CANAMEX CORRIDOR PLAN WORKING PAPER

TASK I: EXISTING INFRASTRUCTURE
Economic Conditions and Programs
Transportation Infrastructure
Telecommunications Infrastructure

Prepared for

THE CANAMEX CORRIDOR COALITION

Submitted by

Economics Research Associates
Wilbur Smith Associates
Comgate Telemanagement Limited

August 3, 2001

ADOT Contract No. AD000088001

TABLE OF CONTENTS

INTRODUCTION

The CANAMEX Corridor Coalition was established by the governors of Arizona, Nevada, Utah, Idaho and Montana. Recognizing the shared challenges and opportunities presented by the region's principle north/south transportation corridor, the governors of these five Western states signed a memorandum of understanding to prepare a corridor plan. The CANAMEX Corridor Plan will be a bold, forward looking document designed to guide strategic transportation and other infrastructure investment. The Plan will aim to enable the five-state region to more fully harness the benefits of a changing national economy. This Task I Working Paper reviews existing conditions in the CANAMEX Corridor.

The report lays the foundation for identifying critical infrastructure deficiencies along the Corridor and for using public policy and investment decisions to enhance regional economic development. The infrastructure reviewed in this report includes transportation and telecommunications facilities and networks essential for the continuance and future growth of Corridor communities. Drivers of economic development such as industry clusters, universities, training centers, research facilities and other institutions, as well as local development tools and programs, are also considered as part of the Corridor's underlying infrastructure. This task is divided into the following three sections:

Section I, **Economic Conditions and Programs**, details current and historic economic conditions in Corridor states and communities. This section presents an overview of each state's economy, by industry sector, with an emphasis on specific conditions in the metropolitan areas directly along the Corridor highway. Economic development programs and districts are considered within each state and Corridor region.

Section II, **Transportation Infrastructure**, presents an inventory of transportation facilities in the Corridor including highways, airports, railroads, ports, and customs operations. This section considers existing and projected utilization at key points of the highway system, along with current levels of service.

Section III, **Telecommunications Infrastructure**, presents an analysis of existing wireline and wireless communication and data transmission facilities and services. Section III identifies points of weakness in the existing networks along the Corridor, such as "deadspots" in cellular service and areas with limited access to broadband data transmission capability.

Section I
ECONOMIC CONDITIONS AND PROGRAMS

SUMMARY OF FINDINGS

The CANAMEX Corridor region now has 11.3 million residents as compared to 6.8 million only 20 years ago. Nevada's population increased by two and one-half times over this period, and Arizona's increased by 80 percent during the past two decades. In terms of absolute growth, the southern states in the Corridor are growing much faster than the northern states. During the past decade, Nevada, Arizona, Utah and Idaho ranked first, second, fourth and fifth in terms of the rate of population growth among all states in the nation. In 30 years, the Corridor region is projected to have a population of over 20 million, indicating a tripling of population in the 50 years from 1980 to 2030.

Population (1,000)	**1980**	**2000**	**2030**
Arizona	2,738	4,927	8,600
Nevada	810	2,065	4,605
Utah	1,473	2,158	3,897
Idaho	948	1,272	1,880
Montana	789	905	1,245
Total	**6,758**	**11,327**	**20,228**

Source: Department of Commerce and ERA forecast

With a total employment of 6.5 million, the economies of these five CANAMEX states have entered into the technology driven information age at varying levels of depth. Arizona, the largest of the five states in population, has perhaps the most diversified economy. Its recent manufacturing growth has been led by the technology sector. The Nevada economy continues to be dominated by gaming and tourism. Utah has a well-established medical technology and software industry and is looking to the long-term tourism impact of the 2002 Olympic Winter Games. With the Idaho National Engineering and Environmental Laboratory (INEEL), a world-renowned research facility administered by the Department of Energy, and the likes of Micron Computers, Idaho is well poised for the information age. Montana's economy, with a tradition in mining, agriculture and tourism, recently has begun to participate in the new economy.

ARIZONA ECONOMIC OVERVIEW

The State's Economy

Arizona has transformed during the past 50 years from an economy based heavily upon agriculture and mining, to a diversified mix of rural and urban businesses covering virtually every sector. Agriculture alone accounted for nearly a quarter of the state's earnings as recently as 1955, while today it accounts for about three percent. Since the mid 1960s, Arizona's economy has transformed into something similar in composition to the nation as a whole. The state differs in its greater emphasis on services, construction, and real estate and its comparatively lower share of manufacturing activity.

Population growth and tourism have driven a large portion of the economy—Arizona's population growth ranked second only to booming Nevada during the past decade, and the state has added over two million residents since 1980. Tourism, which ranges across a number of economic sectors through both direct and indirect demand impacts, is estimated to support about 350,000 jobs or 17 percent of the state's employment. Although manufacturing accounts for a smaller portion of state jobs than the national average, the sector has grown far more quickly in Arizona than in the rest of the US. A high percentage of these jobs are focused on high technology manufacturing processes and products. Arizona's economy includes a diverse range of high technology clusters such as biotech, aerospace, electronics components, semiconductors, software, and many others.

The Phoenix and Tucson metro areas account for the vast majority of employment growth in Arizona, while many rural areas have experienced relatively little. While these two metro areas accounted for approximately 82 percent of population growth in the state since 1980, their share of employment growth was significantly higher. Phoenix and Tucson accounted for almost 95 percent of Arizona's employment growth during the 1980s, and nearly 88 percent of job growth during the 1990s.

Growth Trends

Growth has been nearly a constant in Arizona during the past two decades, with population increasing by two to four percent per year and employment growing by over four percent annually. Employment growth amounted to double the national average with increases occurring every year with only one exception. Employment in every sector of the Arizona economy, with the exception of mining, grew substantially during the period—ranging from about two to over six percent annually. Services, finance, insurance, and real estate, and wholesale trade all grew faster than the state average. Similar to the nation as a whole, the fast-growing services sector now accounts for nearly one third of Arizona's employment, up from about one fifth in 1980. Business services and health services account for nearly half of this sector's employment, with business services growing faster than most areas of the local economy during the 1990s. While manufacturing employment has declined by 0.5 percent annually in the US since 1980, Arizona's manufacturing sector grew by 1.7 percent per year. High technology industries accounted for the majority of the state's manufacturing growth.

High Technology Industries

High technology industries are driving the majority of Arizona's manufacturing sector and accounting for some of the fastest growing employment fields in the state. According to the

Milken Institute's 1999 study, "America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas," Arizona's economy is more concentrated in high technology fields than the nation's as a whole. Overall in 1996, the state's high tech manufacturing sectors (including drugs, computer equipment, communication equipment, electronic components, aircraft, space vehicles, navigation equipment, laboratory instruments, and medical instruments) along with high tech services (including telephone communications, computer/data services, motion picture production, engineering, and research) accounted for almost eight percent of private sector employment compared with about six percent in the US.

Arizona's high tech industries are concentrated in four areas of manufacturing: 1) electronic components and accessories (principally semiconductors), 2) aircraft and parts, 3) guided missiles, space vehicles and parts, and 4) search, detection, and navigation instruments and equipment. The electronics and instruments sector grew by 15 percent annually between 1986 and 1997, far surpassing growth in any other manufacturing sector in the state. Gains in the computer and data processing services sector led to high growth in high technology services overall. The state's 2,400 software firms employ over 28,000 workers, or approximately two percent of the workforce. The broader information technology sector, of which software is a component, employs over 100,000 workers in the state.

The state's largest high technology companies are manufacturers employing between 5,000 and 10,000 workers. They include: Intel, the world's largest computer chip maker and manufacturer of assorted computer, networking, and communications products; Raytheon, builder of missile systems and electronics; recently merged Honeywell, designer and developer of space and aviation control hardware, and AlliedSignal, manufacturer of aerospace hardware, engines, and aircraft systems; and Boeing, builder of aerospace products. These companies are all concentrated in the greater Phoenix and Tucson metro areas, as are the vast majority of the state's high technology firms.

Tourism Industry

The tourism industry plays a key role in Arizona's economy, generating $12 billion in annual impact and 350,000 jobs. The state's warm weather, natural amenities, and developed attractions bring in visitors from northern states as well as other parts of the world for outdoor recreation and Old West/Native American history and heritage. International air carriers now provide direct service into Arizona from Canada, Germany, and Mexico. Grand Canyon National Park, one of the most popular in the nation, draws about five million visitors annually. Park visitation supports some 2,000 rooms in hotels, motels, lodges, and other resort accommodations. Numerous additional parks, natural monuments, and wildlife preserves attract visitors as well. Outdoor recreation covers the full range from hiking and camping in the deserts and mountains to skiing to year-round golf, tennis, biking, and many others. The large metro areas such as Phoenix and Tucson serve as destinations in their own right providing a full range of entertainment, cultural offerings, and professional sports events.

Economic Development Resources

Arizona's Department of Commerce has business development representatives available to assist companies looking to locate in the state as well as local firms considering expansion. The development representatives provide help locating available sites, conducting background research, identifying Federal, state, and local incentive programs and helping with the application process, and coordinating meetings with relevant agencies, organizations, financial institutions, etc. Additional economic development resources include job training grants, the Enterprise Zone program, manufacturing business incentives, the Defense Restructuring program, and Foreign Trade Zones. Local economic development departments act at the city and county level to encourage business location and expansion through these programs as well as their own approaches.

Job training grants are administered by the Department of Commerce to help offset the cost of developing and implementing employee training programs specific to a company. Funds typically provide between $300 and $1,000 per net new job created. The Enterprise Zone program similarly encourages employment creation by funding companies on the basis of net new jobs. The Enterprise Zone program targets specific economically distressed areas within the state and requires minimum salary levels for the positions created. The program can provide up to $3,000 per net new full-time job in state corporate income tax credit over a three-year period. Arizona has 22 Enterprise Zones located throughout the state including portions of Phoenix, Prescott, Tempe, and Tucson as well as all or part of more rural counties such as Mohave, Santa Cruz, and Yuma.

Manufacturing businesses may be specifically encouraged in Enterprise Zones through a property tax reclassification over five years resulting in up to an 80 percent tax savings. Manufacturers can also access beneficial bond funding mechanisms for construction of new facilities and equipment purchase. Private activity bond interest is exempt from Federal income tax, providing savings to manufacturers who participate in the program. The Defense Restructuring Program assists many manufacturers as well as service providers in maintaining Federal defense contract work and converting to non-defense production. The program accomplishes these goals through a variety tax credit and accelerated depreciation schedule approaches.

Foreign Trade Zones (FTZ) serve as economic development resources by providing a variety of benefits to attract foreign distributors to an area. Goods shipped to a FTZ in the United States do not pay customs duties until they actually leave the site, allowing for greater response to existing market conditions and delaying costly duties until the actual time of sale. Arizona has six FTZs located across the state: Yuma, Mesa, Sky Harbor International Airport in Phoenix, Tucson, Sierra Vista, and Nogales.

CANAMEX Corridor Region

The CANAMEX Corridor crosses through Arizona’s most populated areas including Tucson and Phoenix. The Corridor runs from Nogales to Tucson along Interstate 19, from there to Phoenix along Interstate 10, and through Kingman to Las Vegas on US Route 93. The Corridor traverses some of the state’s fast-growing high technology areas as well as major warehousing and distribution centers. Significant economic development jurisdictions in the Corridor include Foreign Trade Zones and Enterprise Zones. Moving from north to south along the Corridor, Enterprise Zones cover: western Mohave County, portions of greater Phoenix and western Maricopa County, Pinal County, Tucson and South Tucson, and Santa Cruz County including Nogales. There are Foreign Trade Zones in: Phoenix at Sky Harbor International Airport, Mesa, portions of Tucson including the International Airport, and Nogales.

Nogales is the largest port of entry for winter fruit and vegetables in the US: produce imports through the port amount to some 1,200 truckloads per day during the growing season. Nogales also serves as a key retail hub for Northern Mexico, with nearly 50,000 Mexican shoppers crossing into the city on an average day. Along with its sister city, Nogales, Sonora, Mexico, Nogales forms one of the largest clusters of cooperative manufacturing (maquiladoras) along the US-Mexico border.

Phoenix

For the third year in a row, the Phoenix Metropolitan Area has been named the number one “entrepreneurial hot spot” in the nation by Cognetics, Inc., as measured by the percentage of new companies with at least five workers and the percentage of young companies adding workers. The area is a center for high technology manufacturing and the west side has become an increasingly important warehousing and distribution center for products such as apparel and electronics. Arizona State University in Tempe, with branches in Mesa and Phoenix, has played an important role in the area’s high technology sector development in addition to serving as the largest local institution for higher education. Population growth has been an important driver in the Phoenix economy, with the vast majority of migrants coming from other US states rather than abroad. New households drawn to Phoenix’s amenities, weather, and more affordable conditions compared to areas such as Los Angeles and San Francisco create new demand for a full range of goods and services.

The Phoenix metro area has experienced strong steady population and employment growth during the past two decades. Phoenix has had the highest employment growth of any large metro area in the US during four of the past five years. Since 1980, the area’s population has nearly doubled to over three million and employment has increased by nearly five percent per year on average. The strongest employment growth has been in services, finance, insurance, and real estate, and transportation, communications and utilities. Annual overall employment growth rates as well as manufacturing growth rates exceeded the very high state average. High technology manufacturing companies such as Motorola and Philips are planning to expand local operations in semiconductor production, Maxwell may expand its DVD manufacturing plant, and distributors such as Avnet (electronics) are growing as well. Significant back-office operations such as Metris (credit card marketing center), McCord Consumer Direct (travel management call center), PCS Health Systems (call center), and DHL Worldwide Express (customer service center) are growing in the area.

Tucson

Tucson has undergone strong population and job growth since 1980, but to a less pronounced degree than the state as a whole. Population increases ranged from one to three percent per year and employment grew by just over three percent annually. Tucson outpaced the state economy in one area, manufacturing jobs. Although manufacturing remains a slightly smaller share of the Tucson economy, its rate of employment growth exceeded the state’s by a few percentage points each year. Greater Tucson’s manufacturing sector is focused on a number of high technology industries such as aerospace, bioindustry, plastics and composite materials, optics, and others.

Tucson’s concentration of high technology industries has resulted in part from the strength of the University of Arizona Science and Technology Park—currently ranked as the sixth largest in the country in terms of both square footage and number of jobs. The Technology Park is continuing to expand and spin-offs from the Park are an important factor in spurring development of local technology firms. Local defense industries are clustered around Davis Monthan Air Force Base, which itself employs about 7,500 people and collectively supports an estimated 4,000 additional workers. Aerospace employment has experienced declines due to defense cut backs in recent years, but the industry as a whole remains poised to benefit from commercial production demands.

Tucson's role as an international cargo hub has increased in recent years as trade with Mexico has grown. Growth in Mexico's manufacturing industries in northern states have translated into heavy flows of products through areas such as Tucson which are near the border and accessible to rail, air, and highway transport systems. The Tucson-Mexico Project is aimed at increasing trade ties between northern Mexico and Tucson. The organization supports development of an integrated cargo hub at Tucson International Airport to accommodate trade and distribution growth.

Kingman

Kingman and Mohave County, at the northwest corner of the state closest to Las Vegas, have become increasingly important centers for manufacturing industries as well as warehousing and distribution functions. Although local manufacturing employment includes some high technology products such as aircraft components, most firms in the area make products such as home furnishings, miscellaneous household items, and processed foods. Local industrial parks and distribution centers benefit from transportation access via Interstate 40 and Burlington Northern Santa Fe rail lines to large west coast markets such as Southern California.

The Kingman area's population and employment base both increased by nearly 150 percent during the past two decades. The area's employment growth rate exceeded that of the state, averaging nearly five percent annually. The trade sector has accounted for a greater share of jobs in Kingman historically, and that emphasis has become even more pronounced since 1980. Local trade employment grew by nearly six percent annually, well above the state average of four percent growth. The retail and wholesale trade sector now accounts for over 30 percent of local jobs compared with about 24 percent in the state overall.

NEVADA ECONOMIC OVERVIEW

The State's Economy

Nevada has had one of the fastest growing economies in the nation during the past two decades. Gaming and related tourism growth continues to drive the state's economy. Although some degree of diversification has followed from overall expansion, local employment remains heavily focused in tourist services. The Las Vegas metropolitan area (defined in this report to include Clark County) continues to account for the majority of the state's population and employment—nearly three quarters of Nevada residents live in the area. Throughout the state, mining remains a relatively important industry, although to much less of a degree than in previous years. High technology industries have begun to locate in the state, with an emphasis on aerospace technologies and a geographic focus around the Nevada Test Site well to the northwest of Las Vegas. Some major warehousing facilities have taken advantage of favorable tax laws and distances to population centers in neighboring Southern California and Arizona, although this industry remains relatively small at present. In rural areas of the state, the importance of tourism has increased as mining employment levels fluctuate.

Growth Trends

During the past two decades state employment growth has proceeded at rates well above the national average: about five percent per year locally compared with two percent in the US. Every sector of the Nevada economy grew at over three percent annually during the period, including mining and manufacturing. Service sector growth has been dramatic, increasing by five percent annually during the past 20 years. Services now account for over 43 percent of state employment, well above the national level. Population growth occurred in every year during the period and employment increased in all but one. Since 1980, service jobs (mainly related to gaming and tourism), construction, and wholesale trade have increased their share of total employment. Mining, manufacturing, transportation, communications, and utilities, and government each account for smaller shares. More recently, since 1990 the mining sector has experienced a decline in the total number of jobs. Although mining industry employment has nearly doubled since 1980, 2,000 jobs have been lost during the most recent decade.

Gaming and Tourism Industry

As a national and international center for gaming and related tourist industries, Las Vegas continues to expand and evolve. New, continually more extravagant hotels and gaming casinos are added every year, so that within the past decade the Las Vegas Strip has literally been reinvented. The ten largest hotels in the US are all located in Las Vegas, each of them containing over 3,000 rooms. Seven of them were built within the past decade, including Mandalay Bay and the Venetian, which were just completed in the past year. The growth in hotel rooms alone has driven a large share of the state's employment growth by providing a large number of service as well as construction jobs. The inventory of rooms within Greater Las Vegas has increased dramatically, nearly doubling since 1986 to over 123,000. Employment in hotels, gaming establishments, and recreation accounts for 26 percent of total jobs in Clark County.

The success of the local tourism industry has been astounding. Gaming revenues in Clark County amounted to over $7 billion in 1999, twice the level achieved a decade earlier. Despite enormous growth in the number of hotel rooms, hotel occupancy levels have actually increased. Occupancy in Clark County has remained above 90 percent since 1993, reaching 92 percent during the past year—well above almost every hotel market in the country. Las Vegas received almost 34 million visitors in 1999, and smaller gaming centers in the state attracted large numbers as well. Laughlin, to the south of Las Vegas near the Arizona border, attracted almost 4.5 million visitors and over $500 million in gaming revenues. Mesquite, located to the northeast of Las Vegas at the state border, attracted 1.7 million visitors and over $90 million in gaming revenues. Mesquite attracts visitors primarily from neighboring communities in Utah. Laughlin serves a growing number of more elderly retirees from Arizona who prefer the convenience of the city's location and the slower pace compared with Las Vegas.

Gaming revenue is closely linked to the number of visitors—as visitor volumes have steadily risen, so too have overall gaming revenues. However, gaming revenues per visitor have varied over time, including a slow decline throughout much of the 1980s and the early to middle 1990s. During the first half of the 1990s, many casinos turned to a more family-oriented marketing focus, which may have contributed to this decline. Since 1997, however, through the combination of a strong national economy and a shift toward more luxurious accommodations and entertainment approaches, revenues per capita have trended upward.

The Las Vegas area draws visitors from around the world through a combination of gaming, entertainment, and shear spectacle, as well as convention and other business. The Las Vegas Convention Center, one of the largest in the US at over 1.2 million square feet, competes with the top tier of meetings hubs in the country such as Los Angeles, Chicago, Atlanta, and San Francisco. According to the Las Vegas Convention and Visitors Authority, visitors to Las Vegas stay an average of 3.3 nights, and almost half arrive by plane. Approximately 13 percent of visitors come from outside the US. California accounts for nearly one third of visitors to the area, while Arizona adds another five percent. Southern California alone accounts for 28 percent of area visitors. California's economic wellbeing has a very significant impact on the Nevada tourist industry. The impact of the booming Southern California economy since 1995 has driven a large share of gaming and hotel demand growth in Las Vegas and surrounding cities.

High Technology Industries

Nevada's high technology sector is currently focused on aerospace-related research and development. A few firms have located between Las Vegas and the Nevada Test Site. Nevada's high technology undertakings have historically been centered around the Nevada Test Site, a 1,350-square-mile area to the northwest of Las Vegas established as the Atomic Energy Commission's on-continent proving ground and used for more than four decades of nuclear weapons testing. Since the nuclear weapons testing moratorium in 1992, under the direction of the Department of Energy (DOE), test site use has diversified into other programs such as hazardous chemical spill testing, emergency response training, conventional weapons testing, and waste management and environmental technology studies.

Economic Development Resources

Nevada promotes economic development through a variety of programs and taxing approaches. The state has no corporate or personal income tax and lacks a variety of taxes that are collected in most other states. Additional approaches include: Small Business Development Centers, the Manufacturing Assistance Partnership, a variety of local development authorities, the Global Trade Program, and Foreign Trade Zones. Nevada's Commission on Tourism plays a key role in advancing tourism-related industries. The Commission is active in publicizing the state's tourism resources, advocating on behalf of industry needs and researching trends, and sponsoring industry gatherings to enhance local and state-wide development opportunities.

The Nevada Small Business Development Center (NSBDC) has offices located in cities throughout the state with staff available to provide assistance to existing businesses and entrepreneurs with ideas. The NSBDC is a cooperative working relationship between the University of Nevada, the US Small Business Administration, and local chambers of commerce. The Center provides management consultants and business development specialists along with a range of support services with the goal of encouraging business creation and expansion in the state.

The Manufacturing Assistance Partnership (MAP) emphasizes training programs to supply Nevada construction, manufacturing, and mining firms with qualified workers. MAP is the industrial outreach program of the University and Community College System of Nevada. In addition to worker and management training, MAP also works on technology development and business systems improvement projects.

