Colorado State Roads and Highways

National Register of Historic Places Multiple Property Submission

OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
COLORADO HISTORICAL SOCIETY

NPS Form 10-900-b
(Revised March 1992)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places
Multiple Property Documentation Form

This form is used for documenting multiple property groups relating to one or several historic contexts. See instructions in *How to Complete the Multiple Property Documentation Form* (National Register Bulletin 16B). Complete each item by entering the requested information. For additional space, use continuation sheets (Form 10-900-a). Use a typewriter, word processor, or computer, to complete all items.

XX New Submission ____ Amended Submission

A. Name of Multiple Property Listing

Colorado State Roads and Highways

B. Associated Historic Contexts

The Historical and Technological Evolution of Colorado State Roads and Highways, 1861 - 2000
- Territorial and Pre-Automobile State Roads, 1861 – 1890
- The Automobile Age Begins, 1890 – 1930
- Good Roads Out of Bad Times: Depression and World War II, 1930 – 1945
- Postwar and Interstate Era, 1945 – 1973
- Completion and Augmentation of the State Highway System, 1973 – 2000
- Designing and Constructing Colorado Highways: An Engineering Context

C. Form Prepared by

name/title Robert Autobee and Deborah Dobson-Brown (additional material by OAHP)

organization Associated Cultural Resource Experts date January 10, 2003

street & number 8341 Sangre de Cristo Road, Suite 202 telephone 303-925-1095

city or town Littleton state Colorado zip code 80127

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation.
(See continuation sheet for additional comments [ ].)

State Historic Preservation Officer
Signature and title of certifying official — Date

Office of Archaeology and Historic Preservation, Colorado Historical Society
State or Federal agency and bureau

I hereby certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper — Date of Action

Table of Contents for Written Narrative

Provide the following information on continuation sheets. Cite the letter and the title before each section of the narrative. Assign page numbers according to the instructions for continuation sheet in *How to Complete the Multiple Property Documentation Form* (National Register Bulletin 16B). Fill in page numbers for each section in the space below.

E. Statement of Historic Contexts **Page number**

F. Associated Property Types

(Discuss the methods used in developing the multiple property listing.)

(List major written works and primary location of additional documentation: State Historic Preservation Office, other State agency, Federal agency, local government, university, or other, specifying repository.)

Primary location of additional data:

[ ] State Historic Preservation Office
[X] Other State Agency
[ ] Federal Agency
[ ] Local Government
[ ] University
[ ] Other
Name of repository: Colorado Department of Transportation

COLORADO STATE ROADS AND HIGHWAYS

IF WE TEAR UP THE ROAD BEHIND OURSELVES, HOW WILL WE KNOW HOW FAR WE'VE COME?

Introduction

There are few historic context studies of Colorado's roads and highways, in part because these transportation features remain functional and changing components of the modern landscape. With the exception of the Interstate highway system, nearly all of Colorado's highways were constructed in some form more than fifty years ago. Some modern highways have historical associations that began long before the automobile era, such as the portion of US Highway 50 that follows the Santa Fe Trail through southeastern Colorado. Other early highways later played a vital role in the state's history. State Highway 141 traversed the red mesas of western Colorado, serving both the federal government and private prospectors in the development of the nation's uranium and atomic industries during and after World War II. Some Colorado highways contain design features representing discrete time periods and methods of construction, such as the original concrete paving in segments of former U.S. Highway 85 near Aguilar, or the New Deal-era stone retaining walls paralleling State Highway 74 along Bear Creek outside of Morrison.

This context study focuses on the historical development of the Colorado state road and highway system. These are the state and federal roads and highways over which the Colorado Department of Transportation and its predecessor agencies have or once had authority for planning, construction or maintenance. The context traces the beginnings of intercity roads and presents the changing political, economic and engineering climate in which these roads became state and federal highways. Central to this story is the state highway department. This organization, through all its organizational and personnel incarnations, came to assume the primary role in planning, building, maintaining and operating the state's highway system.

This historic context does not include a discussion of roadside commercial or residential architecture. For example, the history and architecture of gas stations, diners and motels is not addressed. Substantial bridges are also excluded as these were extensively addressed in an earlier historic context, *Highway Bridges in Colorado*. Historic trails are covered briefly as antecedents to automobile roads and highways.

This study is not intended to be a complete history of Colorado highways, highway transportation, or the Colorado Department of Transportation and its precursor agencies. Rather, it focuses on roads and highways now or previously in the state highway system. It only briefly discusses roads and highways built or maintained by county and local governments. The state highway context is intended to provide information for the specific purpose of evaluating the National Register of Historic Places eligibility of Colorado state roads and highways.

Streets, Roads and Highways

Before proceeding, a few road-related definitions are in order.

Streets define the urban grid, whether as a handful of gravel lanes in a small town or multi-lane paved arterials in a large city. It is along streets that we build our houses, establish businesses, and erect our schools, parks, and civic structures.

Roads constitute the vehicular routes joining town to town, farm to market, and mine to industry. They also form the scenic drives where the route is more important than the destination. Road is the generic term for all intercity routes. A road may become a street, often Main Street, as it passes through one municipality on its way to another.

Highways are older roads improved and new roads constructed with a greater emphasis on speed, safety and carrying capacity. While some roads were organized into regional and even national routes, it is the highway that we most associate with a state and national system of vehicular routes whose design, construction and operation followed an increasingly uniform set of engineering standards.

The National Task Force for Historic Roads (NTFHR) was formed in the mid-1990s as an ad hoc organization seeking the participation of anyone interested in historic roads. NTFHR is part of the Rural Heritage Program of the National Trust for Historic Preservation. NTFHR's mission is to maintain the integrity, design, purpose, and use of historic highways in ways appropriate and responsive to modern safety needs. NTFHR promotes the recognition of historic roads. To better identify the historical use of the nation's roads, NTFHR established three classifications of historic roads: *cultural routes, engineered routes* and *aesthetic routes*. This study employs that basic classification system.

Cultural routes are legacies handed down from the first people to venture through a mountain pass or trek over the prairie. Cultural routes evolved through necessity or tradition. While these roads may have a documented date of origin, they developed without the intensive engineering and design practices associated with aesthetic and engineered routes. These may be roads that evolved from Native American trails, trade routes, or simply from convenient connections between villages. "Now in automobile use, cultural routes have generally undergone significant changes and modifications since their inception, often leading to multiple layers of development, providing interesting historical juxtapositions, and a challenge for preservationists. Generally the only original feature of these roads is the historic corridor through which they pass." Remaining roadside features such as lodgings and barns may provide clues to the history of the route—their spacing an indication of settlement and travel patterns. Road construction projects done at different times in the route's history may have left different layers of significant historic resources (Marriott, 1998: 16).

Engineered routes are roads designed for a specific transportation goal, such as the movement of people, goods and services. This type forms "the largest road category. Engineered routes, like aesthetic routes, have a documented origin or authorization and construction date. These roads may have been developed to open isolated areas to commerce, link the nation, or simply serve communities—roads for which the aesthetic experience was secondary. Their alignment and detail are important in their representation of technology and culture." Generally, speed, safety and economy determined the design. With passing time and changing use, many engineered routes have taken on aesthetic qualities and associations. The first transcontinental highways are typical of this category (Marriott, 1998: 13-14).

Aesthetic routes are roads designed for a specific interaction with the natural or built environment. The design and provision of a specific visitor experience constituted the primary rationale for the development of aesthetic routes. "Parkways and park roads have historically been intensively designed and developed for the purpose of leisure, recreation and commemoration. They have a documented origin and construction date. Never intended as the fastest or quickest route, such roads typically follow the natural topography of the region and are most often associated with a designed landscape or park space. In urban areas, park boulevards and monumental avenues exhibit an equally high level of detail and composition. Aesthetic routes are roads for which the alignment and details are key to the experience. Special materials, plantings, lighting, and even building facades contribute to the character of these roads. Alterations to any component of these roads (alignment, details and affiliated landscape) will significantly impact the historic integrity of the resource" (Marrriott 1998: 11)

These historic road classifications are not mutually exclusive. Cultural routes generally begin as trails or roads formed only by the repeated passage of thousands of feet and hundreds of carts

and wagons. Cultural routes tend to be widely defined as multiple paths weaving along a corridor, reacting to temporary changes in vegetation, water and other route obstructions. As these routes evolved into automobile roads, permanent alignments were defined and surface improvements made. Such alterations often destroyed much if not all of the original cultural route, leaving only the general historic corridor surrounding a newer engineered route.

Engineered routes, particularly those in the mountains, may have been constructed for the specific purpose of accessing mining districts. The very location of these roads bestowed upon many extraordinary scenic beauty. As the original mining activity waned, the use of these roads as aesthetic routes became paramount.

On roads initially designed as aesthetic routes, engineering changes generally occurred over time to accommodate greater numbers of automobiles traveling at higher speeds. Those wishing to understand the history of roads and highways must be prepared to peel back the layers of time to discern the evolutionary process. Evaluation of these resources requires an understanding of both the original and later uses, knowledge of changing transportation and construction technologies, and an ability to identify the character defining qualities of these various uses and technologies.

Topographic, Economic and Political Landscape

Colorado's climate and natural features challenge road builders in ways few states can duplicate. Extending nearly 400 miles from east to west and nearly 300 miles from north to south, Colorado is the nation's eighth-largest state. Dividing this nearly perfect rectangle is the continent's largest mountain range. The state counts nearly 1,500 peaks rising 10,000 feet or more in elevation. Colorado has a mean altitude of 6,800 feet—higher than any other state. Though Colorado's broad high plains, occasional sand hills, and isolated mesas do not receive as much publicity as the Rocky Mountains, each of these features defines the state's varying social and economic cultures (Writers' Program of the WPA, 1941: 4).

For much of the past 8,000 years indigenous peoples migrated over the region's prairies, mountains, and mesas. From the mid-fifteenth to the early nineteenth century, the Spanish and French laid claim to the region. Rumors of easily obtainable gold and silver stimulated adventurism but did little to encourage permanent settlement. By 1706, Spain claimed the eastern plains of modern Colorado and named the Province of San Luis. Spain subsequently transferred its massive trans-Mississippi River holdings to the French. Because of the Louisiana Purchase of 1803, the United States acquired from France that vast area including what is now most of eastern Colorado. Under orders of President Thomas Jefferson, Lieutenant Zebulon M. Pike and a small party of U.S. soldiers explored the southwestern boundary of the Louisiana Purchase during 1806-07 (Athearn, 1976: 1-2).

In Pike's wake, fur trappers followed to establish commerce on the far edge of America's territorial possessions. A number of New Mexico-bound fur traders crossed southeastern Colorado in the early 1800s and, a few years later, trappers like Jim Bridger made their way into the mountains in search of beaver pelts. Trading posts—known among trappers as forts—soon sprang up at the base of the foothills. Located on the lower Arkansas River near modern La Junta, Bent's Fort gained renown as a hub of frontier civilization during the 1830s and 1840s (Writers' Program of the WPA, 1941: 35).

The first permanent non-Native American settlement in Colorado occurred in the San Luis Valley. Hispanic settlers followed the Rio Grande valley north from New Mexico in search of pasture and farm land. They founded the placita of San Luis in 1851. The river valley formed a natural transportation route between the San Luis Valley, Santa Fe and Mexico.

Early transportation corridors linked varied landforms and people. The most well traveled route in the state is the corridor from the Wyoming state

line south to the New Mexico border along the edge of the foothills. With the exception of Grand Junction, most of Colorado's largest cities and towns came to hug the eastern foothills, or Front Range, of the Rocky Mountains along this corridor. Supported by the streams trickling out of the Rockies, the first Euro-Americans settled along the Front Range more than 150 years ago. For these fortune seekers the valleys leading into the mountains were the easiest routes to the next big gold or silver strike (Writers' Program of the WPA, 1941: 6).

The region's relative isolation disappeared once stories of gold discoveries made their way back east during the late 1850s. By the end of the decade, a miner from Georgia, Green Russell, discovered small placer gold deposits near the confluence of the South Platte River and Cherry Creek. Rumors and subsequent gold strikes did more than ignite a major population migration; they led to the establishment of the region's first Euro-American political organization. On November 6, 1858, a score of prospectors met and organized the gold fields scattered around Russell's find as Arapahoe County, Kansas Territory. Somewhat prematurely, the miners elected delegates to sit in both the territorial legislature and the U.S. Congress. The first immigrants also established Peoples' and Miners' Courts to quickly resolve personal clashes and mining claim disputes. In 1859, prospectors and settlers organized Jefferson Territory without sanction of Congress to govern the often-unruly gold camps. Within two years, the growing number of people coming to Colorado convinced the U.S. Congress to establish a territory along the boundaries of the present state. By spring 1861, President Abraham Lincoln appointed William Gilpin as Colorado's first territorial governor. By July, Colorado Territory organized its first Supreme Court and selected delegates to send to Congress. As the population grew to 25,371 in September 1861, the first Territorial Assembly met and divided Colorado into 17 counties (Writers' Program of the WPA, 1941: 42, 467-9).

Colorado's first legislators occasionally debated transportation issues and questioned how to connect the isolated region to the rest of the nation. In 1865, the Territorial Assembly passed an act regulating toll roads. Two years later, the Assembly voted to grant small appropriations toward road improvement. It would take another four decades—and the introduction of the automobile—before the state legislature directed any serious attention toward road and highway construction (Writers' Program of the WPA, 1987: 47).

The Colorado Highway Commission and Succeeding Agencies

The arrival of a new transportation technology in the form of the automobile persuaded state officials to take a greater interest in Colorado's roads. Throughout the first decade of the twentieth century, Colorado's prominent automobile owners lobbied the General Assembly to establish a state authority over highway construction and development. Swayed by the auto owners' high profile and financial prestige, the state legislature created the Colorado Highway Commission in 1909. Over the next ninety years, the General Assembly occasionally changed the commission's name and direction as a response to increased traffic volume and the ever-expanding role of the federal government in state highway construction. A winding route leads from the hopes of the first commission to the realities of today's Department of Transportation. Before investigating the history of Colorado's state highways, it is important to understand the development of the State's highway agency.

On May 5, 1909, the General Assembly created the Colorado Highway Commission (L. 09, Ch. 57). Appointed by Governor John F. Shafroth, the three-man commission of C.P. Allen of Denver, William M. Wiley of Holly, and Thomas H. Tully of Durango, selected James E. Maloney as the commission's first secretary and engineer. The commissioners first met in the State Capitol on January 17, 1910. Over the next twelve months, the commission gathered twenty-three times to map and plan the state's highway system (Merchant, 1955: 76). Operating with an initial budget of $50,000, the commission planned to conduct a general survey of the state's roads and apportion

state aid to the counties. According to the new law, no county would receive state aid unless it agreed to raise and expend an amount equal to twice the amount apportioned by the State Highway Commission (Hafen, 1931: 14).

The commissioners did the best they could with their initial $50,000, but the meager funding threatened to stop road construction in Colorado as soon as it started. By 1913, automobile clubs and other enthusiasts worked to put a $10,000,000 bond issue on the state ballot for constructing and improving highways. Most Coloradans had yet to own an automobile and voters rejected the initiative, many believing it to be a state subsidy for the rich. In spite of the loss at the ballot box, the General Assembly reorganized the State Highway Department in 1913 (L. 13, Ch.88). The Assembly authorized a number of precedents crucial to the department's development. Legislators established a continuing appropriation for state roads and dedicated all the accumulated money in the State's Internal Improvement Fund to state highways. The money from the Internal Improvement Fund increased the Highway Department's annual budget to $766,311. The 1913 reorganization also directed the governor to appoint a State Highway Commissioner. The commissioner would oversee road development and maintenance assisted by a highway advisory board, replacing the earlier highway commission. The measure also enacted the first laws regarding the registration and licensing of motor vehicles. Colorado's first license fee varied from $2.50 to $10 depending on the horsepower of the owner's car. The state and the existing sixty-two Colorado counties divided the collected licensing revenue (Hafen, 1931: 14).

Between 1914 and 1922, the General Assembly initiated a number of measures providing additional revenue solely for highway construction. In 1914, voters approved a half-mill state tax to build new roads. The State Highway Advisory Board distributed 50 percent of the tax money to counties and retained 50 percent for state highway expenditures. Five years later, the General Assembly levied an additional half-mill tax and introduced a gasoline tax. Colorado was one of the first four states to enact a gas tax. Originally set at one-cent-per-gallon, the tax grew to four cents a gallon by the end of the 1920s (Maloney and Reedy, 1929: 6-7).

State taxes helped fund small projects, but those involved with Colorado's highway program believed that the federal government should and would provide greater direction and money over time. Responding to the passage of the 1916 Federal-Aid Road Act, the following year the Colorado General Assembly transformed the State Highway Advisory Board into the State Highway Department. Under the Colorado Highway Act of 1917 (L. 17, Ch. 78), the Assembly established a fund strictly for the Highway Department's use. The new legislation also retained the office of commissioner, but changed the five-man advisory board to a five-man highway commission. This commission held the authority to approve new road projects (Colorado State Archives, c. 1975: 1).

In 1920, and again in 1922, voters approved multi-million-dollar bond issues to take full advantage of the Federal-Aid Road Act. The legislation provided matching federal funds to state highway commissions eager to build new auto roads. Only one in ten Coloradans owned a car in 1920, but approval of both measures reflected how in less than a decade the attitude of the state's voters had changed to support highway funding (Maloney and Reedy, 1929: 6-7).

In 1921, the General Assembly again reshaped and expanded the bureaucracy of the state highway authority. Colorado's legislators took this action in response to the federal Bureau of Public Roads (BPR) readiness to unite the nation's highway system. The BPR sought to establish and regulate a fully integrated network of highways eligible for federal aid. Under the 1921 law, Colorado established the office of state highway engineer as head of the department. The statute divided the state into seven districts with an advisory board member appointed from each district for a term of three years. The legislation gave the highway department responsibility for construction and maintenance of the state highway system.

The state would share highway maintenance costs with the counties (Maloney and Reedy, 1929: 6-7).

During the mid-1920s, the Highway Department derived revenues from five sources—federal aid, an internal improvement tax, a motor-vehicle tax, a gasoline tax, and a one-half-mill property tax (Weiser, April 1924: 7). By the decade's close, the state spent nearly $2.5 million annually on highways. After the federal government added matching funds to the state appropriations, highway funds roughly equaled a fourth of the state's total annual budget (Noel, 1987: 43).

Federal public works programs and a voter-approved bond issue kept construction going during the Depression years. In 1935, Colorado voters approved a $25,000,000 anticipation warrant for new road construction. The bond helped match federal highway funds before being paid off in the mid-1950s (Colorado Department of Highways, 1954: 12).

A post-war rush of people and cars to Colorado signaled the next transformation of the state highway bureaucracy. In 1952, the General Assembly created the Department of Highways replacing the State Highway Department (L. 52, Ch. 57). Colorado's governor appointed the chief engineer to serve as the chief administrative officer of the department. The state's chief executive also appointed an eight-member State Highway Commission that replaced the Highway Advisory Board. Serving staggered four-year terms, commission members represented eight different regions across the state (Colorado Department of Highways, 1954: 14).

The Department of Highways thrived during the Interstate highway construction years of the late 1950s and 1960s. In 1968, the General Assembly again passed legislation reconstituting the State Department of Highways (L. 68, Ch. 53). The 1968 act entrusted the Governor to appoint an executive director to head the department and transferred the State Highway Commission to the State Department of Highways. The law divided highway responsibilities within the department between two separate divisions—the Division of Highways and the Division of the Colorado State Patrol. Former Department of Highways personnel and the chief engineer transferred from the department to the newly created Division of Highways. In 1971, an amendment to the Colorado constitution (L. 71, Ch. 29) authorized the governor to appoint the Division of Highway's executive director and chief engineer (Colorado State Archives, c. 1975: 4). Over the next two decades, the only substantial change to this system resulted from the 1983 transfer of the Colorado State Patrol from the Highway Department to the newly created Department of Public Safety (Colorado Department of Transportation, 2000(a): 42).

Since the middle 1970s, the legislature occasionally considered bills to establish a state department of transportation designed to oversee highways, public transportation and aeronautics. After numerous bills died on the floor of the legislature, the Department of Highways was finally reincarnated as the Colorado Department of Transportation (CDOT) in 1991. The Transportation Commission manages the Department of Transportation through its executive director. The Transportation Commission is composed of commissioners representing eleven regional districts. The governor appoints each commissioner to a four-year term subject to state senate confirmation. Among its many duties, the commission formulates general policy regarding construction and maintenance of state highways and transportation systems, advising and making recommendations to the governor and the General Assembly relative to transportation policy, budgets and programs (Colorado Department of Transportation, 2000(a): 40).

By the century's close, CDOT received funding from four primary revenue sources: the state's Highway Users Tax Fund (HUTF), Senate Bill 97-001, the Federal Highway Users Trust Fund and miscellaneous funds such as interest, fees, and gaming revenue. The state transportation system's leading source of revenue is HUTF. Seventy-five percent of HUTF comes from motor fuel taxes with the remainder provided by motor vehicle registration and driver's license fees. Estab-

lished in 1987, revenue from HUTF grew an average of 2.8 percent per year during the 1990s, reflecting an increase in the number of registered motor vehicles (Colorado Department of Transportation, 2000(a): 31).

Since 1996, all state General Fund revenue allocated for transportation by the legislature goes directly to CDOT. This is not the case when allocating HUTF. Prior to distribution to CDOT, the legislature appropriates funds to other state agencies related to HUTF, including the Department of Revenue and the Colorado State Patrol. These appropriations to other agencies are referred to as "off-the-top" deductions. The remaining funds are then allocated among the cities, counties, and CDOT. In state fiscal year (FY) 2000, HUTF totaled $715 million, of which $398 million was made available to CDOT. Between 1987 and 1999, the percentage of state revenue directed toward transportation increased from 48.5 percent to 69 percent. In 1987, 48.3 percent of CDOT revenue came from federal sources. Legislative measures directing more General Fund revenue toward transportation resulted in a decrease in the federal portion to the state's transportation budget to 31 percent by the close of the 1990s (Colorado Department of Transportation, 2000(a): 31).

Another important source of funding resulted from the passage of Senate Bill 97-001 in FY 1997. Effective July 1997 (and originally scheduled to end in 2002), SB 97-001 allocated 10 percent of the proceeds from sales-and-use taxes to the State Highway Funds. This is the estimated amount of sales-and-use taxes generated by the sales of motor vehicles and related items such as tires and batteries. In FY 2000, CDOT received $609.8 million in state funds for transportation (Colorado Department of Transportation, 2000(a): 31-2).

Colorado still receives a substantial amount of funding from the federal government. In 1998, the U.S. Congress passed the Transportation Equity Act for the Twenty-first Century (TEA-21). CDOT expected to see a significant increase in its budget resulting from this legislation. In FY 2000, Colorado received $311.3 million in federal highway funds. In addition, CDOT received $6.6 million in supplemental federal transit funds. Combined with monies from the state, CDOT's budget in FY 2000 totaled $960.3 million (Colorado Department of Transportation, 2000(a): 32-3).

EARLY TRAILS AND WAGON ROADS IN COLORADO PRE-HISTORY – 1860

Native Trails and the Routes of Exploration

Over Colorado's prairies and mountains, layers of asphalt now cover many of the pathways first cut centuries ago by the region's indigenous peoples. These were the state's earliest cultural routes. The transformation of Colorado's trails into highways is an important historical theme. The Utes established several routes that later became important highways. Nearly 1,000 years ago, the Utes traced a path over the Continental Divide between today's Estes Park and Middle Park. Subsequent explorers, trappers, and settlers followed the same route later known as Trail Ridge. In 1933, a new highway across the ridge in Rocky Mountain National Park assumed the name Trail Ridge Road, a part of US 34 (Buchholtz, 1983: 176).

Other modern highways that trace their lineage back to the Utes include a portion of US 24, crossing the Rockies west of Colorado Springs to South Park, the trail over 10,032-foot Cochetopa Pass that is today's State Highway 114, and US Highway 160 from South Fork over Wolf Creek Pass to Pagosa Springs (Long, 1953: vi).

In 1540, the Europeans first arrived in Colorado. Twenty-two members of a scouting party from the expedition under the command of General Don Francisco Vasquez de Coronado wandered across southeastern Colorado in search of the Seven Cities of Cibola. Over the next one hundred and fifty years, the Spanish struggled to control the Pueblo Indians and other native tribes prevented colonization beyond Santa Fe, the capital of New Spain's province of New Mexico. In 1694, Governor Don Diego de Vargas led an expedition north from Santa Fe along the course of today's US Highway 285. During the 18th century, conquistadors and friars followed their own routes through the San Luis Valley. Spanish trailblazers Juan de Ulibarri, Fathers Silvestre Escalante and Francisco Dominguez, and Don Juan Bautista de Anza all left descriptions of Colorado's geography, plants, and wildlife (Christensen, et. al, 1987: 48).

While the Spanish built roads in California and New Mexico, they never launched similar efforts in Colorado. To the conquistadors and priests, the land north of Santa Fe was too wild, too distant, and seemingly lacking in desirable resources.

Emigrant and Trade Routes

In the five decades following Major Stephen Long's 1820 expedition across the Colorado plains, subsequent sojourners followed along important immigrant trails, including the Santa Fe, Cherokee, Smoky Hill, and Overland. The latter two trails brought the greatest numbers. The Smoky Hill Trail originated in Leavenworth, Kansas, and led west through present day Cheyenne Wells, Hugo, Limon, Bennett and Denver. The Overland Trail ran southwest along the southern bank of the South Platte River from present day Julesburg to Greeley before following the Cache La Poudre River northwest to LaPorte (Wiley, 1976: 2-3). A branch later reached Denver. The mountain man era concluded abruptly by the late 1850s with the mass migration of the first gold-seekers' wagons. In 1860 alone, nearly 70,000 adventurers survived raiding parties, inclement weather, starvation, and drought to take a chance on finding gold—following routes first utilized by the trappers and traders. Many emigrant and trade routes live on as the alignments of several major state automobile highways.

Santa Fe Trail

For much of the nineteenth century, the nation headed west on the Santa Fe Trail. The trail served as the primary route between St. Louis, Missouri, and the outpost of Santa Fe, New Mexico. The trail's history began in the late summer of 1821 when a trading party led by William Becknell left Missouri and ventured through southeastern Colorado. In November of that year, Becknell and

his party reached Santa Fe and established a caravan trade that lasted more than forty years (Moody, 1963: 186). The trail linked New Mexico, the trading posts along the Arkansas River and the markets of the Missouri Valley.

In 1833, William and Charles Bent, along with Ceran St. Vrain, began operating a trading post, Bent's Fort, on the Arkansas River and in so doing, added a new chapter to the history of the Santa Fe Trail. By the early 1830s, Becknell's original route had fallen into disuse, resulting from attacks by Kiowa and Comanche tribesmen incensed by the increasing number of outsiders trespassing on their land. Traders seeking a safer way to Santa Fe established the northern, or "Mountain Branch" of the Santa Fe Trail. Though nearly one hundred miles longer, the northern route by way of Bent's Fort lessened the likelihood of Indian attack. In addition to safety, the new route followed the Arkansas River and Timpas Creek that provided water for travelers and their stock. The Santa Fe Trail fell out of favor with the arrival of the railroad in the late 1870s. As the automobile supplanted the train in the twentieth century, the Santa Fe Trail became a part of the legend of the American West. The cultural route lives on as a way west in the alignment of two primary Colorado highways—US 50 and 350 (Moody, 1963: 209, 220).

Cherokee Trail

Nearly as well traveled as the Santa Fe Trail, but not as storied, is the Cherokee Trail. During the mid-eighteenth century, French explorers followed the trail into central Colorado. Subsequent men of commerce and adventure began their journey along the Cherokee Trail from the Arkansas River near today's Arkansas-Oklahoma border. Tracing the path of the Santa Fe Trail, once in Colorado the Cherokee branched off at La Junta. From there, the Cherokee continued up the Arkansas River, followed Fountain Creek to Colorado City, and then on to the area of Denver before passing through Virginia Dale to Wyoming. The trail reached its conclusion in the California gold fields surrounding Sacramento (Long, 1953: 125).

With the discovery of gold in Colorado, the Cherokee Trail formed the southern route to the gold fields. US Highway 50 now follows the route of the trail from the Kansas border to the east side of Fountain Creek at Pueblo. In the mid-nineteenth century, a stage road continued north along the west bank of Fountain Creek to Colorado City. A half-century later, the original alignment of the Great North-South Highway (subsequently US Highway 85 and now Interstate 25) followed the general alignment of the stage route through this section of southern Colorado (Long, 1953: 138).

Smoky Hill Trail

Three branches comprised the Smoky Hill Trail—North, Middle, and South. During Colorado's gold rush era, most would-be prospectors followed the Middle Smoky along the Smoky Hill River out of Kansas through Old Cheyenne Wells (north of the current town of Cheyenne Wells) in Colorado and onto Denver. Though the most direct route to gold camps, the Middle Smoky was known to pioneers as the "Starvation Trail." During its heyday in the 1860s, the Middle Smoky measured more than ten miles wide. The trail traced the contours of the prairie as it followed the flat lower ground while avoiding the surrounding sand hills (Long, 1953: 21). Exposed to all the elements, many people died from hunger and thirst along this route. Three modern highways roughly follow the Smoky Hill Trail through Colorado: US Highway 40 from the Kansas border to Limon; State Highway 86 from Interstate 70 exit 352 west to Elizabeth; and State Highway 83 from Parker to Denver (Long, 1953: 20, 27-36).

Overland Trail

Coming out of Nebraska, the Overland Trail ascended the south bank of the South Platte River as it entered northeastern Colorado. Through northern Colorado, both the Overland and the Oregon Trails followed the same path before separating at the Upper California Crossing near Ovid. The Overland continued along the south bank of the South Platte into Denver. The modern alignment of both US 138 and US 6 in northeastern Colorado follows the general course of the Overland route (Long, 1953: 170).

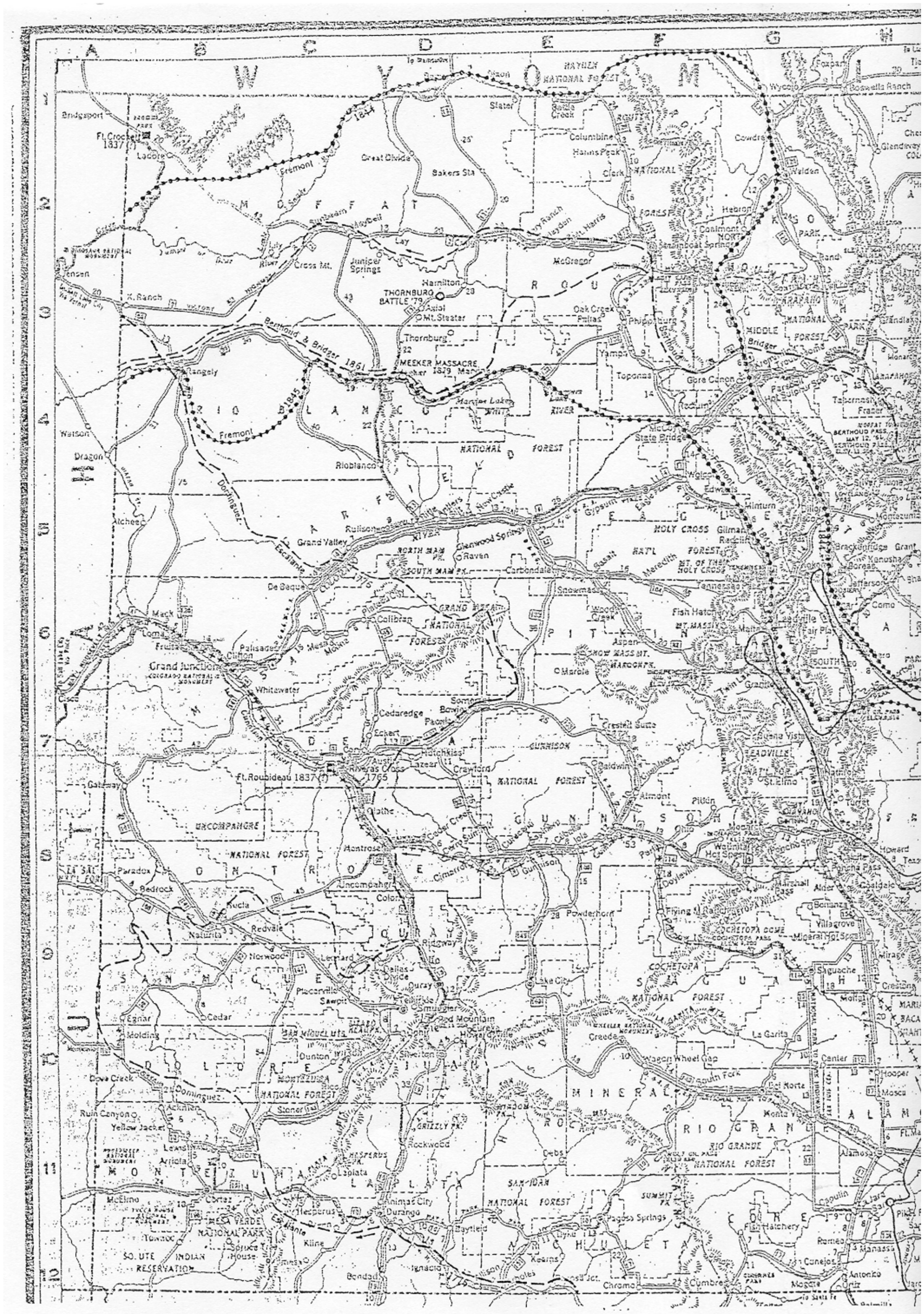
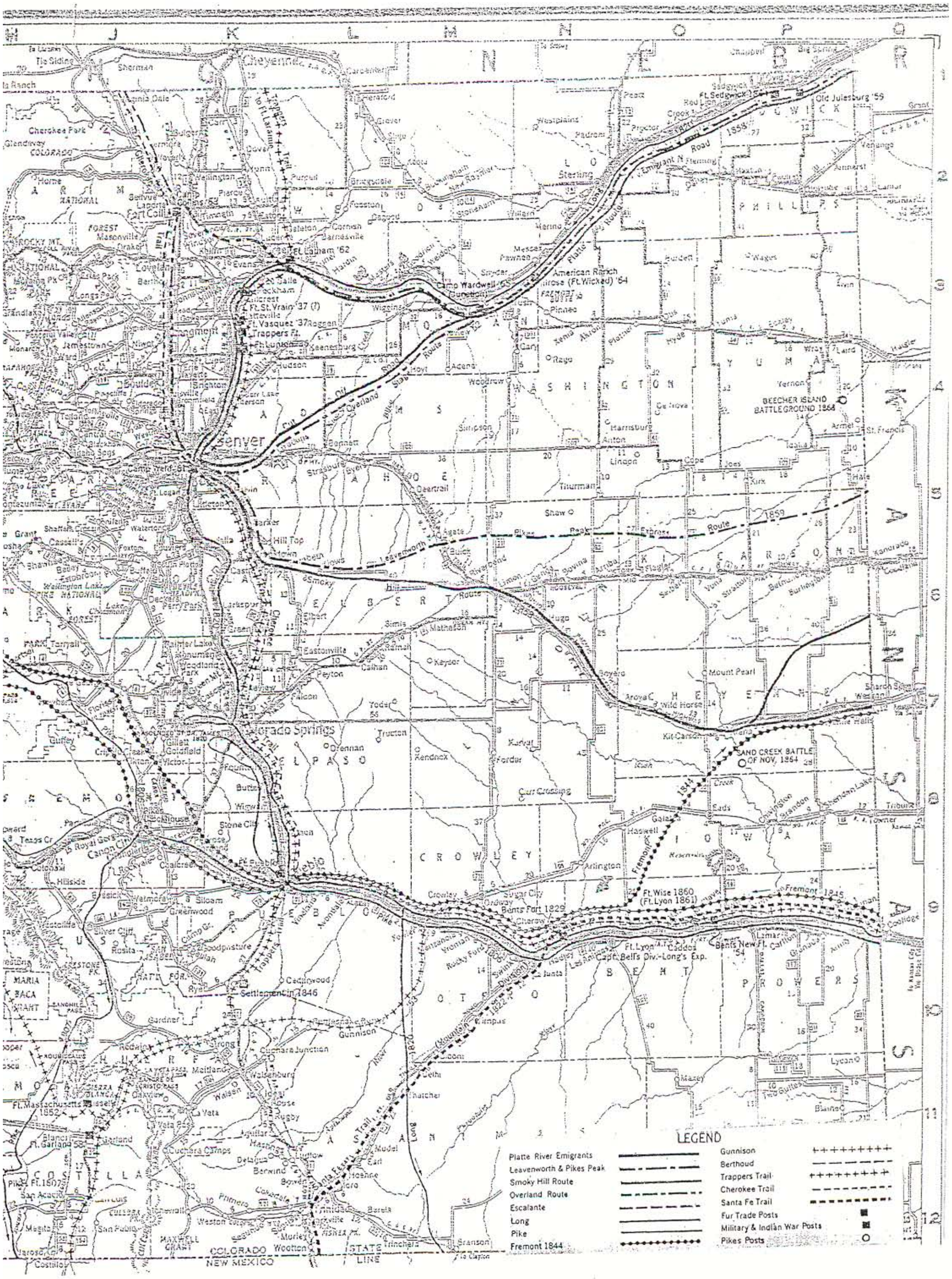

Grand Junction
Glenwood Springs
Rangely
Meeker Massacre
Thornburg Battle '79
Montrose
Durango
Ouray
Telluride
Silverton
Gunnison
Leadville
Walden
Steamboat Springs
Craig
Delta
Cortez
Rifle
Aspen
Lake City
Creede
Del Norte
Monte Vista
Saguache
Pagosa Springs
Mesa Verde National Park
Ft. Roubideau 1837
Ft. Crockett 1837
Uncompahgre National Forest
Gunnison National Forest
Routt National Forest
Holy Cross National Forest
Rio Grande National Forest
San Juan National Forest
Montezuma National Forest
Grand Mesa National Forest
Cochetopa National Forest
Hayden National Forest
Berthoud & Bridger 1861
So. Ute Indian Reservation

Figure 1.


