Historic Context

Vail Pass Segment of Interstate Highway 70

Prepared for

Colorado Department of Transportation

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Summary Statement

The Vail Pass segment of Interstate Highway 70 (I-70) represents an important part of the history and development of the Interstate Highway System through Colorado. Design and planning for the Interstate Highway occurred during a time of increasing environmental awareness and focus on conservation issues. The final design and engineering of the highway, bridges, and surroundings, achieved through the integration of landscape architecture principles, resulted in an innovative highway that complemented its natural surroundings and coincided with the establishment and expansion of tourism and communities in the Colorado high country. Throughout the late nineteenth and early twentieth centuries the Rocky Mountains west of Denver served as a barrier to travel and were historically avoided due to the topography and engineering required for roadbuilding. Many areas remained remote and inaccessible, especially in Eagle and Summit Counties and the vicinity of present-day Vail. In 1940 a new mountain road, Vail Pass, was constructed to carry U.S. Highway 6 (US 6) between Dillon and Eagle and provided a more direct route for those traveling west from Denver. Discussions about a national Interstate Highway System were underway by this time but early plans had the highway system ending at Denver. In 1957 the Bureau of Public Roads granted Colorado additional mileage to extend the planned Interstate Highway between Denver and the Utah border. Between 1958 and 1973, politicians, community leaders, local businesses, environmentalists, and others discussed and disagreed over the route of the new highway west of Denver. The Vail Pass segment of I-70 was constructed between 1973 and 1978 and generally followed the path of US 6 over Vail Pass. The historic context that follows provides a brief overview of road development in Colorado and highlights the important events and developments related to the design and construction of I-70 over Vail Pass, a colossal undertaking that represents the conciliation of environmental concerns and highway design principles that set standards for later Colorado and national transportation projects.

I-70 extends in an east-west direction across Colorado. From Kansas the highway crosses Colorado's eastern plains, extends through Denver, then enters the foothills and winds its way through valleys and over mountain passes on its way toward Grand Junction and the Utah border. Within the Rocky Mountains are a number of smaller mountain ranges, wilderness areas, and watersheds. The Vail Pass segment of I-70 is 15.2 miles long and located along the southern Gore Range, a mountain range that runs for approximately 60 miles through Grand, Summit, Routt, and Eagle Counties, and is near the Eagles Nest Wilderness Area and within the White River National Forest. The Vail Pass segment of I-70 also passes through the Tenmile Creek and Gore Creek watersheds. Figure 1 on the next page illustrates the location of Vail Pass and other pertinent landforms and features.

The historic property boundary defined for the segment reflects the location of structures, objects, and buildings associated with the historic significance of the Vail Pass corridor. The boundary is defined as the current I-70 right-of-way, which has remained unchanged since the end of the period of significance and provides an appropriate setting for the roadway. The boundary begins at milepost (MP) 180 at the east side of Vail and ends at MP 195.2 at Copper Mountain, just west of Wheeler Junction, and State Highway 91. The boundary is expanded beyond the right-of-way to incorporate the Vail-Frisco Recreational Path and other recreational features such as Black Lake No. 1 and Black No. 2, which were directly associated with the construction or design of the highway corridor but are outside of the current right-of-way.

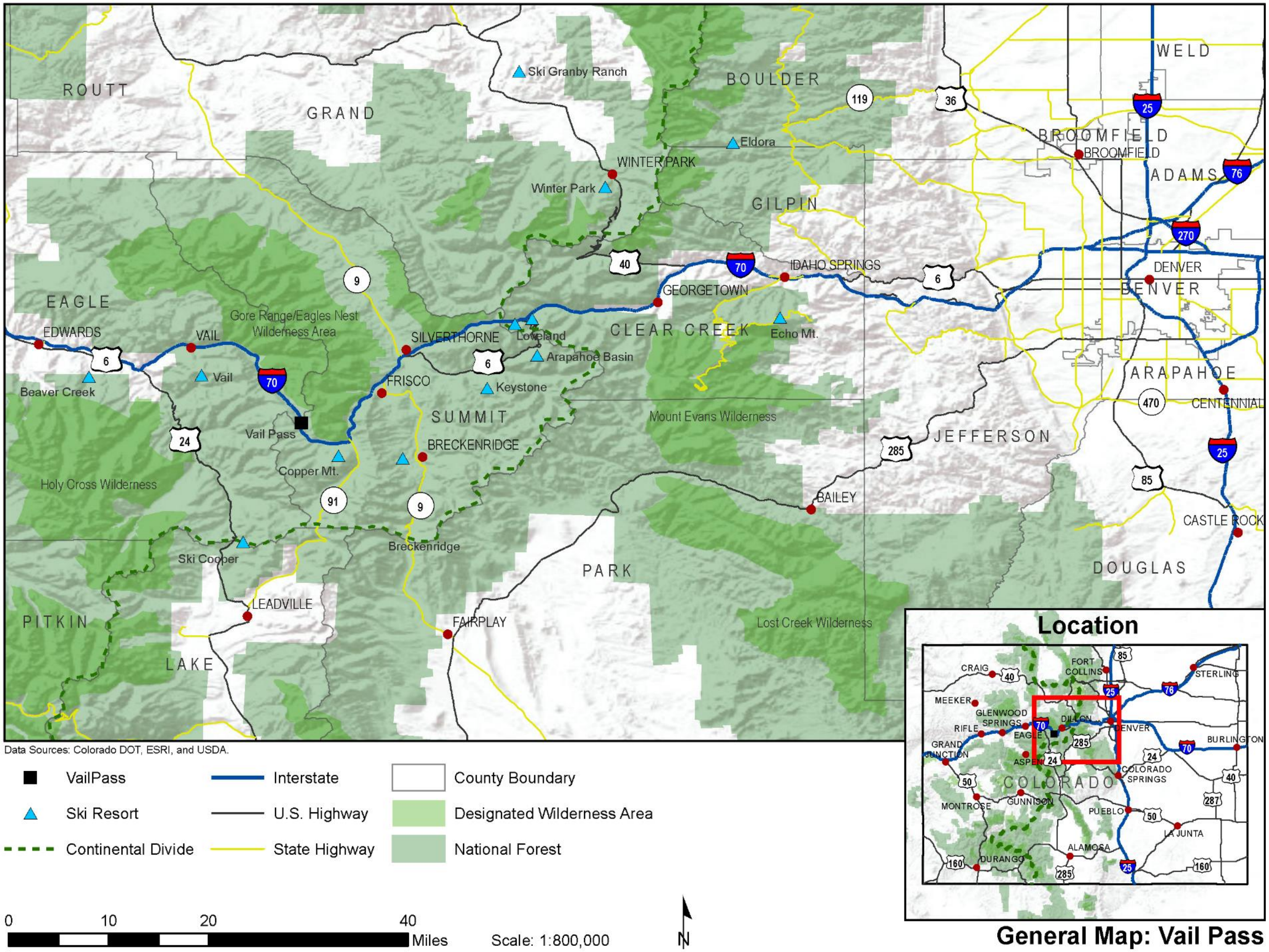

Figure 1. Overview map of Vail Pass.

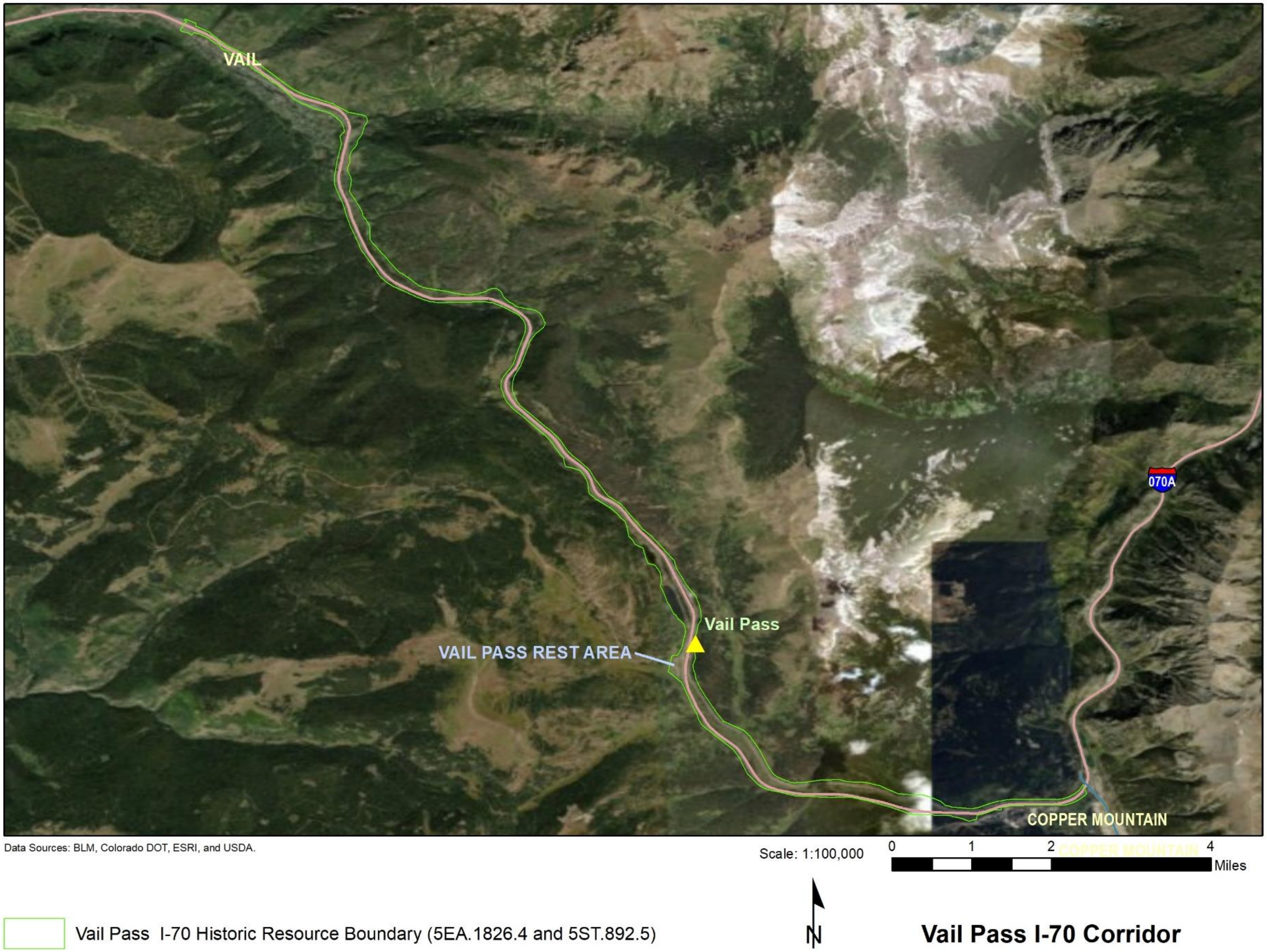

Figure 1A. Overview map of Vail Pass.

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1. Background History

A. Early development of roads in Colorado, 1880-1925

By the 1880s roads throughout Colorado and the nation were in poor condition and the "Good Roads Movement" emerged in response to the need for a more passable and connected road network. Campaigns to improve roads were generally at the local level until the mid-1880s, when organized cycling groups joined the cause to improve roads.[1] By 1893 efforts by road advocates led to the creation of an Office of Road Inquiry. The mass production of automobiles beginning in 1901 further bolstered public demand for better roads and put pressure on the government to assist in road construction and maintenance.[2] In 1905 the Office of Road Inquiry changed its name to the Office of Public Roads and was housed within the U.S. Department of Agriculture. Following national trends, the Colorado State Highway Commission (Commission) was established by the state legislature in 1909 and three individuals—Charles P. Allen of Denver representing the Front Range, Thomas Tully of Durango representing western Colorado, and W.H. Wiley of Holly representing the eastern plains—were appointed as commissioners and took their posts on January 1, 1910. Later that spring and summer the commissioners set off on road trip across Colorado to interact with people across the state to build support for and gauge public interest in establishing a State Highway network; they also identified potential routes along the way. After returning, they mapped out Colorado's first road system and by years end had designated 1,600 miles of State Highways. Initiatives by the Commission proceeded with road building, bridge replacement, and uniform sign installation activities.[3]

Progress toward establishing road-related agencies and legislation continued throughout the first decades of the twentieth century. In 1915 the Office of Public Roads changed its name to the Bureau of Public Roads (BPR), which was the predecessor to the Federal Highway Administration (FHWA). In 1916 the U.S. Congress passed the Federal-Aid Road Act, committing the federal government to funding highway construction and requiring states utilizing federal funds to set up commissions or departments to oversee

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[1] Melissa Keane and Simon Bruder, *Good Roads Everywhere: A History of Road Building in Arizona* (Phoenix, Ariz.: Arizona Department of Transportation, March 2004), 25; Paul Daniel Marriott, *The Preservation Office Guide to Historic Roads* (Washington, D.C.: Center for Preservation Education and Planning, 2010), 36, www.historicroads.org/documents/GUIDE.pdf; U.S. Department of Transportation, Federal Highway Administration, *America's Highways, 1776-1976: A History of the Federal-Aid Program* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1976), 42.

[2] Colorado Department of Transportation, *100 Years of Colorado State Transportation History* (Denver: Colorado Department of Transportation Public Relations, 2010), 12; National Register of Historic Places, Multiple Property Documentation Form, "Historic and Architectural Resources of the Lincoln Highway in Nebraska," Statewide, Nebraska, E-2.

[3] National Register of Historic Places, Multiple Property Documentation Form, "Historic and Architectural Resources of the Lincoln Highway in Nebraska," Section E, Page 2; Colorado Department of Transportation, *100 Years of Colorado State Transportation History*, 13–15, 109; Associated Cultural Resource Experts and Deborah Dobson-Brown, "Colorado State Roads and Highways" (National Register of Historic Places Multiple Property Submission, 2003), E27–28, http://www.historycolorado.org/sites/default/files/files/OAHP/crforms_edumat/pdfs/645.pdf; "FHWA History," *Federal Highway Administration, U.S. Department of Transportation*, September 12, 2012, https://www.fhwa.dot.gov/about/.

highway construction activities. As a result, the Commission was reorganized as the State Highway Department in 1917 and began building and improving mountain pass roads, starting with the 27.5-mile Monarch Pass between 1919 and 1922 and followed by improvements to the Million Dollar Highway in the San Juan Mountains between 1921 and 1924 and Mount Evans Road just three years later. These roads enabled further automobile tourism by providing more reliable access to some of Colorado's most spectacular scenic areas.[4]

B. The U.S. Highway era in Colorado, 1926-1955

In 1926 the American Association of State Highway Officials (AASHO) and the BPR designated a U.S. Highway System by assigning numbers to highways, many of them previously named highways, across the country. The goal of the new system was to connect major roads throughout the nation to better facilitate travel. Despite the new national highway system, no direct route through the Colorado high country from Denver into Utah existed throughout the late 1920s and early 1930s; the path of roads was dictated by the terrain. For example, by 1925 the travel route between Denver and Eagle encompassed several State Highways, extending southwest through Bailey and Fairplay, then north to Dillon, then south again toward Leadville before turning northwest toward Red Cliff and onto Eagle. In 1931 dirt roads were completed over Shrine Pass and Loveland Pass at elevations topping 11,000 feet. Throughout the early 1930s existing local roads across eastern Colorado were gradually consolidated to form a more direct route that extended west of Denver through Idaho Springs and Georgetown to Dillon, bypassing the older indirect route through Fairplay. At Dillon the new route connected with the previous route through Leadville, Red Cliff, and Eagle and extended further west toward Utah. This was among the earliest continuous routes to cross the Continental Divide in Colorado and was designated US 6 in 1937.[5]

In 1940 US 6 was rerouted over an unnamed pass between Frisco and Eagle, in Summit and Eagle Counties, respectively, instead of along its previous route further to the south through Climax, Leadville, and Minturn. The Public Works Administration funded construction of the new paved US 6 route around the southern edge of the Gore Range. This new mountain pass was named Vail Pass, after State Highway Engineer Charles Vail, who served as director of the State Highway Department between 1930 and 1945. The new highway provided a more direct route between Denver and Eagle by eliminating the route southwest through Leadville.[6]

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[4] Associated Cultural Resource Experts and Dobson-Brown, "Colorado State Roads and Highways," E29–32; Colorado Department of Transportation, *100 Years of Colorado State Transportation History*, 18–20; Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System* (Prepared for the Colorado Department of Transportation, April 24, 2002), 5.26-5.27; "FHWA History."

[5] William Philpott, *Vacationland: Tourism and Environment in the Colorado High Country* (Seattle: University of Washington Press, 2014), 90–91; Marion C. Wiley, *The High Road* (Prepared for the Colorado Division of Highways, 1976), 21.

[6] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 90; National Park Service, *Lincoln Highway: Special Resource Study, Environmental Assessment* (Washington, D.C.: National Park Service, U.S. Department of the Interior, 2004), 5; Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 6–5.

The increasing demand for more direct road access to destinations throughout Colorado resulted in several important developments between 1940 and the mid-1950s. By the mid-1940s Colorado had 12,394 miles of official State Highways, and the booming post-World War II (postwar) consumer economy meant an increasingly high number of automobiles traveling on the state's highways. This demand led to several significant road-building projects during this period, including widening and paving US 6 over Loveland Pass in 1950, completion of the Denver-Boulder Turnpike in 1952, and extension of US 6 through Clear Creek Canyon in 1952. Despite these important road projects, most Colorado highways were in need of major updates by the mid-1950s due to heavy use and deferred maintenance. [7]

[7] Associated Cultural Resource Experts and Dobson-Brown, "Colorado State Roads and Highways," E39–41; Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 7–6 to 7–7.

