic technological functions, such as communications or surveillance, have been deployed for one or more user services, the additional functions needed by related user services may entail only a small incremental cost, while producing broad additional benefits. User services can be combined for deployment in a variety of ways depending upon local priorities, needs, issues and market forces.

- **Adaptable to local settings**
  ITS user services are specific to a particular location. The function of the service can be adapted to meet local needs, issues and conditions.

2.3 User Service Bundles

As part of the national ITS program planning process, the FHWA identified 29 user services. At the beginning of this project, DKS recommended adding a 30th user service called “Railroad Crossing Safety”.

Although it is possible to deploy an individual user service, there are combinations of user services that are closely related. Their users may share a common institutional perspective or they may have common technical functionalities. These combinations of user services have been termed “bundles.”

The user services are shown by bundles in Table 2-1 and are described in the following section.

TABLE 2-1: User Service Bundles

BUNDLE	USER SERVICES
1. Travel and Transportation Management	1. En-Route Driver Information 2. Route Guidance 3. Traveler Services Information 4. Traffic Control (Arterial and Freeway Systems) 5. Incident Management 6. Emissions Testing and Mitigation
2. Travel Demand Management	7. Pre-Trip Travel Information 8. Ride Matching and Reservation 9. Demand Management and Operations
3. Public Transportation Operations	10. Public Transportation Management 11. En-Route Transit Information 12. Personalized Public Transit 13. Public Travel Security
4. Electronic Payment	14. Electronic Payment Services
5. Commercial Vehicle Operations	15. Commercial Vehicle Electronic Clearance 16. Automated Roadside Safety Inspection 17. On-Board Safety Monitoring 18. Commercial Vehicle Administrative Processes 19. Hazardous Material Incident Response 20. Freight Mobility
6. Emergency Management	21. Emergency Notification and Personal Security 22. Emergency Vehicle Management
7. Advanced Vehicle Control and Safety Systems	23. Longitudinal Collision Avoidance 24. Lateral Collision Avoidance 25. Intersection Collision Avoidance 26. Vision Enhancement for Crash Avoidance 27. Safety Readiness 28. Pre-Crash Restraint Deployment 29. Automated Highway Systems 30. Railroad Crossing Safety

Bundle 1: Travel and Transportation Management

- **User Service 1: En-Route Driver Information**

Driver advisories *and in-vehicle signing for convenience and safety during travel.*

Once travel begins, driver advisories and in-vehicle displays (such as computerized maps, heads-up-displays and audio information) convey real-time information about traffic conditions, incidents, construction, transit schedules and weather conditions to drivers of personal, commercial and public transit vehicles. This information allows a driver to select the best route or shift to another mode in mid-trip, if desired.

In-vehicle signing, the second component of en-route driver information, would display the same types of information found on physical road signs today, directly in the vehicle.

- **User Service 2: Route Guidance**

Provides travelers with simple instructions on how to best reach their destinations.

The route guidance service provides a suggested route to reach a specific destination. Early route guidance systems will be based on static information about the roadway network, transit schedules, etc. When fully deployed, route guidance systems will provide travelers with directions to their destinations based on real-time information about the transportation system. The route guidance service will consider traffic conditions, status and schedule of transit systems and road closures in developing the best route. Directions will generally consist of simple instructions on turns or other upcoming maneuvers. Users of the service include not only drivers of all types of vehicles, but also non-vehicular travelers, such as pedestrians or bicyclists, who could get specialized route guidance from a hand-held device. Route guidance can, therefore, be in a form of roadside display, in-vehicle display or personal hand-held units.

- **User Service 3: Traveler Services Information**

Provides a *business directory or "yellow pages" of service information.*

Traveler services information provides quick access to travel related services and facilities. Examples of information that might be included are the location, operating hours and availability of food, parking, auto repair, hospitals and police facilities. Traveler services information would be accessible in the home, office or other public locations to help plan trips and might also be available en-route.

- **User Service 4: Traffic Control**

Manages *the movement of traffic on streets and highways.*

This service will provide for the integration and adaptive control of the freeway and surface street systems to improve the flow of traffic, give preference to public safety, transit or other high occupancy vehicles and minimize congestion while maximizing the movement of people and goods. Through appropriate traffic controls, the service will also promote the safety of non-vehicular travelers, such as pedestrians and bicyclists. This service requires advanced surveillance of traffic flows, analysis techniques for determining appropriate traffic signal and ramp metering controls and communication of these controls to the roadside infrastructure. This service gathers data from the transportation system, organizes it into usable information and uses it to determine the optimum assignment of right-of-way to vehicles and pedestrians. The real-time traffic information collected by the Traffic Control service also provides the foundation for many other user services. This user service will supplement the Las Vegas Valley Computer Traffic System (LVACTS), which is a centrally controlled system, and is currently being upgraded based on a distributed control architecture. The system is being designed around a centralized database and will be capable of controlling signalized intersections, supporting video surveillance and other ITS technologies.

- **User Service 5: Incident Management**

Helps public and *private organizations quick/y identify incidents and implement a response to minimize their effects on* traffic.

This service enhances existing capabilities for detecting and verifying incidents, in both urban and rural areas and then taking the appropriate actions in response. The service would use advanced sensors, data processing and communications to improve the incident management and response capabilities of transportation and public safety officials, the towing and recovery industry and others involved in incident response. Incident Management could also involve legislative changes to allow for quicker removal of stalled and abandoned vehicles, especially on freeways.

- **User Service 6: Emissions Testing and Mitigation**

Provides information for monitoring air quality and developing air quality improvement strategies.

This service uses advanced vehicle emissions testing systems to provide information to identify environmental “hot spots” and implement strategies to reroute traffic around sensitive air quality areas. Other technologies provide identification on vehicles that are emitting levels of pollutants that exceed state, local or regional standards and provides information to drivers or fleet operators to enable them to take corrective action. The service also provides transportation planning and operating agencies with information that can be used to facilitate implementation and evaluation of various pollution control strategies.

Bundle 2: Travel Demand Management

- **User Service 7: Pre-Trip Travel Information**

Provides information for selecting the best transportation mode, departure time and route

Pre-trip travel information allows travelers to access a complete range of intermodal transportation information at home, work and other major sites where trips originate. Real-time information on transit routes, schedules, transfers and fares and ride matching services are available to encourage the use of alternatives to the single occupancy vehicle. Information needed for long, inter-urban or vacation trips would also be available. Real-time information on accidents, road construction, alternate routes, traffic speeds along given routes, parking conditions, event schedules and weather information is also included. Based on this information, the traveler can select the best route, modes of travel and departure time.

- **User Service 8: Ride Matching and Reservation**

Makes ride sharing easier and more convenient.

This service provides real-time ride matching information and reservations to users in their homes, offices or other locations and assist transportation providers, as well as van/carpoolers, with vehicle assignments and scheduling. This will expand participation in ridesharing as an alternative to single occupant automobile travel.

- **User Service 9: Demand Management and Operations**

Supports policies and regulations designed to mitigate the environmental and social impacts of traffic congestion.

This service generates and communicates management and control strategies that support the implementation of programs to reduce the number of individuals who choose to drive alone, especially to work; increase the use of high occupancy vehicles and transit; and provide a variety of mobility options for those who wish to travel in a more efficient manner, for example in non-peak periods. Demand management strategies could ultimately be applied dynamically, when congestion or pollution conditions warrant. For example, disincentives such as increased tolls and parking fees could be applied during pollution alerts or peak travel periods, while transit fares would be lowered to accommodate the increased number of travelers changing modes from driving alone.

Bundle 3: Public Transportation Operations

- **User Service 10: Public Transportation Management**

Automates operations, planning and management functions of public transit systems.

This service provides computer analysis of real-time vehicle and facility status to improve transit operations and maintenance. The analysis identifies deviations from schedule and provides potential solutions to dispatchers and drivers. Integrating this capability with traffic control services can help maintain public transportation schedules and assure transfer connections. Information regarding passenger loading, bus running times and mileage accumulated will help improve service and facilitate administrative reporting. Automatically recording and verifying performed tasks will also enhance transit personnel management.

- **User Service 11: En-Route Transit Information**

Provides information to travelers using public transportation after they begin their trips.

This service provides information to assist the traveler once public transportation travel begins. Real-time, accurate transit service information on board the vehicle helps travelers make effective transfer decisions and itinerary modifications, as needed, while a trip is underway.

- **User Service 12: Personalized Public Transit**

Flexible route transit vehicles offer more convenient service to customers.

Small publicly or privately operated vehicles provide on-demand routing to pick up passengers who have requested service and deliver them to their destinations. Route deviation schemes, where vehicles would leave a fixed route for a short distance to pick up or discharge passengers, is another way of improving service. Vehicles can include small buses, taxicabs or other small, shared ride vehicles. This service can provide almost door-to-door service, expanding transit coverage to less densely populated locations and neighborhoods. This can potentially provide a transportation option at lower cost and with greater convenience than conventional fixed route transit.

- **User Service 13: Public Travel Security**

Creates a secure environment for public transportation patrons and operators.

This service provides systems that monitor the environment in transit stations, parking lots, bus stops and on-board transit vehicles and generate alarms, either automatically or manually, when necessary.

Bundle 4: Electronic Payment

User Service 14: Electronic Payment Services

Allows travelers to pay for transportation services electronically.

This service will foster intermodal travel by providing a common electronic payment medium for all transportation modes and functions, including roadway tolls, transit fares and parking. The service provides for a common service fee and payment structure using pre-paid "smart cards" or other technologies. Such systems will be truly multi-use, allowing personal financial transactions on the same medium. The flexibility that electronic payment services offer will also facilitate travel demand management, if conditions warrant. They could, if local authorities so choose, enable application of road pricing policies which could influence departure times and mode selection.

Bundle 5: Commercial Vehicle Operations

- **User Service 15: Commercial Vehicle Electronic Clearance**

Facilitates domestic and international border clearance, minimizing stops.

This service will enable transponder-equipped trucks and buses to have their safety status, credentials and weight checked at mainline speeds. Vehicles that are safe and legal and have no outstanding out-of-sewice citations will be allowed to pass the inspection/weight facility without delay. By working with neighboring states such as California, Arizona and Utah, a more efficient traffic flow would be provided at border crossings and the deployment of technologies in these states could ultimately prevent overweight, unsafe or improperly registered vehicles from entering Nevada.

- **User Service 16: Automated Roadside Safety Inspection**

Facilitates roadside inspections.

Automated roadside inspections would allow real-time access at the roadside to the safety performance record of carriers, vehicles and drivers. Such access will help determine which vehicle or driver should be stopped for an inspection, as well as ensuring timely correction of previously identified problems. This service would also automate as many items as possible of the manual inspection process. It would, for example, allow for more rapid and accurate inspection of brake performance at the roadside. Through the use of sensors and diagnostics, it would efficiently check vehicle systems and driver requirements and ultimately driver alertness and fitness for duty. Chapter 706 of the Nevada Administrative Code (NAC) provides a detailed listing of Nevada law regarding inspection of vehicles by the Public Service Commission. Sections of the NAC include Section 706.379, 706.380 and 706.381.

- **User Service 17: On-Board Safety Monitoring**

Senses the safety status of a commercial vehicle, cargo and driver.

On-board systems would monitor the safety status of a vehicle, cargo and driver at mainline speeds. Vehicle monitoring would include sensing and collecting data on the condition of critical vehicle components such as brakes, tires and lights and determining thresholds for warnings and countermeasures. Cargo monitoring would involve sensing unsafe conditions relating to vehicle cargo, such as shifts in cargo while the vehicle is in operation. Driver monitoring is envisioned to include the monitoring of driving time and alertness using non-intrusive technology and the development of warning systems for the driver, the carrier and the enforcement official.

- **User Service 18: Commercial Vehicle Administrative Processes**

Provides electronic purchasing of credentials and automated mileage and fuel reporting and auditing.

Electronically purchasing credentials would provide the carrier with the capability to electronically purchase annual and temporary credentials via computer link. It will reduce burdensome paperwork and processing time for both the States and the motor carriers. For automated mileage and fuel reporting and auditing, this service would enable participating interstate carriers to electronically capture mileage, fuel purchased, trip and vehicle data by State. It would also automatically determine mileage traveled and fuel purchased in each State, for use by the carrier in preparing fuel tax and registration reports to the States.

- **User Service 19: Hazardous Material Incident Response**

Provides immediate description of hazardous materials to emergency responders.

This service would enhance the safety of shipments of hazardous materials by providing enforcement and response teams with timely, accurate information on cargo contents to enable them to react properly in emergency situations. When an incident involving a truck carrying hazardous material occurs, the material or combination of materials involved would be electronically provided to emergency responders and enforcement personnel at the scene so that the incident can be handled properly. This requires voluntary participation by the trucking industry until specific legislation is enacted.

The Legislative Commission's Subcommittee made the following recommendations to the 67th Session of the Nevada Legislature, for emergency response or hazardous materials regulation. The subcommittee recommends the the State must encourage a "partnership" between State and local entities and between Government and business, in order to protect the environment, ensure public safety, and still foster economic development. Other recommendations include consolidation of similar State hazardous materials, environmental fees and reporting requirements, and inspection and fines. Chapter 606 and 459 among others, of the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC), provides a detailed listing of the laws governing the transport of and emergency response for Hazardous Materials.

- **User Service 20: Freight Mobility**

Provides communications between drivers, dispatchers and intermodal transportation providers.

The availability of real-time traffic information and vehicle location for commercial vehicles would significantly enhance the management of fleet operations by helping drivers to avoid congested area and improving the reliability and efficiency of pickups and deliveries. These benefits would be particularly important for operators of intermodal and time-sensitive fleets who can use these ITS technologies to make their operations more efficient and reliable.

Bundle 6: Emergency Management

- **User Service 21: Emergency Notification and Personal Security**

Provides immediate notification of an incident and an immediate request for assistance.

This service includes two capabilities: driver and personal security, and automatic collision notification. Driver and personal security capabilities provide for user initiated distress signals for incidents like mechanical breakdowns or carjacking. When activated by an incident, automatic collision notification transmits information regarding location, nature and severity of the crash to emergency personnel.

- **User Service 22: Emergency Vehicle Management**

Reduces the time it takes emergency vehicles to respond to an incident.

This service provides public safety agencies with fleet management capabilities, route guidance and signal priority and/or preemption for emergency vehicles. Fleet management will improve the display of emergency vehicle locations and help dispatchers send the units that can most quickly reach an incident site. Route guidance directs emergency vehicles to an incident location, while signal priority optimizes the traffic signal timing in an emergency vehicle's route.

Bundle 7: Advanced Vehicle Control and Safety Systems

- **User Service 23: Longitudinal Collision Avoidance**

Helps prevent head-on, tear-end or backing collisions between vehicles or between vehicles and other objects or pedestrians.

This service helps reduce the number and severity of collisions. It includes the sensing of potential impending collisions, prompting a driver's avoidance actions and temporarily controlling the vehicle.

- **User Service 24: Lateral Collision Avoidance**

Helps prevent collisions when vehicles leave their lane of travel.

This service provides crash warnings and controls for lane changes and road departures. It will help reduce the number of lateral collisions involving two or more vehicles or crashes involving a single vehicle leaving the roadway. For changing lanes, a situation display can continuously monitor the vehicle's blind spot and drivers can be actively warned of an impending collision. It needed, automatic control can effectively respond to situations very rapidly. Warning systems can also alert a driver to an impending road departure, provide help in keeping the vehicle in the lane and ultimately provide automatic control of steering and throttle in dangerous situations.

- **User Service 25: Intersection Collision Avoidance**

Helps prevent collisions at intersections.

This service warns drivers of imminent collisions when approaching or crossing an intersection that has traffic control (e.g., stop signs or a traffic signal). This service also alerts the driver when the proper right-of-way at the intersection is unclear or ambiguous.

- **User Service 26: Vision Enhancement for Crash Avoidance**

Improves the driver's ability to see the roadway and objects that are on or along the roadway.

Improved visibility will allow drivers to avoid potential collisions with other vehicles or obstacles in roadway, as well as help the driver comply with traffic signs and signals. This service requires in-vehicle equipment for sensing potential hazards, processing this information and displaying it in a way that is useful to a driver.

- **User Service 27: Pre-Crash Restraint Deployment**

Anticipates an *imminent collision and activates passenger safety systems before the collision occurs, or much earlier in the crash event than is currently feasible.*

This service identifies the velocity, mass and direction of the vehicles or objects involved in a potential crash and the number, location and major physical characteristics of any

occupants. Responses include tightening lap-shoulder belts, arming and deploying air bags at the optimal pressure and deploying roll bars.

- **User Service 28: Safety Readiness**

Provides warnings about the condition of the driver, the vehicle and the roadway.

In-vehicle equipment will unobtrusively monitor a driver's condition and provide a warning if he or she is becoming drowsy or otherwise impaired. This service could also internally monitor critical components of the automobile and alert the driver to impending malfunctions. Equipment within the vehicle could also detect unsafe road conditions, such as bridge icing or standing water on the roadway and provide a warning to the driver.

- **User Service 29: Automated Highway Systems**

Provides a fully automated, "hands-off, " operating environment.

Automated highway systems are a long-term goal of ITS which would provide vast improvements in safety by creating a nearly accident free driving environment. Drivers could buy vehicles with the necessary instrumentation or retrofit an existing vehicle. Vehicles that are incapable of automated operation, during some transition period, would drive in lanes without automation.

- **User Service 30: Railroad Crossing Safety**

This non-federal user service has been added to the Las Vegas User Service Plan by NDOT and RTC. ITS technology can be used for providing surveillance and monitoring of railroad crossings. Surveillance of these crossings are necessary for enforcement purposes. Automatic monitoring devices could be utilized to sense the approach of a train and control access gates. Use of this technology will enhance a railroad crossing operation and improve safety for both the train and vehicles.

These user services can be grouped into functions. As discussed in the ITS Strategic Deployment Grant Application, submitted by NDOT and RTC, the following four key ITS visions are envisioned to be important to the Las Vegas Valley.

1. Advanced Traffic Management System
2. Advanced Traveler Information Systems
3. Incident Management
4. Public Transit and Vehicle Tracking

These visions are graphically presented in Figures 2-1 through 2-4.