The Nevada Commission on Economic Development works with a network of regional development authorities (DAs). These DAs are the experts regarding local political climates, business opportunities, and real estate costs and availability. DAs provide information to prospective businesses and work to retain existing businesses in an area.

The Global Trade Program is designed to assist local businesses in accessing foreign markets. Administered by the Nevada Commission on Economic Development, the program conducts export seminars and trade missions, provides counseling services, and hosts foreign delegations. Foreign Trade Zones (FTZ) serve as economic development resources by providing a variety of benefits to attract foreign distributors to an area. Goods shipped to a FTZ in the United States do not pay customs duties until they actually leave the site, allowing for greater response to existing market conditions and delaying costly duties until the actual time of sale. Both Reno and Las Vegas contain an FTZ.

CANAMEX Corridor Region

The CANAMEX Corridor enters Nevada at the Hoover Dam along US Route 93 from Arizona. After passing through Boulder City and Henderson, it transitions to Interstate 15 in Las Vegas and heads northeast through Mesquite. The Corridor passes through southern Nevada's fast-growing Las Vegas Metropolitan Area, which contains 69 percent of the state's population and employment.

Greater Las Vegas Overview

Economic growth in the Las Vegas area has outpaced growth in the rest of the state during the past two decades, with average annual employment increases of over six percent—three times the national average. Employment has increased at nearly six percent annually in every sector of the economy during the period. The highest growth sectors include construction, manufacturing, mining, and trade, although mining has suffered from employment losses during the most recent decade. The area's emphasis on service sector jobs is slightly greater than in the state as a whole, and well above the national average. Over 46 percent of local workers are employed in services.

In addition to the tourist draws of gaming and entertainment within Las Vegas and the border towns, the area is within a few hours of Hoover Dam, Lake Mead National Recreation Area, Grand Canyon National Park, and a number of other parklands and recreation areas.

Las Vegas has a foreign trade zone located at McCarran International Airport, a few miles from I-15. In 1994, a grouping of nine census tracts at the city's core were designated the Southern Nevada Enterprise Community, which brought with it Federal economic development funding for a ten-year period. The Enterprise Community encompasses neighborhoods on both side of I-15 as it passes through Las Vegas.

Light Industrial and Distribution Space Growth

A combination of factors have led to high growth in light industrial and warehouse distribution uses in the Greater Las Vegas area. Relatively low land costs, low energy costs, and high population growth have fueled development of industrial space in North Las Vegas, Henderson, and the southwest Las Vegas/McCarran Airport area. Between 1990 and 1999, local population increased by approximately 61 percent. During the same period, industrial and warehouse space increased from 25 million to 59 million square feet, growing over 130 percent. Local industrial and warehousing operations serve the growing needs of a booming population and construction industry in Las Vegas as well as surrounding metropolitan areas in Southern California and Arizona. Las Vegas has certain advantages such as a large 24-hour work force relative to competing regions. The area also benefits from lower outbound shipping costs due to the high number of trucks entering the area with goods and leaving without cargo. Internet-based operations such as CyberBills have begun to locate distribution facilities in the area and more are expected.

North Las Vegas has seen the majority of industrial space development during the past decade, with large projects such as Dermody Business Center containing over six million square feet of light industrial and distribution buildings. In the vicinity of the Las Vegas Speedway, located north of Las Vegas directly alongside the CANAMEX Corridor on Interstate 15, large amounts of industrial space have been developed and industrial land prices remain competitive with the surrounding region. Land alongside Nellis Air Force Base is becoming available for industrial and warehousing uses. In the southeast area, including Henderson, warehousing and distribution development is appearing in anticipation of the completion of the I-215 beltway project. The region's largest industrial project with at least ten million square feet of space, Black Mountain Industrial Center, is continuing to expand in the area. The southwest area near McCarran Airport includes a mix of light industrial, distribution, and flex industrial/office space. The area is poised for eventual development of industrial lands to be released for auction by the airport in the near future.

UTAH ECONOMIC OVERVIEW

The State's Economy

Utah has made a significant shift toward information technologies and service industries during the past two decades. Following significant military base closures and resultant restructuring during the first half of the 1990s, and the continuing contraction of local energy, mineral, and agricultural industries, the state has strengthened its position nationally as a center for high technology electronic components manufacturing, software development, biotechnology, and other specialized fields. Tourism employment has continued to strengthen as well, with the industry now accounting for nearly one in nine jobs in the state.

Growth Trends

A diversified and dynamic Utah economy has demonstrated longstanding vitality through periods of national economic distress. The state experienced positive non-agriculture employment growth during every year of the past two decades. Growth fell below one percent in only two of these years. Total employment growth averaged 3.5 percent annually during the period, well above the national average of 1.9 percent. With the exception of mining, non-agriculture employment grew by nearly two percent annually in every sector in the state. Utah has experienced a shift in industries similar to the nation as a whole, with high growth in services and to a more modest degree trade and finance, insurance, and real estate. The notable exception to the rule in Utah has been continued expansion in manufacturing employment, a sector which grew in the state by over two percent annually during the period. This compares with an average annual decrease nationally of 0.5 percent. Utah's manufacturing sector has expanded through an emphasis on high technology products such as computer chips and medical instruments.

High Technology Industries

Utah's high technology-based employers cover a diverse range of industries, most notably: computer software, aerospace, electronic components, medical supplies, and automotive components. During the past decade the software industry has expanded in the state, reaching nearly 23,000 workers in 1999—about two percent of total jobs. But the industry's expansion has continued despite the disappointing experience of the state's largest software development employers, Novell and WordPerfect. Following rapid growth in the early 1990s, these two firms accounted for 70 percent of local computer software and integrated systems design by 1993. Following an acquisition by Canada's Corel and a competition-induced merger, however, their local growth had remained relatively flat by the end of 1998. Due to expansion in other areas of this field such as computer programming services and internet access providers, the sector has continued to grow overall despite these challenges.

Following local expansion, aggressive competition from abroad in the 1980s, and consolidation in the US, the local electronic components sector has seen its total employment cut in half during the past decade. One plant has closed in Utah. During the past five years, however, both Intel and Micron have planned new facilities in the state. Micron has indicated a commitment to build a memory chip plant in Lehi, south of Salt Lake City, employing up to 3,500 workers. Intel acquired a 154-acre site in Riverton for development of a computer chip research facility which would employ up to 8,000 workers at build out. The company broke ground on the project in 1999. If fully built out, these additions will nearly quadruple Utah's employment in electronic components.

Utah's aerospace industry has been significantly transformed during the past decade as a result of reductions in military spending. The state's aerospace industry, once the largest component of local high technology activity, now employs fewer than 6,000 workers—half its level of a decade ago. This restructuring has created opportunities for automotive components manufacturing. Autoliv ASP, a spin-off during the early 1990s from one of the state's largest aerospace companies, has continually expanded its operations to reach 6,500 workers at present. The company builds trigger devices for air bags in automobiles. Similarly, medical instruments and supplies manufacturers have enjoyed success, expanding at a rate of over seven percent annually during the past decade. Since 1990, the number of local workers in medical instruments production has nearly doubled, reaching 8,300 in 1999.

Tourism Industry

Travel and tourism continues to be one of Utah's top five economic activities, along with manufacturing, trade, services, and government. Tourism covers a broad range of activities ranging from primary services, lodging, retail trade and transportation to secondary impacts such as construction and real estate. Utah's tourism industry has kept pace with the overall economy in recent years, with the number of visitors increasing by two to three percent annually. Visitor spending increases have outpaced growth in arrivals, possibly indicating a shift towards higher quality tourism overall. The Salt Lake Convention and Visitors Bureau has specifically targeted higher end convention attendees in an effort to further upgrade the local tourist market. Utah's tourism industry is diverse, including a wide offering of federally administered national parks, monuments and recreation areas along with world-class ski areas and local cultural events. The Church of Latter-Day Saints (LDS) plays an important role in attracting tourists to the state, acting as a major draw bringing in visitors from around the world.

The 2002 Winter Olympics will make Salt Lake City a center of attention around the world for a period of several weeks. Utah visitor numbers are expected to rise dramatically during the months surrounding the Games and the tourism and recreation industry hopes the exposure will carry over into following years as well. In contrast to many past Winter Olympics sites, the Salt Lake events will be highly concentrated around the metropolitan area, further increasing the city and region's exposure and impact from visitation spending. In terms of direct expenditures in preparation for the Games, the Organizing Committee is working with a budget of $1.35 billion to cover a range of building projects and planning activities.

Economic Development Resources

Utah supports local economic development through the following programs: Utah Industrial Assistance Fund (IAF), Enterprise Zones, Redevelopment and Economic Development Agencies, sales tax exemptions, and job training. Utah does not have any active Foreign Trade Zones currently. Created in 1991, the IAF provides loans or other financial assistance for the "establishment, relocation, or development of industry in Utah" of which 50 percent must be used in "economically disadvantaged rural areas." The fund is administered by the Department of Community and Economic Development and has been used recently to support companies ranging from Detroit Diesel in Tooele County (350 jobs) to Accu-Plastics in Washington County (20 jobs).

The Enterprise Zone program was created in 1988 specifically to encourage new development and expansion in rural counties (less than 50,000 population) with an emphasis on employing local residents. The Department of Community and Economic Development administers the program, which provides corporate and individual tax credits for creating new jobs at higher than average wage levels. Most of Utah's counties are eligible for the Enterprise Zone program, with the exception of the Wasatch Front area and Washington County. Designated Enterprise Zones are clustered in the northeast and central areas of the state.

Redevelopment and Economic Development Agencies work throughout urban and rural communities in Utah to encourage new development and revitalization, primarily by wielding the power of eminent domain to assemble land for reuse. The emphasis of these organizations shifted during the 1980s from redevelopment of blighted neighborhoods to attraction of new commercial and industrial enterprises.

Sales tax exemptions are provided by the State Legislature to aid existing businesses in the state as well as to encourage location of new ones. Most sales tax exemptions are provided to goods producing industries: mining, manufacturing, and agriculture. The inputs to production are the focus of these exemptions, encouraging purchase of replacement machinery and equipment as well as new additions and expansions.

Utah's Custom Fit Training Program is managed by the State Office of Education. The programs are focused on attracting new employers to the state, but can also be used for existing local businesses. The state pays for all or a portion of training costs and the employer chooses the trainees and determines the goals and objectives of the course.

CANAMEX Corridor Region

The CANAMEX Corridor runs the entire length of Utah along its main north/south highway, Interstate 15. The vast majority of Utah's population is concentrated along the Corridor in the cities and towns along the Wasatch Front (Salt Lake City, Ogden, and Provo), where more than three quarters of the Utah population resides, and growing St. George in the far southwest corner of the state. The majority of the state's economic activity is centered in Corridor communities, and the Corridor includes a widely representative section of Utah. Designated Enterprise Zones located directly along the Corridor include: Tremonton, Box Elder County; Nephi, Juab County; unincorporated areas of Millard County; and Parowan, Iron County.

Wasatch Front

The Wasatch Front encompasses the string of communities stretching north and south from Salt Lake City, including Provo and Ogden. The six-county area accounts for over 78 percent of Utah's population and 82 percent of employment. Founded by Mormon pioneers, Salt Lake City and the region remain at the center of the LDS Church. The Wasatch Front also serves as the center of Utah's high technology industries, including electronics hardware, software, and biotechnology. Although electronics manufacturing companies are located throughout other regions of the state, the vast majority reside within the Wasatch Front. Biotechnology and software companies are concentrated in the area as well.

The University of Utah Research Park, located in Salt Lake City, has served to create a center of high technology development within the region. The Research Park was founded in

1968 in order to attract and promote the growth of industrial technology by providing a conducive research environment with strong links to the university. More than 40 companies are currently located at the park employing over 5,500 workers. Expansion of existing facilities are currently under way. Many of the region's high technology firms are clustered between Salt Lake City and Provo in Lehi, Orem, and American Fork as these areas provide access to qualified labor pools as well as Brigham Young University and the University of Utah. On the west side of Salt Lake City another industry, warehousing and distribution, is clustered around access to highways and rail depots.

Salt Lake City-Provo was named the number two "entrepreneurial hot spot" in the nation for 1999 (second to Phoenix) by Cognetics, Inc., as measured by the percentage of new companies with at least five workers and the percentage of young companies adding workers. Back office call centers, among others, are representative of high growth industries which have sprung up in the Wasatch Front. The majority of the state's call centers are concentrated in Salt Lake County, where 23,000 workers—almost four percent of the local workforce—are employed. Call centers have been drawn to the region by the high quality of labor, low labor and facility costs, the Mountain Time zone (within one hour of both the coastal and central zones), and the neutral local accents. Portions of the region have continued to struggle economically, Odgen's central business district and three surrounding residential neighborhoods have been designated an Enterprise Community.

St. George

Brigham Young selected a group of hand-picked Mormon pioneers in 1861 to colonize this area and raise cotton. The first Temple building in Utah for the LDS Church was finished in St George in 1877. Agriculture dominated the local economy for the next hundred years. With mild winters, warm but dry summers and 300 sunny days per year, the St. George area became a popular second home and retirement location for Utahans during the 1970s. Brian Head Ski Area, Zion National Park, Bryce Canyon National Monument, Grand Canyon National Park, and Las Vegas are all within a couple hours drive. The area became a popular retirement destination during the 1980s, drawing from across the nation rather than just locally. St. George and Washington County have been transformed during the past twenty years from an economy largely dependant upon agriculture to one largely driven by retirement as well as a growing range of industries.

Spurred by a booming Utah economy and out-migration from a California deep in recession, growth was further accelerated in the St. George area during the early 1990s. Population growth ranged from six to nine percent annually during the period, and employment increases were even more pronounced. St. George and its surroundings shifted further during these years toward becoming a year round metropolitan area. Since 1980, population has more than tripled, and non-agriculture employment has increased nearly five-fold. Employment growth averaged nearly nine percent annually during the period, two and a half times the state average. Employment growth has been most pronounced in the service and transportation, communications, and utilities sectors, although every other sector has increased by nearly five percent annually as well.

IDAHO ECONOMIC OVERVIEW

The State's Economy

Idaho's economy continues to expand from its traditional core industries, natural resource extraction and farming, into a more diverse range of manufacturing and service sector roles. Idaho's traditional natural resource industries remain important. Agriculture, mining, forest products, and food processing together still constitute the largest segment of the economy. But the last two decades have brought increases in such areas as electronics, paper products, printing and publishing, electrical machinery, construction, hospitality, and health services. Areas in the western and northern part of the state around Boise and Coeur d'Alene have enjoyed the greatest benefits of economic growth, along with, to a slightly lesser degree, the eastern centers of Pocatello and Idaho Falls. Smaller rural communities throughout the state have continued to struggle.

Growth Trends

Following a growth spurt in the 1970s, employment growth in the state has proceeded relatively steadily over the past two decades. With the exception of recession years during the early 1980s and again at the middle of the decade, annual employment growth has been strong—ranging from 1.7 to 5.6 percent during the period. Employment totals in most non-farm sectors of the state economy have grown. As a whole, non-farm employment increased by 2.6 percent annually during the past two decades. Average annual increases were highest in services, construction, and trade, while finance, insurance, and real estate remained relatively flat and mining declined. The significance of the services sector has increased most relative to other areas of the state economy. Services now account for nearly one quarter of the state's employment, up from about 18 percent in 1980.

Manufacturing Sector

Growth in Idaho's manufacturing industries have been especially notable. Between 1988 and 1997, the state gained nearly 16,500 new manufacturing jobs for an annual average growth rate of 2.8 percent. During this period in the US as a whole, manufacturing employment declined slightly. Important changes have taken place in the mix of the state's manufacturing industries during the past two decades. The state's traditional manufacturing-based industries, food processing, lumber, and primary metals, have become far less dominant. These three sectors accounted for 43 percent of Idaho's manufacturing jobs in 1997, down from 51 percent in 1990 and 64 percent in 1980. The number of jobs in these categories remained relatively stable during the period, while "high technology" industries accounted for most of the state's manufacturing growth. Idaho's non-electrical machinery and electronics and electronic equipment manufacturing sectors surged from about 8,000 jobs in 1986 to nearly 24,000 in 1998. Machinery and electronics accounted for nearly 60 percent of Idaho's manufacturing job gains during the past decade. The vast majority of these high tech jobs have been concentrated in the Boise metro area and around Pocatello and Idaho Falls.

Additional Sectors

Trade and services together account for approximately half of Idaho's employment base. The service sector especially has grown during the past two decades to encompass a greater share of the state's economy. Idaho's service sector has shown a strong resilience to recessionary pressures. The national recession during the early 1980s resulted in minimal service job losses in Idaho, and service job growth continued unabated in the state during the early 1990s national downturn. The fastest growing categories in the state within this sector include business services, personal services, and engineering, accounting, research and management services. The fast pace of local growth in these areas mirrors the national trends. Overall, service employment in Idaho has grown by nearly six percent annually during the past decade, up from about three percent annually during the 1980s.

During the 1970s, wholesale and retail trade employment grew rapidly in Idaho driven by high population and personal income growth. This sector experienced overall employment losses during the recession of the early 1980s, but has continued to expand at nearly three percent annually during the past twenty years. Retail employment has increased at a higher pace during the period, with growth above three percent annually. Wholesale trade has expanded as well, but at a pace closer to two percent per year.

Finance, insurance, and real estate (FIRE) industries account for a relatively small five percent of Idaho's employment. Consolidation within these industries nationally has contributed to periods of slow growth and some modest declines in Idaho's FIRE sector. Real estate employment tends to follow economic upturns and downturns closely, and a series of bank mergers have brought about job losses in the state. The FIRE sector accounts for a shrinking portion of Idaho jobs, 4.4 percent currently, down from 7.1 percent in 1980. Despite national consolidation pressures on the industries, however, Idaho's level of FIRE employment has remained relatively flat rather than declining during the past two decades.

CANAMEX Corridor Region

The CANAMEX Corridor traverses Eastern Idaho along Interstate 15. The Corridor encompasses the largest cities in this part of the state, Idaho Falls and Pocatello, along with a number of smaller towns to the immediate north and south of these cities. Eastern Idaho is home to the Idaho National Engineering and Environmental Laboratory (INEEL), a world-renowned research facility administered by the Department of Energy. INEEL encompasses a 890-square-mile area to the west of Idaho Falls and numerous research and support facilities are located within the city. A number of high technology manufacturing facilities area located in the Corridor, some of them associated with INEEL operations.

The region encompasses a number of natural resource assets and the dramatic Grand Teton National Park is accessible to the east in neighboring Wyoming. The Fort Hall Indian Reservation is located directly on I-15, encompassing land on both sides of the highway. Idaho State University is located in Pocatello and Eastern Idaho Technical College, a two-year school, is located in Idaho Falls. Both schools emphasize applied technical skills and vocational programs, qualifying many students for work at INEEL and local high technology manufacturing sites.

Corridor Economy

Idaho Falls is the third largest city in the state, with a metropolitan population of over 80,000. The area's employment base has increased by over two percent per year during the past two decades, a rate of growth slightly below the state as a whole. Employment growth in nearby Pocatello averaged approximately one percent per year during the period. Compared with the state as a whole, the Idaho Falls economy is slightly more weighted toward trade, with a greater concentration of wholesale trade employment specifically. Manufacturing accounts for about nine percent of Idaho Falls employment versus 15 percent in Pocatello and the state as a whole. Similar to the state and national economies, service sector growth has been one of the strongest areas of expansion in Eastern Idaho.

Two areas of local economic strength are the chemical industry as well as a growing number of back-office management centers. Idaho's chemical industry employment is concentrated in the Corridor region near its large phosphate ore deposits. A few large manufacturers dominate the local industry, most of them located in Pocatello and Soda Springs. In terms of back-office management, Eastern Idaho has attracted a number of large call centers which tend to locate near the military bases and rely primarily on female labor.

In many respects, the Eastern Idaho economy as well as culture is oriented toward Salt Lake City to a greater degree than Boise. The direct I-15 freeway connection brings Eastern Idaho closer to Salt Lake than Boise.

High Technology Development

The INEEL complex in Eastern Idaho has spawned a number of high technology spin-off companies and support services and it's impacts are pronounced throughout the Eastern region. Established in 1949 as the National Reactor Testing Station, INEEL is the site where nuclear fission was first used to produce electricity. Today there are three companies, Bechtel, B&W Idaho, and Argonne National Laboratory-West, under contract to perform research, waste processing, and support functions for the Department of Energy. INEEL is widely considered a leading center for nuclear safety research, defense programs, nuclear waste technology, and advanced energy concepts. The 8,000 workers at INEEL account for over ten percent of the households in the region's largest cities. Nearly 45 percent of INEEL workers are employed in high technology research applications. A number of spin-off companies, many started by former INEEL workers, are locating in the newly built Bonneville Technology Center which is located directly across the street from the labs.

The American Microsystems Inc. (AMI) plant in Pocatello, maker of semiconductors, represents the largest high technology manufacturing site in Eastern Idaho. With 1,600 employees, AMI accounts for a significant portion of the state's fast-growing electronics components industry. Other Eastern Idaho high technology manufacturing firms cover a wide range of applications such as computerized welding, fertilizer utilization, and zero-added waste approaches. Non-manufacturing high technology firms make up a much smaller share of the Eastern Idaho employment base. The Eastern Idaho Forum for Information Technology serves as an industry advocate and soundboard for local software development and telecommunications enterprises.

Tourism and Recreational Amenities

The CANAMEX Corridor aids access to a number of natural amenities in Eastern Idaho. The Grand Teton Range, lying on the Wyoming side of the eastern border, can be viewed in the distance from much of the region. Second home development in the foothills on the Idaho side has increased in recent years. The terrain leading up to the Tetons includes portions of the Snake River, Targhee National Forest, and Mesa Falls Scenic Byway—passing by a number of waterfalls. Travelers access Wyoming's Yellowstone National Park via the Corridor as well. Eastern Idaho is renowned for its fly fishing opportunities found throughout the Henry's Fork portion of the Snake River and its many tributaries. Bear Lake, a massive body of water measuring seven miles wide and 20 miles long, offers ample room for sailing and power boating among other water sports. Lava Hot Springs, south of Pocatello, is a naturally heated series of pools open to the public and maintained by the state. Other tourism attractions include Craters of the Moon, City of Rocks, and significant portions of the Oregon Trail. In addition to natural attractions, Eastern Idaho offers access to a broad range of outdoor activities including world-class downhill and cross country skiing, biking, hiking, camping, fishing, whitewater rafting, and many others.