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2. Beginnings of the Interstate Highway System in Colorado, 1956-1960

A. Development of the Interstate Highway System nationally

The idea for a national Interstate Highway System dates to just after World War I with the objective of linking the entire country for both economic and military purposes. President Franklin D. Roosevelt was keenly interested in an Interstate Highway System and, after coordination with BPR head Thomas H. MacDonald, had that agency prepare an internal study on the need for such a system. At the request of Congress, the BPR prepared an additional report in 1939 entitled "Toll Roads and Free Roads" that contained the first formal concept of an Interstate Highway System. The report discussed development of a national highway system with coordinated contributions by federal and state governments, counties, and municipalities and highlighted its importance to national defense. In 1941 President Roosevelt appointed a National Interregional Highway Committee to investigate creation of a limited-access, national highway system, efforts that were summarized in a 1943 report. This report and several subsequent reports provided the basis for the 1944 Federal-Aid Highway Act, which officially authorized construction of a national system of Interstate Highways; however, this act did not provide funds for construction. By 1947 the first 37,700 miles of Interstate Highways was announced. The Federal-Aid Highway Act of 1952 authorized the first funding ear-marked for construction of the Interstate Highway System. In 1956 the official plan for a National System of Interstate and Defense Highways was introduced under the Federal-Aid Highway Act of 1956. This system of Interstate Highways was conceived of as high-speed and multi-lane facility, with divided roadways used by both civilian traffic and military vehicles as needed for national security.[8]

B. Evolution of the I-70 route in Colorado

(1) Envisioning the route of I-70 across the Rockies

Early planning for the Interstate Highway System in the 1940s called for I-70 to begin in Washington, D.C. and terminate at Denver. Officials at the BPR hoped to avoid the engineering challenges presented by Colorado's mountainous topography and saw no economic benefit to crossing the mountains, and therefore did not envision a continuous east-west link across the state. Colorado highway officials swiftly protested the plans as they foresaw a significant downturn in the state's booming tourism industry should residents and visitors be unable to easily and quickly cross the Continental Divide.[9] At the time the only

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[8] Federal Highway Administration, U.S. Department of Transportation, "Highway History," *Federal Highway Administration, U.S. Department of Transportation*, n.d., https://www.fhwa.dot.gov/infrastructure/mcdonaldtoll.cfm; Federal Highway Administration, "Contributions and Crossroads - Timeline," *Federal Highway Administration, U.S. Department of Transportation*, n.d., https://www.fhwa.dot.gov/candc/timeline.cfm; Richard F. Weingroff, "Public Roads," *Federal Highway Administration, U.S. Department of Transportation*, February 6, 2018, https://www.fhwa.dot.gov/publications/publicroads/06mar/07.cfm.

[9] Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 7–9; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 97–99; Associated Cultural Resource Experts and Dobson-Brown, "Colorado State Roads and Highways," E-42.

two existing highways that extended through the mountains between Denver and the Utah state line were US 6 over Loveland Pass and US 40 over Berthoud Pass.

Prior to 1957 no plans for an Interstate Highway across the Continental Divide in Colorado existed, but with tourist dollars and accessibility in mind, interested groups and individuals began advocating for possible routes for such a highway. Two possible routes that received a lot of publicity included US 6 and US 40. Local business owners, chambers of commerce, newspapers, booster organizations, local politicians, and even those in communities tangentially linked to each of the highway corridors by secondary roads promoted and lobbied for their respective highway in hopes of tourist dollars once the new Interstate Highway was built. US 6 provided the most direct route but required traversing more mountainous terrain whereas US 40 provided a much less direct route but had only one mountain pass (Berthoud Pass) for engineers to deal with as it generally extended through valleys around surrounding mountains. Arguments for and against each of the highway corridors continued through much of 1956 and cited various factors such as traffic counts, safety, economic development, and others as supporting evidence. The notion of boring a tunnel through the Continental Divide was another point of contention among the various US 6 and US 40 boosters. In the 1940s the highway department had considered a tunnel under Loveland Pass along US 6. However, test boring revealed unstable rock and despite subsequent lobbying of the State Highway Commission by the Loveland Tunnel Association and others, more viable options developed, and over time numerous tunnel sites had been identified throughout the high country. Some advocates promoted tunnel locations along US 6, such as the Straight Creek location. US 40 backers proposed tunnel options at Devil's Thumb Pass, Jones Pass, or expansion of the Moffat Tunnel, located between Boulder and Granby. Colorado Governor Edwin Johnson became heavily involved in the debate between US 6 and US 40, advocating for the US 40 route and calling for a tunnel through the Continental Divide. Johnson eventually proposed a deal whereby Colorado would pay for a tunnel through the Continental Divide if the federal government extended the highway through the Colorado high country.[10] In 1957, amid growing protests by Colorado officials and after over a decade of lobbying and disagreeing by locals and state politicians, the BPR awarded an additional 547 miles to extend I-70 west from Denver, across the Continental Divide, to I-15 near Cove Fort, Utah. However, the location of the tunnel through the Continental Divide remained undecided.[11]

(2) The Pavlo Report

Although the BPR authorized the additional mileage between Denver and Fort Cove, it did not determine the actual route of I-70 through the Colorado high country. In 1959 Colorado Governor Stephen

[10] Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 7–9.

[11] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 108–9, 116–18; Associated Cultural Resource Experts, "Colorado State Roads and Highways," E42; Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 7.9; Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado* (Prepared for the United States Department of Transportation, Federal Highway Administration Office of Development, 1978), 2; American Association of State Highway and Transportation Officials, *The States and the Interstates: Research on the Planning, Design and Construction of the Interstate and Defense Highway System* (Washington D.C.: American Association of State Highway and Transportation Officials, 1991), 44.

McNichols hired the E. Lionel Pavlo Engineering Company of New York to assess several route options across the Continental Divide using factors such as traffic flow and geological and slope gradient analysis to provide a recommendation. Preliminary studies considered routes over Berthoud Pass, Jones Pass, Loveland Pass, and several that slightly diverged from US 6 along more direct routes through the Gore Range (see Figure 2). The "Pavlo Report" was complete by April 1960 and asserted that the new highway must have a tunnel in order to meet federal design standards for Interstate Highways. Seven alignments (A through H) were identified and several included at least one proposed tunnel, most of which were eventually dismissed due to faulted rock and threat of avalanche or landslide; the report assessed only two alignments in detail, one along US 40 and another along US 6. Regarding the site of the much-discussed tunnel, the report dismissed most of the proposed locations due to faulted rock and vulnerability to rockslides and avalanches. The report assessed in more detail two tunnel locations: the Vasquez or Stanley Mountain site near Berthod Pass along US 40 and the Straight Creek location along US 6.[12] Ultimately, Pavlo recommended that I-70 follow the path of US 6 for most of its route with a tunnel at Straight Creek (eventually named the Eisenhower-Johnson Memorial Tunnel); this recommendation was based on a combination of technical considerations, geologic conditions, weather patterns and avalanche analysis, and current highway standards, as well as a projected cost of $55 million less than the US 40 option.[13] The Straight Creek Tunnel recommendation was also pivotal in determining the route of I-70. The path of the recommended alignment along US 6 dipped south around the highest portions of the Gore Range west of Dillon, marking one of I-70's largest deviations from a straight route between Baltimore and Utah.[14]

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[12] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 117–18.

[13] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 118–20.

[14] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 119, 230; E. Lionel Pavlo Engineering Co., *Interstate Highway Location Study : Dotsero to Empire Junction, State Project No. HPS-1-(20)* (Prepared for Colorado Department of Highways, 1960), Figure 9.

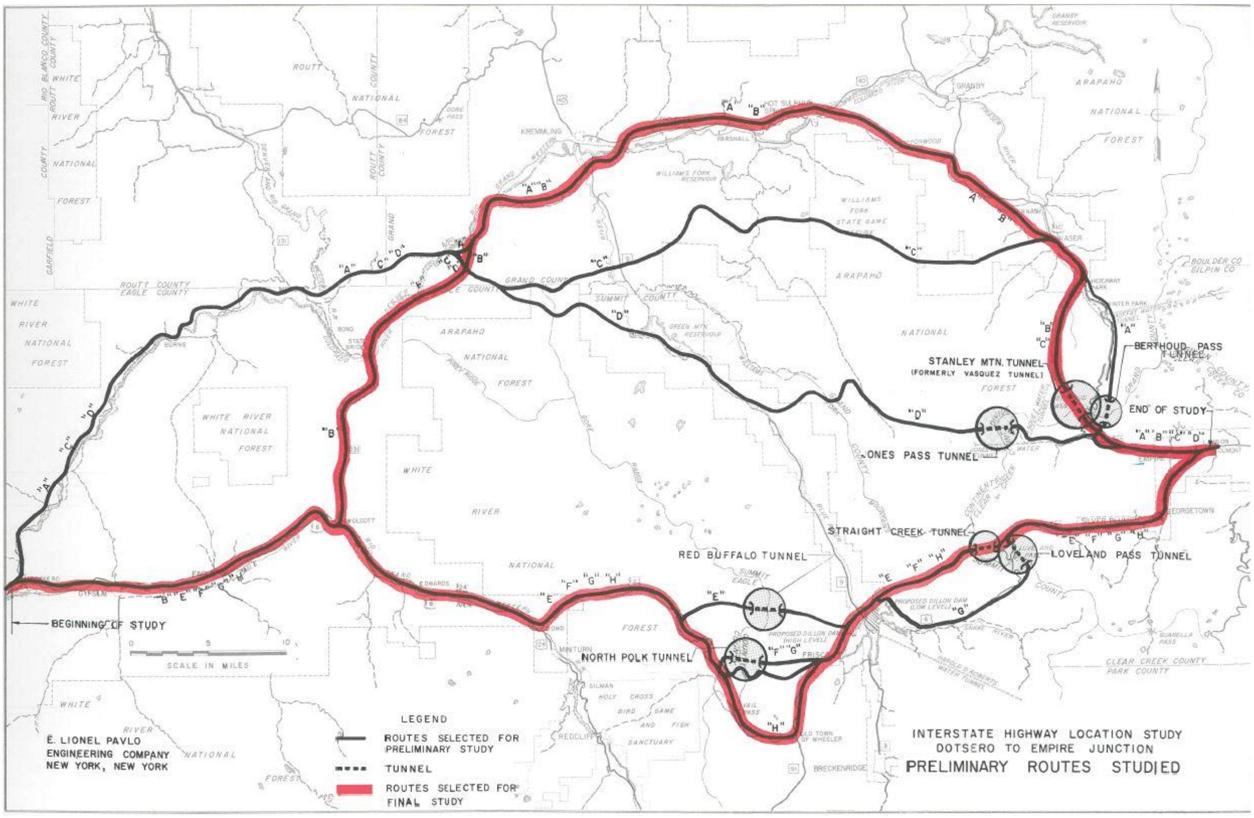

Figure 2. Excerpt from the Pavlo Report illustrating the various routes (A through H) considered for I-70. The Red Buffalo route (see discussion below) is shown near the center. Alignment H, shown in red near the bottom, was the route over Vail Pass eventually chosen for I-70.[15]

Despite Pavlo's recommendation, the CDOH supported one of the shorter and more direct routes proposed, which was known as "Red Buffalo" because it cut between Buffalo Mountain and Red Peak through the Gore Range; Pavlo had advised against it based on the need for construction of a long tunnel at a high elevation and steep grades that posed avalanche threats to motorists. The route of the Red Buffalo option also cut directly through the Gore Range-Eagles Nest Primitive Area, known as one of the most scenic wilderness areas in Colorado.[16]

[15] E. Lionel Pavlo Engineering Co., *Interstate Highway Location Study : Dotsero to Empire Junction, State Project No. HPS-1-(20)*, Figure 9.

[16] Richard E. Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," n.d., 6,30; Colorado Department of Transportation, *100 Years of Colorado State Transportation History*, 86–87; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 230–31.

3. Rise of Environmentalism and the Red Buffalo Controversy, 1961-1968

A. Interstate planning and the rise of environmentalism nationally

The early foundations of the modern environmental movement date back to the establishment of the Sierra Club, National Audubon Society, and National Parks movement in the late nineteenth and early twentieth centuries as values related to conservation began to take hold. While conservationists of preceding decades often focused their efforts on the management of natural resources and preservation of wilderness areas for human uses, the emergence of modern environmentalism in the 1960s reflected a broader set of concerns and values. Rachel Carson's popular 1962 publication *Silent Spring* provided a sharp and detailed critique of observed environmental neglect and destruction. For the first time, many Americans were beginning to understand the ecological effects of pollution and other destructive human activities and increasingly supported environmental protection.[17]

Prior to the 1960s, the BPR and state highway departments around the country gave little consideration to the environmental and scenic impact of highway locations and designs. However, during the early years of Interstate Highway planning and construction, freeway protests emerged over the impacts of Interstate Highway routes on businesses and communities around the country and new federal policies and legislation were enacted to address these impacts. In 1963 the BPR implemented a new policy requiring states to consider possible impacts of any federal-aid highway project on fish and wildlife resources.[18] In 1964 Congress enacted the Land and Water Conservation Act and the Wilderness Act, which created the National Wilderness Preservation System. By 1966 Congress passed the Department of Transportation Act, which created the U.S. Department of Transportation (USDOT) and transferred the responsibilities of the BPR, including overseeing funds and ensuring compliance with regulatory requirements, to the new Federal Highway Administration (FHWA).[19] The Department of Transportation Act also included a landmark environmental regulation, known as Section 4(f), which required state highway departments to consider impacts to a wide set of resources such as publicly owned parks, recreation areas, wildlife refuges, and historic sites. Section 4(f) required USDOT agencies to justify use of any of these property types by demonstrating that there was "no feasible and prudent alternative" to their use. As further evidence of increased public scrutiny on federal activities, Congress passed the National Historic Preservation Act (NHPA) in 1966, which required agencies using federal funds or permits to review proposed project activities and determine potential effects on cultural resources such as historic buildings and archaeological sites. The NHPA and Section 4(f) required coordinated environmental review for all federal undertakings, including the construction or improvement of Interstate Highways. Additional environmentalist legislation passed during this period included the National Trails

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[17] Richard F. Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969," *Federal Highway Administration*, June 27, 2017, https://www.fhwa.dot.gov/highwayhistory/nepa/index.cfm.

[18] Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969."

[19] "The Trailblazers: Brief History of the Direct Federal Highway Construction Program," *Federal Highway Administration*, September 2017, http://www.fhwa.dot.gov/infrastructure/blazer01.cfm.

System Act and establishment of the National Wild and Scenic Rivers System in 1968.[20] The BPR also adjusted its policies on public hearing requirements several times during the course of the 1960s. One change required that two public hearings be held for Interstate Highway projects: one before the BPR's selection of a route and a second hearing after route approval but prior to approval of the design. Together these laws significantly altered the processes by which state agencies planned highway infrastructure.[21]

Several other federal initiatives emerged during this period that indicated a growing interest in preserving scenic and aesthetic qualities along the nation's highways, including the Highway Beautification Act of 1965 and a study conducted under the Department of Commerce titled *A Proposed Program for Scenic Roads and Parkways.*[22] Scenic roadbuilding as a concept preceded the interstate era by several decades; as early as the 1920s urban parkways and highways in scenic destination areas were constructed with careful design considerations to complement their setting and enhance scenic views.[23] Highway departments that implemented aesthetically sensitive designs in the early and mid-1960s often enjoyed public praise for their efforts. For example, *Parade Magazine* offered its "Scenic Highway Award" annually to roads that exhibited exceptional aesthetic qualities. Among recipients of the award in the mid-1960s were several Interstate Highway segments, including a 22.5-mile section of I-75 between the Gaylord and Indian Rivers in Michigan and a 30-mile segment of I-87 through the Adirondack Northway in New York. Both segments were designed to enhance views of the scenic landscape with widely separated lanes at different elevations and medians landscaped with trees and natural features to shield the driver's view from oncoming traffic.[24]

B. Environmentalism in Colorado and the Red Buffalo controversy

(1) Environmentalism, recreation, and tourism in Colorado

In Colorado, postwar conservation and environmentalism were closely tied to the values of outdoor recreation. One of the most respected early conservationists by the 1950s was Arthur Carhart, who was the U.S. Forest Service's first recreational engineer and subsequently worked as a landscape architect. Carhart wrote prolifically on recreation and natural resource issues, and served as director of wildlife research for the Colorado Game and Fish Department. Carhart and others promoted the idea of outdoor recreation that was tied closely to wilderness preservation. The mid-twentieth century was a time of great consumerism and the natural environment was not immune to this phenomenon. A certain "recreational

[20] Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969."

[21] Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969."

[22] Richard F. Weingroff, "History of Scenic Road Programs," *Federal Highway Administration*, June 27, 2017, https://www.fhwa.dot.gov/infrastructure/scenichistory.cfm.

[23] Associated Cultural Resource Experts, "Colorado State Roads and Highways," E-76; Weingroff, "History of Scenic Road Programs."

[24] "Michigan Freeway Wins Scenic Highway Award," *The Herald-Press*, October 22, 1963; "Adirondack Northway Called 'Unique Link,'" *Poughkeepsie Journal*, September 16, 1967.

consumerism," as historian William Philpott describes it, developed in Colorado whereby people began to idealize the high-country environment and began molding their lifestyle and activities toward it. Residents and tourists also found new ways to enjoy the environment and profit from it through new outdoor recreational activities, services, and tourism. A prominent example was Colorado's ski industry, which boomed during the postwar period. Arapahoe Basin and Aspen both opened in 1946 and Buttermilk (near Aspen), Aspen Highlands, and Steamboat Springs opened in 1958. The growing interest and pressure for new places to ski led the U.S. Forest Service to create a master plan for ski resort development in 1959.[25] By the 1960s a movement for conservation had coalesced in Colorado. Its supporters viewed recreational development as a means for protecting and maintaining the state's wilderness and scenic qualities. By this time tourism was a major component of the economy in Colorado's high country. Boosters were intent on maintaining the natural landscape that had come to define Colorado as a tourist destination. They also promoted increased access to Colorado's scenery and recreational opportunities, mountain towns, and tourist corridors. Enthusiastic interest in recreation fueled a growing popular interest in the high-country environment.[26]

(2) The Red Buffalo controversy

Amid growing concerns over the environment nationally and increased attention to the importance of wilderness areas for recreation and tourism in Colorado, the CDOH's decision to endorse the Red Buffalo route through the Gore Range-Eagles Nest Primitive Area generated a controversy that lasted for years. The CDOH favored the Red Buffalo route for its shorter distance and lower highway-user cost (discussed further below) and proceeded with plans for the Red Buffalo alignment by hiring consultant Donald Sutherland to design the proposed route.[27] Extending the route through the environmentally sensitive Gore Range-Eagles Nest Primitive Area would require boring a second tunnel along the I-70 corridor under the Continental Divide at Gore Range and into the Vail Valley. Opposition to the Red Buffalo route stemmed from the growing environmental movement, and the CDOH received almost 10 times more letters against the Red Buffalo route than in favor of it. Despite this, however, officials remained insistent.[28]

To comply with BPR policies regarding Interstate Highway-related public hearings, the highway department held a public meeting on October 22, 1966, in Frisco to discuss the various alternative routes

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[25] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 51, 92–98, 137–38, 190–91; "Colorado Ski History Timeline," *Colorado Ski Authority*, 2016.