Figure 2-1: ATMS Vision

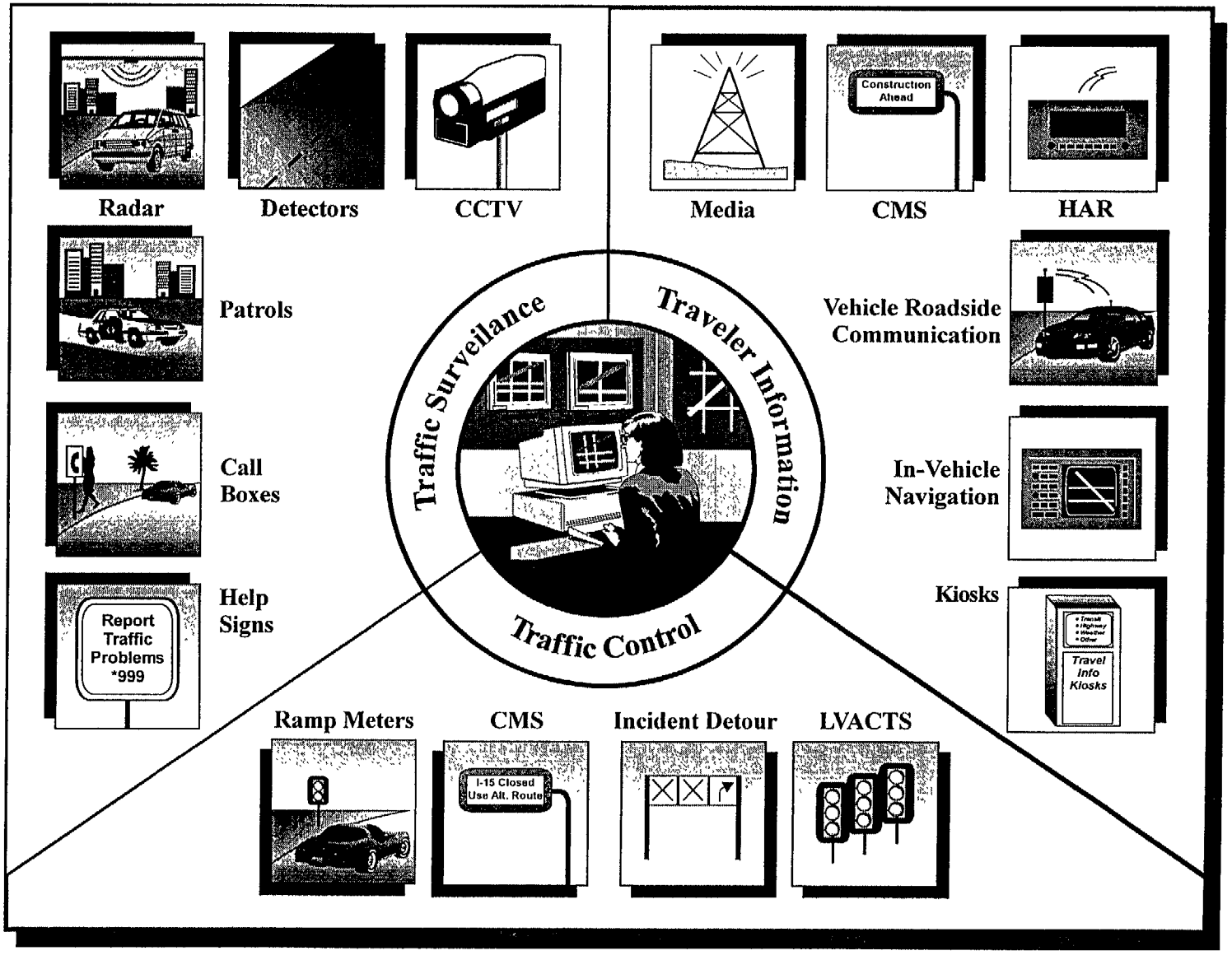


Figure 2-2: Incident Management Vision

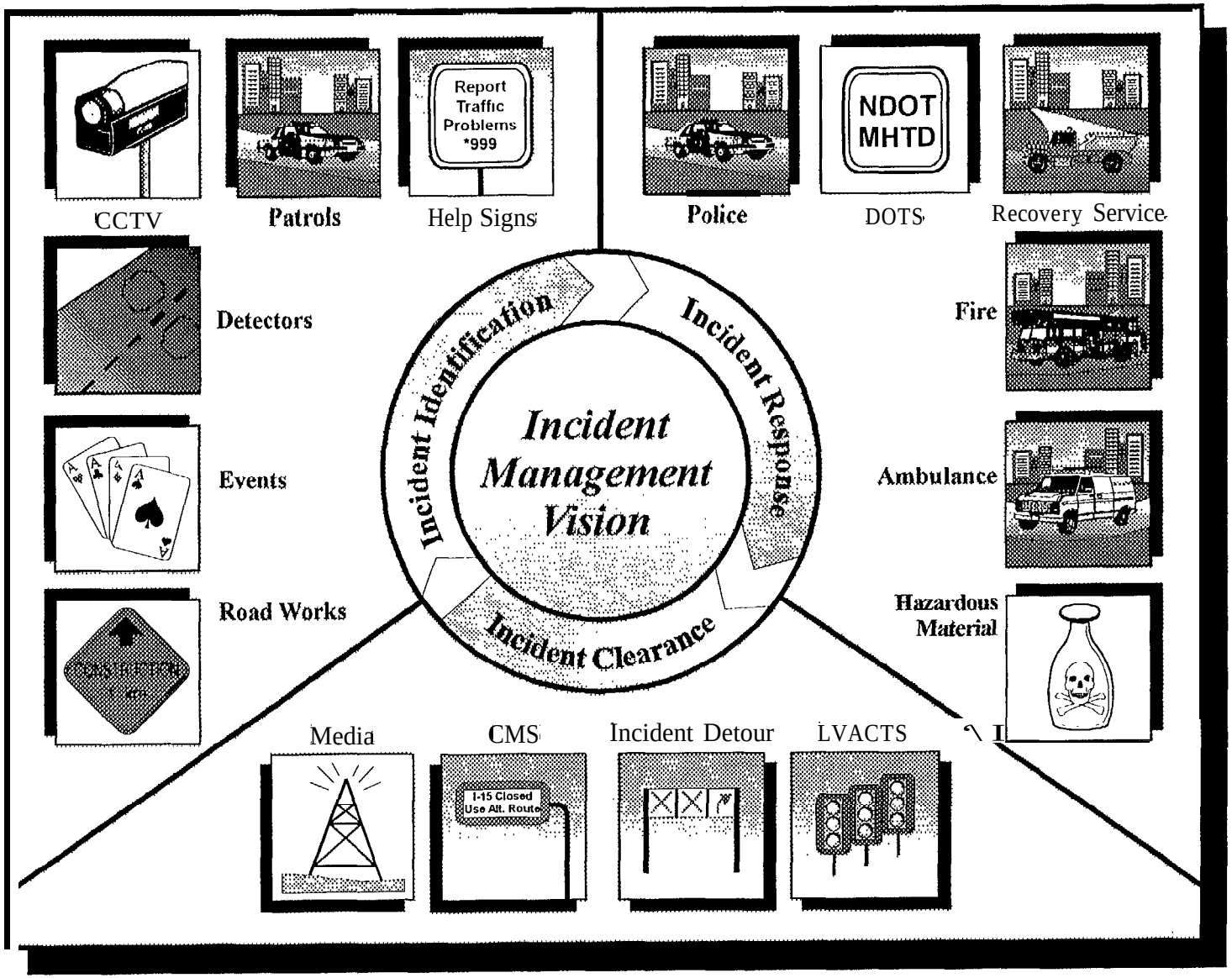


Figure 2-3: ATIS Element

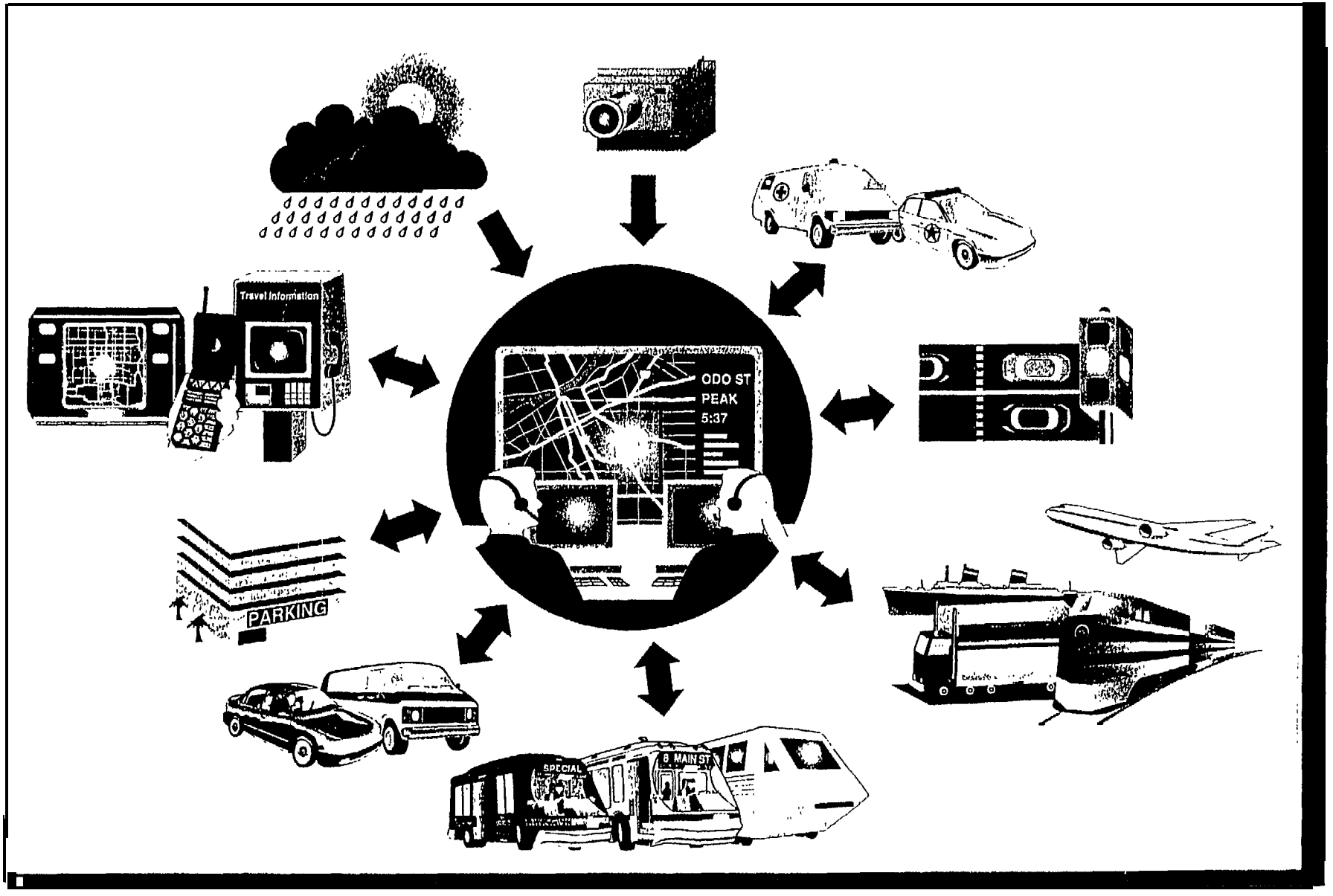


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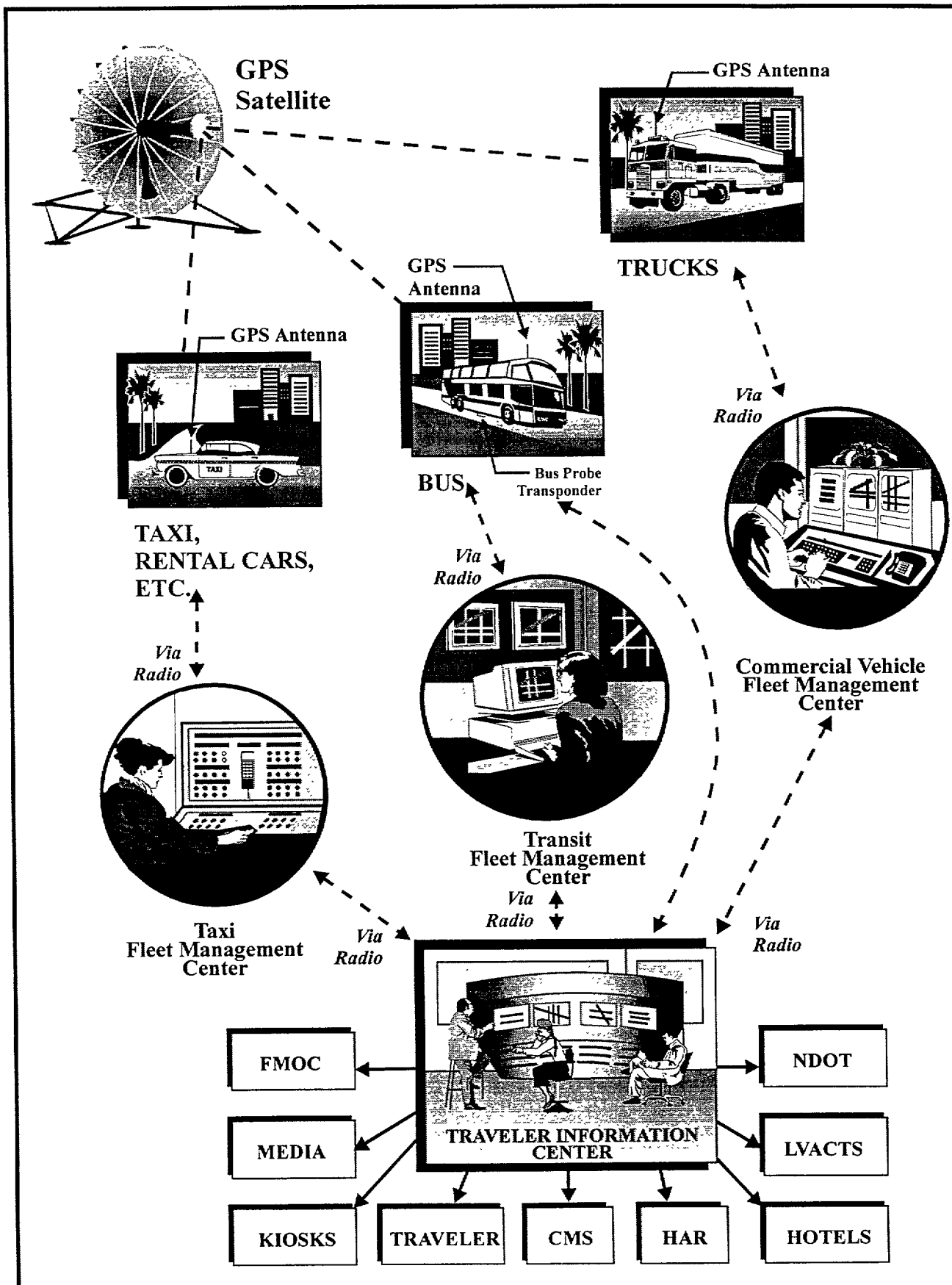
Figure 2-4: Transit and Commercial Vehicle Tracking



3. Existing System Assessment

3.1 Overview

The Las Vegas Valley is bound by the Sheep Mountain Range to the north, Frenchman Mountain and the Lake Mead National Recreation area to the east, the Spring Mountain Range to the west and the McCullough Mountain Range to the south. This area encompasses approximately 850 square miles.

The Las Vegas Valley area consists of four incorporated cities (Henderson, North Las Vegas, Las Vegas,and Boulder City), and a large unincorporated area of Clark County. A map illustrating the study area and jurisdictional boundaries is presented in Figure 3-1.

The Las Vegas Valley and Clark County have experienced unprecedented levels of growth over the last decade. Recent projections based on census estimates have placed the population at approximately 1 million people, which represents an average growth rate of 4.5% per year for each of the last five years. If this trend continues, Clark County could expect to grow by another 250,000 people by the turn of the century. Table 3-1 presents the population statistics for the Las Vegas Valley, listing Year 1990 and 1994 census data and Year 2010 forecast population is listed for Clark County unincorporated areas, and the cities of Las Vegas, North Las Vegas, Boulder City, Mesquite and Henderson.

3.2 Roadway Network

The Las Vegas Valley freeway system currently consists of two major facilities, Interstate 15 and U.S. Route 95 including that portion of l-515. Interstate 15, which runs from southern California to Salt Lake City, Utah, provides north-south line haul movement through the Valley. U.S. Route 95, which runs from California stateline near Needles, California to north of Reno, Nevada, provides primarily northwest-southeast line haul movement through the Valley, but does run in an east-west direction for approximately 9 miles through the central portion of the Las Vegas metropolitan area. U.S. Route 93, which is also located in the Valley, runs from Boulder Dam to Jackpot, Nevada overlapping both U.S. Route 95/Interstate 515 and Interstate 15 through most of the Las Vegas Valley.

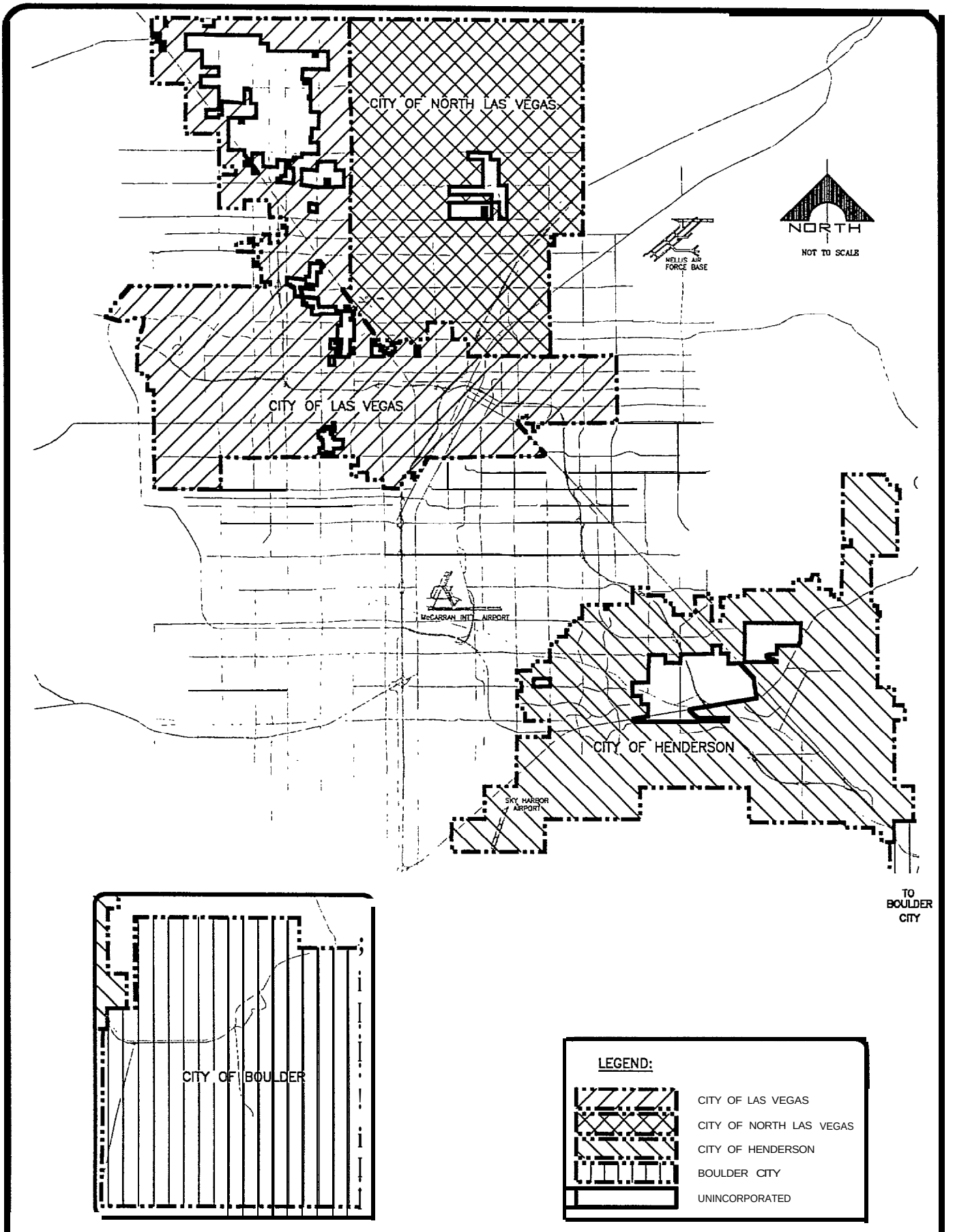


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FIGURE 3-1
STUDY AREA

TABLE 3-1: Clark County Population Summary

CITY/COUNTY	1990	1994	2000	2010
Boulder City	12,760	13,640	17,280	25,173
Henderson	69,390	105,610	133,791	194,904
Las Vegas	268,330	346,350	438,770	639,192
Mesquite	1,960	3,850	4,877	7,105
North Las Vegas	50,030	69,700	88,299	128,632
Unincorporated County/City	367,810	432,530	547,946	798,239
TOTAL	**770,280**	**971,680**	**1,230,963**	**1,793,245**

Source NSBDC Bureau of Business and Economic Research

The Valley's freeway system also contains two minor facilities, the Summerlin Parkway and Interstate 215 (the Las Vegas Beltway). These highways will become major facilities in the movement of people and goods as they are builtout. Currently, the Summerlin Parkway extends from U.S. Route 95, 4 miles westward toward the residentially developed northwest Las Vegas (Summerlin area). As this master planned community continues to grow, this facility will be extended further westward thereby providing primary east-west line haul movement for its residents.

Interstate 215 is currently a three mile east-west section of the south leg of the Las Vegas Beltway connecting Interstate 15 with McCarran International Airport and Windmill Road. As this facility is builtout, it will provide east-west line haul movement connecting southwest Las Vegas and Henderson while maintaining essential access to Interstate 15 and McCarran International Airport. Although no eastern leg is planned for Interstate 215, its completion through the Western and Northern segments of the Valley will provide a circumferential route around the Las Vegas metropolitan area.

In the Las Vegas Valley there is a heavy reliance on the arterial network to accommodate vehicular travel demand. Consequently, the arterial network plays an essential role in the movement of people and goods. The arterial network in Las Vegas, like many other southwestern cities, has been built around the established system of rectangular survey coordinates yielding a grid network.

The combination of land development patterns and the arterial network have given rise to several high volume corridors throughout the valley. These corridors are readily recognizable when examining the annual average daily traffic (AADT) volume on the existing system, shown in Figure 3-2.

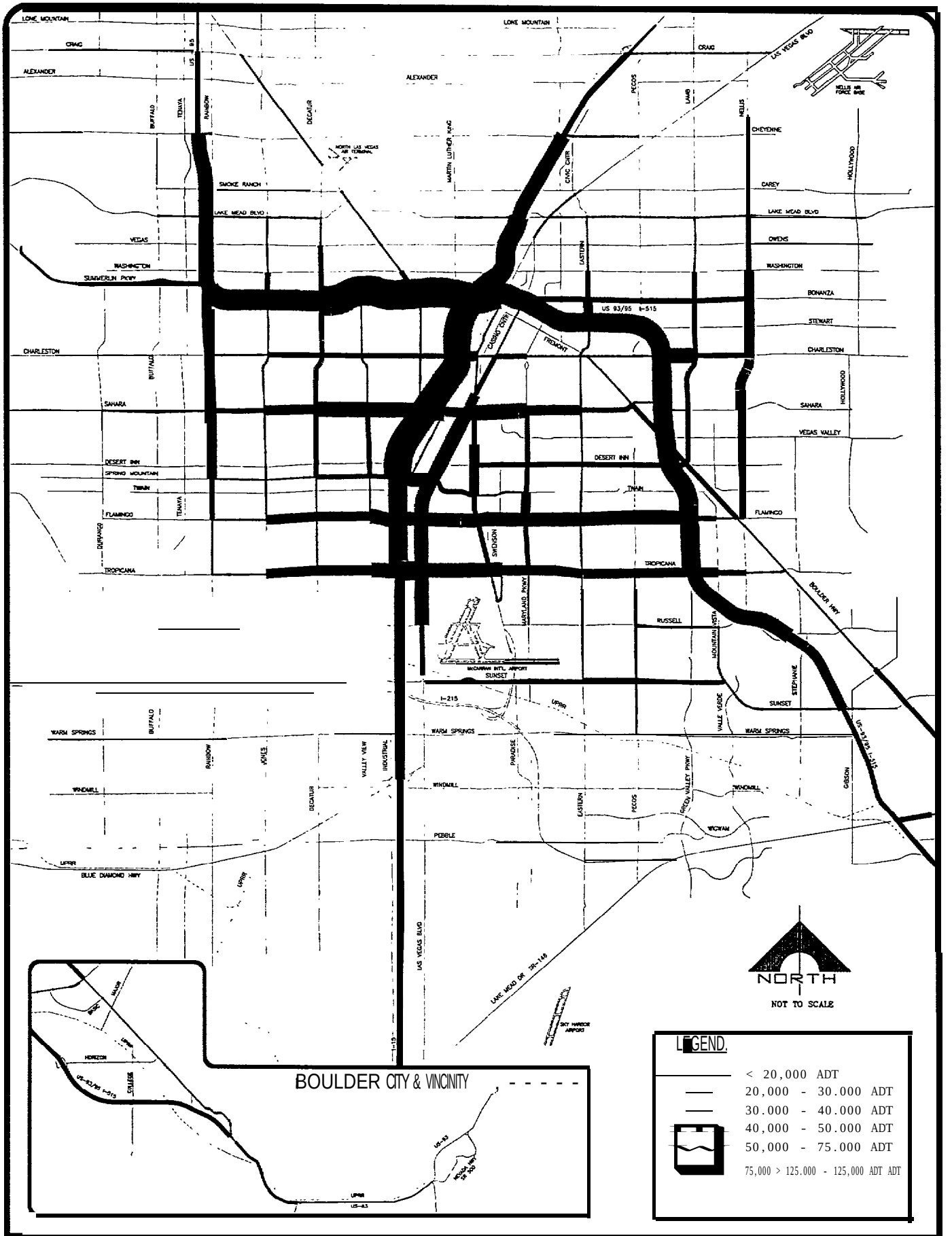

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FIGURE 3-2

ADT MAP

The major corridors identified by direction are listed below.

North-South Corridors

- Interstate 15
- U.S. 95/I-515 (excluding east-west section)
- Tropicana Ave. (S.R. 593)
- Boulder Highway (S.R. 582)
- Las Vegas Blvd. (Resort Corridor)
- Rainbow Blvd. (S.R. 595)
- Charleston Blvd. (S.R. 587)
- Decatur Blvd. (S.R. 597)
- Spring Mountain Rd. (S.R. 591)
- Paradise Rd. (Airport to Conv. Center)
- Cheyenne Ave. (SR 574)
- Maryland Pkwy. (UNLV to Downtown)
- Craig Road (SR 573)
- Eastern Ave. (S.R. 607)
- Nellis Blvd. (AFB to Boulder Hwy.)
- Jones Blvd.
- Valley View Blvd.
- Lamb Blvd.
- Pecos Road
- Koval Lane
- Durango Drive
- Buffalo Drive

East-West Corridors

- U.S. 95 (9 mile east-west section)
- Flamingo Rd. (S.R. 592)
- Sahara Ave. (S.R. 589)
- Warm Springs Road
- Desert Inn Road
- Sunset Road (S.R. 146)
- Lake Mead Blvd. (S.R. 147)

Figure 3-2 was primarily developed from the 1993 Annual Traffic Report published by the Nevada Department of Transportation (where available, more recent count data was utilized). In reducing the data, it becomes apparent that several facilities are not adequately represented in the traffic count report. As a result, the Regional Transportation Commission in cooperation with NDOT, have recommended that additional count locations be added to the existing count stations. Figure 3-3 shows the existing and recommended traffic count locations in the Las Vegas Metropolitan Planning Area.

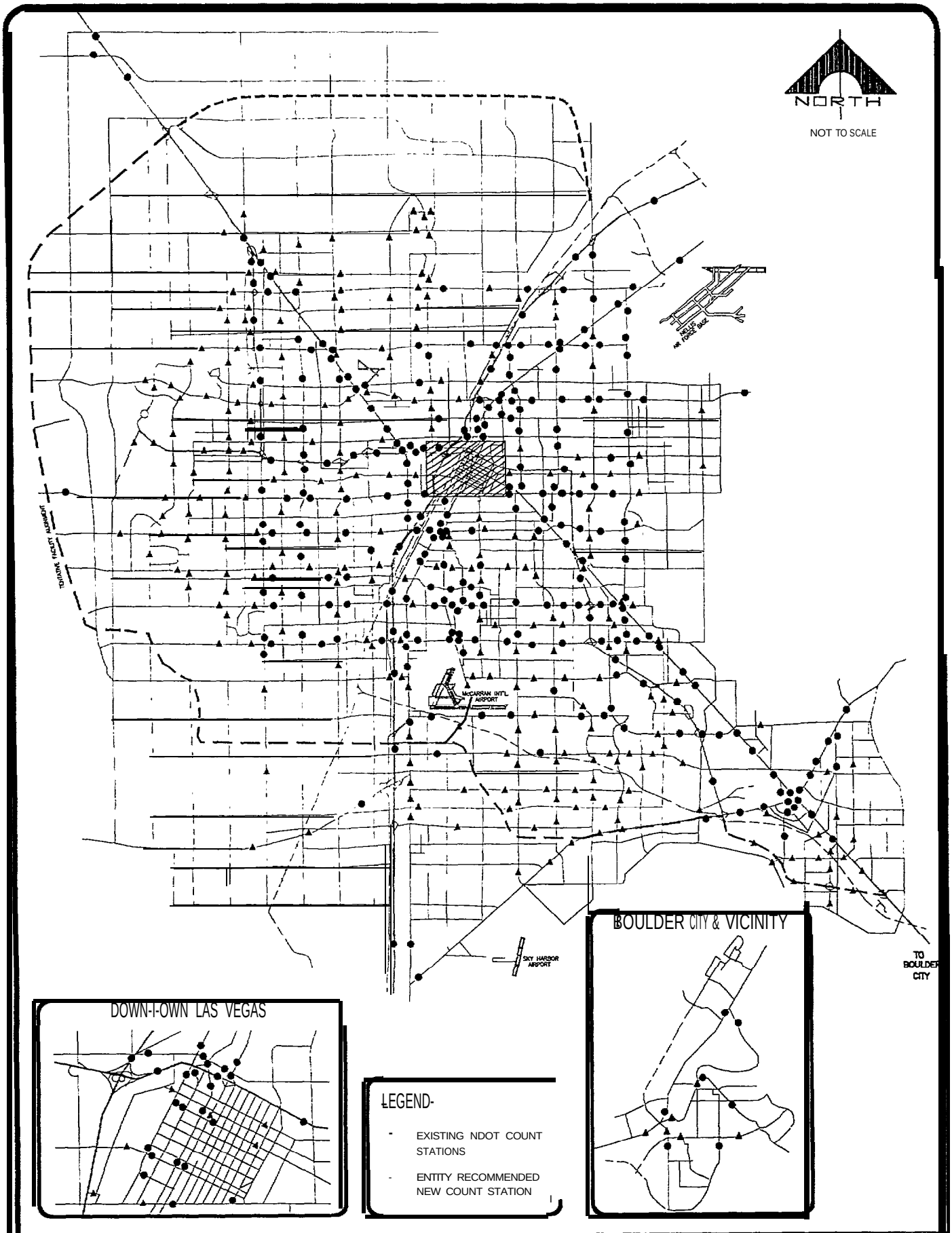

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FIGURE 3-3
TRAFFIC COUNT LOCATIONS

3.3 Las Vegas Valley Computer Traffic System (LVACTS)

In 1972 the Federal Highway Administration (FHWA) initiated the Urban Traffic Control System (UTCS) demonstration and research project in Washington D.C. The focus of this project was to develop and test computer-based traffic control strategies that would improve traffic flow in a real world environment. The success of the project was promulgated by the FHWA resulting in several pilot projects across the United States.

The Las Vegas Valley Computer Traffic System (LVACTS), which is based on the UTCS concept, became operational in 1983 and is capable of controlling up to 512 signalized intersections. LVACTS is a centrally controlled system based on the "first generation" of traffic control. "First generation" systems use a library of pre-stored timing plans developed by off-line optimization programs. The timing plan selected can be based on time of day (TOD), measured traffic patterns (traffic responsive), or operator specification. LVACTS also features a critical intersection control (CIC) mode which allows cycle by cycle adjustment of the green times on competing intersection approaches.

LVACTS is currently being upgraded to a "hybrid" traffic signal system based on a distributed control architecture which will be capable of accommodating up to 1,200 intersections. The system is being designed around a centralized database and will be capable of fully integrating video surveillance and other ITS technologies. The new "hybrid" system is expected to become operational in 1996 and at that time will incorporate approximately 43 closed circuit television (CCTV) cameras. The tentative CCTV camera locations, are depicted in Figure 3-4. CCTV cameras will allow the Transportation Management Center (TMC) and the Jurisdictional Management Centers (JMC) to monitor congested and critical locations when incident detection algorithms identify the likely occurrence of congestion or an incident. Additionally, with the recent advances in video image processing, the CCTV cameras could be used for both vehicle detection and data collection.

3.4 National Highway System (NHS)

Since Congress enacted the intermodal Surface Transportation Efficiency Act of 1997 (ISTEA), the direction of transportation agencies in the United States has shifted from one of providing more infrastructure to meet demand, to one of making the existing infrastructure more efficient by planning for and providing for an INTEGRATE, MULTI-MODAL System. ISTEA authorizes $121 billion for projects.

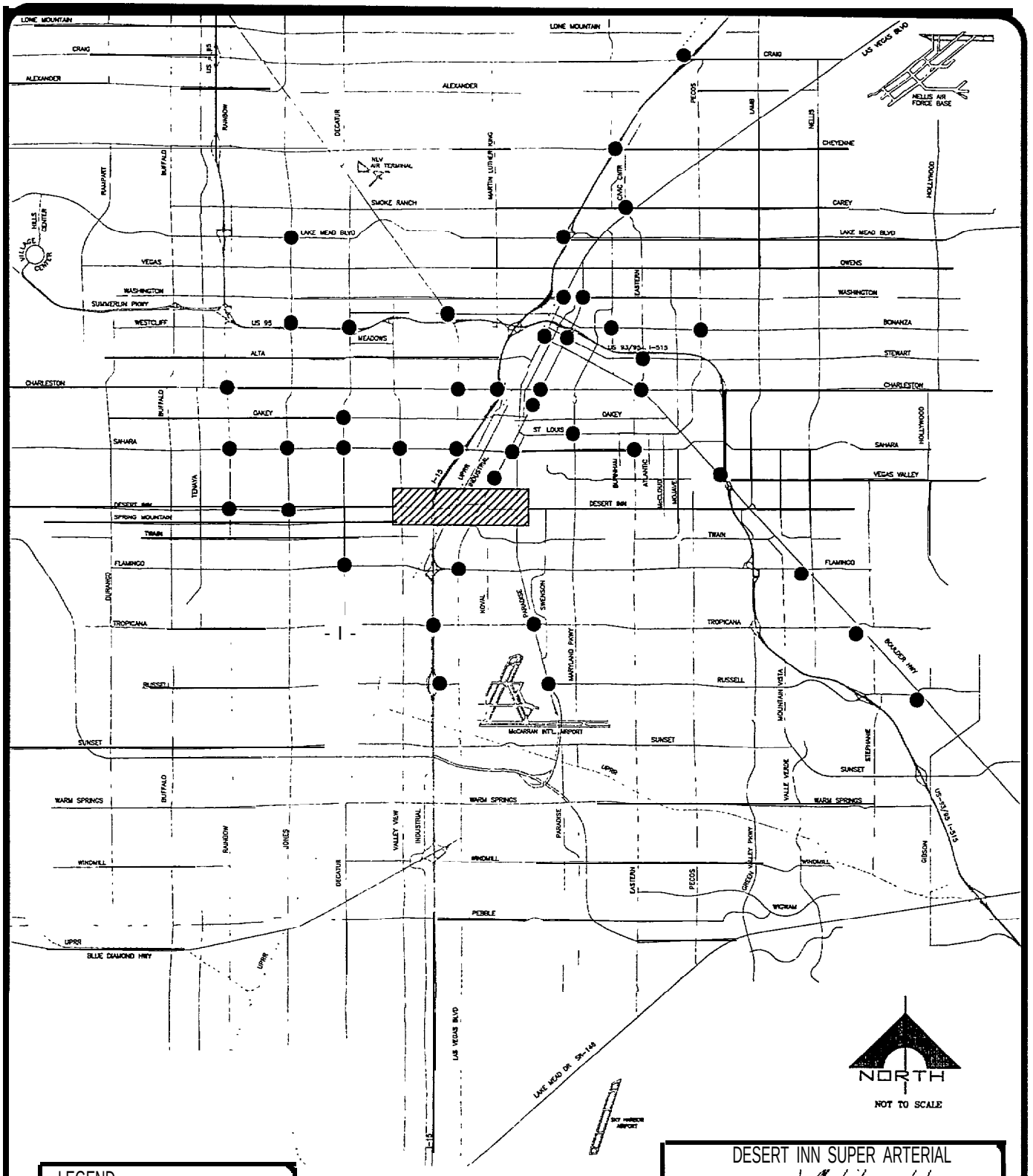

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FIGURE 3-4
PROPOSED LVACTS CCTV CAMERA LOCATIONS

Federal funds, which have historically been distributed into four roadway classifications systems according to the Federal-Aid Highway Act of 7921, will be distributed now into two systems under ISTEA. The Interstate System, Primary System, Secondary System and Urban System have been consolidated into the National Highway System (NHS) and the Surface Transportation Program. The NHS will consist of all interstate routes, the strategic defense highway network, strategic highway connectors, and a considerable percentage of urban and rural principal arterials. When completed, the NHS will include approximately 155,000 miles of roadway throughout the United States. Figure 3-5 graphically illustrates the proposed NHS facilities in the Las Vegas Valley which are listed below (It should be noted that Congress has not yet approved the National Highway System):

- Interstate 15 from stateline to stateline
- U.S. Route 95 Interstate 515 from stateline to Nye County
- U.S. Route 93 from stateline to Lincoln County
- State Route 595 (Rainbow Blvd.) from U.S. Route 95 to State Route 593 Tropicana Ave.
- State Route 593 (Tropicana Ave.) from Rainbow Blvd. to U.S. Route 93/95/interstate 515
- l-215 from l-15 to l-515 (US 93-95)

To encourage strategic planning for the implementation of an intermodal transportation system, ISTEA authorized the Secretary of Transportation to provide up to $3 million in grants for individual states to develop model intermodal transportation plans. To this end, ISTEA established the Office of Intermodalism (within the Office of the Secretary of Transportation) whose mission is to maintain and disseminate transportation data and coordinate Federal research regarding intermodal transportation.