Economic Development Resources

The Eastern Idaho Economic Development Council (EIEDC) and the Regional Development Alliance (RDA) serve as the main economic development organizations in the CANAMEX Corridor. The RDA has supported projects such as the Bonneville Technology Center, a high technology incubator space located alongside the main INEEL complex. EIEDC is currently working on a cluster development strategy for the region, along with other site specific efforts. The State of Idaho funds local economic development through its GEM Community Program. The GEM Program provides focused technical assistance in order to build communities' capacity to meet economic development challenges, and is coordinated with existing local, state, and Federal programs. Additional organizations involved in Eastern Idaho economic development activities include the East-Central Idaho Planning and Development Association and the Idaho Falls and Pocatello Chambers of Commerce.

Tax increment finance (TIF) zones create opportunities for economic development at the local level within designated districts. TIF is designed to fund local development authorities in their efforts to plan and implement district improvements and encourage local business expansion and relocation. As TIF zones increase in value due to local improvements, the added property tax return (increment) feeds directly into the local development authority's budget, and is then put back into the local community via additional economic development projects. Within the CANAMEX Corridor, Pocatello and Idaho Falls each have a TIF zone. Pocatello's TIF zone encompasses a 1940s era industrial park property and surroundings located within one mile of the I-15 freeway. The Lyndsey Boulevard area of Idaho Falls is a TIF zone which includes a number of motel properties located near I-15. The City of Blackfoot, located along the CANAMEX Corridor between Idaho Falls and Pocatello, is currently pursuing a TIF designation for its downtown area.

Foreign Trade Zones (FTZ) serve as economic development resources by providing a variety of benefits to attract foreign distributors to an area. Goods shipped to a FTZ in the United States do not pay customs duties until they actually leave the site, allowing for greater response to existing market conditions and delaying costly duties until the actual time of sale. One FTZ is located in Idaho, well outside the CANAMEX Corridor near Boise.

MONTANA ECONOMIC OVERVIEW

The State's Economy

Montana has become less dependent on traditional resource-based industries such as agriculture and mining, and has expanded its range of manufacturing functions beyond food products, metals refining, and lumber and wood products. Although agricultural and mining outputs have not declined in the state, the number of workers employed in these industries has been reduced. The greatest shift in employment, reflecting a national trend, has been toward service sector industries such as professional services, healthcare, and retail trade.

Montana continues to supply some of the most competitively priced electricity and natural gas in the country. Low energy costs have drawn new manufacturing firms to the state, including high technology firms such as Advanced Silicon Materials and others makers of electronic devices and machinery. Tourism plays an expanding role in the state economy as resource industries roll back employment demands.

Montana experienced a period of employment declines during the early to middle 1980s related to energy industry restructuring in the Rocky Mountain region. As the state with the lowest average incomes in the US, and the highest proportion of workers holding second jobs, Montana faces significant economic challenges. Much of the state's economic and population growth has been centered in a relatively small number of counties. Just over one quarter of the state's counties have experienced significant growth during the past decade, while almost a quarter—all mainly rural areas—have lost significant population.

Growth Trends

Montana's employment base grew at a slightly slower pace than the national average during the past two decades. Annual employment growth averaged 1.6 percent in the state compared with 1.9 percent nationally. Employment declines occurred during a number of years in the 1980s, while the 1990s have been characterized by relatively steady employment gains. Layoffs in the mining industry during the past two decades accounted for the only local sector with real declines in the number of jobs. Service sector jobs experienced the greatest increases by far, growing by nearly four percent annually since 1980. Other areas of relatively strong employment growth include retail trade, finance, insurance and real estate, and construction. Transportation, communications, and utilities employment remained flat, while manufacturing, wholesale trade, and government employment increased by under one percent annually. The importance of both services and retail trade have increased during the past 20 years, now accounting for over half of total employment. Mining, manufacturing, transportation, communications, and utilities, and government account for declining shares of local employment.

Manufacturing Industry

While manufacturing employment declined in the US as a whole during the past two decades, Montana experienced some growth in the sector. The state's industries have undergone a significant shift during the period from more basic resource production to later stages of manufacturing. Ultimately however, local manufacturing concerns remain focused on primary materials. As recently as the mid 1980s, wood, paper, and furniture products accounted for half of the state's manufacturing labor income. These industries currently account for just over a third of manufacturing labor income. Light and heavy manufacturing of machinery, electronics equipment, instruments, and a variety of miscellaneous goods have increased during the period. These fields now employ over a quarter of local manufacturing workers, up from 16 percent in 1988. Montana's manufacturers are spread throughout the state, although the majority are concentrated around Whitefish, Billings, Missoula, and Bozeman. These areas together account for over 60 percent of the state's manufacturing labor income. The areas surrounding Great Falls and Butte account for five and two percent of manufacturing labor income respectively.

High Technology Industries

Although still a relatively small portion of total employment, high technology firms have a growing presence in Montana. Local manufacturers produce computer chip components, aerospace tools and parts, optical equipment, dental instruments, and diet supplements among other products. Advanced Silicon Materials brought 200 new jobs to Butte during the past two years. The firm's 100-acre plant produces polycrystalline silicon and silance gas, two key materials used in the production of silicon wafers for use in semiconductors. Advanced Silicon Materials fills a primary role in the semiconductor manufacturing chain, essentially purifying raw materials to the extremely high standards required for high-speed processing chips. The plant has plans for additional expansion. In the town of Poplar, at the opposite corner of the state, West Electronics makes printed circuit boards for the military as well as corporations. Electronics components are also produced by S & K Electronics north of Missoula and Semitool in Kalispell. Summit Design & Manufacturing engineers and fabricates aerospace components at their facility in Helena.

Research and development functions in Montana are carried out through university partnerships. The Center for Biofilm Engineering at Montana State University in Bozeman generates medical applications and technologies for handling toxic compounds. The Center works with 19 industry partners and has aided in the creation of new local high tech firms such as a group of companies focused on optics technology. Big Sky Laser Technologies, for example, creates laser products covering a range of uses such as dermatology, remote sensing, and chemical agent detection. The Mine Waste Technology Program at Montana Tech in Butte develops solutions to environmental problems created by mining and smelting operations.

Tourism

Glacier National Park, in the northwest area of the state, and Yellowstone National Park to the south, create a corridor of tourist travel between them. Glacier draws some two to three million visitors per year while Yellowstone (most of the park located across the border in Wyoming) averages closer to four million. Many tourists come to Montana for world-renowned trout fishing as well as hunting, camping, and rafting trips. Numerous ski areas and outdoor resorts serve a growing number of outdoor recreation enthusiasts. Additional tourist draws include the collection of nearly 4,000 historic structures in Butte which recall the city's heady days as a booming mining capital at the early part of the last century.

Economic Development Resources

A variety of economic development programs serve to retain and expand existing Montana businesses as well as attract new ones. These programs include: the Regional

Development program and associated Business Finance programs, Small Business Development Centers, Tax Increment Finance districts, and Foreign Trade Zones.

The Regional Development program, administered by the Department of Commerce, serves Montana through a system of regional development officers covering distinct regions of the state. Officers provide support and direct assistance to local and regional business development efforts by identifying needs and leveraging existing and potential resources. Officers train local economic development agencies in the state's Job Investment Loan program and the Federal Community Development Block Grant (CDBG) program, as well as additional finance opportunities. Development Officers work with the Commerce Department's Location Officer to follow up leads on new businesses considering location in Montana.

The Small Business Development Center (SBDC) helps Montana's potential and existing small businesses to get off the ground and prosper by providing information, group training, and business counseling. Funded jointly by the US Small Business Administration, the State Department of Commerce, and local organizations, the SBDC works through a network of local service centers located in cities throughout the state.

Tax Increment Finance (TIF) areas create opportunities for economic development at the local level within designated districts. TIF is designed to fund local development authorities in their efforts to plan and implement district improvements and encourage local business expansion and relocation. As TIF zones increase in value due to local improvements, the added property tax return (increment) feeds directly into the local development authority's budget, and is then put back into the local community via additional economic development projects. TIFs are located in Butte, Helena, and Great Falls.

Foreign Trade Zones (FTZ) serve as economic development resources by providing a variety of benefits to attract foreign distributors to an area. Goods shipped to a FTZ in the United States do not pay customs duties until they actually leave the site, allowing for greater response to existing market conditions and delaying costly duties until the actual time of sale. Montana has FTZs in Great Falls, Butte, and Shelby.

CANAMEX Corridor Region

The CANAMEX Corridor crosses through the western portion of Montana along Interstate 15. The Corridor crosses through Butte at the Interstate 90 connection, and up through Helena and Great Falls. Tourist traffic between Montana's main draws, Glacier and Yellowstone National Parks, passes along the Corridor between the north and south ends of the state. The Sweetgrass border station at the Corridor's northern extreme serves as many as 1,000 trucks a day hauling products including oil, grain, cattle, and used vehicles among others. Truck traffic has been increasing at 10 percent annually, and the crossing serves as a major livestock certification center. The border station has plans to rebuild and expand.

Further south of the border along the Corridor, the town of Shelby has developed an intermodal transportation facility in conjunction with a foreign trade zone. The facility, operated by the Port of Northern Montana, serves as the connection point between truck and rail transport at the intersection of Interstate 15 and Burlington Northern East-West and North-South rail lines. Warehouse and grain facilities serve storage and transfer needs on site. Although Corridor hauling activity has continued to rise, the facility has yet to fully capitalize on potential demand. The Port Authority is active in pursuing economic development opportunities for the area.

Helena

Helena's 29,000 residents (approximately 50,000 in the greater Helena valley) are principally employed by Federal, state, and local government agencies and larger institutional employers such as the school district, hospitals, and area colleges. The University of Montana College of Technology is located in Helena, and two tax increment finance zones serve as local economic development tools.

Great Falls

At a population of 80,000, Great Falls and surrounding Cascade County represent the largest community along Montana's CANAMEX Corridor. The area's population has remained relatively unchanged during the past two decades while non-agriculture employment has increased at just under one percent annually on average. Services and retail trade account for the vast majority of job growth, while wholesale trade has led declines. Since 1980, wholesale trade has shifted from over ten percent of total employment to under six percent, while services have increased from about 24 percent to almost 32 percent. Overall, the Great Falls economy depends upon the basic industries of agriculture, manufacturing, and military spending to spur the range of secondary economic activities supported locally. Malmstrom Air Force Base is by far the largest employer in the area, accounting for approximately 12 percent of local jobs. Housing at the base has recently been expanded, upgrades to the runway were completed, and indications are currently that funding will remain stable into the foreseeable future. The area's reliance on this single employment source, however, causes concern.

The area's manufacturing base has expanded slowly through additions such as the Pasta Montana plant (80 jobs) and American Agri-Technology's ethanol plant (100 jobs expected). The High Plains Development and Port Authority serves as the principal promoter of economic development in Great Falls, recruiting new businesses to the area and assisting expansion of existing firms. A foreign trade zone at the Great Falls International Airport serves as one additional development resource to attract wholesale trade business. Federal Express has plans to turn the Great Falls Airport into one of its regional hub distribution sites. Downtown Great Falls includes multiple tax increment finance districts located four to five miles from I-15.

Butte

The population of Butte numbered nearly 100,000 in 1917, making it the largest city in the west between Seattle and St. Louis. Butte was the world's biggest copper producer in its day, and it remained focused on labor-intensive underground mining up through the 1950s. Open pit mining followed, a more capital-intensive practice which created the city's most visible landmark: a 1,800-foot deep pit measuring over a mile long and nearly a mile wide. Mining in the pit ceased in 1982, but toxic mine tailings have polluted the water in the pit and created the threat of contamination in nearby water sources. ARCO, owner of the mine property, is working with the Environmental Protection Agency currently to figure out how to address the problem. With a current population of about 33,000 residents, the city has a legacy of 4,000 historic buildings—more landmark structures than any US city outside of New Orleans. A number of grand structures, such as the Copper King Mansion, have been well-maintained and are currently open to tours. Thousands of others remain unrealized assets.

Approximately one mile to the west of Butte in Silver Bow, the Port of Montana facility includes a foreign trade zone. Two tax increment finance districts are located in the area as well, one near the intersection of I-15 and I-90 which now houses the Advanced Silicon plant, and another within the City of Butte which includes a number of warehouse facilities. The Headwaters Resource Conservation and Development Area serves economic development purposes within the eight counties surrounding Butte. Headwaters assists local government planning, economic development activities, and provides EDA loan funds for financing local business development.

Section II
TRANSPORTATION INFRASTRUCTURE

This section provides information on existing roadway, railroad, aviation and bridge conditions as well as freight activity. Information collected for this report was received from each of the state's Departments of Transportation, several Metropolitan Planning Organizations, national transportation organizations and national statistics organizations. The information included long-range plans, state transportation improvement plans, state traffic counts, bridge reports, road reports and intermodal reports.

SUMMARY OF FINDINGS

The CANAMEX Corridor has a developed transportation infrastructure that provides reasonable service in the five CANAMEX states. Nonetheless, transportation deficiencies and needs were noted for all five states and included all modes of transportation. All initiatives that are being developed for the Corridor have a transportation component. While each state has unique conditions and issues, the CANAMEX Corridor presents needs and objectives that are common to all states.

This section documents an overview of the transportation infrastructure that serves as the base condition for Corridor development. Below are a few of the more notable findings and observations.

- The highway/truck component of CANAMEX is the primary transportation mode for freight movement. While other modes will gain in value and use over the next 30 years, most goods will continue to be transported by truck.

- Most of the Corridor is constructed to interstate standards. However, of the 1,504-mile (2,406 km) length, 247 miles in Arizona and Nevada is not to interstate standards. This deficiency is particularly acute at the Arizona and Nevada approaches to the Hoover Dam.

- Rail is the second most used transportation mode in the Corridor. However, the rail infrastructure in the CANAMEX states is primarily oriented in an east-west direction. While an enhanced north-south rail Corridor could be developed, no reasonable solutions exist for north-south rail service between Arizona and Nevada.

- There is a shared challenge of addressing freight mobility through urban areas. Several states have corridor or other related studies underway to help define beneficial strategies.

- Regulations among the five states are not uniform. Many participants viewed seamless movement through the five states, as a high-priority need to make the CANAMEX Corridor more competitive.

- Many rural areas throughout the Corridor have limited access to convenient air service. This transportation mode is very important in developing rural areas. Convenient air service supports many aspects of electronic commerce and enables a larger population to enjoy a rural lifestyle while being connected to business centers.

- The CANAMEX Corridor provides convenient access to numerous national parks, monuments and areas of interest. The recreational value of the Corridor is a significant feature and provides considerable opportunity for a robust tourism business.

- While the metropolitan areas of Phoenix and Salt Lake City have and continue to improve Advanced Traffic Management Systems (ATMS), Las Vegas is the only other city in the Corridor that is planning and designing a system on a similar scale. Tucson is developing a smaller scale ATMS. Intelligent Transportation Systems (ITS) infrastructure is very limited in many rural portions of the Corridor.

A more in-depth evaluation of existing conditions for the CANAMEX Corridor is presented in the following sections. The information presented in these sections was obtained from State Departments of Transportation and Metropolitan Planning Organizations along the Corridor.

HIGHWAY FACILITIES

The CANAMEX Corridor is described in the National Highway System Designation Act of 1995, Sec. 1105. High Priority Corridors On National Highway System, as follows:

"The CANAMEX Corridor from Nogales, Arizona, through Las Vegas, Nevada, to Salt Lake City, Utah, to Idaho Falls, Idaho, to Montana, to the Canadian Border as follows:

A. In the State of Arizona, the CANAMEX Corridor shall generally follow--
   i. I-19 from Nogales to Tucson;
   ii. I-10 from Tucson to Phoenix; and
   iii. United States Route 93 in the vicinity of Phoenix to the Nevada Border.

B. In the State of Nevada, the CANAMEX Corridor shall follow-
   i. United States Route 93 from the Arizona Border to Las Vegas; and
   ii. I-15 from Las Vegas to the Utah Border.

C. From the Utah Border through Montana to the Canadian Border, the CANAMEX Corridor shall follow I-15. "

The CANAMEX Corridor is shown in Figure II-1 as it exists between Nogales, Arizona and Sweet Grass, Montana based on the above description.

The CANAMEX Corridor consists of interstate highways along its 1,504-mile route, except for US 93 between Phoenix, AZ and Las Vegas, NV. US 93 consists of 160 miles of 2-lane highway and an additional 87 miles of a 4-lane divided highway. This is a total of 247 miles or sixteen (16) percent of the Corridor, which are not of four-lane divided, access controlled standards. US 93 is however, on the National Highway System (NHS).

The CANAMEX Corridor is the only Interstate / US Highway route linking Mexico to Canada between I-5 on the Pacific Coast and I-25 / I-90 / I-15 through New Mexico, Colorado, Wyoming and Montana to the east. The CANAMEX Corridor bisects this distance between the I-5 to I-25 corridors, which is approximately 900 miles. The CANAMEX Corridor is interconnected with many other interstates and major highways along its alignment. Table II-1 lists the major connections with and orientations of these routes.

Table II-1
Interconnecting Interstates / Major Highways Along the CANAMEX Corridor

CANAMEX Corridor	Interconnecting Interstates / Freeways	
	Identification	**Orientation**
Nogales, AZ (Begin)		
Tucson, AZ	I-10	East – West
Casa Grande, AZ	I-8	East – West
Phoenix, AZ	AZ 202 I-17 AZ 51 AZ 101	Circumferential North-South North-South Circumferential
Kingman, AZ	I-40	East- West
Las Vegas, NV	I-515 I-15 US 93	Circumferential North-South North-South
Cove Fort, UT	I-70	East-West
Scipio, UT	US 50	East-West
Spanish Fork, UT	US 6	East-West
Salt Lake City, UT	I-80 I-215 US 89	East – West Circumferential North-South
Ogden, UT	I-84	East-West
Tremonton, UT	I-84	East-West
Virginia, ID	US 91	North-South
Pocatello, ID	I-86	East-West
Blackfoot, ID	US 26	East-West
Idaho Falls, ID	US 20	East-West
Butte, MT	I-90	East-West
Helena, MT	US 12	East-West
Wolf Creek, MT	US 287	North-South
Great Falls, MT	US 89 / US 87	North-South
Vaughn, MT	US 89	North-South
Shelby, MT	US 2	East-West

Sweet Grass, MT (End)

Source: Rand McNally & Company

Base Conditions

The ultimate charge of the CANAMEX Study is to develop existing and potential deficiencies in the CANAMEX Corridor and offer solutions to determine deficiencies. The existing "base conditions" must be established to provide the starting point for evaluation. For this portion of the CANAMEX Corridor Study, the "base conditions" will be established as *existing infrastructure* conditions plus *identified and funded projects* through Year 2005. Projects beyond this horizon and un-funded projects will be used to evaluate future conditions. The projects to be included in the "base conditions" are identified in the Highway Improvement Projects portion of this report.

The Hoover Dam Bypass Project is the one exception to this criterion. Because this project is such a vital component of the ultimate CANAMEX Corridor, it must be constructed, and is included in the "base conditions". The funding sources to complete this project are not fully known at this time. Including this project in the base conditions by no means suggests that efforts to bring it about should not be fully pursued. This project is a vital, key element to the remedy this deficient portion of the Corridor to improve safety and efficiency. Additional details of this project are provided later in this report.

Urban Areas Served

The CANAMEX Corridor is the connection between several major urban areas. The metropolitan statistical areas (MSAs) or cities and their associated 1999 populations along the Corridor are listed in Table II-2.

Table II-2
1999 Population Estimates for CANAMEX Corridor Metropolitan Statistical Areas (MSA) / Cities

MSA	Population
Nogales, AZ	22,371
Tucson, AZ	803,618
Phoenix, AZ	3,013,696
Las Vegas, NV	1,381,086
St. George, UT	47,994
Provo / Orem, UT	346,997
Salt Lake City / Ogden, UT	1,275,076
Pocatello, ID	74,881
Idaho Falls, ID	48,627
Butte, MT (city)	33,325
Helena, MT (city)	29,081
Great Falls, MT	78,282

Source: U.S. Census Bureau

The urban areas each have unique shapes and alignments. For the purpose of this study, the extent of each of the urban areas along the exact CANAMEX Corridor is as follows:

Tucson	from I-19 MP 92 to I-10 MP 246
Phoenix	from I-10 MP 162 to US 60 MP 148
Las Vegas	from US 93 MP 56 to I-15 MP 52
St George	I-15 from MP 6 to MP 8
Provo / Orem	I-15 from MP 266 to MP 276
Salt Lake City / Ogden	I-15 from MP 295 to MP 352
Pocatello	I-15 from MP 67 to MP 72
Idaho Falls	I-15 from MP 117 to MP 121
Butte	I-15 from MP 124 to MP 129
Helena	I-15 from MP 192 to MP 194
Great Falls	I-15 from MP 279 to MP 281

The CANAMEX Corridor covers a distance of 1,504 miles (2,406 Km). The distances between the MSAs / Cities and cumulative distances traveling both north and south are listed in Table II-3. The CANAMEX Corridor travels through five states and 31 counties (Arizona-6, Nevada-1, Utah-10, Idaho-6, Montana-8).