[26] Bruce Cousins et al., *Interstate 70 Routing Project Economics vs. Aesthetics*, 1967, 2; Bureau of Outdoor Recreation, *The Selection of a Highway Route: Choices and Values: A Report on the "Red Buffalo: Section of the Interstate Highway 70 in Colorado*, January 1968, 5–9; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 121.

[27] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 30, 34–35.

[28] Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 11–70 to 11–71; Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 30; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 235, 294, 386.

of the highway corridor, including the Red Buffalo route and the other following US 6 over Vail Pass. That same year the CDOH officially endorsed the Red Buffalo route instead of the Vail Pass option.[29] The CDOH and others in support of the Red Buffalo route preferred this option because it provided the most direct route and was 10 miles shorter than the Vail Pass option; it would also enable a faster drive time for motorists wanting to access recreational amenities in the Colorado high country. Cost-wise, the CDOH estimated that the shorter distance for the Red Buffalo route would result in a lower highway-user cost and save about 0.94 cents per one-way trip for each vehicle compared to the Vail pass option, an estimated annual savings of $3.3 million.[30] The Red Buffalo route was further bolstered when in 1964 a clause added to the Wilderness Act provided a special provision enabling the Secretary of Agriculture to provide an easement for up to 7,000 acres within the Gore Range-Eagles Nest Primitive Area for construction of the new Interstate Highway if such an action was deemed to be in the public interest. Amid criticism and demands for other options, the CDOH held firm on the Red Buffalo option and proceeded with the design process in the mid-1960s.[31]

In response, environmentalist groups and concerned citizens became more organized to voice their opposition to the Red Buffalo route; a coalition of environmental organizations eventually formed the Colorado Open Space Coordinating Council (COSCC) and led the fight against the Red Buffalo route.[32] Organization of environmental groups in Colorado during this period mirrored the growing awareness of environmental issues and the rise of freeway protests around the nation in the late 1960s.

Highway engineers observed these protests and began to understand the broad scope of changes in their field. Known as experts in traffic studies, cost estimating, and developing bridge and highway plans, the engineers had experienced very little criticism in the past when members of public thanked them for building highways to solve transportation problems and rarely questioned their decisions. But now they regularly encountered citizens and groups demanding a voice in highway planning decisions. This resulted in a new era for engineers who had to adapt to work with government agencies, politicians, and residents.

To bridge the gap between engineers and environmentalists, the groups started to convene to share ideas and concerns. During the summer of 1966 the COSCC organized an overnight camping trip by horseback to investigate the Red Buffalo route for representatives from several environmental organizations as well as the BPR and CDOH (see Figure 3); representatives from the CDOH included Prosence and Joe Montana, Chief Counsel for the CDOH. On the first night of the trip, Prosence recalls that all participants enlightened one another around the campfire; the environmentalists discussed and defined “ecology” for perhaps the first time for the highway engineers and the highway engineers shared what was needed to build the new Interstate Highway through the mountains. Other efforts to mediate

[29] W. J. Barton, “Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design,” June 19, 1972, 4, Available at Region 3 Office, Colorado Department of Transportation, Grand Junction, Colorado.

[30] Cousins et al., *Interstate 70 Routing Project Economics vs. Aesthetics*, 3.

[31] Bureau of Outdoor Recreation, *The Selection of a Highway Route: Choices and Values: A Report on the "Red Buffalo: Section of the Interstate Highway 70 in Colorado*, 5–9.

[32] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 231.

the divide between engineers and environmentalists included the 1968 establishment of an environmental-consulting nonprofit called the Rocky Mountain Center on Environment (ROMCOE), whose mission was to provide research, information, and education to various government agencies, scholars, citizen groups, and businesses. ROMCOE did much to advance the notion that environmentalism and business interests could work together through its partnership and consultation with ski resorts, the American Hotel and Motel Association, and other organizations.[33]

Notable CDOH personnel involved in the early planning, design, and construction of I-70 who learned to work with new stakeholders on Vail Pass and other projects included Richard Prosence and Charles Shumate. Prosence was a civil engineer who oversaw design development for the Red Buffalo route and was instrumental in identifying the eventual path of the highway. He developed cost estimates for I-70 and was involved with most I-70-related discussions and decisions between 1960 and the early 1980s. Years later Prosence recalled the Red Buffalo route having been chosen by Charles Shumate as he piloted his airplane over the area. Shumate began working for the CDOH in 1924 in southwestern Colorado and in 1951 relocated to Denver to work as an Administrative Engineer at the headquarters office. By 1960 Shumate was promoted to Chief Engineer. He later became CDOH's Executive Director and oversaw construction of the Eisenhower Tunnel between 1968 and 1973 before retiring in 1975.[34]

Figure 3. Bill Cron of the Bureau of Public Roads (left) and Jim Casey, Durango District Engineer (near center) on a pack trip investigating the proposed route known as Red Buffalo, c.1966.[35]

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[33] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 228–29; Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 34–35.

[34] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 6, 30; Colorado Department of Transportation, *100 Years of Colorado State Transportation History*, 86–87.

[35] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 35.

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4. I-70 Through Vail Pass: Environmentally Sensitive Design, 1968-1973

In May 1968 United States Secretary of Agriculture Orville Freeman denied the CDOH an easement through the Gore Range-Eagles Nest Primitive Area within the Arapaho and White River National Forests, ending the Red Buffalo route controversary and debate over the location of the Interstate Highway.[36] The Secretary's rejection of the Red Buffalo route came as a shock to many within the CDOH. Shumate refused to accept the decision for months and was convinced that the Red Buffalo route would be allowed to proceed. Reflecting the attitudes of many highway engineers at the time, Shumate did not support environmentalism and sometimes showed resentment toward its proponents as they gained influence over highway department activities. At one point Shumate even expressed his desire to "rough up" a state senator interested in environmental causes.[37] The department's chief of the design section also showed frustration toward the Red Buffalo decision, asking, "How can these flower-sniffers tell us where we can build a road?"[38] In general CDOH officials underestimated the increasing power of the environmental movement, and as a result the concerns of environmentalists and opponents of the Red Buffalo Route had been largely ignored. By 1968, when the Secretary of Agriculture announced his decision, much of I-70 from Denver to Silverthorne, including construction of the first bore of what would become the Eisenhower-Johnson Memorial Tunnels had started, at which time the design process for Red Buffalo was already underway. Thus, with the elimination of the Red Buffalo route, the CDOH was left with no construction plans for the highway west of Silverthorne.[39]

With the Red Buffalo plan, I-70 would have headed directly west from Silverthorne through the Gore Range, but without this option the only available route remaining was the path of existing US 6 through Vail Pass (see Figure 4). The CDOH knew that constructing the highway through Vail Pass would pose significant engineering challenges, so the agency obtained preliminary geologic studies of the corridor from experts including University of Colorado geologists who had worked in the area for many years. Vail Pass lies within the valleys of Black Gore Creek and Tenmile Creek on the edge of the Gore Range, a granite uplift formation flanked with sedimentary rock such as sandstone, siltstone, shale, and limestone. Much of the area on the flanks of the Gore Range were subject to landslides due to natural geologic processes. The geologic issues of the Vail Pass corridor were already known before the selection of the corridor for the Interstate Highway route. Highway surveys in the 1950s had shown that US 6, constructed less than two decades earlier, had shifted from its original location by up to 50 feet in some

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[36] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 3.

[37] Dianna Litvak, "Freeway Fighters in Denver, 1948-1975" (University of Colorado at Denver and Health Sciences Center, 2007), 114.

[38] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 39.

[39] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 35–39.

locations. As highway engineers began considering the new highway's alignment, one of the major concerns was the potential for reactivating or creating new landslides during construction.[40]

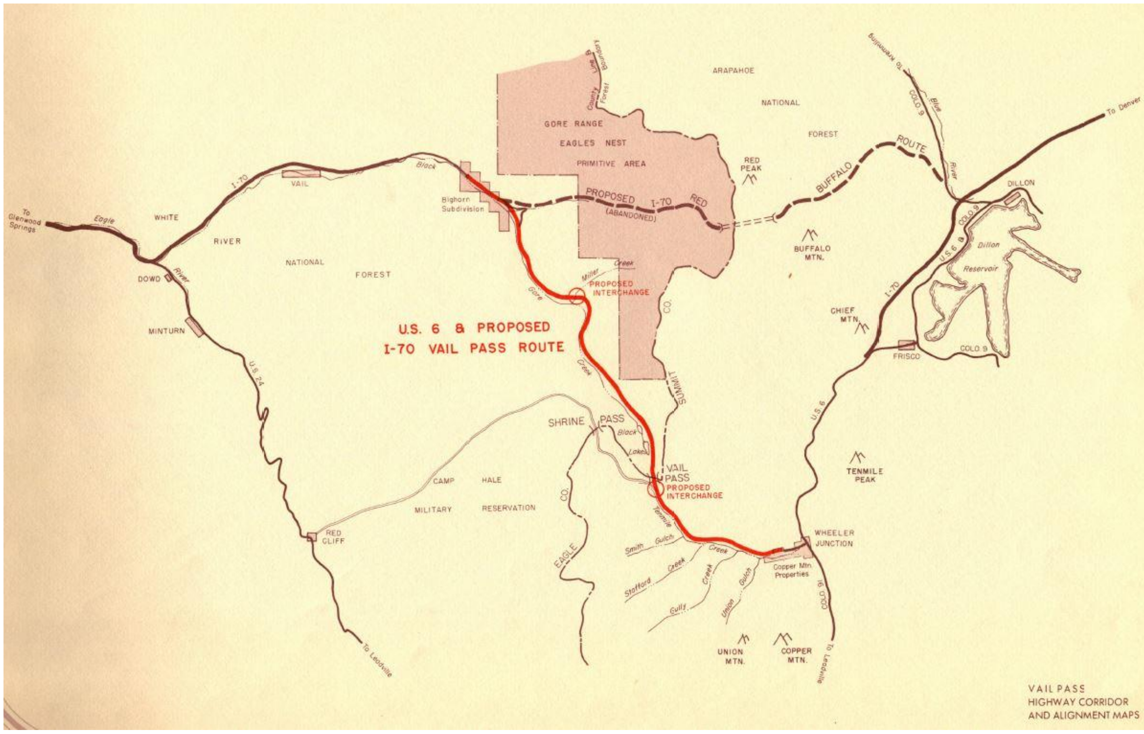

Figure 4. Map illustrating the geographic location and length differences between the US 6 corridor and the Red Buffalo route; the US 6 corridor shown in red was eventually chosen for the I-70 segment over Vail Pass.[41]

By the summer of 1969 the CDOH hired engineering geologists Charles S. Robinson and Associates and soil engineers R.V. Lord and Associates to study the Vail Pass corridor for geological issues. Adding to known geologic constraints, the passage of the National Environmental Policy Act of 1969 (NEPA) would require additional regulatory procedures and impose potential design constraints. Thus, along with the traditional factors considered in Interstate Highway design such as safety, cost, and efficiency, and recently imposed requirements under the NHPA and Section 4(f), the CDOH would now need to address a wider range of environmental issues including aesthetics, recreation, economic impacts, water quality, and ecology.[42]

[40] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 39–41.

[41] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction* (Prepared for the Colorado Division of Highways, 1972), 13.

[42] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado* (prepared for the United States Department of Transportation, Federal Highway Administration Office of Development, 1978), 3–4.

A. NEPA and Interstate planning and design nationally

By the late 1960s, the environmental movement had succeeded in influencing major policy changes at the federal level. Officially signed into law by President Richard Nixon on New Year's Day of 1970, only a year and a half after the end of the Red Buffalo route controversy, NEPA demonstrated that the federal government recognized the destructive effects of human activities on the environment, and it aimed to prevent future environmental damage and foster a greater understanding of the ecosystem and natural resources. NEPA was an "umbrella" regulation that established a federal regulatory body in the Council on Environmental Quality (CEQ) and incorporated a wide set of requirements on federal agencies, including the development of an "interdisciplinary approach" to integrating the use of the "natural and social sciences and the environmental design arts" to address potential environmental impacts, consultation with CEQ to develop procedures for addressing environmental considerations, and the development of a "detailed statement" (later named Environmental Impact Statement [EIS]) to be included with all reports and proposals for major federal actions. EISs were to include analyses of potential and unavoidable environmental impacts and proposed alternatives for project plans. Through the process of development and review of EISs, NEPA also required consultation with various agencies at the federal, state, and local levels that held legal jurisdiction or "special expertise" regarding potential environmental effects of federal actions.[43] These requirements transformed the highway planning process.

As implementation of the law began in 1970, many agencies attempted to avoid compliance. Some argued that the burden of completing environmental impact analysis should be the responsibility of the newly created CEQ, but the regulatory council countered that it should become an integral part of the agencies' decision-making process rather than something imposed by outsiders. During NEPA's first year, the CEQ worked to further clarify and define the law's provisions and establish guidelines for compliance. The CEQ attempted to clarify which projects would require intensive environmental analysis, which NEPA defined as "major Federal action significantly affecting the quality of the human environment." By the fall of 1970 the FHWA began issuing draft guidelines for developing EISs and clarified "significantly affecting" as "likely to be highly controversial on environmental grounds." Environmental effects were defined broadly and included human factors (e.g., increased noise pollution, major population displacement or disruption of established communities), scenic or aesthetic factors (e.g., impacting visual elements of a scenic or unique landscape), and biological factors (e.g., altering wildlife behavior patterns or habitats, increasing air or water pollution, or contaminating public water supplies or treatment facilities). Although still in draft form, state highway departments were to immediately implement the guideline procedures for any federally funded projects. By August 1971 the FHWA issued a notice with final procedures for developing EISs.[44]

NEPA's review process initially frustrated many highway engineers. Highway departments complained of a number of issues the new laws imposed including delays and increased costs. NEPA also required a significant change in the interrelationships between highway departments and other state and federal

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[43] "The National Environmental Policy Act of 1969, as Amended," January 1, 1970, https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/Req-NEPA.pdf.

[44] Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969."

agencies, some of which now had authority to impose specific restrictions on highway builders. Although public hearings had been a part of the Interstate Highway planning process for some time, NEPA required that the demands and recommendations of the public and various stakeholders be considered as part of the environmental review process. For example, highway departments developed alternatives to proposed projects upon which interested parties were allowed to comment. The input of citizens and stakeholders now significantly influenced the consideration of Interstate Highway location alternatives and design concepts.

The indifference of some highway departments toward the new regulations was reflected in the quality of early EIS documents. Regulators criticized states for minimizing potential environmental impacts and overemphasizing the potential benefits of highway projects. Additionally, some states attempted to skirt around environmentally sensitive issues by "piece-mealing" or submitting multiple EIS documents for short highway segments rather than a single submission for a longer segment that together would have a significant impact. Project delays were common as highway departments adjusted to the new requirements of NEPA and attempts to avoid or minimize the requirements caused further delay. However, following a series of lawsuits in the early 1970s, state highway departments began to understand it was in their best interest to devote enough resources and attention to NEPA regulations to meet compliance early in the process. Eventually, NEPA and environmental stewardship became an integral part of highway planning, and state agencies that were once staffed primarily with engineers were now developing into interdisciplinary organizations with planners, biologists, ecologists, historians, archaeologists, and other specialists.[45] As a result, consideration of impacts to the natural environment became evident in the locations and designs of various Interstate Highway segments and structures constructed after 1970, including I-93 through Franconia Notch in New Hampshire (1973), I-90 over Snoqualmie Pass in Washington (1971-1981), and I-15 through the Virgin River Gorge in Arizona (1973). These highway segments utilized new design techniques and aesthetic treatments to reduce environmental impacts and create a sense of harmony with the surrounding landscape.[46]

B. CDOH and early environmental considerations in Colorado

The designs of I-70 segments constructed west of Denver in the early 1960s usually reflected the traditional highway engineering calculations of cost and user benefit ratios and included straight alignments, vertical rock cuts with drill marks, and exposed areas with little or no attempt to revegetate. Segments where this is most apparent include the straight cuts through the Dakota Hogback and the section through Idaho Springs. However, by the late 1960s designs began to reflect subtle adjustments that reflected environmental considerations such as curves to avoid historic sites, revegetated construction areas, and a deer underpass located west of Vail. Increased attention to enhancing the views of motorists by carefully considering visual impacts and aesthetic considerations were also evident along portions of the highway. The Genesee Park Interchange, for example, included a bridge with one

[45] Weingroff, "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969."

[46] Federal Highway Administration, "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System," *Environmental Review Toolkit | FHWA*, accessed August 5, 2018, https://www.environment.fhwa.dot.gov/env_topics/historic_pres/highways_list.aspx.

long span engineered without a center pier to provide an unobstructed view of the Colorado Rocky Mountains.[47] In the wake of the Red Buffalo controversy, the CDOH released a publication intended for the general public that highlighted the agency's efforts to protect environmental resources along I-70. The booklet, titled *Through the Colorado Rockies: Interstate Colorado 70* opened with the following statement:

> Many of our highways extend through or near open spaces, parks, fishing areas, historic sites, and other tracts of great value. The development of a highway certainly can be compatible with the preservation of such national wonders by virtue of early overall planning. The highway must not only protect these resources, but also fit the plans of other agencies responsible for developing recreation and conservation in our rural regions. Today, as land more and more becomes a scarce and valued commodity, our federal state highway efforts must be directed increasingly toward such cooperation.[48]

After the passage of NEPA, Shumate appointed a landscape architect named Harvey Atchison to head up a new environmental unit called the Environmental Research Analysis Section and develop the CDOH's first NEPA Action Plan. The Action Plan addressed all steps in the environmental review process and had to be approved by the FHWA. Early environmental reviews often caused delays and slowed the construction of highway projects, but the newly appointed environmental staff slowly demonstrated the importance of successful environmental clearances. After the passage of NEPA in January 1970, the Vail Pass project became an opportunity for the CDOH to fully demonstrate the possibilities of careful environmental planning and design.[49]

C. Planning I-70 through Vail Pass

In the summer of 1970, while geologic investigations were underway, the CDOH began preliminary plans for possible alignments through the Vail Pass corridor.[50] Early studies and field surveys showed that engineering the route through the geologically complex and unstable terrain of the mountain pass would present significant challenges. Adding to this, the CDOH had to comply with the requirements of the complex set of regulations under NEPA. Responding to these constraints, the CDOH immediately began coordinating with various stakeholders and initiated work on several environmental studies.