3.5 Recurring and Non-recurring Congestion Areas

Freeways:

The significant increase in vehicular traffic resulting from the unprecedented levels of growth in the Las Vegas Valley have exceeded the capacity of the existing freeway facilities during peak periods. The result is recurring unstable traffic flow characterized by “stop and go” traffic at specific locations along these facilities. Identification and elimination of these “bottlenecks” would decrease overall fuel consumption and mobile source pollutant emissions along their freeway corridors. Application of ITS should, therefore, focus in these problem areas. Figure 3-6 shows the locations of recurring freeway congestion.

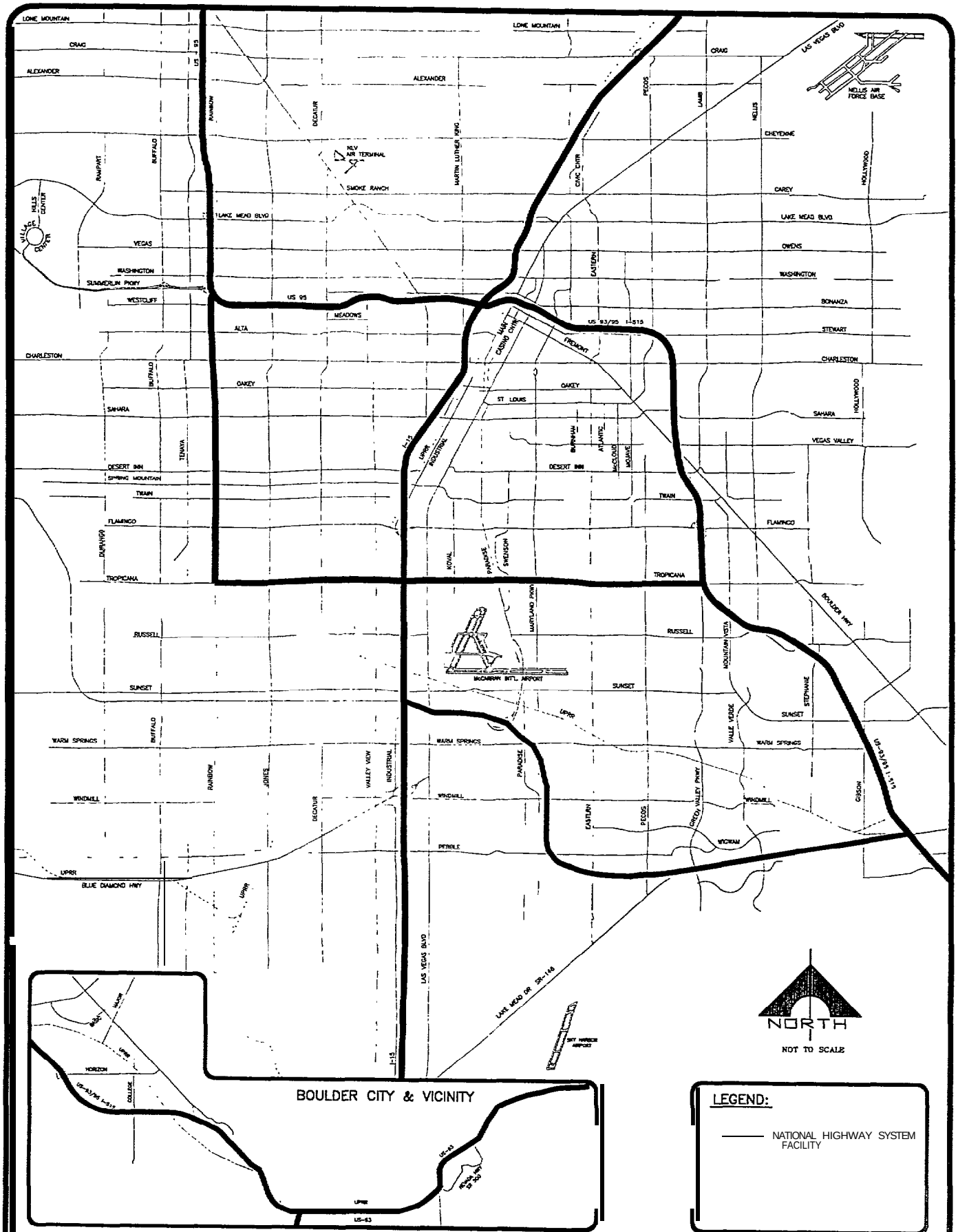

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FIGURE 3-5

PROPOSED NATIONAL HIGHWAY SYSTEM FACILITIES

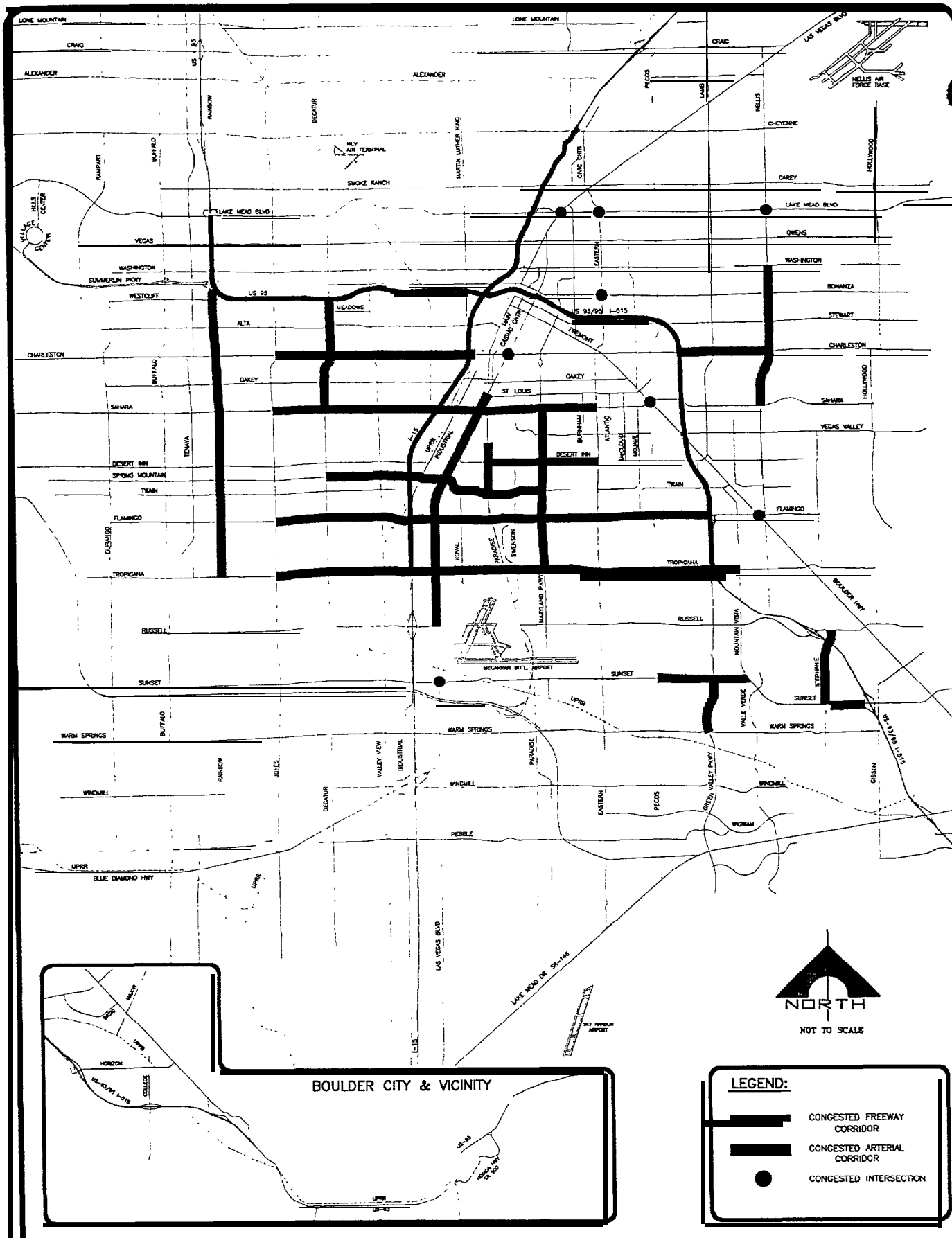

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FIGURE 3-6
HIGH CONGESTION LOCATIONS

Arterials:

The Valley's arterial system is established on a one-mile rectangular grid network. The efficiency of this grid network has become degraded due to the high vehicular demand to travel both north south and east-west, resulting in the formation of "traffic demand barriers". During peak periods, the result is substantial recurring congestion at several intersections along the "traffic demand barrier". Figure 3-6 also shows the locations of recurring arterial congestion. As illustrated, Las Vegas Boulevard represents one such "traffic demand barrier" where high demand for north-south travel, through the resort corridor, inhibits east-west travel there effectively dividing the valley in half. The problem is compounded by the close proximity and the limited number of arterial grade-separations with the Union Pacific Railroad and I-15.

Non-recurring congestion, by its very nature, is difficult to pinpoint valley-wide. Accidents, break-downs, cargo spills, and other random incidents are the cause of non-recurring congestion. The duration and severity of this type of congestion is typically a function of the demand on the facility, the type of incident, geometrics of the facility, and the emergency response time. Although there is no realistic way of eliminating non-recurring congestion, the ability to quickly respond and clear an incident from a given facility will reduce overall traffic impacts. Figure 3-7 depicts those intersections which have experienced the most number of accidents in 1994.

Traditional accident/safety analysis examines the accident rate of a given facility instead of simply the number of accidents as shown in Figure 3-7. However, the focus of an effective incident management program is to minimize the relative impact of a given incident on the network. Intuitively, an incident at a high volume location is more likely to have a detrimental impact on the surrounding transportation network than a similar incident at a low volume intersection. With this in mind, it is logical to concentrate on those locations with both high traffic volumes and a high number of accidents. These locations would not be easily recognizable if only accident rates were examined.

According to METRO statistics, there were 7,401 injury and 16,836 non-injury accidents on the surface streets of Las Vegas reported in 1994. The 1994 total of 24,237 accidents represents a 45 percent increase in the total number of accidents reported in 1991 and a 12 percent increase over those reported in 1993. More accidents occurred on Friday (18.4%) than any other day of the week in 1994. Also, more accidents occurred from 5:00 pm to 6:00 pm (9.7%) than any other time of the day in 1994. It should be noted that the interval from noon to 6:00 pm accounted for approximately 48% of all accidents last year. Although the total number of accidents has risen markedly from 1991 to 1994, no sound inferences can be made regarding the relative safety of the roadway system without examining the accident rates.

According to the City of Henderson Police Department statistics, there were a total of 1486 accidents in 1994 and 1692 accidents in 1993. This represents a 14% decrease in total accidents from 1993 to 1994. Similar statistics from the City of North Las Vegas shows **a** total of 2210 accidents in 1994 which represents a 13% increase from a total of 1955 accidents in 1993.

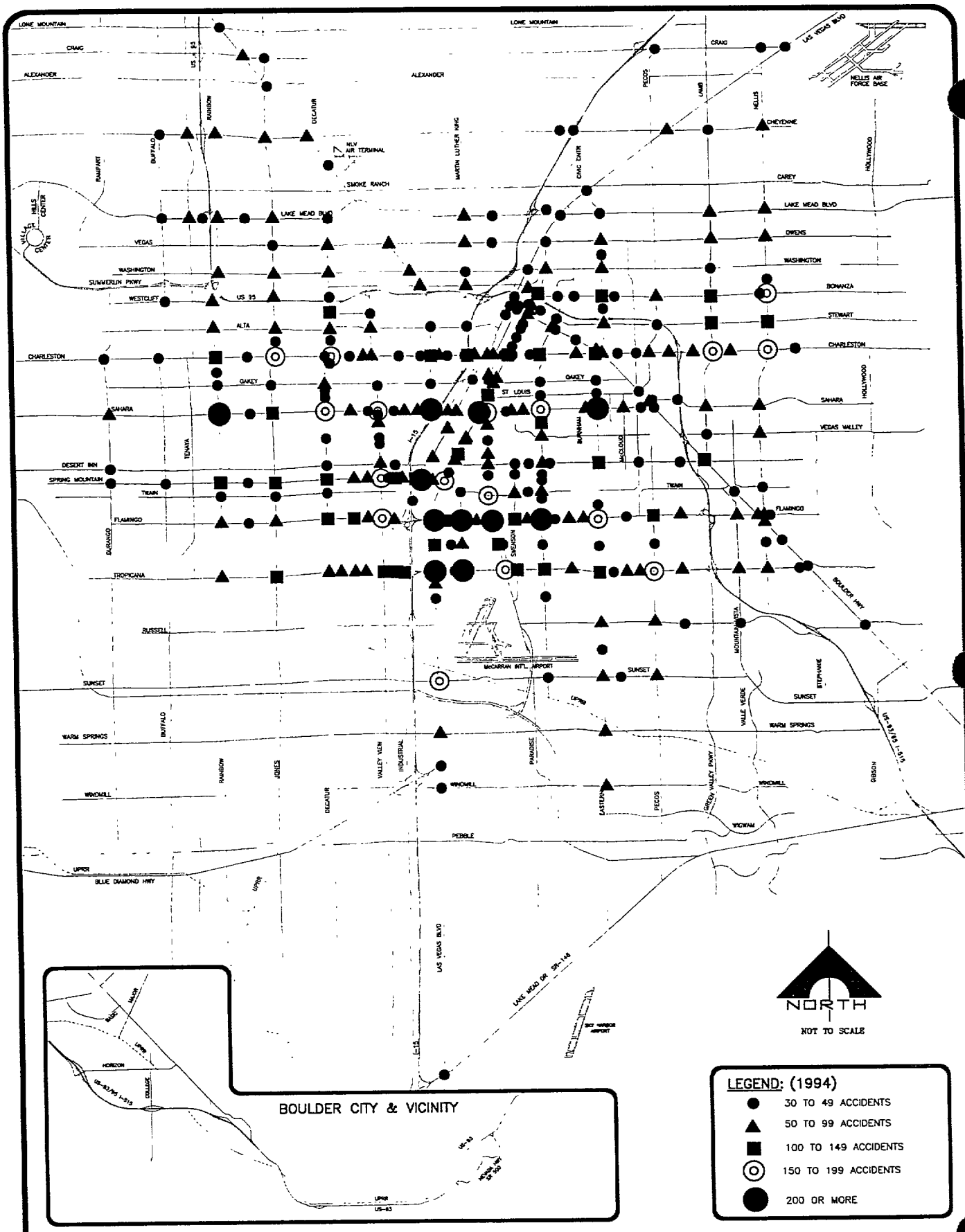

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FIGURE 3-7
HIGH ACCIDENT LOCATIONS

In an attempt to better service incidents around the Las Vegas Valley, the Nevada Highway Patrol has initiated a new response program. The program, which takes advantage of the substantial cellular phone ownership per capita in the Las Vegas Valley, relies on drivers to report accidents and incidents immediately after they occur by dialing *NHP on their cellular phone. The call is free to the cellular customer and should result in shortening the NHP's incident detection and response time.

3.6 Construction Projects

Several construction projects, either currently underway or in the planning/design stage, will become major corridors in the Las Vegas Valley. These facilities will likely shift traffic patterns significantly in the near future. A brief description of their major projects is provided in the paragraphs below. Figure 3-8 graphically illustrates the RTC's 1994 Transportation Improvement Program (TIP).

The Desert Inn Super Arterial, estimated to open early in 1996, will provide efficient east-west line haul movement by restricting access to and from Las Vegas Boulevard, Interstate-15, and Industrial Road. When completed, this facility will be the only major east-west arterial that provides grade-separation with Las Vegas Boulevard. Additional grade-separations with the Union Pacific Railroad, Industrial Road, and Interstate-15 will virtually assure non-stop travel from Valley View Boulevard to Paradise Road. The latent or "hidden" demand for this facility is undoubtedly very high and, consequently, it should attract a significant amount of traffic from Sahara Avenue, Spring Mountain Road, and Flamingo Road.

The Las Vegas Beltway (Interstate-21 5) has recently opened a segment connecting Interstate-15 with McCarran International Airport and on Southeastward to Windmill with planned future connection to U.S. 93/95 in Henderson. As shown in Figure 3-8, completion of the links from Buffalo Dr. to U.S. 93/95/I-515 is anticipated by 2000. This limited access facility will ultimately provide line haul movements between southwest Las Vegas and the Green Valley/Henderson area thereby reducing the overall demand for U.S. 93/95 Flamingo, Tropicana, and Sunset as an east-west line haul facility.

Design improvements to the existing I-151U.S. 93/95 core interchange ("The Spaghetti Bowl") will eliminate the numerous operational problems associated with the current design. The new design incorporates directional ramps that are more conducive to high speed traffic flow and removes the existing short weaving and merging areas. When completed, the interchange will be able to safely accommodate much higher volumes resulting in less vehicular delay, reduced fuel consumption, and power vehicular emissions.

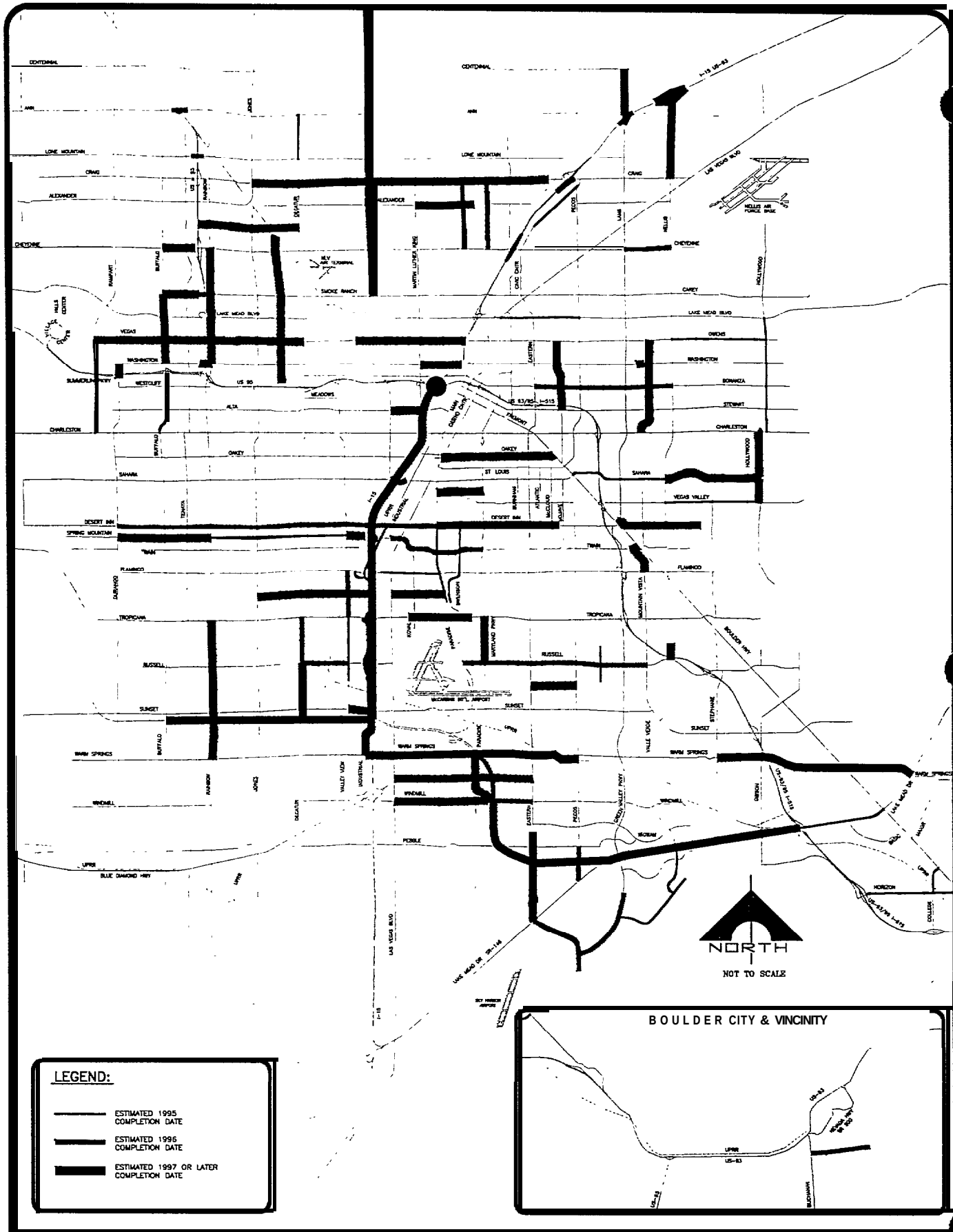

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FIGURE 3-8

RTC'S 1994 TRANSPORTATION IMPROVEMENT PLAN

A feasibility study for the extension of the Paradise/Swenson one-way pair Northward from Naples Drive to Sahara Avenue is being performed. Such development will probably promote a shift in current traffic patterns. The Las Vegas Strip (Las Vegas Boulevard) has become severely congested due to the extensive expansion of the hotel/resorts along this corridor. As a result, the need exists for a high capacity parallel route which affords access to the various properties along the Strip and McCarran International Airport. This project should help meet the latent demand that exists for north-south movement.

The significant pedestrian traffic along the resort corridor often impedes the movement of vehicles at intersections. The problem is magnified by the frequent disobedience of the "DON'T WALK" indications and "jaywalking" of pedestrians unwilling to wait curbside for appropriate walking intervals. The recently constructed pedestrian overpasses at Tropicana Avenue and Las Vegas Boulevard have eliminated this conflict at one intersection by grade-separating the pedestrians. Tentative plans call for similar pedestrian facilities at the intersection of Flamingo Road and Las Vegas Boulevard. ,and Las Vegas Blvd. and Spring Mountain Road.

Another recently completed project that could reduce pedestrian and vehicular traffic along the Strip is the MGM/Bally's Monorail people mover system. Similar systems may eventually connect all the hotels/casinos along the resort corridor with downtown Las Vegas and McCarran International Airport.

Despite the large number of construction projects valley-wide, very few have made provisions for future ITS technologies outside of providing empty roadway conduit. A brief listing of the projects that have incorporated future ITS applications is provided below:

- The airport connector road utilizes lane use and changeable message signs in and around the tunnel.
- The NDOT permanent count station #0312109 located on I-15 north of Charleston Boulevard will be upgraded to provide vehicle classification and speed data as part of the I-1 5 improvements.
- The LVACTS upgrade will incorporate the use of CCTV cameras at critical intersection locations.
- Desert Inn super arterial with CCTV cameras, Variable Message Signs, Incident Loop detectors and communication network (telephone lines, fiberoptic cable and microwave).

3.7 Regional Activity Centers

Regional activity centers are those facilities that are primary destinations for both residents and visitors in the Las Vegas Valley. Not surprisingly, the facility that attracts the most trip ends is McCarran International Airport (LAS). LAS which handled approximately 26.8 million total passengers in 1994, is the 8th busiest airport in the United States. MIA is the pulse of the Las Vegas entertainment industry with approximately 44.4 percent of all visitors arriving via air transportation. Figure 3-9 shows the location of MIA in relation to the existing transportation network. Further discussion of MIA is provided in the transportation mode section of this report.

The primary recreational activity centers in Las Vegas are, without a doubt, the hotel/casino resort facilities. Las Vegas has more hotel/motel rooms, over 86,000, than any other U.S. city and is home to eleven of the thirteen largest hotels in the world. City-wide, these facilities maintain an annual occupancy rate of over 89 percent. Indeed almost every one who visits Las Vegas will have a trip end at one or more of these facilities. Figure 3-10 graphically depicts the locations of the major hotel facilities throughout the Las Vegas Valley.

Las Vegas, long known as the "Entertainment Capital of the World", has become a premier location for meetings and conventions. The Las Vegas Convention and Visitors Authority (LVCVA) has successfully promoted Las Vegas as a preeminent convention location as evidenced by the 2,662 gatherings attended by 2.7 million people in 1994. The focal point of convention activity is the Las Vegas Convention Center which offers more than 1.3 million square feet of meeting and exhibit space making it the largest single level convention facility in the United States. The major hotels provide an additional 2 million square feet of meeting and exhibit space, including the Sands Expo and Convention Center with approximately 570,000 square feet. Another 100,000 square feet is available at Cashman Field. The locations of the major convention facilities are shown in Figure 3-9.

International and national convention bookings for 1995 indicate that 35 meetings are expected to have an attendance of 10,000 delegates or more. A brief listing of the largest events is provided below:

Convention	Estimated Attendance
Comdex	***190,000***
Consumer Electronics Show	***91,200***
National Association of Broadcasters	***80,000***
Men's Apparel Guild in California	***70,000***
Specialty Equipment Market Association	***60,000***
Interop Corporation	***50,000***
Air Force Association	***45,000***

Other major event centers include the Thomas & Mack Center, Las Vegas Silver Bowl Stadium, Cashman Field and the MGM Grand Garden. These facilities will host a majority of the largest annual non-convention related events in Las Vegas including the National Finals Rodeo, June Fest, the Western Athletic Conference (WAC) Championship and the PRCA Championship Rodeo. Figure 3-9 graphically illustrates the location of these facilities in relation to the transportation network.