LEGEND
Platte River Emigrants
Leavenworth & Pikes Peak
Smoky Hill Route
Overland Route
Escalante
Long
Pike
Fremont 1844
Gunnison
Berthoud
Trappers Trail
Cherokee Trail
Santa Fe Trail
Fur Trade Posts
Military & Indian War Posts
Pikes Posts
Cheyenne
Denver
Colorado Springs
Pueblo
Sterling
Old Julesburg '59
BEECHER ISLAND BATTLEGROUND 1868
SAND CREEK BATTLE OF NOV. 1864
Ft. Wise 1860 (Ft. Lyon 1861)
Bents Fort 1829
Settlement in 1846
COLORADO
NEW MEXICO
STATE LINE

From the late 1850s into the mid-1860s, wagons and stages followed a bypass of the Overland Trail known as the Fort Morgan Cutoff. Situated on a diagonal line from Fort Morgan to Denver, the cutoff shaved forty miles off the journey. Built on heavy sand that stage and freight wagons could not have handled, modern US Highway 6 is approximately forty miles west of the Fort Morgan Cutoff (Long, 1953: 193).

From Denver, the Overland Trail turned north following the west bank of the South Platte. Today's Interstate 25 duplicates the alignment of that portion of the trail. The trail swung west of Fort Collins to LaPorte before eventually crossing the Wyoming state line. That divergence from LaPorte to Wyoming is today's US Highway 287 (Long, 1953: 211).

Trapper's Trail

The Trapper's, or Taos, Trail ran north from Taos, New Mexico, to Fort Garland along the San Luis Valley. Colorado State Highway 159 roughly follows this alignment. The trail continued northeast over La Veta Pass to the base of the Front Range before turning north. During the mid-nineteenth century, the Trapper's Trail divided at the Huerfano River with one branch following the river to Fort Reynolds, nineteen miles down the Arkansas River from Pueblo, while the other branch turned toward Pueblo. The Pueblo branch then headed north to Denver. Once in Denver, the trail followed a route roughly paralleling today's Kalamath Street. After departing the banks of the Cherry Creek, the Trapper's Trail eventually crossed the border into Wyoming near Cheyenne (Long, 1953: 147-9).

Military Roads and Federal Involvement

From the 1820s to the Civil War, the federal government and United States military assumed an increasing role in locating new routes over the mountains and beyond. The federally sponsored expeditions of Lewis and Clark, Lieutenant Zebulon Pike, and Major Stephen H. Long began the process of mapping the West. In subsequent decades other military parties led by Lieutenant John C. Fremont and Captain John Gunnison gave the American people more detailed information about the far-off Rockies. Their reports, however, did little to inspire mass migration westward (Athearn, 1976: 2).

The 1848 Treaty of Guadalupe-Hidalgo concluded the war with Mexico and placed the Rocky Mountains in the hands of the United States. In the late 1840s and early 1850s, the United States Army Corps of Topographical Engineers, led by Captain Howard Stansbury, surveyed potential supply routes across Colorado, Utah and Wyoming. Stansbury's officers, John C. Fremont, John Gunnison and Edward G. Beckwith, recorded their observations and experiences as they made their way through the mountains. Portions of US Highway 50 follow Gunnison's route west of the Continental Divide (Sprague, 1964: 146-150).

Congressional passage of the Kansas-Nebraska Act in 1854 is most often remembered as the opening chapter of the Civil War. Nearly forgotten is the act's initiation of federal direction and funding for roads in Colorado. Under the legislation, Congress placed much of the land later to become Colorado under the jurisdiction of the Nebraska and Kansas territories. In 1855, the federal government detailed plans to build trails and improve existing routes in both Kansas and Nebraska. Congress authorized $50,000 for improvements to the road between Fort Riley, Kansas, and Bent's Fort. On this military road, soldiers conducted surveys and escorted the civilian construction parties who cleared and improved the route (Tate, 1999: 56).

Although preoccupied by the Civil War, the federal government continued to survey trails and establish wagon routes over the Rocky Mountains. In 1861, Captain Edward L. Berthoud and his guide, Jim Bridger, conducted a survey through the Rockies in search of a route to Utah Territory. Traveling north from the headwaters of Clear Creek in May, Berthoud's party recorded a pass through the mountains. In September, Berthoud's report to the U.S. Army described a 413-mile route from Clear Creek to Salt Lake City. It took another thirteen years before the first stagecoach

conquered the 11,315-foot high pass named in Berthoud's honor (Sprague, 1964: 185-7).

One post-Civil War military route of note is still in use today across remote northwestern Colorado. Between 1880 and 1884, the U.S. Army built the Government Road (now known as State Highway 13) to protect settlers in the wake of the Massacre of 1879. The original Government Road ran from Ft. Steele in Wyoming to the San Juan Mountains in southwestern Colorado (McNess, et all, 1995).

Mining and Stage Roads

The gold rush of the late 1850s brought stagecoaches to Colorado's Front Range communities and on into the mountain mining camps. In the spring of 1859, the Leavenworth and Pikes Peak Express began carrying passengers, mail and freight from Leavenworth, Kansas, over the prairie before reaching the banks of Cherry Creek and Denver City. Stagecoaches followed the trails established earlier by Native Americans, trappers and traders. Comfort was a luxury and often employees and passengers alike pitched in to clear an obstructed trail. One story surrounding an early journey between Leavenworth and Denver involved passenger Horace Greeley swinging a pick and manning a shovel to clear the road. Mapped out by Beverly D. Williams, later Colorado's first territorial delegate to Congress, the Leavenworth and Pikes Peak line followed the general route of today's US Highway 36.

Other stage lines began service to Colorado throughout the 1860s. In 1864, the Butterfield Overland Dispatch hauled its first freight and passengers along the Smoky Hill route. By late 1866, Wells Fargo bought out small stage operators and established a monopoly over all transcontinental stage lines coming in and out of Denver (Wiley, 1976: 4).

By the late 1860s, stagecoach routes expanded well beyond Denver and the eastern plains to serve the isolated mining communities in the foothills and the higher mountains. Anxious to receive supplies or a letter from home, miners used their

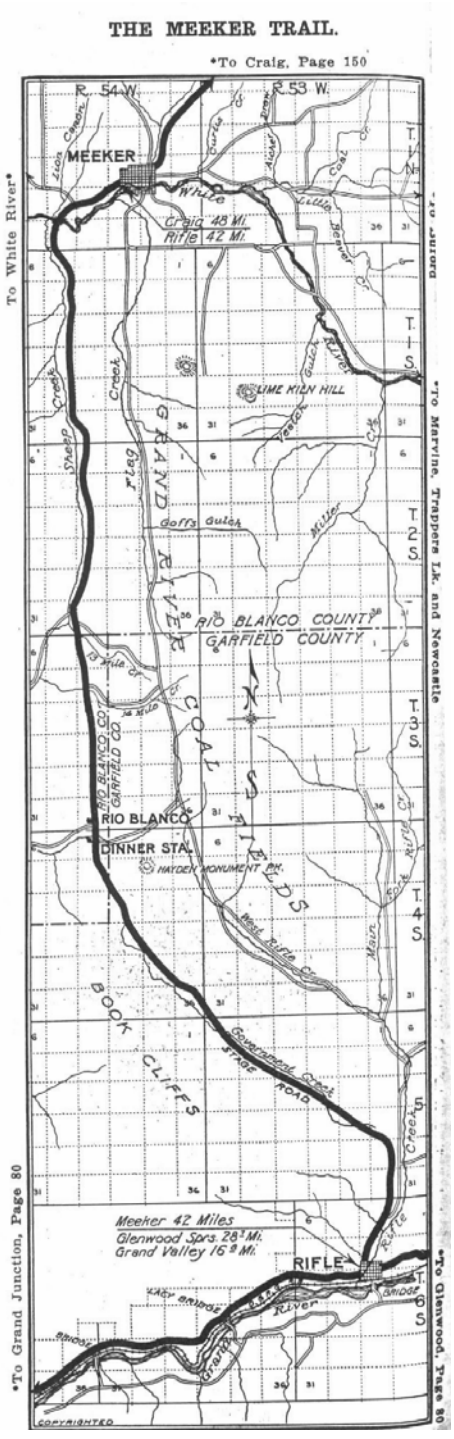


Figure 2. As late as 1918 stagecoaches competed for space with automobiles on the 1884 Government or Meeker Road (later Colorado Highway 13). Source: Denver Chamber of Commerce, ca. 1912: 148.

picks and shovels to carve mountain roads. In their haste, road engineering often suffered. A stagecoach journey through the mountains epitomized a "wild ride." On a few crude mountain roads, the grades were so steep that drivers had to drag huge logs as a way to control the occasional breakneck downhill ride (Writers' Program of the WPA, 1941: 71).

Railroads and the Decline of the Wagon Road

In the late 1860s, Colorado fought an economic life-and-death struggle with its northern neighbor, Wyoming, to be the beneficiary of the first railroad line into the Rocky Mountain West. The mountains stood as the ultimate double-edge sword for the state's promoters. The peaks lured miners and tourists while causing severe headaches among road and rail builders.

The 1869 joining of the United States by rail at Promontory Point, Utah, placed Colorado at a crossroads. The Union Pacific Railroad's decision to build over the easy grade of South Pass in Wyoming put Colorado territory in a panic. Everyone realized Colorado needed the railroad to survive. A line from Denver to the Union Pacific tracks in Cheyenne would provide a critical rail link between the mining camps and eastern markets. By June 1870, local boosters convinced others of the economic advantages of building a line into Colorado. They formed the Denver Pacific Railroad and soon laid track from Cheyenne to Denver. Further rail links came in 1870 when the completion of the Kansas Pacific system connected Denver to Kansas City and St. Louis (Writers' Program of the WPA, 1941: 71). The railroad's arrival in Denver provided the impetus for growth. The city emerged as the economic center of the Rocky Mountain West. The railroad's impact on Denver was immediate. By the close of the 1870s, the city's population increased 700 percent to almost 36,000 residents (Thomas, 1996: 38).

Engulfed by a cloud of locomotive steam, stagecoaches slowly faded from the scene, though some companies hung on well into the twentieth century. The relative speed and comfort of the railroad ended the dominance of the stagecoach across most of the urban and prairie West. Nevertheless, the stage remained the chief means of travel in the mountains and between the sparsely populated communities of Colorado lacking rail service. Stages operated by speculators Billy McClelland and Bob Spottswood ran from Denver to Morrison over the route of today's US Highway 285, through Turkey Creek Canyon to Fairplay. In 1873, McClelland and Spottswood expanded their passenger and express service over the Continental Divide by way of today's US 50 to Salida, and then northward along present US 24 from Granite to the town of Oro. The partnership subsequently established a separate line between Colorado Springs and South Park that also followed US 24 (Moody, 1967: 297).

Figure 3. A six-horse team brings a wagon down grade near Silverton about 1890. A wood-cribbed retaining wall helps support the roadway. Photographer: C.R. Worthington. Source: Denver Public Library, Western History Department.

Figure 4. A three-team stagecoach crosses an impressive timber pile bridge in western Colorado near the end of the nineteenth century. Photographer: Harry H. Buckwalter. Source: Colorado Historical Society

From the 1880s to 1918, one stage line continued to make the thirty-mile run between Rifle and Meeker (*Fig.* 2). The stage followed the alignment of today's State Highway 13. In a 1918 decision symbolizing the end of the Old West, the line's management determined to end the Rifle-to-Meeker run claiming its teams and drivers could not keep pace with the increasing automobile traffic (Bury, 1972: 8-9).

Silver outshone gold during the 1870s and 1880s in Colorado's mountain mining camps. The success of mountain mining depended on transportation networks capable of taking ore out while bringing in equipment and people. General William J. Palmer founded and led the construction of the Denver & Rio Grande rail system as he sought to create a north-south rail artery along the Front Range with lines west into the gold and silver mining camps. The Denver & Rio Grande was the first railroad to lay narrow gauge lines along the steep mountain cliffs. Measuring three feet between the rails, the narrow gauge line could "curve on the brim of a sombrero" as it snaked along canyons to reach nearly inaccessible camps (Writers' Program of the WPA, 1987: 72).

The narrow gauge lines through Colorado left a transportation legacy. As the silver boom went bust in the 1890s and production of other metals began to wane, many small railroads abandoned their lines. Following World War I, the state and private speculators removed miles of track, and over time, adventurous drivers along the Continental Divide and Western Slope rediscovered these grades as some of the state's most scenic auto roads (Wiley, 1976: 27).

An example is the Corley Mountain Highway (*Fig.* 38). Originally constructed in 1900 as the Colorado Springs & Cripple Creek District Railway, the route was converted to an auto toll road known as the Corley Mountain Highway during the early 1920s. Referred to as the Gold Camp Road since being taken over by the U.S. Forest Service in 1939, this scenic route extends from Victor to Colorado Springs. The historic origins of the rail line and the toll road are evident along the route, and portions of it continue to be a popular attraction for local residents and tourists.

By the early 1880s, Colorado's railroad network formed the foundation for Colorado's agricultural industry, soon to be dominated by the irrigated production of sugar beets and the dry-land cultivation of winter wheat on the eastern plains. The Atchison, Topeka and Santa Fe and the Union Pacific rail lines carried the majority of goods and materials between the plains farmer and mer-

chants located in Denver and across the Midwest. In the early automobile age, the railroad influenced the alignment of developing auto highways. During the 1910s and 1920s, the Omaha-Lincoln-Denver road (the precursor to US 6 and 138) paralleled the route of the Union Pacific Railroad through northeastern Colorado (Thomas, 1996: 46).

In 1938, the State Highway Department reclassified many abandoned rail alignments as state highways as part of a plan to add 4,400 miles to the state's highway system. The department later returned most of the former rail routes to the counties during the 1950s, but some still survive as state highways. These include State Highway 67, south of Divide, State Highway 82 between Basalt and Aspen, and State Highway 103 from Clear Creek to Georgetown (Wiley, 1976: 28-9).

First trod by man and animal, most of the state's old trails and earliest roads now lay beneath the asphalt strips traveled by Coloradans in their automobiles. The mass migration to Colorado in the late nineteenth century brought commerce and technology. Colorado's territorial status blossomed into statehood in 1876. From statehood to the end of the century, the state government gradually assumed a greater role in planning and constructing a network of safe roads.

Figure 5. This concrete bridge near Proctor dates to the 1920s when the route formed a part of the Detroit-Lincoln-Denver and Omaha-Lincoln-Denver highways. The highway paralleled the route of the Union Pacific Railroad. Source: Office of Archaeology and Historic Preservation, Colorado Historical Society.

TERRITORIAL AND PRE-AUTOMOBILE STATE ROADS 1861 – 1890

Kansas Territorial Road Improvements

The discovery of gold triggered the first mass migration to Colorado. Illustrating the routes from Nebraska and Kansas territories to the gold fields along Cherry Creek, the initial April 1859 *Rocky Mountain News* deserves credit for printing Colorado's first road map. In January 1860, the Kansas Territorial Legislature authorized construction of a limited number of toll bridges and roads. These included a toll road from Soda Springs (today's Manitou Springs) into South Park along the "Ute Trail," (now US 24) and a toll bridge across the Arkansas River near Pueblo (Ridgway, 1932: 163, 165). From the fall of 1859 to the spring of 1860, private-wagon transport companies constructed toll roads from Denver to Bergen Park near Evergreen and from Mount Vernon to Tarryall in South Park (Ridgway, 1932: 164).

Building Colorado's Territorial Roads, 1861-1876

The United States Congress granted Colorado separate territorial status on February 28, 1861. That September, during the territorial legislature's first session, lawmakers authorized construction of a number of private toll roads. On July 7, 1862, the second session of the Colorado Territorial Legislature approved a bill to build a territory-wide network of nineteen roads. The proposal's language identified these routes by specific terminal points. One route, "from Denver, by way of Boulder, to Laporte," adapted the established route known as the Cherokee Trail (Colorado Department of Highways, 1964: 1).

Prospectors west of the Continental Divide established numerous camps and settlements in pursuit of gold. Private toll roads, chartered by the Territorial Legislature for five dollars each, provided avenues for the movement of ore, people and supplies. From the 1860s to the 1890s, the territorial and then state legislature chartered forty-three toll roads statewide, ranging from two to two hundred miles in length. Tolls varied with the length of the road and cost of construction. Travelers could expect to pay the following prices during the 1870s:

Each vehicle with one span of horses, mules or cattle	$1.00
Each additional pair of draft animals attached	25¢
Each horse or mule with rider	25¢
Horses, mules, cattle or jackasses driven loose, per head	10¢
Sheep, hogs or goats, per head	5¢
Travel for attendance at funerals	Free

(Ridgway, 1932: 168)

Early Post-Statehood Public and Private Roads, 1876-1890

After statehood, and for the remainder of the nineteenth century, a small portion of the state's Internal Improvement Fund went toward road and bridge construction. The first state legislature in 1876 authorized that proceeds from the sale of state lands and interest on deferred payments connected to those sales be deposited in the Improvement Fund. Never a sure source of revenue, the Improvement Fund's coffers fluctuated between a few thousand dollars a year to a peak of $341,000 in 1889. Not every citizen approved of the criteria for the state distributed construction appropriations. Many Coloradans perceived the fund as a "pork barrel" for politicians seeking to repay favors to cronies through construction projects (Merchant, 1955: 75-6).

As the state government proved fiscally and politically unwilling to embark on a massive road-building program in the quarter-century after statehood, construction became the province of profit-seeking stage lines, mining companies, and industrious entrepreneurs. Embodying the spirit of

the times, Otto Mears functioned as a one-man highway department during the 1870s and 1880s. Mears built 383 miles of toll road across western Colorado. He is best known for his masterwork, the road over Red Mountain Pass. In 1881, crews working for Mears blasted a shelf across the solid granite of Red Mountain (*Fig. 6*). After the road was complete two years later, Coloradans gossiped that Mears' efforts cost him an estimated $40,000 per mile. Soon after the toll road opened, public support for Mears quickly turned to wrath when he began levying $5 tolls for a team and wagon, $2.50 for a trail wagon, and $1 for saddle animals. Public outcry pushed the county and state to assume control of the road by 1887. Despised by many of his contemporaries for his greed, Mears is generally remembered as the man who opened western Colorado to the rest of the state (*Colorado Highways*, March 1926(a): 8; Clay, April 1927: 6).

Across Colorado, toll roads slowly passed from existence by the early 1890s. Increasing residency in the various mining districts and counties allowed local governments to fund new roads through poll taxes. Many communities organized and built local access roads for the common good.

As the nineteenth century came to close, new transportation technologies and new industries shook Colorado's leaders from their complacency regarding the state's roads. Heady from the scent of gasoline, a cadre of influential automobile owning citizens drove Colorado's elected representatives to a legislative crossroads resulting in one of the most monumental decisions in state history.

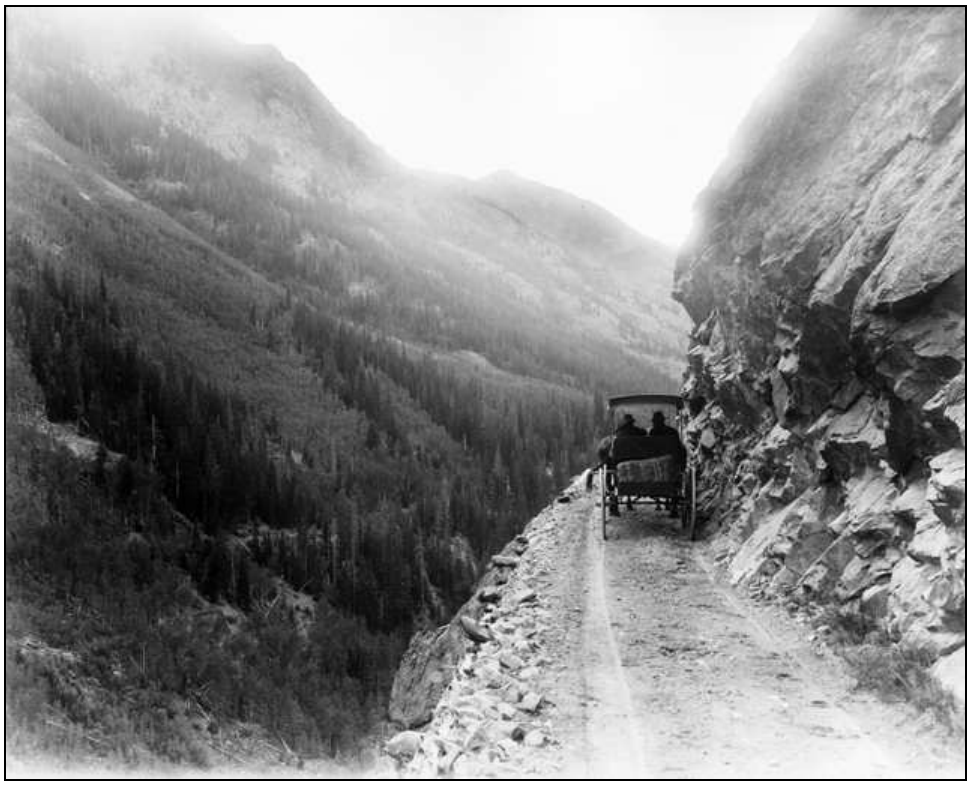


Figure 6. Otto Mears built his toll road over Red Mountain Pass for strictly economic reasons. Yet the incidental scenic qualities were evident from the beginning…for those travelers brave enough to look. Photographer: George L. Beam Source: Denver Public Library, Western History Department.

THE AUTOMOBILE AGE BEGINS, 1890-1930

For the nation, the four decades between 1890 and 1930 were bracketed by two financial depressions and punctuated by two wars. In Colorado, the Silver Crash of 1893 brought economic ruin to much of the mining industry and ushered in a period of general economic depression. As conditions began to recover by century's end, an increasing number of motorcars headed toward the Centennial State, signaling a new age in private transportation. The automobile brought newcomers and new industries and introduced the reality of greater federal involvement in the state's activities.

The Good Roads Movement

Mud and uncertainty were the constant traveling companions for nineteenth century Americans. Travel by wagon or foot in the nation's cities or countryside was often a dirty, dusty nuisance. After the Civil War, the growing prominence of the railroad, aided by the national government's issuance of construction land grants, convinced many that roads for foot or horse travel would ultimately become unnecessary (Holt, 1923: 4). This perception changed in 1878, when Colonel Albert Pope introduced a "safety bicycle" and subsequently touched off a cycling craze. By 1900, more than three hundred companies produced over a million bicycles a year (Lewis, 1997: 7).

In order for his bicycles to travel safely, Pope became the nation's loudest advocate for what he termed "Good Roads." In his pamphlet, *Highway Improvement*, Pope wrote, "American roads are among the worst in the civilized world, and always have been. I hope to live to see the time when all over our land, our cities, towns, and villages shall be connected by as good roads as can be found." (Lewis, 1997: 7). In the 1880s, Pope organized the League of American Wheelmen lobbying group to push his cause. He also built a short stretch of macadam road in Boston to demonstrate the safety and enhanced pleasure afforded by traveling on a smooth surface.

Each edition of the League's publication, *Good Roads*, found the Wheelmen supporting the activities of Good Road associations across the country, holding conventions and lobbying state legislatures for road improvements. The movement's initial success came in 1891 when the New Jersey legislature passed the nation's first state-aid bill for road construction. Two years later, Pope and the League of American Wheelmen persuaded the US Department of Agriculture to create an Office of Road Inquiry (ORI) to distribute public information about road construction. From 1893 to 1913, the relationship between the states and federal road authority remained indirect. The federal Office of Public Roads, as the ORI was known after 1905, produced pamphlets on how to build good roads, but the office did not assist in construction work itself. Growing automobile use later stimulated widespread and insistent public demand for direct federal participation in road construction (Holt, 1923: 8-12).

More Horses Under the Hood: The Automobile's Early Years

The high cost of the first motorcars prohibited their use by any but the wealthy. According to one of the first advertisements for a local car "dealership" from May 1900, a Denver cycling shop offered a steam-powered *Locomobile* for $750 (Hafen, 1931: 3). The Locomobile was a bargain compared to other models of the day. By 1904, eleven European and twenty-four American manufacturers sold cars in the United States. A potential horseless carriage owner could drive away in a domestically built model at around $3,700 while imports averaged $8,000 (Lewis, 1997: 31).

Ransom Olds built the first automobile for the masses when in 1900 he began manufacturing the Oldsmobile Curved Dash. First to use a progressive assembly system, production peaked in 1904, the final year of manufacture, when 5,508 rolled off the assembly line. The car retailed for $650.

Guided by Midwestern simplicity and driven by populist beliefs, Henry Ford further democratized the automobile by building and selling a truly affordable automobile. Introduced in October 1908, Ford's Model T was a workingman's car built for work. Ford designed his vehicle with high axles and 3.5-inch wide tires to better travel rutted roads cut deep by farm wagons. The first Model T sold for $850—windshield, top, and headlamps were extra. By 1914, Ford began building his chassis for the Model T on a moving assembly line. This first step toward full mass production lowered costs, allowing lowered retail prices. According to the 1920 census, Americans owned 9.5 million cars and trucks. In 1924, nearly anyone could own a Model T for $290 and the American auto industry produced close to 3.5 million cars (Lewis, 1997: 31-3). The rise of the Model T and safer, better-designed roads handling increased auto traffic began erasing memories of the recent struggles to travel just a few miles.

Behind the Wheel: Early Motoring in Colorado

The mists of time, in the guise of clouds of exhaust, have made it difficult to determine exactly who operated the first motorized vehicle in Colorado. Depending on the account, the horseless carriage's first appearance in the 1890s was as either a circus attraction or a hobbyist's backyard project.

The distinction of being the first in a long line of Colorado motorists appears to belong to a carnival performer, Achille Philion. During June 1892, Philion and his four-wheel, steam-operated carriage chugged around the Manhattan Beach amusement park on the northwest shore of Sloan's Lake in Denver. An advertisement in the June 11, 1892, *Denver Times* heralded the steam carriage's arrival as "a grand day for Denver." Illustrations of the steam carriage show it to be little more than a chair attached to four bicycle wheels with a boiler placed precariously in the middle. There is no record of how fast Philion's contraption traveled, or if it ever ventured off the grounds of Manhattan Beach. (Miller, 1999: 25).

A diary makes the case for Denver's David W. Brunton being the state's first automobile owner. A mining engineer, Brunton became intrigued after viewing an exhibition of motorized vehicles in Boston. On October 14, 1898, Brunton wrote: "Went to automobile show at Mechanics Institute, Boston, and tested several motor cars." A few months later in May 1899, Brunton noted in his diary: "May 7. Left Butte [Montana], reaching Denver on the 9th. Found Columbia electric automobile awaiting me. Spent day setting it up. May 10. Ran electric carriage on the streets in Denver" (Hafen, 1931: 2).

In the wake of Brunton's initial trip in his Columbia, the first decade of the new century saw motorists attempting to drive to almost every corner of the state. In September 1900, entrepreneur John Brisben Walker failed in his attempt to ascend Pike's Peak by car. Walker's ten-horsepower "mobile steamer" reached an elevation of 11,000—just 3,114 feet short of the summit—and set the record for the highest altitude yet reached by any car and driver. Walker later recounted that the drive back down was similar to "plummeting down a toboggan chute" (Miller, 1999: 26). On August 12, 1901, W.B. Felker and C.A. Yount of Denver attempted to reach the summit of Pike's Peak. Above timberline, the steep road offered a challenge to the duo's Locomobile, and at one point, the pair had to lift the machine over a snowdrift. The Locomobile reached the summit just as the 3:20 p.m. cog train left from Pike's Peak for Manitou Springs. A week later, on August 28, J.E. Barnes crossed "the Crest of the Continent" when his horseless carriage reached Leadville. At times on the journey from Denver to the Divide, Barnes wrapped ½-inch rope around the rear wheels to prevent his car from slipping on the steep grades (Miller, 1999: 26-7).

Stories of the horseless carriage soon filled Denver's newspapers as well as the files in police stations and municipal courts. In January 1902, a Denver police court fined a driver for operating "his machine along the streets of the city at a speed which endangered the lives of the pedestrians." Clocked at 40 miles per hour by a police

officer on 16th Street, the judge fined the speeder $25 and costs (Hafen, 1931:5-6).

For the first decade-and-a-half after its arrival in Colorado, the automobile remained the province of wealthy, white males. Regarding the control of the state's steering wheels in the hands of one group, in November 1902, *The Denver Post* commented, "Out of the 200 owners of machines in town today about a dozen women only have had the courage to take their levers and their destinies in their own hands, and face the world." The report failed to note if any of the women owned a vehicle outright (Hafen, 1931: 6).

The Romance of the Open Road: Beginnings of Automobile Touring

The automobile liberated Americans to travel whenever and nearly wherever they pleased. Unfortunately, the roads of the early twentieth century could only take a driver so far, as none of the states could boast of a comprehensive highway system designed for auto travel.

Not long after automobiles first began appearing on the nation's streets and county lanes, a loose alliance of motorists, automobile industry executives, community boosters, and business speculators envisioned the construction of a transcontinental automobile highway. On August 1, 1912, Colorado congressional representative Edward T. Taylor introduced a bill "establishing the Lincoln memorial highway from Boston, Mass. to San Francisco, Cal." The bill died in the House Agriculture Committee, but the name caught the nation's attention (Wolfe, 1999: 4). A little more than a month later on September 6, Carl G. Fisher, developer of the Indianapolis Motor Speedway, presented his plans for the creation of a coast-to-coast highway to an approving audience of automobile manufacturers. In less than a year, various individuals and groups pledged $4 million toward construction. In July 1913, Fisher and the other organizers agreed to call their venture the Lincoln Highway Association (AASHO, 1952: 109).

The association planned to build an automobile highway along the most direct route from New York to San Francisco. The highway planners of the mid-1910s faced a dilemma similar to the one confronted by the leadership of the Union Pacific Railroad during the late 1860s—how to build a transcontinental road that would safely and economically cross the Rocky Mountains. Like the Union Pacific, the Lincoln Highway Association selected South Pass in southern Wyoming as the most practical route over the Continental Divide. Not wanting to lose tourist dollars to Wyoming, the Denver Chamber of Commerce and Colorado Governor Elias M. Ammons attempted to broker a deal with the association's leadership. In discus-

Figure 7. Bumper-to-bumper traffic held a different meaning on the streets of Denver at the turn of the twentieth century. These proud horseless carriage owners met at the corner of 18th and Stout in front of the Colorado Winton Motor Carriage Company. Source: Denver Public Library, Western History Department.

sions with the association, the governor and Denver's boosters pressed for recognition of a spur route of the Lincoln Highway. The alternate route would run from Julesburg in northeastern Colorado along the path of today's US 138 and 6 to Denver. From Denver, the proposed route ran north to Fort Collins where it followed the North-South Highway back to Cheyenne and a return to the main Lincoln Highway. The state promised to maintain the road at no cost to the Lincoln Highway Association. A rough and rocky drive by Lincoln Highway officials through western Colorado did not help the state's chances and soon the association's leadership viewed Colorado as a "state full of malcontents." Relations worsened to the point where the Lincoln Highway Association eventually warned travelers to avoid the loop—and consequently Colorado—in its 1916 auto guide (Wolfe, 1999: 12-13, 17, 19).

In 1924, Thomas MacDonald, director of the federal Bureau of Public Roads, initiated a nationwide system of numbered highways in place of the overlapping network of named interstate routes. The Lincoln Highway now left New York as US 1 then switched to US 30 as it crossed America into Wyoming. From there the highway's identity further suffered as it became first Routes 305, 530 and 40 through Utah, then State Highway 2 in Nevada, before being designated US 50 to Sacramento, briefly changing to US 99, and finally becoming US 48 as it terminated in Oakland. A romantic era in auto touring disappeared.

The Dawn of Auto Tourism in Colorado

Those able to afford an automobile naturally wanted to see how fast and how far their new toy could travel. Colorado's scenery made the state a logical journey's end for the initial generation of car owners. In 1903, the first automobile to venture from San Francisco to New York passed through Colorado. Driven by E.T. Fetch, with M.C. Krarup as passenger, the twelve-horsepower, one-cylinder Packard crossed the state by way of Grand Junction, Glenwood Springs, and Colorado Springs before reaching Denver on July 20. When asked by the *Denver Post* about the drive over rocky, hilly mountain trails, Krarup responded, "At times the sand has been so deep that canvas had to be spread in front of the machine in order that it might be moved. Heavy chains were necessary to be wrapped around the wheels at other times in order that the steep mountain grades might be overcome" (Hafen, 1931: 10).

During the summer of 1911, a rumor spread that Colorado charged out-of-state motorists $15 for a state travel permit and $20 for extended stays beyond a month. In the vernacular of the day, the "bleaching" of tourists had the State Highway Commission's leadership feverishly writing neighboring Good Roads Associations to quash the erroneous stories. In June 1911, Highway Commissioner C.P. Allen notified Nebraska's Omaha-Denver Good Roads Association of Colorado's concerns in a comment that subsequently became a state mantra, "Colorado is looking for all the tourists she can get" (Colorado Department of Highways, 1911(b)).