The CDOH and its consultants worked in cooperation with several agencies during the development of early environmental studies and preliminary design concepts. Since most of the Vail Pass segment passed through the White River National Forest, careful coordination between the CDOH and the U.S. Forest Service (Forest Service) was required throughout every stage. The Forest Service imposed a

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[47] Federal Highway Administration, "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System"; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 291–92.

[48] Colorado Division of Highways, *Through the Colorado Rockies: Interstate Colorado 70* (Denver: Colorado Department of Highways, c 1970), 1.

[49] Colorado Department of Transportation, *100 Years of Colorado State Transportation History*, 73–74; Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 8.

[50] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 39–41; Barton, "Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design," 8.

series of stipulations through easement deed restrictions and signed a Memorandum of Understanding (MOU) with the CDOH in June 1970 that defined the environmental concerns and established responsibilities and procedures for coordination between the CDOH, Forest Service, and other stakeholder agencies, including the Colorado Division of Wildlife, FHWA, U.S. Geological Survey, Colorado Department of Public Health, and U.S. Environmental Protection Agency. During the environmental review and preliminary design concept phases, these agencies and others provided the CDOH and its consultants with data and expertise that helped identify potential environmental impacts and develop solutions (see Figure 5).[51]

Figure 5. Gathering of engineers and other interested parties on US 6 to review the routing of the highway over Vail Pass, c.1970.[52]

Environmental studies commenced in August 1971 when the CDOH contracted with the firm Barton, Stoddard, Milhollin & Higgins, a division of International Engineering Company (IEC), to conduct studies that included environmental impact analysis, alignment alternatives, and design concepts. The IEC

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[51] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 3; Charles H. Miller, "U.S. Forest Service Involvement in and Overview of the Vail Pass Project," *Transportation Research Record* 717 (1979): 14–15; Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 2,6.

[52] Colorado Department of Highways, "Engineers on US 6," c 1970, Colorado Department of Transportation, Environmental Library.

assembled an interdisciplinary team that consisted of engineers, ecologists, biologists, and other scientists, as well as architects, planners, and landscape architects from the Taliesin Associated Architects of the Frank Lloyd Wright Foundation.[53] The studies were completed in two phases and resulted in two separate reports. The first report, titled *Vail Pass Environmental Study*, addressed environmental concerns and provided general recommendations on alignments and design features to avoid or mitigate impacts. The second report, titled *Vail Pass Alignment Studies and Design Concepts*, provided detailed alignment recommendations and design concepts.[54] The study results also served as a basis for the EISs required by NEPA and were presented to various stakeholders including environmental organizations and residents of Eagle and Summit Counties who attended public meetings. A summary of each study phase is provided below.

(1) *Vail Pass Environmental Study*

The *Vail Pass Environmental Study* (see Figure 6) was completed under NEPA compliance guidelines developed by CEQ, the FHWA, and the Environmental Research Analysis Section of the CDOH.[55] Under typical circumstances, the NEPA process required environmental studies before the final selection of a highway corridor location, which meant consideration of multiple route locations and potential environmental impacts on a broad regional level. However, the rejection of the Red Buffalo route left the Vail Pass corridor as the only practical alternate and the location had already been finalized prior to the initiation of the environmental study, which allowed the study team to limit its scope to impacts only within or near the Vail Pass corridor.[56]

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[53] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 2.

[54] Austin B. Milhollin, "Environmental Constraints on the Vail Pass Project," *Transportation Research Record* 717 (1979): 2; Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*; Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts* (Prepared for the Colorado Division of Highways, March 1972).

[55] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 8.

[56] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 8–9.

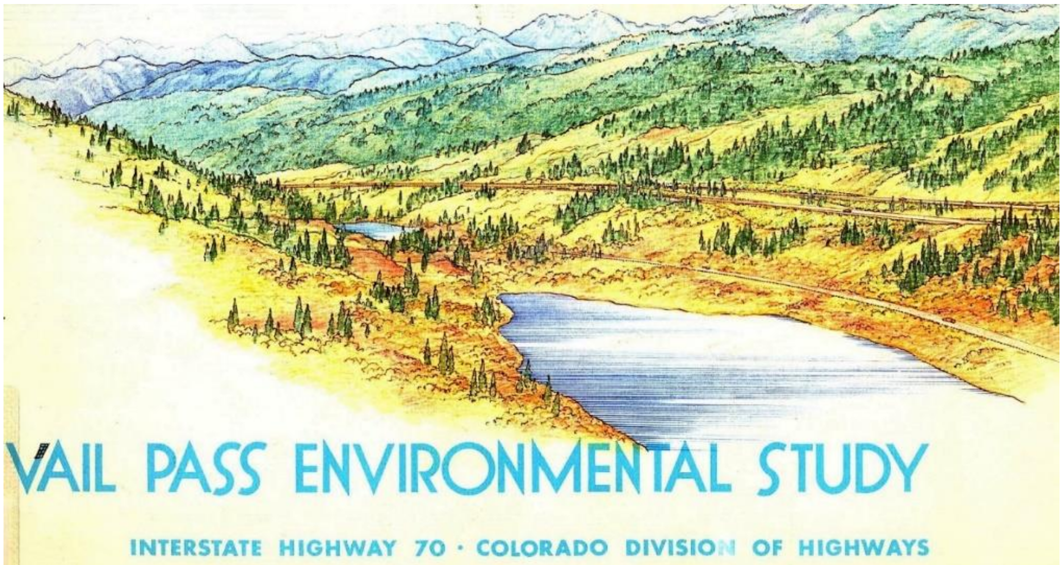

Figure 6. Vail Pass Environmental Study, March 1972.[57]

The study addressed a wide range of environmental factors within five categories: social, economic, physiographic and operational, aesthetic and cultural, and ecological and interrelated.[58] Throughout the report, potentially adverse impacts were presented with general recommendations to mitigate or avoid negative effects, and the projected benefits of the proposed Interstate Highway segment were highlighted whenever possible. For example, the report noted that the construction of the highway would have some detrimental effects to property owners in the Bighorn Subdivision of East Vail (see Figure 7), requiring relocation of several residents and resulting in a loss of scenic views for others. However, the study also highlighted the benefits that would result from the new highway, such as safer and faster connections to nearby communities, and argued that a number of "recreational and social enhancements" could help counteract negative social effects.[59]

[57] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, cover.

[58] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 8, 31–36.

[59] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 50.

Figure 7. Image of the Bighorn Subdivision before completion of I-70.[60]

Since most of the Vail Pass segment passed through national forest land between two major ski areas, Vail Village and Copper Mountain, recreational values were emphasized by the study team. One of the goals in the design of the Vail Pass segment was to “offer a wilderness experience to those entering the area.”[61] Special aesthetic considerations and “recreational enhancements” were proposed to mitigate adverse effects to the landscape. Examples included a rest area that would appear as an “extension of the natural surroundings” near the Vail Pass summit, and an improved parking area near the existing trailhead and Gore Creek Campground east of the Bighorn Subdivision. The study also emphasized the importance of reducing views of I-70 from the Black Lakes and recommended that the alignment of US 6 between the lakes and the Vail Pass Summit be retained as an access road for recreational uses (see Figure 8).[62] To preserve the scenic beauty of the pass, the study team recommended that roadbuilders take great care in the design of the roadway and aesthetic treatments of associated structures. The final alignment was to fit into the landscape with a curvilinear design, molded variable slopes, widely separated lanes, and elevated structures where possible to minimize terrain disruption.[63]

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[60] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 41.

[61] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 41.

[62] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 42–44, 47.

[63] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 67–74.

Figure 8. One of the Black Lakes near the Vail Pass Summit showing the alignment of US 6 before construction of I-70.[64]

The ecological and interrelated impacts analyzed in the study included noise factors, air pollution, water quality, and impacts to fish and wildlife.[65] Erosion and water quality issues related to the construction of I-70 were expected but considered temporary. The use of elevated structures instead of cut-and-fill slopes would reduce exposed surfaces, reduce erosion, and preserve vegetation.[66] To mitigate impacts to wildlife, the study team proposed the use of underpasses, which had proved successful on other portions of I-70 constructed several years earlier. The location selection and design development of game underpasses was to be completed in coordination with the Colorado Division of Game, Fish and Parks.[67] Completed in March 1972, the *Vail Pass Environmental Study* served as a basis for the project's Draft EIS required under NEPA. In April 1972 the FHWA approved the Draft EIS and allowed the CDOH to send the document to stakeholders for comment.[68] The Vail Pass Environmental Study did not address Section 106 National Historic Preservation Act as would be required of large-scale environmental studies like this in subsequent decades.

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[64] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 47.

[65] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 77–97.

[66] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 80.

[67] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 87.

[68] Colorado Division of Highways, *Draft Environmental Statement Administrative Action for Project I 70-2(19) Vail Pass*, April 1972.

(2) Vail Pass alignment studies and design concepts

Following the completion of the environmental study, the IEC produced a detailed report including alignment alternatives and design concepts titled *Vail Pass Alignment Studies and Design Concepts* (see Figure 9) that would be presented at the public design hearing and inform engineers during final design phases.

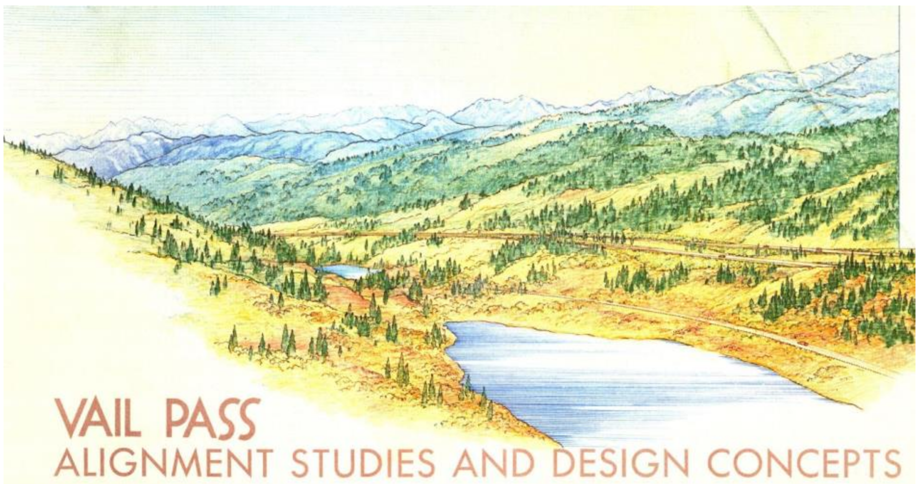

Figure 9. Vail Pass Alignment Studies and Design Concepts, May 1972.[69]

Alternative alignments were ranked and selected in consideration of several factors, including cost, operation, geology, and environmental impacts. Generally, environmental factors that guided the alternative alignments were private property encroachment, geologic constraints, stream encroachments, and aesthetic considerations.[70] The report recommended that geologic considerations override other environmental factors in some cases to prevent causing unintended environmental damage such as landslides.[71]

Preliminary design concepts were developed in consideration of the various operation, environmental, and aesthetic concerns identified in the *Vail Pass Environmental Study*.[72] The overall goal of preliminary design concepts was to meet Interstate Highway safety and efficiency standards and minimize damage to the sensitive environment and scenic landscape. According to the report, the construction of I-70 through Vail Pass should be used as an opportunity to "rectify past errors" caused by the construction of US 6, and "enhance the natural scenery." If constructed, the concepts recommended would establish

[69] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*.

[70] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 12; Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 8.

[71] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 58.

[72] Austin B. Milhollin and Cade L. Benson, "Structure Design and Construction on the Vail Pass Project," *Transportation Research Record* 717 (1979): 30.

"standards of excellence" for other highways in scenic areas, and "exemplify Frank Lloyd Wright's doctrine that manmade structures can be harmonious enhancements of nature."[73] The design concept study team analyzed the concepts for slope treatments, retaining walls, bridges, and road-related structures.

(a) Slope treatments

In order for the roadway to blend with its natural surroundings, sharp angular edges and smooth cut slopes were to be avoided in favor of sculpted cuts that reflected the natural terrain. To achieve this, the report recommended blending slope grades into adjacent slopes and implementing a revegetation program that utilized native flora and species whose habitat was comparable to that of Vail Pass.[74]

(b) Retaining walls

Retaining wall design concepts also emphasized blending with the textures and contours of the landscape. Avoidance of smooth and flat surfaces and incompatible colors were important principles. To achieve the desired aesthetic qualities, the study team recommended adding natural colors and applying textures or patterns to concrete surfaces. The study also recommended a maximum height of 20 feet for each wall and suggested a preference for terracing. Five specific concepts were presented in the report, including angled precast concrete units, precast concrete cribs, precast flat panels supported by concrete A-frame structures, poured-in-place concrete walls, and stone rubble walls. The study team recommended the use of precast angled units since they would allow adjustment to follow a curved alignment and provide pockets for plantings between each level (see Figure 10).[75] This concept was later adapted to a design that included curved panels that served a similar function.

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[73] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 75.

[74] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 75.

[75] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 77–84.

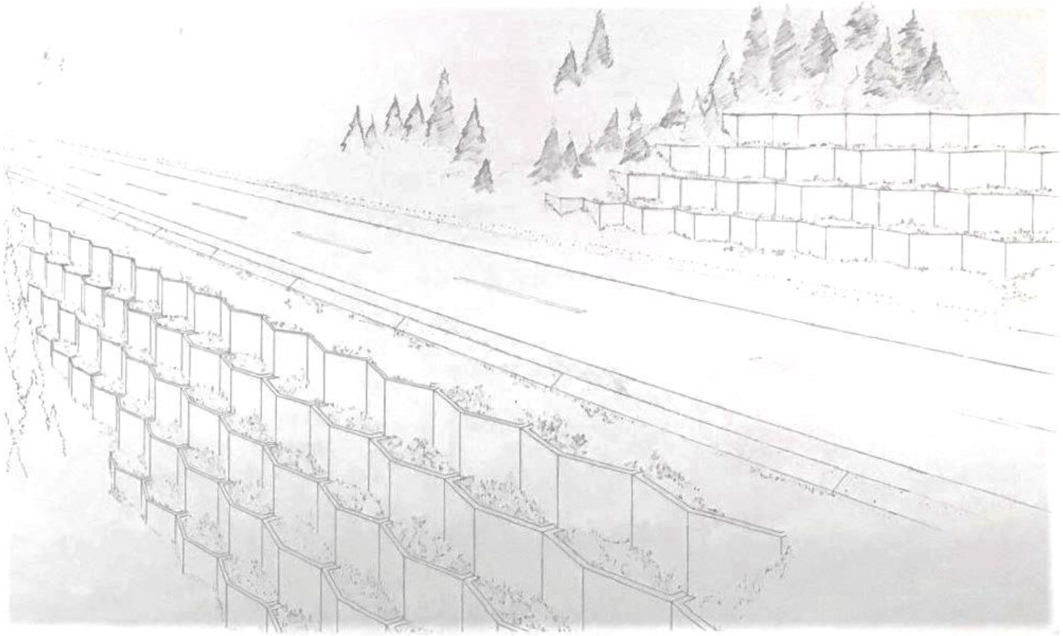

Figure 10. Preliminary retaining wall drawing showing angled precast units with planting pockets.[76]

(c) Bridges

Seven types of bridges were evaluated and considered for use on the Vail Pass segment, including short-span, precast concrete girders; tubular steel space frames; welded plate girders; precast, concrete, earth-filled arches; long-span, open-spandrel, concrete arches; long-span, welded, plate box girders with concrete decks; and long-span, precast and post-tensioned, segmental concrete box girders.[77] Although numerous designs were submitted, only a few were actually implemented. Overall, the final design of the bridges minimized the visual impacts of the bridges for motorists, with designs that, emphasized horizontal lines of the superstructures, created unobtrusive vertical supports, and created continuity between bridge ends and adjacent slopes.[78] The architects who helped with the bridge designs recommended that both the steel and concrete box girders should have shallower depths than traditional box girders. The steel box girders were specifically designed with a high span to depth ratio to give the bridges a “slim-line appearance.”[79] Similarly, the concrete box girders were designed with prestressed concrete to add strength to beams and girders and allowed the bridges to support larger loads with shallower depths than conventional reinforced-concrete girders.

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[76] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*, 77.

[77] Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 30.

[78] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 84–86.

[79] Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 31.

The IEC and CDOH prepared the bridge designs for the construction bid packages. Two primary bridge types were selected during the design phase: long-span, welded, plate box girders with concrete cast-in-place decks and long-span, precast, post-tensioned, segmental concrete box girders.[80] The steel boxes and precast concrete segments were considered suitable for the project because the units could be raised and cantilevered from the ground using smaller pieces of construction equipment, which helped limit the amount of ground disturbance. Concrete, precast pier columns supported the bridge types and were colored to match the surrounding terrain. Cost analyses indicated minor price differences between the steel and concrete types, and full plans and specifications were developed for both types. Contractors were allowed to choose which material they wanted to use and prepared bid sets based on their choice.[81]

(d) Road-related structures

In addition to major structures, design concepts included recommendations for the rest area and roadway appurtenances (i.e., signs, culverts, lights, and fencing). Guidelines for these elements reflected the overall objective of minimizing manmade visual elements and creating a sense of harmony with the environment. Unnecessary barriers, signage, fencing, lighting, and glare screens were to be avoided and, when used, methods to blend these elements into the landscape were preferred. Additionally, preliminary designs advised that any potential retaining walls used for stream relocations should conform to the same design criteria as those recommended for the highway as they would be seen by hikers and fishermen.[82]

(3) Public design hearing and Final EIS

The *Vail Pass Alignment Studies and Design Concepts* report was published in May 1972, and on June 19 the CDOH held a hearing to allow public input on the design concepts and environmental studies. The hearing was moderated by Judge Carl Fulghum and included a panel of speakers, including Richard Prosense, then a District Engineer at the Grand Junction CDOH location; Lee Graham, CDOH district right-of-way engineer; Charles Montooth of the Frank Lloyd Wright Foundation; Austin Milhollin of the IEC; and several environmental scientists.[83] Following the panel presentations, which included background on the project's development, geological and environmental findings, and a presentation of the design concepts, attendees of the meeting were permitted to provide questions and comments to the panel. Many of the public comments pertained to environmental impacts and concern over quality control during construction, as well as landslides and erosion during construction.[84] One detailed discussion centered on the possible issues related to the elevated highway structures proposed. Wesley Curtis, a representative of the American Automobile Association (AAA) in Grand Junction, stated that the new highway would address safety issues related to the current road through the area but asserted that there

[80] Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 30.