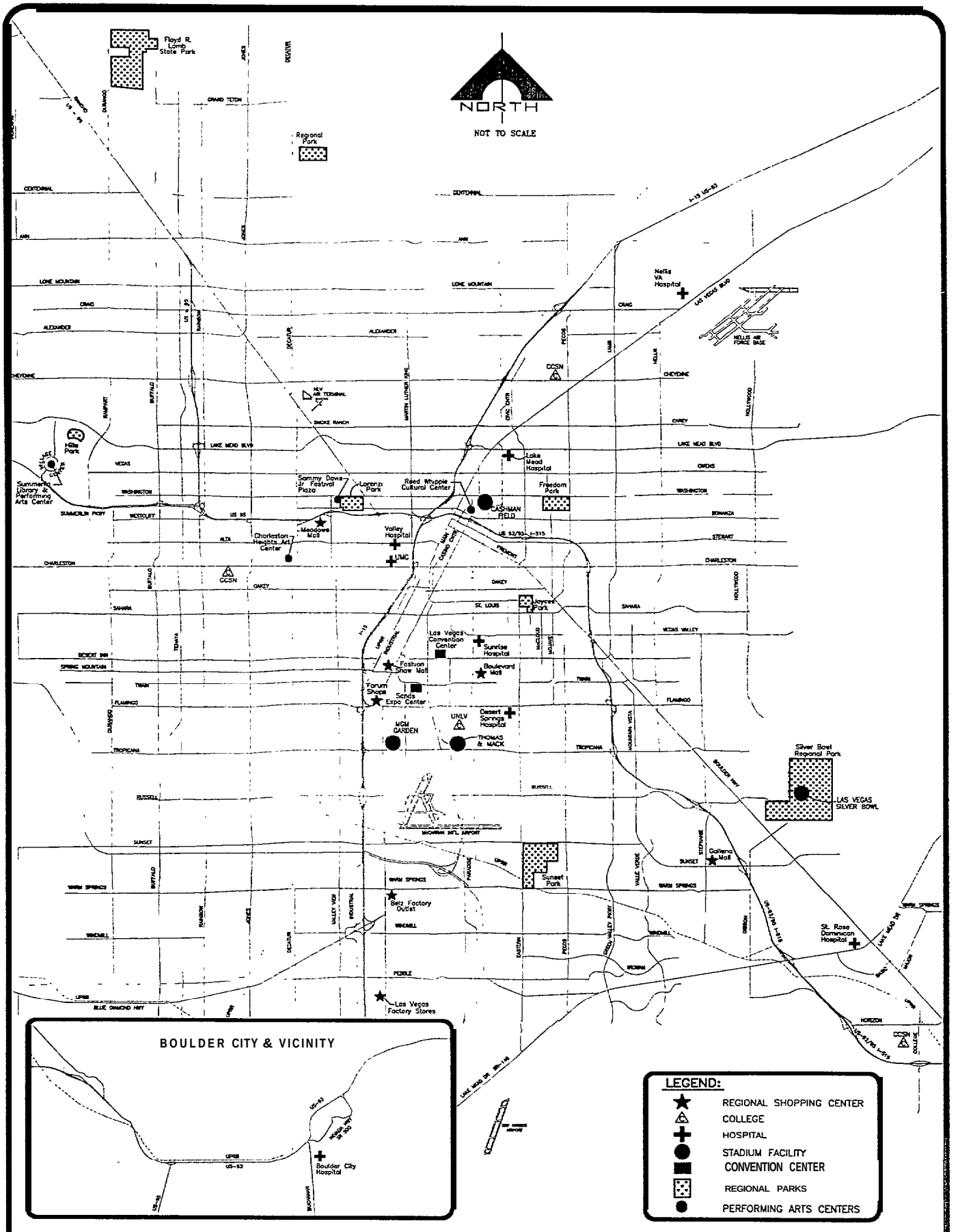

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FIGURE 3-9
REGIONAL ACTIVITY CENTERS

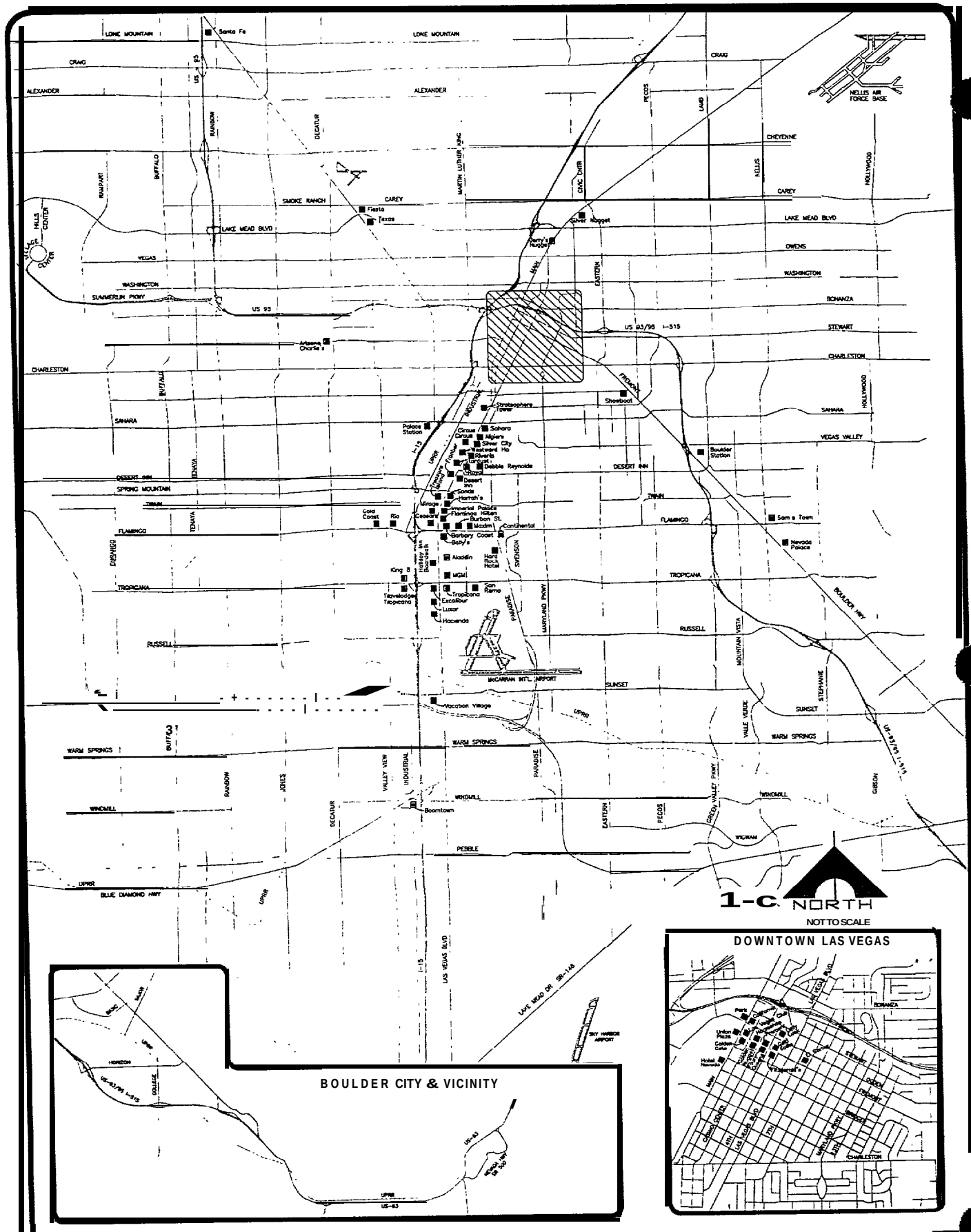

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FIGURE 3-10

MAJOR HOTEL/CASINO FACILITIES

The large amount of visitors in Las Vegas offer an interesting set of opportunities to implement traveler information and route guidance technologies.

Figure 3-9 also shows the locations of the seven regional malls in the Las Vegas Valley. These activity centers generate trips from both residents and visitors and have become an integral element of the Nevada economy, by providing a significant amount of sales tax dollars.

Major recreational areas located outside the boundaries of the Las Vegas Metro area include Lake Mead recreational area, Hoover Dam, Red Rock Canyon, Valley of Fire State Park, Mount Charleston/Lee Canyon, and the Grand Canyon (Arizona). Summary statistics for these facilities are provided below.

- Lake Mead, the largest man-made lake in the United States with 500 miles of shoreline, had approximately 9.9 million recreational visitors in 1994. This represents an increase of 7 percent from 1993.

- The recently renovated Hoover Dam facility has attracted approximately 725,000 visitors annually. This facility is the largest tourist attraction outside the metropolitan area for those visiting Las Vegas.

- In 1994, Red Rock Canyon, a scenic and recreational area in addition to being a nationally recognized area for rock climbing, had 236,105 visitors which represents a 19.8 percent increase from 1993.

- The Valley of Fire State Park attracts approximately one-quarter of a million visitors annually.

- Mount Charleston and Lee Canyon, located in the 3.5 million acre Toiyabe National Forest, offers scenic mountain vistas and winter sports within an hours drive of the desert climate of Las Vegas. Temperatures at Mount Charleston/Lee Canyon are typically 10 to 15 degrees cooler than those in Las Vegas offering relief from the intense summer heat.

Las Vegas is home to two institutions of advanced education. The University of Nevada Las Vegas (UNLV) has an enrollment of 19,500 students and employs more than 2000. The campus, which is located on 335 acres just north of McCarran International Airport (see Figure 3-9), is integral to the city's cultural life offering music, drama, dance, art and sporting events. The Community College of Southern Nevada (CCSN) has three campus locations throughout Las Vegas. CCSN has become the largest of all the Nevada University and Community College institutions with enrollment topping 23,000 students.

Nellis Air Force Base (NAFB), located in the City of North Las Vegas, is another major activity center. The base covers approximately 12,000 square miles of airspace and 3 million acres of land. With 7,100 military, 2,000 civilian, and 5,000 temporary duty personnel, NAFB is one of the largest employers in the Las Vegas Valley. In 1993,21,609 sorties were flown making NAFB one of the busiest air bases in the world. This facility represents the largest and most complex installation in the Air Combat command.

3.8 Transportation Modes

Air Travel:

The distribution of externally based trips that have the Las Vegas Valley as a destination is illustrated in Table 3-2 below. As indicated, personal automobiles are still the most highly utilized mode but air transportation has become more prominent in recent years.

TABLE 3-2: Mode Choice of Visitors Traveling to Las Vegas

MODE OF TRANSPORT	PERCENT DISTRIBUTION BY YEAR		
	1985	1990	1994
Airlines	*38.5%*	*41.6%*	*44.3%*
Automobile	*49.0%*	*46.8%*	*46.9%*
Bus	*12.4%*	*11.2%*	*8.5%*
Train	*0.1%*	*0.4%*	*0.3%*
TOTAL	*100.00%*	*100.00%*	*100.00%*

McCarran International Airport (MIA) represents the Valley's link with the nation and the world. The importance of MIA to Las Vegas is readily apparent by examining the total number of enplaned-deplaned passengers over the last ten years, shown in Table 3-3. As indicated, the airport's passenger totals have more than doubled over the last ten years and the Federal Aviation Administration predicts that those numbers will double again in the coming ten years. If this forecast proves accurate MIA will become as busy as Los Angeles International is today.

MIA's rapid growth has triggered substantial facility improvements as the Clark County Department of Aviation (CCDOA) prepares for continued growth. Recent completion of the 2.5 mile Airport Connector Road will provide non-stop service to MIA from Interstate 15. The Connector has reserved right-of-way for a future mass-transit system. In addition, a new parking garage facility is being constructed that will provide 3,000 short and long-term parking spaces. Completion date of the new garage is anticipated to be 1997.

TABLE 3-3: Total Enplaned/Deplaned Passengers at McCarran International Airport

YEAR	TOTAL ENPLANED/ DEPLANED PASSENGERS	PERCENT CHANGE
1985	*10,924,047*	---
1986	*12,428,748*	*13.8%*
1987	*15,582,302*	*25.4%*
1988	*16,231,199*	4.2%
1989	*17,106,948*	*5.4%*
1990	*19,089,684*	*11.6%*
1991	*20,171,969*	*5.7%*
1992	*20,912,585*	*3.7%*
1993	*22,492,156*	*7.6%*
1994	*26,850,486*	*19.4%*

LAS is operated by CCDOA and is the place of work for nearly 10,000 employees! The airport currently processes 783 arriving and departing scheduled flights daily. Sunday and Friday are the highest arrival volume days of the week with 20% and 17%, respectively, while Tuesday and Saturday are the lowest with 10% each. The majority of passengers (55 percent) arrive between noon and 6:00 pm. The estimated mode choice distribution for air passengers leaving the airport is shown in Table 3-4.

North Las Vegas Air Terminal, operated by CCDOA, is the general aviation reliever for LAS. It is located north of Carey Avenue and east of Rancho Drive. Besides general aviation services, the airport offers flight training, avionics and aircraft maintenance, and aircraft sales to the Valley. The airport also has significant charter operations. The major facilities on site include a 5,000 foot lighted runway, restaurant and a fixed base operator.

Sky Harbor Airport is primarily used for airplane tours of the Grand Canyon and various recreational-related aviation activities. The airport provides, among other things, a glider towing service, ultra-light aircraft operations, skydiving, and aircraft storage. CCDOA, in an effort to meet the anticipated future growth, is currently negotiating to purchase this privately-owned airport to use as a second general aviation reliever for MIA.

TABLE 3-4: Approximate Mode Distribution for Air Passengers Leaving McCarran Airport

MODE CHOICE	PERCENTAGE OF ARRIVING PASSENGERS
Passenger Car	52%
Rental Car	20%
Taxi/Limo	14%
Hotel/Motel Shuttle Bus	9%
Other	5%

Taxicabs:

Not surprisingly, the taxicab industry in Las Vegas has experienced tremendous growth over the last ten years as indicated in Table 3-5. There are currently seven taxicab owners operating fourteen taxicab companies, with 740 cabs providing service to the Las Vegas Valley. Table 3-6 provides a breakdown of the total number of trips, total revenue, and total number of vehicles by company for 1994. It should be noted, McCarran International Airport only accounted for 11.2 percent of the total taxicab trips in 1994.

Despite the growth in the taxicab industry, the taxicab operators appear to have a meaningful commitment to providing quality service to the riding public. An overwhelming 93 percent of the visitors who used a taxi while in Las Vegas said they were satisfied with the service they received.

The large fleet size of taxicabs in Las Vegas offers an opportunity to use them as vehicle probes. Since each taxi is already equipped with two-way radio, they can quickly report incidents and traffic conditions to a TMC or JMC. This could provide to be a valuable source of real-time travel information.

Rental Cars:

The demand for rental cars in the Las Vegas Valley is extremely high due to the number of annual visitors that choose to fly into Las Vegas as a vacation destination. Preliminary estimates place the number of auto rentals at approximately two million annually. Based on the 1994 average length of stay of 4.0 days, average party size of 2.7, and that Friday through Monday account for 64 percent of the total arrivals in Las Vegas, it is estimated that one in every 50 vehicles in the Las Vegas Valley is a rental vehicle. This represents a significant number of unfamiliar drivers on the Valley's roadways. It offers an opportunity to deploy route guidance technology to assist the visitors to find their routes. The large rental car fleet sizes also offer opportunities to deploy in-vehicle navigational devices.

TABLE 3-5. Yearly Taxicab Trips and Revenues

YEAR	TRIPS	PERCENT CHANGE	REVENUE	PERCENT CHANGE
1985	7,306,024	---	$43,353,831	---
1986	7,641,708	4.60%	$50,875,189	17.35%
1987	8,319,195	8.87%	$56,808,695	11.66%
1988	8,498,399	2.15%	$58,037,262	2.16%
1989	8,557,894	0.70%	$59,580,946	2.66%
1990	9,622,631	12.44%	$66,991,603	12.44%
1991	9,490,714	(1.37%)	$69,314,580	3.47%
1992	9,711,755	2.33%	$73,334,161	5.80%
1993	10,569,912	8.84%	$82,569,560	12.59%
1994	13,629,007	28.94%	$107,244,686	29.88%

TABLE 3-6. Taxicab Industry Statistics for 1994

COMPANY	TOTAL NUMBER OF CABS	TOTAL TRIPS	TOTAL REVENUE
Ace	66	1,193,820	$9,369,056
Union	56	1,010,413	$8,035,089
Vegas-Western	39	737,596	$5,782,940
ANLV	39	357,467	$3,178,744
Yellow	113	2,068,899	$16,111,332
Checker	113	2,045,341	$16,071,254
Star	41	780,553	$6,129,282
Whittlesea	101	1,936,988	$15,094,491
Henderson	40	795,876	$6,121,888
Western	43	828,682	$6,636,602
Desert	42	874,026	$7,166,868
Nellis	39	899,390	$6,978,305
Lucky	5	95,671	$516,912
TOTAL	**740**	**13,629,007**	**$107,244,686**

Public Transit:

The Las Vegas Valley's first publicly-owned/operated mass-transit system, Citizen's Area Transit **(CAT(R)),** began operations in 1992. CAT(R) currently operates 171 buses and is carrying over 2.0 million passengers per month. The system, which provides service 7 days a week, currently runs 20 hours (from 5:30 am to 1:30 am) in the residential areas of the Valley and 24 hours along the Strip and downtown. The fixed-route bus network consists of crosstown lines that utilize the arterial grid network, radial routes that extend along three major corridors, and resort corridor routes.

CAT(R) offers a new paratransit service which provides on-demand transportation for those with disabilities that preclude them from utilizing the CAT(R) fixed-route service. CAT(R) Paratransit service consists of 80 buses that will provide over 200,000 passenger-hours of curb-to-curb transport. The American with Disabilities Act (ADA) of 1990 requires the Paratransit system to provide service to 239.8 square miles of the Valley. The RTC has gone beyond this minimum requirement and the current system has a service area of 502 square miles.

Intercity Rail:

Trips made to and from the Las Vegas Valley by train account for a small percentage of the overall number of trip ends. Nevertheless, train travel is a viable option for approximately 85,000 people annually. Amtrak reports that Las Vegas is the origin or termination point for a substantial portion of their annual ridership on the Desert Wind Route serving Salt Lake City and Los Angeles. Ridership numbers for Las Vegas over the last five years are provided below.

Year	Ridership
1990	
1991	**82,020**
1992	**84,406**
1993	**81,769**
1994	**85,475**

Intracity Rail:

People mover systems of various technologies continue to be considered as viable modes of transport. The future of these light rail and fixed guideway systems in the Las Vegas Valley is currently under investigation in a Major Investment Study being conducted by Parsons Brinkerhoff Quade and Douglas for the Regional Transportation Commission, The results of their analysis will be incorporated into this report at the time of publication. The recently opened monorail system connecting the MGM hotel with Bally's hotel should provide insight into the future of such systems along the resort corridor.

Non-Motorized Mode:

The Bicycle/Pedestrian Element of the Regional Transportation Plan is one element of the sub-regional planning process managed by the Regional Transportation Commission. It is intended to further integrate development of bicycle and pedestrian facilities with street and highway projects. The ultimate goal is to provide the Valley with greater opportunities for non-motorized, non-polluting forms of transport. The proposed regional bicycle network connects the areas where people live to the areas where they work, shop, go to school, and recreate.

Automobiles:

The private vehicle is still the dominate mode of transport throughout the Las Vegas Valley and will likely continue to be in the foreseeable future. As a result, the existing system is sensitive to the perceived driver level-of-service. One of the most easily perceived measures is speed, or its inverse, travel time. Drivers are keenly aware of the amount of time it takes for them to reach their destination. On freeway facilities, speed is the most evident measure of service quality, while on surface streets, the driver is more sensitive to the total travel time. To this end, Figure 3-11 depicts the current permanent speed loops located on the freeway facilities in the Las Vegas Valley. The figure also illustrates major at-grade railroad crossing locations across the Valley which can induce significant surface street delays.

3.9 Emergency Vehicle Requirements

As with any emergency response agency, the needs and requirements of Local police agencies, Nevada Highway Patrol, Mercy Ambulance, and the various fire departments focus on emergency response time. Accordingly, these agencies are interested in an effective and efficient incident management program including appropriate interagency communication/coordination.

Las Vegas Metro, the Nevada Highway Patrol, the City of Henderson and North Las Vegas Police Departments are responsible for traffic control in the event of an accident on the Las Vegas Valley roadway system. To reduce the adverse impacts that an accident has on the system, these agencies must be able to quickly secure the scene, safely detour traffic, clear the incident, and take the necessary measurements for future reconstruction. The ability to expedite this process is as important to these agencies as it is to the Valley's traffic engineers.

Traffic control during an incident often requires an alternate parallel route for the diversion of traffic. On the arterial grid system, these routes are readily available for surface street incidents. Unfortunately, no effective parallel routes with under-utilized capacity currently exists for incidents that occur on Interstate 15.

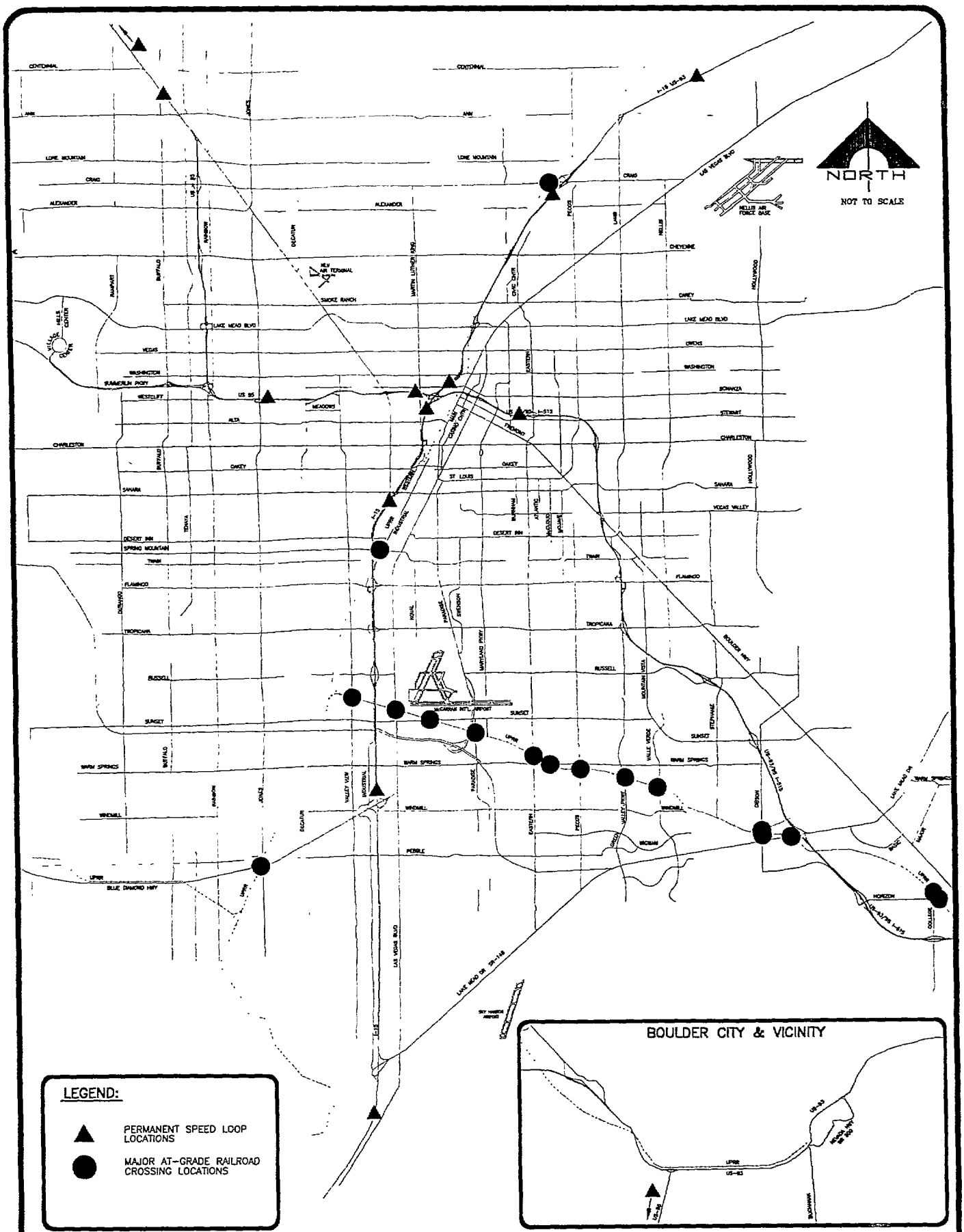
Nevada Highway Patrol is currently considering a motorist assistance program. The program would utilize inspectors and maintenance personnel already under contract to the state for various maintenance efforts, to patrol I-15 during peak periods providing basic roadside assistance. This program would be the first step toward a freeway service patrol program, similar to that in California.

The fire departments and Mercy Ambulance are responsible for providing emergency medical care and emergency health care transport, respectively, in the event of a serious accident. Every second is critical in their response time. Accordingly, the ability to dispatch the closest available unit in terms of travel time (not necessarily distance) is paramount.

These agencies must keep abreast of roadway construction projects, up-to-date traffic conditions, and periods of high railroad activity to effectively service an emergency.

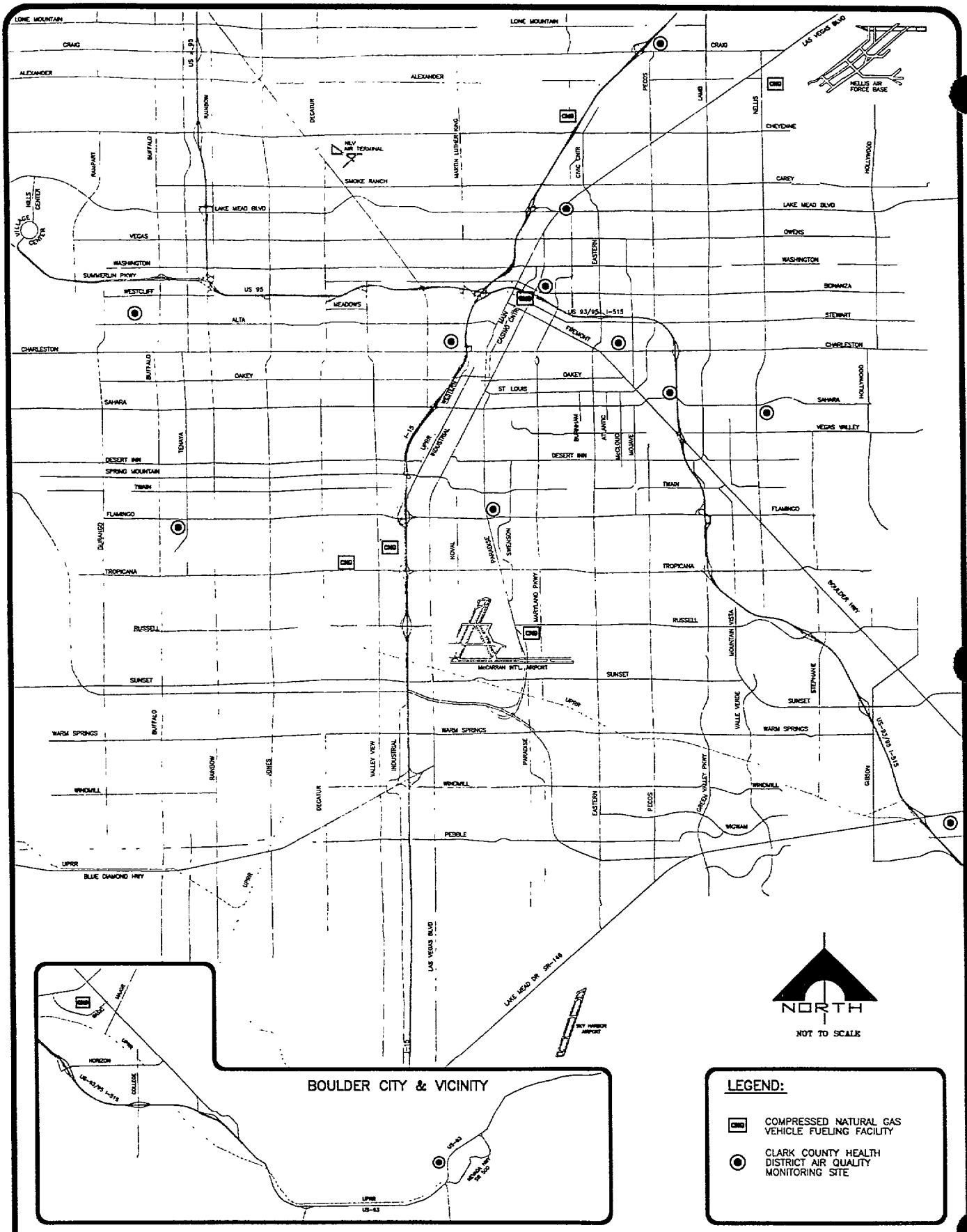
3.10 Air Quality

According to the provisions of the **Clean Air Act of 1990**, Las Vegas is a non-attainment area for both Particulate Matter less than 10 micrometers (PM,,) and Carbon Monoxide (CO). Thus, the State is mandated to develop a State Implementation Plan that details the regulations and outlines the strategies that will be utilized to bring the area into attainment of the NAAQS. Air quality monitoring stations throughout the Las Vegas Valley are shown in Figure 3-12.