Table II-3
CANAMEX Corridor Distances
Between Major Urban Areas

From	To	Distance between MSAs		Cumulative Distance S-N		Cumulative Distance N-S	
		(mi)	(km)	(mi)	(km)	(mi)	(km)
Nogales	Tucson	65	104	65	104	1,504	2,406
Tucson	Phoenix	118	189	183	293	1,439	2,302
Phoenix	Las Vegas	216	346	399	638	1,321	2,114
Las Vegas	St George	116	186	515	824	1,105	1,768
St George	Provo / Orem	253	405	768	1,229	989	1,582
Provo / Orem	Salt Lake City / Ogden	48	77	816	1,306	736	1,178
Salt Lake City / Ogden	Pocatello	161	258	977	1,563	688	1,101
Pocatello	Idaho Falls	47	75	1,024	1,638	527	843
Idaho Falls	Butte	207	331	1,231	1,970	480	768
Butte	Helena	65	104	1,296	2,074	273	437
Helena	Great Falls	91	146	1,387	2,219	208	333

Great Falls	Sweet Grass	117	187	1,504	2,406	117	187
Total Distances		**1,504**	**2,406**				

Source: Rand McNally & Company

CANAMEX Metropolitan Planning Organizations

The CANAMEX Corridor passes through nine metropolitan areas, which are covered by Metropolitan Planning Organizations (MPOs). The metropolitan areas have a population of over 50,000. Nationwide, MPOs have several different titles, such as: Council of Governments, Association of Governments, Transportation Councils, Transportation Committees, Regional Councils, Regional Planning Councils, Planning and Development Commissions and Metropolitan Councils. Regardless of the title, the organization is challenged to perform the same type of tasks. These MPOs are responsible for coordinating regional transportation planning, investment decisions and implementation concerns. The CANAMEX Corridor MPOs include:

Pima Association of Governments (Tucson)
Maricopa Association of Governments (Phoenix)
Regional Transportation Commission of Clark County, Nevada (Las Vegas)
Five Counties Association of Governments (St. George)
Mountainland Association of Governments (Provo / Orem)
Wasatch Front Regional Council (Salt Lake City / Ogden)
Bannock Planning Organization (Pocatello)
Bonneville Metropolitan Planning Organization (Idaho Falls)
Great Falls City-County Planning Board

Highway Design Standards

CANAMEX Corridor consists of existing highways. Because of this alignment, the possibilities for long stretches of new highway alignment are unlikely. Alternative treatments to be evaluated to improve existing alignments will include additional urban travel lanes, truck climbing lanes and some possible bypass routes.

Although the design standards in each state along the Corridor vary, the generalized standards used for this study are summarized below.

Typical Sections

The typical CANAMEX section is a divided facility with four 12-foot lanes (two in each direction) in rural areas and four to ten lanes in urban areas. Urban areas have ten-foot inside shoulders and six to ten-foot outside shoulders. Concrete “jersey” barriers divide opposite direction travel lanes. Certain urban areas also have High Occupancy Vehicle (HOV) lanes. Interchange ramps have one exit lane, typically, or may have two in urban areas.

Rural areas typically have four-foot paved inside shoulders and six-foot to ten-foot outside shoulders. An additional width of unpaved shoulders provides safety buffers for vehicles that pull off the road. Opposite directions of travel are separated by grassed medians from 48 to 120 feet.

The CANAMEX right-of-way (ROW) varies between states and within urban and rural areas. The desired ROW for a rural four-lane divided facility is 300 - 400 feet. In urban areas, a minimum of 240 feet is desirable.

Pavement Sections

Typical pavement sections include sub-base, base, binder (intermediate) and surface courses. The surface course can be either concrete or asphalt. Pavement sections vary between states and a generalized section will be used for estimating construction costs.

Interchanges and Connectors

There are many interchanges and intersections on the CANAMEX Corridor including sixteen interchanges with other interstate standard highways. The many other interchanges include the full multitude of possible orientations including diamond, cloverleaf, full directional, semi-directional, multi-level, trumpet and single point urban interchanges (SPUI). The reconstruction of I-15 through Salt Lake City is reconstructing all interchanges (11 each) as SPUIs.

Ports of Entry

The Ports of Entry (POE) in each of the CANAMEX states have the mission to ensure compliance with motor carrier regulations; to provide assistance and information to the motor carriers; and to assist in the preservation of the highway system and the safety of the traveling public. This mission is accomplished through safety inspections and educational programs provided to commercial vehicle drivers and motor carrier companies. The states have ports of entry along the CANAMEX Corridor to enforce the laws and regulations of the state.

Any vehicle exceeding 80,000 pounds requires special permit in each of the CANAMEX states. Each state along the CANAMEX Corridor has different maximum allowable weights for the permitted trucks. Table II-4 shows the different requirements for trucks traveling along the corridor. Longer Combination Vehicles (LCV or "triples") are also listed in the table.

Table II-4
Truck Gross Vehicle Weight (GVW)
Maximum Allowable by State

State	Max. Allowable Gross Vehicle Weight * (GVW) (lb)	Longer Combination Vehicles (LCV - "Triples")	
		Length (ft)	Weight (lb)
Arizona [1]	80,000	Not Allowed	
Nevada	129,000	105	129,000
Utah	125,000	105	129,000

Idaho	105,500	105	105,500
Montana	122,620	105	131,060
Canada	137,500	82	137,500
Mexico	132,000	102	132,000

* See following paragraphs for additional discussion
[1] Arizona does allow trucks weighing up to 129,000 pounds on I-15 in the northwest corner of the state.
Source: State DOTs, Ports of Entry

Truck maximum weight is calculated on the Federal Bridge Formula for non-reducible loads. The number of axles and axle spacing of the vehicle determine the maximum allowable weight for a truck hauling a reducible load. The standard allowable axle weights are 20,000 pounds for a single axle, 34,000 pounds for dual (tandem) axle and 42,500 pounds for triple (tandem) axle.

Arizona's ports of entry along the CANAMEX Corridor are located at Nogales on I-19 and in Kingman on Highway 93. Arizona does not have a published maximum allowable truck weight, however does allow overweight permits, provided standard axle weights are not exceeded. Arizona does allow trucks weighing up to 129,000 pounds on I-15 in the northwest corner of the state.

Nevada has no Ports of Entry. The maximum operating weight for trucks in Nevada is 129,000 pounds. Nevada uses standard maximum axle weight and the Federal Bridge Formula to permit overweight loads. Overweight/Oversized loads are typically not routed on US 93 over the Hoover Dam.

Utah presently has ten permanent and one mobile ports of entry. Along the CANAMEX Corridor, the ports of entry are located in St. George and Perry. Utah authorizes gross vehicle weights up to 125,000 pounds. Non-divisible (non-reducible) loads are subject to the Utah Bridge Formula. Longer combination vehicles are not allowed in the construction area of I-15. They must use I-215 as a detour.

Idaho has a total of eight primary ports of entry. Along the CANAMEX Corridor, Idaho has primary ports of entry in Inkom and Sage Junction. Rover ports of entry in Pocatello and Idaho Falls supplement the primary ports. In Idaho, a maximum weight of 105,500 is allowed for interstates and major highways. A pilot test project allowing weights up to 129,000 is being conducted with US 93/SH 33, US 91/SH 34 and US 30. The program ends on July 1, 2001.

Montana's ports of entry along the Corridor are located in Lima, Butte, and Sweet Grass. Truck maximum weight in Montana is allowed at 122,620 pounds provided that axle weights are distributed at maximums, although Montana does allow the larger Canadian trucks on the stretch of I-15 from Sweet Grass to Shelby.

As reflected in the freight assessment, the type of commodities traveling by truck to/from the various CANAMEX states differ in bulk and weight characteristics. Lumber shipments on Montana roads have weight issues while the food products on Arizona's highways tend to “cube out” in volume before weight restrictions apply. With these different characteristics, a single standard may not necessarily encourage freight activity.

As CANAMEX becomes a corridor between three nations, coordination with Canada and Mexico become more vital. Currently, the Canadian regulations, established as a result of the Road and Transportation Association of Canada study, provide for maximum axle weight limits of 12,125 pounds for steering (single) axle, 37,479 pounds for tandem-axle and 46,297 to 52,911 pounds for tandem-axle. The maximum gross vehicle weight is up to 137,500 pounds. Each of these weight limits is higher than the presently allowable US standards.

The Mexican Federal government establishes vehicle weight standards in Mexico. Maximum axle weights are 14,330 pounds for steering axle, 42,990 pounds for tandem axle and 49,604 pounds for tridem axle. Maximum gross vehicle weight is also higher than US Standards at 136,600 pounds.

Rest Areas

Rest areas along the CANAMEX Corridor offer convenient locations for weary travelers to refresh themselves. Each of the CANAMEX states has public rest areas along the interstate portions of the Corridor. The CANAMEX Corridor has 24 rest areas or welcome centers. The more rural, non-interstate segments do not have rest areas. Travelers on these segments of the Corridor rely on small towns and cities to provide the amenities found at rest areas.

The rest areas along the CANAMEX Corridor are located between 35 and 85 miles from each other or from urban areas. With two exceptions, the rest area locations are evenly distributed along the route. The two “gaps” in rest area locations are between Phoenix and Nevada (non-interstate US 93) and between Cove Fort (Dog Valley Mile Post 136) and Perry, Utah (Mile Post 363), a distance of 227 miles. Utah has proposed public rest stops and several public / private partnership sites at interchanges, to fill in the “gap” along the Corridor. Figure II-2 also shows the rest areas and welcome center locations for each state. The illustration identifies if the rest area serves travelers in both or only one direction.

Intelligent Transportation Systems (ITS) Activities

Intelligent Transportation Systems (ITS) refers to projects that improve the efficiency of personal or freight mobility utilizing communications and electronics technologies in lieu of new roadway infrastructure. ITS programs create benefits that include increased travel safety, reduced roadway delay, and improved connectivity between different travel modes and services. Some practical benefits include reductions in total time for incident detection, response and clearance, providing advanced warning of inclement weather or accidents, providing improved real-time route information and improved traffic signal operations, and reduced delay to trucks through electronic pre-clearance and weigh-in-motion systems. ITS is typically divided into the following elements:

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Public Transportation Systems (APTS)

- Commercial Vehicle Operations (CVO)
- Advanced Vehicle Control and Safety Systems (AVCSS)

Urban ITS in the CANAMEX Corridor

Several existing ITS initiatives are underway or have been completed within the CANAMEX Corridor. They can be classified as Urban area ITS activities or Intercity/rural ITS activities. Urban area activities in the Phoenix, Las Vegas, and Salt Lake City regions are in various stages of completion, with smaller scale activities occurring in the Tucson area. At this time, no other urban ITS initiatives are in place in the Corridor. These are summarized below:

Tucson – Pima Association of Governments completed an ITS Strategic Plan for the Tucson area in 1996. The following activities are completed, underway or programmed over the next five years:

- ATMS: Arizona Department of Transportation and the City of Tucson have identified $6.3 million to provide real-time traffic monitoring (traffic sensors and video cameras, connected by fiber optics) along I-10 and I-19. Variable message signs will provide real-time en route information. This freeway management system will be co-located at City of Tucson's Traffic Management Center with their existing traffic signal system. Construction began in early fall 1999, and the system is to be operational by 2001.

- ATIS: Metro Networks is serving as the private sector partner with the City of Tucson in developing a Regional Traveler Information Center that will coordinate dissemination of traffic information

- APTS: Kiosks are proposed for real-time transit information.

Phoenix – Phoenix was one of four regions in the U.S. involved in a "Model Deployment" initiative. Known as AzTech, the initiative (started in 1995) integrates the region's Freeway Management System (FMS) with traffic signal systems in Phoenix and Maricopa County, along with Valley Transit. The main benefits include reduced freeway congestion through improved incident management, real-time information (via variable message signs and Internet information), and traffic control (ramp metering and real-time adjustments to computerized signal timing on arterial routes. Sixteen different transportation and emergency management centers in the region are connected through the AzTech communications network. Fiber optics along the roadway network have been implemented by ADOT and various local and county agencies. The following activities are completed or programmed over the next five years:

- ATMS: 42 miles of freeways and eight major surface streets form a series of "smart corridors" which include a network of cameras, traffic sensors, upgraded traffic signals, and electronic variable message signs. These components are connected through a fiber optic communication network totaling some 200 miles. The Phoenix area region's Freeway Management System (FMS) has a completion date for the entire planned system of 2013. The majority of the I-10 corridor through Phoenix presently has the FMS in place and functioning. This system includes closed circuit TV cameras, real-time video, traffic condition status, incident alerts, variable message signs, ramp metering and permanent loop (traffic count) detectors. The portion of I-10 from Chandler Boulevard to Southern Avenue was scheduled for completion in 1999, but is currently under design. The section from Queen Creek Road to Chandler Boulevard is scheduled for completion in 2005. Other significant portions of Phoenix's freeway system are scheduled for the FMS, but no other portions of the CANAMEX Corridor are part of that system.

- ATIS: Metro Networks and workstations have been installed in the Arizona Department of Transportation (ADOT) Traffic Operations Center, permitting traffic reporters to more quickly disseminate information to the public via radio and TV. ADOT currently supplies real-time traffic information over its web site. Personalized traffic reports and information services are being provided through a series of public-private partnering initiatives.

- APTS: Automatic vehicle location systems using Global Positioning Systems (GPS) have been installed on over 90 transit vehicles to provide real-time traffic condition updates and schedule information for transit operators and for waiting passengers at transit centers. Kiosks at these locations provide bus route, schedule and traffic condition information.

Las Vegas – The region is implementing the areawide Freeway and Arterial System of Transportation (FAST) Program, to be deployed in 2002. The initiative includes integration of existing traffic signal systems with a new freeway management system, with a focus on reduction of delays due to congestion and incidents, as well as expedited response to roadway incidents. A new regional traffic management center is being developed as the "nerve center" for the operation, and will be located at the regional Nevada Highway Patrol facility. The following elements are to be included:

- ATMS: Deployment of traffic sensors, video cameras, ramp metering and variable message signs along freeway network (including I-15 and I-515), and integration with traffic signal systems along arterial routes.

- ATIS: Includes implementation of data archiving functions to permit access to historical traffic data collected by the system, and a real-time traveler information dissemination capability to support media and public information needs.

Salt Lake City – The Utah Department of Transportation (UDOT) has recently implemented CommuterLink, their Advanced Traffic Management System (ATMS), which includes the implementation of a regional Traffic Operations Center (TOC) at UDOT's Region 2 offices as well as satellite operations centers for Salt Lake City and Salt Lake County traffic signals. The system includes freeway management system elements covering the freeway network (most of which were installed as part of the I-15 reconstruction project). Utah Transit Authority is also implementing a number of monitoring and information systems for its bus, light rail, and resort-area services. Many of the early initiatives will support transportation activities during the 2002 Winter Olympics. Traffic management software is being implemented under a design-build procurement, concurrent with implementation of 300 miles of fiber optic communications, variable message signs, closed circuit TV, arterial signal upgrades under the I-15 reconstruction effort. Video cameras have been installed both by UDOT and by local television stations to monitor operations for informational purposes.

Rural ITS in the CANAMEX Corridor

Intercity/rural activities in general have involved traveler information systems and commercial vehicle pre-clearance and administrative systems – generally implemented through public-private partnerships. Most activities to date have been in Arizona, though a number of proposed initiatives have been identified in other locations in the Corridor as discussed below.

Arizona DOT has developed a rural corridor information system along Interstate 40, which could easily be expanded or replicated to encompass the entire CANAMEX Corridor, as well as specific intercity corridors where links can be provided to urban area travel information. In addition, the Western Transportation Institute (Bozeman, Montana) has developed a regional ITS architecture for Yellowstone National Park, focusing on traveler information services. This is discussed in more detail below under "General ITS Developments". Such activities may be expanded or replicated for other national parks in the Corridor, including Glacier National Park, Wasatch National Forest, and the Grand Canyon.

A current research project in Arizona is developing a statewide incident management plan to establish consistent methods, responsibilities and communication channels among both the state-level agencies and local responders, with the intention of developing procedural consistency between the urban and rural regions in Arizona with respect to incident response. Arizona is developing a Statewide Alternate Route Plan to provide route alternatives for all major rural highway segments across the state of Arizona in the event of incidents, construction or weather-related closures. Utah and Arizona have implemented a number of Road Weather Information Systems (RWIS) locations that detect low visibility, icing and precipitation conditions. Utah has been experimenting with bridge de-icing systems; both states are using RWIS data in dissemination of statewide traveler information over the Internet.

Just outside the CANAMEX Corridor, Arizona has developed a number of traveler information services along I-40, including real-time weather, construction and incident information as well as traveler services information. The information, obtained from ADOT sources, is disseminated through the Internet as well at strategically located kiosks.

Commercial Vehicle Operations (CVO) in the CANAMEX Corridor

Pre-clearance of trucks through weigh stations and ports of entry are among the most common Commercial Vehicle Operations (CVO) applications to date, permitting reductions both in delay to truckers and in the paperwork required for issuing credentials to freight carriers and specific freight loads. These technologies utilize automatic vehicle identification (AVI) systems permitting transponder-equipped commercial vehicles to bypass designated weigh stations and port-of entry facilities. There are two primary standards in place at this time, *PrePass* and *Norpass*, both of which are represented in the CANAMEX Corridor.

The more common of the two standards is *PrePass*, operated by the non-profit consortium Help, Inc. Montana, Arizona and Nevada utilize the *PrePass* system. In contrast, the *Norpass* program is used in Utah, Idaho and Washington as well as the Canadian province of British Columbia. *Norpass* is operated as a private organization with public membership open to all US states and Canadian provinces. Currently, *PrePass* is capable of reading information from *Norpass* transponders, but not vice versa.

Nevada, Utah, Idaho and Montana are part of a coalition of Western states (also including Washington, Oregon, and Wyoming) that have been jointly studying methods to improve trucking regulation and enforcement. Idaho National Engineering and Environmental Laboratory (INEEL) is conducting a field operational test designed to demonstrate automated technologies that monitor the status of commercial vehicles taken out of service due to safety deficiencies detected at inspection stations (e.g., operator exceeding his hours of continuous service, necessary repairs needed to vehicle) and to aid in efficiently clearing violations once these violations have been corrected. Technologies being utilized include Automatic Vehicle Identification systems, video image processing, and database systems. The system is initially being deployed at the East Boise Port of Entry.

General ITS Developments

The Western Transportation Institute (WTI) at Montana State University in Bozeman emphasizes deployment of Rural ITS activities, including rural safety systems, automated snowplow operations, and road weather information systems. WTI and Montana Department of Transportation, the sponsoring agency, are involved with the Greater Yellowstone Rural ITS Priority Corridor efforts involving Montana, Idaho and Wyoming and serving the Yellowstone and Grand Teton National Parks. To date, A Rural Regional Architecture has been developed which identifies potential activities and communication links based on input from local and regional stakeholders. Projects recommended for initial deployment include interactive information kiosks, electronic fee payment at park entrances, variable message signs, cellular incident reporting services, and incident management plans. Initial efforts funded to date include one test site for electronic payment using transponder-reader technology similar to electronic toll roads.

Research in Arizona has focused on developing automated snowplow operations using roadway guidance magnets at six sites. The installations in 1999 addressed the behavior of those materials, and the pavement itself under winter condition. Four miles of magnets in the roadway on US 180 were installed for evaluation of automated plow operations using ADOT winter maintenance personnel.

Privately developed systems tested on public roadways have included machine-vision and enhanced-vision systems in automobiles. Currently, Cadillac offers a “NightVision” system as an option on several of its models that provides improved “reverse image” graphics for detection of obstacles under unlighted night-time conditions.

Highway Improvement Projects

The proposed highway improvement projects along the CANAMEX Corridor are shown for the CANAMEX states in Figures II-3 through II-6. These projects were obtained by a review of each state's and MPO's Transportation Improvement Program (TIP) for FY 2000-2004. These projects, along with existing infrastructure conditions will establish the "Base Conditions" for the study. The projects listed show roadway widening, truck lanes, and interchange construction or reconstruction projects. Projects, which replace existing conditions such as, design, resurfacing, reconstruction, rehabilitation, joint repair and striping are not listed.

As depicted in the figures, except for the Hoover Dam Bypass, these projects are scheduled for completion by FY 2004. These projects will provide 36.5 more miles of four-lane divided, access control highway for US 93 in Arizona. Additionally, 3.5 miles of US 93 in Nevada will be upgraded to interstate standards. These improvements will reduce the length of US 93 that remains as a two-lane highway to 120 miles. Sixteen miles of I-15 in Salt Lake City will be reconstructed and widened.

Highway Constraints

The CANAMEX Corridor has several constraints, or bottlenecks, along the route from Mexico to Canada. In addition to the identified and funded improvement projects, however, several states are conducting significant studies to determine alternatives to existing constraints. These studies are identified in *italicized* text in the following descriptions. It is not an element of this study to comment on the progress, feasibility or preferred alignments of these studies. They are, however, being mentioned as part of the comprehensive overview of transportation activity within the CANAMEX Corridor.

Congestion in and around the Phoenix area is a hindrance to rapid movement of traffic and goods through the metropolitan area. US 60 is a signalized, four-lane arterial through metropolitan Phoenix. The arterial is oriented northwest-southeast through the city's grid system of east-west, north-south streets. The intersections are a difficult 6-legged configuration, because of US 60's diagonal orientation. West of AZ Loop 101, US 60 contracts to a two-lane facility. The study to designate CANAMEX Corridor through Maricopa County is being conducted. It is expected to be completed by late 2001 or early 2002.

US 93/US 60 is currently a two-lane facility for most of its route through Arizona and Nevada. The upgrading of this highway to a four-lane divided, access controlled highway between Phoenix and Las Vegas is a recommendation of this study in order to reduce delays, improve safety and remove significant bottlenecks along the corridor. As part of the potential upgrade of US 93, the *Wickenburg/US 93 Location/Design Report* is being undertaken to examine, among other options, possible alternatives in order to take US 93 on a bypass route around the city.

A significant hindrance to traffic in the CANAMEX Corridor is the two-lane, winding section of US 93 leading to and from the Hoover Dam. *The Hoover Dam Bypass* project is being conducted to determine the best route for a new road and bridge over the Colorado River.

The project cost is estimated at $198 million. Of this amount, $118 million has been allocated, with the remaining $80 million yet to be identified. Eight of the original eleven alternatives studied have been eliminated. The three remaining alternatives are:

? Sugarloaf Mountain Alternative south of the dam (preferred alternative); and

? Promontory Point Alternative north of the dam; and

? Gold Strike Canyon Alternative further south of the dam.