[81] Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 30–31, 33.

[82] Barton, Stoddard, Milhollin, and Higgins, *Vail Pass Alignment Studies and Design Concepts*, 86–90.

[83] Barton, "Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design," 2–32.

[84] Barton, "Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design," 40–61.

was too much emphasis on creating innovative designs and that the proposed elevated highway was likely to cause safety issues due to icing during the winter season. He recommended building on solid ground instead.[85] After the meeting, the CDOH incorporated comments into the Final EIS, which was approved by the FHWA on September 22, 1972.[86]

(4) Interagency cooperation and the *Landscape and Erosion Control Manual*

The design process continued following approval of the Final EIS and final designs incorporated many of the aesthetic and environmental considerations addressed in the preliminary studies. Before construction commenced, the concerns of various agencies including the Colorado Division of Wildlife, the Soil Conservation Service, and the U.S. Geological Survey were addressed in a set of guidelines developed in June 1973 by the IEC for the CDOH called the *Landscape and Erosion Control Manual*. The manual contained concepts on landscaping and erosion control that emphasized sculpted rock cuts, slope molding, and accented ridges. The manual also recommended leaving natural features such as rocks and boulders in place when possible to ensure that the right-of-way blended with the surroundings. Concepts presented in the manual became integral guidelines for developing landscaping techniques and erosion control measures, and some of the concepts presented were utilized in later contract specifications. The Forest Service laid out several areas of concern that were to be addressed in the construction plans. These included fire protection plans, locations of detours and haul roads, pollution and erosion control measures, aesthetic considerations, and the restoration of disturbed areas. Final agreements between the agencies emphasized the need for cooperation to ensure the objectives of each organizations were met. Prior to construction, the Forest Service reviewed all plans and specifications and held conferences and site visits with the CDOH, contractors, and various agencies involved in the project.[87] The first construction activities on the Vail Pass project began in September 1973.[88]

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[85] Barton, "Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design," 40–43.

[86] Colorado Division of Highways, *Final Environmental Statement Administrative Action for Project I 70-2(19) Vail Pass*, September 1972.

[87] Miller, "U.S. Forest Service Involvement in and Overview of the Vail Pass Project," 14–20.

[88] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 3.

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5. Construction of Vail Pass: Significant Engineering, Planning, and Management Innovations

Construction of I-70 over Vail Pass began in 1973 and ended in 1978. The short construction season had a significant impact on the amount of work that could be completed as construction began in May and stopped in November when temperatures began to drop and snow to fall. The CDOH advertised approximately 20 separate bid packages, dividing the plan sets according to location or by grouping several structures to be constructed under one project.

A. Role of environmental specialists

By 1973, with the start of construction, the CDOH added several new environmental staff to its payroll, working alongside engineers to develop environmentally responsible projects and meet environmental requirements. Vail Pass became a major focus for these experts, who worked with environmental experts in consulting and engineering companies that were hired to construct the highway. Geologists and landscape architects constantly monitored the project to help ensure rock cuts were being done in stable terrain, and that they looked similar to natural rock outcrops. Prior to a rock being cut, a landscape architect would show the workers operating the equipment where the cuts should be placed. A staggered bench cut design was developed for the rock cuts to match the natural terrain. Biologists helped develop new channel designs for Gore Creek and Tenmile Creek in locations where relocation of the streams were necessary (see Figure 11). If a creek or spring was present, the design incorporated the water feature into the rock cuts or slopes to maintain its original pathway. Ecologists selected trees that should be kept to maintain a natural appearance of the forest, and recommended planting trees and shrubs on the rock cuts to minimize scarring. A team of archaeologists discovered a prehistoric encampment and hunting area at the top of the pass during the summer of 1975, excavating artifacts including projectile points, knives, scrapers, and other tools, as well as dozens of fire hearths (see Figure 12).[89]

[89] Colorado Encyclopedia, "Vail Pass," n.d., https://coloradoencyclopedia.org/article/vail-pass-0#page-title; Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado* (prepared for the United States Department of Transportation, Federal Highway Administration Office of Development, 1978), 87. Detailed exhibits were created for the rest area with replicas of some of the tools found at the site to provide interpretation and information to visitors at the rest area.

Figure 11. Biologists checking Tenmile Creek for trout habitat in a section rebuilt as part of Vail Pass I-70 construction.[90]

Figure 12. Archaeologists conducting an excavation of an open campsite on Vail Pass in 1975, with evidence of use by various Native American groups beginning in 6400 BCE up to the late 1800s.[91]

[90] Colorado Department of Highways, "Vail Pass Trout Habitat," n.d., Colorado Department of Transportation, Environmental Library.

[91] Colorado Department of Highways, "Vail Pass Archaeologists," 1975, Colorado Department of Transportation, Environmental Library.

B. Erosion and water pollution

The erosion and water quality environmental requirements involved in construction were new for many of the contractors who were interested in bidding on the Vail Pass project. The CDOH created trainings for contractors to educate them on the reasoning behind the laws, penalties, and potential risks before bidding began. As one contractor on the job noted, penalties were stiff, such as this one for water quality control:

> Any person who fails to notify the division [of pollutant discharge] as soon as practicable shall, upon conviction thereof, be punished by a fine of not more than ten thousand dollars, or by imprisonment in the county jail for not more than one year, or by both such fine and imprisonment.[92]

The requirements included following the IEC's 1973 *Landscape and Erosion Control Manual* as part of the environmental planning. The manual included monitoring plans, guidelines, and detailed instructions for water quality issues. Despite the manual and advanced planning, however, unforeseen issues arose during construction, which required constant readjustments in the field and to guidance manuals.

Cost overruns for environmental compliance became a major concern, and contractors requested a system to reimburse them for costs they incurred for unpredictable situations in the field. The CDOH had special accounts to reimburse contractors for environmental costs, paid by actual time and expense materials or hourly equipment. This helped deal with unpredictable situations and their costs. Most of the contractors preferred suggesting cost-effective procedures to the CDOH rather than being told how to solve problems. The environmental procedures included flexibility to allow contractors to discuss the issues with CDOH engineers and agency liaisons to recommend solutions. Contractors also became savvier and more experienced in water control techniques and pollution avoidance that were later applied to other highway construction projects.[93]

As construction entered its second year in the spring of 1974, citizens in Frisco, Breckenridge, and the town of Vail were complaining to Vail officials and CDOH engineers about water pollution of municipal drinking water on West Tenmile Creek on the east side of the pass and Gore Creek on the west. Wildlife conservation officers also expressed concerns about soil erosion and the detrimental impacts on fish habitat. The red soil of Gore Creek was easily eroded, and grading operations and revegetation added heavy siltation to streams. Contractors either were unaware or unprepared to handle the extreme runoff, and corrective measures were needed.[94]

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[92] Robert H. Lowdermilk, "Meeting the Challenges of Environmental Restrictions in the Vail Pass Project (Abridgement)," *Transportation Research Record* 717 (1979): 19.

[93] Lowdermilk, "Meeting the Challenges of Environmental Restrictions in the Vail Pass Project (Abridgement)," 19.

[94] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 3–4; William N. Johnson and R. Scott Fifer, "Water-Quality Considerations for Highway Planning and Construction of the Vail Pass Project," *Transportation Research Record* 717 (1979): 40.

In particular, the construction of I-70 at Black Gore Creek, including new bridges, was going to impact the sole water supply for the Bighorn Subdivision in East Vail, and Vail Town Manager Terrell Minger wanted the CDOH to halt construction if major siltation affected the area's water supply. Prosence, then District Highway Engineer in Grand Junction and lead engineer on the Vail Pass project, noted the amount of silt in the water had long been a problem in the area, but had been exacerbated by the construction, stating "Sometimes, even before construction started, when a cloudburst hit in the upper part of the basin you would get red water. There's a limit to what humans can do in that kind of terrain."[95] Deep snows began to melt in April and the stream levels remained full through the spring and summer, with sometimes frequent spring and summer cloudbursts that added to the water runoff. It took some experimenting for the CDOH to determine what kind of monitoring was helpful, and how to best manage the water quality in the complicated conditions.

The Forest Service submitted updates to the *Landscape and Erosion Control Manual* to the CDOH in March 1974. The update stipulated that the CDOH should continue to monitor water quality but added the requirement that each separately bid construction project would be monitored individually and problems and corrections had to be discussed immediately with the project engineer and the Forest Service liaison. The CDOH adopted the Forest Service plan late in 1974, to use during the 1975 construction season. It also appointed a full time erosion control/water quality specialist for Vail Pass in January 1975. The field coordination between the CDOH, Forest Service, and local water supply officials helped establish new techniques to be vetted and implemented immediately. These changes also controlled costs and ensured environmental compliance.

The updated manual required contractors to prepare a contingency plan for erosion control and water quality and submit for approval prior to construction. Contingency plans varied depending on project location. Steep terrain adjacent to streams had more complex plans than projects on relatively flat terrain that were not near streams. The plans typically included methods to handle snowmelt, rainfall runoff, and the small streams flowing through project limits, and recommended locations for temporary and permanent water quality measures. Contractors had to appoint erosion control and water quality supervisors who made sure water quality measures were implemented. Contractors also had to provide the erosion control materials, machinery, and personnel, and to have these materials at the construction site to be implemented immediately when problems occurred. Finally, contractors had to agree to make erosion control solutions the priority rather than making progress on construction to hold them accountable to fix issues.[96]

The methods of erosion control on Vail Pass were designed as either permanent or temporary measures. Permanent erosion control included retaining walls, location of drainageways and culverts, and cut and fill slopes. Additionally, the plans for revegetation, including topsoil, seeding, fertilizer, mulch, and jute netting, became important components in the long-term viability of the replaced trees, shrubs, and

[95] Steve Wynkoop, "Vail Pass...a New Look in Highways," *Denver Post*, October 13, 1974.

[96] Johnson and Fifer, "Water-Quality Considerations for Highway Planning and Construction of the Vail Pass Project," 41.

grasses (see Figures 13 and 14). The timing was also critical, as newly cleared slopes needed to be revegetated as soon as possible to avoid additional erosion. In addition to permanent design measures, temporary measures were implemented to manage issues during construction, but removed after construction was over. These included building haul roads and timber bridges to reduce crossings of streams with construction equipment. Other temporary measures included sediment basins where turbid runoff could be held, and sediment traps that slowed the velocity of runoff so sediment could be caught in materials such as straw bales, fabric filters, or sandbags. These methods were used with varying success throughout construction due to the harsh environment and weather and had to be continually maintained and replaced after storms and high winds. One final method of temporary remediation was redirecting clear water away from construction sites using shallow hand dug ditches. [97]

Figures 13 and 14. Placing jute netting on cleared slopes on Vail Pass to help stabilize and revegetate the slopes.[98]

C. Sensitive landscape implementation measures

The landscape design on Vail Pass developed during the environmental planning sought to replicate and honor the existing forests and valleys and the surrounding natural environment. To that end, the landscaping replaced natural elements removed during construction back into the right-of-way once the road was constructed (see Figure 15). Construction techniques helped to preserve scenic quality, stabilize the highway slopes, and ensure highway safety. The goal was to make it difficult to discern any change in the environment once construction was over. In areas where motorists would be traveling

[97] Johnson and Fifer, "Water-Quality Considerations for Highway Planning and Construction of the Vail Pass Project," 42-43.; Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 75.

[98] Colorado Department of Highways, "Vail Pass Jute Netting," n.d., Colorado Department of Transportation, Environmental Library.

through at the designed speed of 50-55 miles per hour, less detailed landscape plans were implemented. For areas with slower vehicle speeds, or bicyclist and pedestrian use, more attention was paid to designing the natural elements. For example, plantings in areas of high traffic speeds would include two to three tree species without understory shrubs and forbs, whereas more varieties of these species were concentrated in areas with slower traffic speeds.[99] Species planted in areas with high visibility included wildflowers such as penstemon, primrose, fringed gentian, wild iris, columbine, and aspen daisy; trees including young aspen, spruce, fir, and lodgepole; shrubs including willows and bog birch; as well as a mixture of native and adaptable grass mixtures. Much of the vegetation was transplanted from nearby forests.[100]

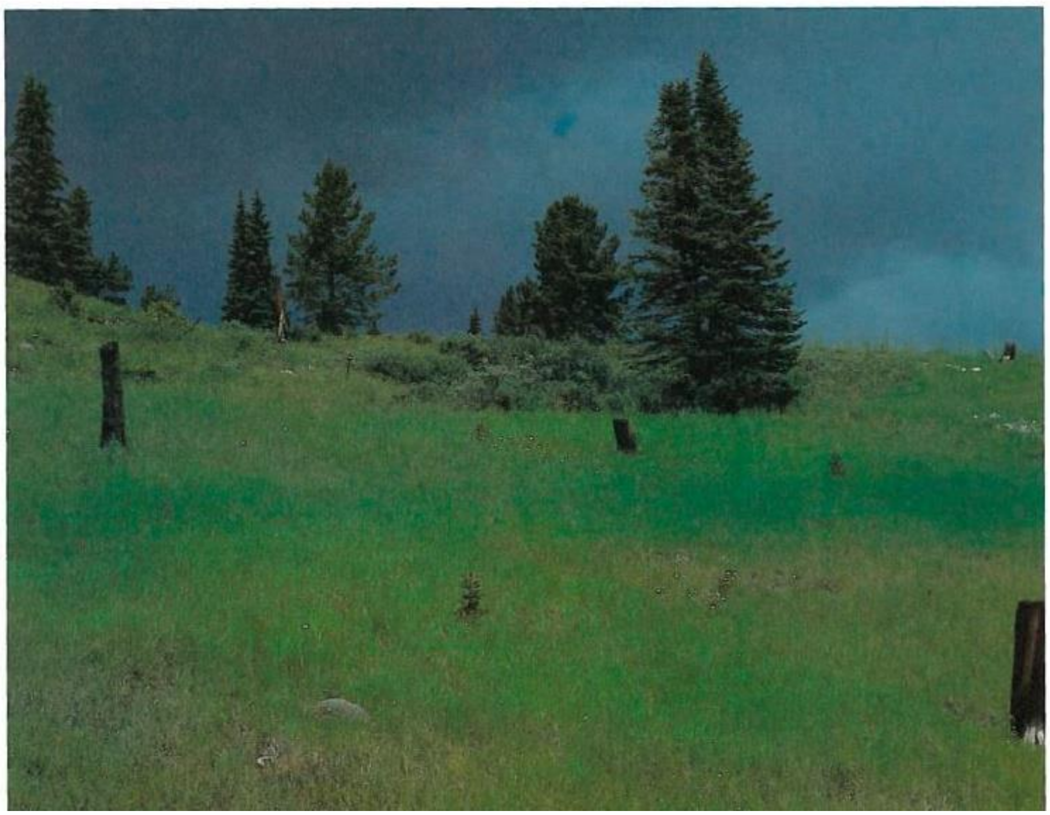


Figure 15. Stumps were randomly placed on cleared highway slopes to match the conditions on undisturbed lands outside of the highway right-of-way.[101]

Slope molding techniques were adjusted during construction in the field by project landscape architects who worked with contractors to find the best locations to blend the slopes into the surrounding environment. In addition to slope molding, the landscape architects directed contractors to round the tops of cut slopes so the transition between the cut slope and the natural slope was less obvious. Rocks and

[99] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 7.

[100] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 27–28.

[101] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 32.

stumps were taken from outside of the project area and randomly placed within the slopes to imitate a natural scattering of these features nearby (see Figure 16). Rock cuts were also specified in the plans to be altered according to conditions on site, with landscape architects directing where the rock cuts would occur to encourage a natural, staggered bench effect. This resulted in natural fracture lines in the rock, including vegetation pockets for future plants to take hold and soften the rock cuts.[102]

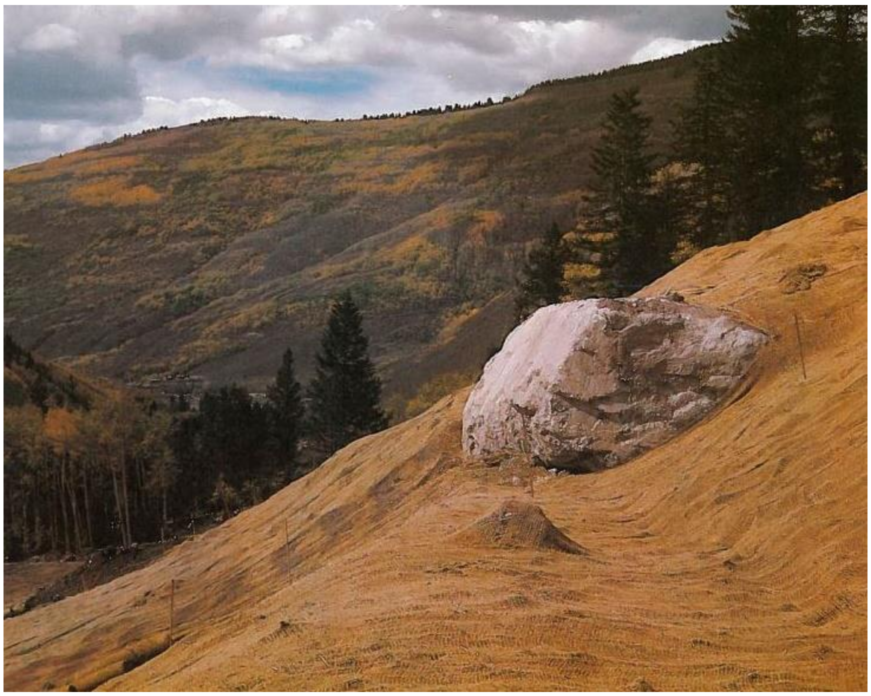


Figure 16. Large boulders like this one were buried into the disturbed slope to appear natural.[103]

D. Stream relocations

Two segments of Gore Creek on the west side of the pass and one segment of Tenmile Creek on the east side of the pass were relocated during construction, but the amount of stream moved was limited to reduce siltation and protect and enhance fish habitat. Working with the Forest Service and Colorado Division of Wildlife, the CDOH developed a plan to reconstruct the new streams to match their original condition as close as possible, including designing deep pools and shallow areas with numerous small rocks (riffle areas) for fish and insect habitat (see Figure 17). Large rocks and boulders were also placed randomly in the stream to replicate the natural conditions. The Tenmile Creek relocation was more involved on the east side of Vail Pass, and rebuilt a segment of the stream that had been moved for the construction of US 6 in the 1930s. The I-70 project replaced the straightened area of the creek with a meandering section that matched other natural sections.