During the 1910s, each driver venturing across Colorado came back with varying opinions—from splendid to treacherous—regarding the quality of the state's roads. A seventy-five-mile auto trip between Denver and Colorado Springs—part of the Great North - South Highway—took five hours and twenty minutes over gravel, steep grades, sharp turns, ruts and chuckholes. Despite those obstacles along the state's primary north-south route, drivers kept coming. By 1915, traffic between Denver and Colorado Springs averaged 253 cars per day, with 85 of those vehicles from out-of-state (*Colorado Highways*, April 1929(a): 8).

Colorado suffered only briefly from the sting of being left off the Lincoln Highway. By 1916, a number of named interstate roads entered the state from all directions. Some, like the National Roosevelt Middle Trail and the Victory Highway, followed the route of modern US Highway 40 over the plains into Denver and on to the Western Slope. Mostly tracing modern US 50, the National Old Trails Highway served as the primary auto highway for southern Colorado while the Great North-South Highway ran south from the Wyo-

ming border to the New Mexico state line. Along the Omaha-Lincoln-Denver (OLD) Road, early drivers could easily stay on course by following the 18-inch-wide band of white paint on telephone poles or fence posts. The president of the Omaha-Denver Good Roads Association, W.A. Taylor, wrote to Colorado Highway Commission Chairman C.P. Allen with praise for how well-marked the road was west of the Nebraska-Colorado line. Taylor's comments recall the "frontier" era of auto travel when only the brave motorist ventured on rough roads without the aid of traffic or direction signs, reliant only on painted posts to guide his way:

"From Fleming on westward, the road is quite well marked. I found on my way coming home traveling along the road that there was wonderful satisfaction whenever I was in sight of the white band on the telephone pole or post, and I am satisfied that tourists who are strangers through the country will have very much the same feeling in regard to it as I did" (Colorado Department of Highways, 1911(a)).

The Colorado Automobile Club

To promote their hobby, and to bond with other owners, auto clubs developed in the state's larger cities. Similar to organizations in other states, Colorado's auto clubs helped develop a number of scenic roads across the state. By the mid-1910s, motorists could travel the Fort Collins and the Poudre Canyon Road, motor to Durango's Electra Lake Drive, venture down Trinidad's Stonewall Canyon Road, or pay a $2 toll to drive to the top of Pike's Peak (Bartlett, November 1918: 10). Automobile clubs played a vital role nationwide in furthering the construction of better highways in general and scenic roads in particular. However, their role in the state's highway history was brief. By the late 1910s, as more drivers ventured on the road and the federal government took an increasing role in construction, the auto clubs' influence in developing and maintaining roads began to fade.

From 1899 to 1902, a cadre of Colorado's well-to-do doctors, lawyers, and businessmen introduced the automobile to the state. In October 1900, a Good Roads Convention met in Denver. Delegates presented papers in favor of building a national highway from Denver over Berthoud Pass to Salt Lake City (Hafen, 1931: 12). The number of the city's automobile owners grew over the next two years. On May 15, 1902, forty-two devotees of this exclusive hobby met in Denver and organized the state's first auto club, the Colorado Automobile Club. Membership elected as president the state's first automobile owner, David W.

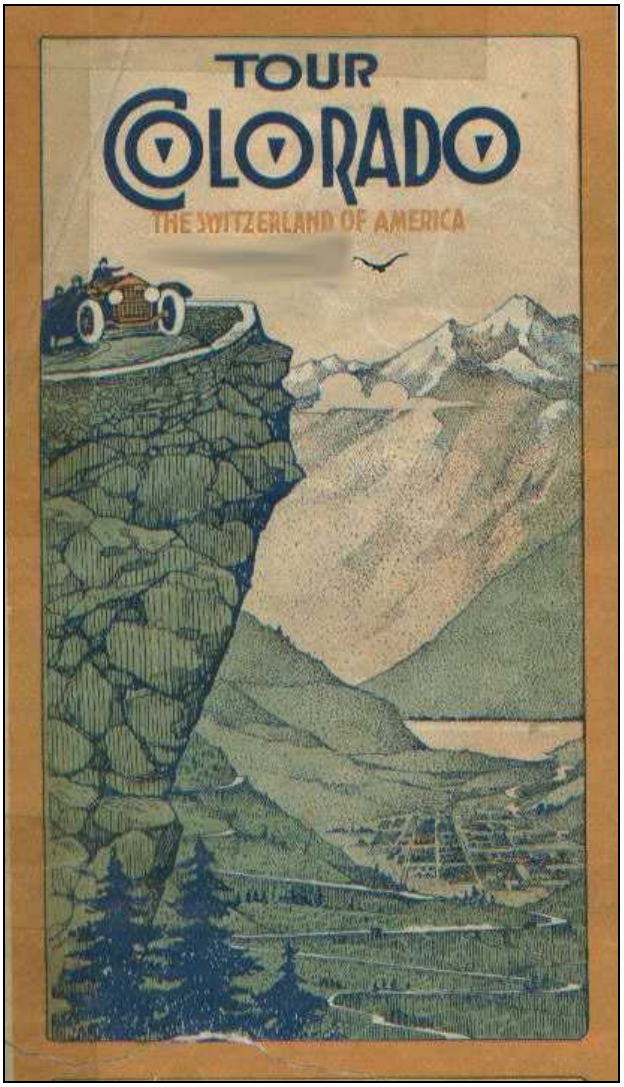


Figure 8. Tourism, the automobile and Colorado were made for each other. In 1915, the Denver Motor Club issued this map urging motorists to see "The Switzerland of America." Source: Rocky Mountain Philatelic Library.

Brunton. The organization's constitution listed the following club "objects":

1st The securing of rational legislation.
2nd The formation of proper rules governing the use of the automobile.
3rd To protect the interests of automobilists against unjust discriminations.
4th To maintain their lawful rights and privileges.
5th To encourage prudence and care in driving automobiles.
6th To promote the Good Road movement. (Hafen, 1931: 8).

Similar to highway organizations in other states, the Colorado Automobile Club lobbied local politicians to upgrade the state's roads. The automobile enthusiasts' voice and political influence reached their apex during the first decade of the twentieth century. At the suggestion of Governor Jesse F. McDonald, sixty-five owner-delegates from across the state met in Denver in July 1905 and formed the Colorado Good Roads Association. At the next convention the following summer, membership drafted language supporting the creation of a state highway commission. A number of powerful state legislators opposed state control of roads and the bill never reached the floor of the House or Senate. Undaunted, association members launched another effort during 1909. Through a well-managed information campaign, the association demonstrated to legislators the economic benefits of good roads. Their efforts convinced the General Assembly to pass the state's first highway bill on May 5, 1909 (Maloney and Reedy, 1929: 2-3).

Colorado's earliest auto owners followed more than one avenue in their quest to construct roads to their liking. Some high-profile members of the state's motoring class used their own money and notoriety to develop automobile routes through some of the state's most scenic regions.

Colorado's Private Auto Roads

Some of Colorado's first important auto roads were built by the wealthy for the wealthy. Two men—Frelan Stanley and Spencer Penrose—symbolized the elitist nature of the automobile's first decade in the state.

In 1903, one of the inventors of the Stanley Steamer automobile, Frelan Stanley, successfully drove his self-propelled namesake from Denver to Estes Park, then an exclusive resort near Long's Peak. Upon completing his journey, Stanley concluded that the Rocky Mountains should be the highlight of every automobile owner's cross-country travels. Stanley proceeded to clear a huge tract of land in Estes Park, build a hotel, and operate a fleet of Stanley Steamers to ferry guests from Denver and other Front Range cities to his new resort. During the ensuing decade, a torrent of visitors to the Stanley Hotel turned Estes Park from an isolated retreat for wealthy hunters to one of the leading tourist attractions in the state. By 1913, Estes Park welcomed 50,000 visitors a year (Thomas, 1996: 55-6).

Another well-to-do car owner took his passion for speed in a different direction. Colorado Springs mining baron Spencer Penrose boasted a fleet of cars at a time when many Coloradans had yet to see their first. The *Colorado Springs Gazette* noted in 1910 that Penrose built an oversized garage to house his four canary-colored Lozier cars costing some $5,000 each (Breckenridge, 1985: 186). When not out buying automobiles, Penrose stayed active in the Colorado chapter of the National Good Roads Association and the Rocky Mountain Highway Association, while playing a role in the creation of the State Highway Commission in 1909. Penrose also spent a quarter of a million dollars transforming an old carriage road into the Pike's Peak Auto Highway. After completion in July 1915, Penrose sponsored an annual auto race to the peak's summit to demonstrate the practicality of auto travel in the mountains. The first Pikes Peak Hill Climb on Labor Day 1915 brought thousands of spectators to cheer the nation's best drivers as they roared along the narrow shelf road only inches from sheer drops of 1,000 feet. The first hill-climb winner, Ray Lentz of Seattle, drove his Romano Special to the top of Pike's Peak in just under twenty-one minutes (Breckenridge: 187). The toll road continues to operate under the management of the city of Colorado Springs.

Figure 9. A Stanely Steamer pauses near Sheep's Head Rock in the Big Thompson Canyon between Loveland and Estes Park. The distinctive rock formation in this ca. 1910 view fell victim to later highway improvement projects. Photographer: Louis Charles McClure. Source: Denver Public Library, Western History Department.

Figure 10. The Lariat Trail winds its way up Lookout Mountain above Golden. Designed for automobile touring as part of the Denver Mountain Park system, this early postcard shows the route's double hairpin curves. At one point the trail was part of the nationwide Victory Highway. Source: Office of Archaeology and Historic Preservation, Colorado Historical Society.

Municipal Mountain Parks

Looking west from the offices and municipal buildings of downtown Denver, the city's business and political leaders viewed the mountains differently after the first automobiles passed through town. Denver's power brokers realized that automobile tourism held unlimited economic potential for both the city and other Front Range communities. Recognizing an opportunity to gather an unprecedented amount of tourist dollars, Denver's municipal leadership devised a plan to link the city with the mountains.

In 1909, Mayor Robert Speer used the occasion of a Chamber of Commerce banquet to propose the possibility of bringing the high country to the city through the annexation of a chain of mountain parks west of Denver (Author Unknown, n.d.(a): 1). Four years later, the city obtained an amendment to the State Constitution allowing the purchase of land in neighboring counties. To acquire land for parks and mountain roads, primarily in Jefferson County, the city proposed that Denver property owners invest one-fifth of a mill over a five-year period. Subsequent negotiations with Jefferson County proceeded smoothly. Speer commissioned a scion of the renowned Brookline, Massachusetts, landscape design family, Frederick Law Olmsted, Jr., to plan the city's mountain parks and scenic roads.

Olmsted initially ruffled a few feathers with his proposal that the Denver Tramway Company build trolley lines to the mountain parks. The city administration vetoed Olmsted's suggestion outright as his idea did little to lure well-off motor tourists. Olmsted claimed a victory when he blocked Denver Mountain Park's Superintendent Edward S. Letts' plan to level the summit of Genesee Mountain, the city's first mountain park, to make it more accessible to automobiles (Noel, 1987: 44). Olmsted did design almost nine miles of mountain roads. The roads he recommended included a passage through Mount Vernon Canyon, near Lookout Mountain. The designer predicted that this route would "become the most direct and probably the most useful business road to the mountains from Denver." Olmsted's foresight was uncanny, as a half-century later, the Mount Vernon alignment served as the right-of-way for Interstate 70 west of Denver (Thomas, 1996: 87).

Within the five years mandated by the state to raise tax money for the project, Denver acquired more than five square miles of future parkland for $34,000 and invested $225,000 for construction of seventy-five miles of roads. The mountain park system expanded after the federal government sold the city several thousand acres for only $1.25 per acre.

Officially opened in 1913, Lariat Trail was the first of several scenic drives constructed as part of Denver's mountain park system. Beginning in Golden, where two 35-foot high stone pylons mark the entry, the drive connects with Floyd Hill Road at the top of Mount Vernon Canyon. Frederick Law Olmsted, Jr. completed the early designs and Saco R. DeBoer, Denver's noted landscape architect of the period, prepared the survey and final layout, and served as construction superintendent. Six overlooks offer scenic views as the drive switches back and forth up the steep side of Lookout Mountain.

Denver was not the only Front Range city to establish mountain parks. Begun in 1919, the Pueblo Mountain Park near Beulah offered over 600 acres of automobile accessible mountain recreation outside the urban environment. The city of Loveland opened its Loveland Mountain Park in the Big Thompson Canyon along the National Park to Park Highway (now US 34).

While the Denver city government planned its mountain park system, the municipality offered weary motorists a place to rest while in the city. In 1915, Denver built its first free municipal auto camp in City Park. In operation until 1918, the City Park camp was a welcome site to cross-country motorists. One traveler, Horace Albright, assistant director of the National Park Service, expressed his admiration for the city's accommodations:

"It is an inspiring sight to go into a park like the beautiful City Park of Denver and see several hundred cars parked in their allotted spaces and

their happy owners, many of them with large families, enjoying camp life" (Athearn, 1986: 147).

Subsequent urban camps expanded on the City Park concept, notably Rocky Mountain Park in northwest Denver and Overland Park on the South Platte in south Denver. Opened in 1920, Overland Park featured campsites, water, fuel, toilets, and showers—all things the weary traveler sought after a long journey to Colorado. Overland Park also boasted a billiard room, restaurant, barbershop, and dance floor. Some condemned Overland Park as dangerous to public morals. In 1923, the city charged 50 cents a night to help finance the upkeep of the site in hopes of attracting a "better class of tourist" (Noel, 1987: 47). As the darkest days of the Depression headed towards Colorado, poor migrants from the southwest flocked to the grounds. Overwhelmed by crowds of the poor and hungry and their ramshackle vehicles, the city closed Overland in 1930. Historian Thomas Noel noted the deeper meaning behind Overland's closing. "Poor motor migrants of the 1930s killed the idea that automobiles were only toys of the rich" (Noel, 1987: 47).

Developed by the automotive elite, Colorado's scenic and tourist roads subsequently became a source of civic and state pride and provided the foundation of the tourist industry. As more people owned automobiles, visiting and resident drivers demanded better roads to Colorado's best-known locations as well as to farms, mines, and growing towns and cities. The creation of a highway authority to build roads signified the first serious attempt by state government to address Colorado's diverse transportation needs

State Highway Construction

Effective January 1, 1910, the General Assembly established the Colorado Highway Commission to build and construct state roads and highways. The commission's primary responsibility was to map and lay out a state road system for automobile use. The commission asked each county to submit maps and documentation indicating its most heavily traveled roads. Thirty-three of Colorado sixty-two counties sent maps to the commission during 1910, from which the commission designated the first 1,643-mile system of state primary roads. The lack of county surveys forced the commission to schedule an automobile expedition to examine the condition of the state's roads (Wiley, 1976: 11).

Likening himself to the pioneers, Commissioner Thomas H. Tully found that both nature and the average citizen were unprepared for a state highway system:

"We found that the people were apathetic. There didn't seem to be any particular interest in highways. There was a disposition manifested in virtually every section of the state of jealousy of some other section. The belief seemed to prevail that all the highway commission was after was to put in a few good roads around Denver" (*Colorado Highways*, April 1929(b): 9).

The commission faced more than apathy and suspicion. Tully recalled that the most disheartening aspect of their adventure was driving over the same rutted ground covered by the pioneers' wagons a half century earlier:

"We traveled 1,600 miles in the state and the motorist today who is not familiar with the highway conditions of that day has no conception of what we had to contend with. We found bridges we did not dare to cross in a car, encountered mud that stuck us, found grades we managed to crawl up at a speed a snail could beat, and roads that were never meant for anything but a horse-drawn vehicle" (*Colorado Highways*, April 1929(b): 9).

Seeing that they had their work cut out for them, the commissioners moved quickly in their first year. In a letter to a Texas colleague, Tully described his commission's expediency regarding road construction:

"Since the creation of the commission last January we have declared 1,600 miles of state highway and there is now work underway at fifteen different points in the state by contract and at three different points in the state by convict labor" (Colorado Department of Highways, 1910).

Colorado boosted its highway building capacity by adopting a nationwide trend. In 1899, the General Assembly passed a bill authorizing the use of convict labor to build a wagon road between Leadville and Pueblo. State officials deemed the experiment a success, and once the automobile came on the scene, Colorado used more of its state convicts in road construction than any other state in the nation. The reliance on prisoners had much to do with the proximity of both men and materials. The state quarried the lime, gravel, and stone necessary for road construction from the state prison at Cañon City.

From 1905 to 1926, prisoners built a number of important roads still in use today, including those from Pueblo to Leadville, Colorado Springs to Leadville, Cañon City to the site of the Royal Gorge Bridge (itself completed in 1929), and roads through the Big Thompson, Colorado, and Saint Vrain river canyons. By the late 1920s, complaints from private contractors and regulations by the Federal Bureau of Public Roads prohibiting the use of prison labor on federal-aid projects ended the state's use of convict labor (Maloney and Reedy, 1929: 17).

Drawing from their experiences, the Highway Commission sent its first recommendation filled annual report (1910) to the governor. The commissioners supported the creation of a permanent Internal Improvement Fund directed solely for road construction, the replacement of wooden bridges with concrete, the continued use of convict labor in roadwork, and the installation of uniform, statewide road signs (Colorado State Highway Commission, 1910: 30-1).

Residents of southwestern Colorado sought a road east over the Continental Divide to open their region to traffic between Alamosa, the San Luis Valley, and the rest of the state. The only route connecting the two regions at that time was a rough wagon road over Elwood Pass, where grades ran as high as 25 percent.

Responding to those pleas in 1913, the Highway Commission searched for a feasible route over the San Juan Mountains. The commission considered both Elwood Pass and a recently surveyed route near Wolf Creek. The commissioners took a "hair-raising" automobile ride over Elwood Pass's steep grade, and while the engine was still warm, immediately named Wolf Creek the winner. During 1916, crews cleared Wolf Creek Pass at a cost of $100,000. Subsequently surfaced with dirt and gravel, the road measured from six-feet to twelve-feet wide with occasional turnoffs allowing cars traveling in opposite directions to pass. To avoid expensive blasting through the South Fork Canyon, engineers located a portion of the roadbed along steep cliffs bordering the canyon. On completion of the road in 1916, drivers by the hundreds took a chance to cross the new pass (Federal Highway Administration, n.d.: 4).

Figure 11. Men from the State Penitentiary eat a meal at a road building camp in 1918. The Highway Department used convict labor for road construction until the late 1920s. Source: Denver Public Library Western History Department.

By the time of America's entry into World War I, the state and federal government shared similar aspirations for better roads. Lack of sufficient funding resources and the extreme cost of mountain highway construction limited road building in Colorado. The end of the war ushered in a long partnership between the state and federal government.

The Federal Presence in Colorado

In 1916, the U.S. Congress considered a number of measures to fund the construction of a national highway system. Colorado Congressman Edward Taylor sponsored four pieces of highway legislation that session, including an unsuccessful bill proposing the sale of public lands in Colorado, Arizona, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming and Oregon with half of the revenues going toward a "public-roads fund" (Thomas, 1996: 63).

Passage of the Federal-Aid Road Act of 1916 committed the federal government to provide funds for highway construction matching funds collected by each state's highway commission. The legislation also required that each state designate seven percent of its total road mileage as "primary" or interstate, and thus eligible for federal funds. The remaining roads were classified as "secondary." In 1917-18, Colorado received $17,000 for its first installment of federal grants. Such grants would eventually total into the hundreds of millions of dollars (Zahn, 1922: 10).

Initially some in the Highway Department felt that the federal government should do more for Colorado. In 1916, responding to an inquiry from the editor of *Motor Print* magazine, Highway Commissioner Thomas J. Ehrhart articulated the view of many Coloradans looking from the narrow end of the federal funnel:

"A very large percentage of the land area of Colorado is included in forest reserves and other public lands, from which the federal government is deriving an income through its system of Landlordism from our own people and the state and the county governments of Colorado are spending many thousands of dollars each year on public highways across the public lands." (Colorado Department of Highways, 1916).

An additional element of the 1916 Federal Act required every state's highway commission to meet certain minimum organizational standards in order to receive and distribute aid. The federal government determined that Colorado was one of fifteen states failing to meet the standards. The state legislature responded in 1917 by passing a new highway act creating a State Highway Fund to distribute state and federal funds for the development and maintenance of the state highway system. Lawmakers also reorganized the State Highway Commission into the State Highway Department. A commissioner and a five-man advisory board assumed responsibility for the new department's policies (Wiley, 1976: 15).

At the initial meeting of the Highway Advisory Board on December 6, 1917, the membership approved the first direct highway construction contracts let by the State Highway Department. Colorado and the federal government split the costs on six Federal Aid Projects (FAP):

FAP-1	Denver-Littleton (Santa Fe Drive)	$73,940
FAP-2	Pueblo-Trinidad	$267,192
FAP-3	Granite-Twin Lakes	$37,090
FAP-4	Rifle-Meeker	$79,083
FAP-5	Placerville-Norwood	$7,480
FAP-6	Lamar to Springfield	$10,031

Supported by FAP money, the Highway Department laid its first stretch of concrete pavement south of Denver along today's Santa Fe Drive (US Highway 85) in 1918 (*Fig. 30*). At the time, Santa Fe Drive was part of the Great North-South Highway extending along the Front Range from Wyoming to the New Mexico border. It also formed part of the Dallas-Denver, Colorado to Gulf, and the Albert Pike highways. Taking nearly a year, contractor Charles Connor of Denver poured a four-mile long, 16-foot-wide strip of concrete from Denver to Littleton at a cost of $77,571. By 1923, the state counted 1,200 to 3,500 vehicles a day over the highway between Denver and Colorado Springs. That year, the Highway Department widened the road to 18 feet to accommodate more traffic and renamed the road State Highway No.1 (SH 1) (Maloney, 1924: 8-9). In 1927, a subsequent Federal Highway Aid program redesignated SH 1 as US Highway 85. US 85 remained Colorado's major north-south highway until the construction of Interstate 25 during the late 1950s and early 1960s (Herbst and Rottman, 1990).

It took a while before the spread of Model T-ownership opened the state's roads to all classes of drivers. After initial distrust of the auto as a rich-man's toy, rural Coloradans enthusiastically took the wheel after cars became more affordable. In 1919, after almost a decade of state statistic keeping, a State Highway Department publication chronicled the impact of the auto on the state's farms and farmers:

Figure 12. On Colorado's eastern plains, the automobile was a familiar sight by the early 1920s. However, the ruts in this photo attest to how far the country had to catch up with the state's cities when it came to road construction. Postcard courtesy: Lyle Miller.

"The biggest advance made by any industry in this state in the past decade has been in agriculture; road building, perhaps, stands second. The former has been the result of bringing under cultivation hundreds of thousands of acres of fertile land in nearly all sections of the state and of the introduction of better methods in eastern Colorado. The latter has been largely the result of the agricultural growth of the state, for new and better highways have been required to transport the immensely increased products of our farms to market" (*Colorado Highways Bulletin*, July 1919: 14).

The same study showed that the state's highway mileage grew from 25,000 in 1909 to 45,000 by 1919. Over that same period, the amount of farm acreage grew from 2,614,312 acres to 4,500,000 acres—an increase of more than 70 percent (*Colorado Highways Bulletin*, July 1919: 14).

The development of farm-to-market roads was a high priority for state highway authorities. This emphasis was mirrored nationally as evidenced by the establishment of the Office of Road Inquiry and its successor, the Bureau of Public Roads, within the Department of Agriculture.

In the 1920s, the combination of federal dollars and gasoline tax revenues encouraged the Highway Department to tackle new challenges. Flush with more funding, and pushed by an increasing number of drivers, the department headed for the hills.

Mountain Road Building and High Altitude Highways

During his fifty years with the Highway Department, Charles E. Shumate participated in nearly every aspect of road construction from road crew membership to determining the alignment of the Interstate highway system in Colorado. Shumate ultimately served as Colorado Department of Highways executive director from 1963 to 1975. Looking back on his life's work in 1974, Shumate remembered he experienced his greatest frustration yet derived his most satisfaction from building roads over Colorado's lofty peaks:

"Other states have short areas of difficulty in highway construction. Washington and California have some challenging terrain, but every highway west of Denver has to go through the mountains. I don't think any other place in the United States presents the problems that Colorado has in highway construction" (*The Denver Post*, 1974: 18).

There are thirty-four mountain passes on the state highway system. Two of these passes are over 12,000 feet, seven more top 11,000 feet, and an additional ten are over 10,000 feet above sea level. The most traveled in the 1920s, and occasionally, feared, included Raton, La Veta, Cochetopa, Poncha, Tennessee, Monarch, Berthoud and Rabbit Ears passes. Inspired by their occasional inaccessibility, the Rockies offered Colorado's highway engineers and designers challenges few states could match.

Since the first whiff of automobile exhaust in the high country air, both the state government and the national media extolled the scenic wonders of Colorado. Inspired by a 1915 *Kansas City Post* article describing the Rocky Mountains as the "Playground of America," many drivers came from across the nation to the see Colorado's natural wonders (*Colorado Highways*, March 1926(b): 9).

The same year Congress passed the first Federal-Aid Road Act, the federal government established Rocky Mountain National Park near Estes Park. Only a short drive from Denver, the park stands unique among other national parks due to its proximity to a major urban center. By 1919, just three years after its creation, Rocky Mountain Park drew almost 170,000 visitors. A motor guide leading drivers through the park advised use of "extreme caution" and to "blow the horn at every turn" while maintaining a speed below 12 miles per hour (Noel, 1987: 46). According to the National Park Service, by the early 1920s Rocky Mountain National Park was the leading tourist destination of all the national parks (Thomas, 1996: 89).

The automobile fostered tourism in its development as one of the state's most important industries. After World War I, it became the job of the Highway Department to keep visitors coming back to Colorado along well-designed and constructed highways.

In 1919, the Highway Department launched its first major post-war mountain construction project over 11,400-foot Monarch Pass. Two-thirds of the 27.5-mile long Monarch Pass Highway ran through Cochetopa National Forest with the U.S. Forest Service contributing $204,450 to complete the job. Returning servicemen from World War I carved the road from the face of the mountain with pick and shovel while supply teams and wagons navigated the steep elevations and tight curves of the narrow canyons (*Colorado Highways*, April 1922: 8; Jeffrey: 1922). Many considered Monarch Pass, completed in 1922 by the federal Bureau of Public Roads, an engineering triumph. Rattled motorists held a different opinion after completing the difficult and dangerous ride. In the late 1930s, the Highway Department rerouted Monarch Pass less than a mile southeast of the original alignment. Re-opened in 1939, the upgraded highway featured wider, easier curves over the 11,312-foot high pass (*Rocky Mountain Contractor*, October 12, 1938: 6).

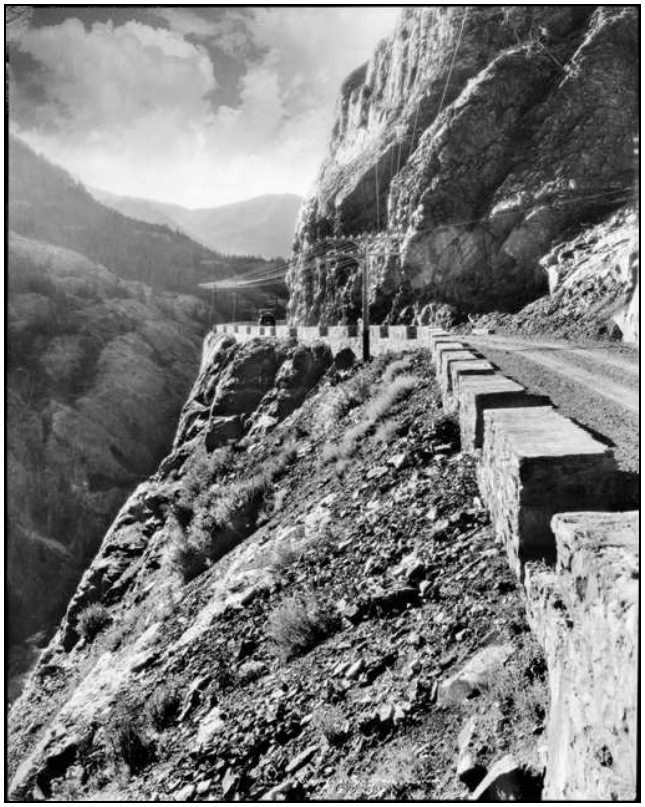


Figure 13. Otto Mears' Red Mountain toll road had a much safer appearance in the late-1920s than in its wagon road days (*Fig. 6*). In addition to providing protection for motorists, the crenellated stone shoulder guard added to the aesthetic qualities of this scenic mountain highway.
Source: Denver Public Library, Western History Department.

The first generation of high-country construction strictly for automobiles spread across the Rockies during the 1920s. In the San Juan Mountains, the Highway Department, with funding from the federal government, expanded Otto Mears' former toll road to seventy-eight miles. Between 1921 and 1924, crews widened curves, lowered grades, and surfaced the roadway from south of Ouray to the top of Red Mountain Pass.

Normally, the bidding process to award a highway construction contract is devoid of memorable phrases. In 1921, the submission of bids to upgrade Mears' road added a touch of legend to one of the state's most scenic roads. As county and state officials reviewed the bids, one contractor spoke up after he realized all the work necessary to improve the road. Referring to the project as "the million dollar highway that we're building," the moniker gained widespread acceptance. Three years later, in July 1924, local promoters prominently displayed a sign bearing the name "The Million Dollar Highway" at the ribbon cutting ceremony opening the highway. After completion, the Department of Highways publication *Colorado Highways* commented that although the Million Dollar Highway offered "some of the most difficult and costly road-building in the world" it was in "as fine condition as the best of the Denver boulevards" (Wilson, 1924: 4). Since the 1920s, the "Million Dollar" label has remained the popular reference for the entire 129 miles of US 550.

In 1915, members of the Denver Mountain Parks Commission conceived the idea of constructing the highest highway in the world to the summit of Mt. Evans. By the mid-1920s, the city of Denver, the federal government, and the state each contributed funds to the quarter-million-dollar road. State highway engineers designed the route to meet the standard road width of 20 feet and a six-percent grade from Bergen Park to the mountain's summit. From the summer of 1924 to October 1927, four different contractors worked to complete the road. The last section from Echo Lake to the summit offered its own set of problems. Engineers and crews scrambled to complete as much as possible during the three-month warm-weather construction season. Additionally, the thin atmosphere above timberline added to the difficulties of hard labor-intensive jobs like blasting rock and clearing debris. The Mt. Evans Road opened in 1927, offering the adventurous driver the opportunity to conquer its 14,130-foot summit by automobile (*Colorado Highways*, April 1927: 4). Mt. Evans Road, now State Highways 5 and 103, remains the highest paved automobile highway in America.

Figure 14. A motorist pauses on the Mt. Evans Road in 1924. The lack of designated scenic overlooks left drivers to park on the road itself. Photographer: Louis Charles McClure. Source: Denver Public Library, Western History Department.

Despite a decade of accomplishments, some out-of-state highway officials thought Colorado had not done enough since the passage of the 1916 Federal Highways Act. The usually taciturn Chief of the Bureau of Public Roads, Thomas H. MacDonald, stated in 1928: "Colorado is overlooking one of the biggest opportunities that could possibly come to a state. She is letting the big stream of traffic go by her to the north through Cheyenne,

and south over the old National Trail, instead of bringing it into her state and making provision for it to travel through the Rockies" (*Colorado Highways*, April 1928(a): 4). Colorado turned the argument back on Washington, claiming a large number of the state's roads passed through untaxable federal lands, thus preventing the state from drawing on a large revenue base for highway construction. State officials pointed to the abundance of federally held property as the reason Colorado ranked 40th of out of the 48 states in total highway revenues (University of Denver 1940: 15). All was soon forgiven between Colorado and the federal highway authorities. The deprivations of a worldwide financial collapse offered Colorado the opportunity to build roads like never before.

GOOD ROADS OUT OF BAD TIMES
DEPRESSION AND WORLD WAR II, 1930-1945

During the Great Depression of the 1930s, Colorado went on a road-building binge funded by a succession of federal back-to-work programs for the state's unemployed. The years between the stock market crash and the beginning of World War II were a time of standardization and modernization for Colorado's highways. The man who envisioned and executed these changes was State Highway Engineer Charles D. Vail. Appointed in December 1930, Vail immediately established a policy of oiling the state's roadways to ensure miles of safe, dustless, hard-surfaced highways. A colleague described Vail as "blunt, undiplomatic, tough as leather, he never dodged a fight or an issue" (Williams, 1945: 30). Vail used these characteristics to win appropriations from the state legislature and the federal government to build and improve the state's roads. In 1930, Colorado counted only 533 miles of hard-surfaced routes with most of the mileage covered in concrete. By 1941, asphalt covered 4,200 miles of highways statewide (*Rocky Mountain Contractor*, January 8, 1941: 22-3).

Back to Work: "New Deal" Road Building in Colorado, 1933-1942

If Vail had the vision, federal New Deal programs supplied the money to hire and pay the necessary labor. In the early 1930s, drought and dust storms blew Colorado's agricultural economy toward disaster. Combined with an increasing number of jobless in the state's towns and cities, the economic situation in Colorado was as a bleak as at anytime in its history (Colorado State Highway Commission, Minutes of Highway Advisory Board Session, April 12, 1935: 8-9).

Throughout the 1930s, federal work programs improved the state's roads, provided work to thousands of citizens desperate for a job and left a legacy that benefits today's drivers. By the close of 1939, thousands of enrollees labored to build Colorado's streets and highways (Thomas, 1996: 115). In Colorado, Works Progress Administration (WPA) employees built or improved 5,760 miles of highways and constructed 1,698 bridges from July 1936 to December 31, 1939. WPA workers commonly constructed locally quarried stone roadway bridges. The Douglas Crossing Bridge over Two Butte Creek in Douglas County remains an example of this type. Completed by an eight-man crew in 1936, the Douglas Crossing Bridge required a large volume of WPA-quarried stone for its six 14-foot-span semicircular arches.

Most WPA work was concentrated in rural Colorado where crews widened, graded, and resurfaced 5,065 miles of farm-to-market roads. Some important WPA projects included the reconstruction and oil-surfacing of thirty-eight miles of State Highway 12 west of Trinidad in Las Animas County; construction of thirty-one miles of new oil-surfaced highway north of Fort Collins to the Wyoming border; and the completion of a four-lane, oil-surfaced highway extending West Alameda Avenue eleven miles through Jefferson County. Construction on the new West Alameda skirted Green Mountain before joining US Highway 40 on the other side of the hogback rock formation (*Rocky Mountain Contractor*, March 27, 1940: 8).