Each of the remaining alternatives for the Hoover Dam Bypass includes a new four-lane highway and new four-lane bridge. The Hoover Dam Bypass would allow trucks to use the new alignment, which would be a significant improvement to the safety and efficiency of CANAMEX Corridor. Negative aspects of the present alignment include poor geometry on the approaches to the Hoover Dam; hours of delays to traffic; and the mixing of trucks and tourist traffic on the route.

The US 93 route north of the Hoover Dam travels through the city of Boulder. The present geometry, signalized intersections and local traffic from new housing development slow through traffic in this suburban area. *The Boulder City/US 93 Corridor Study* is examining the best ways to accommodate traffic in and through Boulder City.

Another constraint on the CANAMEX Corridor is between Salt Lake City and Ogden, where the available land for transportation development is constrained by the proximity of the Wasatch Mountains to the Great Salt Lake. I-15 is currently being widened to eight-lanes with HOV lanes in this area. *The Legacy Parkway Study* is examining the feasibility of a new interstate standard highway north of Salt Lake City through this bottleneck. Existing development along the corridor, extreme slopes of the mountains and wetlands and the Great Salt Lake all hinder the development of additional lanes on I-15 or new roads in this section of the corridor.

Traffic / Estimated Capacities

Current traffic volumes for the CANAMEX Corridor were determined from state traffic volume reports. These traffic volumes were used to evaluate the capacity of the existing roadways along the Corridor. Levels of Service and volume/capacity ratios were used to evaluate the performance of locations along the Corridor. For the purpose of calculating volume – capacity (v/c) ratios, 24-hour, two-way capacities were established for CANAMEX, as shown in Table II-5. The capacities were based on traffic characteristics in the Corridor and developed in accordance with the 1994 Highway Capacity Manual.

Table II-5
Estimated Interstate 24-Hour Capacities

Area	Number of Lanes(1)	Estimated 2-Way Capacity(2)
Rural	2-lane	28,000

	4-lane 6-lane	50,000 75,000
Urban	4-lane 6-lane 8-lane 10-lane	80,000 125,000 160,000 205,000

(1) Total through lanes in both directions combined.

(2) Source: Highway Capacity Manual, 1994

The volume – capacity (v/c) ratio is a determination of roadway conditions based on the volume of annual average daily traffic divided by the theoretical capacity of the road to accommodate traffic. The closer the resulting ratio is to 1.0, the closer the road is getting to its ability to accommodate the traffic. The volume-capacity ratio is correlated to a Level of Service. The level of service (LOS) ranges associated with the volume to capacity ratios are presented in Table II-6. The Levels of Service are found in the 1994 Highway Capacity Manual. Levels of Service depict traffic as fully free operation (LOS A) to some deterioration of movement (LOS C) to complete hindrance of operation (LOS F).

Table II-6
Levels of Service

LOS	Volume/Capacity Ranges
A	0.00 - 0.25
B	0.26 - 0.40
C	0.41 - 0.60
D	0.61 - 0.80
E	0.81 - 1.00
F	> 1.00

Source: Highway Capacity Manual, 1994

Existing Performance

Existing v/c ratios and the corresponding LOS for selected rural locations are given in Table II-7. The 1998 Average Annual Daily Traffic (AADT) volumes were selected from each state's annual traffic reports at locations between major urban areas, or between a major urban area and a state line. These locations serve as midpoints, with minimum influences by major traffic generation areas. At these locations the CANAMEX Corridor is assumed to be a four-lane highway (two lanes in each direction), except for US 93 in Arizona and Nevada, which is a two-lane roadway.

The rural sections of the CANAMEX Corridor, according to 1998 traffic counts operate at acceptable levels of service, except for the Ogden to Brigham City, Utah segment. Bottlenecks occur, however, at urban locations indicated in Table II-4. The traffic volumes for urban locations were chosen where significant traffic existed. The limits of the urban areas correlate to the metropolitan planning organization boundaries. The number of lanes in urban areas along the CANAMEX Corridor varies from four-lanes to ten-lanes with High Occupancy Vehicle (HOV) lanes. The highest traffic volumes in each section of the urban corridor were selected for the Table II-8. The following lane configurations correlate to those volumes:

? 6-Lanes - Tucson, Las Vegas, Provo/Orem, Salt Lake City (Bountiful)
? 8-Lanes – Phoenix I-10 NB
? 10-lanes – Phoenix I-10 EB, Salt Lake City

Table II-7
1998 Existing Typical Rural CANAMEX Corridor Performance

To City [1]	Route	AADT	V/C Ratio	LOS
Nogales, AZ (Begin)				
Tucson, AZ	I-19	22,600	0.28	A – B
Casa Grande, AZ	I-10	32,429	0.41	B – C
Phoenix, AZ	I-10	41,122	0.51	C
Kingman, AZ	US 93	7,778	0.27	B
Nevada Stateline	US 93	8,571	0.31	B *
Las Vegas, NV	US 93	14,000	0.28	B *
Utah State Line	I-15	14,985	0.30	C
Cedar City, UT	I-15	14,865	0.30	B
Salt Lake City/Ogden, UT	I-15	10,990	0.22	A
Brigham City, UT	I-15	38,540	0.77	D
Idaho Stateline	I-15	8,840	0.18	A
Pocatello, ID	I-15	7,944	0.16	A
Idaho Falls, ID	I-15	18,000	0.36	B
Montana Stateline	I-15	6,200	0.12	A
Butte, MT	I-15	4,030	0.08	A
Helena, MT	I-15	4,690	0.09	A
Great Fall, MT	I-15	3,520	0.07	A
Sweet Grass, MT	I-15	3,070	0.06	A

[1] The city on line with the AADT traffic volumes, is the end point of the segment. The traffic volume provided is at a midpoint between that city and the previous city., eg. The AADT volume of 41,122 occurs between Casa Grande and Phoenix, AZ.

* The Levels of Service are calculated at mid points between the Hoover Dam and Kingman, AZ and the Hoover Dam and Las Vegas, NV. These LOS are not meant to represent the significant delays and poor LOS at the approaches to the Hoover Dam itself.

Table II-8
1998 Existing Large Urban CANAMEX Corridor Performance

City	Route	AADT	V/C Ratio	LOS
Tucson, AZ	I-19	48,537	0.60	B – C
	I-10	121,895	0.97	C – E
Phoenix, AZ	I-10 NB/SB	140,000	0.86	C – F
	I-10 EB/WB	236,387	1.15	D – F
	US 60	30,496	0.38	B – C
Las Vegas, NV	US 93/US 95	37,900	0.47	C
	US 93/US 95/I-515	122,765	0.98	E
	I-15	110,710	1.38	E
Provo/Orem, UT	I-15	81,185	0.65	D
Salt Lake City/ Ogden, UT	I-15	73,096[1]	0.46	C
	I-15 (Bountiful)	112,705	0.90	E

[1] I-15 is undergoing reconstruction. 1996-97 volumes ranged from 150,000 to 200,000 AADT

All urban areas are performing near or above capacity and at minimum levels of service, especially the Salt Lake City and Phoenix areas. The reconstruction of I-15 in Salt Lake City, due for completion in late 2001, will enhance and extend its capacity. Only short segments of I-10 in Phoenix are scheduled for widening. Additional studies are currently underway to determine the possibilities of widening and adding HOV lanes to I-10. Continued growth in Tucson, Phoenix, Las Vegas, Provo/Orem and Salt Lake City/Ogden areas will add stress to the corridor's existing capacity.

In summary, the rural sections beyond the urban areas have acceptable Levels of Service (LOS), the exceptions being the rural sections between Ogden and Brigham City in Utah, and the approaches to the Hoover Dam in Arizona and Nevada. Conversely, many urban sections are highly congested. These urban locations include Tucson and Phoenix in Arizona; Las Vegas, Nevada; and Provo/Orem and Salt Lake City/Ogden City/Ogden in Utah.

Pavement Investigation

The Present Serviceability Rating (PSR) of evaluating pavements is based on a five-unit system, which is related in Table II- 9 below. The PSR information is displayed in Tables II-7 and II-8 above for segments of CANAMEX Corridor in each state. The value provided in the tables is an overall average for the segment. Each segment will contain sections of pavement that are in better condition, and some sections which are worse condition than the average value provided.

Table II- 9
Present Serviceability Rating (PSR)

PSR	Condition	Description
0.0 –1.0	Very Poor	Extremely Deteriorated
1.0 – 2.0	Poor	Deteriorated over 50%, Large Pot Holes, Effects speed of traffic
2.1 – 3.0	Moderate	Barely tolerable for high speed traffic
3.1 – 4.0	Good	Relatively Smooth
4.1 – 5.0	Very Good	New or only superior pavement

Utah Department of Transportation uses an Overall Condition Index (OCI) formula that takes into consideration factors to include ride smoothness, rut depth, environmental cracking wheel path cracking and estimated years to fatigue failure. These factors are used to produce values from 0 – 100 for sections of the roadway. These values are correlated to a table that is divided the same five categories as the PSR varying from Very Poor to Very Good. The numbers used in Tables II-7 and II-8 are PSR values that would directly correlate to the UDOT categories.

Though PSR 3.0 and higher is considered acceptable, deterioration of the pavements will continue as the CANAMEX Corridor develops. Rehabilitation plans and timelines should be implemented for these pavements.

Bridge Sufficiency Ratings

Bridges are assigned Sufficiency Ratings (BSR) from 0 – 100 based on the Structural Inventory and Appraisal Form. The form analyzes information including structural type, age, load rating, geometry and traffic volumes. The larger the BSR, the more sufficient the bridge is to continue to perform. The Bridge Sufficiency Ratings are used to categorize bridges as described in Table II- 10.

Table II- 10
Bridge Sufficiency Rating (BSR)

BSR	Category
0 – 49	Eligible for replacement
50 - 79	Eligible for rehabilitation
80 - 100	Good / Sufficient Condition

Many bridges along the Corridor have BSRs between 50 and 79 and are noted for rehabilitation, however are not scheduled for replacement. The following table lists bridges in the CANAMEX Corridor that are presently below BSR 50, and are eligible for replacement; structurally deficient "S"; or are on the state TIP for widening.

Table II-11
Deficient Bridges

Route	Mile Post	Name	BSR
I-10	AZ 154.62	Ramp SE over Southern Ave	15.3
I-10	AZ 155.00	WB 60 – EB10 Ramp	25.5
US 60	AZ 321.02	Side Hill Viaduct	27.7
US 93	AZ 105.5	RCB	S 53.7
US93	AZ 157.60	Cottonwood Canyon	S 56.9
US 93	AZ 199.56	Sols Wash Bridge	44.2
I-15	SLC	I-15 Reconstruction Project	----
I-15	ID 69.2	Clark Street Bridge	71.7
I-15	ID 94.3	Snake River Bridge Widening	73.8
I-15	ID97.3	Riverside Canal Bridge	61.0
I-15	MT 193.3	Bridge Widening	67.1

The locations of these bridges are shown in Figures II-7.

AIRPORTS

Major Commercial Airports in the Western states, to include the five CANAMEX states, are shown in Figure II-8. Airports that serve international passengers (commercial) are identified with a circle. The CANAMEX Corridor includes four (4) airports that are listed in the Airport Council International's top 100 US Airports for total passengers and cargo activity. The 1990 and 1998 data for enplanements and air cargo for the commercial airports along and adjacent to the CANAMEX Corridor are listed in Table II-12 below. The four international commercial airports along the Corridor are also identified in the table.

Table II-12
Commercial Airport Activity

Airport (International)	Code	Aircraft Opns 1998	Total Passengers 1990	Total Passengers 1998 (1)	Air Cargo (Metric Tons) 1990(2)	Air Cargo (Metric Tons) 1998 (1)
Along CANAMEX Corridor						
Tucson, AZ (Intl-Commercial)	TUS	266,428	2.6 Million	3.5 Million (68)	17,300	35,629 (82)
Phoenix-Sky Harbor, AZ (Intl-Commercial)	PHX	519,663	21.7 Million	31.8 Million (9)	114,200	332,638 (27)
Kingman, AZ	IGM	1,040	2,372	2,680	-------	-------
McCarran-Las Vegas, NV (Intl-Commercial)	LAS	470,707	18.6 Million	30.2 Million (14)	30,300	73,846 (58)
St. George, UT	SGU	10,190	13,673	26,447	-------	-------
Cedar City, UT	CDC	8,393	5,762	7,649	-------	-------
Salt Lake City, UT (Intl - Commercial)	SLC	366,171	11.2 Million	20.3 Million (26)	115,700	249,838 (31)
Pocatello, ID	PIH	16,075	31,000	39,579	-------	-------
Idaho Falls, ID	IDA	26,399	123,033	119,199	-------	-------
Butte, MT	BTM	11,578	32,578	43,836	688	100
Helena, MT	HLN	15,740	51,455	74,528	638	667
Great Falls, MT	GTF	21,454	116,443	125,747	1,212	852
Adjacent to CANAMEX Corridor						
Sierra – Vista, AZ	FHU	5,944	10,555	10,528	------	------
Prescott, AZ	PRC	5,127	9,932	7,844	------	------
Laughlin – Bullhead City, AZ	IFP	5,663	50,216	29,912	------	------
Twin Falls, ID	TWF	9,344	36,627	32,396	------	------
Bozeman, MT	BZN	37,572	127,977	217,308	370	386

Sources: Airport Council International Statistics; Federal Aviation Administration; State DOTs
(1) Number in parentheses is ACI Ranking for US Airports
(2) Montana Cargo Data from 1993

The table reflects varying increases in aviation activity at the various airports. The large commercial airports all showed a significant increase in passenger and cargo activity. The increases in total passengers for the large commercial airports varied from 35 percent (Tucson) to 81 percent (Salt Lake City). The smaller commercial airports, over the 1990 to 1998 period varied from actual decreases in total passengers to increases of 93% (St. George).

Primary Commercial airports, other commercial airports and significant General Aviation Airports are depicted for each state in Figures II - 9 through II - 12. These airports may serve international passengers and cargo (commercial) or only as cargo clearing facilities (cargo). The international commercial airports are identified with a circle while the international cargo airports are shown with a square.

Not all airports are ideally located for truck access. Though located near I-10, Phoenix Sky Harbor Airport is surrounded by development and served by an existing surface street system through which trucks destined for the airport must maneuver. The other major airports in the Corridor are served by interstate highways directly into the terminal or cargo areas. The Corridor's smaller airports have significantly less of a truck access issue, such as Tucson, only insofar as the trucks intermingle with car traffic, which at times creates some congestion.

PORTS AND WATERWAYS

Being an inland trade corridor, CANAMEX is not directly connected with any water ports. One CANAMEX state has a water port facility. This is the inland water Port of Lewiston, Idaho. This port is accessible to the Corridor by US 95 / I-84 or US 12 / I-90. This port is identified on the Federal Highways Administration's list of Intermodal Connector Facilities.

Several ocean ports in the United States and Mexico can easily reach the CANAMEX Corridor by interstate highway. These ports and their connections include San Diego (I-80); Los Angeles (I-10); Oakland (I-80); Portland, Olympia, Tacoma and Seattle (I-84, I-90). In Mexico, ports along the extended CANAMEX Corridor include Guaymas, Topolobampo, Mazatlan, Lazaro Cardenas and Manzanillo.

RAILROADS AND INTERMODAL LINKAGES

The Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroads are the dominant rail lines in the Corridor. Known as Class 1 railroads[1], the UP and BNSF are also the dominant rail systems in the Western United States. BNSF was created by the 1995 merger of the Burlington Northern and the Atchison, Topeka and Santa Fe (ATSF) railroads. Union Pacific, which had been acquiring a number of other railroads through the 1980s and 1990s, bought Southern Pacific and began combined operations in 1996. A total of 20 other local and regional rail companies serve the five CANAMEX Corridor States. The mileage of track for the two major companies and local / regional rail companies is shown in Table II-13. The alignment of rail track in the CANAMEX Corridor is depicted in Figure II-13.

[1] The US Surface Transportation Board classifies railroads on the basis of their annual revenue. For 1996, a Class 1 railroad was one having $255 million in revenue. This level may vary from year to year. UP's 1998 revenues totaled $10.6 billion. BNSF's 1998 revenues totaled $8.9 billion.

Table II-13
Total Miles of Track

Railroad	BNSF	UP	Local/ Regional	Switching & Terminal	Total
Arizona	595	738	373	203	1,909
Nevada	809	1,107	133	0	2,049
Utah	436	1,331	450	30	2,247
Idaho	125	983	653	71	1,832
Montana	2,136	125	1,033	0	3,294
Total	**4,101**	**4,284**	**2,642**	**304**	**11,331**

Source: American Association of Railroads

The CANAMEX Corridor is crossed in Arizona, by two east-west rail lines. A UP line parallels I-8 and I-10 from New Mexico through Tucson and Phoenix through Yuma to Colton, California. A BNSF line, in northern Arizona, parallels I-40 through Flagstaff and Kingman and runs through Needles to Barstow, California. A UP line exists from Los Angeles through Las Vegas, Salt Lake City and Pocatello extending north to Silver Bow, Montana. Local rail companies connect the UP and BNSF lines in Montana. The Montana Western exists from Silver Bow to Garrison. The Montana Rail Link has a line from Garrison to Helena. The Montana Division of BNSF has a rail line from Helena to Sweet Grass, which parallels I-15 through the state.

A deficiency of the CANAMEX rail infrastructure is that in the lower CANAMEX states, in particular, the railroads are primarily oriented in an east-west direction. In Montana, connections using smaller rail companies are required to complete the transit along the Corridor. Rail movement between Nogales, AZ and Sweet Grass, MT requires the use of railroad tracks owned by at least four separate railroad companies. Rail movement along the Corridor is not nearly as direct as highway movement.

Union Pacific Railroad

The major north-south rail line in the Corridor carries in excess of 40 million gross ton-miles per mile annually[2], a comparatively "heavy" volume indicating a major amount of trains and rail-borne cargo. This is the historic Union Pacific transcontinental line from Los Angeles via Las Vegas, Salt Lake City and Ogden, where it joins another UP route running east-west between the San Francisco Bay Area and Chicago. North to Salt Lake City/Ogden, ton-mileage declines significantly, except for the northern most section of the line to Pocatello, a segment which is actually part of UP's Portland to Chicago transcontinental route. North of Pocatello, volumes decline again. Two more UP lines are also in the Corridor. These run from Ogden to Pocatello,

[2] Gross ton-miles per mile are a measure of traffic density. One ton moved one mile is one ton-mile.

Idaho, and from Pocatello to Silver Bow, Montana. Both of these lines have significantly lower gross ton-mileage (with the exception of a short segment southeast of Pocatello).

Union Pacific has three main line routes that cross the Corridor. Mentioned before, one runs east-west between the Bay Area and Chicago via Salt Lake City and Ogden[3]; this route hosts Amtrak's California Zephyr intercity passenger service as well. Another UP route runs from Portland, Oregon to Granger, Wyoming via Pocatello; a short portion of this line from Pocatello east to McCammon is part of the CANAMEX rail corridor. A third parallels I-8 and I-10, and runs between Southern California and Texas via Tucson. This southern tier transcontinental line is connected to Phoenix from Picacho (west of Tucson) in the south; a connection to Phoenix from Welton in the west, however, is out of service. The southern tier main line hosts Amtrak's Sunset Limited intercity service. Each of these three main routes carry in excess of 40 million gross ton-miles annually.

Burlington Northern Santa Fe Railway

Also crossing the Corridor is the historic Santa Fe transcontinental line between Los Angeles and Chicago. The BNSF's southern tier route parallels I-40 and includes the segment between Kingman and Flagstaff. The route handles more than 40 million gross ton-miles annually, and hosts Amtrak's Southwest Chief intercity service. A branch line runs from the main line at Williams south to Phoenix. BNSF's northern tier route crosses the CANAMEX Corridor at Shelby, MT. This route hosts Amtrak's Empire Builder intercity service. The Montana Rail Link, which forms part of the CANAMEX rail corridor between Garrison and Helena, Montana, is an east-west line running between Sandpoint, Idaho and Huntley, MT. Known as a "bridge carrier", it connects with the BNSF at Sandpoint and Huntley. BNSF provides freight service via trackage rights on UP across Colorado, Utah, Nevada and California enroute between Denver to Stockton, CA.

A CANAMEX Rail Route

While there is no single, direct rail route through the entire length of the CANAMEX Corridor from Nogales, AZ to Sweet Grass, MT, a direct route does exist between Las Vegas and the Canadian border. The existing CANAMEX railroad route is made up of the following segments:

Nogales is linked with Phoenix via the UP. The route consists of three segments: Nogales to Tucson; Tucson to Picacho (on the UP's southern tier transcontinental main line); and Picacho to Phoenix. While volumes between Tucson and Picacho are heavy, they are comparatively light on the northern and southern segments. There are three potential rail routes that link Phoenix and Las Vegas. These involve the UP; the BNSF and the UP; and the Arizona and California Railroad, BNSF, and the UP. Unfortunately, all are circuitous in relationship to the CANAMEX Corridor.

[3] West of Salt Lake and Ogden, this route actually consists of parallel lines of the former Southern Pacific and Western Pacific railroads which were acquired by UP in 1996 and 1983 respectively.

A UP line exists between Las Vegas and Silver Bow, Montana. This segment consists of the UP transcontinental line between Las Vegas and Salt Lake City; a line between Salt Lake City and Pocatello; and a line between Pocatello and Silver Bow.

The Montana Western Railroad (MWRR), a “short line” (a local railroad having comparatively few total track miles) runs between Silver Bow and Garrison, MT. Annual ton-miles on this line are less than 5 million.

Montana Rail Link (MRL) is a regional railroad between Garrison and Helena. This line generates annual ton-miles of between 20 and 30 million. MRL handles some transcontinental traffic for BNSF, with which it connects at Sandpoint, ID and Huntley, MT.

The BNSF Montana Division exists between Helena and Sweet Grass, on the Canadian border. Annual ton-miles on this northern most section of the CANAMEX rail route vary, from 5 to 10 million, between Great Falls to Shelby, and less than 5 million ton-miles elsewhere.