[102] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 8–33.

[103] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 34.

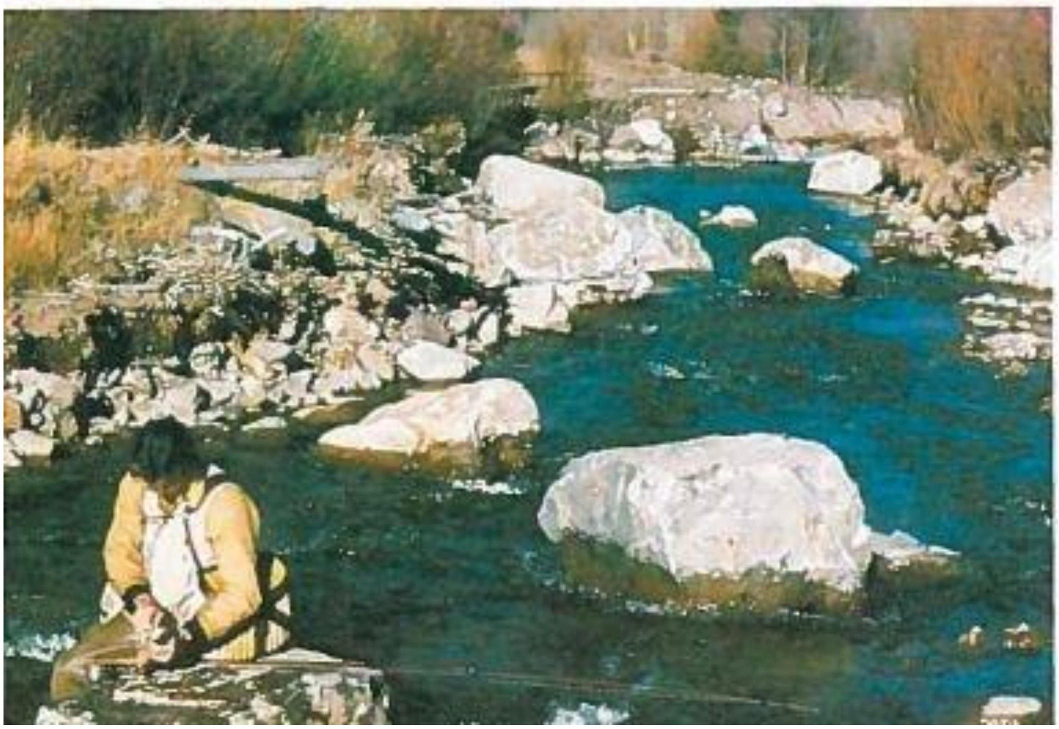


Figure 17. Stream reconstruction with large boulders placed intermittently in streambed for fish habitat.[104]

E. Bridges on Vail Pass

Twenty-three bridges were constructed on the I-70 Vail Pass segment (see Table 1), with all of them supported on beige-colored concrete pyramidal piers and tinted in colors of red, beige, and pink to complement the surrounding terrain. Preliminary plans indicated a minimal construction cost difference between constructing steel box girders or concrete box girders. The average cost for steel box bridges was $46.28 per square foot while the concrete bridges were $42.16 per square foot. As a result, the CDOH prepared two sets of plans for each bridge type and allowed contractors to choose the bridge type when preparing their bids.[105]

Table 1. Bridges built between mileposts 180 and 195

Bridge Type	Abbreviation	Quantity	Structure Number	Milepost	Feature Crossed
Concrete box girder	CBG	2	F-11-AQ F-11-AR	183	Game underpass
Concrete box girder, continuous	CBGC	1	F-12-AM	191.8	Smith Gulch

[104] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 78.

[105] Cade L. Benson, “Highway in Harmony with Its Environment,” *Civil Engineering - ASCE*, September 1976.

Table 1. Bridges built between mileposts 180 and 195

Bridge Type	Abbreviation	Quantity	Structure Number	Milepost	Feature Crossed
Concrete box girder, segmented	CBGS	8	F-11-AW F-11-AX	180.8	Hillside
			F-11-AU F-11-AV	181. 8	County road, Gore Creek
			F-11-AM F-11-AN	184.4	Black Gore Creek
			F-11- AK F-11-AL	184.9	Miller Creek
Steel box girder, Continuous	SBGC	12	F-11-AS F-11-AT	182.4	Black Gore Creek
			F-11-AO F-11-AP	183.8	Timber Creek
			F-12-AS F-12-AT	185.3	Polk Creek
			F-12-AJ	190	Shrine Pass Road
			F-12-AK	190.8	Wilder Gulch
			F-12-AL	191	Corral Creek
			F-12-AN	192.4	Stafford Gulch
			F-12-AO	193.3	Guller Gulch
			F-12-AP	193.6	West Tenmile Creek

(1) Steel box girders

Advances in steel bridge technology in the U.S. during the late 1960s included developments in metallurgy, engineering, and computer science. Engineers began to design complex and customized designs for long-span steel girders, particularly with horizontally curved box girders that became useful in building bridges in urban areas where bridges spanned industrial yards or near dense neighborhoods. The type had similar benefits in mountain environments where minimizing impacts to the landscape became important to meet environmental demands.[106] This bridge type was selected as one of the primary bridge types used on Vail Pass because it minimized disturbance of the terrain, could be designed in long span lengths, and met the aesthetic considerations to design bridges with a slim and elegant appearance that blended into the landscape (see Figures 18 and 19). The lengths of the continuous steel box girder structures on Vail Pass ranged from 243 feet to 743 feet, and most of the structures featured slight curves. The bridges consisted of two welded box girders, measuring 38 feet wide for the typical section, with Jersey barriers on either side for a total bridge width of 42 feet. The box girders were designed to be continuous over the piers and had composite concrete decks. The steel remained unpainted to allow it to weather and blend into the surrounding environment, and concrete decks, curbs, and substructures were tinted a reddish-beige color to match the rest of the concrete bridge structures.[107]

[106] Subcommittee on Curved Girders: Joint AASHO-ASCE Committee on Flexural Members, “Survey of Curved Girder Bridges,” *Civil Engineering - ASCE* 43, no. 2 (February 1973): 54–55.

[107] Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 31; Benson, “Highway in


Figures 18 and 19. Welded steel box girder bridges under construction on Black Gore Creek, May 25, 1977.[108]

(2) Concrete segmental box girders

The concrete, segmental, post-tensioned box girders chosen for some of the Vail Pass bridges were still a new type in the U.S., and the first of their kind to be constructed in Colorado.[109] Segmental concrete box girder bridges were initially designed and built in Europe after World War II. With steel production facilities still recovering from the war, prestressed concrete became the preferred material to quickly rebuild hundreds of major bridge structures destroyed during the war.

The U.S. began to adopt the type in the late 1960s, as highway departments across the country were designing the Interstate Highway System, requiring the construction of thousands of concrete and steel bridges according to FHWA standards. One of the first bridges of this type in the U.S. was the John F. Kennedy Memorial Causeway, a precast, segmental, box girder bridge completed in 1973 between Corpus Christi and Padre Island by the Texas Highway Department.[110] Another early bridge was the Pine Valley Creek Bridge, a cast-in-place, box girder, multi-span structure built by the California Division of Highways that opened in 1974 on I-8 in San Diego County near the town of Pine Valley.[111] By 1979 at

Harmony with Its Environment."

[108] Colorado Department of Highways, "Steel Box Girder Closeup Black Gore Creek," 1977, Colorado Department of Transportation, Environmental Library; Colorado Department of Highways, "Steel Box Girder Black Gore Creek," 1977, Colorado Department of Transportation, Environmental Library.

[109] Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 31.

[110] Juan A. Murillo, "Modern Bridge Construction and Engineering Services," in *Managing Innovation: Cases from the Services Industries*, ed. Bruce R. Guile and James Brian Quinn (Washington, D.C.: National Academies, 1988), 170; Walter Podolny Jr., "An Overview of Precast Prestressed Segmental Bridges," *PCI Journal*, n.d., 61, http://www.pci.org/uploadedFiles/Siteroot/Publications/PCI_Journal/1979/DOI_Articles/jl-79-january-february-4.pdf.

[111] Henrie H. Henson, "Construction Difficulties on I-70 Vail Pass Segmental Concrete Bridges" (U.S. Department of Transportation, Federal Highway Administration, August 1979), inside cover.

least 24 precast segmental bridge projects were undertaken in the U.S., including Vail Pass, indicating the beginning of the adoption of this bridge type by this time.[112]

The cantilever construction method used for segmental concrete box girders was ideal for situations where ground disturbance had to be minimized. The segments could be precast or cast in place, and this option was provided to the contractors bidding on the Vail Pass bridges. The concrete segments were constructed progressively from the piers by adding balanced cantilevered girders from either end of the pier and connecting them in matched pairs. After the girders were connected to a single pier, the sections between piers were joined together. The procedure was repeated until the sections were constructed and supported by end spans and abutments. The method used to join the sections together was post-tensioning, which involves laying cables within the concrete sections but not tightening the cables until after the concrete had hardened. Post-tensioning closed the gaps between the cantilevered spans. This post-tensioning method became predominant in the U.S. after 1965.[113]

(3) Construction issues

The choice of a new bridge type for Vail Pass presented some issues during construction for the CDOH, designers, fabricators, and contractors. H. Henrie Henson, assistant bridge engineer at the CDOH during the Vail Pass project, prepared a paper dealing with construction issues encountered on the project for an FHWA bridge symposium in Arkansas in 1979. As he noted, very few of the people working on the project had prior experience in building segmental bridges and the complexity of the design and construction required a great deal of problem solving.[114]

Some of the issues involved design plans that could not be carried out once construction started. For example, the first precast concrete bridges built were designed with Jersey barriers to be cast monolithically as part of the bridge structure. However, once these were constructed, vertical alignment problems necessitated removing the rails and installing precast rails after all post-tensioning was completed.[115] The first precast segmental structure had both a vertical and horizontal curve, which made connecting the segments more complicated than envisioned.[116] Joe Siccardi, CDOH bridge engineer, noted that the concrete began to shrink after it opened in 1980, requiring replacement of the joints, and that the bridge “probably would have collapsed if we didn’t catch [it].”[117]

One contractor disagreed with the CDOH design method for prestressing concrete to account for the expected movement of the concrete in the superstructure. He negotiated for his more conservative

[112] Podolny Jr., “An Overview of Precast Prestressed Segmental Bridges,” 62.

[113] Murillo, “Modern Bridge Construction and Engineering Services,” 166; Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 31–32.

[114] Henson, “Construction Difficulties on I-70 Vail Pass Segmental Concrete Bridges,” 67–68.

[115] Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 32; Prosence, “Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado,” 44.

[116] Jack Kinstlinger, “The Start of Something Big,” ???, no. January 1979 (January 1979): 17.

[117] “Design Boosted Costs Nationwide,” *Fort Lauderdale News*, August 28, 1988, 18.

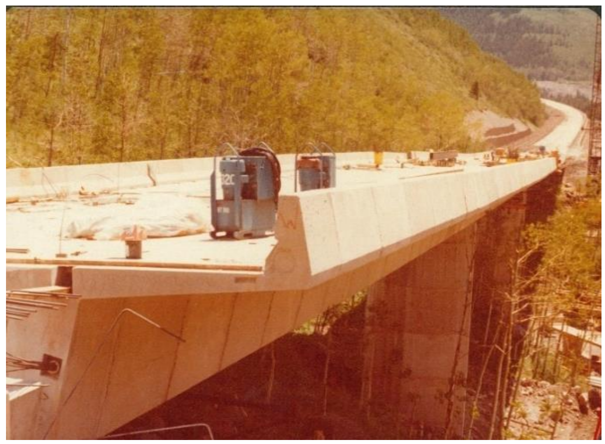
approach to be used instead, even though CDOH had provided satisfactory plans that corrected for this issue. Henson's recommendation was, "If the design criteria is clearly shown on the plans and specifications the contractor can evaluate the design prior to bidding and if there are unresolved differences of opinions he has the option not to bid the work."[118]

Design plans also stipulated that the bridges would be built from above using a gantry to minimize disturbance under bridges. However, another contractor argued this was unrealistic due to the high costs of building the bridges from overhead, and a compromise allowed the precast segmental bridges to be built using cranes that lifted and lowered the segments into position. The cranes were positioned on 70-foot square pads at the base of each pier and could reach to the end of each cantilevered section. This required clearing an area for the cranes and building haul roads for the construction equipment. The 52-ton segments, all of which were 42 feet wide, were precast in Denver at a construction yard, and delivered, one at a time, up to the construction site on semi-truck trailers. The cranes lifted each segment into place on the pier, where an epoxy held the piece in place before post-tensioning cables were strung through the girder segments (see Figures 20 through 23).[119]

[118] Henson, "Construction Difficulties on I-70 Vail Pass Segmental Concrete Bridges," 68.

[119] Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 33; "Centric Corp. Builds Bridges a New Way," *The Denver Post*, October 17, 1976, 1, 6.





Figures 20, 21, and 22. Precast concrete segmental box girders and piers constructed over Gore Creek in East Vail.[120]

[120] Colorado Department of Highways, "Precast Girders on Gore Creek," 1977, Colorado Department of Transportation, Environmental Library.

Figure 23. Gore Creek prior to the post-tensioning of the joint closure, westbound structure, August 5, 1977.[121]

Four of the concrete box girders on Vail Pass were built as cast-in-place bridges, over Miller Creek and Black Gore Creek. All of the bridges had to be built during a single construction season in 1977 that began in May and ended in November. The cast-in-place method relied upon special movable equipment that supported the necessary forms to pour the concrete to create the girders. The equipment, called a form traveler, was situated at the abutment and moved toward the center of the bridge as the girders were created, and then dismantled and moved on to the next section to be built (see Figure 24).[122] Six form travelers had been provided for the project, and even though they allowed the bridges to be constructed from above, the weight of the equipment required heavy supporting falsework and crews found it cumbersome to move the traveler to the next location once the girders had been constructed. Two form travelers were used for both of the Miller Creek bridges, so four of the travelers were being used at one time, which meant construction on the Black Gore Creek bridges had to wait until after the Miller Creek bridges were done. As construction progressed, crews began to realize that the logistics and time associated with moving the form travelers between shorter spans made them better suited to longer

[121] Colorado Department of Highways, "Gore Creek Joint Closure," 1977, Colorado Department of Transportation, Environmental Library.

[122] Man-Chung Tang, Khaled M. Shawaaf, and Juergen L. Plaehn, "Cast-In-Place Segmental Bridges in the Vail Pass Project," *Transportation Research Record* 717 (1979): 37–39; Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 33.

spans of 500 feet or more, not on short to medium spans such as the 125- to 225-foot spans in the Miller Creek and Black Gore Creek Bridges.[123]

Figure 24. Miller Creek eastbound structure, with the form traveler and gantry for cast-in-place concrete box girder construction, September 1977.[124]

In 1982 routine bridge inspections of the cast-in-place concrete box girders at Miller Creek and Black Gore Creek discovered openings in the segmental joints. Detailed inspections immediately took place, revealing that extreme transverse cracking had occurred near the center of the spans as well as along the length of the bridge, causing the joints to open at the girders. The original designs did not allow for the amount of natural movement that occurred in the concrete of the Vail Pass bridges and neglected to account for the effect that changes in temperature would have on the concrete structures. Sunlight heated up the asphalt overlay during the day, but the bottom of the bridges tended to be kept cooler because of the colder temperatures in the creeks below the bridges. As a result, the segment joints began to separate. The repair project in 1983, which cost $1.3 million, placed additional post-tensioning across the segmental joints to close the longitudinal cracks and openings between segments.[125]

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[123] Henson, “Construction Difficulties on I-70 Vail Pass Segmental Concrete Bridges,” 97.

[124] Colorado Department of Highways, “Cast in Place Girder Form Traveler Miller Creek Bridge,” 1977, Colorado Department of Transportation, Environmental Library.

[125] “Those Vail Pass Bridges: Money Wasted,” *Louisville Times*, April 20, 1983, Colorado Historic Newspapers Collection; Juan A. Murillo, James W. Englert, and Paul R. Steiljen, “Concrete Box Girders,” in *Bridge Inspection and Rehabilitation: A Practical Guide* (Hoboken, N.J.: John Wiley & Sons, Inc, 1993), 67–69.

F. Retaining walls

Retaining walls designed for Vail Pass were an important feature of the landscape design and aesthetic treatments of the highway. The design blended into the existing environment with natural colors, and wall faces were textured or patterned to match the terrain. Some walls reached as high as 70 feet and architects wanted the imposing walls to blend into the terrain when seen from the roadway. Instead of designing one single monolithic wall, designers staggered the placement of several walls of approximately 6 to 8 feet high and provided terraces for the native shrubs and small trees to grow within the spaces to mimic surrounding rock faces (see Figure 25).[126]

Figure 25. Precast tieback retaining wall, 1975.[127]

As part of the design process, a test wall was constructed in a construction yard in Sedalia, Colorado, to determine if the wall would meet the aesthetic and design criteria. A full-scale, four-tier test wall was built with 31 L-shaped, precast concrete tiebacks, which were long horizontal legs that extended into the fill, along with a vertical leg that extended upward to be attached to the retaining wall panels. The wall also included 81 facing panels, designed in precast concrete parabolic shapes to make them more visually

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[126] Milhollin and Benson, “Structure Design and Construction on the Vail Pass Project,” 34; Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 59.