Despite the Depression, tourism remained an important element of the state's economy. During the 1930s, tourist travel contributed "an estimated gross income of $100,000,000 a year" while the transportation and communication industries regularly employed "some 35,000 Coloradans" (Writers' Program of the WPA, 1941: 73). Both the Highway Department and federal work programs were involved with a number of mountain road construction projects throughout the 1930s. Work progressed on six main highways leading to the Rockies: the Big Thompson and North Saint Vrain highways serving Estes Park and Rocky Mountain National Park in northern Colorado; the Mount Vernon Canyon-Floyd Hill highway on US Highway 40 between Denver and Idaho Springs; US Highway 24 west from Colorado Springs and

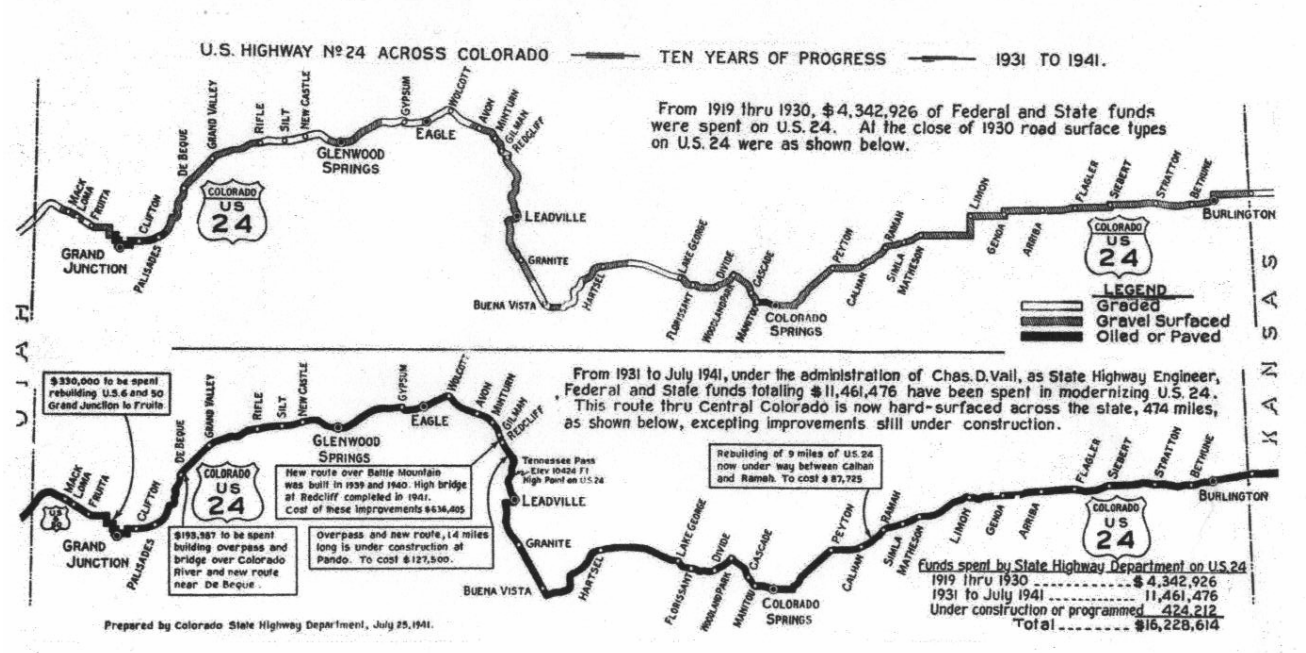


Figure 15. During the1930s, the State Highway Department transformed US 24 from a graded and graveled road to a hard-surfaced highway across Colorado. Source: *Rocky Mountain Contractor*, September 14, 1941: 8.

Figure 16. Rocky Mountain National Park visitation grew dramatically following the completion of Trail Ridge Road in 1933. Motorists accessed the park west of Estes Park through this Rustic style entrance at Fall River. Photographer: Fred Payne Clatworthy. Source: Colorado Historical Society.

Manitou Springs by way of Ute Pass and Florissant to Buena Vista and Leadville; US 50 west from Cañon City to Salida; and US 160 west of Walsenburg over La Veta Pass to Alamosa and then over Wolf Creek Pass to southwestern Colorado. Approximately 1,700 miles of new roads were built during the last half of the 1930s. A large portion of that mileage went through the Rocky Mountains. Construction through the Rockies did not come cheaply—engineers estimated that blasting an auto road through the solid granite of a canyon cost from $25,000 to $130,000 per mile.

New Deal programs also aided local road projects. Federal work programs provided money and men to realign and protect park roadways from flooding. WPA workers completed Red Rocks Park outdoor amphitheater (Thomas, 1996: 88). Depression-era improvements to the park's roads, buildings, shelter houses, picnic grounds, and parking eventually totaled $3 million. (Noel, 1987: 45).

The Civilian Conservation Crops and the Works Progress Administration constructed most of the Pueblo Mountain Park's Rustic style picnic, lodging, and sports facilities during the Depression. Trinidad established Monument Park on the Stonewall Canyon Road and utilized WPA labor for the construction of the park's Pueblo Revival facilities.

During the late 1930s, the state highway department rebuilt US 160 and Wolf Creek Pass along its present alignment. US 160 linked the San Luis Valley to the Colorado-Utah border. The highway covered a distance of 315 miles from Walsenburg to the Utah state line past Alamosa, Durango and Cortez. Construction of one 7.5-mile road segment proceeded along "precipitous walls of granite" at a cost of $2.6 million. Completion of US 160 and upgrading Wolf Creek Pass in 1938 brought far southwestern Colorado several hours closer to the rest of the state (Williams, 1937(a): 7).

The Public Works Administration (PWA) pumped hundreds of thousands of dollars into state highway projects in the form of grants and loans. By the late 1930s, the PWA replaced the WPA as the primary federal work provider in the state. PWA-funded labor forged a new route between Wheeler Junction and Minturn, now known as Vail Pass. In June 1936, the Highway Department conducted a reconnaissance survey from the road near Shrine Pass northwesterly over the top of an unnamed pass near Black Lake and following Black Gore Creek to Gore Creek. From 1939 to 1940, two crews of PWA-funded laborers built 4.6 miles of highway between Wheeler Junction and the top of the new pass, while a contractor tackled the 9.5-mile stretch from the top of the pass down the west side to Gore Creek. Another contractor built the remaining 9.8 miles from Gore Creek to the town of Dowd. Several mountain counties passed resolutions urging the department to name the new road Vail Pass, after State Highway Engineer Charles Vail. Bowing to popular demand, in December 1939, Vail ordered the department's shop to create signs along the pass bearing his name (Wiley, 1976: 27).

Tourism in the Clouds

Not every major highway constructed during the Depression years was a work relief project. Trail Ridge Road, constructed between 1929 and 1932, connected Estes Park with Grand Lake and opened Rocky Mountain National Park to greater levels of automobile tourism. "Road construction of this type," Park Service Director Horace Albright believed, "is meeting an obligation to the great mass of people who because of age, physical condition, or other reason would never have an opportunity to enjoy, close at hand, this marvelous mountain park" (Buchholtz, 1983: 176).

Park superintendent Edmund Rogers repeatedly walked the planned route and based on his recommendations, the road followed the most scenic route possible, including the dramatic Rock Cut area. Careful supervision by W.T. Lafferty, district engineer for the Bureau of Public Roads, and continuous inspection by Superintendent Rogers helped maintain esthetic sensitivity. Road workers to care to protect neighboring rock pillars from noticeable scarring when blasting outcroppings at the Rock Cut with dynamite. (Buchholtz, 1983: 176-77).

Figure 17. Trail Ridge Road (US 34) crosses the Continental Divide in an ecologically delicate area. At the Rock Cut, shown in this postcard view, crews carefully wedged the highway through with limited damage to the flanking formations. Native rock walls provide protection at the highway's edge while adding to the rustic setting. Source: Office of Archaeology and Historic Preservation, Colorado Historical Society.

"In 1929, an estimated 256,000 people entered the park, and by 1933, with Trail Ridge Road fully opened, the number increased to nearly 292,000, traveling in 83,000 automobiles. By 1938, the number of people entering the park climbed to nearly 660,000, bringing with them some 200,000 cars. Local businesses reaped a harvest of tourist dollars" (Buchholtz, 1983: 177).

Expansion Through Absorption

Engineer Charles Vail worked quietly behind the scenes to expand the State highway system. Eager to gather additional federal highway funding, the highway commission passed a resolution in 1938 expanding the state highway system by adding 2,700 miles of previously local roads. State Highway Engineer Vail recommended this be accomplished "in such a way as not to materially change the proportion of the mileage of state highways in each county." Many of these routes were short spurs and links that the state returned to local jurisdictions by the early 1950s (Colorado Department of Highways, April 22, 1938: 2).

The crafty Vail knew that the state would need all the miles it could count as state highways when Congress passed another highway aid package. This maneuver was Vail's final contribution to the state, as he died in office in January 1945.

Depression-era federal work programs continue to provide numerous aesthetic elements to Colorado auto travel that subsequent generations of highway designers chose not to duplicate. Rural areas benefited the most from construction of all-weather roads along with grading, graveling and bridge building. (Christensen, et. al., 1987: 53).

Bound by governmental budget constraints, and with the attention of its citizens diverted overseas, Colorado mostly ignored its highways during World War II. This inattention did not stop military trucks and transports from pounding the state's road system from Camp Hale near Leadville to the military bases around Denver and along the roads carrying material for the Manhattan Project's atomic bomb development activities on the Western Slope. Due to shortages in labor, equipment, and materials, an enormous backlog of deferred maintenance piled up during the war years. Highway Department leadership worried that roads considered "a high type of construction" during the late 1920s and early 1930s had not kept up with "the rapid advance in motor equipment and the ever-increasing volume of heavy and high-speed traffic" (Watrous, 1946: 13). The root of this dilemma stemmed from the relatively small funding resources available to the Highway Department. During the 1940s, the state's average highway revenue per vehicle placed Colorado 43rd among the 48 states (Colorado Department of Highways, 1945: 2).

POSTWAR AND INTERSTATE ERA, 1945-1973

Colorado emerged from World War II with a lengthy state highway network in desperate need of funds to remedy years of heavy use and deferred maintenance. Colorado's highway system totaled 12,394 miles by the mid-1940s, making it the eleventh largest among the forty-eight states—only 1,500 miles short of California. Colorado's Federal-Aid Primary System roads measured 4,050 miles, comprising only 5.3 percent of all mileage in Colorado. However, those roads carried sixty percent of all rural traffic, primarily heavy trucks and buses. In addition to those totals, 63,000 miles of county and local roads crisscrossed rural Colorado (Colorado Department of Highways, 1945: 1, 3).

Vail's successor as state highway engineer, Mark Watrous, complained in print about the possibility of remaking the state's road system after the war. "Money, man-power, materials, and time are the essential components of highway building. Colorado is far, far short of having any single one of these essential components" (Watrous, 1946: 13). In 1945, a state traffic study counted 800,000 cars and trucks passing through Colorado annually. The same study encouraged the construction of four-lane highways through the state's most traveled areas (the Denver metro area, the Front Range, and into the Rockies) that would cost from $40,000 to $100,000 per mile. The state's less-traveled roads also demanded attention. Of 3,500 miles of secondary roads, the Highway Department determined that less than 1,000 miles were satisfactory to carry the anticipated post-war traffic volume. The estimated cost of improving the state's farm-to-market and other rural roads ranged from $8,000 to $10,000 a mile (Colorado Department of Highways, 1943: 1; 1945: 3).

In 1949, a division of the Highway Department, the Highway Planning Commission, began a four-year odyssey to examine and recommend improvements to the state's highway system. The commission published its findings in 1953. The four-pound report suggested a reorganization of the department and favored returning nearly 4,000 miles of state highway to the counties. Effective January 1, 1954, the "Big Switch" reduced the state highway system from 12,400 to 8,000 miles. In announcing the change in highway jurisdiction, the department claimed that under the larger system, it actually had less responsibility, since it maintained only 4,000 miles of primary highways. After the switch, the department's responsibility included the construction and maintenance of all state highways, including over 3,900 miles of Federal-Aid secondary roads previously maintained by each county (Colorado Department of Highways, 1954: 14).

Making up for years of sacrifice, the nation went on a consumer goods spending spree after the war. Leading the list of new purchases was the automobile. As more people took to the road, Coloradans joined the chorus of voices asking Washington to improve the nation's highways. The federal government responded with the last, greatest, and most expensive round of highway construction of the twentieth century.

Year-Round Tourism

In the decades before World War II, Colorado's boosters promoted visits to the Rockies during the spring and summer before ice and snow cloaked the mountains in winter's isolation. The automobile provided a few hardy individuals the means to venture into the high country during the off-season, and as early as 1929, a Denver newspaper suggested that Colorado could draw more visitors in wintertime if private interests developed ski runs, jumps and skating facilities (Leonard and Noel, 1990: 437).

Outlasting the economic hardships brought by the Great Depression, tourism in 1940 constituted Colorado's third-largest industry after agriculture and manufacturing. During the war years, travel restrictions and gasoline rationing limited summer auto travel. Across the West, tourist revenue dropped by a third, but Colorado was less affected than neighboring states. Things began to

pick-up in the months after the war, as the Colorado Publicity Bureau received as many as fifty inquiries a day from ex-servicemen looking to return to Colorado (Athearn, 1976: 289). One notable group of soldiers, the 10th Mountain Division based at Camp Hale, had trained on the west side of Tennessee Pass near Leadville. After the war, members of the 10th Mountain returned to Colorado to lay the foundation of the state's ski industry in resorts like Aspen, Vail, and Breckenridge (Fay, 2000: 65). The ski industry became one of the primary benefactors of state and federal improvements to existing mountain roads and development of Interstate 70 through the Rocky Mountains. By the end of the twentieth century, Colorado counted fifty-five ski areas and the number of skier days reached ten million (Leonard and Noel, 1990: 438).

In one of the first post-war projects, the Highway Department widened and paved US 6 over the summit of Loveland Pass. Completed in 1950, one construction worker recalled how difficult it was to get a day's work done at 11,000 feet. "The year round, you can dig into mountain mud and within a few feet strike ice, and when that happens, the work really gets rugged" (Christensen, et. al., 1987: 54).

Encouraged by the state's "Colorful Colorado" tourism campaign, each community in the state developed its own means of luring auto tourists during the 1950s and 1960s. Some critics felt many of Colorado's small towns engaged in overkill. Towns such as Central City "stood out as the classic example of fakery in the world of tourist traps" while the one-time mining metropolis of Victor survived as an example of "a place where one could . . . drive along streets of abandoned buildings without the feeling that these relics had been embalmed for viewing by paying customers" (Athearn, 1976: 324).

By the late 1960s, Colorado's inherent desire to sell and promote the wonders of the state to the rest of the nation ran headlong into a new spirit of environmentalism laced with noncommercialism. In the battle to preserve the natural wonder that made the state special in the first place, developers and environmentalists fought many skirmishes on a new battleground—the Interstate highway.

The Freeway Era Begins

As federal money developed and supported mountain roads during the 1920s and 1930s, postwar highway construction brought the greatest immediate benefits to Denver. Beginning in the 1930s, the city unsuccessfully proposed a number of expressway projects to federal authorities (Hermsen Consultants, 1999: 15).

In 1941, State Highway Engineer Vail convinced the state legislature to pass the Freeway Act to provide funding for construction of a multi-lane thoroughfare across Denver. In September 1944, Vail commissioned consulting engineers Herbert S. Crocker and Alfred J. Ryan to study "The Denver Project," a north-south, limited-access highway through the city. Their report, "The Valley Highway: A North-South Limited-Access Highway" marked the first recorded use of the name "Valley Highway," a reference that later became part of the local jargon (Crocker and Ryan, 1944: 29). The engineers visualized a traffic-way "independent of the cross-flow of city traffic" which "will serve as an artery of unimpeded transport while at the same time providing fully for distribution and reception of traffic destined to or from Denver. It is clear, also, that a vital facility of this kind must be planned for enduring service. Its function is to carry not merely the traffic of today or of the next few years but that of the future, so far as can be foreseen" (Crocker and Ryan, 1944: 35).

Adapting elements from existing freeways like the Davidson in Detroit and the Arroyo Seco across Los Angeles, the Valley Highway was unlike anything ever attempted in Colorado. At a cost of $14.5 million, including right-of-way acquisition, the Valley route was the least expensive of four proposed to the State Highway Department (Crocker and Ryan, 1944: 43-4). Access to the highway was to be limited and at every interchange and all intersections with city streets or railroads the freeway utilized overpasses and underpasses to separate traffic flow. The final de-

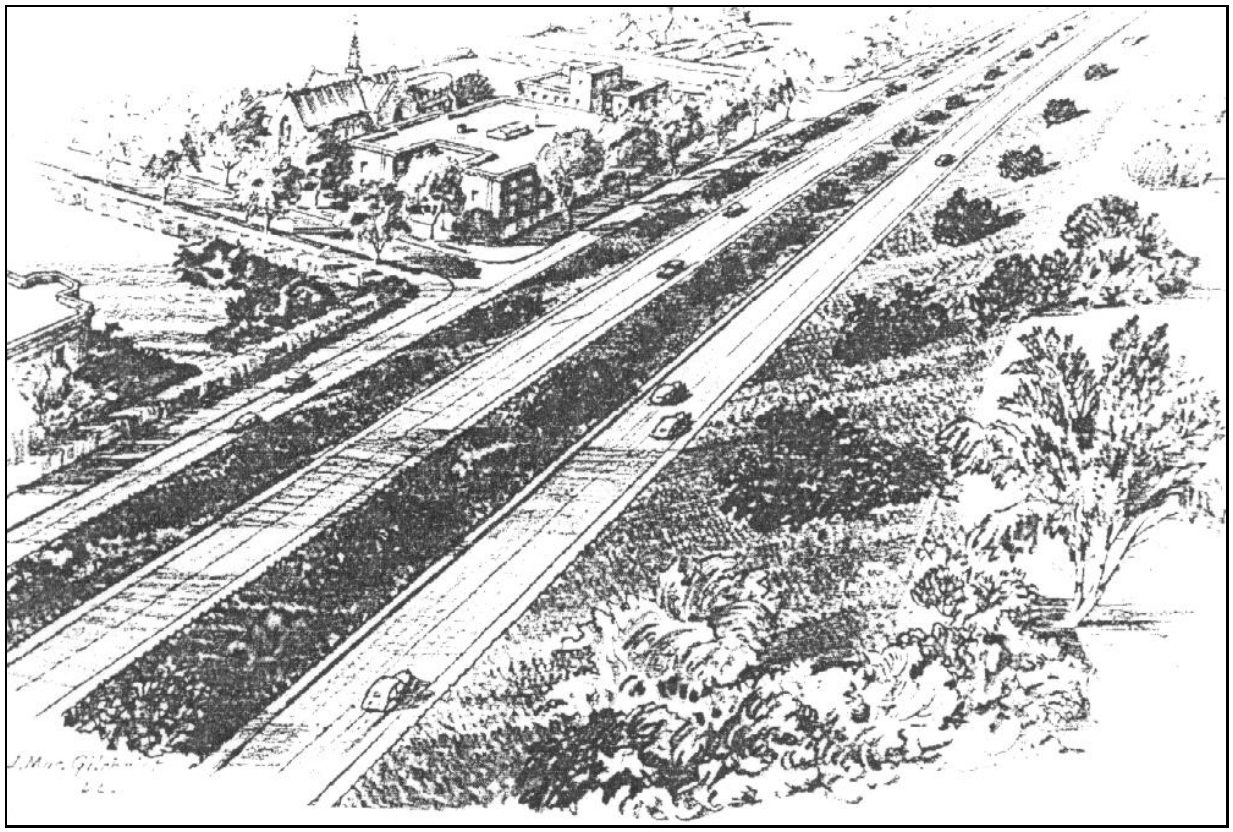


Figure 18. Engineers Herbert Crocker and Alfred Ryan emphasized aesthetics when proposing the state's first freeway (later known as the Valley Highway) in 1944. While modern Interstate 25 bears little resemblance to the illustration, Crocker and Ryan's original design featured "dual roadways separated by a landscaped median strip and bordered by service roads." Source: Crocker and Ryan, 1944: 63.

sign incorporated sixty-two grade separation structures over the highway's eleven-mile course.

Lack of funding slowed the Valley Highway's progress during the late 1940s and early 1950s. As work crept along Denver's north side, a popular effort grew to build an additional highway providing a direct route between Denver and Boulder. For most of the automobile era, right-angled State Highway 7 served as the primary route between Colorado's biggest city and the home of the state university. Roderick Downing, a University of Colorado professor in the School of Engineering, led the campaign to build the proposed highway.

The citizens of Boulder were much more vocal than their Denver neighbors in supporting a new freeway. In 1949, following a recommendation from the Highway Advisory Board, the State General Assembly adopted a resolution authorizing the Highway Department to issue construction bonds . Reflecting tight state budgets after the war, the legislature had approved construction of the first state-owned toll automobile highway. The legislature agreed that tolls would be collected only until the construction bonds were fully redeemed. The consulting engineering firm for the project, Howard, Needles, Tammen, and Bergendorf, drew plans and supervised construction under direction of the Highway Department. After court action upheld issuance of the bonds, the state prepared and sold bonds totaling $6.3 million, payable over thirty years. The department purchased the right-of-way and construction began October 2, 1950 (Portland Cement Association, 1952: 1).

Completed in January 1952, the Denver-Boulder Turnpike featured fully controlled access to two 12-foot lanes for each direction of travel. Eight bridges spanned the turnpike to accommodate cross-traffic. Twelve major structures, primarily tollbooths at Broomfield, lined the turnpike. When the turnpike experiment opened in January, many thought it would be part of the local scene for years to come (Portland Cement Association, 1952: 4-5).

The turnpike exceeded all expectations from its first day of operation. The engineering consultants forecast average daily turnpike traffic at 2,580 vehicles. The actual count reached 7,000 a day by the mid-1950s before increasing to 13,774 vehicles a day by 1966. A quarter toll paid for the 17.3-mile ride between Denver and Boulder. An unexpected windfall of spare change paid off the $6.3 million debt plus $2.3 million in interest by 1967—fifteen-and-a-half years after completion. Honoring a promise future generations of Colorado politicians later regretted, the state removed the last tollbooth on September 14, 1967. Part of US 36 since 1967, the Denver-Boulder Turnpike remains the only toll road in the U.S. public highway system ever to revert to a free highway (Colorado Department of Highways, 1950(b): 86; Wiley, 1976: 33).

Elsewhere across the state, communities needed improved roads to handle growing traffic. In 1949, a ten-year project began to build a four-lane highway from Pueblo to Denver. Along with the Monument Valley Freeway, completed by 1960 and transecting Colorado Springs, this route eventually became part of the modern Interstate 25 through southern Colorado (Christensen, et. al., 1987: 54).

Another important road project after the war involved completing the Clear Creek Canyon road. The highway tied directly into 48th Avenue and provided mountain access for Denverites. Delayed by wartime shortages, this route finally opened as part of US 6 through Clear Creek Canyon in 1952 (Christensen, et. al., 1987: 54).

Figure 19. Work progresses on a highway tunnel in Clear Creek Canyon in the late 1940s. Tunnels straightened highway alignments allowing motorists to travel at higher speeds. The original road around the outcropping is visible to the left. Photographer: Bob Zeller. Source: Colorado Historical Society.

To concur with the tenets of recent federal highway acts, the state legislature made a slight reorganization of the Highway Department in 1952. The Highway Department became the Department of Highways. The legislature also adopted a state fiscal year ending June 30 to match the timetable used by the U.S. Bureau of Public Roads. Led by a Chief Highway Engineer, an eight-man Highway Commission replaced the existing Advisory Board (Colorado State Highway Commission, Book 1, Feb. 26, 1952: 1-5). The department immediately overturned Charles Vail's 1938 highway absorption and returned some 4,000 miles of state highways back to the counties. The reduction to 8,000 state highway miles

placed full responsibility for maintenance with the department while counties and cities held responsibility for their roads and streets (Colorado Department of Highways, 1954: 14).

Colorado Joins the Interstate System

Ever since the First World War, a nationwide alliance of politicians, military planners, highway engineers and members of the tourism industry supported the development of an interstate highway system. In Colorado, a national highway would do more than link the state to the rest of the nation; it would link the state's eastern and western halves. As one Coloradan noted, "Colorado was more like two states independent of each other. There were months and months when you didn't go to Steamboat Springs on the highway; you didn't go to Grand Junction; you didn't go any place on the Western Slope"(Lewis, 1997: 254).

Inspired by nineteenth century achievements that linked the continent by Pony Express, telegraph and rail, and twentieth century examples like the German Autobahn, the Federal-Aid Highway Act of 1944 directed the Bureau of Public Roads to create a master plan for an interstate highway system (Lewis, 1997: 84). Little happened beyond planing until Dwight Eisenhower assumed the presidency in 1953. A strong advocate of an interstate highway system for defense purposes, the president teamed up with members of Congress and a coalition of highway and auto industry interest groups to press for a National System of Interstate and Defense Highways. The powerful pro-highway forces prevailed with the passage of the Federal-Aid Highway Act of 1956. The bill authorized $25 billion for twelve years to accelerate construction of a National System of Interstate and Defense Highways; create a Highway Trust Fund; increase the federal portion of construction costs for Interstate highways to ninety percent; require that the Interstate highways be built to the highest standards and capable of handling projected 1972 traffic levels; and pledge to complete the Interstate Highway System by 1972 (Lewis, 1997: 121-122).

The proposed 42,500-mile system would connect important centers of population and areas of national strategic importance by four-lane divided highways with a grade separation at points of crossing and interchanges at points of ingress and egress.

Interstates Cross Colorado 1956 - 1973

When the federal government first considered the original 40,000-mile Interstate system in 1956, plans called for I-70 to begin in Washington, D.C. and terminate in Denver. The Bureau of Public Roads initially feared committing the work force and money necessary to build a road through the Rockies. Colorado Governor Edwin C. Johnson offered Washington a deal whereby Colorado would build its own Continental Divide tunnel as long as the Interstate went through the state. Construction of a four-lane highway to the western state line would ensure the future of tourism as a primary state industry. Johnson directed a personal campaign toward an occasional and influential Colorado visitor, U.S. President Dwight Eisenhower. On fishing holidays, Eisenhower, like many others stuck in traffic, complained about the traffic jams between Denver and the mountains. Governor Johnson heard and subsequently played on those concerns in letters and personal appeals to the president (Thomas, 1996: 208).

Bowing to concerns from western congressional delegations, the Federal Highway Administration (FHWA) agreed in 1958 to extend I-70 by an additional 547 miles to connect with Interstate 15 near Cove Fort, Utah. Across Colorado, much of I-70 would follow the route of US Highway 6. The state's Chief Highway Engineer, Mark U. Watrous, remarked that the reassessment was "as important to Colorado as the discovery of gold" (Reef, 1961: 17).

Supported by federal funding, the Department of Highways immediately went to work in October 1956 on a six-mile section known as the Floyd Hill-Idaho Springs complex. Some of the engineering challenges this section presented in-

cluded drilling twin two-lane tunnels, expanding the existing road over Clear Creek to four lanes and constructing nine concrete bridges. After five years of work from 1956 to 1961, the federal and state government had spent $7.5 million on the first stage of the Interstate through the Rockies (Reef, 1961: 16).

A beneficiary of the new Interstate system was the stalled Valley Highway project. In lean funding years during late 1940s and early 1950s, the state continued to acquire right-of-way and award new contracts when funds became available. Federal money helped the state meet its ten-year construction goal. In November 1958 the $33-million, 11.2-mile highway opened with the completion of the Broadway Viaduct and the last section between South Emerson Street and West Third Avenue (Colorado Department of Highways, 1958:1-3). Use of the road quickly surpassed designed capacity, requiring the expansion of the highway in less than a decade.

During the 1960s, the department expanded the Valley Highway, completed I-25, and began work on I-70. When the eastern plains segment of I-70 opened to Denver traffic in 1964, the Interstate terminated as an elevated highway at 46th Avenue. For the next two decades, the Valley Highway interchange at 46th Avenue served as the crossroads between I-70 and I-25.

Eisenhower and Johnson Tunnels

When in 1967 the Department of Highways opened bids on a project to bore a highway tunnel through the crest of the Rockies, the agency began resolving one of Colorado's greatest remaining engineering challenges—building an Interstate highway over the Continental Divide. Construction of one or more tunnels was clearly needed to allow unimpeded highway traffic to cross the rock spine that formed 11,992-foot Loveland Pass.

Based on information gathered during a 1963-65 pilot boring for the Straight Creek Tunnel Project (renamed the Eisenhower Tunnel by the state legislature in 1972), the department planned to drill the first of two tunnels above the town of Bakerville and under the Continental Divide between Clear and Straight Creek Canyons. A consortium of Al Johnson Construction Company of Minneapolis, Gibbons and Reed Company of Salt Lake City, Western Paving Construction Company of Denver, and Kemper Construction Company of Los Angeles presented the low bid of $54.1 million. Adopting the name Straight Creek Contractors, the builders began tunneling the western portal on March 13, 1968. By October of that year, Straight Creek completed the tunnel's upper portion to the midway point. Excavation for the heading on the east portal started on December 11, 1968 (Colorado Division of Highways, 1973: 2).

Charles Shumate, state highway engineer, led the department through a gauntlet of new engineering challenges. Shumate likened the task of building a tunnel at 11,000 feet to "putting a five-story building through a mountain" (Lewis, 1997: 255). Shumate and all involved soon found the threat of landslides, rock falls and cave-ins only some of the project's challenge. During construction, movement in surrounding rock created a squeezing action on a section of tunnel floor, causing it to rise almost 1.4 feet in two months. Crews corrected the problem and by employing resourceful corrective measures, avoided cave-ins during the tunneling process. Engineers and workers prevented major earth slides at the west tunnel approach by controlling runoff drainage (Christensen, et. al., 1987: 55).

According to a sign located at the tunnel's west portal, Eisenhower's official elevation is 11,158 feet. While state officials have never made the claim, the Eisenhower Tunnel is most likely the highest part of any Interstate highway in the United States and the highest vehicular tunnel in the world. The completed tunnel measures 1.7 miles in length with two 13-foot-wide lanes. Ceiling placement of huge exhaust and fresh air ducts lowered the roadway's overhead clearance to sixteen feet, four inches. Eight fans draw 533,000 cubic feet of fresh air per minute into the tunnel, while eight exhaust fans expel a similar volume. Governor John A. Love opened what is now

Figure 20. A pair of bridges stands partially completed in 1949. Though begun before the initiation of the Interstate highway program, the Valley Highway in Denver benefited financially by being absorbed into the new federally funded construction program. Source: Denver Public Library, Western History Department.

Figure 21. Perhaps the greatest engineering accomplishment in state history, the Eisenhower Tunnel took 13 years and $125 million to complete. Vital to the completion of Interstate 70 through the Continental Divide, the tunnel provides a high-speed automobile link between the eastern and western halves of Colorado. Photographer: Johan Gordon, September 24, 1970. Source: Denver Public Library, Western History Department.

the westbound bore of the tunnel to two-way traffic at noon on March 8, 1973 (Lewis, 1997: 256).

In 1972, Highway Department designers started planning a second tunnel to serve eastbound traffic. Officials opened bids on August 8, 1975, for the mining, lining, drainage, support and approach roads. A joint low bid of $102,800,000 presented by Peter Kiewit Sons' Company of Omaha and Brown and Root of Houston won the contract to build the next phase. Preparatory work outside the mountain started on August 18, 1975, and excavation began that November. The eastbound bore, named for Colorado Governor and U.S. Senator Edwin C. Johnson, opened in 1979. It took nearly fourteen years and $125 million to complete the Eisenhower and Johnson Tunnels, about two and one-half times the original estimate. A few years into retirement, Shumate remarked, "I told many people that one of those [tunnels] in a lifetime is enough" (Lewis, 1997: 256).

Traffic through the first of the twin tunnels increased beyond all projections, as tourists, skiers and the general traveling public crossed the Continental Divide in relative speed and safety. Approximately 3.4 million cars went through the tunnel during the first full year of operation in 1974, and volume increased 3 to 5 percent annually thereafter. Completion of most four-lane construction in 1978 made I-70 an extremely popular mountain vacation route and one of the most important general transportation routes in the nation, with upward of one million cars a month passing through the tunnels during July and August.

Highway Bypasses

By the 1950s, intercity highways carried so much traffic that long-distance travelers passing through town commercial centers conflicted with local motorists. While local merchants welcomed the extra traffic afforded by the highway, motorists were less enthusiastic. Long distance travelers grew increasingly annoyed at having to slow down to pass through each town along the route. Local motorists did not like having to compete with highway traffic while shopping downtown.

Relief came in the form of the highway bypass. The bypass redirected intercity traffic on a new route around the edge of town. This allowed long-distance motorists to maintain highway speeds as they avoided the congestion of downtown. Local shoppers were again able to navigate main street without fighting highway traffic.

The highway bypass left merchants with a dilemma. While the bypass made it easier for local customers to shop, the highway traveler was no longer exposed to local shops and businesses. Many businesses catering to highway motorists abandoned downtown locations for the higher traffic location next to the byway. This was particularly true of businesses such as gas stations, diners and motels. New chain operators in the fields of gasoline, lodging and fast food built new outlets along the highway bypass, taking business away from and sometimes bankrupting downtown merchants.

The initial bypasses in Colorado all diverted traffic along US 85. The first opened in 1949 around the Greenhorn/Crow area south of Pueblo. The second opened the following year at Palmer Lake/Larkspur. Three more US 85 bypasses reached completion in 1957 and relieved congestion on Main Street in Brighton, Denver Avenue in Fort Lupton, and around Fountain south of Colorado Springs.

The sixteen-mile bypass on US 50 at Pueblo began diverting traffic from the Old Santa Fe Trail route along the eastern edge of downtown in 1957. Other early bypasses included the 2.5-mile diversion on US 34 around Estes Park, the 4.5-mile loop on US 24 at Manitou Springs, and US 34's 5-mile swing around Greeley completed in 1970.

The bypassed original highway segments remained marked as business routes for those wishing to continue into town for services.

COMPLETION AND AUGMENTATION OF THE STATE HIGHWAY SYSTEM, 1973-2000

By the mid-1980s, Colorado built few new highways. However, eighty years of construction did not suddenly end. Instead, the state began to centralize and play catch-up in those areas burdened with the largest traffic volume. Construction of multi-lane highway bypasses began looping their way around Denver. In 1985, the state completed 1.2 miles of I-76 from Wadsworth Boulevard to Sheridan Boulevard. That segment represented the first Interstate opening in Colorado since the May 1976 completion of I-225 in Aurora. With the end of construction on a 1.7-mile gap between Pecos Street and Interstate 25, the Colorado Department of Transportation declared I-76 complete in 1993. The last segment of I-70 opened the previous year with the completion of the Glenwood Canyon corridor.

Growth Demands Pavement: Colorado's Economic and Population Boom

The expansion of the nation's Interstate highway system opened Colorado to more vacation visitors and transplants in search of a new home. Much of the inspiration leading newcomers to Colorado was rooted in the environmental movement of the 1970s. In the national mind, Colorado represented a refuge of mountains untouched by overdevelopment, urban decay and sprawl. Ironically, the primary mode of travel around and to this idealized paradise was behind the wheel of an automobile.

In the state's largest city, efforts to accommodate the car continued to direct design and policy making while contributing to Denver's growth. By 1974, metropolitan Denver had almost as many vehicles (1,178,054) as people (1,498,000). However, during the 1970s the population of the City and County of Denver declined from 514,678 in 1970 to 492,635 in 1980. During the same ten years, the surrounding counties of Adams, Arapahoe, Boulder, Clear Creek, Douglas, Gilpin and Jefferson jumped from 728,686 to 1,133,404 (Noel, 1987: 48). The automobile remained at the very foundation of Colorado's economic fortunes during the 1980s. At the start of the decade, Colorado had the sixth-highest per capita motor vehicle registration in the country (Noel, 1987: 42). These numbers only grew as the state basked in its longest period of economic and population growth during the 1990s. Over the last decade of the twentieth century, the state gained more than a million people from 3,294,394 in 1990 to 4,301,261 in 2000 (Colorado Department of Local Affairs, 2002).

In the face of increasing air pollution and traffic congestion, the state's voters concluded a decade of growth with the approval of a multi-billion-dollar package to upgrade Colorado's primary thoroughfare—Interstate 25. The vote ensured that Colorado's dependence on cars would continue into the next century.