DKS Associates

FIGURE 3-11
SPEED DETECTION SYSTEM LOCATIONS



DKS Associates

FIGURE 3–12

AIR QUALITY IMPACT FACILITY LOCATIONS

In terms of PM, Las Vegas is classified as a serious non-attainment area ,and must meet the national standards by 2001. Natural background concentrations due to the desert climate of Las Vegas appear to account for 20 to 30 percent of urban area particulate levels. The problem is further magnified by the number of unpaved roads valley-wide. The State Implementation Plan addresses this issue by recommending the agencies paving 40 plus miles of publicly maintained unpaved roadways.

Carbon monoxide levels in the Las Vegas Valley are directly related to the amount of vehicular travel. Mobile sources account for 94 percent of the total carbon monoxide burden. The second highest 8-hour average carbon monoxide level for Las Vegas was 9.9 parts per million in 1993. This ranked seventh nationally for all metropolitan areas. In an effort to improve urban air quality, the Federal government has mandated that public agencies incorporate alternative fuel vehicles into their fleets. In the Las Vegas Valley, the most widely used alternative fuel is compressed natural gas (CNG). Last year approximately 80,000 gasoline equivalent gallons were consumed by approximately 580 CNG powered vehicles valley-wide. The Southwest Gas Corporation has the largest CNG fleet with 230 vehicles. The remaining 350 vehicles are predominately owned by public entities such as the Regional Transportation Commission, the City of Las Vegas, and Clark County.

A partial list of the public and private entities which have CNG powered vehicles is provided below, refer to Table 3-7. Figure 3-12 shows the locations of the five natural gas vehicle fueling facilities in Las Vegas. Clark County has planned to build more stations to service CNG fleet operators and ultimately the general public.

Notwithstanding Southwest Gas Corporation's fleet, the utilization of CNG powered vehicles in the private sector is minimal. The lack of interest in these vehicles by the private sector in the State of Nevada is partially attributable to three institutional factors which discourage their use. First, the State offers no tax incentives for companies to encourage the use of natural gas powered vehicles in their private fleet. Second, the State has one of the highest natural gas fuel taxes in the United States. Finally, the relatively low cost of gasoline and diesel state-wide continues to promote these fuels despite their detrimental environmental impacts. Overcoming these institutional obstacles should go along way toward promoting the increased use of CNG as an alternative fuel in the Las Vegas Valley.

The Standards and Requirements adopted by the California Air Resources Board on May 14, 1992 entitled "Certification and Installation Procedures for Alternate Fuel Retrofit Systems for Motor Vehicles Certified for 1994 and Subsequent Model Years for Low Emission Vehicles" have been adopted by reference for the State of Nevada. The Standards and Requirements are published at sections 2030 and 2031 of Title 13, California Code of Regulations and a copy of the same can be obtained from the Nevada Department of Environmental Protection, Bureau of Air Quality.

TABLE 3-7: Public/Private Entities with Natual Gas Vehicles

PUBLIC AGENCIES	PRIVATE ENTITIES
Regional Transportation Commission	Southwest Gas Corporation
City of Las Vegas	Car Doctor
Clark County	Americal Automibile Association
City of North as Vegas	Prime Cable
City of Henderson	Yellow Checker
University of Nevada Las Vegas	
Las Vegas Valley Water District	
Sanitation District	
McCarran International Airport	

Regarding acquisition of or conversion of vehicles to clean alternative fuel vehicles, all covered fleets, including those with buses and heavy-duty trucks, must obtain clean alternative fuel vehicles in the following percentages of vehicles acquired or replaced, in compliance with the following schedule, as required by the State:

Fiscal Year 1995	10 percent
Fiscal Year 1996	15 percent
Fiscal Year 1997	25 percent
Fiscal Year 1998	50 percent
Fiscal Year 1999	75 percent
Fiscal Year 2000 and each year thereafter	90 percent

4. Stakeholder Meeting Summary

4.1 Purpose of Meetings

One of the methods used to identify issues and other problems associated with the transportation system is through one-on-one meetings with selected public and private agency stakeholders. These individuals represented entities which often times are not fully included in regional transportation discussions. Their insights into the region's transportation issues has provided the ITS Strategic Deployment Planning effort with original "user" input and opinions, and will help to build consensus which will be beneficial in developing public/public partnership and public/private partnership opportunities for implementing ITS in the Las Vegas area.

The issues which have been identified by the agency stakeholders were discussed and evaluated as part of the ITS User Service Workshop which was attended by the project Steering Committee and representatives from NDOT, RTC and the FHWA. The list of stakeholder agencies that were contacted were identified by the NDOT and RTC project managers and the consultant team. The specific transportation issues identified through this process are included in the User Service Workshop Summary located in Section 5 of this document.

4.2 Meeting Notes

A summary of each of the stakeholder meetings is provided in the following pages. Discussions at each of the meetings concentrated on agency responsibilities, areas of concern relating to transportation, and potential ITS applications.

Stakeholder: **Nevada Resort Authority**
2300 W. Sahara Ave.

Contact: **Alma Bromley**

Telephone: **362-2472**

Meeting Date: June 19, 1995

1. The Nevada Resort Authority serves as a consultant for most of the hotel/casinos in the State.

2. Hotel/casino employee work hours could be more staggered so that shift changes do not significantly impact congestion and circulation in areas of dense development.

3. Visitor luggage could be bar coded for hotels at flight origin or at McCarran so that transportation options from the airport to the hotel could be considered.

4. There is a need for delivery vehicle access to the rear of strip resorts on the west side of the Las Vegas Blvd south of where Industrial crosses over to the west side of I-15.

5. The Resort Authority suggested that arrangements be made for traffic and parking for the "Fremont Experience" in downtown Las Vegas, which is scheduled to open in December of this year.

6. Thomas and Mack Arena has poor access. Long lines of vehicles are experienced when improved parking arrangement where parking fee is included in event tickets or exiting for an event.

7. Changeable message signs located where could indicate appropriate exits for specific events at particular facilities, such as the Las Vegas Convention Center, Cashman Field, the Sam Boyd Silver Bowl, fights at MGM, Caesar's, etc.

8. Suburban casino access and circulation could create traffic problems where several hotel/casinos are developing away from Strip and downtown areas, such as those along Rancho Drive (Santa Fe, Fiesta and Texan), Boulder Highway (Sam's Town, Boulder Station), at Arville and Tropicana and on W. Flamingo at Valley View (Gold Coast, Rio). New expansion at the Stateline, NV also creates additional I-15 congestion.

Stakeholder: **Las Vegas Metropolitan Police Department**
400 E. Stewart Ave.

Contact: **Captain Carl Fruge**

Telephone: **229-4074**

Meeting Date: June 19, 1995

1. Metro has no jurisdiction on I-15, but the Nevada Highway Patrol (NHP) relies on Metro for incidents on the State Highways within the urban Las Vegas region. NHP responds to incidents on State Routes in suburban/rural areas.

2. Metro would like to consider the opportunity to use the I-15 median for vehicle storage during I-15 incident.

3. Congestion on surface streets results in accidents, primarily rear-end accidents. This is a particular problem on the westbound Sahara and westbound Tropicana as you approach I-15. Topography/sight distance is one of the major causes of rear end collisions in these areas.

4. Pedestrian deaths account for approximately 50% of all traffic related deaths. Metro has experienced a 70% "non-use" of crosswalks. This is largely due to the distance between crosswalks, often 1/8 to1/4 mile apart. Most of the deaths are residents on arterials other than the Strip. Visual speed "monitoring" could deter motorists from speeding by helping them realize the speed at which they are travelling.

5. The 911 Center gets all accident calls, and dispatches them to appropriate agencies. There is no formal agreement between law enforcement agencies for accidents/incidents on freeway ramps, storage lanes and areas beyond gore points at interchanges. The agencies are in the beginning steps of developing a formal agreement.

6. NHP rural demands are growing, placing more demands on Metro to handle urban calls. Metro currently has 74 officers that responded to 24,000 annual accident calls. An additional 8-I 0,000 responses were recorded with no reports filed. Metro also responded to 438 vehicle breakdowns. Typical Metro response time is 7 minutes. Metro has not measured the typical amount of time it takes to clear an accident scene, but estimates it to be 30-40 minutes. The more severe the accident, the longer it takes to conduct the investigation and clear the scene. A laser designator with a GPS system, could reduce clearing time for accidents.

7. Metro has no accident data base. Many of the accidents are improperly recorded because of the way the accident is described by the drivers or recorded by officers. For example, the major/minor streets and intersections are sometimes mis-represented.

8. Law enforcement agencies could benefit from advance notice of lane closures and construction projects. This knowledge could help prepare for circulation changes, resulting in fewer accidents and discourage the number of incidents and congestion.

9. Metro would like more input to traffic control plans and better coordination with other City departments (Traffic and Planning in particular). For example, according to Metro, approval of flat curves on ramps have resulted in an increased number of accidents. Metro would also like to review zoning change applications.

Stakeholder: Taxicab Authority
1785 E. Sahara Ave.

Contact: Rick Boxer

Telephone: 486-6532

Meeting Date: June 19, 1995

1. There are seven taxicab owners/companies in the Las Vegas Valley owning 14 different taxicab companies.

2. The taxicab industry in the Las Vegas Valley operates on a "medallion system". Medallions are badges which are attached to the vehicle and are like permits. A vehicle must have a medallion to operate as a private transportation carrier.

3. There are 740 "regular" medallions. In 1992, legislation allowed each company to have 8 "geographically restricted medallions" - 2 are full time and 6 are for Fridays and Saturdays. In 1993, "time restricted" medallions were introduced. Each company has 11 of these, which are in use from 12 noon to 12 midnight.

4. The biggest events which rely on taxicabs are: Comdex, New Years Weekend and the Consumer Electronics Show. Residential areas often experience delays in getting a cab.

5. whittlesea/bell recently installed a computer dispatch (AVL) system tied to GPS. They are now working out the bugs to provide drivers with better information.

6. Cab companies are interested in new technology for better coordination and to deter crime.

Stakeholder: **Clark County Department of Aviation**
4th Floor Administration Office

Contact: **Jacob Snow**

Telephone: **261-5117**

Meeting Date: **June 19, 1995**
July 18, 1995

1. The Airport is on the Resort Corridor MIS team. The MIS will analyze a free or subsidized high-order transit facility.

2. Terminal D is expected to open mid-1998. McCarran will then have 138 gates. An expanded parking garage will be opened in October, 1996.

3. Construction of the tunnel roadway provided the airport with an opportunity to implement a message sign to advise motorists of adverse conditions in the tunnel. The airport access road currently has 4 Variable Message Signs (VMS), 14 gantry lane signals and 18 CCTV cameras inside the tunnel.

4. Security and luggage handling are issues which the Airport would like to see addressed by the ITS Plan, if possible.

5. It would be beneficial for the above equipment to be inter-tied with the future freeway operation system.

6. It would be beneficial to add traveler information VMS's and CCTV's to other streets near the airport to advise travelers which route to take.

7. Air travelers can drop off passengers at third floor of parking garage. VMS's can be added to relieve curbside congestion.

8. Cable lV hookup can be provided easily to display flight information in hotels and homes. The airport has an integrated flight information display.

Stakeholder: **UNLV College of Business**
Rm. 205 Frank & Estelle Beam Hall

Contact: **Keith Schwer**

Telephone: **895-3011**

Meeting Date: June 19,1995

1. People in the Las Vegas area who have been around for 10 years or more have noticed a significant deterioration in circulation and mobility.

2. UNLV has conducted surveys indicating how people get around town: to/from airport, and by which mode.

3. No studies have been conducted by UNLV departments concerning advanced transportation technologies such as ITS.

Stakeholder: **Nevada Highway Patrol**
2601 E. Sahara Ave.

Contacts: **Captain Ron Lavine**
Lieutenant Kenneth L. Peppley
Lieutenant Rick Lange

Telephone: **486-4100**

Meeting Date: June 20, 1995

1. l-15 interchanges at US 95, Sahara Avenue, Flamingo Road and Tropicana Avenue were identified as obvious areas of congestion. It was also noted that a good parallel roadway system does not exist along most of l-15. It was speculated that the Major Investment Study (MIS) now underway may make significant recommendations in this area. The Circus Circus proposed l-15 Frontage Road announced in the media was noted as a potentially helpful improvement.

2. Captain Lavine advised that the cellular *NHP Program started in the Spring of 1995 as a State-wide program. The call is taken by dispatch. A similar local program; *DUI, has been in operation considerably longer.

3. A motorist assistance program is being planned to put civilian inspectors and maintenance personnel on patrol on l-15 to provide assistance during holidays and heavy use periods. This program would aim to reduce the incidents of stalled or disabled vehicles and keep patrol officers freed up for their other duties. It is envisioned that the patrol would run between the I-15/US 95 interchange and Stateline.

4. Fridays and Mondays experience the highest rate of accident occurrence.

5. NHP is responsible for Las Vegas Boulevard. NHP advised that a bike patrol program was being considered for Las Vegas Boulevard. One of the primary goals of this program would be reductions in pedestrian/vehicular accidents. It should be noted that the Metro police already has a bicycle patrol on Las Vegas Blvd.

6. The visual presence of a vehicle on the shoulder of l-15 results in significant traffic slow downs and congestion. Lieutenant Lange suggested that non-visible breakdown areas, such as depressed shoulders, be provided where feasible. NHP also advised that current law prevents them from towing a vehicle on the shoulder for 24 hours unless it presents an immediate hazard. Legislation should be considered to reduce this period to alleviate the impacts posed by disabled vehicles on shoulder areas. It was noted that many other cities have these vehicles removed immediately, and that they could be looked at as examples for revised law and policies in Las Vegas.

7. The status of adding additional call boxes to l-15 was questioned.

8. Lieutenant Lange described a FHWAC film which demonstrated the use of freeway lane use signals to close travel lanes. He thought the system was in Washington, D.C. It

was noted that such a system would be useful for construction activities as well as accident or incident blockages.

9. A major goal of the ITS project should be to speed incident response through earlier detection. NHP is very interested in having monitoring capabilities through an ITS system, particularly video surveillance of congested areas.

10. The impact of incidents can also be reduced through incident management programs that may divert traffic from the affected facility. Advance notice to motorists of an incident will induce some drivers to leave the facility earlier than planned to reach their destination via alternative routes. In other cases, the advance notice may be supplemented with identification of alternative parallel routes. Lieutenant Lange noted that the freeway management system would need to be closely tied to the traffic signal system to coordinate traffic flows. For instance, traffic diverted from a freeway to a surface street would require additional green time on that street. Freeway-surface street coordination is an essential element of the ITS system. Lieutenant Lange asked if traffic signal timing adjustments would be automatically formulated by the computer system based on real time flows or if the adjustments would be implemented manually or pre-programmed.

11. Lieutenant Peppley explained that there is a coordination problem which is encountered with the Fire Department relating to an accident involving potentially hazardous material. The Fire Department, who is responsible for clean up of the hazardous material, had assumed that NHP would make necessary phone calls and contacts relating to the clean up. It was noted that jurisdictional responsibilities relating to incident clearing activities should be clear to avoid any potential delays.

12. NHP does not currently utilized an accident data software such as Cross-Roads or Traffic. NHP advised that accident reports had recently been expanded to incorporate 22 additional data items, and that they now involve up to 5 pages compared to the previous 2 page report. There is concern that the additional data requirements will lengthen investigation times. It was suggested that the use of electronic data collection systems be looked into as a means to reduce investigation times. The use of such equipment, in lieu of tape measures and more traditional means, should also reduce impacts on traffic during the investigation.

13. NHP is responsible for commercial vehicle compliance, but weighing operations generally occur outside the urban area. There may be benefits in the application of weigh-in-motion technologies. Lieutenant Peppley noted that weigh-in-motion technology had been discussed at the CVA Committee.

14. NHP has not given the use of AVL systems much thought, but would certainly not rule out their usefulness.

Stakeholder: **Mercy Ambulance**
1130 S. Martin Luther King Boulevard

Contact: **Shelly Cochran**
Regina Connell

Telephone: **386-9985 ext. 310**

Meeting Date: June 21,1995

1. Mercy Ambulance is franchised by the City of Las Vegas and Clark County as the sole health-care transport provider in Clark County. Mercy operates under a performance based contract with the Las Vegas City Council and the Clark County Commission. It is the responsibility of the Council and Commission to decide what company will provide health-care transport service to the Valley based on the individual company's ability to provide lifesaving and cost-effective paramedic service.

2. Mercy Ambulance has a unique partnership with the local fire departments. In an emergency situation, fire departments are dispatched as first responders. The fire department immediately relays the relevant information via computer link to the Mercy Ambulance dispatch operator. Mercy Paramedics are then dispatched from one of the 21 strategic posts across the Valley and have less than 9 minutes to arrive on-scene. Mercy provides the health-care transport thereby allowing the fire department to return to available status.

3. Mrs. Cochran noted that Mercy operates approximately 60 ambulances and services roughly 350 calls per day. Currently, Mercy transports patients to UMC, Valley, Sunrise, Lake Mead, Desert Springs, Nellis, St. Rose Dominican, and Boulder City Hospitals.

4. Mrs. Connell advised that Mercy's primary concern is fast, safe, and efficient response times. To this end, Mercy needs to be current on roadway construction projects, traffic conditions, and traffic signal failures throughout the Valley. Mrs. Cochran noted that Ms. Debbie Hoff of the City of Las Vegas faxes up to date construction information to Mercy dispatch operators daily, but that no system is in place to provide real-time traffic conditions and traffic signal status updates.

5. Any of the eight major hospitals serviced by Mercy can divert emergency vehicle traffic if they are too busy. This process is currently not automated. The hospital simply notifies Mercy over the telephone that they are on divert and this information is disseminated to the Mercy Paramedics via alphanumeric pagers.

6. Mercy has no traffic signal pre-emption capability.

7. Each ambulance is equipped with an ENCODER that is linked to the central dispatch computer which dispatch operators utilize in selecting the most appropriate ambulance to service a call. The ENCODER, which is operated manually by Mercy Paramedics, advises dispatch that the vehicle is either at the *signed strategic post, enroute to the assigned post, or currently servicing a call. Currently, dispatch has no way, outside of

radio contact, of knowing exactly where their vehicles are at any given time. Mrs. Connell added that although the central dispatch computer will recommend an emergency vehicle to service a call, it is the responsibility of the dispatch operator to assign a vehicle based on historic congestion patterns, roadway construction information, high railroad activity periods, etc., which the computer does not account for.

8. Strategic response posts are based on high accident locations throughout the Valley. Emergency vehicles assigned to a strategic post must remain within a 1/2 mile radius of the post until they receive a call or are taken off-line. Ms. Cochran noted that Mercy was recently involved in an AVL test project. She said the system was very useful, but extremely cost prohibitive and, consequently, was taken off-line after the termination of the pilot project.

Stakeholder: **Ray and Ross Transport**
300 W. Owens Ave.

Contact: **Elgin Simpson**

Telephone: **646-4661**

Meeting Date: June 20,1995

1. Ray 8 Ross provides large and small charter buses for groups of travellers (scheduled trips). Many international customers are carried, often for extended trips (7-10 days).

2. Ray and Ross has twenty-one large buses(44 passengers), sixteen small buses (21 passenger).

3. There are two-way radios in every Ray and Ross vehicle. No advanced technology system has been considered.

4. Traffic congestion throughout the Las Vegas Valley slows the buses down, and effects schedule performance.

5. Ray & Ross provides two-way airport service for $5.50 per passenger. All shuttles pay a fee to use the McCarran Airport curb front.

Stakeholder: **Citizen Area Transit (CAT@) System**
301 E. Clark Ave.

Contact: **Linda Tunstall**
Wayne Meisner

Telephone: **455-4481**

Meeting Date: June 1,1995

1. The CAT(R) System is interested in using on-board video cameras for security reasons. Another option would be AVL. The AVL option could provide the exact location of each vehicle, and also allow for better customer information.

2. CAT(R) is considering swipe cards for fares.

3. The RTC wants to put Mobile Data Terminals (MDT%) on board each paratransit vehicle. A MDT is a device installed in a vehicle that allows voice and data communications between the vehicle and the dispatch.

4. The CAT(R) control center includes 2 consoles and 5 channels for 171 buses and 104 paratransit vehicles. (80 in service).

5. Needs Assessment

5.1 Introduction

A Fundamental aspect of ITS strategic planning is that the ITS elements to be deployed should be identified based on the local needs. Hence the first step towards ITS User Service prioritization is to identify and prioritize the needs specific to the Las Vegas Valley.

The existing transportation needs in the Las Vegas Valley were identified based on an assessment of the transportation system (Chapter 3 of this report), meetings with the Steering Committee, meetings with individual stakeholders who are tranportation providers or service providers in the Las Vegas Valley (Chapter 4), and conduct of a "Needs Assessment Workshop". This section discusses the synthesis and prioritization of these needs.

5.2 Synthesis of Local Needs

Based on an evaluation of the existing transportation system, and individual meetings with the stakeholders, the transportation needs of the Las Vegas Valley can be summarized into the following five categories:

1. System Utilization Issues
2. Travel Delay Issues
3. Traveler Information Issues
4. Environmental Issues
5. Safety, Security and Regulatory Issues

The following subsections summarize the issues under each of the above categories. Some of these issues as they are related by different stakeholders may be repeated or they may overlap. In the interest of being comprehensive, such repetitions and overlaps are not screened.

5.2.1 Category 1: System Utilization Issues

This category relates to the existing transportation system utilization including highways and transit. Addressing these issues will improve and balance system utilization across all travel modes.

1.1 **Under-utilization of parallel facilities to freeways:** There is a general lack of facilities parallel to freeways. This leads to lack of detour routes in case of incidents. Where parallel freeway alternates do exist, they are lightly used.

1.2 **Freeway Traffic Control System:** There is a need to improve freeway operations by installing a freeway control and surveillance system.

1.3 **Transit Ridership:** Despite the success of CAT, there is a need to further improve transit ridership and expand transit services.

1.4 **Predominance of Single-Occupant Vehicles:** A large number of automobiles are single occupant vehicles, especially for commuters and business travelers.

1.5 **Priorities for transit:** Providing priorities for CAT buses at signalized intersections can improve transit schedule adherence and promote transit reliability.

1.6 **Need to improve efficiency of paratransit:** Both privately-operated and publicly-operated paratransit serves an important travel market.

1.7 **Need to promote ease of transit payment:** Electronic payment services can streamline transit payment and transfers.

1.8 **Access for delivery to resort properties:** Access to resorts for delivery vehicles can be difficult at times.

1.9 **Integrate LVACTS, freeways and transit operators:** Integrated operation among the various agencies and systems will promote seamless multimodal travel.

1.10 **Use of non-public transit (taxi, limo, shuttle, monorail):** Large amounts of visitors and business travelers use non-public transit. Their operation can be improved and coordinated.

1.11 **Intermodal transfers:** Provision of enroute transit information may streamline transfers and reduce delay and traveler frustration.

5.2.2 Category 2: Travel Delay Issues

This category relates to reducing delay and improving the reliability of the transportation network.

2.1 **Recurrent congestion at bottlenecks on freeways:** This occurs when demand exceeds capacity at peak periods causing service break down. Sub-standard or narrow roadway sections reduce capacity, causing bottlenecks that slow traffic, including buses.

2.2 **Non-recurrent congestion on freeways:** This is typically due to incidents/accidents that occur on freeways.

2.3 **Recurrent congestion on major arterials:** This occurs when demand exceeds capacity at peak times causing service break down.

2.4 **Non-recurrent congestion on major arterials:** This is typically due to incidents/accidents that occur on arterials.

2.5 **Access to/from Strip/Airport & tourist attractions:** Access to the Strip area and the tourist attractions is hindered by congestion, arterial signal operations, and traveler familiarity with the area.

2.6 **Access to/from east/west arterials:** East-west traffic arterials experience major congestion due to congestion along the Strip or physical barriers such as the freeway and the railroad.

2.7 **Traffic Management at special events:** Special events require special traffic management strategies involving multiple modes (roadways, parking and transit).

2.8 **Priorities for emergency vehicles:** "Emergency vehicles" priority over other vehicles at signalized intersections promotes speed of emergency response.

2.9 **Emergency response to hazardous material incidents:** Hazardous material incidents require quick incident response time and special handling procedures.

2.10 **Transit in mixed-flow travel lanes:** Transit vehicles moving in mixed-flow lanes need to stop at bus stops, causing delay to other traffic.

2.11 **Short term non-recurring congestion in construction work zones:** Construction work zones require lane closures or traffic diversions that cause increased delay.

5.2.3 Category 3: Traveler Information Issues

This category relates to providing travelers with information to assist them in making better travel decisions.

3.1 Tourist route information and guidance: Travelers, drivers, and emergency operators need to obtain accurate, timely, or predictive information about traffic conditions and route options. This need applies before a journey begins or while en-route. It is a special problem for visitors not familiar with local routes and traffic conditions; such as the tourists visiting Las Vegas.

3.2 Advise travelers of incidents: Travelers need to be given accurate information about incidents on freeways or arterials which can encourage them to change the travel route, mode or time.

3.3 Route diversion during incidents: During major incidents, it is necessary to divert traffic along alternative routes. Travelers need to be given detailed route information white en-route.

3.4 Coordinate and integrate data from different agencies: Different agencies may be operating with limited coordination or sharing of data. Improved coordination between different operating agencies would result in reduced delay and improved safety.

3.5 Integrate ground-air airport operations: Airport access is an important aspect, especially for Las Vegas, due to the large number of visitors. Travelers should be provided with real-time airline and ground access information.

3.6 Provide parking advisory at airport and major attractors: Drivers need to get accurate and timely parking information as they approach their destination, especially for major attractors like the airport.

3.7 Ease of access to freeways: It is important to provide easy access to the freeways from the resorts/facilities, special events and other special attractions. This problem is especially important when the freeway entrance ramps are uni-directional, and given a large number of unfamiliar drivers.

3.8 Provide information to special events: Special events require additional driver route information and guidance.

3.9 Provide information for private operated transit: Privately operated transit or paratransit requires information regarding traffic conditions and route guidance for optimum operation.

3.10 Commuter route information and guidance: Local residents, like visitors, also need route information and guidance regarding traffic conditions and incidents.

5.2.4 Category 4: Environmental Issues

This category relates to improving environmental conditions caused by traffic.

4.1 Improve air quality: Vehicles emit air pollutants and stir up dust resulting in poor air quality.

4.2 Reduce intrusion to residential neighborhood: Through-traffic diverted to local streets due to incidents or traffic congestion causes high traffic volumes that can seriously impact residential neighborhoods.

5.2.5 Category 5: Safety, Security, and Regulatory Issues

This category addresses issues related to traffic control, incident management, Advanced Vehicle Control and Safety Systems, Commercial Vehicle Operations and public transportation operations.

5.1 Improve roadway safety: Accident rates at intersections are high in Las Vegas. Need to improve roadway safety.

5.2 Improve pedestrian safety: Accidents involving pedestrians could be serious or fatal. Vehicle-pedestrian accidents are common, "jaywalking" is common in residential and resort areas. Improve pedestrian access and education.