FREIGHT ACTIVITY

The CANAMEX Corridor is active in freight operations between states and nations. Information supplied by Reebie Associates has been evaluated to provide an overview of Corridor freight movements. As potential Corridor treatments are defined, this database will be examined in more detail to provide additional insight into opportunities and impacts.

Tables II-14 through II-17 provide information on 1998 annual freight movements for the five study Corridor states for all freight movements (truck, rail, air and water) and for the two predominant modes – truck and rail, respectively. Figures II-14 through II-17 depict the railroads and amount of annual freight activity for each segment of the track.

Table II-14
1998 Annual Freight Movements – All Modes

Type Movement	Notes	AZ	NV	UT	ID	MT
Internal and/or To/From Other CANAMEX Corridor States	CANAMEX Corridor States are Arizona, Nevada. Utah, Idaho, and Montana	55%	63%	57%	63%	37%
To/From Neighboring States to the West	Oregon, Washington, California	14%	23%	20%	17%	11%
To/From Neighboring States to the East	Wyoming, North Dakota, South Dakota, Nebraska, Colorado, New Mexico	13%	2%	5%	6%	5%
To/From Canada/Mexico		4%	1%	1%	2%	6%
To/From Other States		14%	11%	17%	12%	41%
PERCENT OT TOTAL FREIGHT MOVEMENT		**100%**	**100%**	**100%**	**100%**	**100%**
TOTAL FREIGHT MOVEMENT (Millions of Tons)		**120.2**	**45.2**	**102.5**	**72.2**	**78.3**

SOURCE: Reebie Associates
Totals may not sum properly due to rounding

Table II-15
1998 Annual Freight Movements – By Truck

Type Movement	Notes	AZ	NV	UT	ID	MT
Internal and/or To/From Other CANAMEX Corridor States	CANAMEX Corridor States are Arizona, Nevada. Utah, Idaho, and Montana	69%	67%	75%	73%	77%
To/From Neighboring States to the West	Oregon, Washington, California	13%	22%	11%	14%	5%
To/From Neighboring States to the East	Wyoming, North Dakota, South Dakota, Nebraska, Colorado, New Mexico	3%	1%	4%	3%	5%
To/From Canada/Mexico		4%	0%	1%	2%	5%
To/From Other States		11%	8%	9%	9%	8%
PERCENT OT TOTAL FREIGHT MOVEMENT		**100%**	**100%**	**100%**	**100%**	**100%**
TOTAL FREIGHT MOVEMENT (Millions of Tons)		**93.8**	**36.9**	**62.4**	**53.5**	**35.7**

SOURCE: Reebie Associates
Totals may not sum properly due to rounding

Table II-16
1998 Annual Freight Movements – By Rail

Type Movement	Notes	AZ	NV	UT	ID	MT
Internal and/or To/From Other CANAMEX Corridor States	CANAMEX Corridor States are Arizona, Nevada. Utah, Idaho, and Montana	8%	44%	29%	35%	3%
To/From Neighboring States to the West	Oregon, Washington, California	18%	24%	35%	22%	16%
To/From Neighboring States to the East	Wyoming, North Dakota, South Dakota, Nebraska, Colorado, New Mexico	46%	9%	6%	17%	6%
To/From Canada/Mexico		2%	3%	1%	4%	2%
To/From Other States		26%	20%	29%	23%	72%
PERCENT OT TOTAL FREIGHT MOVEMENT		**100%**	**100%**	**100%**	**100%**	**100%**
TOTAL FREIGHT MOVEMENT (Millions of Tons)		**26.0**	**8.0**	**39.8**	**17.0**	**40.7**

SOURCE: Reebie Associates
Totals may not sum properly due to rounding

Table II-17 summarizes the percentage that each mode represents of freight movements by state.

Table II-17
1998 Annual Freight Movements By Mode

Mode	AZ	NV	UT	ID	MT
Truck	78%	82%	61%	74%	46%
Rail	22%	18%	39%	23%	52%
Air/Water	< 1%	< 1%	< 1%	3%	2%

PERCENT OT TOTAL FREIGHT MOVEMENT	**100%**	**100%**	**100%**	**100%**	**100%**
TOTAL FREIGHT MOVEMENT (Millions of Tons)	**120.2**	**45.2**	**102.5**	**72.2**	**78.3**

SOURCE: Reebie Associates
Totals may not sum properly due to rounding

As reflected in Table II-14, with the exception of Montana, roughly sixty percent of freight movements are "internal" to the CANAMEX Corridor or CANAMEX states. This freight is predominantly moved by truck (Table II-17)

INTERMODAL FACILITIES

The principal modes of surface transportation in the Corridor are the highways and rail lines. However, the intermodal facilities within the Corridor are also of importance. These "other" intermodal transportation facilities are the initiators and/or receptors of much of the freight served by the highways and rail lines. Several intermodal / transfer facilities exist along the CANAMEX Corridor. Since airports and port facilities are described elsewhere in this report, the definition of intermodal facilities for this section will be limited to rail intermodal facilities which include Container on Flat Car / Trailer on Flat Car (COFC/TOFC), grain elevators, bulk transfer and reload facilities. Focusing on the CANAMEX Corridor, only facilities within 50 miles of the Corridor are listed as part of the Corridor's facilities.

Intermodal rail facilities are locations where trailers and containers are interchanged or transferred between trucks and rail cars. For example, a trailer filled with consumer items arriving at an intermodal facility in Salt Lake City from Chicago is unloaded from a rail flat car and attached to truck tractor for a road haul to a Provo area distribution warehouse. The term intermodal is derived from the movement of the trailer from origin to destination by two distinct modes – rail and truck.

Intermodal facilities are distinct from traditional rail yards, where trains with a mix of different car types are sorted for final delivery to shippers' loading and receiving docks. With an intermodal shipment, shippers have their trailers and container delivered to an intermodal transfer facility. At the facility, they are loaded onto "unit trains" consisting solely of trailers and containers set on flat cars or double-stack cars[4], which are bound typically, but not exclusively, for major cities. Similarly, shippers pick up their trailers and containers at intermodal facilities at destination. Intermodal shipments have been growing at higher rates than traditional carload volumes on BNSF[5] rail lines. Intermodal revenue growth during the same period on Union Pacific declined as a result of severe service problems, which have since abated. These problems contributed to BNSF's higher intermodal revenues in the period.

The CANAMEX states offered different criteria for classifying grain elevators. The grain elevators listed here focus on large operations, which are significant to the regional economy. Idaho grain elevator intermodal facilities are those capable of handling more than 26-car trains.

[4] A double-stack car consists of up to five articulated units that can each hold two levels on containers, one on top of the other.
[5] BNSF intermodal revenues increased 21 percent during the same two-year period.

Montana grain elevators are those capable of handling more than 52-car trains. Grain elevators have the ability to store the grains and to combine and sort grains for outbound shipments.

The Federal Highway Administration (FHWA), Office of Intermodal and Statewide Programs, identification of intermodal facilities is limited to those facilities that generate large volumes of traffic. Some intermodal facilities in this study (specifically grain elevators) are not identified by the FHWA as Federal Intermodal Connectors (F.I.C.). The table notes which intermodal facilities in this study are also identified as Federal Intermodal Connectors by the FHWA.

Table II-18 describes the Intermodal facilities along the CANAMEX Corridor:

Table II-18
Intermodal Facilities

State	City	F.I.C.	Owner	Lift Capacity (Annual)	Location
Rail					
AZ	Phoenix	Yes	UP	60,000	Harrison St.
AZ	Phoenix	Yes	BNSF	134,000	Glendale
UT	Salt Lake City	Yes	UP	140,000	Beck St
UT	Sharp	Yes	UP	Coal Transload	
MT	Silver Bow	No	BNSF/UP	NA	German Gulch Rd
MT	Shelby	No	BNSF	21,000	BNSF Right-of-Way
MT	Sunburst	No	BNSF	Transload Service	
Grain Elevators					
ID	American Falls	No			
ID	Ashton	No			
ID	Bancroft	No			
ID	Bussell	No			
ID	Casmas	No			
ID	Collins	No			
ID	Idaho Falls	No			
ID	Inkum	No			
ID	Lincoln	No			
ID	Michaud	No			
ID	Newdale	No		(3 elevators)	
ID	Pocatello	No			
ID	Rockford	No			
ID	Tybee	No			
MT	Butte	No			
MT	Carter	No		(2 elevators)	
MT	Chester	No			
MT	Choteau	No			
MT	Conrad	No			

MT	Cut Bank	No		(2 elevators)	
MT	Dutton	No			
MT	Fairfield	No			
MT	Great Falls	No		(3 elevators)	
MT	Joplin	No			
MT	Rudyard	No			
MT	Shelby	No		(2 elevators)	

Source: Individual States participating in Western Transportation Trade Network (WTTN) Study

Other UP rail intermodal facilities near the CANAMEX Corridor include Denver, CO; Reno and Sparks, NV; Seattle, WA; Green River, WY; Nampa, ID; and Portland and Hinkle, OR. BNSF has other rail intermodal facilities near the Corridor at Denver, CO; Portland, OR; and Seattle and Spokane, WA.

PIPELINES

Natural gas pipelines parallel and cross the CANAMEX Corridor throughout its length. Some natural gas pipeline systems travel each of CANAMEX state. The pipelines vary in size up to 30 inches. The general route of these pipelines in the CANAMEX Corridor is shown in Figure II-18.

The Transwestern pipeline runs east-west through Arizona roughly paralleling I-40. The El Paso Natural Gas Pipeline also covers this route. Additionally, the El Paso Natural Gas Company has a transmission line which traverses the southern portion of Arizona along I-10.

The Kern River pipeline system generally parallels I-15 from California through Nevada and most of Utah. From Salt Lake City, the pipeline follows I-80 into Southwest Wyoming. Questar Gas Company has a series of pipelines that connect to the Kern River pipeline, and travel through the northeastern portion of the state along I-70 and I-80. The Overthrust pipeline extends from Salt Lake City along I-15 into Idaho.

Idaho is bisected by the Northwest Pipeline that exists from Montpelier to Ontario. This pipeline system follows US 30, I-86 and I-84 from east to west through the state. The Northwest Pipeline continues through the northeast corner of Oregon and on to Portland and Seattle. Idaho also has the Central portion of Pacific Gas & Electric's Western Pipeline system. This pipeline travels along the US 95 Corridor from Couer d' Alene to Kingspoint.

Montana has two main pipeline systems, but only one of these is in the CANAMEX Corridor.

INTERNATIONAL CUSTOMS OPERATIONS

International Customs operations in the CANAMEX Corridor exist at Nogales, AZ (Mexican) and Sweet Grass, MT (Canadian). Both of these sites have undergone improvements in recent years and are continuing to be enhanced. The goal of these enhancements is to make the process of moving goods though the border simpler and more efficient.

Both international border crossings are served by interstate highways (I-19, I-15) and rail access. The crossings connect with major highways in the adjacent countries. At Nogales, I-19 connects with Mexican Highway 15. At Sweet Grass, I-15 connects with Canadian Highway 4.

Nogales is the largest port of entry for winter vegetables in the United States. Commercial daily truck traffic at the Nogales Port of Entry varied from 400 to 1,200 vehicles per day in 1998 with the heaviest traffic occurring during the winter months. A total of 14.4 million passengers and pedestrians; 255,412 commercial trucks; and 34,485 rail cars crossed the border from Mexico in 1999.

The Nogales Port of Entry actually consists of three crossings. Nogales I (Dennis DeConcini) and Nogales II (Morley Gate) are located in the downtown area of Nogales, near the terminus of I-19. Nogales III (Mariposa) is located on SR 189 approximately 1.5 miles west of Nogales I & II. Nogales I has pedestrian, passenger vehicle, and rail access between Mexico and the United States. Nogales II is only a pedestrian crossing and is located immediately east of Nogales I. Nogales III serves commercial and passenger vehicles.

The US facilities at Nogales I were constructed in 1964 with a new facility constructed in 1994. The pedestrian crossing at Nogales II was constructed in 1924. Nogales III facilities were constructed in 1991.

Access to Nogales I and II is provided by Grand Avenue, which interchanges with I-19 at Crawford Street. Nogales III is accessed via SR 189 (Mariposa Road) which interchanges with I-19 approximately 3.1 miles north of the border crossing. Mariposa Road is a two-lane facility from Nogales III to I-19.

The Sweetgrass, MT Port of Entry is located at the terminus of I-15 in the United States and Canadian Highway 4. The port averaged 727 commercial and 1,900 total daily traffic trips in 1998. A Sweetgrass / Coutts Project in Commercial Vehicle Operations is designed to coordinate two different automated vehicle identification (AVI) systems used in the US and Canada. Projects planned as part of this study include a weigh-in-motion and coordinated weight station bypass criteria. Future phases will include coordinated ITS / CVO technologies, custom and immigration policies.

Recent / Planned Improvements

The International Ports of Entry continue to undergo improvements. In 1998, a "SuperBooth" and bypass lane for pre-cleared commercial vehicles were constructed at the Nogales III compound. A Cargo Search Vehicle Inspection System was completed in 1999.

The port has been undertaking the "Mariposa Cargo Redesign Project" to enhance screening of commercial vehicles. These improvements include a Drug Screening Area; Rapid Enforcement Lanes and designate enforcement section on existing docks.

In November 1999, Arizona applied for two projects under the TEA-21 Section 1118-1119 National corridor and Border Program. These projects are:

- ? Commercial Vehicle Port Intelligent Transportation System (EPIC 2) $875,000
- ? Commercial Vehicle Inspection Station Land Acquisition. $1,175,000

These applications are part of a facility improvement effort at Nogales III which has to date received $5.48 million in Federal grants.

A recent port efficiency study recommended redesign of the entrance and deployment of a Traffic Management System.

The lack of space available around Nogales III and congestion caused by custom agents processing paperwork on the Mexican side is hindering the speed at which trucks can be processed.

A study has been undertaken (January 2000) to determine the feasibility of new north-south, east-west connector road and I-19 frontage roads in Nogales. The north-south connector would provide new four-lane divided access from Nogales III to I-19.

At the Sweetgrass / Coutts Port of Entry, significant plans are currently being prepared for construction of a new joint border crossing facility. This project will construct a new joint facility for U.S. and Canadian operations. In addition to the $32 million Main Port Building, other facilities include a US Commercial Inspection Building and Secondary Inspection Building, Canadian Inspection and Tertiary Inspection Buildings. The projects are designed to reduce processing time and costs. The project will also provide commercial truck storage and parking. A weigh-in-motion system is also currently planned for the facility.

Recent grants to Sweetgrass include $700,000 for automated permit ports (APP), including equipment and facilities modifications at nine sites around the country, including the port-of-entry at Sweetgrass. The APP is an alternative inspection system to extend the hours when a person involved in the program may enter the United States. The program involves a photo-ID, personal identification number and voice recognition. An amount of $500,000 was granted to Sweetgrass for the CVO projects.

NATIONAL PARKS

One unique aspect of the CANAMEX Corridor is the number of National Parks, National Monuments, National Historical Sites, National Forests and National Recreational Areas surrounding the Corridor. The Corridor serves as a main access to numerous of these tourist sites and attractions. The parks, monuments and recreational areas in the five CANAMEX states are depicted in Figures II-19 and II-20.

The National Parks along or accessed by the Corridor include:

Saguaro National Park - AZ
Petrified Forrest National Park - AZ
Grand Canyon National Park - AZ
Zion National Park - UT
Arches National Park - UT
Bryce Canyon National Park - UT
Capitol Reef National Park - UT
Canyon Lands National Park - UT
Grand Teton National Park - WY
Yellowstone National Park - WY
Glacier National Park - MT
Waterton-Glacier International Peace Park - MT

Numerous other monuments, sites and areas include:

Tumacacori National Historical Park - AZ
Casa Grande Ruins Nation Monument - AZ
Tonto National Monument - AZ
Lake Mead National Recreational Area - AZ, NV
Pipe Spring National Monument - AZ
Las Vegas - NV
Cedar Breaks National Monument - UT
Grand Staircase Escalante National Monument - UT
Timpanogos Cave National Monument - UT
Golden Spike National Historical Site - UT
Craters of the Moon National Monument - ID

OTHER US CORRIDORS

Several other corridor studies have been undertaken to pursue the regional concept of trade and transportation. The studies have been undertaken to seek Federal funding for corridor improvements; coordinate transportation investments within a region; encourage regional economic development and to utilize freight transportation to depict how transportation needs are special, and should be addressed as such.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) designated twenty-one highway corridors of national significance. The CANAMEX Corridor (No. 26) was included in the eight additional "High Priority Corridors" listed in the National Highway Systems Designation Act of 1995. The Transportation Equity Act for the 21st Century (TEA-21) reaffirmed these corridors and added an addition 14, for the present total of 43.

The corridors most closely related to and in competition with CANAMEX Corridor are:

I-5 (High Priority Corridor No. 3);
Camino Real Corridor (CAMREAL) I-25 / I-90 / I-15 (27);

I-35 Corridor (23); and
Corridor 18 US 59 / I-69 (18).

Each of these corridors is a Mexico to Canada route, however each is progressing at different rates and with different degrees of effort and coordination between the states. These corridors are shown in Figure II-21.

The I-5 Corridor to the west and the Camino Real Corridor to the east are the main competition to CANAMEX in the region. I-5 Corridor is heavily used, somewhat congested and has significantly different corridor issues from CANAMEX. There is currently no coordinated effort between the states to develop neither the I-5 nor the Camino Real Corridor.

The six states containing the I-35 Corridor have developed a coordinated effort to move this trade corridor forward in the High Priority Corridor standings. I-35 is the only complete Mexico to Canada Interstate. The corridor also has a border crossing at Laredo, TX. Texas has been designated as the lead state, with all state departments of transportation in close coordination. A $1.5 million consultant study was undertaken for this corridor in 1998/99. The study evaluated existing conditions, determined alternate improvement schemes, screened these schemes and recommended viable alternatives to be followed by detailed evaluation. Iowa was the lead state on an ITS study in the corridor.

Corridor 18, named the 18th corridor in the original ISTEA legislation, has been expanded from its original Indiana to Tennessee route to include extension to the south, to a crossing to Mexico in the Lower Rio Grande Valley; and to the north, via I-69 to Canada. These extensions now make Corridor 18 a Mexico to Canada corridor. The corridor was officially designated I-69 in the TEA-21 legislation. Each of the eight states has appointed representatives to the Corridor 18 committee. Two preliminary studies, Feasibility and Special Issues, have been conducted. The Special Environmental Studies are currently underway. New highway alignment and widening of existing facilities will be required to complete the corridor.

Section III
TELECOMMUNICATIONS INFRASTRUCTURE

The CANAMEX Corridor Plan objectives include the identification of projects, programs and initiatives that will stimulate economic development and enhance economic opportunity in the communities traversed by the Corridor. In addition, the objectives include the identification of the most critically needed infrastructure projects within the Corridor, for the purposes of facilitating the safe and efficient movement of people, goods, services, and to plan for their development.

Certain key telecommunications technology issues have been identified for review in support of the achievement of these objectives including:

a) Rural area access to advanced telecommunications capabilities including broadband Internet access.

b) The investment of fiber optic cables in the highway right-of-way to stimulate high technology development.

c) The implications of E-commerce on the development of new distribution centers.

d) Cellular coverage “deadspots” along the Corridor highways which could pose a barrier to the use of cellular spectrum for commercial vehicle operation applications; and

e) Technologies in support of commercial vehicle operations such as Just-in-time (JIT), credentialing and safety monitoring.

This report addresses both wireline and wireless infrastructure and services. The inventory of wireline infrastructure addresses the availability of copper and fiber based technologies that provide for advanced telecommunications capability in the Corridor.

For the purpose of this report, advanced communications capability is defined to encompass communications of data at speeds equal to or higher than 256,000 bits per second (256 Kbps). This threshold is consistent with standard digital signaling practice[1] in the industry and is similar to a definition of advanced telecommunications capability already proposed by the Federal Communications Commission (FCC)[2].

---

[1] Signaling systems in digital communications are defined as multiples of 64 Kbps (equivalent to one pulse code modulated voice channel without compression) such as 256 Kbps (4 voice channels), 512 Kbps (8 voice channels) and 1.544 Mbps (24 voice channels , a DS-1 or T-1).

[2] In the Matter of Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable And Timely Fashion, and Possible Steps To Accelerate Such Deployment Pursuant To Section 706 of the Telecommunications Act of 1996, Report, CC Docket No. 98-146, February 2, 1999, the *Advanced Telecommunications Report* and In the Matter of Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable And Timely Fashion, and Possible Steps To Accelerate Such Deployment Pursuant To Section 706 of the Telecommunications Act of 1996, Notice of Inquiry, CC Docket No. 98-146, February 18, 2000, the *Advanced Telecommunications Notice of Inquiry*. The definition supports, in both the downstream and upstream directions, a speed in excess of 200 Kbps in the last mile.

The inventory of wireless infrastructure focuses upon the issue of cellular “deadspots” along the Corridor highways, spectrum in support of commercial vehicle operation applications and wireless technologies that may be used for advanced telecommunications capability, especially as it relates to local access. The next portion addresses the inventory of wireline networks and services that are considered relevant to the development of the Corridor Plan, including a background discussion of the related public networks, technologies and services. The final portion addresses the inventory of wireless networks and services including a preliminary discussion of emerging wireless technologies.

SUMMARY OF FINDINGS

The principal findings of this section are as follows:

1) That the availability of “last mile” access to advanced telecommunications capability as provided by Incumbent Local Exchange Carrier (ILEC) Digital Subscriber Line (DSL) technology is well developed in most major urban areas of the Corridor highway especially in Arizona, Nevada and Utah and that rural access is generally deficient throughout the Corridor.

2) That access to high speed fiber backbone transport as provided by a number of carrier network hubs is well developed in most of the major Corridor highway communities especially in Phoenix, Las Vegas and Salt Lake City but that the availability of fiber backbone transport capacity in the smaller Corridor highway communities remains unclear.