The Toll of Traffic

By the 1980s, Colorado's heaviest traveled roads strained under the traffic load. When I-25 and I-70 moved toward completion in the 1960s and l970s, few could have accurately predicted the enormous growth along the Front Range. Engineers failed to anticipate what bigger, faster, and heavier trucks could do to a road system. Design faults in the I-25/I-70 interchange became evident almost immediately after completion. These included inadequate ramps and curves that engineers and drivers alike blamed for numerous accidents. One of Denver's air-traffic reporters nicknamed the knot of concrete "The Mousetrap," because entering drivers were never sure they would leave in one piece. The flawed design did not stop traffic and the dangerous interchange remained in place for another two decades. By the mid-1980s, the interchange carried over 300,000 vehicles a day.

Spurred by a spectacular 1984 Mousetrap accident involving a truck carrying torpedoes, the federal government authorized $186 million in 1987 to upgrade the notorious Interstate interchange. The new construction elevated I-70 above I-25 and widened the entry and exit ramps for greater capacity and higher operating speeds. The Department of Highways eventually expanded the project east along I-70 to Brighton Blvd., raising the cost to $266 million and pushing the completion date to 2002 (Colorado Division of Highways, 1987: 11).

Nearly 75 percent of Colorado's Interstate highways were complete by 1970. Federal and state officials opened the last portion of the 299 miles of Interstate 25 from the Wyoming line to Raton Pass in 1967. The Department of Highways and its successor Colorado Department of Transportation (CDOT) also completed the 184-mile route of I-76 from Denver to the Nebraska state line (originally designated as Interstate 80 South) with the opening of a 1.7-mile section across northwest Denver in 1993. The section connected I-25 south of the Boulder turnpike (US 36) to I-70 near the Wadsworth Boulevard exit. The final 1.7 miles took four years and $91 million to complete (*Rocky Mountain News*, September 15, 1993: 4-A).

Highway Bypasses: Routes, Loops and Spurs

As highways grew larger, so too did the bypasses. I-225, I-270, C-470 and E-470 represented successive efforts to keep traffic flowing on I-25 and I-70 through Denver. Construction on the twelve-mile southeastern loop of I-225 began in 1966 and reached completion in 1977. I-270 served as a bridge between I-70, I-76 and I-25. Begun in 1968, the last piece of the six-mile highway opened in 1999.

Controversy over a proposed Interstate bypass around southwest Denver resulted in the construction of the alternative C-470 freeway. Begun in 1986, the 27-mile freeway linked I-25 with I-70 in 1991.

E-470, a 46-mile eastern loop connecting I-25 on the north and south ends of Denver with I-70 and Denver International Airport, became the first major toll road constructed in the state since the Boulder Turnpike. Built and operated by a public highway authority, the first segment opened in 1991 and was fully completed in 2003.

Bypass construction continued on non-Interstate routes as well. New routes diverted highway traffic around Mancos and Bayfield on US 160 in 1972. US 50 skirted Olathe by 1977. The Department of Highways extended the bypass on US 34 at Greeley and a new bypass on SH 82 rerouted the heavy Glenwood Springs-Aspen traffic around downtown Basalt.

While intended to keep traffic moving on existing overcrowded highways, the new bypasses also significantly affected urban development in the metropolitan area. Shopping centers, office parks and residential development quickly sprouted along the newly accessible transportation corridors. New growth led to heavier traffic on the bypasses and growing concern that yet more highways will be necessary in the future.

Bypassed Communities

For many Colorado communities, being bypassed resulted in severe economic decline. The Interstate system was specifically designed to move traffic rapidly with limited numbers of interchanges to enter or exit the highway. The Interstate often ran at a considerable distance from existing towns, leaving them connected to the transportation and economic artery only by a sign on the Interstate.

The routing of I-76 along the south bank of the South Platte River isolated the communities north of the river along US 6 and 138. Towns like Ovid, Sedgwick, Crook, Atwood, Morino and Hillrose experienced significant declines in automobile traffic and subsequent losses of auto-dependent businesses. Larger communities, such as Sterling, Brush and Fort Morgan, managed to draw travelers off the Interstate, but many travel-related businesses opened or relocated next to the Inter-

Figure 22. This closed Standard service station in Sedgwick stands in silent testament to the loss of traffic on US 138 following the opening of I-70 two miles to the south. Source: OAHP, CHS.

state interchange rather than in the traditional downtown business district.

The same thing happened along I-70. Burlington and Limon remained important highway stops, though much of the commercial growth centered around the Interstate interchanges. Smaller communities on US 24 bypassed by I-70 withered on the vine. Bethune, Stratton, Seibert, Arriba and Genoa all experienced a loss of commercial services, particularly gas stations, restaurants and motels.

Glenwood Canyon: The Last Great Challenge

The state's east-west Interstate route, I-70, runs a total of 450 miles across the state—176 miles between the Kansas state line to Denver, and 274 miles west from Denver to the Utah border. After twelve years of controversy, CDOT completed work on the last twelve-mile portion of I-70 through Glenwood Canyon in October 1992. In opening the $490-million-dollar project to traffic, Governor Roy Romer labeled Glenwood Canyon's highway design as timeless. "As a society we need to save, to invest, and to forgo instant gratification to build these kinds of monuments so when they unearth our remains in 2,000 years, they will say, 'Yes, civilization does progress'" (*Rocky Mountain News*, October 15, 1992: 10).

Those who drove US 24 through the Glenwood Canyon in the 1920s were always grateful to tell how they survived the journey. Falling off into the canyon while driving near Shoshone Dam was always possible regardless of weather conditions. Dr. Woodrow E. Brown grew up in Eagle and remembered the adventure of passing along the road during the 1920s:

"The road was extremely narrow (an estimated width of a lane-and-a-half) and if you met a car you darn sure got over, got to a wide place and let 'em go by" (Schader, 1996: 131).

Between 1936 and 1938, WPA crews blasted rock from the canyon, pushing the debris into the Colorado River to clear a broader highway. The widening and paving of the road through the canyon cost $1.5 million. After completion of improvements to US 6 and US 24, the state re-opened both roads on August 1, 1938. The reconstructed highway provided a paved lane for both eastbound and westbound traffic through the canyon (Schader, 1996: 133-4).

The late 1960s and early 1970s brought the Interstate to the canyon. In 1971, the Division of Highways estimated that completing Interstate 70 through a twelve-mile stretch of Glenwood Canyon would cost $65.2 million. Six years of debate saw the cost climb to $211.9 million. By the 1980s, the Glenwood Canyon Interstate averaged slightly over $40 million per mile, or more than forty times the 1957 projected cost of a mile of Interstate highway. The $490 million segment cost more than twice the first estimate for all of I-70 from Denver to the Utah border. The rise of the environmental movement and the passage of the National Environmental Policy Act (NEPA) of 1969 reversed many people's opinions that highways in and of themselves were a good thing. The effect of the environmental legislation was to

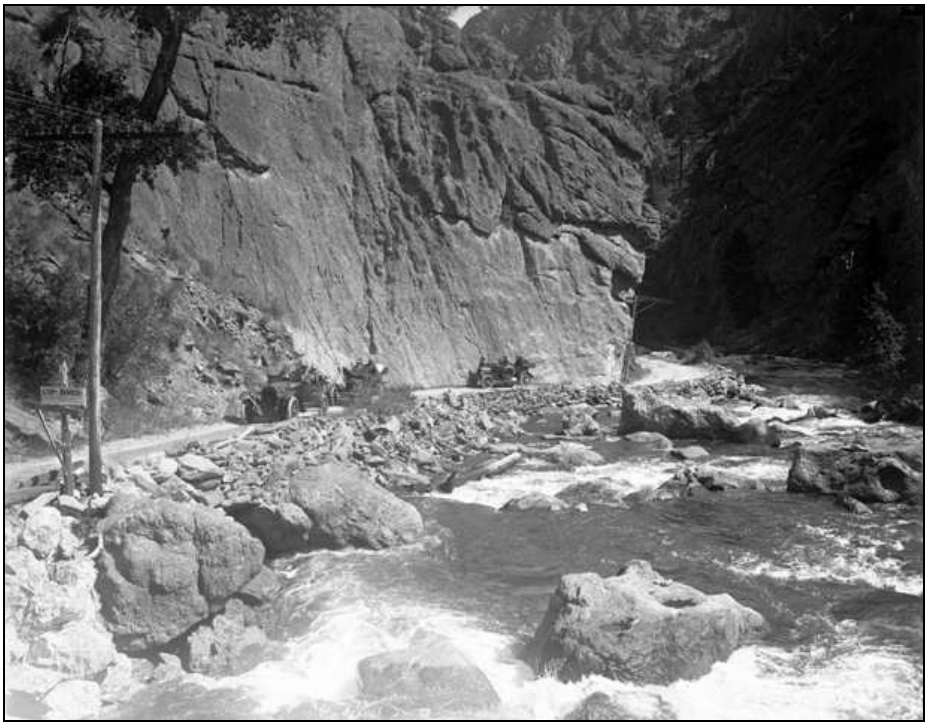


Figure 23. Glenwood Canyon offered adventurous automobile tourists unsurpassed natural scenery. In many places, the narrow road did not permit the passage of vehicles traveling in opposite directions. The roadside sign at the left of the photograph eloquently sums up the situation—"Stop Danger." Photographer: Harry Mellon Rhoads, ca. 1920 Source: Denver Public Library, Western History Collection

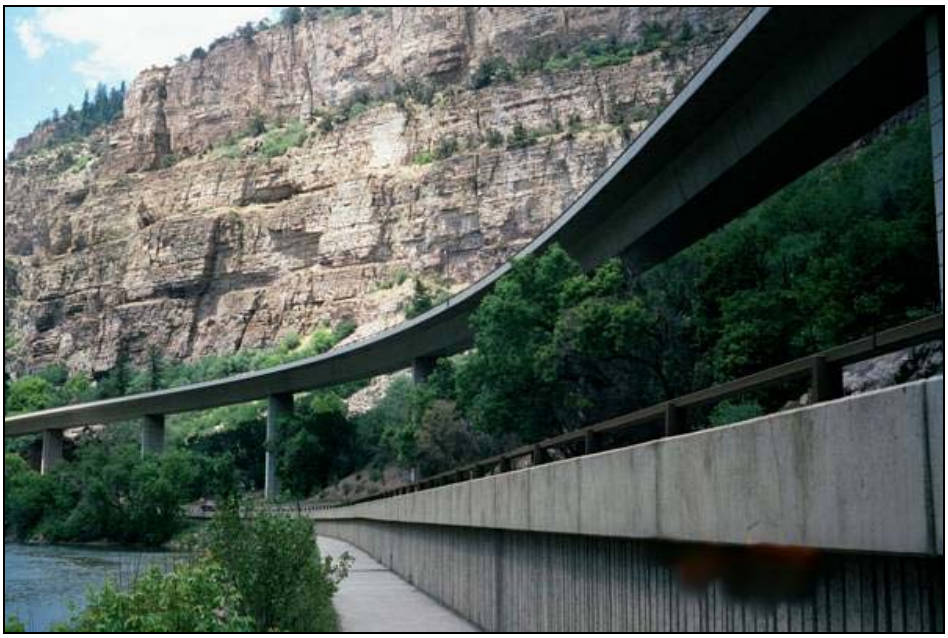


Figure 24. The cantilever lanes on Interstate 70 through Glenwood Canyon carry thousands of vehicles every day safely and rapidly while allowing traffic and scenic beauty to coexist. This view looks west from the recreation trail east of Hanging Lake. Photographer: Matthew Salek, July 22, 2002.

delay Glenwood Canyon and other highway projects to accommodate greater preliminary planning and environmental-impact studies. After the project received final executive branch approval in 1975, opponents filed suit, lobbied against funding, and generally proclaimed that the Interstate would wreck the canyon's natural beauty (Thomas, 1996: 299).

Despite initial opposition and continuing reservations from those with environmental concerns, work on the twelve-mile section in Glenwood Canyon finally got underway in 1981. Project engineers worked within a number of environmental, recreational and aesthetic constraints. Over time, the design of bike paths, cantilevered lanes, rock-toned concrete, alpine landscaping and dozens of other design innovations, eventually, in the opinion of the *Rocky Mountain News*, "won over the staunchest opponents." Sam Caudill, an Aspen architect who headed local opposition to the project announced at the highway's opening, "This 12 miles of highway is sensitive to the environment and graceful. This was a win-win all the way" (*Rocky Mountain News*, October 15, 1992: 10). After nearly a half century of construction, Colorado's Interstate system—north to south, east to west—totaled 951 miles (Colorado Division of Highways, 1987, 8).

Highway Projects to the End of the Century

Without the fanfare of the early automobile age, Colorado saw its most monumental highway projects completed or begun during the last quarter of the twentieth century. The period began with the opening of the westbound bore of the Eisenhower Tunnel. Planning and construction of I-70 through Glenwood Canyon consumed nearly the entire period. The century of the automobile in Colorado closed with voters agreeing to fund the largest construction and improvement project in state history—the $1.67 billion Transportation Expansion (T-REX) project.

The 1980s closed with the opening of bigger and better roads along the northern Front Range. In 1988, new off-ramps known as "flyovers" loomed over the heads of drivers on I-25 and I-70, guiding cars along at greater speeds. Other accomplishments included completion of the Boulder and Foothills Parkways and Denver's six-lane Walnut Street Viaduct. In the 1990s, the latter road served as the front gate to Denver's Lower Downtown neighborhood and contributed to a resurgence of residential and business development in that area of the city.

In 1991, the legislature approved changing the Department of Highways to the Colorado Department of Transportation (CDOT). The change reflected a policy of integration in the planning, construction and operation of the state's transportation systems.

While new highways remained a priority in parts of the state, much of the new planning and construction focused on expanding the capacity of the existing highway system. On August 15, 1996, the State Transportation Commission adopted the Strategic Transportation Project Investment Program. The program identified twenty-eight high-priority projects for placement on an accelerated construction schedule. By using projected Transportation Commission funds alone, the state originally estimated it would take forty-eight years to complete the strategic projects. Passage of Senate Bill 97-001 allowed the state to take a portion of the state General Fund revenue over five years for completion of strategic highway projects. With the indefinite extension of SB 97-001, and the ability to issue bonds granted by voters in 1999, CDOT predicted completion of most projects within ten years (Colorado Department of Transportation, 2000(a): 5).

A 1995 study by the Denver metro area's planning organization, the Denver Regional Council of Governments (DRCOG), found population and commercial growth from Denver to Douglas County had overwhelmed Interstate 25's original design. In 2000, daily traffic counts totaled 230,000 vehicles per day. This topped the 1995 prediction that the corridor would not reach maximum capacity—183,000 vehicles per day—until 2015 (Colorado Department of Transportation, 2002: 5). A 2000 traffic study listed metro Denver

as the seventh-most congested metropolitan area in the United States.

In November 1999, Coloradans voted to allow CDOT to issue bonds for future construction projects. CDOT's first sale of bonds in May 2000 brought $530 million into the department's construction budget. Among the projects was the biggest highway undertaking since the beginning of the Interstate era—the Transportation Expansion Project, better known as T-REX. The project brought together CDOT, the Regional Transportation District (RTD), the Federal Highway Administration, the Federal Transit Authority, and several counties, cities and business districts. T-REX's primary objective was to modernize and expand the state's most heavily traveled road, Interstate 25 from Lincoln Avenue in Douglas County to Broadway in Denver, and I-225 from I-25 to Parker Road in Aurora. For the first time, rail and highway came together in a single project. RTD will benefit through the construction of a light-rail route integrated into the expanded highway. Barring delays, the seventeen-mile-long T-REX project will continue until 2006 and will carry the largest price tag in state highway history—$1.67 billion (Colorado Department of Transportation, 2002: T-REX website, TREXProject.com/about .asp/).

Figure 25. The 1953 Franklin Street overpass came down in 2001 as part of the T-REX project. The former Valley Highway bridge on I-25 predated the Interstate system. Source: CDOT.

DESIGNING AND CONSTRUCTING COLORADO HIGHWAYS
AN ENGINEERING CONTEXT

The previous sections focused on the historical chronology of road and highway construction in Colorado. This section discusses the various physical elements of highway design which characterize different periods and types of construction.

The precise science of engineering brought order to the chaos of Colorado's trails and early auto roads. The first wave of gold seekers followed existing native trails, or blazed new paths, with little consideration for configuration or design. Subsequent settlers brought concepts of travel and commerce that demanded better, safer roads. Within the first decade of Colorado's statehood, elected leaders made initial attempts to improve the state's roads. Change came on the wheels of the horseless carriage. The self-directed travel promised by the automobile ironically bound individuals together in demands for better highways. By the mid-1910s, both state and federal governments responded to those demands with the creation of the first standards regarding highway design, grade, and materials. Under the authority of state and federal agencies, highway design standards evolved through the century. Today, Colorado drivers travel over a highway system incorporating design and construction elements reflecting successive periods of construction and local topography, as well as regional economies and social character.

Alignment, Grade and Surface

Wagon Road Construction

Trails first led gold seekers and settlers west to Colorado. Countless wagon teams following the same general path left the prairie rutted and scarred. On the eastern prairies, early travelers faced dry winds and dusty trails punctuated by sticky bogs and swollen rivers. These prairie trails were smooth highways compared to the mountainous routes to the gold camps of the Rocky Mountains. A number of different conveyances traveled over Colorado's first trails, from the dog or horse-drawn travois of the Plains tribes, to the cumbersome Spanish two-wheeled ox-driven *caretta* and the prairie schooners of the gold rush era. While ideal for the high plains caravan, the covered wagon was not designed for the steep slopes of a mountain road. In addition, there were often insufficient draft animals available to pull wagons over the seemingly endless summits. Overlooked in the haste of the Gold Rush was the necessity to build safe and suitable wagon roads.

Over the eastern plains, the first wagon roads were built quickly and were rough surfaced. These roads were nothing more than wagon tracks with the largest stones removed. Trails were "little more than many pairs of ruts made by the wheels of heavy wagons" (Writers' Program of the WPA, 1941: 70). When a pair of ruts wore too deep for continued use, wagons straddled the old ruts and created new ones. Travelers themselves were responsible for whatever road maintenance conditions might demand. The pioneers took immediate action as needed to insure their own passage, leaving the next travelers to improve road conditions at their own discretion (Ridgway, September 1932: 162). The pioneers exerted little effort to level the roads. Their wagons were forced to climb or descend steep slopes and to ford streams. At times, strong rains and heavy snowfall made passage on the plains difficult, if not impossible (Writers' Program of the WPA: 71).

The Homestead Act of 1862 encouraged the settlement of Colorado and other western territories. Small towns sprang up across Colorado. The space between most towns generally measured no more than ten miles apart—the distance a team and wagon could travel from a nearby town and back in a day (Scott, 1999: 5). The first roads tended to follow property and General Land Office surveyed section lines, converting the plains landscape into a giant grid.

Early Automobile Highways 1900-1930

In 1908, James E. Owen, in an address before the Good Roads-Automobile Convention in Atlantic City, New Jersey, explained the transitional nature of the nation's roads from horse and carriage to horseless carriage:

"Just consider what a road has to undergo. A heavy team comes tearing along with the horses' caulked feet, hammering and packing the stones for the heavy wheels to grind them to powder. Behind this comes a light buggy with a fast trotting horse and rubber tires, stirring up the loose material, then as a climax a six-ton motor car at 45 miles – excuse me, 21 miles per hour [New Jersey speed limit] whizzes along throwing and hurling this loosened material into the gutter, or gently bedewing a strawberry patch with pure stone. Then what becomes of the road?" (AASHO, 1952: 105).

Figure 26. Concrete right-of-way markers still delineate boundaries on US 138 and US 40 in eastern Colorado. Source: OAHP, CHS.

Since its beginnings in 1917, the State Highway Department established and followed standards for all graded and surfaced roads. According to the department's first chief engineer, James E. Maloney, the department's principles were "the outgrowth of our experience with the construction of different roads in different parts of the state." For graded and paved roads, the state demanded a 60-foot-wide right-of-way to accommodate a 24-foot-wide road. The spacious right-of-way allowed room for additional lanes and future surfacing. The department wanted standardization so that any grader or scraper could build roads that would be, in Maloney's words, "uniform, sightly, practical, and I believe, more economical." Conversely, the chief engineer warned that a crooked line of ditch and grade was "unsightly and unworkmanlike, indicating either carelessness or lack of skill" (Maloney, June 1918: 9).

Figure 27. A road crew grades a highway in western Colorado. Dirt roads required constant maintenance to deal with the ravages of traffic and weather. Photographer: Either Fred Garrison or Ola Aftinson Garrison, June 5, 1924. Source: Colorado Historical Society.

With the federal government taking a greater hand in road construction nationwide, the highway engineers of Colorado and forty-seven other states followed a general Bureau of Public Roads (BPR) guide for surveys and plans. A survey party consisted of a field engineer in charge, instru-

ment man, rodman, two chainmen, one or more axemen and a camp man. In surveying a potential road, a survey party recorded a variety of information:

"All fence and property lines, and intersecting roads. These should be carried back at least 300 feet. Telephone, telegraph and power lines—the number on several of the poles should be noted, and street or stream or electrical railroad lines crossing or parallel to surveys, if within 500 feet, culverts and siphons. The span, width of roadway, and character of all bridges, also diameter, length and kind of culverts—also the angle at which the stream crosses the road, the profile of the stream crossings and all information that can be had as to depth of foundation and area of drainage—also a profile up and downstream for 500 feet is to be taken when the bridge is on a stream that is liable to scour. Location and character of all material suitable for road surfacing or construction should be noted." (*Colorado Highways Bulletin*, June 1919: 21).

Both the BPR and the State Highway Commission followed a set of rules regarding grade limits and road curvature. Engineers knew that a road grade should not exceed six percent (a rise of 6 feet in elevation for every 100 feet of length). Short distances not exceeding 2,000 feet could reach seven percent to avoid heavy road work. Regarding road curvature, BPR philosophy maintained, "A great many of the present curves on the roads are unnecessary and could be eliminated by a little grading work." Where that was impossible, the BPR recommended a radius of not less than 100 feet. In the tight canyons and ledges of the Rocky Mountains, a 100-foot radius often proved economically impossible. The BPR suggested a radius of no less than forty feet on any mountain switchback or curve (*Colorado Highways Bulletin*, June 1919: 21).

Local representatives of the Bureau of Public Roads took a keen interest in the developments of the burgeoning highway departments in each state. In 1917, BPR's Acting District Engineer J.W. Johnson wrote to his boss, Thomas McDonald, the engineer in charge of federal road work for the BPR, that construction progress in Colorado was hindered by the state highway law that required a large portion of the state road fund be pro-rated to the counties. Road projects in each county had to expend that county's share of state funds. Johnson found that "the commission has been forced to submit a number of very small projects, several of them being concrete surfaced roads averaging from 2,200 feet to a mile and a half…. The character of the projects submitted could be very materially improved were it not for the fact that the State Highway Commissioner of the individual district apparently attempts to please everyone by the submission of a number of small projects rather than to submit a smaller number of projects and have them substantial in size and quality." (Bureau of Public Roads, 1919: 10). Johnson concluded, "If the Colorado Highway Commission would form a proper kind of an organization for carrying out the work and submit projects more from the point of view of improvement of state highways, it is believed that a decided betterment would result." (Bureau of Public Roads, 1919: 11).

A number of Colorado cities exhibited ingenuity when laying out their first traffic grids. In 1909, the Santa Fe Trail, an offshoot of one of the state's oldest routes, received a modern makeover after Pueblo County Commissioners contacted Thomas Tynan, warden of the Colorado penitentiary. The commissioners sought the use of thirty-five convicts to perform "experimental road work" towards hard surfacing a portion of the "Old Santa Fe Trail" located on Pueblo's eastern city limits. Convicts graded an adobe roadbed for drainage and placed corrugated iron culverts below road level to eliminate bumps along the surface. They spread a foundation of smelter slag from the Colorado Fuel & Iron plant and rolled the material into the roadbed. The road was then soaked with water and a layer of gravel rolled into the slag. After completion, residents of Pueblo boasted, "the Santa Fe Trail became the most modern section of highway in the West" (Taylor, March 1927: 9).

During this period, Denver also weighed how best to improve and pave its urban grid. Experimenting

Figure 28. The sign reads "M. A. Masters General Contractor Paving District No. 1 Montrose, Colorado." The firm is paving Main Street in Montrose. A crew is leveling concrete being poured from a mixer, while others haul rock and dirt in wheelbarrows. Main Street in 1919 formed a part of the Rainbow Route through western Colorado. Source: Denver Public Library, Western History Department.

with four separate materials, the city paved four blocks of Speer Boulevard in 1910. On successive blocks, city crews alternated between asphalt concrete, tar concrete, a patented type of bituminous concrete known as "Amiesite" and tar concrete placed over an existing Macadam base. The city committed to asphalt concrete when it paved eight additional blocks of Speer in 1912. From 1916 to 1918, the city paved thirty-five to forty blocks with asphalt and asphalt concrete. Denver owned and operated the asphalt plants and trucks while day labor performed all the grading (Johnson, 1922: 20).

Technologies developed during the First World War benefited the postwar quality of road building across the United States and in Colorado. Colorado contractor Edward Honnen told *The Denver Post* that machines built for war helped the state build better roads in peacetime:

"When I took over my dad's company in 1920, there had been very little change in the tools from about 1860 to 1920. World War I had the greatest effect on the construction industry because they (the U.S. Army) developed a power unit. And from then on, we pulled wagons, we pulled plows, we pulled scrapers, we pulled everything" (*The Denver Post*, 1974: 14).

By the start of the 1920s, screened or crushed gravel, stone and/or shale constituted most of Colorado's surfaced roads. The state constructed gravel roads in two courses, or layers. A 2.5-inch base of stone formed the bottom layer while three inches of gravel running to a feathered edge at the sides formed the top course. A road roller weighing 300 pounds compacted the material to a three-inch thickness (Colorado State Highway Commission, 1919: 14).

The reorganization of the State Highway Department in 1921 improved the increasingly distant lines of communication between headquarters and construction jobs in the field. The department established an engineering division under supervision of an assistant highway engineer. Before creation of the engineer's divi-

Figure 29. A Wood Roadmix Machine applies asphalt to Colorado Highway 7 south of Estes Park in 1936. The treaded tractor is the power unit for the entire operation. Source: Community Services Collaborative, 1981: 5.

sion, communications between headquarters and the field was haphazard. In remote areas of the state, crews relied on their own judgment during road surveys. Under the new system, highway location crews made initial surveys and were followed by other teams that conducted the final engineering surveys. Headquarters in Denver prepared construction plans and specifications based on the two surveys to bring the prospective project to contract (Wiley, 1976: 17).

Figure 30. The first application of concrete in the state highway system occurred with the 1918 paving of the Great North-South Highway (also US 85, SH 1 and Santa Fe Drive). The initial 16-foot wide strip ran from Littleton to Denver. Photographer: Rocky Mountain Photo Company, August 6, 1924. Source: Denver Public Library, Western History Department.

After 1921, the federal government assumed the dominant role in directing road construction in Colorado and across the nation. Road building between the two world wars took place within "the federal-aid structure of shared power, responsibilities and finances" (Seely, 1987: 67). The Federal Highway Act of 1921 (42 Stat. 212) retained the outstanding features of the Federal-Aid Road Act of 1916 and added the important requirement that the U.S. secretary of agriculture and the several state highway departments should jointly designate a system of important interstate and intercounty roads. Limited to seven percent of the country's total road mileage, these designated roads constituted the Federal-Aid Highway system on which all future federal appropriations were expended (Strobridge, 1962: 4).

The pavement of the first Federal-Aid concrete road in the state—Federal Aid Project No. 1 from Denver to Littleton—measured 16 feet wide, 5.5 inches thick at the edges and 6.5 inches at the center. Within five years of its 1918 completion, BPR engineers noted that this section of highway showed "more defects, especially in the corner cracks, than any other project" due to a lack of a sand cushion, and the narrow width of the pavement, causing the load to come closer to the edges (Bureau of Public Roads, 1923).

Beginning in the 1920s, federal aid paid for practically every concrete road in Colorado. These roads measured 18 feet wide, 6 inches thick at the sides and 7.5 inches thick at the center (Bureau of Public Roads, 1923). Because of BPR regulations, all pavements in Colorado had traverse joints every 30 feet and were laid on a two-inch sand cushion wherever the soil had a large percentage of clay. Most of Colorado's soil is sandy loam. Colorado also used a 4-foot wide and 6-inch deep sand or gravel shoulder on the sides of the road. Before the Bureau of Public Roads instituted its standards, the State Highway Commission constructed sand and gravel shoulders only two inches in depth. Once the state followed the federal agency's guidelines, the BPR gave Colorado's roads good marks. A 1923 BPR review noted "the pavements in Colorado are today in good shape. The only defects are minor in character, due to poor construction such as slight unevenness or roughness at the joints, or irregularities in the slab itself" (Bureau of Public Roads, 1923).

As the 1920s progressed, the state built more concrete roads. An abundance of raw materials and available labor convinced engineers to use the durable concrete at every opportunity. A 1923 Highway Department audit found that the cost of concrete paving in Colorado averaged $2.22 per square yard, lower than in thirty-five other states

(*Colorado Highways*, October 1923: 11; December 1923: 16).

The heyday of concrete-highway construction in Colorado lasted from the late 1910s to the 1930s. During this period, builders used three standard mixes for construction: Class A and Class B concrete and a paving mix for concrete roads. The paving mix consisted of one part cement, two parts fine aggregate (sand), and three parts coarse aggregate (gravel or crushed rock) mixed with enough clean water to form a stiff, workable substance. The Colorado Department of Highways used Class A and B concrete to form bridges, culverts, headwalls and spillways. Class A concrete consisted of one part cement, two parts fine aggregate and four parts coarse aggregate with just enough water to make the concrete flow easily into place. Mixing Class B concrete required one-part cement, one-part sand, two-and-one-half-parts fine aggregate and five-parts coarse aggregate combined with enough water to form concrete with the same consistency as the paving mixture (Pierce, 1923: 5).

The vagaries of Colorado's topography greatly influenced the construction of its first concrete roads. Most of the state's sand and gravel could be found in creeks, riverbeds, and along valley slopes. Unfortunately, sand and gravel tended to be found in separate geographic areas. In most of Colorado's waterways, the heavy gravel remained in the upper elevation creek beds while currents carried the lighter sand hundreds of miles downstream. In eastern Colorado, along the valleys of the South Platte and Arkansas rivers, good sand was readily obtainable but coarse gravel was in short supply. In the valleys of the Colorado River and its tributaries on the Western Slope, good gravel was available in huge quantities, while the sand contained large quantities of oil shale or dirt. Faced with this situation, the State Highway Department soon established a laboratory to test local samples well in advance of road construction (Pierce, 1923: 5-6).

By the early 1920s, the Highway Department increasingly experimented with asphaltic materials. The Denver firm of Miller, Douglas & Haines poured the first mile of state-funded asphalt paving in 1923 under a $36,618 contract. Crews spread a two-inch-thick asphalt top that covered a six-inch concrete base along the Victory Highway (now US 40 and E. Colfax Ave.) near Fitzsimons Hospital, east of Aurora (*Colorado Highways*, August 1923: 1).

A 5.3-mile project between Romero and Antonito in the San Luis Valley launched the department's first attempt at oil surfacing in 1928. Pople Brothers Construction of Trinidad won the contract supervised by Colorado Highway Department's resident engineer W.J. Walsh. After the contractor laid a gravel surface, crews used an oil distributor to spread three applications of about a half gallon per square yard. Crews used a double-disc harrow to work the oil into the gravel. The machinery bladed the oil back and forth until it thoroughly mixed and spread the material over the road. Cars could drive over the road without getting splattered with fresh oil, as traffic compacted the mixture into place. Walsh later recalled that the road lasted for several years before resurfacing. This experiment on an isolated Colorado road convinced the Highway Department to build fewer concrete and more asphalt-based roads (Wiley, 1976: 24).

Blacktopping Colorado: Vail's Vision in Asphalt

Under the leadership of State Highway Engineer Charles Vail, asphalt was the material of choice to pave most of the state's roads during a ten-year period beginning in the 1930s. Asphalt's popularity resulted from its durability and ease of application. In the nineteenth century, bituminous materials for roads in the United States were limited primarily to the use of natural deposits and bitumens found in limestone and sandstone impregnated with asphalt. After 1900, discovery of additional crude petroleum sources and a heightened demand for fuels and lubricants resulted in the construction of more asphalt roads. Since Vail's era, the Hot Mix Asphalt process has served to blacktop Colorado's roads. The Hot Mix process required transporting, applying, and compacting hot asphalt over a road site to ensure a uniformly dense pavement layer (Baker, 1979: 515).

Figure 31. A Works Progress Administration crew applies a three-inch layer of asphalt in Fort Collins. Photographer: Writers' Program of the WPA. Source: Denver Public Library, Western History Department.

Charles Vail's decision to asphalt the state's roads did not come without controversy. During the mid to late 1930s, Highway Department policy advocated the coating of as many main roads as possible with a slow-curing oil of low asphaltic content. Asphalt oil acted as a binder for the sand and gravel aggregate. Oil rich with asphalt allows the surface of the road to cure and dry rapidly, forming a very hard surface. The department directed Colorado crews to spread a comparatively thin oil mat of less than half the amount required by federal specifications. Some critics of the department complained that this policy resulted in inferior roads and precluded the possibility of obtaining federal aid for oiling (University of Denver, 1940: 14-5).

A 1941 study tabulated state highway miles according to surface treatment:

Materials	**Mileage**
Unimproved (projected, primitive, or bladed)	2,034
Graded and drained	1,256
Gravel surfaced	4,688
Low-type Bituminous (oil)	3,764
Paved (concrete, brick, etc.)	626
Total	**12,368**

(Colorado Department of Highways, 1941).

As traffic in Colorado increased by the late 1930s, state highway engineers paid greater attention to safety. This was especially true for roads through the Rockies. Six major highway projects constructed during this period (1930-1941) reflected those concerns: Big Thompson Canyon-North St. Vrain; the Mount Vernon-Floyd Hill Highway on US Highway 40 between Denver and Idaho Springs; US Highway 24 west from Colorado Springs to Leadville; US Highway 50 west from Cañon City to Salida; and US Highway 160 west from Walsenburg to southwestern Colorado. Each design featured wider roadways and curves, longer sight distances, and easy grades rarely exceeding five or six percent.

Colorado's heavy snows, scant humidity, hot summers, and continual use by motorists demanded that the state set aside much of each year's highway budget toward maintenance. As early as 1922, C.T. Brock, assistant superintendent of maintenance in Division 1 (Denver), stated that maintenance was "the most important function of the Highway Department" (Brock, 1922: 6). In dry weather, Colorado's sand-clay roads needed continual dragging, as they soon rutted and turned impassable. A tractor and a grader moving at a rate of one mile a day kept roads smooth. A crown of too much loose sand or gravel quickly turned the road into a washboard. To further harden the surface, crews in the wintertime dumped loose gravel onto the crown from the side of the road. (Brock, 1922: 6; Taylor, 1923: 8-9).

Repairs to the state's concrete roads offered their own set of problems. In the early 1930s, the maintenance division devised a system to bring worn concrete slabs up to grade. The method for reversing under grade depressions required pressure pumping mud and concrete beneath the slabs. Selected loam material (in the ratio of two parts to one part cement) and water brought the

material to a "soup" consistency. The mixture was then forced through a hose leading to the point of application. Crews drilled two-inch diameter holes at six-foot intervals, starting at the center of the most depressed portion of the slab. The Highway Department claimed this method filled nearly 85 percent of the depression beneath a selected slab (Williams, 1937(b): 18).

The asphalt flow rolling over Colorado's roads during the 1930s still required the state to perform upkeep. Douglas N. Stewart, superintendent of maintenance, stated that maintaining oil-surfaced roads required "constant vigilance" (*Rocky Mountain Contractor*, October 13, 1937: 8). Small holes caused by oversized gravel, friction, or water, soon resulted in potholes expanding across road surfaces at a relentless pace. Crews fixed these irregularities with pre-mix asphalt to maintain a smooth road surface.