5.3 Improve rail road crossing safety: Positive control and warning at railroad crossings would reduce incidents.

5.4 Coordinate with neighboring states to improve commercial vehicle operations: Truck inspection, fees and credential checking spanning across different states involves a lot of paperwork, increased truck stops and freight costs, and large fleet management operations.

5.5 Improve security of transit services: Increased police presence and enforcement at bus stations would reduce passengers" anxiety towards crime.

5.6 Regional accident database: The development of an accident database for the area will help identify problem locations, reduce paperwork and improve accident investigations.

5.7 Improve local resident pedestrian safety: Local pedestrian safety is of extreme concern for the local residents and visitors, given the high number of recent accidents involving pedestrians.

5.3 Prioritization of Local Needs

After the local needs are synthesized from the different sources, they are prioritized to serve as a basis for user service planning. For this purpose, a "Needs Assessment Workshop" was conducted with the ITS Steering Committee on June 29, 1995. Participants at this workshop include regular Steering Committee members as well as parties who have a regional transportation interest in Las Vegas:

Participants at the Needs Assessment Workshop:

Rich Romer, Clark County
P.D. Kiser, NDOT
Glenn Grayson, City of Las Vegas
Ray Burke, City of North Las Vegas
John Bartels, City of Henderson
Captain Carl Fruge, Metro Police
Gary Johnson, Clark County RTC
Keith Maki, NDOT
Bob Hilderbrand, NDOT
Greg Novak, FHWA

The prioritization process took the form of a workshop, whereby the participants were given a summary of the issues discussed in Section 5.2, and after some deliberations, each participant scored the issues individually based on their degree of severity and priority, on the following scale:

Severity Index:	**Priority Index:**
1 - Not very severe	1 - Lowest Priority
2 - Moderately severe	2 - Moderate Priority
3 - Severe	3 - Intermediate Priority
4 - Very Severe	4 - High Priority
5 - Extremely Severe	5 - Extremely High Priority

The "seventy index" reflects the seriousness of that particular issue in the Las Vegas Valley. The "priority index" reflects the relative priority of that issue when compared to other issues as a function of its regional significance. Figure 5-1 shows an example of a score sheet.

After each workshop participant had completed the scoring individually, the scores for each issue was averaged for each of the two indices. Since there were overlap and repetitions among these issues, the similar ones were then combined into the same group. This consolidated the total issues into 28 groups, as shown in Table 5-1. A single score is then calculated for each group based on the following formula:

Total Score for each group = (Average of "Severity Index") x (Average of "Priority Index")

Figure 5-1: Example of Score Sheet

TRANSPORTATION NEEDS ASSESSMENT AND EVALUATION WORKSHEET

	Issues	System Objectives	ITS User Services	User Service Objectives	Performance Criteria	Your Severity Score	Your Priority Score
Category One: System Utilization							
1.1	Under-utilization of parallel facilities to freeways	Identify alternate routes during incidents	Incident Management,	Develop detour routing plans	Incident recovery time	4	3
1.2	Freeway Traffic Control System	Improve traffic operations on freeway	Traffic Control,	Provide traffic control & surveillance on freeways.	Travel Time on freeways	5	5
1.3	Transit Ridership	Increase mass transit utilization	Public Transportation Management, Personalized Public Transit,	Support increased mass transit usage	Transit Patronage	3	3
1.4	Predominance of Single-Occupant vehicles	Promote personal HOV usage	Ride matching & Reservation, Demand Management & Operations; Personalized Public Transit;	Provide opportunities for rideshaiing; Increase vehicle occupancy	Average vehicle occupancy	4	4
1.5	Priorities for transit	Improve transit level of service	Traffic Control; Public Transportation Management;	Enhanced transit schedule adherance	Pre-emption/ Priorities	3	3
1.6	Need to improve efficiency of para-transit	Promote HOV	Personalized Public Transit, Public Transportation Management,	Increase vehicle occupancy	Schedule adherence	2	4
1.7	Need to promote ease of transit payment	Improve transit patronage	Electronic payment services,	Make transit payment easier & promote transit usage	Ease of payment	2	4
1.8	Access for delivery to resort properties	Improve delivery access to resorts	Traffic Control	Improve traffic flows along arterials paralleling Strip	Travel time	4	4
1.9	Integrate LVACTS, freeways & Transit operations	Integrated transportation Management & database	Traffic Control; Public Transportation Management;	Allow sharing of data and traffic control parameters	Overall System Traffic Delay	3	4
1.10	Use of non-public para-transit (taxi, limo, shuttle, monorail)	Increased mode split, HOV	Traffic Control,	Increased use of private para-transit	Ridership	3	3
1.11	Intermodal transfers	Promote ease of transfer	En-route transit information,	Provide alternative mode information	Balanced mode usage	2	3

LEGEND:	
SEVERITY INDEX:	PRIORITY INDEX:
1 - Not very severe	1 - Lowest Priority
2 - Moderately severe	2 - Moderate Priority
3 - Severe	3 - Intermediate Priority
4 - Very Severe	4 - High Priority
5 - Extremely Severe	5 - Extremely High Priority

EXAMPLE

ITS STRATEGIC DEPLOYMENT PLAN FOR THE LAS VEGAS VALLEY

Las Vegas Area ITS Early Deployment Plan

Figure 5-2: Performance Criteria Workshop Methodology

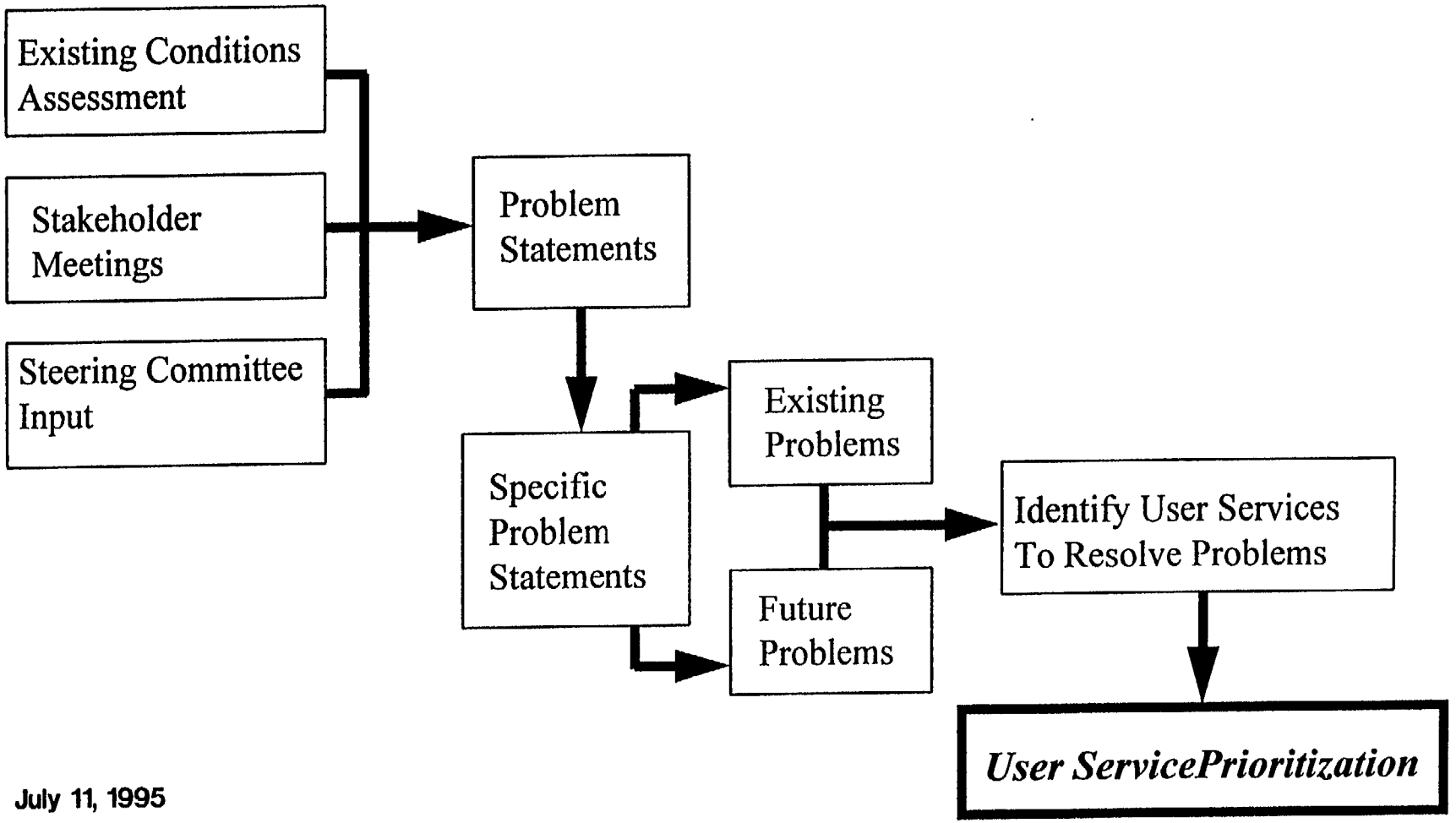


Table 5-1: Transportation Needs Assessment and Evaluation Worksheet

	DKS #	ISSUES	USER SERVICES	USER SERVICE OBJECTIVES	SEVERITY SCORE	PRIORITY SCORE	TOTAL SCORE
☑ 1.	1.1	Utilization of Parallel Facilities	◆ Incident Management	Identify & Develop detour routing	3.44	3.33	15.0
	2.2	Non-Recurrent Freeway Congestion	◆ Traffic Control	plans; Reduce incident related	3.77	4.44	
	3.2	Advise Travelers of Incidents	◆ En-route Driver & Transit Info.	delay; Coordinated diversions;	3.77	4.22	
	3.3	Route Diversions during Incidents	◆ Pre-trip Travel Info.	Provide reliable advisory service.	3.88	4.11	
			◆ Incident Management				
☑ 2.	1.2	Freeway Traffic Control Center	◆ Traffic Control	Provide Control & Surveillance. Improve operations.	4	4.4	17.6
☑ 3.	1.3	Increased Transit Ridership	◆ Public Transit Management	Achieve higher transit mode	3	3.22	9.7
			◆ Personalized Transit	share & utilization.			
☑ 4.	1.4	Predominance of SOV	◆ Ride Matching & Reservation	Providing HOV opportunities;	3.55	3.44	12.2
			◆ Demand Mgmt. & Operations	Increase Avg. Veh. Occupancy.			
☑ 5.	1.5	Priorities for Transit	◆ Traffic Control	Enhance Schedule adherence	2.66	2.77	7.4
			◆ Public Transit Management	and improve transit LOS.			
☑ 6.	1.6	Disabled Access to Transit Service	◆ Public Transit Management	Increase System Utilization;	2.11	2.11	4.5
			◆ Personalized Transit	Ease of Access.			
☑ 7.	1.7	Promote ease of Transit Payment	◆ Electronic Payment	Make Fare Payment easier	2.44	2.55	6.2
				Increase Utilization;			
☑ 8.	1.8	Access for delivery to Strip	◆ Traffic Control	Permit Informed Routing	3.44	3.77	13.0
			◆ Route Guidance	Decisions in real-time;			
			◆ En-route Driver Info.	Reduce Delay; Improve access			
			◆ Commercial Fleet Mgmt.	to resorts & other destinations.			

	DKS #	ISSUES	USER SERVICES	USER SERVICE OBJECTIVES	SEVERITY SCORE	PRIORITY SCORE	TOTAL SCORE
☑ 9.	1.9	Integrate LVACTS, freeway & transit	◆ Traffic Control	Share Data & Control	4.22	4.88	17.0
	3.4	Coordinate & Integrate Data	◆ Public Transit Management	Parameters; System Mgmt. & Coordination.	3.55	3.88	
☑ 10	1.11	Intermodal Transfers	◆ En-route Driver Information	Provide alternate mode info.;	3	3.63	10.9
			◆ En-route Transit Information	Schedule coordination;			
			◆ Pre-Trip Travel Information	Provides Travel Information.			
☑ 11	2.1	Recurrent Freeway Congestion	◆ Traffic Control	Improve Freeway LOS;	4.44	4	17.8
			◆ Pre-Trip Travel Information	Reduce Congestion.			
			◆ En-Route Driver Information				
☑ 12	2.3	Recurrent Arterial Congestion	◆ Traffic Control	Improve Arterial LOS;	3.77	4.22	13.9
	2.5	Strip/Airport/Resort Access	◆ Pre-Trip Travel Information	Reduce Travel Times;	3.55	3.88	
	2.6	East/West Access through Resort Corridor	◆ En-Route Driver Information	Integrate Freeway/Arterial	3.77	4.11	
	3.7	Ease of Access to Freeways		Operations; Improve Signal	3	3.55	
				Operations.			
☑ 13	2.4	Non-Recurrent Arterial Congestion	◆ Incident Management	Traveler Diversion & Reduced	3.55	3.88	13.8
				Incident induced delay.			
☑ 14	2.7	Special Event Traffic Management	◆ Traffic Control	Event Traffic Control; Route	3	3.22	10.1
	3.6	Event Parking Information	◆ Pre-Trip Travel Information	Guidance & Information;	3.22	3.77	
	3.8	Event Traveler Information	◆ Public Transit Management	Reduce travel delays.	2.66	3.22	
			◆ En-route Driver Information				
			◆ Route Guidance				
			◆ En-route Transit Information				
☑ 15	2.8	Emergency Vehicle Priority	◆ Incident Management	Develop emergency routes;	3.11	3.55	11.0
☑ 16	2.9	Haz-Mat Emergency Response	◆ Haz-Mat Incident Response	Develop Detour & Coordination	2.55	3.44	8.8

	DKS #	ISSUES	USER SERVICES	USER SERVICE OBJECTIVES	SEVERITY SCORE	PRIORITY SCORE	TOTAL SCORE
				Plans.			
❑	172.10	Transit Induced Congestion	- Public Transit Management - Traffic Control	Reduce Delay due to transit, by providing signal priority & transit only lanes.	2.88	3	8.6
❑	812.11	Short-Term Work-Zone Congestion	- Traffic Control - Pre-Trip Travel Information - En-route Driver Information	Develop work zone traffic plans; Alert travelers to possible Delays: Reduce Caoacitv loss due to work zones.	3	3.88	11.6
❑	193.1 3.10	Route Info. & Guidance for Tourists- & Commuters - En-route Driver Information	Pre-trip Travel Information - En-route Transit Information - Route Guidance	Area-wide dissemination of clear & consistent info., taroeted for specific users.	4.11 3.5	4.77 4.38	17.4
❑	203.5 3.6	Integrate Ground-Air Operations Airport Parking	- Pre-trip Travel Information - En-route Driver Information - En-route Transit Information - Route Guidance	Provide real-time airport info. regarding parking - flights; Improve airport access and provide seamless intermodal connections	2.66 2.66	2.66 3.22	7.8
❑	214.1	Reduce Mobil Source Emissions	- Traffic Control - Incident Management - Emissions Testing & Mitigation	Promote Air Quality Imps. incl. lower emissions by reducing stops & delays; Identify high emitters.	4.11	4.33	17.8
[X]	224.2	Reduce Neighborhood Cut-Through Traffic	- Traffic Control - Incident Management - Pre-trip Travel Information ◆ En-route Driver Information	Maintain neighborhood quality of life and maintain arterial flow.	3.22	2.88	9.3

	DKS #	ISSUES	USER SERVICES	USER SERVICE OBJECTIVES	SEVERITY	PRIORITY	TOTAL
[X]	235.1	Improve Roadway Safety	- Traffic Control - Incident Management	Reduce primary & secondary roadway accidents	3.77	4.33	16.3
❑	245.2	Improve Visitor Pedestrian Safety	- Traffic Control	Accommodate increased	4.33	4.55	18.1
	5.7	Improve Resident Pedestrian Safety	- Pre-trip Travel Information	pedestrian activity & reduce accidents.	4		
❑	255.3	Improve Rail Crossing Safety	- Railroad Crossing Safety - Pre-trip Travel Informatron - En-route Driver Information	Reduce railroad crossing accidents by providing warnings.	2	2.55	5.1
❑	265.5	Improve Transit Security	- Public Transit Security - En-route Transit Information - Public Transit Management	Promote transit usage through increased safety & improved communication during an incident.	2.88	3.77	10.9
❑	275.6	Establish Regional Accident Database	- Traffic Control	Develop regional accident database: analyze & store accident data.	3.33	3.77	12.6
❑	281.10	Use of non-public para-transit	- Personalized Transit	Increased use of private paratransit	2.71	2.71	7.6
	3.9	Info. to private transit operators	- En-route Driver Information	Promote mobility of private transit.	2.75	2.88	

Table 5-1 also shows the scores of each of the 28 groups. The score for each group reflects its relative priority. Even though the scoring process and formula are not totally scientific, this process can nonetheless objectively prioritize the issues with collective participation from the transportation system managers in Las Vegas Valley. The absolute score is not as important as the relative ranking of these issues.

As a result of this process, the ranking of the issues is shown in Table 5-2, and further elaborated below:

Top Priority Issues

- Improve visitor and resident pedestrian safety.
- Reduce mobile source emissions and air quality by reducing stops and delays and identifying high emission vehicles.
- Reduce recurrent freeway congestion.
- Provide freeway traffic control and surveillance system to improve freeway operations.
- Provide traveler information and route guidance for visitors and residents
- Integrate the operations of the transportation systems, including LVACTS, freeway and transit. Allow sharing of data and some control parameters.
- Improve roadway safety by reducing accidents
- Reduce non-recurrent freeway congestion by incident management and providing incident information to travelers.
- Reduce recurrent arterial congestion, especially through the resort corridor, east/west access arterials, and access to freeways
- Reduce non-recurrent arterial congestion by incident management and providing information to travelers.
- Improve delivery access to the Strip.
- Establish **a** regional accident database.

Moderate Priority Issues

- Reduce the predominance of single-occupant vehicles.
- Reduce congestion around construction work zones.
- Provide priority for emergency vehicles at signalized intersections.
- Promote ease of intermodal transfers (highway/transit/airport).
- Improve security of transit services
- Provide special event traffic management, traveler and parking information
- Promote transit ridership by improving service
- Reduce neighborhood cut-through traffic
- Provide coordinated hazmat incident response.
- Reduce congestion cause by transit vehicles having to pick-up and discharge passengers
- Integrate airport ground/air operations by providing airlines, traffic and parking information
- Promote use of private transit and improve their operations
- Provide priority for transit at signalized intersections
- Promote ease of transit payment and transfers
- Improve railroad crossing safety
- Promote disabled access to transit

		TABLE 5-2: Priority of Issues	
	ISSUE NO.	FOCUS OF ISSUE	SCORE
	TOP PRIORITY ISSUES:		
1	24	⇨ Pedestrian Safety	18.1
2	21	⇨ Mobile Source Emissions	17.8
3	11	⇨ Recurrent Freeway Congestion	17.8
4	2	⇨ Freeway Control Center	17.8
5	19	⇨ Route Guidance and Info.	17.4
6	9	⇨ Integrate LVACTS; Freeway; Transit	17.0
7	23	⇨ Improve Roadway Safety	16.3
8	1	⇨ Non-recurrent Freeway Congestion	15.0
9	12	⇨ Recurrent Arterial Congestion	13.9
10	13	⇨ Non-recurrent Arterial Congestion	13.8
11	8	⇨ Access for delivery to Strip	13.0
12	27	⇨ Regional Accident Database	12.6
	MODERATE PRIORITY ISSUES:		
13	4	⇨ SOV Dependence	12.2
14	18	⇨ Work Zone Congestion	11.6
15	15	⇨ Emergency Vehicle Priority	11.0
16	10	⇨ Intermodal Transfers	10.9
17	26	⇨ Transit Security	10.9
18	14	⇨ Special Event Congestion	10.1
19	3	⇨ Increased Transit Usage	9.7
20	22	⇨ Neighbourhood Cut-through Traffic	9.3
21	16	⇨ Haz-Mat Emergency Response	8.8
22	17	⇨ Transit Induced Congestion	8.6
23	20	⇨ Airport Parking/Coordination	7.8
24	28	⇨ Use of non-public paratransit	7.3
25	5	⇨ Signal Priorities for Transit	7.4
26	7	⇨ Ease of Transit Payment	6.2
27	25	⇨ Railroad Crossing Safety	5.1
28	6	⇨ Disabled Access to Transit	4.5
	Note:	Top Priority = Score > 12.25 (3.5*3.5)	
		Moderate Priority = Score < 12.25	
		Low Priority = Score < 4.00 (2*2)	

6. User Service Prioritization

6.1 Prioritization Based on Regional Needs

At the "Needs Assessment Workshop" discussed in Section 5, the Steering Committee scored the transportation issues relevant to the Las Vegas Valley on a severity scale and a priority scale. Mapping the ITS user services that can be used to address these issues results in a score for each ITS service that is representative of the number of issues that it addresses, and the severity and priority of these issues. The results of this ITS user service prioritization is shown in Table 6-1.

From Table 6-1, it is evident that the top priority user services are:

1. Traffic Control (includes traffic signal and freeway management)
2. En-route Driver Information
3. En-route Transit Information
4. Incident Management
5. Route Guidance
6. Pre-trip Travel Information
7. Public Transportation Management
8. Personalized Public Transit
9. Traveler Services Information

The top priority user services can further be grouped into following categories:

1. Traveler Information (encompassing En-route Driver Information, Pre-trip Travel Information, En-route Transit information, Route Guidance, and Traveler Services Information)
2. Traffic Control
3. Incident Management
4. Public Transportation Management (including Personalized Public Transit)

Table 6-1 : User Service Priority

User Service Scores by Category

	USER SERVICES	SCORE *
1	En-Route Driver Information	113 1
2	Route Guidance	78 0
3	Traveler Services Information	19 6
4	Traffic Control	302 4
5	Incident Management	96 4
6	Emissions Testing and Mitigation	17 7
	Travel & Transportation Management	**627.2**
7	Pre-trip Travel Information	71 5
8	Ride-matching & reservation	12 2
9	Demand Management & Operations	12 2
	Travel Demand Management	**95.96**
10	Public Transportation Management	43 9
11	En-Route Transit Information	96 7
12	Personalized Public Transit	26 3
13	Public Travel Security	10 9
	Public Transportation Operations	**177.78**
14	Electronic Payment Services	6 2
	Electronic Payment	**6.22**
15	Commercial Vehicle Electronic Clearance	4 4
16	Automated Roadside Safety Inspection	0 0
17	On-board Safety Monitoring	0 0
18	Commercial Vehicle Administrative Processes	4 4
19	Hazardous Materials Incident Response	8 8
20	Commercial Fleet Management	4 4
	Commercial Vehicle Operations	**21.91**
21	Emergency Notification & Personal Security	0 0
22	Emergency Vehicle Management	11 04
	Emergency Management	**11.04**
23	Longitudinal Collision Avoidance	0 0
24	Lateral Collision Avoidance	0 0
25	Intersection Collision Avoidance	0 0
26	Vision Enhancement for Crash Avoidance	0 0
27	Safety Readiness	0 0
28	Pre-crash Restraint Deployment	0 0
29	Automated Highway System	0 0
30	Railroad Crossing Safety	5 1
	Advanced Vehicle Control and Safety Systems	**5.1**
	TOTAL SCORE:	**945.249**

Priority Ranking of User Services

Rank	USER SERVICES	SCORE *
1	Traffic Control (4)	302 4
2	En-Route Driver Information (1)	113 1
3	En-Route Transit Information (11)	96 7
4	Incident Management (5)	96 4
5	Route Guidance (2)	78 0
6	Pre-trip Travel Information (7)	71 5
7	Public Transportation Management (10)	43 9
8	Personalized Public Transit (12)	26 3
9	Traveler Services Information (3)	19 6
10	Emissions Testing and Mitigation (6)	17 7
11	Demand Management & Operations (9)	12 2
12	Ride-matching & reservation (8)	12 2
13	Emergency Vehicle Management (22)	11 0
14	Public Travel Security (13)	10 9
15	Hazardous Materials Incident Response (19)	8 8
16	Electronic Payment Services (14)	6 2
17	Railroad Crossing Safety (30)	5 1
18	Commercial Vehicle Electronic Clearance (15)	4 4
19	Commercial Vehicle Admin Processes (18)	4 4
20	Commercial Fleet Management (20)	4 4
21	Safety Readiness (27)	0 0
22	Intersection Collision Avoidance (25)	0 0
23	Automated Highway System (29)	0 0
24	Pre-crash Restraint Deployment (28)	0 0
25	Emerg Notification & Personal Security (21)	0 0
26	Vision Enhancement for Crash Avoidance (26)	0 0
27	Automated Roadside Safety Inspection (16)	0 0
28	On-board Safety Monitoring (17)	0 0
29	Longitudinal Collision Avoidance (23)	0 0
30	Lateral Collision Avoidance (24)	0 0

Legend * - Score indicates the applicability of a particular user service to the transortation issues Identified in the Needs Assessment Workshop.

These four categories define the high priority ITS services of Las Vegas Valley. Based on the needs assessment process discussed in Section 5, it is apparent that there are generally two types of issues relating to ITS deployment: technological issues and institutional issues. Technology issues will be evaluated in the next phase of the ITS deployment planning process. Institutional issues, however, need to be dealt with among the local agencies and stakeholders involved. It is, therefore, suggested that four different ITS working groups be established to discuss and resolve institutional issues in parallel with the ITS Strategic Plan development. The regional and agency specific needs identified in this process should be used as agenda for these working groups.

The suggested working groups and their membership include:

Traffic Control Working Group

Core Members:
- NDOT - Traffic
- NDOT - Design
- NDOT - Dist. 1 HQ
- City of Las Vegas
- City of North Las Vegas
- City of Henderson
- Clark County
- LVACTS
- Clark County RTC

Traveler Information Working Group

Core Members:
- Clark County
- NDOT - Traffic
- NDOT - Dist. 1 PI0
- Convention Authority
- Airport Authority
- Resort Association
- City of Las Vegas
- LVACTS
- Newscaster Tom Hawley

Invited Members:
- Rental Car Companies
- Local Broadcaster Association
- Skywatch (Skyview Traffic Watch)
- Cable TV Company
- NDOT Communication Specialist

Incident Management Working Group

Core Members:
- NDOT - Safety
- NDOT - Legal
- Metro Police
- Nevada Highway Patrol
- North Las Vegas Police
- Henderson Police
- Las Vegas Fire Dept
- Clark County Fire Dept

North Las Vegas Fire Dept
Henderson Fire Dept
Office of Traffic Safety
California AAA
Mercy Ambulance
Regional 911 Committee
Clark County Emergency Services
LVACTS

Invited Members: Tow truck operators
Coroner's office
Legal community

Public Transit Working Group
Core Members: Clark County RTC
- Fixed Route
- Paratransit

Taxicab Authority
Ray & Ross Transport
Bell Shuttle
CAT Management Team
NDOT - Modal Management
Greyhound

The above working groups should meet regularly to discuss and resolve the institutional issues. Some working groups may only need to meet for 3-4 times, while other working groups may decide to meet continuously, depending on the complexity of the institutional issues involved. A mission statement and agenda for the working groups should be established in the first meeting. Ad-hoc participants may be invited (invited members) at specific meetings to discuss particular subjects.

The other ITS services that are not among the top priority will, however, not be ignored. Because they are not ranked among the top priority does not mean they should not be deployed. Some of them are matured for private sector deployment in the short term (eg. the Commercial Vehicle Operation services). Others can be very cost-effectively deployed by similar technology as the high priority services (eg. Emergency Vehicle Management can be deployed as part of Traffic Control). These issues are addressed in the following sections of this report.