3) That cellular coverage in all urban areas of the Corridor highway communities is complete and that coverage along the Corridor highways is also complete with the exception of three specific highway segments: (a) the 130 mile section of U.S. 93 between Wickenburg and Kingman, (b) the 103 mile section of U.S. 93 between Kingman and Las Vegas, (c) the 240 mile section of I-15 between St. George and Spanish Fork, and (d) the 200 mile section of I-15 between Idaho Falls and Butte.

4) That nascent and emerging wireless technologies which may be relevant to the development of the Corridor Plan in terms of the issue of the availability of “last mile” access to advanced telecommunications capability include Multichannel Multipoint Distribution Systems (MMDS), Local Multipoint Distribution Systems (LMDS), General Wireless Communications Service (GWCS) and 39GHz service.

5) That nascent and emerging wireless technologies which may be relevant to the development of the Corridor Plan in terms of the issue of mobile communications in support of transportation applications include Personal Communications Service (PCS), Wireless Communications Service (WCS), Location and Monitoring Service (LMS), and spectrum specifically assigned to Intelligent Transportation System (ITS) services

WIRELINE NETWORKS AND SERVICES

Background

The Public Switched Telephone Network (PSTN) is a ubiquitous telecommunications network that has and continues to provide basic telephone service as well as quasi-universal telecommunications access, albeit at low speeds, to modern data networks such as the Internet. An understanding of the basic building blocks of this network is important if one is to inventory and subsequently assess the development of advanced telecommunications capabilities in the Corridor. The PSTN's architecture may be viewed as comprising three distinct yet integrated elements: the Access Network, the Switching Network and the Interoffice Transport Network.

The Access Network provides a service subscriber interconnection to a telephone voice switch located at a central location termed a Central Office via a twisted pair copper loop. The switches at the Central Offices are themselves interconnected via an interoffice network of copper and fiber based carrier systems. The hierarchy of switching offices may be termed the Switching Network while the interoffice transport system may be referred to as the Backbone Transport Network.

A similar architectural view may be applied to other telecommunications networks such as an Internet Service Provider (ISP) network or a specialized data network such as a Frame Relay network. Although these networks differ from the PSTN in the type of switching technologies used, they generally share common access and backbone transport technologies and infrastructure.

Our interest in this section lies mainly with the Access and Backbone Transport networks and technologies in the Corridor.

The Access Network and DSL

The Access Network is often referred to as the "last mile" in discussions of advanced telecommunications capability[3]. It is generally considered the major technical barrier to the ubiquitous deployment of advanced telecommunications via the PSTN given the limited bandwidth capacity of the local loop[4].

---

[3] The following discussion of the Access Network and DSL relies upon information provided in The DSL Source Book, Second Edition, Paradyne Corporation, available at www.paradyne.com.

[4] Bandwidth in telecommunications is a measure of the capacity of a channel. It is usually expressed in Hertz (Hz, cycles per second) for analogue channels and bits per second (bps) for digital channels or data applications.

The Access Network consists of local loops and associated equipment that connect a service user location to the Central Office. This network typically consists of cable bundles carrying thousands of twisted wire pairs to points where dedicated cable is extended out to the individual service users. Some service users are located a long way from the Central Office and require a very long local loop while others are closer. This affects the design of the loop since on very long loops the electrical signals dissipate energy as they traverse the loop, making the signals weak[5].

The major service provided by the PSTN is termed Plain Old Telephone Service (POTS). As a result, PSTN loops are generally designed to carry a voice conversation, which requires the lines to handle frequencies from 0 to 4 KHz. POTS service has historically supported only voice calls or data transmissions using modems at speeds commonly ranging from 9.6 to 33.6 Kbps, and more recently approaching the 56 Kbps range. Other services offered over the local loop include Integrated Services Digital Network (ISDN) services as well as T-1 service. Basic Rate ISDN offers a customer a number of options associated with a 128 Kbps access channel[6].

A copper loop can also be engineered and conditioned to provision T1 service[7]. However, special engineering design rules must be followed[8]. In the early 1990's, a variant of T-1 service, referred to as High Bit Rate Digital Subscriber Line (DSL), was developed. In this implementation the T-1 service was offered over two copper pairs[9]. Today, transceiver systems can achieve T-1 line speeds on a single loop at distances approaching two loop High Bit Rate DSL systems. This single loop implementation is often referred to as Symmetric DSL[10].

The next generation of DSL was termed Asymmetric DSL. Asymmetric DSL systems leveraged the fact that one can more reliably transmit a higher speed signal from the Central Office to the remote location than can be transmitted from the remote location to the Central

---

[5] Telephone companies found two primary ways to deal with long loops: the use of loading coils and remote terminals. Loading coils modify the electrical characteristics of the local loop allowing better quality voice frequency transmission over extended distances (typically greater than 18,000 feet). Remote terminals terminate signals at an intermediate point and aggregate and backhaul them to the Central Office The backhaul to the Central Office is usually via higher capacity digital circuits using copper or fiber technology.

[6] Basic Rate ISDN service is implemented using 80 KHz of the frequency spectrum. Its use of frequencies above 4 KHz prevents its use over loops with loading coils. In addition, special ISDN compatible interface cards must be installed at the Central Office to offer this service.

[7] T-1 service is the North American nomenclature for a DS-1 signal (1.544 Mbps). In some markets, the condition of the copper wire loops cannot be reliably engineered to support T1 services. In these cases, T1 services are provisioned using fiber optic cables. For example, T-1 transmission equipment cannot operate on loops that have bridged taps. A bridged tap is any portion of a loop that is not in the direct talking path between the Central Office and the service user's terminating equipment. It could be an unused cable pair at an intermediate point or an extension of the circuit beyond the service user's location.

[8] Traditional T1 transmission equipment used very simple modulation techniques that could only provide the service over relatively short distances. As a result, the implementation of T1 over longer loops required that the loop be broken down into multiple concatenated stages with electronic repeaters at intermediate points to detect and regenerate the signal for transmission down to the next stage.

[9] The technique split the 1.544 Mbps stream into two 784 Kbps streams in order to avoid the need for repeaters.

[10] T-1 4-wire HDSL loop reach is roughly 12,000 feet while single wire Symmetric DSL is roughly 11,000 feet.

Office[11]. Furthermore, the Asymmetric DSL implementation also recognized that many data applications, especially Internet access, are asymmetric in nature. For example, typical Internet users send a small stream of data to a distant server requesting the download of a particular data, graphic, audio or video file[12].

Finally, a further refinement addressed the particular characteristics of data applications, whereby they can run at a wide range of speeds as opposed to, for example, bit synchronous video which must run at a specified line speed[13]. Therefore with data applications, one has the option of reducing the line speed to allow the service to be provisioned over longer lines. This implementation was termed Rate Adaptive DSL[14].

In summary, the access network provides for varying information carrying capacities ranging from voice calls, video applications and large data transfers depending upon the deployed technology. The table below lists some example applications and their typical capacity requirements. We would note that with the exception of copper loop, all of these technologies, especially fiber, may also be used for backbone transport, as discussed in the next section.

Table III-1
Example Applications and Capacities

Example Technology	Example Application	Typical Capacity (bps)
Copper loop	POTS Modem dial-up (data)	56 Kbps
T-1 on copper	Point to point data Voice trunking (24 channels)	1.544 Mbps
DSL on copper	Data/Internet access	1 Mbps +
Fiber	Video transport (uncompressed) Voice trunking (672 channels) Backbone data transport (OC-1 +)	45 Mbps +

Fiber Backbone Transport

The backbone transport component of advanced land line infrastructure and services is dominated by fiber. In combination with Synchronous Optical NETwork (SONET) standards based transmission equipment[15], the fiber provides for a fast and reliable transport medium. For example, most Internet backbone networks rely upon fiber optic facilities for the transport of aggregated user traffic at speeds ranging from OC-1 to OC-192. The architecture of these

[11] This is due to the effects of a noisy Central Office environment as compared to the far end wire bundles.

[12] Some Internet applications such as File Transfer Protocol (FTP) may be symmetric.

[13] The only effect is that slower speeds take more time to transport large files.

[14] Rate Adaptive DSL transceiver technology support the option of allowing the transceiver to start up by automatically increasing the line speed to the highest attainable data rates that can be reliably achieved over a given loop.

[15] SONET transmission standards are based upon a set of Optical Carrier (OC) speeds which are all multiples of the OC-1(45 Mbps) rate. OC-3: 155.52 Mbps, OC-12: 622.08 Mbps, OC-48: 2.488 Gbps, OC-192: 9.9 Gbps. The OC-1 rate is equivalent to a Digital Signal 3 (DS-3) signal, which is equivalent to 28 DS-1 channels.

backbone networks is based upon major switching nodes interconnected with fiber transmission facilities.

The location of the major backbone nodes associated with these fiber networks is relevant to the development of the Corridor Plan in that it provides a strong indicator of a region's access to the de facto "on ramps" to high speed Internet backbone networks. It also provides an indication of a region's capability to attract major Internet portals or cyber centers. These centers are increasingly associated with Web site hosting, as well as application and networking services related to the Internet.[16]

Corridor DSL

U.S. West, Nevada Bell and Sprint are the major Local Exchange Carriers (LECs) in the Corridor. Nevada Bell's operating area is in the Carson City Reno area of Nevada, Sprint is in the Las Vegas area of Nevada and U.S West's serving area includes Arizona, Utah, Idaho and Montana. The availability of DSL services from the LECs is of particular relevance in assessing the availability of advanced telecommunications services in the Corridor area in that they provision the access facilities for most DSL service offerings in the Corridor. This section addresses the characteristics and availability of DSL as offered by U.S. West, Nevada Bell and Sprint as the basis for assessing its availability in the Corridor[17].

The DSL service offered by U.S. West is a good example of DSL service characteristics in that it provides for a number of options including subscriber and hub options designed for host locations such as Internet Service Providers (ISPs). The options are detailed in Table 1 below[18].

Table III-2
U.S. West DSL Service Options

U.S. West DSL Service Option	Speed (bps)
Subscriber Options	
MegaBit 256 Select or Deluxe	256Kbps
MegaOffice	512Kbps
MegaBuisness	768 Kbps
MegaBit	1 Mbps symmetric
	4/1 Mbps asymmetric
	7/1 Mbps asymmetric
Hub Option	
MegaCentral	1.5 to 45 Mbps

As outlined in **Table III-2**, subscriber upstream access speeds can range from 256 Kbps up to 1 Mbps and downstream speeds can reach up to 7 Mbps[19]. The DSL service is

[16] For example see BT, AT&T to Offer Cybercenters, Wall Street Journal, B-10, April 6, 2000.
[17] DSL is also offered by other smaller LEC's such as Citizens Telecommunications Company.
[18] U.S. West Data FAQs (visited April 5, 2000), www.u.s.west.com/products/data.dsl/faq.htm
[19] U.S. West uses Rate Adaptive DSL. The technology is discussed earlier in this paper.

offered using a standard copper pair phone line and a premise DSL modem. Both voice and data calls are shared on qualifying access loops[20].

The technology leverages the facilities of the existing PSTN such that data travels from the subscriber premise computer via the DSL modem to the corresponding DSL equipment located at the carrier's Central Office. From there the data travels to the carrier's backbone for delivery to the host ISP or other corporate host location.

DSL Service Availability

Table III-3 below summarizes DSL deployment in the Corridor states and the Corridor highway communities. Statewide deployment is expressed as a percent of local switches and as a percent of total access lines. The availability figures in the table simply reflect switch readiness and not actual served customers. A switch may be provisioned to offer DSL service however as discussed earlier some access lines may not technically qualify for the service and some customers may of course not choose to subscribe to the service.

The data in the table highlights how the availability of the technology as a percent of switching locations is significantly lower than its availability as a percent of access lines. This suggests that DSL service availability is more heavily weighted to urban locations where serving area subscriber density is much higher. The table also highlights the higher levels of penetration in Arizona, Utah and Nevada relative to Idaho and Montana. This is likely a reflection of the urban versus rural deployment phenomenon.

In terms of actual customers served, at the end of 1999, U.S. West announced that it had 110,000 DSL customers in its serving areas, which represented 10% of qualified on line households[21]. Although data was not obtained for Sprint and Nevada Bell, one would expect similar penetration levels in terms of percent of qualified lines.

The availability of DSL service access in terms of increased telecommunications capability for a subscriber is significant. As noted earlier, a typical local loop will provide for modem data speeds of up to 56 Kbps while DSL can easily provide for speeds of 1 Mbps and higher. On that basis, a 100 Megabit file download from the Internet can be received in approximately 1.6 minutes with DSL service while a traditional modem dial up connection will require close to 30 minutes. This size of file would normally be associated with video clips for example. In terms of specific applications such as telemedicine or distance learning, one would expect a requirement to transmit and receive files of this size or larger.

Table III-3
DSL Availability in the Corridor

State	DSL availability: Corridor Highway	Total Switches	DSL Capable Switches (Note 1)	Availability as Percent of	Availability as Percent of

[20] DSL technology is premised upon the use of higher frequencies on the copper pairs than those used for voice service. As a result, the technology cannot function on loops with bridged taps or on loops that are connected to the Central Office with remote digital terminals.
[21] See U.S. West Analyst News, February 2000, www.uswest.com:80/news/ind_analysis/, visited on April 6, 2000.

		in State (Note 1)		Access Lines (Note 2)	Switches
Arizona	Phoenix metro Tucson metro	153	50	82%	33%
Nevada	Las Vegas metro Mesquite Moapa Boulder City	106	49	Note 3	46%
Utah	Salt Lake-Ogden metro Provo-Orem metro	79	24	78%	30%
Idaho	Idaho Falls Pocatello	81	11	59%	14%
Montana	Helena Great Falls	72	3	30%	4%

Notes:

1. U.S West data on DSL penetration and switches in Network Disclosure #431, dated March 20, 2000 available at www.uswest.com/disclosures. Data on switches in the company's territory is available from the company's ICONN database available at www.us west.com/cgi-bin/iconn/iconn.pl. Nevada data on DSL penetration and switches is available at the State of Nevada, Office of the Attorney General, Bureau of Consumer Protection, LEC Database at www.governet.net/NV/LEC.
2. Calculated using the data referenced in Note 1. The calculation assumes that all access lines at a switch are technically appropriate for DSL, which is not the case. As noted earlier, loops with bridge taps and digital remotes cannot be used to offer the service.
3. There are over 1.2 million access lines in Nevada however the percent of these lines on DSL capable switches could not be calculated from available data. It is however estimated at over 80%.

DSL Deployment Evolution

All indications are that companies such as U.S. West, Sprint and Nevada Bell will continue to expand the availability of their DSL service offerings. For example, U.S. West's service expansion policy is described in its DSL product Frequently Asked Questions and is summarized as follows[22]:

> Many factors go into our deciding in which cities to deploy. The factors include, but are not limited to, the following:
>
> The concentration of host or MegaCentral locations being high in any given city. In order to financially justify deploying in a city, there must be ample "anchor tenants." These anchor tenants are large corporations that employ many people with high bandwidth needs as well as Internet Service Providers needing to offer their customers high speed access to the Internet… The number of phone lines served by a specific Central Office that meet the qualifications for MegaBit service. This includes but is not limited to the length of cable required to bring MegaBit service to a majority of customers as well any additional equipment that is used to provide voice grade telephone service to certain neighborhoods… Finally, whether the regulatory

[22] See www.uswest.com/products/data/dsl/faq.html/, visited on April 5, 2000.

environment in any given state is favorable or not to U.S. West deploying service also affects our decision.

U.S. West has also announced other programs that are expected to leverage the company's DSL strategy. For example, U.S. West has developed a Connecting OUR Communities Economic Teledevelopment program that appears to be designed to broaden community access to technologies and high speed networks[23]. One would expect that DSL is a prime candidate technology for this type of effort.

We would also note that the regulatory environment has changed to the point that Incumbent Local Exchange Carriers (ILEC) can no longer monopolize the access portion of the PSTN. For example, ILECs are required to "line share" with competitive carriers such that the competitive carriers can obtain access to the high-frequency portion of the local loop from the ILEC over which the ILEC provides voice services[24]. This type of regulation is expected to provide for a more rapid deployment of DSL based data services in the Corridor area.

To date, DSL technology has targeted data communications applications, such as high-speed Internet access and remote LAN connectivity. As a data transport service, DSL is well positioned between inexpensive analog dial-up service and expensive dedicated T1 service. The upcoming availability of Voice over DSL (VoDSL) access solutions should however provide Competitive Local Exchange Carriers opportunities to look at DSL from the perspective of a combined voice data solution for small and medium business customers.

VoDSL enables up to 14 telephone lines and high-speed Internet access to be delivered over a single DSL connection[25]. This technological development is expected to promote the penetration of DSL services in the business community and improve the business case associated with the deployment of the service.[26]

Fiber Transport in the Corridor

As noted earlier, the backbone transport component of advanced land line infrastructure and services is dominated by fiber. In combination with Synchronous Optical NETwork (SONET) standards based transmission equipment, fiber provides for a fast and reliable transport medium. The architecture of these backbone networks is based upon major switching nodes interconnected with fiber transmission facilities. These backbone networks are relevant to the study in that the location of major network nodes provide a strong indicator of a region's capability to attract major Internet portals or cyber centers as well as providing a measure of a community's access to high speed data transport.

---

[23] See State and Local Government Articles, Connecting OUR Communities, www.uswest.com/largebusiness/sl-archive/archive/story2_april00.html/, visited on April 6, 2000.

[24] See Action by the Commission November 18, 1999, by Third Report and Order (FCC 99-355).

[25] See Voice over DSL talk of the town, Tim Green, Network World, 04/10/00, Network World Fusion, www.nwfusion.com/news/2000/0410voicedsl.htm

[26] To date the revenue stream from high speed data services alone had to justify the cost of purchasing (or leasing) and co-locating DSL modems in the ILEC Central Office. With VoDSL, a Competitive LEC can now provide local telephone services over the same access line, generating additional revenues for a similar investment.

The ILEC's in the Corridor offer a number of services in selected urban locations that leverage their fiber backbone networks. ILEC switches are generally interconnected using fiber transport facilities for the transport of voice traffic. These same facilities can be used to offer advanced data transport services such as Asynchronous Transfer Mode services from DS-1 to OC-3 rates. For example U.S. West offers Asynchronous Transfer Mode services in selected service areas including Phoenix, Tucson, Pocatello, Helena, Salt Lake City, Ogden and Provo[27]. Similar high-speed data services are offered by Sprint in the Las Vegas area[28]. In addition, other backbone service providers, including ISPs, maintain their own owned or leased backbone networks.

The fiber backbone infrastructure in the Corridor may be assessed in terms of the extent to which the Corridor houses backbone hubs or nodes associated with non ILEC providers in addition to the services offered by the ILECs. This is considered a practical measure of fiber backbone presence in the Corridor in that these hubs are the de facto "on ramps" to high speed Internet based networks and services.

Corridor Fiber Networks

The major fiber optic trunk lines linking the CANAMEX Corridor are shown in **Figure III-1**. An inventory of the backbone networks is provided in **Table III-4** below. The service providers listed in the table include wholesale service providers, full service retail carriers, major national service providers, regional providers and ISPs. The table is constructed on the basis of Corridor highway hub presence and the providers' advertised fiber backbone cross-section capacity at the hub.

Table III-4
Corridor Fiber Backbone Presence

Corridor Hub	Backbone Networks	Capacity
ARIZONA		
Phoenix	Broadwing (note 1)	OC-192
	Qwest (note 2)	OC-48+
	Williams Communications (note 1), @Home, GST Telecom, PSI Net, PF Net, Touch America (note 3)	OC-48
	MCI WorldCom Advanced Networks	OC-12
	AGIS Global Information Services, GTE Internetworking	OC-3
	Frontier Global Center, Get Net, Electric Lightwave, Cable and Wireless, CERFnet, Winstar, IBM. MCI WorldCom UUNET, SAVVIS Communications	DS-3
Tucson	Qwest (note 2)	OC-48+
	Williams Communications (note 1), GST Telecom, PSI Net, PF Net	OC-48
	AGIS Global Information Services	OC-3
	Winstar	DS-3
NEVADA		

[27] See U.S. West, Network Disclosure Announcement No. 400, March 23, 2000. available at www.uswest.com/disclosures. Asynchronous Transfer Mode service is a fixed packet based service particularly well designed for multimedia signal transport including Internet IP data traffic.

[28] See the State of Nevada, Office of the Attorney General, Bureau of Consumer Protection, LEC Database at www.governet.net/NV/LEC.

Corridor Hub	Backbone Networks	Capacity
Las Vegas	Broadwing (note 1)	OC-192
	Touch America	OC-48+
	Williams Communications (note 1), GST Telecom, PSI Net, PF Net.	OC-48
	MCI WorldCom Advanced Networks	OC-12
	AGIS Global Information Services	OC-3
	GeoNet Communications, Epoch Internet, Cable and Wireless, Netcom, MCI WorldCom UUNET	DS-3
UTAH		
Salt Lake City	Broadwing (note 1)	OC-192
	Qwest (note 2), Touch America	OC-48+
	Williams Communications (note 1), PSI Net, PF Net, @Home (note 4), MCI Worldcom Advanced Networks	OC-48
	AGIS Global Information Services, McLeod USA (note 3)	OC-3
	Electric Lightwave, CERFnet, Winstar, MCI WorldCom UUNET	DS-3
Ogden	Qwest (note 2)	OC-48+
Provo	Qwest (note 2)	OC-48+
	AGIS Global Information Services	OC-3
IDAHO		
Pocatello	Qwest (note 2), Touch America	OC-48+
	McLeod USA (note 3)	OC-3
Idaho Falls	McLeod USA (note 3)	OC-3
MONTANA		
Butte	Touch America	OC-48+
	McLeod USA (note 3)	OC-3
Helena	Qwest (note 2), Touch America., Main Inc. (note 3)	OC-48+
	McLeod USA (note 3)	OC-3
Great Falls	Touch America, Main Inc.(note 3)	OC-48+
	McLeod USA (note 3)	OC-3
Sweetgrass	Touch America, Main Inc.(note 3)	OC-48+

Notes:
1. Wholesale service provider.
2. Includes U.S. West estimated capacity given the pending merger with Qwest.
3. The size of the carrier cross section has been estimated.
4. @ Home provides high speed connectivity to cable television undertakings.