Farm-to-Market Roads into Highways

Agricultural routes began as little more than wagon roads zigzagging along property and section lines between farms and local markets. With advances in road building technology and in response to increasing traffic, the Highway Department slowly upgraded the roads under its jurisdiction to highway standards. In road terminology terms, the early cultural routes became engineered routes.

In addition to widening and paving many farm-to-market roads, efforts were also made to straighten the alignments. Highway routes shifted to cut across section and property lines. This improved both their speed and safety. Where section lines continued to form the basis of 90-degree curves, highway engineers replaced the right-angle turns with high-speed transitional curves. The former right-angle intersections often remain outside the arc of the highway as part of a county road, continuing to convey the original road alignment.

General Highway Design Standards 1937-2000

Since 1937, the American Association of State Highway Officials (AASHO) has published *A Policy on Geometric Design of Highways and Streets,* better known as the *Green Book*. The *Green Book* addresses every element of the nation's road design from city curbs, residential culde-sacs, and posted speeds on the Interstates, to the design of rest areas, commercial intersections, and recreational roads (Marriott, 1998: 69). Similar to all the other states, Colorado adheres to the guidelines published in the *Green Book*. However, the *Green Book* only recommends guidelines to the states and local governments for design of roadways.

By the early 1970s, AASHO added the word "transportation" to its name and became the American Association of State Highway and Transportation Officials (AASHTO). However, AASHTO guidelines regarding highway design remained the same.

The Federal Highway Administration (FHWA) adopted the *Green Book* as the standard for all federal roads and construction projects. Projects not a part of the National Highway System (NHS) do not have to follow the standards, however, because of the expense of developing and enacting their own guidelines, most state and local governments follow AASHTO regulation regarding non-NHS construction (Marriott, 1998: 71).

Anticipating a postwar public demand for a national highway system, the Federal Highway Act of 1944 authorized construction of a road network connecting the nation's big cities. Under the legislation, all designs minimally featured four-lane divided highways, expanding to six to eight in and near large metropolitan areas.

In 1956, the Bureau of Public Roads established Interstate construction standards it had worked out with AASHO. At the time, Colorado was one of only a handful of states with a basic highway design manual, let alone a design standard for superhighways.

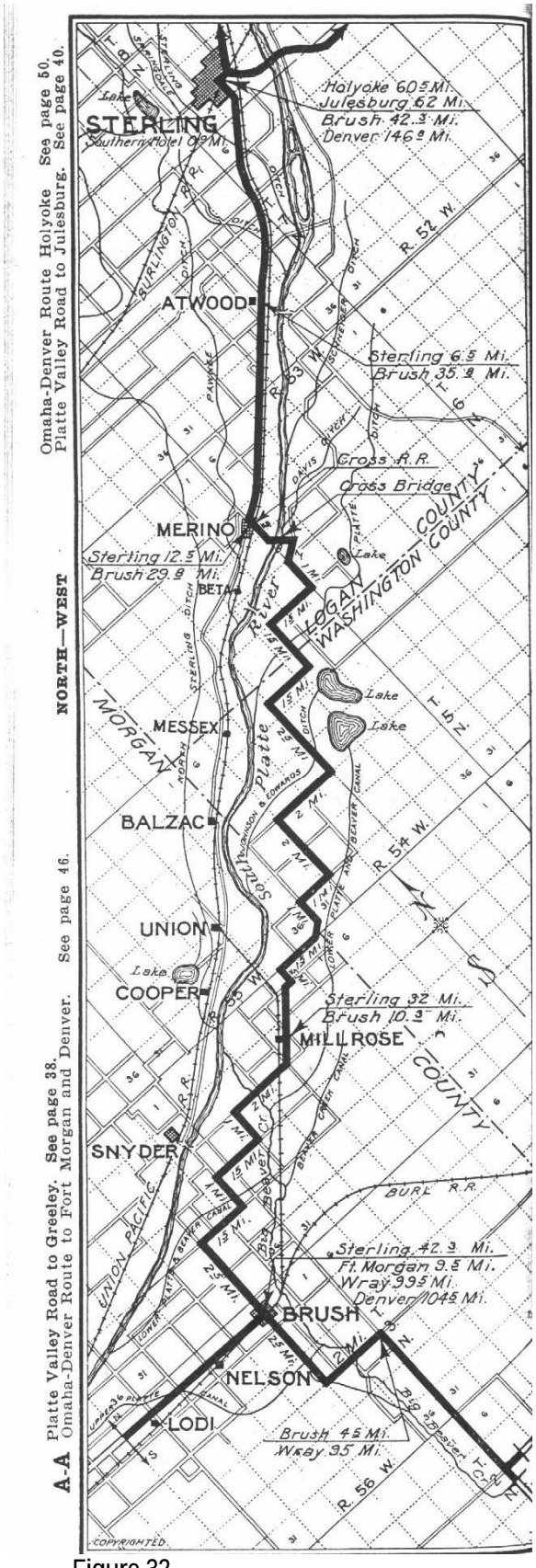


Figure 32.

Improving Farm-to-Market Roads

Stair stepping across the northeastern plains, the Omaha-Lincoln-Denver Highway in 1910 followed the railroad for part of its length south of Sterling (*Fig. 32*). After crossing the South Platte River at Merino, the road zigzagged its way to Brush following section and property lines. As traffic volume increased, the Highway Department replaced many right-angle turns with high-speed transition curves (*Fig. 33*). The older road with its right angle intersection remains outside the arc of the highway. The photograph shows the western swing of US 385 south of Wray depicted on the map at the arrow (*Fig 34*). Source: *Fig. 32*: Denver Chamber of Commerce, 1910: 48. *Fig. 33*: OAHP, CHS. *Fig. 34*: Shearer Publishing, 1996: 94.

Figure 33.

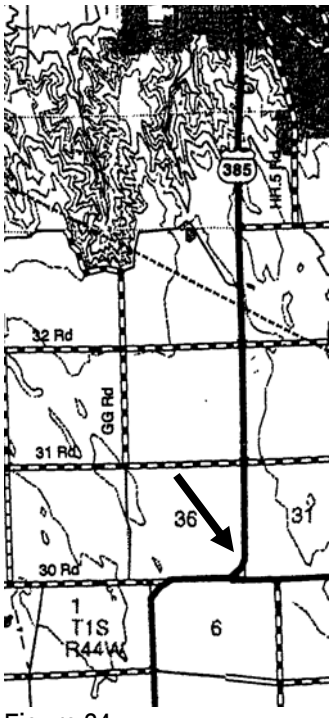


Figure 34.

In the case of the Valley Highway, all the overpasses and underpasses were concrete rigid-frame construction built with movement resistant connections between the superstructure and the substructure to produce an elastic finished product. The river bridge, and the bridges carrying the main line railroad tracks over the highway, rested on steel plate-girder structures placed on concrete substructures. The Valley Highway represented the Highway Department's first use of rigid-frame highway bridge construction. Comprised of a concrete beam superstructure tied rigidly to the abutments with steel reinforcing bars, rigid frame bridges differed materially from conventional support spans. Rigid frames were well suited to support thousands of cars and were aesthetically pleasing (Hermsen Consultants, 1999: 32, 34).

In the first years of Interstate highway construction all forty-eight states followed the design standards laid out by Washington. The Interstates that crossed Colorado adhered to the following nationwide guidelines:

Highways had to meet projected traffic volume for 1975. Traffic lanes had to be at least 12-feet wide and shoulders 10-feet wide. In rural areas, the median strips dividing oncoming traffic measured at least 36-feet wide, while in urban areas the strips could be as narrow as 16-feet. The roads were engineered for speeds of 70 miles per hour and featured grades not greater than three percent. No railroad crossings or grade-level intersections interfered with traffic, and overpasses had to stand at least 14 feet above the road. Access to these new highways was strictly limited to official entrances and exits (Lewis, 1997: 140).

The hallmark of the Federal Interstate Highway System is homogenization. The Interstate system standardized construction and safety standards nationwide. Since the federal government funded 90 percent of Interstate construction, it held the authority to determine the rules of the road.

Historian Tom Lewis commented on the uniformity of the Interstates in his 1997 study:

> The Bureau of Public Roads and the American Association of State Highway Officials issued specifications for construction that left little leeway for interpretation. Engineers simply applied the rules to the task at hand…. They simply repeated the tasks in small increments of usually five, ten, twenty, or thirty miles many times over: surveying, walking the line, grading the land, laying the substrate, laying the asphalt or concrete, painting the lines, erecting the signs, holding the ribbon-cutting ceremony, and moving on (Lewis, 1997: 253).

In spite of the direction of the "unseen hand" of the federal government, Colorado's highway engineers did experiment with different materials and environmentally friendly designs after World War II. In the early 1950s, the Department of Highways conducted experiments with "rubber roads." For five years, engineers studied one-mile sections of rubber road between Blakeland and Castle Rock and south of Pueblo. This was the first attempt to use rubber on any highway in the West. The process required a refinery-blend of two-percent basic rubber with penetration asphalt laid in a special section on each highway. The rubberized sections bore no distinguishing physical characteristics, but engineers were intrigued by their propensity for greater resiliency and resistance to skidding. However, the state chose to discontinue laying rubber by the late 1950s (Colorado Department of Highways, 1954: 54).

In 1979, a resurfacing project on US 160 between west Durango and the town of Hesperus employed a new recycling process for a portion of the work. Crews lifted the existing bituminous mat and reprocessed the roadway, through a hot plant with additives and additional material, and then re-laid the mat. The Division of Highways expressed its pleasure over the results in its 1981 Annual Report. "In a time of declining revenues and resources, pavement recycling will become more prevalent. This project helped develop the technology and experience necessary to make such recycling work on a continuing basis" (Colorado Division of Highways, Annual Highway & Transportation Report, 1981: 55).

Retaining Walls

Retaining walls are an important and necessary element in Colorado highway design. In the mountains, walls made of wood, rock, metal, and poured in place and precast concrete protected drivers from rock falls and prevented roadbeds from slumping down slope.

Wood cribbing often accompanied mining and milling sites. Some of the most extensive use of wood cribbing occurs along Colorado Highway 67 in the mining district between Cripple Creek and Victor. Rock retaining walls may be found throughout the state's mountainous routes. The WPA and the CCC constructed or improved many of these structures in the 1930s.

Concrete retaining walls came into use during the 1920s and increased in popularity over time among highway engineers. Early steel retaining walls sometimes recycled railroad rails to support steel panels or stone infill. Later designs employed specially engineered steel systems. Rock-faced concrete block began to gain acceptance by the end of the century.

According to AASHTO, retaining walls should be located no closer than ten feet from the edge of the pavement and preferably at least two feet from the outer edge of the shoulder, whichever is greater. Where walls are located the same distance from the edge of the pavement as from the bottom of slopes, the effective shoulder width is less and appears narrower. Where the top of a retaining wall is at the level of a frontage road or ramp, the face of the parapet, or rail preferably, should be at least four feet from the edge of the traveled way. Where a retaining wall is adjacent to an auxiliary lane or ramp, the wall should provide ramp shoulder lateral clearance of at least four feet between the edge of traveled way and the face of the wall. Where walls are located near the traveled way, the contour of the lower portion should appear as a slope-faced barrier, to effectively redirect errant drivers and minimize damage to the vehicle.

Along Interstate 70 through the Rocky Mountains, particular attention was paid to aesthetics. Concrete walls between Vail and Glenwood Springs used textured forms to complement the surrounding scenery. The environmental sensitivity of retaining structures along twelve miles of I-70 through Glenwood Canyon brought state highway engineers international plaudits (AASHTO, 1973, 386-7; *Rocky Mountain News*, October 15, 1992: 10).

Guardrails and Safety Devices

Guardrails define the edge of the roadway while offering protection from roadside obstacles and opposing traffic. Many of these systems did a better job of marking the road edge than they did in stopping an errant automobile. Early guardrail designs include rail and post fences, post and cable systems, steel pipes, post and plank, and stone.

Some guardrail systems incorporated aesthetic as well as safety characteristics. This was particularly true in the case of stone barriers (*Fig. 17*). By utilizing native materials, the rock walls provide a more natural edge to the road that helps blend the modern roadway intrusion with the landscape. Such walls are often found along aesthetic routes in national, state and municipal parks. The stone wall may be an above grade extension of a roadway supporting retaining wall.

A 1938 study by the Colorado Highway Patrol uncovered the "increasing danger" of fast highways unprotected on curves and high embankments (*Rocky Mountain Contractor*, May 10, 1939: 11). In the late 1930s, the department installed semi-rigid guardrails to prevent cars from going over steep embankments. Earlier forms of guardrail did not "give" on impact, resulting in serious injuries or death. The state design required installation of a series of rigid posts, with protruding eight-inch, strong springs supporting an outside steel rail or beam. First used along the Mount Vernon Canyon road, this design deflected cars back onto the road and away from the supporting posts (Williams, 1937(b): 17). The regional trade publication, *Rocky Mountain Contractor*, praised the

Figure 35. Mine and mill operators used wood crib walls to stabilize steep slopes. The technology readily transferred to highway construction. Photographer: Muriel Sibell Wolle, 1955. Source: Denver Public Library, Western History Department.

Figure 36. Improvements to the Million Dollar Highway over Red Mountain Pass in the 1920s included this poured-in-place combination concrete retaining wall and bridge. The road edge is protected by a steel pipe railing. Photographer: George L. Beam. Source: Denver Public Library, Western History Department.


Figure 37.


Figure 38.

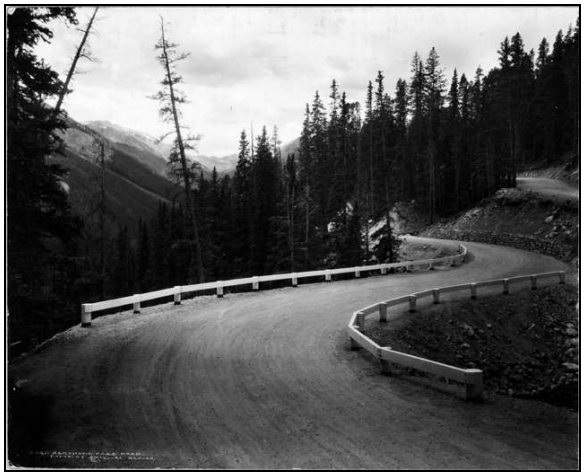


Figure 39.


Figure 40.

Guardrail Systems

The post and cable system (*Fig. 37*) utilized a series of round wood posts joined together by two steel cables passed through the posts. In this 1916 view in one of the Denver Mountain Parks, a sign nailed to a tree truck warns, "Keep to Right, Blow Horn." Post and rail fence systems (*Fig. 38*), like this example on the Corley Mountain Highway in the early 1920s, provided a rustic shoulder definition, though their impact resistance was minimal. The ca. 1925 post and plank system on Berthoud Pass (*Fig. 39*) provides a reasonably strong barrier against errant automobile bumpers. The low profile did not interfere with the scenic view. Among steel guardrail systems, the W-beam (*Fig. 40*) is the most widely used. Early installations used square wood posts while later examples, like that illustrated here, employ steel I-beam posts. Concrete median barriers (*Fig. 41*), the so-called Jersey barriers, divide I-70 in 1999 east of the Colorado Blvd. overpass in Denver. Such barriers deflect vehicles back into their lane of traffic and minimize dangerous high-speed head on collisions. Jersey barriers are widely used as temporary protection in highway construction projects. Source: *Figures 37, 38, and 39*: Denver Public Library, Western History Department. *Figure 40*: Southern Guard Rail Company. *Figure 41*: Hermsen Consultants, Vol. I, 999: 33.


Figure 41.

guardrails “as modernly streamlined with (its) curved convex beam surface gleaming” as it offered drivers an unobstructed view of the state’s “scenic beauty” (*Rocky Mountain Contractor*, May 10, 1939: 11).

Freeway speeds require substantial barrier protection. Galvanized steel “W”-beams attached to wood posts were a popular choice after World War II. Concrete barriers are also widely used, particularly as median protection on divided highways. The most ubiquitous type of concrete barriers is the Johnson Wall, more generally known as the New Jersey Median Barrier or simply as the Jersey Barrier.

Concrete median barriers date back as far as the mid-1940s in California. New Jersey actually installed its first concrete median barrier in 1955. Design changes occurred over the years and there are currently at least six different concrete median barriers being used nationwide, and only one of these, though the most common, is the true New Jersey barrier. The Colorado Department of Highways began using concrete median barriers in the 1970s and they remain a major feature of urban freeway design.

Two safety devices attempt to deal with errant vehicles without the impact of a solid barrier. The first of these is the runaway truck ramp. On steep mountain grades, truck drivers sometimes lose control of their vehicles, obtaining speeds impossible to overcome with wheel brakes. Such a situation endangers everyone in the immediate vicinity. As an aid to stop runaway vehicles, escape ramps have been built on the state’s steep mountain passes, allowing a speeding truck to gently leave the highway traffic lanes and enter a special line designed to slow and stop the vehicle. Speed reduction is accomplished either through the use of gravity, by a transition to a steep upwardly inclined slope, or by means of friction, with roadway surface treatments of deep sand and gravel along with water-filled impact barriers. Examples of the former include two runaway ramps on westbound I-70 past the Eisenhower Tunnel. The latter type of ramp may be found on eastbound I-70 at the base of the 6 percent grades in Mount Vernon Canyon.

The other safety device is the rumble strip, more correctly known as a continuous shoulder rumble strip. These rolled or milled-in grooves cut perpendicular to the highway centerline run in bands along the shoulder of the road. The strips are designed to wake drowsy drivers whose vehicles drift off the roadway. When the vehicle wheels contact the rumble strip the tires bounce rapidly in the grooves, causing a loud rumbling accompanied by major vibrations felt by the driver through the steering wheel.

Rumble strips came into wide use during the 1990s. Some have been installed along the center line of busy narrow two-way highways, such as US 6 and Colorado 119 between Golden and Black Hawk. While generally praised for their effectiveness, bicyclists have voiced opposition to the devices as they make riding on highway shoulders a difficult and dangerous task.

Curbs and Drainage

Curbs border all types of highways to control drainage, deter vehicles from leaving the pavement at hazardous points, protect pedestrians, delineate the edge of pavement, present a more finished appearance, and assist in the orderly development of the roadside. There are two general classes of curbs: barrier and mountable. Barrier curbs are relatively high, steep-faced and designed to inhibit, or at least discourage, vehicles from leaving the roadway. A typical barrier curb features a vertical face, a half-inch radius and a height of at least six inches. Barrier curbs are not used in highways designed for speeds in excess of 50 mph, because when struck at high speeds, drivers risk losing control of their automobiles.

The design of mountable curbs allow vehicles to clear with varying degrees of ease. The height of the mountable curb should not exceed more than four inches. When placed on the outer edge of a shoulder the mountable curbs also help to control drainage, reduce erosion and improve delineation. Nationally, both types of curbs are

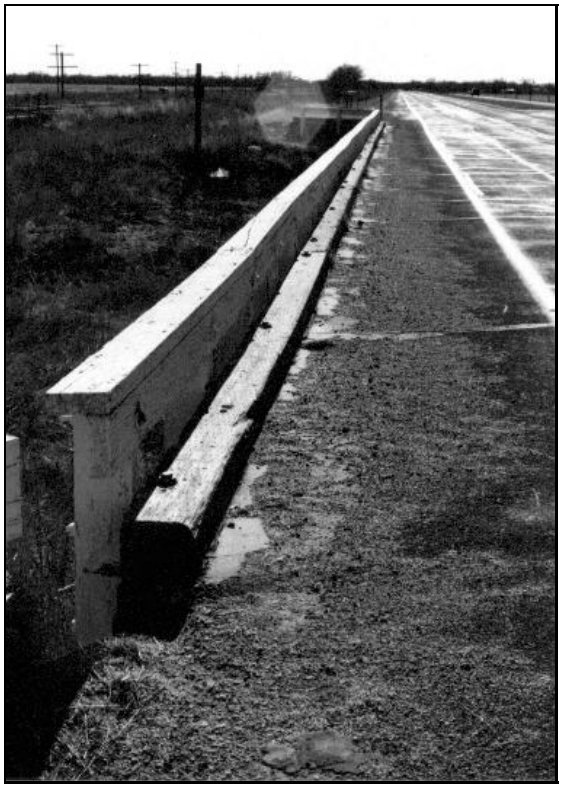


Figure 42.


Figure 43.


Figure 44.

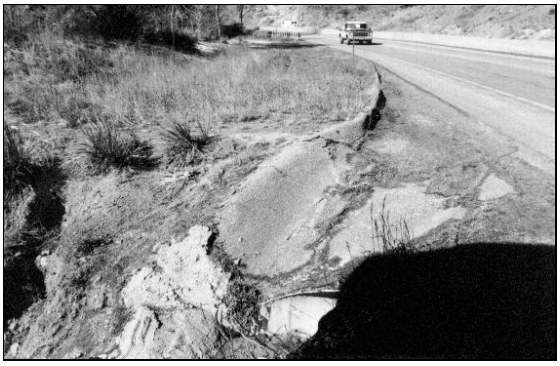


Figure 45.

Curbs and Drainage

Wood curbing is an unusual highway treatment (*Fig. 42*). The curbing shown here protects the railing on the bridge over the 1941 timber stringer Pawnee Creek in Logan County on US 6. Concrete curbing often leads up to a culvert (*Fig. 45*). A PWA-funded crew laid this curb during the 1930s on US 24 west of Manitou Springs. Corrugated metal culverts are widely used where weight from above is not excessive (*Fig 46*). This example is from SH 13. Small concrete culverts allow runoff water to be diverted beneath a road or highway (*Fig. 44*). Only extremely observant motorists would notice the existence of small culverts like this one on SH 13. Larger diameter concrete culverts may have wingwalls and protective grates (*Fig. 43*). The ca. 1925 culvert pictured here is on US 6 north of Merino. Sources: ACRE, 2002.


Figure 46.

made of either Portland cement, asphalt or granite (AASHTO, 1973: 356-9). In Colorado, older highways like US 6, between Brush and Sterling, retain both asphalt and timber curbing.

The first generation of highway road builders knew the importance of drainage in maintaining roads. Roy J. Randall, supervisor of Federal Aid Projects for the Bureau of Public Roads (BPR) wrote in 1922, "The most important factors to be considered in the improvement of highways are foundation and drainage" (Randall, 1922: 1).

As the Highway Department graded the state's first dirt roads for the automobile, engineers paid attention to maintaining clean, free-flowing gutters or side ditches, adequate culverts in sufficient numbers and unobstructed free-flowing outlets. The Bureau of Public Roads warned that these ditches "must not be so deep as to be a menace to travel" (Whittaker, February 1919: 13, 21; Randall, 1922: 1). Throughout the irrigated agriculture lands of northeastern Colorado, highway builders dug side ditches along roads like the Omaha-Lincoln-Denver Highway (now US 6 & US 138) deep enough to transport storm water and carry the moisture flowing from the crown to the shoulder. (Randall, 1922: 1).

Across rural Colorado, bridges, culverts and siphons were necessary to accommodate the natural cross-drainage, of streams, swales and arroyos. On long highway grades, engineers placed culverts at required intervals to carry drainage across and away from the roadway, preventing overflow and wash in the side ditches.

By the early 1920s, a number of culvert types ran beneath the state's roads. These included cast iron, corrugated metal, reinforced concrete boxes and pipes, vitrified tile, and wooden boxes. Early twentieth century engineers and road builders considered the cast-iron culvert to be the standard of excellence, though some engineers avoided using cast-iron because of its excessive weight and cost (Randall, 1922: 1,12).

Subsequent to the introduction of federal standards by the late 1910s, the Bureau of Public Roads attempted to codify culvert construction nationwide. The BPR recommended placing culverts low enough to allow water to enter and yet not be so low as to become filled with sediment. Culverts also needed protection from above through sufficient cover to prevent road traffic from breaking them. All culverts meeting federal regulations required end headwalls to retain the earth fill. Additionally, culverts had to be easily identifiable. Randall recommended one further construction tip, "the best economy lies in using the most permanent structure at the first installation" (Randall, 1922: 12).

The State Highway Department used a number of different kinds of culverts to accommodate variations in Colorado's topography and subsoil. The department's "Standard Specifications for Road and Bridge Construction" (1930) required all non-cast or built-in-place culverts to lie in a trench excavated to the depth and grade established by the project engineer. Concrete in substructures was placed so that all construction joints were horizontal unless otherwise shown on the plans, and in locations difficult to detect in the finished structure. State specifications also reminded engineers to avoid placing construction joints through parallel wingwalls or any surfaces designed for additional architectural treatment. Trenches for pipes had to be completely filled and the pipe covered to a depth of one foot. Crews would place and properly compact materials before the construction of the embankment over the culvert (Colorado Department of Highways, 1930(b), 152-4).

Today's standard "multiple-type" culvert was first used during the building of the Mount Vernon Highway (US 6) in 1937. The multiple-type culvert consists of thick, corrugated iron plates that are curved, punched, and galvanized. The plates were delivered to the job unassembled. On site workers bolted the pieces together to fit the specified design. Four culverts were installed on the Mount Vernon Highway, the longest measuring 338 feet (Tracy, November 10, 1937: 10-11).

Bridges

From 1905 to the 1920s, the state extensively built concrete bridges because they held up under traffic and resisted flood better than truss bridges. In 1921, the Highway Department built a segmentally reinforced concrete bridge just south of Boone on US Highway 50. Subsequent floods destroyed almost all of the trusses in Pueblo County, but the concrete bridge remained structurally intact (Christensen, et. al., 1987: 51).

Despite a preference for concrete, the Highway Department built, and continues to maintain, steel truss bridges, timber stringers, stone and steel arches, and steel stringer and girder bridges. Concrete bridge types found throughout Colorado include slab, girder and arch.

The construction of divided highways brought new bridge types. The Valley Highway represented the Highway Department's first use of rigid-frame highway bridge construction. Comprised of a concrete beam superstructure tied rigidly to the abutments with steel reinforcing bars, rigid frame bridges differed materially from conventional support spans. Rigid frames were also well suited to support thousands of cars and were aesthetically pleasing (Hermsen Consultants, 1999: 32, 34).

A National Register Multiple Property Documentation Form exists for highway bridges. Those desiring a statewide historic context on bridge development should consult *Highway Bridges in Colorado* by Clayton S. Fraser.

Tunnels

Colorado's hard rock mining industry possessed the expertise and the equipment to bore tunnels for mountain roads. Yet, given the rugged terrain, tunnels are rare in the state's highway system. A few former railroad tunnels became automobile tunnels upon the conversion of abandoned rail grades to roads. The Waters or Little Ike Tunnel on Colorado Highway 67, the former route of the Midland Terminal Railroad, is a good example.

US 6 and SH 119 from Golden to Black Hawk contain a series of four two-lane tunnels with rock-faced portals. Constructed between 1937 and 1951, the longest being 1,000 feet, the tunnels shortened and straightened sections of the circuitous highway route along Clear Creek.

The construction of I-70 through the Colorado Rockies resulted in several major tunnels. A pair of two-lane tunnels pierce an outcropping just east of Idaho Springs. Construction of the Glenwood Canyon segment resulted in several important tunnels. The twin bores of No Name Tunnels are just east of Glenwood Springs. The Hanging Lake Tunnel constitutes two separate two-lane bores in the south wall of the canyon. As I-70 approaches the tunnel on both sides, viaducts take the Interstate from the north bank over the Colorado River and directly into the tunnel portals. The tunnel allows I-70 to be completely removed from the canyon in the Hanging Lake area. The Hanging Lake bores are each 3,900-feet long. The Reverse Curve Tunnel is a short, single bore tunnel through a rock outcropping for only the westbound lanes. The eastbound road runs alongside the outcropping.

All the state's highway tunnels pale when compared to the Eisenhower and Johnson bores through the Continental Divide on I-70. The 1.7-mile two-lane tubes are the highest tunnels on the nation's Interstate system.

Intersections and Interchanges

The earliest road intersections consisted of nothing more than the at grade meeting points of two routes. As traffic and speed increased, road and highway design mandated more sophisticated intersections–those protected by traffic control signs and engineered with sufficient sight distances to allow unobstructed views of traffic. Acceleration and deceleration lanes offered protection on higher speed highways.

Divided highways called for grade separations with cloverleaf or diamond interchanges. In the case of Denver's Valley Highway, every interchange and all intersections where city streets or

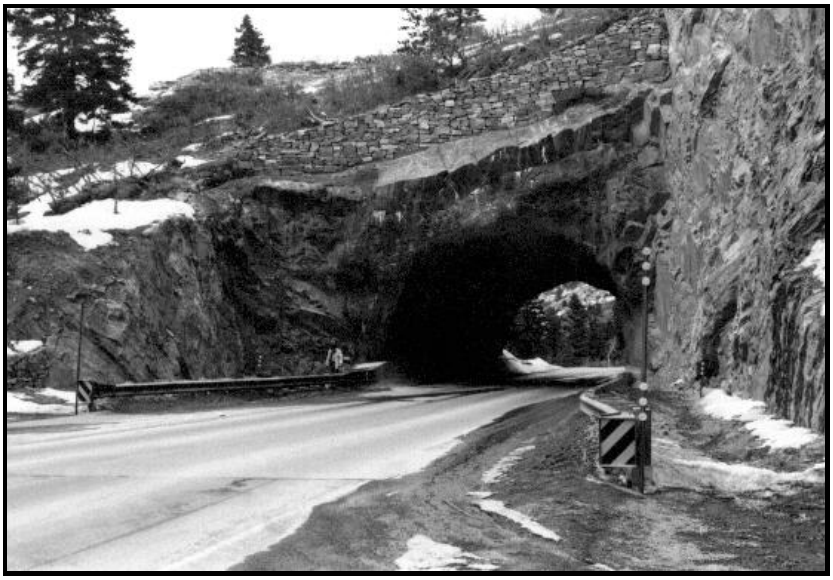


Figure 47. The Ouray Tunnel on US 550 dates to the early 1920s when, after a major construction project, the former toll road emerged as the "Million Dollar Highway." The tunnel was widened in 1958. The granite outcropping did not require a supporting portal structure. A dry-laid stone wall over the tunnel entrance holds the slope and diverts run-off. Source: ACRE, 2002:11-7.

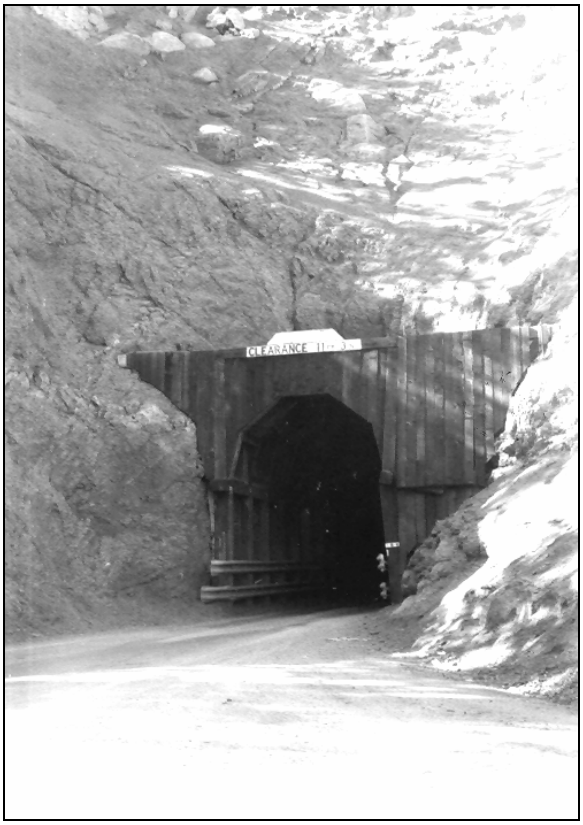


Figure 48. Built in the late 1890s for the Midland Terminal Railroad, the Little Ike or Waters Tunnel became an automobile tunnel on SH 67 after the route was abandoned by the railroad in 1949. Now bypassed by the highway, the one-lane tunnel features a wood portal and a timber lined interior. Source: OAHP, CHS: 1976.

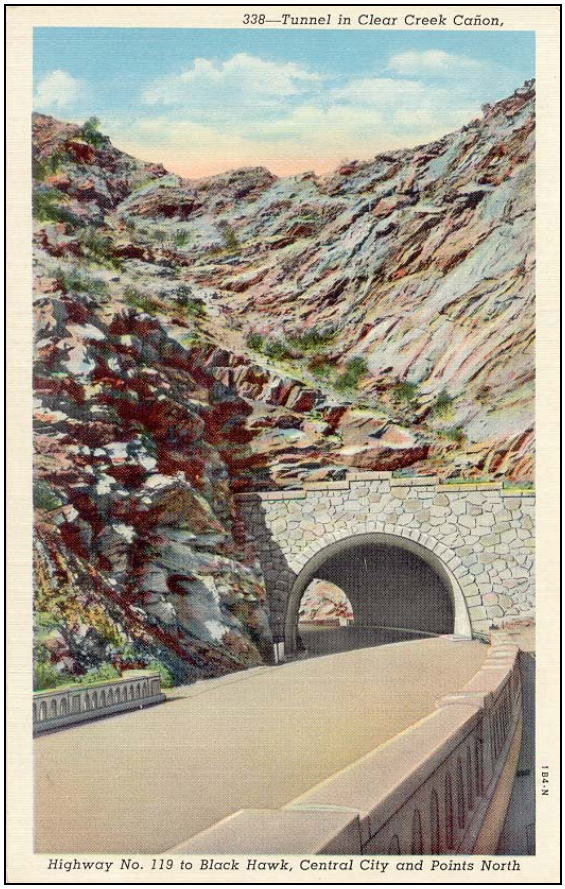


Figure 49. Tunnel No. 4 on SH 119 is one of a series, the other three being along US 6 in Clear Creek Canyon. The concrete lined structure with its rock-faced portal is both sturdy and elegant. Source: OAHP, CHS: 1955.

Figure 50. Early road intersections contained no traffic control devices and were often without route information. Photographer: William Henry Jackson, ca. 1885. Source: Denver Public Library, Western History Department.

Figure 51. By the 1940s, the freeway cloverleaf interchange came to symbolize the future of Colorado highway development. Shown here is an artist's rendering of the proposed 46th Avenue interchange in the 1944 plan for Denver's Valley Highway. Source: Hermsen Consultants, Vol. I , 2000:12.

railroads that crossed the freeway required overpasses and underpasses to separate traffic flow. The final design incorporated 62 structures over the highway's eleven-mile course. All interchange ramps were concrete rigid-frame construction built with movement resistant connections between the superstructure and the substructure to produce an elastic finished product. (Hermsen Consultants, 1999: 32, 34). The Interstate highways employed a similar standard.

Route Markers

In 1923, the Highway Department authorized $70,000 toward erecting route markers in conjunction with the introduction of a new highway numbering system. The department made an arrangement whereby the Mountain States Automobile Association furnished the markers free of charge. The department's maintenance division installed 1,500 signs in the first year. The roads leading from adjoining states carrying heavy tourist were marked first (*Colorado Highways*, June

Figure 52. The federal government's heightened role in building the nation's highways demanded standardization of road signs and maps. The Rand McNally Map Company published this diagram a year after Colorado introduced its first road identification system in 1923. Source: Rand McNally Roads of Colorado Map, 1924. Denver Public Library, Western History Department.