6.2 Consideration of Public Sector versus Private Sector Role

6.2.1 Background

ITS deployment in the Las Vegas Valley depends on a realistic assessment of market context as well as technological expertise. Effective deployment requires sufficient funding for development and distribution of services, and a threshold level of user acceptance (market penetration). Private sector participation can contribute to both. Specifically, it can:

- Leverage public resources, which will promote broader ITS deployment by increasing total funding available for ITS development and distribution, and
- Enhance competition among service providers, which will generate market-responsive ITS design, lower prices, and stimulate market penetration.

Nevada, the Las Vegas Valley and vicinity areas are home to a number of technologically oriented private firms; they constitute a rich source of entrepreneurial and demonstrated technical skills, as well as direct knowledge of the region's transportation needs. These firms, particularly current and former defense contractors, are an important potential source for participants in private and public-private ventures in ITS.

6.2.2 Leveraging Public Resources

A strategic deployment plan will be implementable only if it is financially realistic. With unlimited budget, for example, the Las Vegas Valley public agencies could develop and manage the full ITS system by themselves. Yet unlimited budgets or even sufficient public funding are not realistic. Neither, for that matter, is complete public responsibility for deployment. Private involvement is thus not only appealing from an academic standpoint, but from a practical one as well.

The Las Vegas Valley will have to stage ITS implementation strategically, capitalizing on funding availability and leveraging available public assets to attract private sector partners who can provide necessary funding and management resources. The Las Vegas Valley already has a very strong institutional setup among the public agencies. LVACTS represent a multi-jurisdictional setup of operating and maintaining ITS deployment. Such a setup can be further strengthened with private-public participation.

Therefore, Las Vegas Valley should strive to maximize the benefit/cost ratio of ITS deployment. Clearly, this implies integration of current ITS services already in place in the Las Vegas area, using them as staging for other services that rely on the same infrastructure or other inputs. It also implies shifting as much financial and organizational responsibility as possible to private sector partners.

In this context, public funding is used as support and stimulant, for example, to:

- Limit or minimize risks (or uncertainty) of private investments, which would otherwise inhibit private involvement (for example, underwrite some development costs, provide insurance, and/or guarantee a threshold level of return),
- Establish core infrastructure (detection, surveillance & communication) and services that will be offered without fee to the public to achieve state, regional, and/or local objectives
- Institute links among established ITS services or build incremental infrastructure that significantly adds value to established or contemplated service modules, and
- Provide seed money for services that might in the future be privatized when a fee-paying customer base is better established.

The financial motivation for engaging the private sector in public-private partnerships and as individual private units in a jointly managed ITS system is simple: by broadening the funding base that supports deployment, it allows the public sector to implement a more extensive ITS service system than would be possible if the Las Vegas area had to rely on its public resources alone.

6.2.3 Enhance Competition

A second motivation for private involvement is to enhance (or introduce) competition in the development, production, and delivery of ITS services. The benefits of a more competitive environment include reduced price, improved quality and range of ITS services offered. Competition among private firms, or even between public and private participants, can take several forms:

- Simultaneous provision of equivalent equipment or services,
- Simultaneous provision of services that address the same basic needs but differ in character and cost, thus appealing to somewhat different customer bases, and
- Competitive bidding for franchised monopoly or contracted-out services.

A well-functioning competitive environment ensures greater operating efficiency, better quality, and/or lower fees for services as providers vie for business. This will be true whether the market is served by several providers simultaneously (for example, competing ATIS companies) or a single firm granted a finite monopoly but which must bid against competitors to gain the franchise.

Additionally, private firms generally distinguish themselves from each other by offering somewhat different services or equipment as they work to broaden their customer base. They can use qualitative and/or price differences to lure active customers from their competitors or to tap niche markets and customers not attracted to the other options available. Ultimately, customers benefit from the wider range of choices because they can pick the services and service options that best suit their needs and budget.

A competitive market environment, moreover, will have second-round effects that further support ITS deployment. That is, competitive prices and extended ITS choices will draw more fee-paying users to ITS services; in turn, this will encourage further private investment in service production and refinement, thus accelerating deployment and rates of penetration. Greater or accelerated penetration will help the Las Vegas Valley transportation system to more quickly and effectively achieve its objectives.

6.2.4 Basic Modes of Private Sector Participation

There are three basic modes of private sector participation in ITS:

- **Independent -** A company sells a service or product directly to users of the transportation system (e.g. individual members of the public and fleet operators) in a free market competitive environment. Such a business may make use of publicly provided infrastructure or information, but such information or infrastructure is equally available to any company wishing to compete in provision of the same service or product. In some cases, the company may compete with a similar service or product offered by the public sector. Otherwise, the public sector has no involvement or responsibility for the delivery of the service or product.

- **Controlled** - A company sells a service or product to end users of the transportation system under a public sector controlled franchise, monopoly, subsidy (e.g. money, infrastructure, or right-of-way), exclusive public/private joint venture, regulated pricing, or other limited competition or subsidized arrangement. Such arrangements are needed when the free market cannot operate for the given service or product, because for example, the cost exceeds the price users are willing to pay, or because needed infrastructure (public or private) or other resources involved cannot realistically be shared or duplicated for all companies wishing to participate, or because a "first-in" company has an insurmountable advantage in a free market situation. In any case, the company has chosen to provide the service or product and is fully responsible. The public sector is involved only for the purpose of regulation or subsidy so as to create a business environment which attracts the private sector while protecting the public interest.

- **Contract** - A company sells (or trades) a service or product to a public sector transportation system provider or operator. This category includes public sector use of private sector infrastructure (e.g. communications network) and the case where a company provides a service or product to end users of the transportation system but is paid by a public sector agency on a contract basis (which may include shared revenues, commissions, bonuses, and other performance incentives) rather than directly by the end users (e.g. contract transit operator). In all cases, the service or product is the responsibility of the public sector, even though some aspect or all of its provision may be enabled by the involvement of the private sector on a contract basis.

Provision of a complete ITS service to end users may involve both the private and public sectors, and the private sector's participation may involve multiple companies via any or all of the above participation modes.

6.2.5 Private Sector Opportunities of ITS Services

Several ITS services are viable candidates for independent participation by the private sector. The private sector will naturally recognize and launch such ventures when they become economically feasible. The public sector can help ITS markets reach and maintain economic feasibility in many cases by providing research and development support, providing any needed public infrastructure, helping establish national or international standards, and maintaining stable and clear long term policies regarding public sector involvement in an ITS service where a change in such a policy could threaten the economic viability of private sector initiatives. Otherwise, the public sector cannot directly affect the rate of private sector involvement in independent ventures.

ITS services that are, or will likely be, largely provided independently by the private sector are: pre-trip travel information, en-route driver information, route guidance, traveler services information, freight mobility, emergency notification and persona/ security, on-board safety monitoring, longitudinal collision avoidance, lateral collision avoidance, intersection collision avoidance, vision enhancement for crash avoidance, safety readiness, and pre-crash restraint deployment. Most of these services are based on in-vehicle devices or delivery of information which can be readily obtained from other companies or the public sector. Some of these services, especially those involving travel information, will likely need the cooperation of the public sector in providing raw data from transportation management systems, or some other aspect of the service not readily provided by the private sector. Automated highway systems will likely involve independent private sector ventures in selling in-vehicle guidance and control systems, but the public sector will also have to be heavily involved in infrastructure provision.

Other ITS services are not feasibly provided by independent private sector ventures. Of these, some could be provide by controlled private sector ventures, at least in particular instances. These include commercial vehicle electronic clearance, personalized transit, ride matching and reservation and part of incident management (towing). Public subsidy or regulation of involved companies is likely to be needed for these services.

The remaining ITS services, and the parts of the above services not provided by the private sector, will have to be provided wholly by the public sector. Of course virtually any part, or all, of such ITS services can be provided by the private sector on a contract basis if the responsible public agency so desires. Private sector participation on a contract basis is often essential, especially for products and specialty services needed by the public sector transportation agencies. This type of private sector participation has, and will continue to, occur on a large scale for those ITS services which are primarily the responsibility of the public sector.

A detailed discussion of the private/public partnership evaluation of each ITS service is provide in Appendix A.

6.2.6 Relevant Legal and institutional Issues

The legal and institutional issues associated with public-private partnership in the Las Vegas Valley are related to the prevalent forms of these partnerships, statutes and regulations in Nevada and local jurisdictions, and institutional characteristics of the public agencies involved.

Aside from contractual issues associated with any public procurement, private participation in provision of ITS services can raise issues such as the following:

6.2.6.1 Public Sector Authority

- Public sector authority to enter into joint ventures, sharing risk and/or funding with private profit-making agencies,
- Public sector authority to collect fees from private agencies (for example, in the case of information distribution, can a traffic management center receive cash revenues from private firms and other public agencies?),
- Public sector *authority to allocate such revenues* to ITS or other designated uses,
- Public sector *authority to "sweeten* the *offer"* to attract private partners, for example, by underwriting insurance or otherwise reducing investment risk (thus increasing public sector risk exposure),
- Public sector authority to grant franchises or exclusivity for specified services or products provided by private agencies (for example, can the public agency designate a single monopolistic provider of ATIS services or must it supply data to all who are willing to pay?).

6.2.6.2 Financial Issues

- Valuation of public sector assets or outputs (How to establish the value of a service not traded in a monetized market?) and public sector authority to determine fees (What is a "fair" price? Can the authority charge more than incremental or variable costs, thus receiving some revenue toward capital repayment? Can they make a profit that is available for other ITS needs?),
- Tax implications of partnering (Which, if any, partnering arrangements preclude the use of tax-exempt debt funding? Do public agency revenues from a joint public-private venture or for services delivered as inputs to private sector firms generate a federal income tax liability?).

6.2.6.3 Structural and Contractual Issues

- Form of private participation, that is, criteria and process for choosing joint ventures, exclusive franchises, or open multi-firm markets for private sector participation,
- Allocation of financial and legal liability when problems arise (for example, in the information-distribution relationship, incorrect or missing information, service interruptions due to damaged roadside equipment, accidents attributable to private partner error in assessing road or weather conditions),
- Allocation of financial responsibility when jointly-utilized infrastructure must be modified (for example, if telecommunications infrastructure has to be moved to accommodate roadway widening).

6.2.6.4 Protection of the Public Interest

- Protection of privacy (an issue also for public sector information activities, but perhaps more so when private users have access to data that potentially contains identifying tags),
- Process for screening, if any, of private firms selected as partners,
- Institution of appropriate oversight procedures to protect the general public's safety and ensure private sector financial and operational responsibility.

Two issues quite unlike those listed above relate to private sector attitudes: absence *of* private sector interest in the provision of ITS services (because the risk-return ratio is not perceived as sufficiently attractive), and political opposition to private sector involvement or to specific forms of private-public partnerships (for example, established providers resisting public sector encouragement of new competitors). Moreover, overlaid on all these issues are the inter-agency and institutional complexities that complicate any partnering arrangements. For example, the issue of liability is magnified if each of the many jurisdictions in the Las Vegas area operate under different regulatory constraints.

6.3 Establishing ITS Priorities in an Institutional Framework

The purpose of this section is to establish ITS service priorities within a framework that accounts for institutional issues such as financing and operational responsibility. The priorities of ITS services presented in Section 6.1 was based primarily on a "need" basis and did not consider the institutional issues of who can (or should) provide the service, how it can be financed and how it can be implemented. Since implementation of any ITS service depends on institutional arrangements for financing and operation, these factors need to be considered before establishing ITS service priorities.

The institutional setting in which a given ITS service must be implemented will have an effect on who pays for the service, who benefits from it, who operates it, whether the private sector involvement is required, whether federal, state, or local government participation is required, and which modal operators use, finance, and/or operate it. Some of the more important institutional issues that should be considered when establishing ITS service priorities are listed below.

- **Modal issues**
  Historically, the various modal operating agencies have different institutional settings. These differences affect the way ITS services can be implemented. Most modes have different funding sources, different budgeting practices, and different regulations they are subject to. To be successful, implementation should be tailored to reflect these differences. It is important to assure that each mode is treated equitably and that the ITS strategic plan is **a** full multi-modal plan.

- **Financing issues**
  Financing options vary among the ITS services. In some instances public sector funding is readily available. In other cases, public sector funding is limited to categorical funding programs that restrict the use of funds to one mode. In still other cases, public sector funding is not available at all, yet there are opportunities for private sector participation. While funding should not be the determining factor in establishing priorities for implementing ITS services, the priorities should "reflect" the financing opportunities that are available.

- **Public versus private sector issues**
  While the public sector can be expected to be the developer and operator of many of the ITS services, the private sector can provide value added services or expand the distribution of these services. This is discussed in Appendix A. Priorities for ITS services should reflect the extent of public sector involvement that is required to promote maximum value through private sector participation.

- **Federal, state, or local jurisdiction**
  When public sector involvement is required to plan, develop, finance, or operate an ITS service, the responsibility can rest with the federal, state, or local governments. Priorities should reflect the level of state and local commitment that will be required to implement the ITS services.

Since institutional issues have a major impact on how ITS services are implemented, the final set of ITS service priorities were established within a framework that reflects the institutional setting in the Las Vegas Valley. Rather than establishing priorities among all 30 ITS services, the individual services were grouped into the five service "bundles" or groups presented in Table 6-2. First, the relative priority of each group was set and then priorities within each group were established.

The overall priority for "Travel & Transport Management" and "Transit & Rideshare Management" are high for the public sector. These two ITS service bundles are primarily public sector responsibilities. The private sector may participate on selected elements or services in the joint venture or parallel provision with the public sector.

TABLE 6-2: General Priorities of ITS Service Bundles

ITS SERVICE BUNDLE	PUBLIC OR PRIVATE SECTOR RESPONSIBILITY	PUBLIC SECTOR PRIORITY
1. Travel & Transport Management	Primarily public sector	High
2. Transit & Rideshare Management	Primarily public sector	High
3. Commercial Vehicle Operations	Shared	Low
4. Emergency Management	Shared	Moderate
5. Automated Vehicle Control Systems	Primarily private sector	Low

The overall priority for "Commercial Vehicle Operations" is low for the Las Vegas Valley. Commercial Vehicle Operations is a multi-state regional endeavor. Whereas Las Vegas is in the middle of the trucking route from California and Oregon or maybe Utah, to other southwest regions, any such ITS activities need to be coordinated with the neighboring states.

The overall priority for "Emergency Management" is moderate for the public sector. This ITS service bundles require shared responsibilities between the private sector and public sector. The public sector may provide the safety and roadside infrastructure with the private sector deploying the in-vehicle equipment.

The "Automated Vehicle Control Systems" bundle is primarily a private sector responsibility with research sponsored by the USDOT on a national level. The local public sector priority for the Las Vegas Valley is, therefore, low.

The following sections outline the public sector priorities for ITS services under each of the five bundles.

6.3.1 Travel & Transportation Management

The overall public sector priority for the Travel and Transportation "bundle" is high. The priorities within this bundle are presented in Table 6-3. A discussion of each ITS service follows.

"Traffic Control" and ' incident Management" are both perceived to be highest priority in meeting regional needs (as shown in Table 6-1). They are primarily public sector responsibilities with possible private sector participation through partnership such as exchanging highway right-of-way for telecommunication infrastructure or contracting for freeway safety patrol or towing services. These two ITS services also directly address recurrent and non-recurrent congestion, with potentially high mobility benefits.

TABLE 6-3: Travel & Transportation Management Category
Overall Priority: High

Ratings: 5 = Highest Priority
1 = Lowest Priority

ITS SERVICE	OVERALL NEED	PUBLIC ROLE	PUBLIC SECTOR PRIORITY	COMMENTS
Pre-Trip Travel Information	5	Shared with private sector	5	Benefits "all" modes of travel: drive, bus, train, rideshare. Can help alter demand by mode, time of day and route selection.
En-route Driver Information	5	Shared with private sector	5	Traveler advisories through signs, radio, etc., can help travelers avoid congested areas or at least anticipate the amount of delay.
Route Guidance	4	Shared with private sector	3	Needs in-vehicle equipment.
Traveler Services	3	Primary private sector responsibility	3	Important to McCarran Airport, tourist and business travel industries.
Traffic Control	5	Primary public sector responsibility	5	On the arterial system we already have an extensive traffic signal "system". We need more emphasis on maintaining and improving it.
Incident Management	5	Primary public sector responsibility	5	Incidents cause most congestion yet we have done little to address this. There is significant opportunity for substantial reduction in incident related congestion.
Emissions Testing & Mitigation	3	Primary public sector responsibility	5	Need to identify polluting vehicles

"Pre-trip Traveler information" and "En-Route Driver Information" are both ranked very high among the regional needs. The public sector should take a lead role with some value-added services performed by the private sector. For example, the public sector can provide traveler information through variable message signs, highway advisory radio dedicated Cable TV channel and other conventional means. The private sector can obtain this information and distribute it through other channels such as pagers, personal communicators and kiosks, thus expanding the distribution and enhancing its potential benefits. Since the public sector possesses some of the data sources for traveler information, and such data are useful for traffic control as well as traveler information, it is reasonable for the public sector to take a lead role in these two ITS services. The public sector priority for them is, therefore, very high.

Route Guidance" is perceived to have a high priority in meeting regional needs. Route guidance builds on "En-Roufe Driver information" by processing the basic information on traffic flows, congestion and weather conditions and transforming it into travel directions. Since route guidance would require some in-vehicle equipment, private sector involvement is necessary. The public sector can provide the infrastructure and information for the private sector to equip the vehicles with suitable equipment. The benefits of route guidance would be enhanced for unfamiliar drivers and for incident traffic management purposes. Its value to the region is medium and, therefore, the public sector priority is medium.

"Traveler Services" is moderate to low priority in meeting regional needs. With the travel information system infrastructure, traveler services can be a value added function provided and funded by the private sector. This would have special values for tourist and business centers like the McCarran Airport. Therefore, its public sector priority is medium.

"Emissions Testing & Mitigation" is primarily a public sector responsibility. It is perceived to have a high public sector priority. The Board of City Commissioners adopted in 1995 a program to provide remote monitoring of polluting vehicles.

6.3.2 Transit & Rideshare Management

The overall priority for the "Transit & Rideshare Management" service bundle is high for the Las Vegas Valley. Priorities within this bundle are presented in Table 6-4 and explained below.

Among the ITS services in the bundle, "Public Transportation Management" is considered as top public sector priority, since it meets regional transit needs. This service is primarily the responsibility of the public sector. It optimizes the fleet maintenance and operation features of transit and vanpool programs in the region.

TABLE 6-4: Transit & Rideshare Management
Overall Priority: High

Ratings: 5 = Highest Priority
1 = Lowest Priority

ITS SERVICE	OVERALL NEED	PUBLIC SECTOR ROLE	PUBLIC SECTOR PRIORITY	COMMENTS
En-route Transit Information	3	Primary public sector responsibility	3	There is a special need to help the visually impaired.
Public Transportation Management	5	Primary public sector responsibility	5	There are numerous opportunities to improve the efficiency of operations and maintenance for all transit and rideshare fleets. These can help reduce vehicle maintenance costs, improvement schedule adherence, etc.
Personalized Public Transit	4	Shared provision with private sector	4	Privately operated transit are already very common in Las Vegas.
Public Travel Security	3	Primary public sector responsibility	3	Bus stations are an issue.
Ride Matching & Reservation	4	Share provision with private sector	4	Real-time ride matching with security checks can promote ridesharing
Demand Management	3	Primary public sector responsibility	3	Promote ridesharing requires public policies and regulations
Electronic (fare) Payment Services	4	Primary public sector responsibility	4	"All" transit and rideshare services can benefit from uniform payment system.

"Ride Matching Reservation" and *"Electronic (fare) Payment* Services" are perceived to have moderate to high regional needs. They are given high public sector priority. *"Ride Matching and* Reservation" can be classified as shared provision with the public sector providing subsidized ride-matching services, as is currently provided by the Clark County RTC, and the private sector providing fee-supported ride matching with upgraded services such as security checks, instant matching at ride-match lots, etc. The application of *" Electronic (fare)* Payment System" in the Las Vegas Valley is focused in transit fare payment. It is given a high public sector priority.

The remaining four services in this bundle, *"En-route Transit information", "Personalized Public Transit", "Public* Travel *Security",* and *"Demand Management* & *Operations"* are of moderate priority in the Las Vegas Valley. These four ITS services are perceived to be moderate to low in meeting regional needs and moderate in meeting agency needs. All four services except "*Personalized Public Transit" are* primarily public sector responsibility. The *"Personalized Public Transit"* is a suitable candidate for a shared provision with the public sector (Clark County RTC) providing elderly and disabled services and the private sector providing "Smart Shuttles" or other demand responsive transit. Also, privately operated paratransit in Las Vegas can benefit from this ITS service.

6.3.3 Commercial Vehicle Operations

Most of the ITS services in this bundle require joint venture between public and private sectors with more emphasis on the private sector. Among the services offered, *"Commercial Vehicle Administrative Process"* is of moderate priority to the public sector because it streamlines the public sector tasks such as licensing, registration etc. This service also benefits the private sector agencies by reducing unnecessary delays.

"Freight Mobility" is perceived to have a moderate regional need. However, it is a candidate for private sector taking the lead role with some public sector involvement related to the supply of real-time traffic information. Therefore, its public sector priority is medium to low.

"Commercial Vehicle Electronic Clearance" and *"Automated Roadside Safety Inspections"* are mutually beneficial for public and private sectors, They require joint efforts by the public and private sector. *"Hazardous Materials incident* Response" is an infrequent occurrence but its public safety implication can be significant. It also requires joint efforts between the public and private sector. The overall need for *"On-Board Safety Monitoring"* is perceived as low. This service requires on-board equipment and should be led by the private sector.

TABLE 6-5: Commercial Vehicle Operations
Overall Priority: Low

Ratings: 5 = Highest Priority
1 = Lowest Priority

ITS SERVICE	OVERALL NEED	PUBLIC SECTOR ROLE	PUPLIC SECTOR PRIORITY	COMMENTS
Commercial Electronic Clearance	3	Joint venture with private sector	2	Eliminates "unnecessary" inspections. Allows more efficient use of personnel.
Automated Roadside Safety Inspections	2	Joint venture with private sector	2	Reduces time required on inspection.
On-Board Safety Monitoring	1	Private sector lead	1	Primarily the responsibility of the commercial fleet operator. Requires on-board equipment
Commercial Vehicle Administrative Processes	3	Joint venture with private sector	3	Benefits "entire" trucking industry by streamlining licensing, taxing, etc.
Hazardous Materials Incident Response	3	Joint venture with private sector	3	Hazmat incidents are infrequent but impacts can be severe.
Freight Mobility	2	Private sector lead	2	Primarily the responsibility of the commercial fleet operator. Requires on-board equipment

6.3.4 Emergency Management

"Emergency Vehicle Management" is perceived to have moderate regional needs in the Las Vegas Valley. The public sector plays a key role in the implementation of this ITS service, which involves developing emergency response plans coupled with signal priority systems that result in reduced incident response time.

"Emergency Notification and Personal Security" is beneficial for rural travel. It is therefore, assigned a low priority for the Las Vegas Valley. Implementation of this ITS service involves a joint venture through the private sector with installation of on-board equipment.

TABLE 6-6: Emergency Management
Overall Priority: Moderate

				Ratings 5 = Highest Priority 1 = Lowest Priority
ITS SERVICE	OVERALL NEED	PUBLIC SECTOR ROLE	PUBLIC SECTOR PRIORITY	COMMENTS
Emergency Notification and Personal Security	1	Joint venture with private sector	1	Mayday systems for individual vehicles more appropriate in rural areas.
Emergency Vehicle Management	3	Primary public sector responsibility	3	Providing emergency vehicle priorities in the traffic control system can reduce incident response time.

6.3.5 Automated Vehicle Control Systems

A majority of the ITS services in this bundle require some kind of in-vehicle device(s) aimed at improving passenger safety. For this reason, it is assigned a low public sector priority.

Within this bundle "Automated Highway Systems" can potentially generate great regional benefits. However, it requires a joint national public and private sector involvement. This service involves considerable private sector research and is not implementable in the short term. Therefore, it is assigned a low priority.

TABLE 6-7: Automated Vehicle Control Systems
Overall Priority: Low

Ratings: 5 = Highest Priority
1 = Lowest Priority

ITS SERVICE	OVERALL NEED	PUBLIC SECTOR ROLE	PUBLIC SECTOR PRIORITY	COMMENTS
Longitudinal Collision Avoidance	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Lateral Collision Avoidance	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Intersection Collision Avoidance	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Vision Enhancement for Crash Avoidance	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Safety Readiness	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Pre-Crash Restraint Deployment	1	Primarily private sector	1	Depends primarily in equipment in the vehicle. Will be driven by market forces and private sector.
Automated Highway Systems	2	Joint national public and private research	1	Potentially very beneficial but largely untested and long time frame for implementation. Requires private sector to provide in-vehicle equipment and public sector to provide system control infrastructure.

7. ITS Core Infrastructure

7.1 Concept of Core Infrastructure

The foregoing sections discuss the needs of the Las Vegas Valley, and prioritization of the ITS services to meet these needs. This section discusses the development of an ITS core infrastructure that integrates the high priority ITS services.

Whereas the ITS services define the functions and user objectives, these functions can only be provided by some form of infrastructure. Examples of existing infrastructure in the Las Vegas Valley includes the LVACTS traffic signal control system, and the airport tunnel surveillance and information system operated by the Clark County Department of Aviation. This existing infrastructure relates to the ITS services of "Traffic Control" and "En-route driver information".

Deployment of ITS infrastructure has, in the past, been typically carried out by disjointed efforts of the separate agencies involved. The purpose of developing a core infrastructure plan is to define how these infrastructure elements (or subsystems) should work with and relate to each other, hence providing an inter-relationship of the ITS services in an ultimate system description. The core infrastructure should, however, not identify specific technologies; nor should it constrain the system architecture. The core infrastructure would also guide public sector investment so as to encourage private sector involvement by appropriate provisions and linkages to the core infrastructure.

The concept of "core infrastructure" is first developed by the US DOT as part of the national architecture development, Phase 2. To quote the US DOT:

> *Establishment of the core infrastructure features permits optimal operations and management of* roadway *and transit resources through use of currently-available technologies and strengthened institutional ties. In the near-term, implementation of the core infrastructure features is expected to be led by the public sector, and development of these capabilities is expected to occur in an evolutionary manner. However, private sector participation is highly encouraged, and appropriate partnership opportunities should be actively sought by State and local implementing agencies. Maturation of the core features in a number of metropolitan areas* can *be expected to drive private sector development of products and industries to provide future ITS user services.*

7.2 Key Considerations for Defining Core Infrastructure

In defining the core infrastructure features, the following principles were followed:

Deployment of the feature(s) will facilitate deployment of the high priority ITS services

The core infrastructure is built upon the existing ITS infrastructure. It does not require wholesale replacement of existing infrastructure.

Each feature could be deployed independently of the others, but concurrent implementation would significantly increase overall benefits and/or decrease incremental costs.

The feature(s) can be readily deployed in the near term

Varying technologies, from "low-tech" to "high-tech", can be used to deploy/implement each feature.

The core infrastructure takes into account the institutional relationships of the agencies involved.

It is recognized that the core infrastructure can evolve over time, to provide more ITS services or to enhance existing ones.

Development of the different features of the core infrastructure may take different timeframes, depending on funding availability.

Private sector participation in delivering ITS services will be encouraged to the maximum extent possible. The private sector is encouraged to participate in development of the core features.

The core infrastructure also highlights the need for coordination among jurisdictions and agencies within the Las Vegas Valley. Implementation of the core infrastructure will require deployment of the respective features by the agencies involved. While it is important for individual institutions or jurisdictions to analyze deployment initiatives to meet their specific needs, many advanced ITS services require wide-scale coordination across jurisdictional boundaries. Where these area-wide approaches are envisioned, enhanced communication and coordination of project development concepts, system architectures, interface standards, design/construction schedules, and operations/maintenance responsibilities and resources are crucial.