The table expresses hub transport capacity in terms of SONET transmission speeds. As noted earlier in this paper, SONET standards are based upon a set of Optical Carrier (OC) speeds that are multiples of the OC-1 rate of 45 Mbps. The OC-1 rate is equivalent to a Digital Signal 3 (DS-3) signal, which is equivalent to 28 DS-1 channels. Accordingly, the OC rates are as follows:

OC-3: 155.52 Mbps
OC-12: 622.08 Mbps
OC-48: 2.488 Gbps
OC-192: 9.9 Gbps.

In terms of transport capacity, a good benchmark is provided by the capacity required to transport a commercial color television signal. An uncompressed commercial television signal would require a transport capacity of approximately 45 Mbps, which is equivalent to the OC-1 rate[29]. This transport capacity can of course be reduced significantly through the use appropriate video compression techniques to the point that a high quality signal can be broadcast over 1 to 15 Mbps channels[30].

In terms of the data transport capacity associated with of text or graphic files, the noted cross section capacities represent an enormous file transfer capability since these types of files are relatively small, typically measured in hundreds of kilobytes.

Subscriber access to these fiber transport capacities is through service provider access networks. As discussed earlier, the Access Network provides a service subscriber interconnection to a service provider switch located at a central location. The switches are themselves interconnected by Backbone Transport Network, which is discussed in this section in terms of fiber transport capacity.

As summarized in the table, major Corridor hubs are located in Phoenix, Las Vegas and Salt Lake City. In addition, most larger cities in the Corridor highway have at least two service providers present in their area. The table suggests that the larger communities in the Corridor highway are well served in terms of fiber backbone transport capacity. However, the access to and availability of fiber backbone transport capacity in the smaller Corridor communities remains unclear at this time since detailed information on other than the major network backbone access points is not readily available.

Although **Table III-4** does not identify the network inter nodal links, related maps have been accumulated from industry and public sources that illustrate most of the networks and their topologies[31]. The noted fiber network maps show that the referenced networks provide for links throughout the Corridor highway area with the exception of the U.S. 60/U.S.93 highway segment between Phoenix and Las Vegas and the I-19 segment between Tucson and Nogales[32].

Highway Rights of Way

A second issue associated with the Corridor backbone is the matter of the rights of way along the Corridor states highway systems. State governments are motivated to provide access to interstate rights of way in that the resulting deployed fiber may be used to support state government operations including the transport of signals associated with Intelligent Transportation Systems.

In late 1999, the FCC issued an order in the matter of a petition of the State of Minnesota for a declaratory ruling regarding an agreement to install fiber optic wholesale transport capacity in state freeway right-of-way[33]. The state asked the FCC to find the

---

[29] The analogue television signal has a bandwidth of 6 MHz, which translates into a 45 Mbps digital signal requirement.

[30] The Joint Motion Picture Experts Group (JPEG) and the Motion Pictures Experts Group (MPEG) have developed standards for video compression which allow high quality full-motion video to be transmitted at theses lower speeds.

[31] Network maps are available at most of the providers Web home pages. Maps were also purchased from industry market analysts. An overall consolidated view of the referenced networks has not been provided in this report due to the technical difficulty in presenting such an overview map considering the similar network topologies and service coverage areas and the large number of carriers.

[32] However ILEC facilities are most likely present in these areas.

[33] In the Matter of The Petition of the State of Minnesota for a Declaratory Ruling Regarding the Effect of Section 253 on an Agreement to Install Fiber Optic Wholesale Transport Capacity in State

agreement with a developer and an engineering company concerning access to certain rights-of-way to be consistent with Section 253 of the Telecommunications Act. The Agreement provided the developer with exclusive physical access for at least ten years to the rights of way along Minnesota's interstate freeway system. In exchange for the exclusive physical access to the rights-of-way, the developer committed to construct 1,900 miles of fiber optic transport capacity throughout the state and to provide the state with a portion of that capacity. The Commission ruled that Minnesota failed to demonstrate that the agreement neither prohibits nor has the effect of prohibiting the provision of competitive telecommunications services by certain entities and therefore preempted the agreement.

Accordingly, current initiatives associated with the installation of fiber capacity along interstate fiber rights of way, such as that being undertaken in Utah, must comply with FCC requirements related to open access for competing telecommunications service providers[34].

WIRELESS NETWORKS AND SERVICES

The following sections address a number of wireless networks and services that are considered relevant to the development of the Corridor Plan. Some are existing networks and services for which inventory information is provided. Others are nascent in their development but are nonetheless introduced as a backdrop to the discussion of emerging technologies that will follow in a separate paper.

Wireless networks and services can provide for solutions that address both the issue of access to advanced telecommunications capability in the "last mile" as well as the issue of support for commercial vehicle operations and Intelligent Transportation Systems (ITS) in general. Existing services and networks that may address mobile communications associated with transportation applications include Cellular Service and Personal Communications Service (PCS). Emerging networks that may reinforce the current services include other wireless services such as Wireless Communications Service (WCS) and Location and Monitoring Service (LMS), as well as spectrum specifically assigned to ITS services.

The issue of access in the last mile may be associated with existing wireless networks associated with Multichannel Multipoint Distribution Systems (MMDS) and Local Multipoint Distribution Systems (LMDS) as well as emerging technologies such as General Wireless Communications Service (GWCS) and 39 GHz service. The following sections provide a discussion of the above networks and services as well as an assessment of the existing network and service coverage as appropriate.

Cellular

Cellular radio telephone service operates in the 800 MHz frequency band. Competing cellular systems in each market share 50 MHz of spectrum (25 MHz for each system). A cellular system operates by dividing a large geographical service area into cells and assigning the

---

Freeway Right-of-Way, Memorandum Opinion and Order, CC Docket No. 98-1, December 23, 1999.

[34] The UTAH initiative is described in Report, Progress on "Digital State Goals", January 20, 2000 made available by Mr. David Moon, the Chief Information Officer of the Sate of Utah following a conference call on April 17, 2000.

same channels to multiple, nonadjacent cells. This allows channels to be reused, increasing spectrum efficiency. As a subscriber travels across the service area the call is transferred (handed-off) from one cell to another.

All the cells in a cellular system are connected to a Mobile Telephone Switching Office by landline or microwave links. The Mobile Telephone Switching Office controls the switching between the Public Switched Telephone Network (PSTN) and the cell site for all wireline-to-mobile and mobile-to-wireline calls. Each cell is served by its own transceiver and control equipment and is allocated a set of channels with adjacent cells assigned different channels to avoid interference. In total, the 25 MHz assigned to each cellular system consists of 395 voice channels and 21 control channels.

Cellular service was licensed by the FCC close to 20 years ago and is the most mature of the mobile wireless services in the Corridor. Traditionally offered exclusively using analogue signals, it is now also offered using digital modulation techniques[35].

The significance of cellular coverage for the Corridor Plan is related to the service's capability to support transportation applications associated with commercial trucking fleets as well as normal mobile service to travelers. It would appear that truckers are increasingly moving to cellular from satellite-based technologies for their telecommunications requirements[36]. Accordingly, the cellular coverage of interest is that provided along the Corridor highways. Urban cellular service coverage in the Corridor is for all practical purposes complete.

An inventory of the cellular service provider networks along the Corridor's highways is provided in **Table III-5**. The table is constructed on the basis of Corridor highway segments and a service providers' coverage in those segments. As illustrated in the table, most of the Corridor is well covered by cellular services.

Table III-5
Corridor Cellular Coverage

Corridor Segment	Service Provider	Coverage (Note 1)
ARIZONA		
Nogales/Tucson (65 miles, I-19)	Air Touch, AT&T, VoiceStream, Cellular One, Qwest (note 2)	Yes
	Sprint	Partial
Tucson/Phoenix (120 miles, I-10)	Air Touch, AT&T, VoiceStream, Cellular One, Qwest (note 2), Sprint	Yes
Phoenix/Wickenburg (55 miles, U.S. 60).	Air Touch, Cellular One	Yes
	Qwest	Partial

[35] Digital coverage is mainly provided in urban areas.
[36] This point was raised by ADOT staff in a meeting on February 10, 2000.

Corridor Segment	Service Provider	Coverage (Note 1)
Wickenburg/Kingman (130 miles, U.S. 93)	**Air Touch, Cellular One**	**Partial**
Kingman/Las Vegas (103 miles, U.S. 93)	**Air Touch**	**Partial**
NEVADA		
Las Vegas/St George (118 miles, I-15)	AT&T, Sprint	Yes
	Air Touch, PacBell	Partial
UTAH		
St George/Salt Lake (300 miles, I-15)	Air Touch, AT&T, Sprint	Yes
	Qwest, VoiceStream, CommNet	Partial
Salt Lake/ Brigham City (56 miles, I-15)	Air Touch, AT&T, VoiceStream	Yes
	AT&T	Yes
	Sprint, Qwest	Partial
IDAHO		
Brigham City/Pocatello (107 miles, I-15)	Air Touch, AT&T	Yes
	U.S. Cellular	Partial
Pocatello/Idaho Falls (53 miles, I-15)	Air Touch, AT&T, U.S. Cellular	Yes
MONTANA		
Idaho Falls/Butte (203 miles, I-15)	**Air Touch**	**Partial**
Butte/Helena (71 miles, I-15)	Air Touch	Yes
Helena/Great Falls (85 miles, I-15)	Air Touch	Yes
Great Falls /Sweetgrass (115 miles, I-15)	Air Touch	Yes

Notes:
1. The coverage data is available from service providers in the form of coverage maps. The coverage information was correlated to FCC cellular license data as a reasonableness check. There are approximately 1,150 cell sites in the Corridor states with a significant subset located in the Corridor highway. The FCC data is available at www.fcc.gov/wtb/database_info.html.
2. U.S. West cellular coverage.

A Corridor highway cell site's off highway coverage will vary depending upon the type of antenna and its height, the topography of the terrain and the cell site transmitted power. Off highway coverage could vary from a few miles to as many as ten to fifteen miles depending upon a particular carrier's network design and the geography of the area.

Highlighted segments in the table relate to Corridor sections with partial coverage. The three segments would require on site signal measurements to establish the details of the "deadspots" in the particular segment. The three segments are: (1) the 130 mile section of U.S. 93 between Wickenburg and Kingman, (2) the 103 mile section of U.S. 93 between Kingman and Las Vegas and (3) the 200 mile section of I-15 between Idaho Falls and Butte. The table also highlights that Air Touch is the only provider providing service throughout the highway Corridor[37]. This may be significant in that roaming charges could result in a service being considered uneconomical for a particular application such as commercial trucking.

Personal Communications Service (PCS)

[37] Other providers can of course also provide coverage through roaming agreements.

Personal Communications Service (PCS) encompasses a wide variety of emerging mobile and portable communications services. The PCS spectrum is divided into three broad categories, Broadband, Narrowband and Unlicensed[38].

Broadband PCS operates in the 2 GHz band of the electromagnetic spectrum with 120 MHz of spectrum assigned between 1850 and 1990 MHz. The spectrum is divided into six frequency blocks, half of which have a 30 MHz bandwidth and half a 10 MHz bandwidth. The system design for Broadband PCS system is similar to cellular, except that these systems operate exclusively in a digital format and are expected to use an entire family of new communications devices utilizing very small, lightweight, multi-function portable phones, portable facsimile and other imaging devices, new types of multi-function cordless phones, and advanced devices with two-way data capabilities.

A total of 3 MHz of spectrum has been allocated for Narrowband PCS, which is expected to be used for advanced messaging and paging. Narrowband PCS operates in the 900 MHz band[39].

A total of 20 MHz of spectrum has been assigned for Unlicensed PCS, which is expected to be used for short range communications such as local area networks in offices.

In the context of the Corridor Plan, PCS services may be expected to deploy as an extension of current digital cellular service and eventually analogue cellular. In fact, digital cellular offered in the 800 MHz spectrum is often termed PCS for marketing purposes since it offers similar services to those addressed by Broadband PCS.

Multichannel Multipoint Distribution Services (MMDS)

Multichannel Multipoint Distribution Service (MMDS) is associated with wireless spectrum blocks in the 2.1 to 2.7 GHz band. A total 33 channels, each with a 6 MHz bandwidth, are available[40]. Often referred to as "wireless cable," the service was originally licensed to permit the delivery of video programming to subscribers through microwave transmitting and receiving antennas. The assigned channels were assigned to provide a multichannel video programming service similar to cable television.

MMDS spectrum, until recently, supported one-way transmission only. Accordingly, any offered data services required a wireline telephone return path. The FCC however ruled in favor of MMDS licensees being able to offer two-way digital services with the result that MMDS providers may now offer 2-way high-speed data services[41].

In terms of a system's service coverage, the range of the transmission depends upon the transmitter power, the type of receiving antenna and the existence of a line-of-sight path between the transmitter or signal booster and the receiving antenna. Because the service

---

[38] See Personal Communications Service (PCS) available at www.fcc.gov.wtb/pcs/.

[39] Spectrum is allocated in the 901-902, 930-931, and 940-941 MHz bands.

[40] MMDS is a generic term that includes Multipoint Distribution Service (MDS) and Instructional Television Fixed Service (ITFS) licensees. MDS is assigned thirteen channels in the 2500 to 2686 MHz band. ITFS is assigned twenty channels in the same band. See MDS Fact Sheet at www.fcc.gov.mmb.

[41] See the Advanced Telecommunications Notice of Inquiry, Appendix A, page 3.

depends upon line-of-sight microwave signals, natural and man-made terrain obstructions, such as trees and buildings, can disrupt the transmission of the signal.

The relevance of this technology to the Corridor Plan lies in the service's capacity to provide an alternative to wireline access to advanced telecommunications capabilities in rural areas. Using digital modulation and compression techniques in combination with the large per channel bandwidth, MMDS should be capable of offering maximum data rates well in excess of 1 Mbps for Internet access applications.

The MMDS market is not currently well developed in terms of data applications however is expected to provide for a viable access alternative in the future. In the Corridor states, American Telecasting offers MMDS video service in Montana and Nevada but does not currently offer Internet access in these service areas[42]. Another provider, SpeedChoice provides a one way data service using a telephone line return path in the Phoenix market[43]. In addition, major carriers have acquired licenses from struggling licensees with a commitment to re-deploy their spectrum as broadband telecommunications services[44].

Local Multipoint Distribution Service (LMDS)

Local Multipoint Distribution Service (LMDS) operates in the 28/31 GHz band, representing 1.3 GHz of spectrum[45]. LMDS is a service capable of offering subscribers one or two-way broadband services, such as video programming, wireless local loop telephony, and high speed Internet access. An LMDS system consists of a multi cell distribution system with return path capability within the assigned spectrum. Generally each cell contains a centrally located transmitter hub, multiple transceivers and point-to-point links interconnecting the cell with a central processing center and other cells.

As with MMDS service, the relevance of this technology to the Corridor Plan lies in the service's capacity to provide an alternative to wireline access to advanced telecommunications capabilities in rural areas. LMDS is a nascent market whose evolution remains uncertain at this time. However it appears that Competitive Local Exchange Carrier that hold LMDS licenses plan to bundle local exchange services with high-speed data and Internet access services.[46]

LMDS licensees include Winstar and Touch America. In the Corridor, Touch America has licenses covering all of Montana and Idaho as well as partial coverage in North Central

---

[42] See American Telecasting Homepage at www.amtele.com. American Telecasting offers video service in the Corridor states at Billings, Montana and Las Vegas, Nevada.

[43] See SpeedChoice home page at www.speedchoice.com.

[44] For example, Sprint has acquired People's Choice TV. See The Advanced Telecommunications Notice of Inquiry, page 8.

[45] The service operates in two primary blocks. The A block allocation comprises: 850 MHz at 27.5 GHz, 150 MHz at 29.1 GHz, and 150 MHz at 31.075 GHz. The B block allocation consists of 150 MHz at 31.225 GHz. See LMDS Fact Sheet available at www.fcc.gov/wtb/auctions/lmds/lmdsfact.html.

[46] See In the Matter of Rulemaking to Amend Parts,1,2,21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, CC Docket No.92-297, Sixth Notice of Proposed Rule Making, FCC 99-379, December 13, 1999, Section IV, Deployment of LMDS, page 14.

Utah outside Salt Lake City[47]. Winstar advertises high capacity wireless broadband access in 45 markets nationwide[48].

Other Emerging Wireless Services

Other wireless services of interest to the development of the Corridor Plan include the Wireless Communications Service (WCS), the General Wireless Communications Service (GWCS), the 39 GHz service and the Location and Monitoring Service (LMS).

Wireless Communications Service (WCS)

The Wireless Communications Service (WCS) occupies the 2.3 GHz band of the electromagnetic spectrum[49]. The channeling plan provides for four frequency blocks with two licenses per block in 128 markets. The service is defined to provide fixed, mobile, radiolocation or satellite communication capable of providing more advanced wireless phone services. The WCS is expected to be used to provide a variety of mobile services similar to those expected to be provided by Broadband PCS. Licenses associated with the service were granted in July 1997. In the context of the Corridor Plan, similar to Broadband PCS, WCS services may be expected to deploy as an extension of current digital cellular service.

General Wireless Communications Service (GWCS)

The General Wireless Communications Service (GWCS) occupies the 4.6 GHz band of the electromagnetic spectrum[50]. The channeling plan provides for five frequency blocks of 5 MHz each. GWCS licensee may provide any fixed or mobile communications service except broadcast services (e.g. broadcast television and radio). Five licenses with ten year terms are expected to be awarded in each of the defined service areas following a spectrum auction whose date has yet to be announced. In the context of the Corridor Plan, this service may develop in the future as another wireless alternative to wireline for access to advanced telecommunications capabilities.

39 GHz Service

The 39 GHz Service occupies the 38.6 to 40.0 GHz band of the spectrum. The channeling plan provides for fourteen frequency blocks of 50 MHz each. A 39 GHz licensee may provide fixed communications including point-to-point and point-to-multipoint communications. Fourteen licenses with ten year terms are expected to be awarded in each of the defined service areas following a spectrum auction, which began in April of this year.[51] In the context of the Corridor Plan, this service may develop in the future as another wireless alternative to wireline for access to advanced telecommunications capabilities.

---

47 See Touch America Homepage at www.in-tch.com

48 We were not able to establish the Corridor markets serviced by Winstar however we estimate service in Phoenix and Tucson , both Winstar hub locations. See the Winstar home page at www.winstar .com.

49 WCS operates from 2305 to 2320 MHz and 2345 to 2360 MHz. See WCS at www.fcc.gov.wcs/wcsfctsh.html.

50 GWCS operates from 4660 to 4685 MHz. See GWCS Auction Fact Sheet at www.fcc.gov/wtb/auctions/gwcs/gwcs1fct.html.

51 See 39GHz Fact Sheet at www.fcc.gov/wtb/auctions/39ghz/39ghfact.html.

Location and Monitoring Service (LMS)

The Location and Monitoring Service (LMS) occupies the 904 to 928 MHz portion of the electromagnetic spectrum[52]. The channeling plan provides for three frequency blocks ranging from 2 MHz to 6 MHz in bandwidth. An LMS licensee may utilize the assigned spectrum, with non-voice radio techniques, to determine the location and status of mobile radio units. LMS systems are authorized to transmit status and instructional messages, either voice or non–voice, so long as they are related to the location or monitoring functions of the system.

One license for each of the frequency blocks was made available for auction in February 1999. Four small business bidders won licenses in a number of service areas. The FCC retains the remainder of the licenses. In the context of the Corridor Plan, LMS services may be used in the future to support commercial trucking operations or other location and monitoring transportation applications.

Intelligent Transportation Systems (ITS) Spectrum

In October of 1999, the FCC allocated 75 MHz of spectrum from at 5.850-5.925 GHz for use by Dedicated Short Range Communications (DSRC) systems operating in the ITS radio service[53]. The rationale for the frequency allocation is that DSRC systems are being designed that require a short range wireless link to transfer information between vehicles and roadside systems. Communications are the backbone of most ITS systems and many saw a need for spectrum for reliable short range wireless communications links between vehicles traveling at highway speeds and roadside systems. Licensing, service and channeling plans for the service have yet to be developed, however, the spectrum has been set aside for ITS applications.

[52] LMS operates from 904.0 to 909.75.0 MHz and 919.75 to 928.0 MHz. See LMS Fact Sheet at www.fcc.gov/wtb/auctions/lms/lmsfact.html.

[53] In the Matter of Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, Report and Order, ET Docket No. 98-95 RM-9096, October 22, 1999.

Considerations for the future

"Last Mile" Access to Advanced Telecommunications Services

The non availability of "last mile" access to advanced telecommunications capability is a reality in the Corridor rural areas. Solutions to this problem are expected to be provided by wireless based broadband technologies given the low subscriber density in rural areas and the sunk costs associated with wireline services.

Backbone Fiber Transport

The inventory of fiber networks clearly established the siting of major network hubs in most of the larger Corridor highway communities. However the access to and availability of fiber backbone transport capacity in the smaller Corridor communities remains unclear at this time since detailed information on more modest network backbone access points is not readily available.

It is also apparent that the rights of way along the Corridor states highway systems is a valuable asset associated with support of state government operations including the transport of signals associated with Intelligent Transportation Systems. Initiatives in this area are required to comply with FCC requirements related to open access for competing telecommunications service providers.

Cellular Coverage

Partial cellular service coverage along the Corridor highway has been identified in three specific areas. The three identified segments would require on site signal measurements to establish the details of the "deadspots" in the particular segment. The three segments are: (1) the 130 mile section of U.S. 93 between Wickenburg and Kingman, (2) the 103 mile section of U.S. 93 between Kingman and Las Vegas and (3) the 200 mile section of I-15 between Idaho Falls and Butte.

Intelligent Transportation System (ITS) Spectrum

The FCC has recently assigned spectrum to Dedicated Short Range Communications (DSRC) systems operating in the Intelligent Transportation System (ITS). The DSRC industry and related technology can therefore leverage this communications spectrum assignment for its continuing development.