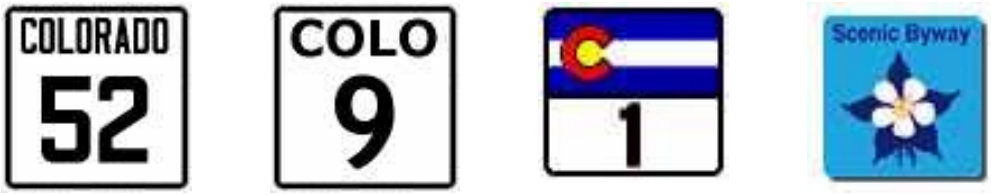


Figure 53. The left-most sign became the official State Highway marker in the 1930s. In the 1950s, the marker used a state name abbreviation. In 1967, the Department of Highways officially adopted the state flag marker. The Scenic Byway marker is posted on routes officially designated under Colorado's Scenic and Historic Byway program.

Figure 54. The state posted the left-most signs on US highways in Colorado during the 1930s. In the 1960s, US highways began to be marked with the simplified sign showing only the shield and route number. The red, white and blue shields for the Interstate system began to appear on Colorado highways by the late 1950s.

1923: 13). A numbering system for US Highways took effect in 1926.

Highway associations marked the named regional and national highways beginning in the 1910s. The identification markers were often painted on telephone poles or fence posts. Familiar markers in Colorado included the brown buffalo of the Buffalo Highway, the red and black bands of the Midland Trail, and the red double "P"s below a red bar denoting the Pikes Peak Ocean-to-Ocean Highway. Porcelain enameled metal signs were also used to mark the named highways.

In the 1930s, the Highway Department posted black on white metal signs to mark both State and Federal highways. By the early 1960s, the state simplified its route markers. The current marker, utilizing the four-color state flag, was officially adopted in 1967. The marker for US highways was also simplified in the 1960s.

In August 1957, AASHO established the tri-color federal shield designating the nation's Interstates. When it came to assigning route numbers to the new Interstates, the organization reversed the numbering system used on the Federal Highway System since 1926. AASHO decided that north-south roads would ascend numerically in odd numbers from Route 1 on the East Coast to 101 on the West Coast. Roads running east-west ascended numerically in even numbers from Route 2 in the north to Route 90 in the south. Interstate numbering reversed the system (Lewis, 1997: 136-7).

Into the 1950s, metal route signs were generally mounted on wood posts, or on steel posts in U-channel or square tube forms. Higher automobile speeds and safety concerns led to the development of steel breakaway posts. The breakaway feature is usually accomplished by adding a slotted plate to the top of the foundation and another slotted plate to the bottom of the signpost, and by cutting the post just below the sign panel and adding a hinge system. When struck by a vehicle, the post slips off the foundation at the bottom and rotates around the hinge plate below the sign panel. This allows the vehicle to pass safely under the sign after impact.

High-speed freeways with multiple exits demand large signs capable of conveying route information from a substantial distance. Large steel frames supporting rectangular green signs serve as the background for route markers and directional arrows. The two major types of overhead sign systems are cantilever and sign bridges.

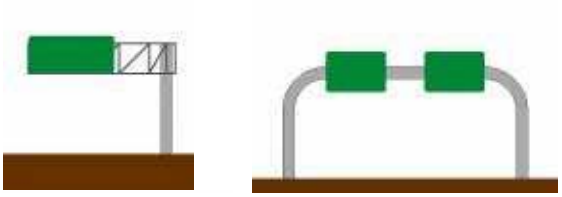


Figure 53.

After World War II, a nationwide movement began to pay tribute to the nation's armed forces by designating various state and federal highways as "Blue Star Memorial Highways." In 1945, the National Council of State Garden Clubs adopted the program and created an official highway marker. Portions of several Colorado highways are in the Blue Star system. These include sections of I-25 and US 40.

The state has also used highway dedication as a means to memorialize military units. In 1947, Governor John Vivian dedicated US 40 in Colorado as the 157th Infantry Memorial Highway. The Colorado National Guard regiment performed combat duty in Sicily, Italy, France and Germany during World War II.

The state's Scenic and Historic Byways use a special highway marker. The columbine on a blue field became the official symbol in 1989. CDOT only places and maintains byways signs on the state highway system.

Because route markers are standardized, older versions are removed when new markers are introduced. Occasionally, special historical route markers are posted to commemorate historic highways. Historical markers for US 40 may be found along Colfax Avenue in Lakewood, Denver and Aurora.

Figure 56. A specially designed sign recognizes the historical designation of US 40 at the highway rest area near Hugo. Source: OAHP, CHS.

Lighting

Only within the last few decades has the lighting of highways extended beyond urban areas. As the earliest roads and highways passed through commercial areas, town and city streetlights provided illumination. First gas lamps, followed by electric arc lights, incandescent bulbs, and finally gas vapor lamps illuminated the night.

Major rural highway intersections first received lighting outside the urban environment. The Interstate system used pole lights to mark major rural interchanges and integral lights to illuminate underpasses. These gas vapor lights, first mercury then sodium, were mounted singly on roadside poles, in pairs on poles placed in the medians, or more recently, in multi-light configurations on high masts rising to heights of seventy-five feet or more.

As highway relighting tends to follow closely behind advances in lighting technology, historic lighting devices are extremely rare. In some cases, towns and cities have installed replica lighting devices that copy original fixtures or merely provide a nostalgic effect unrelated to any historic lighting pattern.

Snow Protection and Removal

Snow is a major obstacle to safe passage along Colorado's highways. Mountain roads can be subjected to heavy snow accumulation and dangerous snow slides and avalanches. While motorists need not worry about avalanches during winter trips on the high plains, ground blizzards can produce extremely dangerous whiteout conditions.

Transportation engineers developed numerous structures to deal with snow protection and removal. Colorado's railroads pioneered the first protection devices. Wooden snow sheds commonly sheltered rail grades over mountain passes. Snow fences of various designs also helped protect railroads from blowing and drifting snow.

Highway engineers adapted railroad designs. Snow sheds of concrete give greater protection with lower maintenance than similar wood structures. Snow fences catch blowing snow before it drifts across highways. These fences usually are constructed of wood. Recently, dense groupings of evergreen shrubs and trees have been planted paralleling highways subject to snow drifting. Though it may take years before such plantings grow sufficiently to provide protection, they do promise a more attractive appearance and lower maintenance than snow fences.

Roads and highways exhibit other characteristics associated with winter travel. Long, lighted pull-offs at the base of many mountain passes, sometimes called chain-up stations, allow vehicles, particularly trucks, to stop and attach tire chains.

Figure 57. Winter driving challenges both automobile owners and highway crews. Snow protection and removal constitute a major part of highway maintenance in Colorado. Photographer: Harry Mellon Rhoads Source, Denver Public Library, Western History Department.

Figure 58. Roads crews use trucks to haul snow away from highways. Both crews and equipment work year-round to keep the state's highways open to traffic. Source: Denver Public Library, Western History Department.

Figure 59. Snow fences flank problem highways along both mountain and plains routes. Such fences fight dangerous drifting snow. Source: Library of Congress.

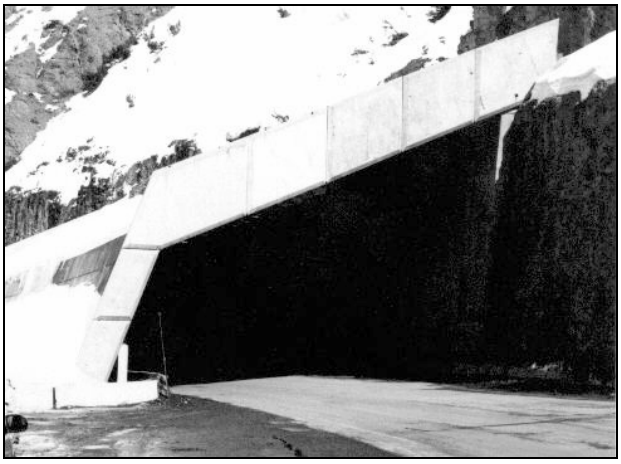


Figure 60. Snow sheds provide avalanche protection to roads and motorists in dangerous mountain corridors. This snow shed on Red Mountain diverts slides over US 550. Source: ACRE, 2002: 11.10.

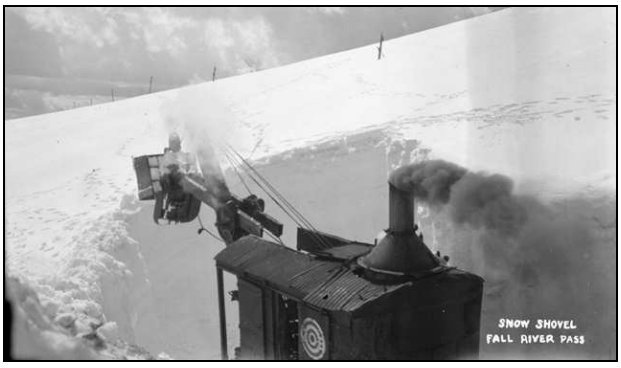


Figure 61. Opening high mountain passes often calls for heavy equipment. Photographer: Fred Payne Clatworth, 1928. Source: Denver Public Library, Western History Department.

The need to remove snow affects highway design. Before the use of mechanical snow plows, men began shoveling passes in May so that traffic could move through the mountains by the middle of June. In 1923, a rotary plow designed by State Highway Engineer L.D. Blauvelt cleared Berthoud Pass in less than seventy-two hours. Crews nicknamed the machinery the "Bull of the Woods" to honor Major Blauvelt. In 1927, the maintenance department mounted a rotary plow on a four-wheel drive Coleman truck with a separate engine to drive the rotary head. Rotary plows demonstrated their worth during the winter of 1928-29, keeping an important route over the Continental Divide—Tennessee Pass along US 24—open all winter. This marked the first time any vehicular mountain pass in Colorado remained open to traffic year round. By 1939, state maintenance crews kept all major passes over the mountains open throughout the winter (Wiley, 1976: 22).

Figure 62. Scenic overlooks offer motorists a safe place to pull off from the highway when stopping to admire the view. Such overlooks often include interpretive signs. Landscaping usually reflects the surrounding environment. Photographer: Harry Mellon Rhoads. Source: Denver Public Library, Western History Department.

Large flat areas resembling scenic overlooks may be found on some mountain roads. These are used as dumping areas for snowplow crews. In other places guardrails may be absent so that snow plows may push snow off the side of the road.

The need for snowplows, as well as sand or chemicals for road application, requires storage facilities close to the highway. These facilities are often used year-round for general highway maintenance in addition to winter snow removal service.

Figure 63. Points of interest direct automobile travelers to sites of historic and natural interest. These sites usually include a marker or sign highlighting the feature. Pictured here in 1928 is the concrete teepee erected in memory of the prominent Ute elder, Ouray, and his wife, Chipeta. Points of interest, like scenic overlooks, might be on or merely adjacent to state highway right-of-way. Source: Denver Public Library, Western History Department.

Scenic Overlooks, Points of Interest and Rest Areas

Scenic overlooks constitute an important element along scenic highways. Early motorists simply stopped in the

road as the mood struck to enjoy the view or take a photograph. Increasing traffic made such impulsive stops dangerous to both the tourist and fellow motorists. Designated pull-offs allowed vehicles to park safely away from the general highway traffic. Designed for both safety and scenic views, such overlooks are a character-defining feature of aesthetic roads and highways.

"Points of interest" are also designed pull-offs, marked by anticipatory signs to alert motorists of their approach. Points of interest designate a location of historical or natural significance. Some form of interpretation is usually present in the form of a marker, plaque, or other type of signage.

Rest areas began as nothing more than roadside pull-offs where a traveler could stop to stretch or to check the automobile. Many of these pull-offs came to include trash receptacles, picnic tables and toilet facilities. Ongoing maintenance proved necessary and this could be provided by the Highway Department, a local government, a non-profit service organization or a paid contractor. Particularly with the inauguration of the Interstate system, rest areas took on increasingly sophisticated designs with substantial buildings and landscaping. Food vending machines and tourist travel information were often installed. In the case of rest areas near the state borders, staffed tourist information offices joined the mix of facilities to serve as official State Welcome Centers.

Environmental Designs and Landscaping

Environmentally sensitive road and highway construction first occurred on aesthetic routes. Such roads were designed to access and highlight scenic vistas. The road itself became part of the scene and was often designed and constructed to harmonize with the setting. Bridges and tunnel portals utilized native stone. Guardrails were often constructed of stone. Road cuts were minimized and replanting of grasses and trees attempted to soften the construction ground disturbance. Trail Ridge Road (US 34) is an example of an early, environmentally sensitive highway.

Figure 64. In what was likely an unintended bit of environmental sensitivity, a tree remains standing between the two lanes of travel in this circa 1920 photograph. Later highway designs required greater ingenuity and expense to minimize environmental impacts. Photographer: Harry Mellon Rhoads. Source: Denver Public Library, Western History Department.

The rise of environmentalism brought pressure for more sensitive highway designs. Particularly in the case of the multi-lane divided highway standards of the Interstate system, new highway construction through the mountains threatened to cut huge swaths through the environment. Innovative design and construction techniques, often at substantial additional monetary cost, allowed less disturbance of the landscape, both during construction and later operation. Cuts and fills were minimized, native vegetation was preserved wherever possible, and elevated and cantilevered roadways lessened the physical impacts on the land. While numerous examples may be cited, I-70 over Vail Pass and through Glenwood Canyon represent major efforts at environmentally sensitive highway construction.

The completion of Vail Pass in 1979 came with a set of engineering fea-

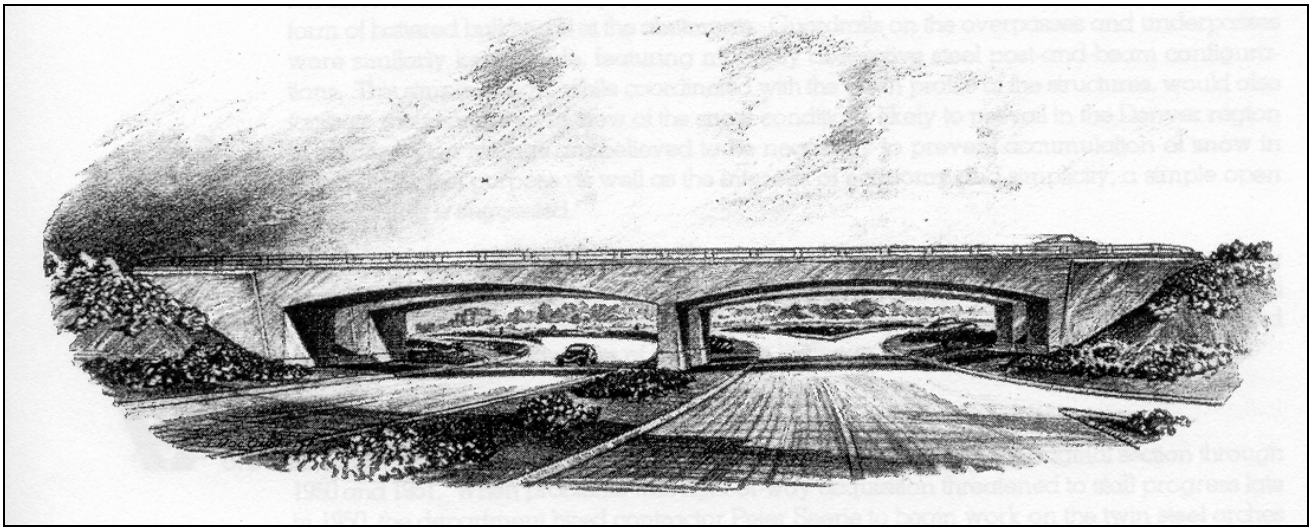


Figure 65. The overpasses designed in 1944 for the Valley Highway typically consisted of paired identical structures. The bridges employed an architectural formality that was as much aesthetic as practical. Designers Crocker and Ryan described their design as "devoid of special architectural organization or ornament, in the belief that the simplicity of such construction and its direct expression of function will have full aesthetic value." Source: Hermsen Consultants, 2000: 23-24.

tures unlike any other mountain highway in the state. A precast retaining wall system controlled erosion, while slope stabilization and revegetation methods successfully protected the surrounding environment. Another innovation involved construction of twin bridges utilizing segmental construction. The segmental bridges were built in relatively short sections involving repetitive sequences of operations. The segments were precast permitting their placement following the erection of supporting piers, thereby shortening construction time. In order to conform as much as possible to the surrounding environment, trees were left in place beneath the structures and engineers designed special underpasses to accommodate game animals (Christensen, et. al., 1987: 57).

The debate over building a twelve-mile section of Interstate 70 through the Glenwood Canyon took the better part of two decades. A number of groups fought the road on the grounds that a major Interstate would destroy the canyon's beauty. The disputed stretch was in a 2,000-foot-deep Colorado River gorge. Completed in 1992, engineers developed a variety of features to minimally impact the canyon's wild splendor. Highway sections featured pre-stressed concrete slabs cantilevering six feet over retaining walls. Many of the thirty-nine bridges along the route were prefabricated superstructures, including several segmental box-girder bridges fabricated off site. In perhaps the most difficult element of the project, the $103 million Hanging Lake Tunnel, four construction companies met the challenge to build two 3,880-foot long tunnels to facilitate traffic movement and protect the Hanging Lake Park area from the highway. As safety features, heated water from nearby springs controls winter icing at the portals of both tunnels, (Christensen, et. al. 1987: 57).

As the project was completed, the *Rocky Mountain News* noted that 265 engineers worked 800,000 hours, or the equivalent of 91 work years, "to pioneer the techniques that will win awards for years to come" (*Rocky Mountain News*, October 15, 1992: 10).

Former Federal Highway Administrator Thomas Larson described the Glenwood Canyon segment of I-70 as "a world-class piece of environmentally sensitive engineering" and "a scenic byway that is

one of the wonders of the interstate system" (Weingroff, 1996: 3).

Landscaped highways are not just rural resources. Urban highways increasingly include landscaping and other environmental elements. Median and shoulder plantings, landscaped interchanges and community gateway features may be found on many urban highways, freeways, and particularly, parkways. Bridges and other structures often incorporate architectural detailing.

One increasingly used urban environmental highway feature is the sound wall. Designed to deflect highway sounds away from adjacent homes and businesses, noise barriers run along the sides of highways, often rising ten or twelve feet above grade. While sometimes a strictly utilitarian structure of wood or concrete, other sound walls incorporate a variety of materials and patterns to provide a point of interest for motorists and to soften their presence on neighboring communities. The actual effectiveness of sound walls as noise mitigation devices is a hotly debated issue.

Electronic Technology

At the close of the twentieth century, highway operation depends increasingly on electronic monitoring, communication and regulation. Weather monitoring devices beside or imbedded in the roadway allow engineers to dispatch snow removal crews as needed. Low frequency radio transmissions inform drivers of real time weather and traffic alerts. Camera monitoring allows for the dispatch of emergency equipment and the adjustment of electronically posted speed limits. Lighted sign boards provide motorists with traffic information. Signal lights on highway entrance ramps, known as ramp metering, match the flow of entering traffic with general highway volume. Continued advances in technology promise an increasing use of electronic systems in the operation of the state highway system.

And the Work Goes On

Annually, the Colorado Department of Transportation expends considerable time, effort and money maintaining and repairing the state highway system. Heavy year-round traffic, plus winter ice and snow, will always place maintenance demands on the state's roads. In Fiscal Year 2000, CDOT apportioned $124.5 million of its total $960.3 million budget toward maintenance. Truly, a road crew's work is never done.

Figure 66. A minimally equipped 1925 road crew faces a daunting task. Photographer: Jesse L. Nusbaum. Source: Denver Public Library, Western History Department.

Glossary of Road and Highway Terms

This is a brief list of descriptive phrases and materials involved in highway construction, design, and preservation.

Aesthetic Routes – Roadways designed for a specific interaction with the natural or built environment. These routes incorporate the surrounding scenery into their design.

Alignment – The vertical and horizontal layout of a highway make up the alignment. The design of the alignment depends of the design speed selected for the highway. The least costly alignment is one that takes the form of the natural topography. It is important that both horizontal and vertical alignments be designed to complement each other.

Amiesite – A patented type of bituminous concrete requiring a fluxed bituminous binder and hydrated lime placed cold on any type of base other than concrete. The City of Denver experimented with this material on a block of Speer Boulevard in 1910.

Arterial – A road providing the principal high-volume and high-speed linkages within a community and between communities.

Bituminous Concrete – A pavement made up of aggregates, such as crushed stone, gravel, or slag, combined with a bituminous binder instead of cement.

Bypass – A route redirecting traffic around the edge of a town or city.

Capacity – The maximum rate of flow in vehicles per hour that can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic and control conditions, usually expressed as vehicles per hour or persons per hour.

Cement – A powder that hardens when mixed with water; an ingredient used in concrete.

Cement Mortar – A mixture of four parts sand to one part cement with enough water added to make it plastic.

Coating – A material that provides a continuous film over surface; a film formed by the material.

Concrete – A mixture of aggregate, water, and a binder—usually Portland cement—that hardens to a stone-like mass.

Context – Refers to the setting, or surrounding area, that influences a resource such as a roadway.

Continuous Shoulder Rumble Strips – Rolled or milled-in grooves perpendicular to the highway centerline running in bands along the shoulder of the road. The strips are designed to wake drowsy drivers whose vehicles drift off the roadway.

Crown of the Roadway – The vertical dimension describing the total amount of the surface that is convex or raised from gutter to centerline; this is sometimes termed the cross fall of the roadway.

Cultural Routes – Roads that have evolved over time. Roads for which there is no recognized date of beginning.

Curb – A short barrier paralleling the outside edge of the roadway to guide the movement of vehicle wheels and safeguard construction and pedestrian traffic existing outside the roadway limit from collision with vehicles and their loads.

Density – The number of vehicles occupying a given length of lane or roadway averaged over time, usually expressed vehicles per mile or vehicles per mile per lane.

Design Speed – Design speed is defined as the "maximum safe speed that can be maintained over a specified section of highway when conditions are favorable such that the design features of the highway govern." Design speed depends on the type of highway, the topography of the area in which the highway is located, and the land use of the adjacent areas.

Embankment – A bank of earth constructed above the natural ground surface to carry a road or to prevent water from passing beyond desirable limits; also known as bank.

Engineered Routes – Roads designed for the movement of people and goods. Roads for which the purpose of traffic movement is the principal underlying force behind their design.

Grade – The degree of rise or descent of a sloping surface on a highway or railroad.

Guardrail – A structural element designed to redirect an errant vehicle onto the roadway (guiderail).

Hot Mix Asphalt (HMA) – Asphalt pavement is any paved road surfaced with asphalt. Hot Mix Asphalt is a combination of approximately 95 per cent stone, sand and gravel bound together by asphalt cement, a product of crude oil. There are 2.27 million miles of paved roads in the United States and 94 percent are surfaced with asphalt, including 65 percent of the Interstate system.

Johnson Wall – An angled concrete barrier that will deflect a striking vehicle back on to the road. Also known as a concrete median barrier, New Jersey Median Barrier or Jersey Barrier.

Joint – In stone masonry, the space between individual stone; in concrete, a division in continuity of the concrete; in a truss, the point at which members of a truss frame are joined.

Macadam – Uniformly sized stones rolled to form a road. Sometimes mixed with tar before application.

Materials – The elements originally combined to make the structure.

Median – A central space, usually planted, with divided opposite travel lanes.

Overpass – A bridge structure where the major thoroughfare is the upper roadway; see *Underpass.*

Plain Concrete – Concrete with no structural reinforcement except light steel to reduce shrinkage and temperature-related cracking.

Precast Concrete – Concrete members that are cast and cured before being placed into their final position on a construction site.

Prestressed Concrete – Concrete in which cracking and tensile forces are greatly reduced by compressing it with tensioned cables or bars.

Ramp Metering – Traffic flow controlled on freeway entrance ramps by means of sequenced traffic signals.

Realignment – The repositioning of a road.

Reinforced Concrete – Concrete with steel reinforcing bars bonded within it to supply increased tensile strength and durability.

Right-of-Way – Right-of-Way is the total land area acquired for construction of a transportation facility. Its width should be able to accommodate all the elements of the cross-section and planned future expansion.

Roadway – The portion of the road intended for the use of vehicular traffic.

Rumble Strips – See Continuous Shoulder Rumble Strips.

Shoulder – A stabilized level area adjacent and parallel to the road. Shoulders provide a recovery space for an errant vehicle or a safe space for a disabled vehicle.

Standards – The legally adopted policies directing the design and construction of roads.

Superelevation – The banking or sloping of a road curve to allow vehicles to maintain a speed consistent with the overall speed of the roadway.

Terrain – Terrain is a portion of land, especially considered with regard to its topography and natural features. For transportation design, topography is generally classified into three groups: level terrain, rolling terrain and mountainous terrain:

- Level terrain is relatively flat and horizontal and vertical sight distances are generally long or can be achieved without much construction difficulty or major expense.

- Rolling terrain has natural slopes that often rise above and fall below the grade, with occasional steep slopes that restrict the normal vertical and horizontal alignments.

- Mountainous terrain has sudden changes in ground elevation in both the longitudinal and transverse directions, thereby, requiring frequent hillside excavations to achieve acceptable horizontal and vertical alignments.

Transition Curve – A high-speed highway curve with a gradually decreasing radius.

Underpass – A bridge structure where the principal, or subject, transportation facility is the lower roadway; see *Overpass*.

Vertical Alignment – The vertical alignment of a highway consists of straight sections of the highway known as grades, or tangents connected by vertical curves. The topography of an area through which the road traverses has significant influence on the design of the vertical alignment.

Viaduct – A series of spans carried on piers at short intervals.

Volume – The number of persons or vehicles passing a point on lane, roadway, or other trafficway during some time interval (often one hour) expressed in vehicles.

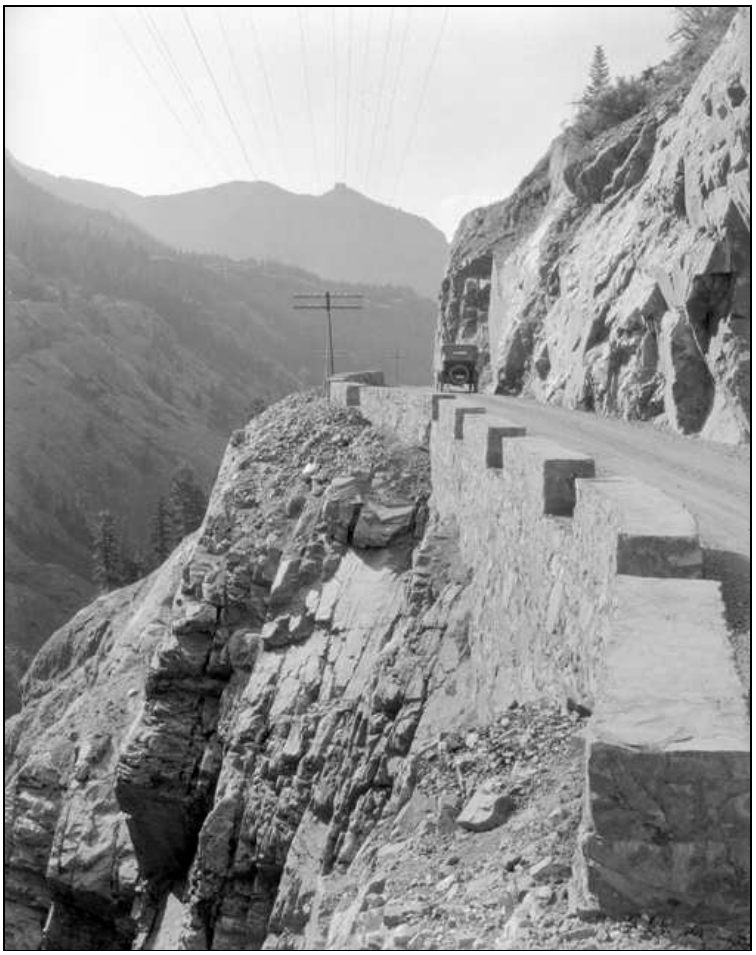


Figure 67. View of the Million Dollar Highway (US 550) over Red Mountain Pass in the late 1920s. Photographer: George L. Beam. Source: Denver Public Library, Western History Department.

REGISTRATION REQUIREMENTS

Highways are significant for their facilitation of many human activities, transportation being only the most obvious. From transportation grows economic enterprise, community development, and social interaction. These activities contribute to societal change on a major scale. The act of highway construction itself represents private initiative, community activism, and government funding and regulation. Occasionally, highway construction has as much to do with promoting social welfare as establishing transportation infrastructure.

The construction of roads and highways often involves significant engineering achievement. Through innovative solutions, adaptive techniques, and the refinement of materials and process, the construction and operation of a highway system constitutes a major engineering achievement.

This is not to say that highway systems grow without controversy. Over the years, many question the means, methods, extent, goals, and the ultimate costs of the system, in part and in total. Despite ongoing controversy, a highway system remains a major force in shaping state and national development. Colorado's state highway system is no exception.

Roads and highways are extremely common as a structure type, though they vary significantly in materials, design and general appearance because of age, use and location. Highways are also exceptionally vulnerable to alteration over time because of maintenance and modernization. A highway cannot be expected to retain all of its original materials and design elements for more than a few years after initial construction.

Highways are often defined as much by their settings than by their physical nature, but the settings can also change dramatically over time, so that the original purpose and effect of a highway is no longer evident. Highways are also among the largest human-made structures, in some cases stretching hundreds of miles, exhibiting various materials, features, environmental and cultural settings, and physical integrity. The historical significance of a highway, like that of a railroad, trail, or canal, may be associated with the whole length of the resource or a discrete segment.

Historic highways usually have significance because they allowed other human activities to occur that are considered important in our past. Some highways may have had particularly important construction histories or may represent variations in materials or structures, but in general, highways are historically important because of their role in affecting economic and social changes in our society. For example, Interstate 70 through the mountains of Colorado includes a number of outstanding engineering features, but those features are fundamentally important because they contributed to the opening of high-volume, high-speed transportation through the Central Rockies. I-70 has had tremendous effects on the tourism, skiing, and general commercial industries in Colorado, and the highway has substantially affected residential and related development in mountain areas along the route. The historical context of a highway is therefore usually the key element in determining historical significance.

Criteria for Evaluation

The National Register of Historic Places applies four Criteria for Evaluation. Criterion A addresses the importance of a property in broad patterns of history. Highways are most likely to be eligible for nomination to the National Register under this criterion in such areas as ***transportation***, ***recreation, community planning and development,*** and ***politics/government***. In rare occasions, a highway may have been the scene of a particular event important in history. In most such cases, only a relatively small segment of the highway is directly associated with the event.

Highways are rarely eligible for nomination to the National Register under Criterion B, because this Criterion requires that a property must (1) be directly associated with a person important in history and (2) be directly associated with the events or work for which the person is important. Criterion B is applicable if a highway is associated with historically important persons other than the designer or builder; associations with the designer or builder are addressed under Criterion C. A highway might be significant under Criterion B if the highway represents the efforts of a specific individual to secure construction of a highway for the economic development of a community or area of the state. These kinds of efforts tend to be associated with organizations rather than individuals, and therefore examples of significant highways under Criterion B are rare.

A highway can be eligible for nomination to the National Register under Criterion C based on engineering or construction features embodied in the highway. A highway can include distinctive characteristics of a type, period, or method of construction, such as stone retaining walls or drainage features built by the Works Progress Administration or the Civilian Conservation Corps during the Great Depression. A highway can (rarely) represent the work of a master or possess high artistic values, although those characteristics are usually confined to specific structures such as bridges. Most historic highways correspond to “a significant and distinguishable entity whose components may lack individual distinction.” Historic highways usually are eligible for nomination to the National Register under a combination of Criteria A and C, where physical features of the highway or the highway as a whole entity can be understood in terms of its relationship to important broad historical patterns.

Highways are extremely unlikely to be eligible for nomination to the National Register under Criterion D. Automobile highways are relatively recent phenomena, and the technology of highway construction is well understood and documented. Study of a physical highway is therefore unlikely to yield information important in expanding our understanding of history. Study and documentation of physical features of a highway are more likely to be applicable to Criterion C considerations.

Highways usually include a number of discrete segments, such as the route between two towns or the route over a mountain pass. Segments of a highway may have substantially different origins, historical associations, and physical features, so that different segments of the same highway may be historically significant for different reasons (and eligible for the National Register under different Criteria). Short mountainous segments may demonstrate 1930s engineering for mountain construction, while an entire highway of many segments may be significant for its importance in the economic development of a region. Length of a segment is not a determinant of historical significance or National Register eligibility, as long as the segment can convey its significance and retains integrity as discussed below.

Integrity

The National Register Criteria for Evaluation require that, in order for a property to be eligible for listing in the National Register, it must possess integrity of location, setting, design, materials, workmanship, feeling, and association. As indicated above, highways are very susceptible to change over time, to the extent that a “pristine” historical highway is extremely unlikely to exist.

Location is the place where the historic highway was constructed. Highways are sometimes locally re-routed to lesser or greater extent, and the names or number designations for particular highways are sometimes changed so that a current route may bear little or no resemblance to an historic highway of the same designation. The principal considerations of integrity of location are (1) the extent to which a highway corresponds to the general route followed during the period in which the highway attained its historical significance, and (2) the relative importance of the route as an element of the significance of the historic highway. For example, a highway over a mountain pass would not be considered to have integrity of location if the original 1930s route crossed

a different pass to reach a mining camp. Similarly, a highway bypass would not have integrity of location if the original route passed through a town's main street. Relatively minor variations of route, such as relocation slightly higher on a slope or road straightening, are usually more appropriately addressed under consideration of integrity of design.

Setting is the physical surrounding of a highway, including the topographic, vegetative, and cultural character of the location of the highway. Cultural character primarily refers to the built environment, including buildings and other structures, but it can also refer to ethnic and other social factors. Every highway was designed to accommodate its setting, whether the highway is in a narrow mountain gorge, a city, or a wide-open plains environment. The principal consideration of integrity of setting is the extent that the general environment and any particular elements of the environment that affected location, design, construction, and use of the highway remain intact from the highway's period of significance. Natural environments tend to remain unchanged unless disturbed by man, but cultural environments are much more prone to change. For example, a forest fire near a highway in a mountain canyon would not substantially alter the setting of a highway, but construction of a condominium complex in the same area might significantly degrade the setting in that locality. Redevelopment of a 1930s commercial area adjacent to a highway would very likely adversely affect the historic setting of the highway.

The extent of the effective setting of a highway varies according to all of the elements that form the setting. The effective setting is usually the viewshed from a highway, meaning all natural and cultural features that can be clearly discerned with the naked eye. In many urban settings, the viewshed extends only to the first or second tier of buildings from each side of a highway, but in some rural areas, the viewshed may be many miles wide. Regardless of the extent of the viewshed/setting, the key integrity consideration is the retention of salient features from the period of significance of the highway.

Design is the combination of elements that create the form, plan, space, structure, and style of a property. Elements of highway design include the height and width of the roadbed, surfacing methods, shoulder width and sloping, ditching and other drainage features, alignments, intersections, pullouts, retaining walls, guardrails and other safety features, bridges and culverts, and signs and signals. The principal consideration of integrity of design for a highway is the extent to which the highway retains the features that defined the physical nature of the highway during the period of its significance. All elements of original (or period of significance) design do not have to be present for a highway to retain its essential physical nature. For example, most signs and many culverts may have been replaced, but these are usually relatively minor elements of a highway as a whole. However, if a highway has been re-graded and substantially widened, the highway has lost important elements of design.

Materials are the physical elements that were combined or deposited to form a highway and its associated structures and objects. Materials are the aspect of highways most likely to have been changed during and after the period of significance, particularly the materials in the driving surface. The principal integrity consideration for materials is the extent to which the highway retains the same general types of materials that were present during the highway's period of significance. For example, a highway that had a concrete driving surface has lost some integrity of materials if the driving surface is now asphalt. A highway that had an asphalt driving surface has lost little integrity of materials if the highway has been resurfaced with similar asphalt materials (assuming the resurfacing was similar in area and location).