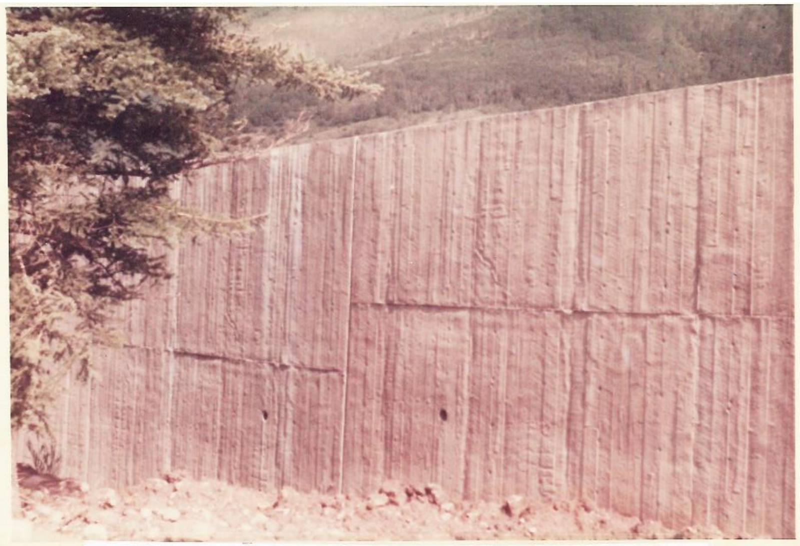
[127] Colorado Department of Highways, “Precast Retaining Wall,” 1975, Colorado Department of Transportation, Environmental Library.

interesting and allow vegetation to grow within pockets between the panels. Pressure cells installed in the backfill mimicked horizontal displacement and settlement conditions. Another test wall was designed for a segment on Vail Pass, this time a six-tier, 50-foot-high wall that included instruments to measure the ability of the wall to withstand slides and other pressures. After the first project was awarded, the Reinforced Earth Company provided plans using reinforced earth walls with curved face panels as an option for contractors bidding on the projects. The reinforced earth walls mimicked the precast tieback walls in appearance but were easier to construct.[128] Seventy percent of all retaining walls on the project were built using the reinforced earth design, with the remaining 30 percent using the original precast tieback walls. The precast tieback walls were patented by the CDOH to protect the agency from possible future litigation, with a royalty free license that allowed the CDOH to use the design or provide the license to other highway departments building projects with federal funds.[129] In addition to the parabolic concrete retaining walls, conventional reinforced retaining walls with flat panels were constructed in locations that lacked the amount of room to build the retaining walls.[130] Timber cribbing was also used as a retaining wall treatment and for cut slope retention, combining natural materials and colors with the surrounding environment (see Figure 26).

[128] Milhollin, "Environmental Constraints on the Vail Pass Project," 5.

[129] Milhollin and Benson, "Structure Design and Construction on the Vail Pass Project," 35. It is unknown if this patented design was used anywhere else in Colorado or by other state agencies.

[130] Milhollin, "Environmental Constraints on the Vail Pass Project," 5.



Rough board finish on a retaining wall.

Cribbing adjacent a housing area.

Figure 26. Two Vail Pass retaining walls. The upper image illustrates the rough surface of the concrete retaining wall, and the bottom illustrates wood cribbing used for a wall near residences.[131]

G. Recreational amenities and rest area

The top of Vail Pass is a subalpine meadow with access to Forest Service land for a variety of year-round recreational activities. The numerous outdoor opportunities accessible from I-70 required that the design provide access to and enhance these recreational pursuits wherever possible.

[131] Colorado Department of Highways, "Concrete and Wood Retaining Walls," 1974, Colorado Department of Transportation, Environmental Library.

The primary recreational feature added to the new highway was the Tenmile Recreation Path for bicyclists and pedestrians, which was the first time an Interstate Highway design included a separate bicycle path that summitted a high alpine mountain pass.[132] In some locations the path followed the old alignment of US 6 on the west side of the pass, but in other areas designers created a new alignment for the trail, and also shared the right-of-way with the highway near the top of the pass. The majority of the path was separated from I-70 to make it safer for recreational use. The 10-foot-wide asphalt path was originally designed to be 13.3 miles long and was later extended through Copper Mountain to Frisco. Stream crossings were spanned by narrow timber bridges.

At 10,662 feet in elevation, the summit of Vail Pass needed a rest area, but the high altitude presented problems for construction and year-round operation. There were no utilities, including gas, water, and sewer, but the pass did have plenty of sunshine. As a result, a solar-powered restroom facility was designed by half burying the building into a south facing slope with passive solar heating to provide heat in the restrooms and a large fireplace in a central gathering place (see Figure 27). The completion of the Vail Pass rest area in 1980 on land leased by the CDOH from the Forest Service supported the recreational uses of the area by providing restrooms, picnic tables, parking areas, and access to back country areas. The rusticated structure was constructed with stone veneer walls, with a covered area next to the rest area entrance and massive stone chimney for a large fireplace in the central part of the building.[133]

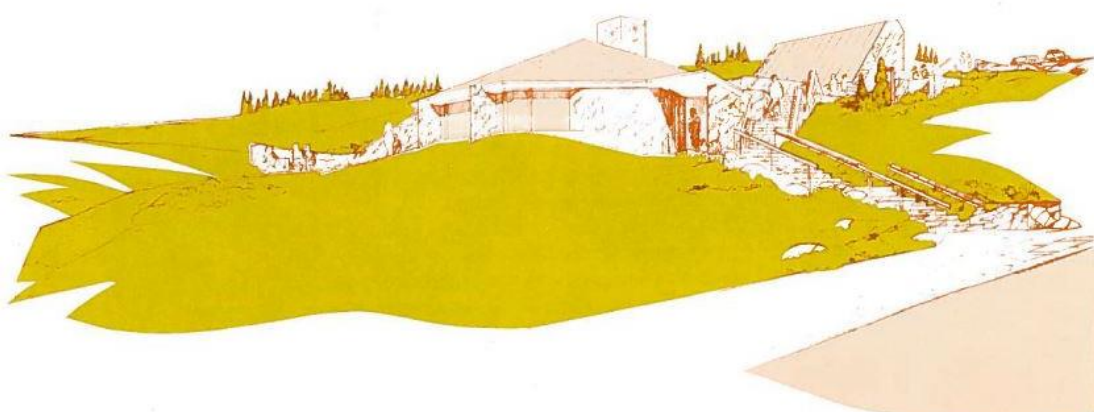


Figure 27. Design plan for the Vail Pass rest area, showing the partially buried structure with solar heat and native landscaping.[134]

[132] Prosence, "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," 47.

[133] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 83–86.

[134] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, 86.

H. Awards and accolades

The CDOH spent a considerable amount of time and money to plan, design, and construct Vail Pass, the first time the agency had to build a major highway under the scrutiny of NEPA.[135] When dedicated in 1978, the agency estimated the total cost was $91 million for the 21.4 miles between Vail and South Frisco, including $775,000 for the recreation trail. Governor Richard Lamm presided over the dedication (see Figure 28), a notable achievement given his "controlled growth" platform that resulted in Colorado voters rejecting the state's bid for the 1976 Olympic games due to potential environmental destruction and concerns about rapid development. The CDOH's sphere of influence grew as engineers and other specialists developed relationships with their counterparts in state and federal agencies and non-profits dedicated to environmental conservation. As a result, the CDOH received numerous awards for the environmentally sensitive design and construction, including from former critics. Among these critics was ROMCOE, which had pushed the CDOH to a higher standard during the design of Vail Pass, and lauded the efforts with its award for outstanding environmental achievement in October 1978. This award, which originated in 1970, recognized agencies for "encouraging joint problem-solving efforts which involve participation of all interested parties, focusing on replacing an adversary, win/lose approach with alternatives designed to reflect the needs of everyone concerned."[136]

[135] Although Vail Pass was the first project built after a NEPA evaluation, Glenwood Canyon was the first highway evaluated under NEPA in Colorado. The Glenwood Canyon Interstate 70 Draft EIS was prepared in July 1971, and the final EIS was submitted to FHWA in March 1972.

[136] "Vail Pass Highway Design Wins Award," *Louisville Times*, November 2, 1978.

Figure 28. Colorado Governor Richard Lamm at the dedication of I-70 over Vail Pass in Denver.[137]

An environmental columnist in *The Denver Post,* Joanne Ditmer, had been critical of the CDOH's ability to build highways through sensitive mountain environments in the early 1970s. After driving on Vail Pass in 1979, however, she praised the agency, saying, "There are great views, the drama of red rock shelves terraced with fresh new green grass…sculptured bridges curve against the landscape like a necklace…even though you're traveling Interstate 70, the imprint of nature is far stronger than man's superhighway." She noted the CDOH had a bicycle coordinator and was impressed by the Vail-Frisco Bike Path, which also featured vehicle access for users in wheelchairs to access fishing spots on Tenmile Creek.[138]

Representatives from the CDOH, Forest Service, and FHWA gathered in Washington, D.C., on August 21, 1979, to accept a joint award from the American Society of Landscape Architects (ASLA). The award recognized the agencies' "cooperation and care in building Vail Pass." All three participated in the publication of a booklet, "I-70 in a Mountain Environment," with numerous illustrations and photographs that highlighted the solutions to build the route through the mountainous environment with minimal impact

[137] Colorado Department of Highways, "Richard Lamm, Colorado Governor, at Vail Pass Dedication.," 1978, Colorado Department of Transportation, Public Relations.

[138] Joanne Ditmer, "Vail Pass Road, Bicycle-Hike Path Are Truly Environmental Jewels," *The Denver Post*, August 9, 1979.

(see Figure 29). The award recognized the highway specifically as an outstanding landscape architecture achievement. Harvey R. Atchison, a landscape architect and CDOH director for environmental research and planning, attended the ceremony.[139]

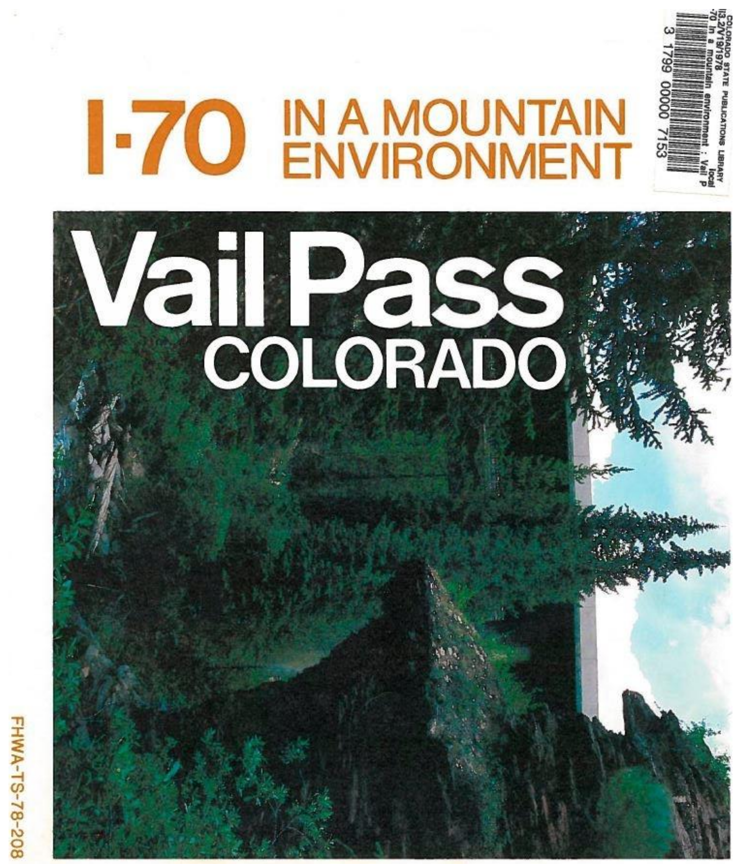


Figure 29. Cover of the joint publication prepared by the CDOH and Forest Service; the FHWA published the document as a technical report in 1978.[140]

In 1976 the Associated Landscape Contractors of America gave the CDOH a national award for erosion control and revegetation projects, recognizing one section between Pitkin and Gore Creeks and another near Timber and Miller Creeks. The award recognized the care taken with seeding, mulching, jute protective blankets, and salvage and replanting of trees during highway projects.[141]

Additional awards came in 1976 from the Colorado Division of Wildlife, which recognized the CDOH and FHWA for helping to improve Tenmile Creek as a trout stream; the Rocky Mountain Chapter of the American Concrete Institute, which recognized four Vail Pass Bridges over Gore Creek as outstanding

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[139] "Agencies Commended for Work on Vail Highway," *Louisville Times*, August 29, 1979.

[140] Colorado Department of Highways, *I-70 in a Mountain Environment: Vail Pass Colorado*, cover.

[141] Colorado Division of Highways, "Award for Vail Pass Construction," February 19, 1976, CDOT Library Archives.

new concrete structures in March 1977; the American Institute of Steel Construction, which awarded four of the steel bridges on Vail Pass first place in their Prize Bridge Competition in 1978; the Forest Service, which presented a plaque to the CDOH honoring the "new and innovative methods for resource protection and sensitivity to environmental concerns," for Vail Pass I-70 construction in 1978; and finally, *Landscape Architecture* magazine, which recognized the CDOH for Vail Pass erosion control and "special effects" in its annual awards issue in 1979.[142]

I. Planning and developing Vail and Copper Mountain Ski Areas and villages

The construction of the Vail Pass segment caused population booms and growing pains in the communities of Vail and Copper Mountain. Vail Ski Area opened in 1962, and Copper Mountain Ski Area in 1972. When the Vail ski area first opened, it had a handful of visitor services, and business remained slow at the resort for the first few years as it began to develop and grow. Vail Associates, Vail's corporate founder, designed the resort area next to the ski mountain (Vail Village) as a Swiss-style resort that banned cars from the village core and developed large condominiums, hotels, shopping centers, and other support services surrounding the village. Vail had 55,000 visitors in 1962, but by the 1965-1966 ski season more people were visiting Vail than its competitors; by 1967 revenue was 250 percent of initial projections. Vail's popularity stemmed from its convenient location, services, and its comfortable ski slopes; even expert skiers preferred the gentler slopes of Vail over steeper and icier runs at rival resorts.[143] The ski area expanded with the LionsHead section west of Vail Village in 1969. Vail also benefitted from a significantly higher amount of snow each year than Copper Mountain on the east side of the pass.

The town of Vail grew rapidly and passed its first zoning ordinance in 1970 and first master plan in 1973 to manage growth and development in the Gore Valley. Congestion and circulation issues were already a concern for the citizens, and the master plan mentioned the need to rewrite the zoning ordinance and create an overall landscape plan to reforest the town and highlight the natural beauty of the valley while masking I-70 traffic (see Figure 30).[144]

While Copper Mountain did not have the land to become the same size or scale of Vail, it was designed on the same model, with a village surrounded by condominium towers, hotels, shopping, and a large parking lot for day skiers.[145]

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[142] "Vail Pass Awards," April 8, 1980, CDOT Library Archives.

[143] Peter W. Seibert, *Vail: Triumph of a Dream* (Boulder, Colo.: Mountain Sports Press, 2003), 106–8.

[144] Royston, Hanamoto, Beck & Abey (landscape architects) and Livington & Blayney (planners), *The Vail Plan* (Vail, Colo.: Town of Vail, 1973), 1–6; Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 255–75.

[145] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 263.

Figure 30. I-70 under construction near Vail Village in the 1970s.[146]

J. Vail Development and connection to I-70

The development at Vail Village included growth in the ski resort, village, and other services at West Vail, as well as new residential development in East Vail in new subdivisions such as Bighorn which broke ground in 1962 and continued to grow rapidly with single-family homes, condominiums, and recreational amenities including a golf course and indoor/outdoor tennis club. With the ski resort booming, more people wanted to own a second home to enjoy quick access to the slopes. The Town of Vail incorporated in 1966, transferring financial responsibility for road maintenance, sewers, schools and other services from Vail Associates to the new municipality. The Town of Vail passed the first zoning ordinance in 1970 and established subdivision standards. The Town also annexed the new LionsHead section of Vail Ski Area and additional land throughout the Gore Creek Valley in an attempt to control condominium development in and around Vail, including East Vail and the Bighorn Subdivision, and to create a unified zoning code for the entire valley.[147] In 1973, the Town of Vail drafted a master plan called the *Vail Plan* to control growth and development.[148] The plan called for a complete rewrite of the zoning ordinance and modification of all systems and circulation patterns of vehicular and pedestrian transportation to alleviate

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[146] Colorado Department of Highways, "I-70 under Construction near Vail Village," 1977, CDOT Library Archives.

[147] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 255–56.

[148] Royston, Hanamoto, Beck & Abey (landscape architects) and Livington & Blayney (planners), *The Vail Plan*, 1.

congestion. The *Vail Plan* also promoted acquisition and development of space for community recreation areas. Regarding the landscape and architecture of the village, the plan mentioned creation of an overall landscape plan to reforest the town and highlight the natural beauty of the valley while masking Interstate Highway traffic, as well as reinstituting the alpine aesthetic and scale into Vail to bring back architectural unity to the village.[149]

The rapid growth of the resort community of Vail beginning in the 1960s through the 1980s was closely linked to the completion of the Interstate through the area. Opportunities for outdoor recreation—specifically skiing, snowmobiling, hiking, hunting, fishing, and cycling—had been a significant draw for tourists travelling through Eagle County before the Interstate was completed. Vail Associates, the town's corporate founders, predicted that the Vail Pass Interstate route would increase tourism to the area and add value to the resort. As the segment neared completion, though, some residents who had supported the highway became concerned with the potential for the influx of traffic and associated development to detract from the natural beauty that had attracted visitors to the area in the first place. Skiing became a lucrative business in Colorado, and Vail Resorts became the largest ski resort company in the U.S. The mountain resorts accessible from I-70 became year-round destinations, and summer competes with winter for attracting tourists as well as residents who want to live in the mountains of Colorado. Congestion and traffic on I-70 on the weekends became a major concern as the population of Denver and other Front Range cities ballooned. This growth has continued with the construction of new vacation homes, condominium complexes, hotels, strip malls, and other commercial development. Efforts to balance new development with retention of the natural environment in and around Vail, as well as along the Vail Pass segment of I-70, has remained a challenge since skiing began in 1962, and I-70 remains a major factor in the growth of Vail and other mountain communities.[150]

K. Conclusion

The Vail Pass segment of I-70 represents an innovative highway design achieved through the integration of engineering and landscape architecture principles that came about during a period of increasing public awareness of and activism associated with environmental and conservation issues both nationally and in Colorado. The final design and engineering of the roadway, bridges, retaining walls, and landscape elements complement the natural environment of the surrounding Gore Range and watersheds at Tenmile Creek and Gore Creek, which set standards for later transportation projects in Colorado, including the design and construction of I-70 through Glenwood Canyon. Construction of the Vail Pass segment of I-70 also coincided with the establishment and expansion of tourism and communities throughout the Colorado high country, notably in Vail. Tourism and the ski industry, especially, came to characterize the lifestyle and pastime of residents and visitors alike in this part of the high country. The Vail Pass segment of I-70 also provided an important east-west linkage in Colorado and for the national Interstate Highway System.