7.3 Core Infrastructure for the Las Vegas Valley

Following the guidelines discussed above, the core infrastructure for the Las Vegas Valley is envisioned to provide for the following high priority ITS services:

- Regional Multimodal Traveler Information System
- Traffic Signal Control System(s)
- Freeway Management System
- Transit Management System
- Incident Management Program

Figure 7-1 shows the concept plan of the ITS core infrastructure for the Las Vegas Valley.

7.3.1 Regional Multimodal Traveler Information System

The Regional Multimodal Traveler Information System (RMTIS) represents the regional center for coordinating all information relating to traffic conditions and multimodal travel needs. It serves as a nerve center for coordination among the agencies and for communicating with the end users (travelers and private sector operators).

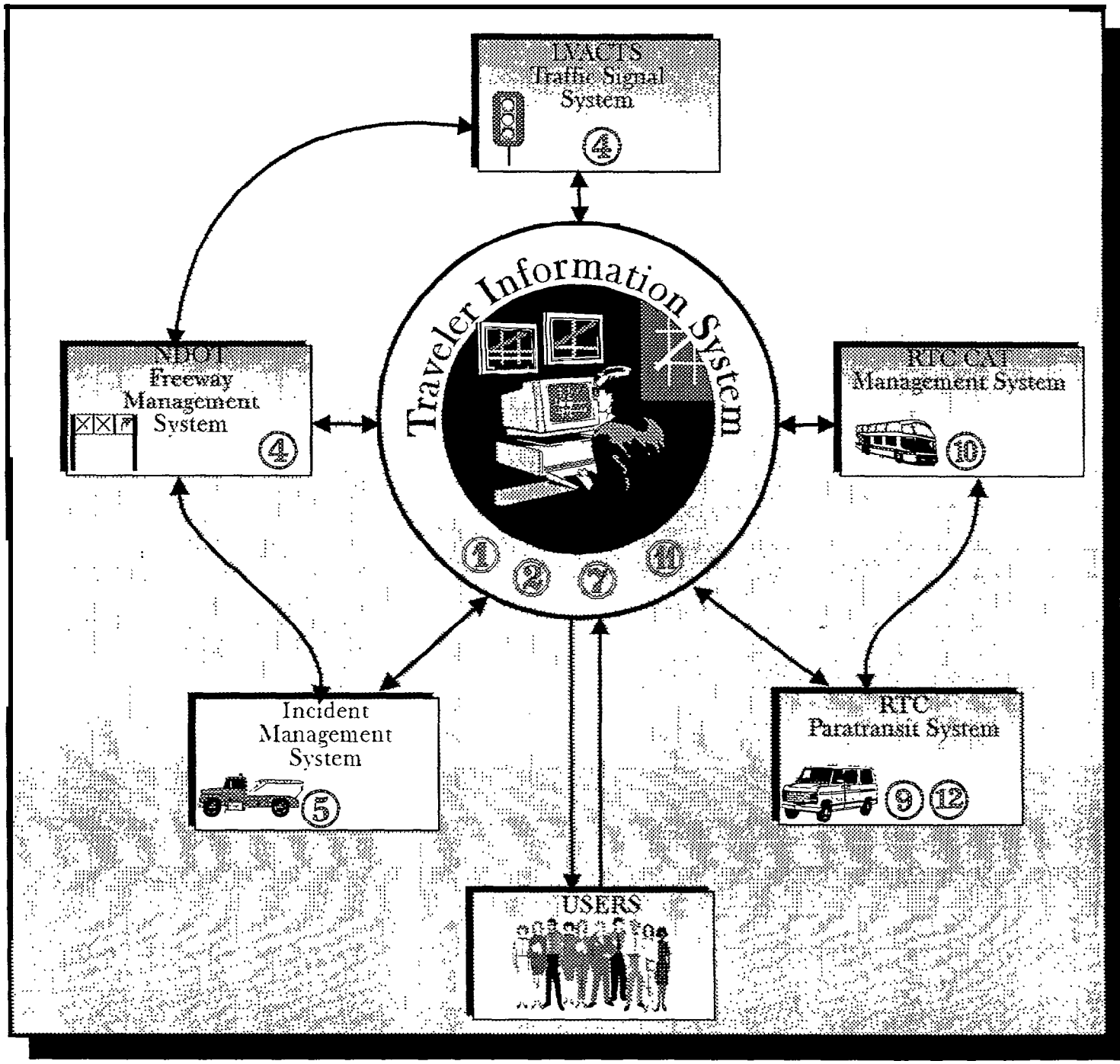
The RMTIS provides four ITS services:

- En-route Driver Information
- Route Guidance
- Pre-trip Travel Information
- En-route Transit Information

The RMTIS can be housed in a single center, or it can be a wide-area network of facilities. It receives roadway and transit system surveillance and detection information from a variety of sources provided by both the public and private sector entities. To a large degree, these sources (and recipients) of information are the other core infrastructure features. The RMTIS has the capability to combine data from varying sources, package the data in various formats, and provide the information to a variety of distribution channels, including voice or computer services, radio broadcasts, kiosks, etc.

A RMTIS does not currently exist in the Las Vegas Valley, although LVACTS processes some data from its own infrastructure. Development of the RMTIS requires careful planning to ensure that the system architecture would be compatible with the emerging national system architecture.

Figure 7-1: Las Vegas Valley ITS Strategic Plan
Core Infrastructure Plan



Legend: ITS services included in core infrastructure

1 En-route driver information
2 Route guidance
3 Traffic Control
4 Demand Management & Operations
5 Incident Management
6 Public Transportation Management
7 Pre-trip travel information
11 En-route transit information
12 Personalized public transit

7.3.2 Traffic Signal Control System(s)

Currently, LVACTS operates some traffic signals in the valley. A project is currently underway to upgrade LVACTS. This represents significant investment in the region and will be proven to provide substantial benefits towards effective traffic management. The core infrastructure provides for additional expansion of LVACTS, linking it to a future freeway operation system to provide inter-operability, as well as linking it to the Traveler Information System (RMTIS).

The expansion and integration of the LVACTS system should also take into account such institutional issues as staffing, operations and maintenance.

The LVACTS traffic signal systems belong to the "Traffic Control" ITS user service.

7.3.3 Freeway Management System

The new Airport tunnel currently has video surveillance, changeable message signs (CMS's) and lane control signs. They are operated by the Clark County Department of Aviation as part of the airport landside operations.

This is an example of the infrastructure that can be deployed to assist freeway operations in the Las Vegas Valley. Additional features can be implemented to monitor traffic flows and provide appropriate traffic management strategies such as ramp metering.

The freeway management system should be linked to the traveler information system (RMTIS) as the real-time data obtained on the freeways can be used for traveler information. The operation of the CMS's can be tied to the traveler information system (RMTIS) to ensure consistency and reliability.

The freeway management system should also be linked to the traffic signal systems (LVACTS) and the Incident Management System. The "inter-tie" to the traffic signal operators will facilitate traffic management on corridor basis, especially during incidents or special events. In fact, there are ongoing discussions that the future freeway operation center may be co-located with the current LVACTS operation center. The linkage to the Incident Management system will ensure implementation of suitable traffic management strategies, such as traffic detours during incidents.

Freeway management is part of the "Traffic Control" ITS User service.

7.3.4 Incident Management System

As discussed above, the Airport Connector Tunnel currently operates a video surveillance system to identify and confirm incidents. This application can be expanded to provide coverage of all the Valley's expressways and freeways. Further, the LVACTS upgrade project has included 43 Closed Circuit Television (CCTV) camera installations on key arterial intersections.

In addition the hardware deployment, implementation of an incident management system requires development of inter-jurisdictional agreements. The various jurisdictions and agencies responsible for operations and enforcement in the Las Vegas Valley need to develop a policies and operations agreement which defines specific responsibilities for all features of incident management, including detection, verification, response, clearance, scene management, traffic

management and information. This multi-jurisdictional operating agreement ensures routine cooperation, coordination and communication among all agencies; including enforcement, fire ambulance, highway traffic control and maintenance, environmental and other public agencies. In addition, private sector participants such as the towing and recovery industry may be saved in clearance.

7.3.5 Transit Management System

The transit system in the Las Vegas Valley could implement a fleet management system, including hardware/software components on buses and in dispatching centers, software, available radio communications spectrum, operator training, and maintenance. Depending upon needs, the fleet management system would utilize automatic vehicle location, include advanced voice and data communications, automatic passenger counting, driver/passenger information (voice and visual), vehicle diagnostics, linkage to geographic information systems, and computer-aided dispatching.

The system could provide reliable bus and paratransit position location to the dispatcher. The dispatcher or a central computer then compares the actual location with the scheduled location, enabling positive action to improve schedule adherence and expanded information for transmission to the RMTIS. In addition, on-board sensors can automatically monitor data such as vehicle passenger loading, fare collection, drive-line operating conditions, etc.; providing for real-time management response. In the event of an on-board emergency, the dispatcher can inform the police of the emergency situation and direct them to the vehicle's exact location.

Currently, RTC is responsible for operating both the **CAT(R)** bus system and the paratransit system in Las Vegas Valley. One system can conceivably function on both the fixed-route buses and paratransit vehicles that are intertied to the RMTIS.

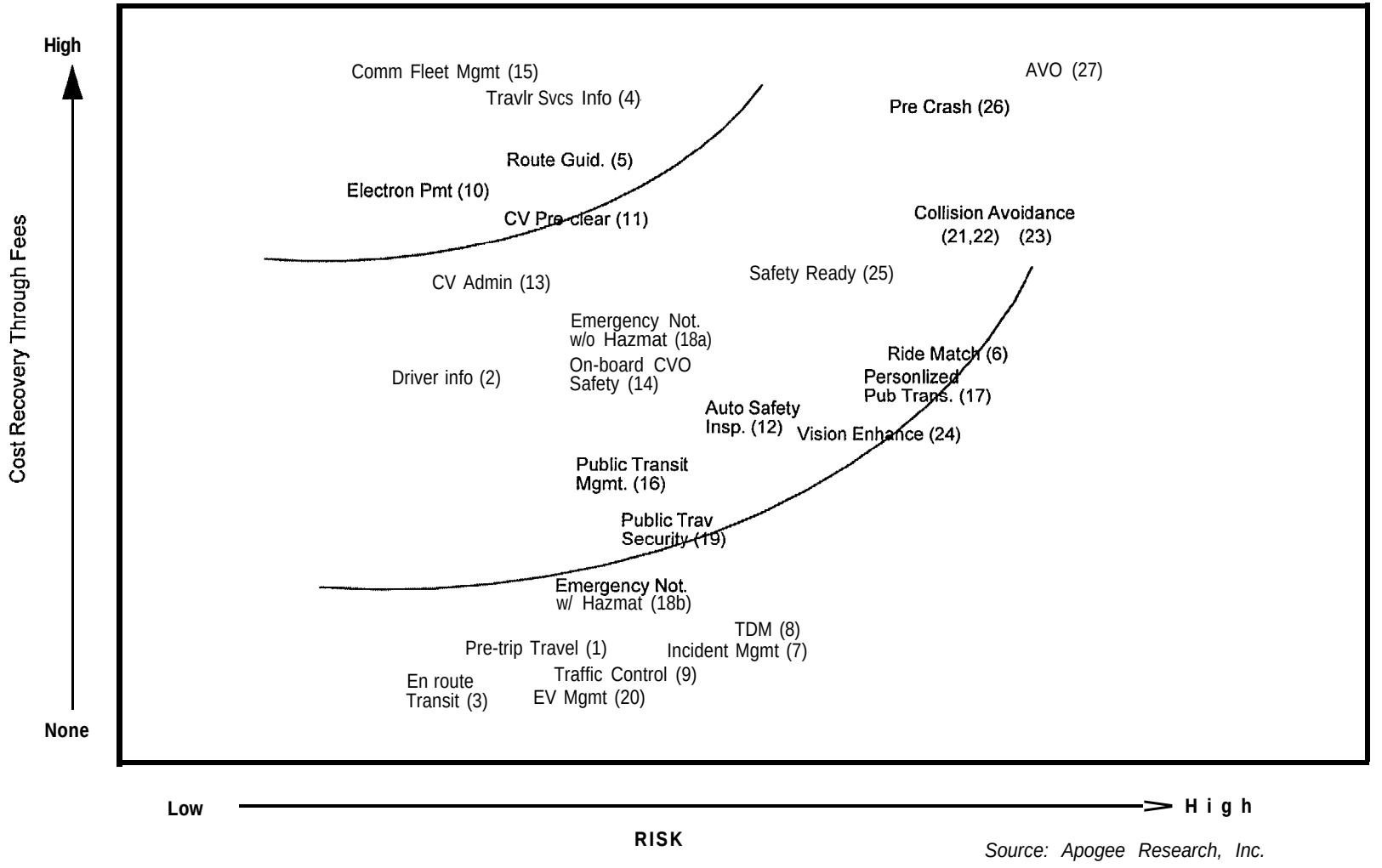
The transit systems provide for the following four ITS services:

- Public Transportation Management
- Demand Management & Operations
- Personalized Public Transit
- Ride-matching & Reservation

7.4 Conclusion

The development of the core infrastructure represents a vision of ITS early deployment for the Las Vegas Valley. It serves to guide the next phase of the Strategic Plan development: to evaluate technologies and develop a system architecture. Within this core infrastructure, needed functional areas will be evaluated. This serves as a basis for prioritizing the technologies to be deployed in the ITS strategic plan.

RISKS AND COST RECOVERY:
IMPLICATIONS FOR SECTOR ROLES IN ITS SERVICES



Source: Apogee Research, Inc.

Nonetheless, there are several ways to incorporate private sector participation, particularly over the longer term. First, major facilities that install kiosks or terminals for direct access to pre-trip information could pay subscription fees that (partially) reimburse the public sector; these could include major employers (e.g., casinos, hotels), shopping malls, and sports and entertainment facilities (e.g., Cashman Field).

Second, private sector firms could act as vendors, installing access terminals on a lease basis, thus broadening the user base for such services for travelers away from home without additional costs to the public sector.

Third, if market demand and the potential for full cost recovery increases over time (moving this service into the middle public-private band), private firms could market more sophisticated pre-trip information services by adding value to publicly-available information, for example, generating trip-specific roadway or transit route graphics distributed to home computers via CompuServe or analogous dial-up system that highlights roadway incidents or particularly congested areas, includes suggested auto routes, and maps alternative transit and/or roadway routes for a series of linked trips. Such upgrading could be an important feature of the facilities installed by private sector vendors in publicly-accessible locations and major employer locations. Public and private providers would therefore be parallel providers, supplying the same category of service but to different customer groups.

Fourth, public agencies could recoup some of their service costs by charging private transportation providers for "listings" in the service. For example, taxi and limo services to McCarran International Airport could be assessed a fee for inclusion in the database. This would not be advertising as such, since the information agency would treat data on these services in the same fashion as for public transit agencies (schedules, fares, length of trip, telephone contact number).

En-Route Driver Information and Route Guidance

Once on the road in a private vehicle, en-route driver information updates the driver with advisories and, ultimately, with in-vehicle signing. Driver advisories are based on the same information as the roadway component of pre-trip traveler services, but delivered to the vehicle. Radio stations and variable message signs already operate today with basic information, not tailored to individual drivers' needs or destinations. In-vehicle signing would replicate the information on roadside signs.

Route guidance builds on en-route driver information by processing the basic information on traffic flows, congestion, and weather conditions and transforming it into travel directions. Although linked, route guidance as a fee-for-service module will appeal to a smaller market than en-route driver information on which the driver has to process the information.

En-route driver information can be developed as a parallel provider service, with the public sector supplying variable message signs and even highway advisory radio, and private firms developing more sophisticated services geared to individual user needs.

INSERT FIGURE 6-1

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Assuming that the public sector is the source for most basic traffic information (gathered for traffic control), private sector involvement can take several forms:

- Private firms supplement publicly-supplied information with independently-gathered data, evaluate the data and, for a fee, distribute current information to local radio and television stations;

- Private firms process publicly-supplied information, perhaps supplementing it with data from other sources (e.g., parking availability at McCarran Airport), and distribute location-specific information on a fee-for-request basis to en-route drivers via cellular phone services;

- Public agencies collect fees from private firms for direct access to the public data base.

Public agencies in the Las Vegas Valley can promote private service development through reducing private sector costs by supplying traffic data to the private sector at low or no cost during the initial start-up period.

The potential market for privately-supplied en-route driver information could be significant. Although radio stations regularly broadcast data on incidents, they typically focus on freeways and major arterials and less on variations in recurrent congestion elsewhere; they are also area-wide rather than trip-specific. For example, some travelers or private fleet operators (such as taxicab operators) should be willing to pay a fee for obtaining current traffic information that quickly and accurately pinpoints specific routes of concern to them. Information can be provided as an added cellular phone service feature, by independent specialists working with the established cellular companies to communicate with their subscribers, or possibly by private firms that invest in their own telecommunications distribution network.

Likewise, the market for privately-supplied route guidance could be very large in Las Vegas, since a large proportion of the travelers are tourists or unfamiliar drivers. The likely route guidance customers are out-of-town visitors and others not fully familiar with local routes. Rather than invest in their own equipment, these drivers are likely to prefer guidance-equipped rental cars or rented on-board equipment for use in their own cars for the duration of their stay. Avis has announced that some of their vehicles will be equipped with a GPS receiver to determine their position and for route guidance.

Thus local private firms can enter the market as vendors for rented equipment and temporary service for Las Vegas Valley visitors who bring their own vehicles. The risk for private sector presumably is lower in Las Vegas and other major tourist areas (such as Orlando) than elsewhere. Private firms can also supply and maintain equipment (updated electronic maps) for rental fleets and provide the data distribution service to support route guidance; logically, route guidance service providers will be spawned from firms providing en-route driver information.

If the national ITS architecture developed in Phase 2 follows the structure presented in Phase 1, in-vehicle equipment for route guidance will perform the data processing rather than merely receive instructions developed at a central location and transmitted to the vehicle; vehicle equipment will also include AVL or some other automatic means of vehicle location. The private sector will develop, produce, and distribute the in-vehicle equipment.

Traveler Services Information

This service focuses on travelers interested in facilities and services related to a trip, for example, food and lodging, local sights, museum location and hours, hospitals and parking. Designed as an interactive network, this service will ultimately connect travelers to service providers.

This service is the electronic analogue of the printed telephone yellow pages and, like the yellow pages, should be funded and managed by private firms. The service should be provided at various locations, including at trip origin points, en-route via cellular phone or roadside kiosks, and possibly electronic hand-held personal data assistant (PDA) which would contain a data base for the Las Vegas Valley. These hand-held units are currently developed by national firms as the electronic substitute for printed guidebooks.

Local demand-responsive services will be developed and managed by private firms. In-home services can be developed by the same firms supplying higher-end pre-trip travel information. Services available at other fixed locations (hotels, offices, tourist sites, roadside rest stops) can be established as kiosks. Database maintenance and two-way communication with service providers may be developed as a separate production module or in conjunction with the information delivery network. Cost-recovery for these services can be from several sources: (1) fees charged for information (access fee from users) and telephone reservations (user fee and/or commission from businesses contacted), (2) listing fees collected from hotels, casinos, restaurants, etc., and, (3) lease fees paid by shopping malls, hotels, casinos, etc. to vendors for kiosks that are considered an attractive customer service feature.

Traffic Control

Traffic control is a public sector function; the private sector will participate only as equipment manufacturers and may be involved as contractors to the state and local public agencies.

This does not preclude the public agencies collecting revenue from the private sector, however, to help defray their costs or entering partnerships for selected production modules that support traffic control services. Firstly, partnerships such as shared resource arrangements (described above) can provide the telecommunications backbone for traffic data collection and traffic management. Leveraging their control of roadway rights-of-way, state and local agencies can gain fiber optic capacity and supporting equipment, and/or cash revenues in return for private sector access to the ROW; these partnerships, however, depend very much on the market conditions faced by the private telecommunications firms and on ROW alternatives to Las Vegas Valley roadways.

Secondly, fees can be assessed for distribution to other users of data collected for traffic management information. ITS traffic management is designed to be flexible and responsive to changing traffic conditions. Thus, it depends on up-to-date traffic information and data on incidents as well as weather conditions and other factors that contribute to congestion. This same information has value to individual drivers and commercial fleet operators (such as taxicab, privately operated shuttles, etc); the public sector can recoup some/all of the costs of the traffic management data base from sales to mass media and specialized traffic information services.

Incident Management

Incident management is essentially a public sector function. However, limited public-private partnerships can be effected with commercial firms such as towing companies for selected functions within this service. For example, although the public sector will take responsibility for incident detection, police response, and responsive traffic management, the private sector can take financial and management responsibility for coordinated dispatch of tow trucks through a consortium of towing companies or even an independent "call" service to which towing companies subscribe. Costs of public detection and notification could be partially defrayed by private sector fees for current data on location, type, and severity of unpredicted incidents.

Emissions Testing

Emissions testing is primarily a public function. Nonetheless, this service can be contracted out with some portion of development and management risk assumed by the private contractor in the long term. In the short term, private firms are unlikely to be interested in developing such services without significant public support to reduce perceived and real risks. One clear option to mitigate these risks is to link testing to a specific regulatory requirement, thereby guaranteeing demand.

A.2 Transit and Rideshare Management

This category includes en-route transit information, public transportation management, personalized transit, transit security, ride-match and reservation, travel demand management, and fare systems. Private sector participation overall in ITS services for transit will be limited. In the Las Vegas Valley as elsewhere, transit must be subsidized as a socially desirable alternative to SOV travel, particularly in light of the Las Vegas area's air quality non-attainment status. This limits the number of ITS-based transit activities that will be financially self-sustaining and thus attractive to private entrepreneurs as independent ventures.

Private firms, however, can take management responsibility as contractors to the public transit agencies. Currently, RTC has contracted out the CAT(R) operations to a private firm, ATC/ Vancom. Such responsibilities can be further developed to include other services such as ITS-based data collection, installation and operation of fare collection equipment using all-transit smart cards. The services will be paid for with public agency funds, but private firms can share some of the risks.

Private sector firms could also be involved in the longer term as partners in developing and managing transit security. Although the public sector will be financially responsible for on-board security and surveillance devices at transit entry and exit points, the private sector could focus on personal security devices that may or may not tie-in to public agencies' alarm systems. These would be developed as independent services analogous to beeper services, fully supported by fees from transit users.

There are three transit management niches in which private firms could take a more pro-active role:

- ITS-based express transit services from high income suburbs to major employment or attractions such as the strip and downtown Las Vegas;
- Ride-share matching and reservation with security guarantees; and

- Demand management planning.

Since time is valuable to higher income commuters, they are often willing to pay higher fares for faster and more comfortable service. If ITS systems can significantly reduce trip time and/or increase convenience, cost-recovery may be sufficient to attract private companies in the longer run as independent ITS service suppliers to new commuter express routes or in partnership with the RTC. In all likelihood, however, significantly reduced travel time will depend on publicly-managed ITS services such as dedicated HOV-bus lanes and signal pre-emption.

The RTC and other privately operated fixed-route transit services and ADA complementary paratransit service, may be integrated into an overall ITS transit management system on a profit-making basis attractive to private investors if users are willing to pay more for upgraded ITS-based services. Examples include security checks, instant matching at ride-match lots, etc. Increased willingness-to-pay for upgraded ride-match services may depend on increased incentives for ride-sharing (e.g., transportation demand management policies such as preference given to carpools, access to HOV lanes).

Fee-supported ride-match services may be one of several transportation demand management services provided by the private sector as part of an overall ITS strategy. For example, employers required to implement TDM policies may hire private firms to implement and manage their plans (ride-share, parking lot management and fee collection).

The private sector will develop and produce the electronic equipment required for security, signal pre-emption, HOV monitoring, fare collection, etc.

A.3 Electronic Payment Services

Due to lack of toll facilities in Nevada, electronic payment services can only be implemented in the Las Vegas Valley for transit and parking payment services. Establishment of a one-card system for diverse services (such as CAT(R) buses, McCarran International Airport and downtown parking, etc.) will depend on public agency initiative and coordination.

A.4 Commercial Vehicle Operations

ITS services for commercial vehicle operations (CVO) include services for improved fleet management as well as services that improve public safety and administration of CVO operations.

The Las Vegas Valley is strategically located in the middle of a commercial vehicle corridor between the Ports of Los Angeles/Long Beach and the mid-west. As such, development of ITS services for CVO in the Las Vegas region needs to be coordinated with the development patterns of the whole southwestern region. This is particularly true for services dependent on inter-regional continuity such as vehicle clearance. Other services that are state or site-specific, such as hazardous material incident notification, commercial vehicle administrative processing, and roadside safety inspections, can be developed in coordination with neighboring states to ensure standardized procedures and equipment. Also, because Nevada has relatively few intra-state commercial vehicle operators, inter-regional coordination and standardization will generate a larger user market that is more likely to lure private ITS service and equipment suppliers.

Private firms should take primary responsibility for ITS-based commercial fleet management for local and long distance companies. On board safety monitoring should be developed and installed by the private sector, though communication of information to public safety agencies (Nevada Highway Patrol, for example) may be a public function.

Several ITS services for CVO serve both public and private interests; these include services that improve safety such as hazardous material incident notification, and services that improve public agency efficiency while saving time for CVOs such as commercial vehicle electronic clearance, commercial vehicle administrative processes, and automated roadside safety inspection. These services can be developed and managed by private firms collecting fees from both CVOs and public agencies that benefit from these ITS-based substitutes for conventional interaction. Given the capital investment required for an effective shift from conventional to ITS-based services, however, it is more likely that these will develop as public-private partnerships sponsored by public agencies interested in improved management.

A.5 Emergency Management

Emergency vehicle management includes coordination of emergency response (dispatch of the closest emergency vehicle) and integration with traffic management functions to expedite emergency vehicle arrival (e.g., signal pre-emption). These are public functions that should be funded and managed within public agencies such as the LVACTS Traffic Operations Center, as is currently planned.

The counterpart service is emergency notification and personal security. This is an user service whereby users involved in incidents can notify public agencies directly. Although emergency notification generates public benefits (faster incident response reduces congestion), it has greater value to some travelers than relying on the general incident detection system. This typically would be more beneficial in rural areas.

Private willingness-to-pay for automatic Mayday services, which respond even when affected travelers cannot use cellular phone systems, will stimulate private firm involvement in public-private partnerships or parallel public and private provision of different modules. That is, the private sector can develop and market Mayday systems to individual private and commercial vehicle owners; commercial services can monitor the alarms and relay information to the LVACTS TOC (independently or on contract to public agencies) or the alarms can be directly relayed to the TOC (analogous to home security systems that automatically notify local police) and the appropriate enforcement agency despatch center.

A.6 Advanced Vehicle Safety Systems

This category of ITS services includes technologically-based vehicle improvements that alert drivers to dangerous situation and supplement driver awareness of his/her own driving environment. It also includes automated highway operation.

In the short run, the risks are high and cost-recovery low for these services. Thus, they appear in the “public sector” domain of the risk-cost recovery figure. However, given fiscal constraints facing the public sector, they will be supported by public agencies only as federally sponsored research. Introduction of these user services in the Las Vegas Valley should be postponed until the research activities reach a mature level for nationwide deployment.

Of these functions, only those services requiring sensors or alarm triggering devices necessarily entail public sector involvement, that is, rail crossing safety, road departure alarms (if triggered by specially-installed roadway systems), and automated highway systems. These services can be developed as parallel provision: the private sector markets the sensing mechanisms and the public sector installs required roadway infrastructure.

The other services, collision avoidance, vision enhancement, and safety readiness, will be incorporated as self-contained mechanisms in the vehicle and, because they generate significant benefits to vehicle occupants, will be developed and marketed by independent providers on a national scale.