Workmanship is the evidence of the particular skill of an artisan in building features or an entire highway, and it can include applications of technology as well as aesthetic principles. Examples might include ancillary statues or structures of concrete or stone or the dry-laid stone retaining walls built by the WPA. Again, the principal integrity consideration for workmanship is the extent of retention of distinctive artistry from the highway's

period of significance. Workmanship is rarely a primary integrity consideration in evaluation of highways, except for portions of highways built mostly by hand by WPA, PWA, and CCC program workers during the Great Depression.

Feeling is a highway's expression of a particular period of time. In essence, feeling is the quality of a highway that results from combination of location, design, setting, materials, and workmanship. This aspect of integrity is more subjective than other aspects, but clearly, a solitary ribbon of highway through Monument Valley elicits a feeling that would be diminished if any of the component qualities were compromised. Although it has lost integrity of design and materials in some areas, Colorado State Highway 74 generally elicits the feeling of the period of initial automobile tourism into the Colorado mountains.

Association is the direct link between an important historical event or person and a highway, usually meaning that distinctive physical features exist as part of the highway that clearly demonstrates the connection to the event or person. For example, remaining dry-laid retaining walls represent the WPA era/event in Colorado, particularly the reconstruction of State Highway 74 after a devastating flood. Association can also mean that individual elements of a highway remain visually and/or functionally connected, so that the historic highway can be easily recognized as a single entity. For example, a tunnel that is no longer part of a highway may still have essential association with the highway if the tunnel is visible from the highway and the former highway route to the tunnel is evident.

Period of Significance

The National Register Criteria for Evaluation requires that a highway must ordinarily be fifty years old or older to qualify for eligibility for nomination to the National Register, in addition to qualifying under at least one of the primary significance criteria and having sufficient integrity to convey its significance.

Highways that can demonstrate exceptional historical importance may be eligible if less than fifty-years-of-age or if their period of significance occurred less than fifty years ago. For example, the highway/causeway built to carry the space shuttle from the assembly building to the launch site is of exceptional historical importance though less than fifty years old. In Colorado, the Glenwood Canyon segment of Interstate 70 might qualify under this consideration for its engineering significance before reaching fifty years of age.

Most highways in Colorado originated in some form more than fifty years ago, and therefore most of the state's highways technically meet the ordinary age requirement. A more useful application of age in the evaluation of significance involves assignment of a highway to one or more of the four principal historic periods of automobile highway construction in the state, and then assessment of the integrity of the highway to that period. As discussed elsewhere in this document, the principal historic periods of highway construction in Colorado are:

1861-1890 – Territorial and Pre-Automobile State Roads
1890-1930 – The Automobile Age Begins
1930-1945 – Depression and World War II
1945-1973 – Postwar Interstate Era
1973-2000 – Completion and Augmentation of the State Highway System

Nearly all highways in Colorado have been in use during more than one of these periods; the earliest roads and highways have been in continuous use through all of the periods. The focal period for historical significance of most highways is the period in which they were constructed and first used. In that initial period, the highway most likely met the need for which it was built, and in that period the highway probably had its most definable effects on the economy and culture of the highway's service area. Use of the initial construction period as the beginning point of a highway's period of significance also establishes a basis for identifying change and assessing integrity of the physical characteristics of the highway. For highways that are significant primarily for their engineering and

construction features, the period of significance may appropriately end with the completion of the highway or a particular segment of the highway.

The ending point of a period of significance is more problematic for most highways, because most highways continue to be vital to the transportation, commerce, and general culture of their service areas. The period of significance is the time in which the highway performed the special function or role that distinguishes it from other highways. The initial construction of a highway will correspond to one of the five principal historic periods listed above, but the period of significance for a particular highway may be only a few short years or may span more than one of the principal historic periods, depending on the particular historical context of that highway. For example, State Highway 141 in western Colorado began as a community funded road in 1921, and was improved by the Department of Highways with funding from the federal government from the 1920s into the 1950s. From the 1940s to the 1960s, SH 141 served a vital role as a supply and haul road for uranium processing for the Manhattan Project and for private mining and development of uranium resources. State Highway 141 continues to serve as an important transportation route across southwestern Colorado, but its importance lessened after the 1970s as the concerns over the disposal of radioactive waste from nuclear power plants cooled the uranium boom. The period of significance for State Highway 141 as an automobile highway therefore extends from 1921 to the mid-1950s (this route also has significance in historic contexts other than automobile highways).

Property Types

The National Task Force for Historic Roads (NTFHR), part of the Rural Heritage Program of the National Trust for Historic Preservation, established three classifications of historic roads: *cultural routes, engineered routes* and *aesthetic routes*. These three broad classifications are used here, though tailored specifically to state roads and highways.

Property Type: Cultural State Roads and Highways

Description

Cultural routes are legacies handed down from the first people to venture through a mountain pass or trek over the prairie. Cultural routes evolved through necessity or tradition. While these roads may have a documented date of origin, they developed without the intensive engineering and design practices associated with aesthetic and engineered routes. These may be roads that evolved from Native American trails, trade routes, or simply from convenient connections between settlements. “Now in automobile use, cultural routes have generally undergone significant changes and modifications since their inception, often leading to multiple layers of development, providing interesting historical juxtapositions, and a challenge for preservationists. Generally the only original feature of these roads is the historic corridor through which they pass.” Remaining roadside features such as lodgings and barns may provide clues to the history of the route—their spacing a clue to settlement and travel patterns. Road construction projects done at different times in the route’s history may have left different layers of significant historic resources (Marriott, 1998: 16).

Some examples of routes used by the first indigenous peoples to Colorado to the present day include US 24, from Colorado Springs over Ute Pass to South Park, and US 50, along the lower Arkansas River. State Highway 13 in the northwest portion of the state is a latter-day example. It began as a route built by the military to protect settlers and remains the primary north-south thoroughfare in that corner of Colorado.

Significance

Cultural state roads and highways are significant under Criterion A in the area of *transportation* for their association with general vehicular travel. Such routes may also be significant in the area of *ethnic heritage* for their association with one or more cultural or ethnic groups. Cultural roads and highways may be significant in the area of *politics/government* for their association with New Deal public works programs. The Works Progress Administration and the Public Works Administration in particular funded or constructed numerous highway-related projects during the Great Depression. Cultural roads and highways may also be significant for their particularly important associations with state or federal highway agencies, either through general planning, policy or funding. These roads and highways may be significant at a local, regional or state level.

A cultural road or highway may be significant under Criterion B for its association with a significant person, as long as the person was not the designer or builder of the road or highway. A cultural route may be eligible by virtue of its designer or builder, but this falls under Criterion C.

Some cultural routes may be significant under Criterion C as structures of engineering significance. This can encompass a broad range of considerations. For instance, an esthetic route can qualify under Criterion C as a well-preserved example of a type, period, or method of construction or as an important variation. Due to the origins of cultural routes, Criterion C is more likely to apply for later modifications than to original construction.

Registration Requirements

The general period of significance for cultural state roads and highways begins in 1909 with the creation of the Colorado Highway Commission. The period of significance ends no later than a date fifty years before the present, unless a particular route possesses exceptional significance. Alterations made during a highway's period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for cultural roads and highways to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

A road or highway segment must be of sufficient length to include the cultural qualities which distinguish this property type and to convey its significance.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:
With its creation in 1909, the Colorado Highway Commission began to inherit cultural roads. Some of these roads may date back to the establishment of Colorado Territory in 1861 or even earlier. By the 1920s, the commission and the Highway Department began improving the safety of cultural routes to handle greater traffic volumes at higher speeds. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

2. Association with a significant event:
If the construction, improvement or use of a road or highway served as an avenue for the development in adjacent communities, the road or highway might be considered eligible under Criterion A. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

3. Association with federal work relief programs, such as the Public Works Administration or the Works Progress Administration:
Cultural road and highway improvements executed or funded by the WPA or the PWA from 1933-1942 might be considered significant under Criterion A in the area of *politics/government* as local manifestations of a national movement. Particularly important are such projects that incorporate cultural or ethnic associations.

Specific requirements under Criterion C:

1. Representative cultural road or highway:

Cultural roads or highways are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Roads and highways may be eligible for their original design or for important later modifications. Features that emphasize cultural or ethnic qualities of the road increase the road's significance. These cultural qualities may be a part of the original construction or they may represent later modifications to the road. Under Criterion C, the period of significance would correspond to that period during which the road achieved its cultural status.

Property Type: Engineered State Roads and Highways

Engineered routes are roads designed for a specific transportation goal, such as the movement of people, goods and services. This type forms "the largest road category. Engineered routes, like aesthetic routes, have a documented origin or authorization and construction date. These roads may have been developed to open isolated areas to commerce, link the nation, or simply serve communities—roads for which the aesthetic experience was secondary. Their alignment and detail are important in their representation of technology and culture." Generally, speed, safety and economy determined the design. With passing time and changing use, many engineered routes have taken on aesthetic qualities and associations. The first transcontinental highways are typical of this category (Marriott, 1998: 13-14).

In Colorado, Interstates 25, 70 and 76 and US Highway 160 meet these criteria. US 550 over Red Mountain Pass is an example of an engineered route (in this case a mountain toll road) which now is popular for its scenic qualities.

Significance

Engineered state roads and highways are significant under Criterion A in the area of ***transportation*** for their association with general vehicular travel. Engineered routes may be significant in the area of ***politics/government*** for their association with New Deal public works programs. The Works Progress Administration and the Public Works Administration in particular funded or constructed numerous highway-related projects during the Great Depression. An engineered road may also be significant for particularly important associations with state or federal highway agencies, either through general planning, policy or funding. These roads and highways may be significant at a local, regional or state level.

An engineered road or highway may be significant under Criterion B for its association with a significant person, as long as the person was not the designer or builder of the road or highway.

An engineered road may be significant by virtue of its designer or builder, but this falls under Criterion C. Many engineered routes will be eligible under Criterion C as structures of engineering significance. This can encompass a broad range of considerations. For instance, an engineered route can qualify under Criterion C as a well-preserved example of a type, period, or method of construction or as an important variation.

Registration Requirements

The general period of significance for engineered roads and highways begins in 1909 with the creation of the Colorado Highway Commission. The period of significance ends no later than a date fifty years before the present, unless a particular route possesses exceptional significance. Alterations made during a highway's the period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for esthetic roads and highways to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

A road or highway segment must be of sufficient length to include the engineering qualities that distinguish this property type and be able to convey its significance.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:
With its creation in 1909, the Colorado Highway Commission began to inherit engineered roads. By the 1920s, the commission and the Highway Department began developing new engineered routes to accommodate the state's growing vehicular traffic. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

2. Association with a significant event:
If the construction, improvement or use of a road or highway served as an avenue for development in adjacent communities, the route or highway might be considered eligible under Criterion A.

3. Association with federal work relief programs, such as the Public Works Administration or the Works Progress Administration:
Engineered roads and highways built or funded by the WPA or the PWA from 1933-1942 as part of a specific transportation project in a community might be considered significant under Criterion A in the area of ***politics/government*** as local manifestations of a national movement.

Specific requirements under Criterion C:
1. Representative engineered road or highway:
Engineered roads or highways are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Roads and highways may be eligible for their original design or for later modifications. Features that raise the engineered qualities of the road increase the road's significance. These aesthetic qualities may be a part of the original construction or they may represent later modifications to the road. Under Criterion C, the period of significance would correspond to that period during which the road first achieved its engineered status.

2. Engineering achievement as part of an engineered road or highway:
Engineered roads and highways are considered significant if they include particularly important engineering achievements on a local, regional or statewide basis. Roads or highways may be eligible for their original engineering achievement or for later modifications. Innovative engineering may relate to such areas as innovative solutions to construction challenges or the development of influential design solutions or material applications. Under Criterion C, the period of significance would correspond to that period when the engineering achievement first occurred.

Property Sub-Type: Farm-to-Market Road

Description
The earliest roads farmers established to reach local market centers are cultural routes. The earliest of these roads were nothing more than a pair of wagon ruts created by the passage of wagons to and from the local market. These roads usually followed along property lines. These in turn tended to follow along section and quarter section lines established under the federal government's Public Land Survey System. The roads are characterized by ninety-degree turns and intersections as they zigzagged across the landscape to match rectilinear property lines.

Some of these roads later became part of the state highway system, particularly those roads that tied small market centers to larger transportation and processing centers. The sub-type includes those roads improved or built by the highway department and well as those built or improved by New Deal WPA and PWA projects. The farm-to-market roads acted as collectors for earlier private and county roads to funnel agricultural products to local market centers. These roads also served to join local markets to regional transportation and processing centers.

As early farm-to-market roads were upgraded, the square corners were often rounded off to sweeping transition curves. Often the original ninety-degree corners remain outside the arc of the new road's curve.

Significance
Farm-to-market roads are significant under Criterion A in the area of *transportation* for their asso-

ciation with general vehicular travel in agricultural regions. Farm-to-market roads may be significant in the area of *politics/government* for their association with New Deal public works programs. The Works Progress Administration and the Public Works Administration in particular funded or executed numerous highway-related projects in agricultural regions during the Great Depression. Many of these projects involved improving farm-to-market roads.

A farm-to-market route may be significant under Criterion B for its association with a significant person, as long as the person was not the designer or builder of the road or highway.

Some farm-to-market routes may be significant under Criterion C as structures of engineering significance. This can encompass a broad range of considerations. For instance, a farm-to-market road can qualify under Criterion C as a well-preserved example of a type, period, or method of construction or as an important variation.

Registration Requirements

The general period of significance for farm-to-market state roads and highways begins in 1909 with the creation of the Colorado Highway Commission. The period of significance ends no later than a date fifty years before the present, unless a particular route possesses exceptional significance. Alterations made during a highway's period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for esthetic roads and highways to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

A road or highway segment must be of sufficient length to include the farm-to-market qualities that distinguish this property type and be able to convey its significance.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:
With its creation in 1909, the Colorado Highway Commission began to inherit farm-to-market roads. By the 1920s, the commission and the Highway Department began establishing and improving farm-to-market routes to accommodate the state's growing agricultural industry. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

2. Association with federal work relief programs, such as the Public Works Administration or the Works Progress Administration:
Farm-to-market roads and highways built or funded by the WPA or the PWA from 1933-1942 as part of a specific transportation initiative in a community might be considered significant under Criterion A in the area of ***politics/government*** as local manifestations of a national movement.

Specific requirements under Criterion C:

1. Representative farm-to-market road or highway:
Farm-to-market roads are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Roads and highways may be eligible for their original design or for important later modifications. Under Criterion C, the period of significance would correspond to that period during which the road achieved its engineered status.

2. Engineering achievement as part of an aesthetic road or highway:
Farm to market roads are considered significant if they include particularly important engineering achievements on a local, regional or statewide basis. Roads or highways may be eligible for their original engineering achievement or for important later modifications. Innovative engineering may relate to such areas as enhanced safety, load capacity or speed. Under Criterion C, the period of

significance would correspond to that period when the engineering achievement first occurred.

Property Sub-Type: Limited Access, Multiple Lane, Divided Highway / Freeway

Description

The limited access, multiple lane, divided highway constitutes the most highly engineered of Colorado's state highways. This property type is commonly referred to as "freeways," regardless of whether these roads may be freely accessed or are subject to a use toll. Divided highways are engineered to accommodate huge volumes of traffic at sustained high speed. The width of these highways combined with the expansive interchange systems, designed to allow stop light free entry and exit, result in a generally massive disturbance of the land, which they traverse. This may be a plains landscape, a mountain canyon or an urban neighborhood. The size of these highway projects made them the most expensive of any in the state. The impacts on the natural environment often caused these highway projects to be the most controversial. The design solutions were often innovative in their consideration of both traffic requirements and environmental restraints.

Early examples of this property type include the Denver-Boulder Turnpike and Denver's Valley Highway. The largest example by far is the Interstate Highway System that crossed the state both north to south and east to west.

Significance

State and federal divided highways are significant under Criterion A in the area of ***transportation*** for their association with general vehicular travel. Divided highways may also be significant for particularly important associations with state or federal highway agencies, either through general planning, policy or funding. These highways may be significant at a local, regional or state level.

A divided highway may be significant under Criterion B for its association with a significant person, as long as the person was not the designer or builder of the road or highway.

Many divided highways will be significant under Criterion C as structures of *engineering* importance. This can encompass a broad range of considerations. For instance, a divided highway may be a well-preserved example of a type, period, or method of construction or as an important or precedent setting variation.

A divided highway may be significant in the area of *landscape architecture* where environmental sensitivity formed an important part of the routes design and construction.

Registration Requirements

The general period of significance for divided highways begins in 1941 with the completion of the state's first limited access, multi-lane, divided highway, West 6th Avenue in Denver and Lakewood. The relatively recent construction of most divided highways places the period of significance in the less-than-fifty-year period, requiring that eligible resources exhibit exceptional significance. Alterations made during the period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for esthetic roads and highways to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

A road or highway segment must be of sufficient length to include the divided highway qualities that distinguish this property type and be able to convey its significance.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:

The Highway Department began planning and constructing divided highways by the early 1940s and continued to do so into the twenty-first century. Such a highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A if over fifty years of age. A divided highway under fifty years of age could

be eligible if exceptional significance can be demonstrated.

2. Association with a significant event:
If a divided highway was built as part of a significant event, such as the opening of an office park or an airport, it may be eligible under Criterion A for its association with that specific activity, assuming that in the case of less-than-fifty-year-old events, the event also meets the requirements of Criteria Consideration G.

3. Association with Interstate Highway System development:
As the largest single federal road or highway project, the construction of the Interstate Highway System is a significant public works transportation project. Divided highways associated with particularly important aspects of this national undertaking in Colorado could be eligible in the area of politics/government as local manifestations of a national movement, assuming they meet Criteria Consideration G.

Specific requirements under Criterion C:
1. Representative divided highway:
Divided highways are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Divided highways may be eligible for their original design or for important later modifications. Features that raise the aesthetic qualities of the road or allow it to flow compatibly with the scenery through which it traverses increase the road's significance. Under Criterion C, the period of significance would correspond to that period during which the road achieved its divided highway status.

2. Engineering achievement as part of a divided highway:
Divided highways are considered significant if they include particularly important engineering achievements on a local, regional or statewide basis. Divided highways may be eligible for their original engineering achievement or for important later modifications. Innovative engineering may relate to such areas as enhanced scenic views or environmental sensitivity. Under Criterion C, the period of significance would correspond to that period when the engineering achievement first occurred.

3. Landscape architecture as part of a divided highway: Innovative engineering may relate to environmental sensitivity where such considerations formed an important part of the divided highway design and construction.

Property Sub-Type: Highway Bypass

Description
The highway bypass redirects intercity traffic on a new route around the edge of a town or city. This allows long-distance motorists to maintain highway speeds as they avoid the congestion and reduced speeds of downtown.

The first bypasses in the late 1940s and early 1950s consisted of two-lane highways meeting contemporary design standards. Bypasses grew larger with advances in highway technology. Bypasses on Interstate highways began to appear by the 1970s, the first being I-225 which opened in 1976.

Significance
Highway bypasses represent the transportation success of the state highway system and an engineering response to that success. State highways sometimes brought so much intercity traffic through communities that local traffic suffered. The bypass functions to separate local from long distance travelers while still allowing communities access to the highway and highway travelers access to community businesses.

In addition to its impact on highway transportation, the construction of bypasses had a tremendous effect on community development. Many businesses catering to highway motorists abandoned downtown locations for the higher traffic location next to the byway. New chain operators in the fields of gasoline, lodging and fast food built at the byway interchanges, taking business away from downtown merchants. Eventually residential construction occurred near the bypass where open land was available for development and when ac-

cess to the byway could be used as a marketing tool. Over time, development and increased volume so over whelmed many bypasses that the initial benefits disappeared. This often led to calls for newer bypasses further out from the community core, only to be followed by more outward migration and development.

Registration Requirements

The general period of significance for highway bypasses begins in 1949 with the construction of the first bypass. The period of significance ends no later than a date fifty years before the present, unless a particular bypass possess exceptional significance. Alterations made during a bypass's period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for highway bypasses to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:
With its creation in 1909, the Colorado Highway Commission began to inherit aesthetic roads, primarily older cultural and engineered routes that evolved into important scenic and tourist routes. By the 1920s, the Commission and the Highway Department began developing new aesthetic routes to accommodate the state's growing tourism industry. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

2. Association with a significant event:
If the construction, improvement or use of a highway bypass served as an avenue for community growth and development, or a change in the pattern of growth and development, the route or highway might be considered eligible under Criterion A.

Specific requirements under Criterion C:

1. Representative highway bypass:
Highway bypasses are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Roads and highways may be eligible for their original design or for important later modifications. Under Criterion C, the period of significance would correspond to that period during which the road first achieved its status as a bypass.

2. Engineering achievement as part of a highway bypass:
Highway bypasses are considered significant if they include particularly important engineering achievements on a local, regional or statewide basis. Roads or highways may be eligible for their original engineering achievement or for important later modifications. Under Criterion C, the period of significance would correspond to that period when the engineering achievement first occurred.

Property Type: Aesthetic State Roads and Highways

Description

Aesthetic routes are roads designed for a specific interaction with the natural or built environment. The design and provision of a specific visitor experience constituted the primary rationale for the development of aesthetic routes. "Parkways and park roads have historically been intensively designed and developed for the purpose of leisure, recreation and commemoration. They have a documented origin and construction date. Never intended as the fastest or quickest route, such roads typically follow the natural topography of the region and are most often associated with a designed landscape or park space. In urban areas, park boulevards and monumental avenues exhibit an equally high level of detail and composition. Aesthetic routes are roads for which the alignment, materials and composition are important to the travel experience. Special materials, plantings, lighting, and even building facades contribute to the character of these roads. Alterations to any component of these roads (alignment, details

and affiliated landscape) will significantly impact the historic integrity of the resource" (Marrriott 1998: 11)

Colorado boasts a number of highways where scenic views and natural detail were central to their design. The automobile highway up Pike's Peak near Colorado Springs is an example of a highway built specifically for appreciation of the aesthetic qualities of the mountain setting. Other highways in Colorado that were originally designed and built for non-aesthetic uses have evolved into aesthetic routes because of their spectacular settings. Some of these highways have been partially re-engineered to support aesthetic uses, including construction of pull-outs and parking areas at scenic locations. Examples of evolved aesthetic routes include US 550 from the Colorado-New Mexico line to Ouray and State Highway 141 from Whitewater to Dove Creek.

Significance

Aesthetic state roads and highways are significant under Criterion A in the area of ***transportation*** for their association with general automobile travel. Such routes may also be significant in the area of ***entertainment/recreation*** for their association with automobile tourism and pleasure driving. This is particularly true where these roads have design features specifically oriented to tourism, such items as scenic pull-offs, or are designed in such a way as to enhance the natural beauty of the route. Aesthetic routes may be significant in the area of ***politics/government*** for their association with New Deal public works programs. The Works Progress Administration and the Public Works Administration in particular funded or constructed numerous highway-related projects during the Great Depression. Aesthetic roads and highways may be significant for particularly important associations with state or federal highway agencies, either through general planning, policy or funding. These roads and highways may be significant in a local, regional or state level.

An aesthetic route may be significant under Criterion B for its association with a significant person, as long as the person was not the designer or builder of the road or highway.

Many aesthetic routes will be eligible under Criterion C as structures of engineering significance. This can encompass a broad range of considerations. For instance, an esthetic route can qualify under Criterion C as a well-preserved example of a type, period, or method of construction or as an important variation.

Registration Requirements

The general period of significance for aesthetic state roads and highways begins in 1909 with the creation of the Colorado Highway Commission. The period of significance ends no later than a date fifty years before the present, unless a particular route possesses exceptional significance. Alterations made during a highway's period of significance are considered part of the highway's historic fabric. Such changes may or may not be in keeping with the highway's original design. Integrity of location and setting is essential to qualify for the National Register under any criterion. A high degree of integrity in the areas of design, materials and workmanship is necessary for esthetic roads and highways to be eligible under Criterion C. Replacement in kind is acceptable in regard to such elements as road surfacing.

A road or highway segment must be of sufficient length to include the aesthetic qualities that distinguish this property type.

Specific requirements under Criterion A:

1. Early and/or prominent project of the Colorado Highway Department:
With its creation in 1909, the Colorado Highway Commission began to inherit aesthetic roads, primarily older cultural and engineered routes that evolved into important scenic and tourist routes. By the 1920s, the Commission and the Highway Department began developing new aesthetic routes to accommodate the state's growing tourism industry. Such a road or highway, if generally unaltered from the period of significance, would be considered eligible under Criterion A.

2. Association with a significant event:
If the construction, improvement or use of a road or highway served as an avenue for recreational

travel and tourism, or contributed to increased recreational development in adjacent communities, the route or highway might be considered eligible under Criterion A. A route, if generally unaltered from the period of significance, may also be eligible under Criterion A if associated with a significant event related to automobile tourism or recreation. Similarly, if an aesthetic route was built as part of a significant event, such as the opening of a state or national park, it may be eligible under Criterion A for its association with that specific activity.

3. Association with federal work relief programs, such as the Public Works Administration or the Works Progress Administration:
Aesthetic roads and highways built or funded by the WPA or the PWA from 1933-1942 as part of a specific aesthetic or recreational initiative in a community might be considered significant under Criterion A in the area of politics/government as local manifestations of a national movement.

Specific requirements under Criterion C:

1. Representative esthetic road or highway:
Aesthetic roads or highways are considered significant if they exhibit physical features indicative of a period and method of construction on a local, regional or statewide basis. Roads and highways may be eligible for their original design or for important later modifications. Features that raise the aesthetic qualities of the road or allow it to flow compatibly with the scenery through which it traverses increase the road's significance. These aesthetic qualities may be a part of the original construction or they may represent later modifications to the road. Under Criterion C, the period of significance would correspond to that period during which the road first achieved its aesthetic status.

2. Engineering achievement as part of an aesthetic road or highway:
Aesthetic roads and highways are considered significant if they include particularly important engineering achievements on a local, regional or statewide basis. Roads or highways may be eligible for their original engineering achievement or for later modifications. Under Criterion C, the period of significance would correspond to that period when the engineering achievement first occurred.

3. Landscape architecture as part of a divided highway:
Innovative engineering may relate to environmental sensitivity where such considerations formed an important part of the divided highway design and construction.

GEOGRAPHICAL DATA

This Multiple Property Documentation Form applies to the entire state highway system across the State of Colorado.

SUMMARY OF IDENTIFICATION AND EVALUATION METHODS

The Colorado Department of Transportation (CDOT) is responsible for planning, building, and maintaining a statewide system of highways. CDOT carries out its mandates with funding from the state legislature and from federal grant-in-aid programs. As a state agency and recipient of federal funds, CDOT must comply with environmental and historic preservation laws and regulations, most notably the National Historic Preservation Act, the National Environmental Policy Act, and the Transportation Act of 1947 as amended and reauthorized. One requirement of these laws and regulations is consideration of possible effects of CDOT's activities on historic resources, which are defined as properties that are eligible for nomination to the National Register of Historic Places. The ultimate purpose of this report is to provide a basis for evaluating the historical significance and National Register eligibility of individual highways or highway segments throughout Colorado. Information gathered for this report may also be useful for interpretation of routes for public appreciation.

With funding and technical assistance from the Colorado Historical Society (State Historical Fund), CDOT initiated a systematic effort to identify historic highways statewide in early 2001. In April 2001, CDOT contracted with Associated Cultural Resource Experts (ACRE) to prepare an historic highway context. ACRE prepared this context through examination of resources relating directly to the design, construction, use and maintenance of Colorado's automobile roads.

This context is limited in scope. It does not include a discussion of roadside commercial or residential architecture. Highway bridges, except for culverts associated with road drainage systems, are also excluded. Highway bridges are fully examined in the Multiple Property Listing, *Highway Bridges in Colorado*. Historic trails are addressed briefly as antecedents to automobile roads and highways. This study is intended to provide information for the specific purpose of evaluating National Register eligibility of highways; the study is not intended to be a complete history of highways, highway transportation, or CDOT and its precursor agencies. This study also focuses nearly completely on highways in the state highway system; it does not extensively address roads and highways built and maintained by county and local governments. This study is also not intended to be a cultural resource management plan for historic highways in Colorado.

Methods and Procedures

This study focuses on five major questions or information requirements:

1. What is the current state of knowledge concerning historic automobile roads and highways, and what information sources are available?
2. Can the history of automobile roads and highways be understood in terms of specific geographic contexts within Colorado? If so, how are those contexts spatially and thematically defined?
3. What are the themes and subthemes of highway development in Colorado, and how are those themes and subthemes reflected in physical resources?

4. In light of the particular history of Colorado highways, what registration criteria (significance and integrity) are appropriate?
5. Which highways in the state highway system may be eligible for the National Register, and what data gaps remain to determine eligibility?

In addressing these questions and information requirements, ACRE extensively researched primary and secondary source materials. A historic context for Colorado highways had not been prepared previously, but several other states had produced or were in process of producing highway contexts. ACRE contacted architectural historians in all fifty State Historic Preservation Offices (SHPO), asking if they had produced a highway context for their respective state and if the existing context was used for evaluation purposes. ACRE also inquired if each SHPO had suggestions for improving on the character of previously prepared highway contexts. Twenty SHPOs responded to the request for information, and SHPOs in Arkansas, Connecticut, Minnesota, Missouri, Montana, New Mexico and Oklahoma provided copies of historic highways contexts. In September 2001, copies of these contexts were submitted to CDOT's Environmental Program Branch. Those responses helped determine the scope of CDOT's proposed context.

Primary resources were gathered from CDOT's central files, Right-of-Way Section, and library. CDOT's office in Evans, Colorado, also provided engineering and construction designs for highways in the northern and northeastern parts of the state. Space at CDOT's headquarters in Denver does not allow for a century's worth of letters, memos and policy statements. Most of those documents are classified in the "Transportation" record group at the Colorado State Archives in Denver. The Archives holds State Highway Commission/ Department of Highways records, letters, maps, and memorandum from 1910 to the early 1970s. These documents offered the only opportunity to gauge the opinions and motivations of the highway department's policy makers and engineers in their own words.

ACRE conducted research in a number of local textural repositories. The Denver Public Library's Western History Department and Government Documents Section hold a great deal of primary and secondary information about road development in Colorado. The Colorado Historical Society's Office of Archaeology and Historic Preservation (OAHP) is the repository of site survey documentation of the state's roads and bridges. Credit is also due to William Dunn and Robert Brown of the Rocky Mountain Philatelic Library in Denver for providing ACRE use of rare automobile maps of Colorado.

During the course of this project, research turned up one nearly forgotten source of documentation. The University of Colorado's Mathematics Library in Boulder holds a collection of *Rocky Mountain Contractor* from 1937 to the present day. From 1937 to the early 1950s, the State of Colorado published *Rocky Mountain Contractor* to update the engineering and construction communities on the progress of state, public, and private works projects with an emphasis on road building.

Regarding the federal influence on Colorado highway and Interstate development, the National Archives-Rocky Mountain Region in Lakewood holds a very limited collection of Bureau of Public Roads (Record Group 30) memorandum and letters from the 1920s and 1930s. The bulk of Record Group 30 is located in National Archives II in College Park, MD.

During January and February 2002, ACRE staff conducted site surveys of ten selected Colorado highway segments based on discussions between CDOT, OAHP and ACRE. Representatives from each organization selected these ten highway segments for their potential historic integrity and the social and economic importance they had on a particular region of the state. ACRE completed site survey forms for each of the highway segments. Survey forms were submitted to CDOT and OAHP.

This document includes an extended bibliography of all resources identified during the records search. This bibliography will assist future re-

searchers in locating records that are not easily accessible.

Property Evaluations

National Register eligibility and registration requirements for three major property types were developed and are outlined in Section F. These registration requirements apply basic National Register Evaluation Criteria and integrity standards to the specific history and engineering features of Colorado state roads and highways. Previously developed registration requirements for similar or related property types were used as an additional guide. These included the registration requirements in the Multiple Property Listings *Highway Bridges in Colorado* and *Railroads in Colorado, 1858-1948*."

Further Areas of Research

Similar to most projects, time and budget prevents a researcher from gathering every piece of information on a certain subject. Further development of this context would require research in the following sources of information. Other potential locations include the Department of Transportation's eleven district offices statewide. These offices hold blueprints, designs, and correspondence on every road in that district that may or may not be at headquarters in Denver. Each office also contains the staff's institutional memory of the difficulties and triumphs surrounding design and construction.

Another potential resource is each county's engineering office. Each county engineer should have technical information regarding alignment, construction, and maintenance on a particular highway. In addition, each county clerk's office holds county commissioner minutes that likely contain additional information regarding a certain road's funding, construction, and maintenance.

The federal government's influence over highway construction in Colorado is another area worthy of further examination. Unfortunately, the collection at the National Archives in Lakewood is limited. Most of the records of the Bureau of Public Roads (Record Group 30) are in National Archives II at College Park, MD.

Personnel

Staff historian Robert Autobee, M.A., developed the context with assistance by Teela Labrum, staff historian and Deborah Dobson-Brown, M.S. Architectural Historian. Robert Autobee and Deborah Dobson-Brown conducted the field reconnaissance survey during January and February 2002. Kurt Schweigert served as the project manager. Colorado Department of Transportation historians Dianna Litvak and Lisa Schoch reviewed the documentation. All work was conducted under contract number 01HAA-00247.

The staff of the Office of Archaeology and Historic Preservation at the Colorado Historical Society edited and reformatted the historic context document into the National Register Multiple Property Documentation Form. The staff conducted additional field surveys, provided supplemental historical background, established the property types, and developed the registration requirements.

Figure 69.

Colorado Highway Segments Field Surveyed			
Highway Number	**Segment**	**Segment Length**	**Selection Criteria**
US 550	New Mexico border to Montrose	129 miles	Example of an “engineered route.” Beginning as a private toll road, this highway, like many engineered mountain routes, also has significant scenic characteristics.
Colo. 112	Del Norte to Hooper	28 miles	Example of an “engineered route.” The road also exemplifies a farm-to-market road.
Colo. 141	Dove Creek to Clifton	162 miles	Example of an “engineered route.” Like many engineered mountain routes, this highway also has significant scenic characteristics.
Colo. 74	I-70 Exit 252 to Jct. of Colo. 8 in Morrison	18 miles	Example of an “aesthetic route” designed to provide a pleasurable motoring experience.
US 6	Brush to Sterling	35 miles	Example of an “engineered route.” The road also exemplifies a farm-to-market road which also served as an important automobile tourist route.
US 85	Trinidad to Walsenburg	40 miles	Example of a “cultural route.” Evolved from a general Native American trade route, to a Euro-American trapper-trader route, to a major north-south automobile highway.
US 385	Cheyenne Wells to Springfield	95 miles	Example of an “engineered route.” The road also exemplifies a high plains farm-to-market road
Colo. 13	Rifle to Wyoming border	127 miles	Example of an “engineered route.” Evolved from a military road to a route supporting NW Colorado economy.
I-70	Vail to Georgetown	36 miles	Example of an “engineered route.” Contains the Eisenhower and Johnson tunnels.
US 24	Antero Junction to Manitou Springs	70 miles	Example of a “cultural route.” Evolved from Native American trail to important tourist highway.

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Abbreviations

The following source abbreviations are used in the text citations:

ACRE	Associated Cultural Resource Experts
CDH	Colorado Department of Highways
CDOT	Colorado Department of Transportation
CHS	Colorado Historical Society
WHC, DPL	Western History Collection, Denver Public Library
OAHP	Office of Archaeology and Historic Preservation
WP-WPA	Writers' Project of the Works Progress Administration in Colorado

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