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[149] Philpott, *Vacationland: Tourism and Environment in the Colorado High Country*, 255–75; June Simonton, *Vail: Story of a Colorado Mountain Valley* (Dallas, Tex.: Taylor Publishing Company, 1987), 96–97; Royston, Hanamoto, Beck & Abey (landscape architects) and Livington & Blayney (planners), *The Vail Plan*, 1–6.

[150] Associated Cultural Resource Experts, *Highways to the Sky: A Context and History of Colorado's Highway System*, 11-72-11–73.

Ongoing maintenance of the heavily traveled highway includes addressing pot holes, pavement cracks, delamination, and damaged guardrail. The highway's location at elevations ranging between approximately 2,600 feet and 10,600 feet above sea level (for all of I-70, not just the portion over Vail Pass) poses unique challenges such as freeze-thaw cycles and pavement deterioration. Erosion from moisture and snow melt runoff is another challenge; deterioration on retaining walls near East Vail observed in 2018, along the westbound lanes, serve as an example of the challenge that moisture poses to maintaining the road and structures along this segment of I-70. During the winter, snow storms can result in major accidents that in turn cause the closure of I-70 over Vail Pass. Despite these maintenance challenges, the Vail Pass segment of I-70 remains in good operating condition and continues to serve as an important transportation facility in the Colorado high country.

6. National Register of Historic Places Evaluation

The Vail Pass segment of I-70 (5EA.1826.4/5ST.892.5) was evaluated for eligibility for the National Register of Historic Places (National Register) as a Linear Historic District and recorded on Management Data and Linear Component Forms from the Office of Archaeology and Preservation suite of Colorado Cultural Resource Survey forms. The following sections are reproduced from those forms and included with the historic context to support Mead & Hunt's determination that the property is a linear historic district considered individually eligible for the National Register under *Criteria A* and *C* applying *Criteria Consideration G* for properties that have achieved significance within the past 50 years.

A. Boundary description and location

The boundary reflects the location of structures, objects, and buildings associated with the historic significance of the Vail Pass segment. The boundary is defined as the current I-70 right-of-way, including the segment defined as Vail Pass, beginning at milepost (MP) 180 at the east side of Vail and ending at MP 195.2 at Copper Mountain, just west of Wheeler Junction. The boundary is expanded beyond the right-of-way to incorporate the Vail-Frisco Recreational Path and other recreational features such as Black Lake No. 1 and Black No. 2, which were associated with the construction or design of the highway segment but are outside of the current right-of-way. The boundary and associated resources are shown on the map titled "I-70 West Vail Pass Auxiliary Lanes APE/Historic Resources" in the OAHP site forms.

B. General description/location

The Vail Pass segment of I-70 is located in Eagle County and Summit County along the southern Gore Range near the Eagles Nest Wilderness Area and within the White River National Forest. The highway passes through the Gore Creek and Tenmile Creek watersheds. Eastbound and westbound lanes of the Vail Pass Interstate segment are situated on south or west facing slopes of adjacent mountain sides from East Vail (MP 180) to the Vail Pass summit at MP 190. Southeast from MP 190 the two lanes are divided by up to 820 feet with a creek and bike path between them as the highway descends to Copper Mountain (MP 195.2). The highway setting includes natural rock outcroppings, boulders, and hills of varying elevations. The highway parallels the Black Gore Creek from the Black Lakes near the Vail Pass summit to the Bighorn Subdivision in east Vail, and West Tenmile Creek flows through the wide median between eastbound and westbound lanes of the highway from south of MP 190 to east of MP 194. Vegetation within the area includes coniferous forest, grass meadows, riparian forests, and shrubs.

C. Summary of historic district and associated property types within the district

The Vail Pass segment of I-70 contains a cohesive grouping of designed and engineered structures, buildings, and objects united aesthetically and functionally as a distinctive transportation segment. While the features within the segment lack individual distinction, the assemblage of objects and structures achieves significance as whole under *Criterion A* in the areas of Transportation and Conservation, and under *Criterion C* in the areas of Landscape Architecture and Engineering.

The Vail Pass segment comprises both contributing and noncontributing structures, buildings, and objects. Contributing features are those that were constructed within the period of significance, possess a direct and important association with one or more contextual themes or areas of significance, and retain the integrity necessary to convey significance. Contributing features are contained within the Vail Pass resource boundary and include the road bed of both eastbound and westbound lanes, medians, bridges, retaining walls, embankments, sculpted rock cuts, landscape features, runaway truck ramps, access ramps, culverts, the Vail-Frisco Recreational Path, Black Lake No. 1, Black Lake No. 2, and the Vail Pass rest area. All of these features (constructed within the period of significance) lack individual originality in design or engineering but are contributing as functional features of the highway design. Bridges, retaining walls, culverts, and other features are not independently eligible for the National Register and only possess significance as components of the Vail Pass historic district. Also within the boundary are features constructed outside the period of significance. These features are noncontributing and include modern signage, a concrete sound barrier, jersey barriers, a lighted chain station, sediment retention ponds, maintenance sheds, and restroom buildings outside of the Vail Pass rest area. These features have been noted on the I-70, Vail Pass Segment Summary of Features table on the OAHP site forms.

D. Area(s) of significance

Engineering, Landscape Architecture, Transportation, and Conservation.

E. Period of significance

The period of significance is 1973-1978 as these were the years of construction for the Vail Pass segment of I-70.

F. Statement of significance

In 2005 the Advisory Council on Historic Preservation (ACHP) approved an exemption that relieved federal agencies from taking into account effects of their undertakings on the Interstate Highway System, except for a limited number of nationally and/or exceptionally significant elements associated with the system. As part of the Interstate Highway System, I-70 as a whole is exempt from review under Section 106. However, in 2006 the Federal Highway Administration published a list of exceptions to the Interstate exemption known as the “Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System” (Final List), available at https://www.environment.fhwa.dot.gov/env_topics/historic_pres/highways_list.aspx. The Final List included four portions of I-70 in Colorado: the Genesee Park Interchange, Eisenhower-Johnson Memorial Tunnels, Vail Pass highway segment, and Glenwood Canyon highway segment. These features were selected because they are considered to potentially possess exceptional significance.. The entire length of I-70 in Colorado did not rise to the level of exceptional significance to be included on the Final List; therefore, the entire resource is not eligible for inclusion in the National Register of Historic Places (National Register).

Mead & Hunt, Inc. (Mead & Hunt) recommends that the Vail Pass segment of I-70, which is defined as the portion from MP 180 to MP 195.2, possesses exceptional significance at the statewide level because it represents an important aspect of highway planning, design, and construction in Colorado. The Vail Pass segment of I-70 represents a historic district as it contains a cohesive grouping of designed and engineered structures, buildings, and objects united aesthetically and functionally as a distinctive transportation corridor. While the features within the segment lack individual distinction, the assemblage of objects and structures achieves exceptional significance as whole under *Criterion A* in the areas of

Transportation and Conservation, and under *Criterion C* in the areas of Landscape Architecture and Engineering.

Criteria Consideration G

Completed in 1978, Vail Pass has not yet reached the 50-year age requirement set forth by the National Park Service. However, under *Criteria Consideration G: Properties that Have Achieved Significance Within the Past Fifty Years*, the Vail Pass segment of I-70 exhibits "exceptional importance" at the statewide level as a resource with direct and significant associations with important events in the development of Colorado transportation networks and early solutions to the conflict between environmental concerns and highway construction that set standards for later Colorado projects.

Criterion A

The Vail Pass segment of I-70 represents a historic district as it contains a cohesive concentration of designed and engineered structures, buildings, and objects united aesthetically and functionally as a distinctive transportation corridor. Under *Criterion A*, the Vail Pass segment of I-70 possesses exceptional significance in the areas of Transportation and Conservation.

In the area of Transportation, Vail Pass provided a critical link in the I-70 mountain corridor, which led to an expanded transportation network in previously remote areas of the Colorado high country in the latter half of the twentieth century. Original Interstate plans had I-70 ending in Denver with no link across the western portion of the state. Years of debate and the efforts of politicians, boosters, and state highway engineers resulted in the 1957 decision to extend I-70 west from Denver across the challenging terrain presented by the Continental Divide. Subsequently, national controversy emerged over the highway's planned route through the Gore Range-Eagles Nest Wilderness. Ultimately, this route, known as "Red Buffalo," was rejected in favor of the Vail Pass route. The completion of the Vail Pass link in the controversial mountain corridor of I-70 resulted in the expansion of transportation corridors throughout previously remote areas of the Colorado high country. Therefore, the highway segment is exceptionally significant in the area of Transportation.

Vail Pass is also exceptionally significant in the area of Conservation as biologists, water quality specialists, designers, engineers, and construction crews developed several innovative solutions to environmental issues presented by the highway's construction in a highly sensitive area. These solutions included complex temporary and permanent erosion control measures, the construction of a designated wildlife underpass, improvements to stream habitats and ponds, and sensitive channel relocations that improved the health of fisheries that had been disrupted by earlier projects. Therefore, Vail Pass is exceptionally significant in the area of Conservation.

Criterion B

Research did not reveal direct associations between the Vail Pass segment of I-70 and any individual that singularly possesses significance for their association with Vail Pass. Although the highway segment bears the name of former State Highway Engineer Charles Vail, it was constructed several decades after his death and adopted his namesake from the preexisting portion of US 6 across the mountain pass. The Interstate segment is only loosely associated with Charles Vail and does not represent his career or achievements across Colorado. Furthermore, the construction of I-70 and the Vail Pass segment was the result of the work of collaborative efforts between numerous individuals, organizations, and agencies rather than a single person. Therefore, this highway does not possess significance under *Criterion B*.

Criterion C

Under *Criterion C*, the I-70 Vail Pass segment possesses exceptional significance in the areas of Landscape Architecture and Engineering as a transportation segment containing a significant linkage of structures and objects united aesthetically and functionally by a planned development. As a historic district, the highway segment and the associated features represent a significant and distinguishable entity whose components may lack individual distinction.

In the area of Landscape Architecture, Vail Pass exhibits a number of exceptionally significant innovations in highway landscape design. While landscape architects had been employed on earlier road projects, such as urban parkways, and to assist with covering construction scars after highway construction, their influence was a key element in the earliest design concepts produced for the Vail Pass segment. Unique and innovative landscape elements were integrated into the highway design to enhance the experience of motorists on the interstate segment; these elements included sensitive earthwork and slope molding techniques, sculpted rock cuts to match natural outcroppings, revegetation with native flora, and selective placement of “natural” features such as boulders, stumps, and old logs along the highway slopes. Furthermore, engineered features of the segment such as retaining walls and bridges exhibited qualities influenced by aesthetic principles of landscape architecture; unique retaining wall styles were used to blend into the landscape and create visual interest, and bridges were used over side valleys and hillsides when possible partly to minimize their visual impacts . Bridges, retaining walls, and some culverts were finished with iron oxide to create a reddish-pink hue to match the natural outcroppings of the Vail Valley. Additionally, several culverts featured a “barnwood” texture on their concrete headwalls and wingwalls. As an early example of a carefully designed highway segment, Vail Pass is exceptionally significant in the area of Landscape Architecture.

In the area of Engineering, the Vail Pass segment of I-70 possesses an exceptional level of significance as it represents early innovative design solutions that met Interstate safety and efficiency standards in a geologically constrained area while minimizing environmental and visual impacts to the landscape. The precast, segmented, concrete, post-tensioned, box girder bridges used on Vail Pass were the first of their kind Colorado and among the earliest used in the country. Due to their assembly method of construction, the use of precast elements reduced construction time and minimized impacts to vegetation. Their placement and orientation enabled trees to grow between bridge decks and only the area immediately surrounding the piers was disturbed. In addition to crossing creeks and streams, bridges were also used on hillsides and side canyons along Vail Pass to minimize terrain disruption. The use of bridges instead of the typical treatment involving major fill and culverts for drainage minimized visual effects to the natural landscape and enabled wildlife to cross the highway beneath the structures. The result of these designs is a highway segment that retains many of the slopes and valleys of the natural landscape and complements its surroundings rather than detracting from them. Vail Pass represents an early example of innovative engineering solutions in mountain highway design in response to environmental concerns and geologic constraints of the site; therefore, it is exceptionally significant in the area of Engineering.

Criterion D

For a property to possess significance for information potential, the information yielded by the property must answer specific important research questions that cannot be otherwise answered. The technology of highway construction is well understood and documented. As such, this highway is unlikely to yield important information that cannot be discerned from archived plans and other records. Therefore, this highway does not possess significance under *Criterion D*.

G. Condition/modifications

The highway segment has undergone routine maintenance since its completion in 1978 and remains in good operating condition. Some deterioration to retaining walls was noted during field observations in June 2018. Alterations to the roadway are consistent with routine maintenance for safety, maintenance, and noise mitigation, and include repaved and restriped travel surface; replaced guardrails; and added jersey barriers, noise walls, a lighted chain station, drainage culverts, sediment retention ponds, several restroom buildings, and CDOT maintenance sheds.

H. Statement of historic integrity related to significance

The Vail Pass segment of I-70 retains a high degree of physical integrity related to its ability to convey significance as an exceptionally designed and engineered interstate segment associated with expanded transportation segments, community development, and conservation in the region. While some deterioration, alterations, and additions to individual features are noted, the overall Vail Pass segment retains all aspects of integrity.

Materials, design, and workmanship

As a highway segment in continuous use since 1978, Vail Pass has undergone routine maintenance, including resurfacing and restriping of the roadbed and travel surfaces of both I-70 and the recreational path. These replacements appear to have been completed in-kind. While the actual materials of these structures have changed, the impact to overall integrity of materials and design is minimal. The most extensive alterations occurred in the 1980s when several segmented, concrete, box girder bridges between MPs 180 and 182 (F-11-AW, F-11, AX, and F-11-AV) required joint replacements. Based on a comparison of historic-age and current photographs, these rehabilitations did not diminish the overall aesthetic design characteristics of the bridges or the overall segment. The bridges retain integrity of design and workmanship necessary to contribute to the significance of the Vail Pass segment. In addition to the bridge alterations, the north headwall and wingwalls of the concrete box culvert crossing the Columbine Drive underpass have been resurfaced or painted and a wooden addition has been constructed at the top of the headwall. These alterations obscure the original “barnwood” textured concrete design of the culvert impacting the integrity of materials, design, and workmanship of this single resource but do not impact the overall integrity of the Vail Pass segment; the size and scale of this alteration is minimal given the length and number of resources within the segment. In addition to minor alterations, deterioration was observed on several precast curved panel retaining walls within the highway median and on both eastbound and westbound lanes. Concrete tiebacks of the retaining wall system appear to have failed and are falling forward away from the curved panels and some have begun to crumble. While this deterioration impacts integrity of workmanship to individual retaining walls in select locations, the retaining walls throughout the segment still exhibit their unique aesthetic qualities that set them apart from standard retaining wall systems. Overall, the Vail Pass segment retains its integrity of materials, design, and workmanship. With intact physical features, the segment continues to convey its significance as an interstate segment designed with careful consideration of the natural environment and use of innovative designs and construction methods.

Location, setting, and feeling

The Vail Pass segment of I-70 retains its integrity of location as it still follows the same alignment as selected for the highway in the early 1970s. Additionally, other contributing features of the highway appear to remain in their original locations as constructed. The highway segment has had few changes that affect its integrity of setting or feeling. Updates to the segment after the period of significance for safety, maintenance, noise mitigation, and conservation have resulted in minor additions such as replaced guardrails; added jersey barriers, noise walls, a lighted chain station, drainage culverts, sediment retention ponds, several restroom buildings, and CDOT maintenance sheds. These additions are minimal in nature and do not detract from the overall setting or feeling of Vail Pass. The segment's natural and landscaped features such as hills, sculpted rock cuts, natural rock outcroppings, creeks and streams, and the Black Lakes, remain largely unchanged. These intact natural and designed features of Vail Pass continue to convey a sense of time and place and exhibit the aesthetic qualities intended by its designers. Overall, the Vail Pass segment retains its integrity of location, setting, and feeling.

Association

Vail Pass retains its integrity of association to historic trends related to its exceptional significance. The segment continues to serve the same function as when it was completed in 1978, and through its recognizable physical elements, it continues to convey its significance as a critical link in the I-70 transportation corridor. The highway segment also remains visually and functionally connected to early planning efforts and development patterns in Vail. The highway segment remains the primary access route to Vail for westbound travelers and its influence in the growth of the town remains evident as development continues to concentrate along the I-70 corridor. The Vail Pass segment also continues to exhibit significance in its association to conservation efforts as its physical structures (bridges, retaining walls, culverts) and landscape treatments (sculpted rock cuts, revegetation areas, slope molding, creek relocations) which were designed to minimize ecological impacts, slow erosion, and reduce adverse visual effects to the natural landscape, remain intact and functioning as intended.

Bibliography

"Adirondack Northway Called 'Unique Link.'" *Poughkeepsie Journal*. September 16, 1967.

"Agencies Commended for Work on Vail Highway." *Louisville Times*, August 29, 1979.

American Association of State Highway and Transportation Officials. *The States and the Interstates: Research on the Planning, Design and Construction of the Interstate and Defense Highway System*. Washington D.C.: American Association of State Highway and Transportation Officials, 1991.

Associated Cultural Resource Experts. "Colorado State Roads and Highways." National Register of Historic Places Multiple Property Submission, 2003. http://www.historycolorado.org/sites/default/files/files/OAHP/crforms_edumat/pdfs/645.pdf.

———. *Highways to the Sky: A Context and History of Colorado's Highway System*. Prepared for the Colorado Department of Transportation, April 24, 2002.

Barton, Stoddard, Milhollin, and Higgins. *Vail Pass Alignment Studies and Design Concepts*. Prepared for the Colorado Division of Highways, March 1972.

———. *Vail Pass Environmental Study I-70 2(19), Vail To Wheeler Junction*. Prepared for the Colorado Division of Highways, 1972.

Barton, W. J. "Transcript of Proceedings of Public Hearing on Interstate 70 Vail Pass Design," June 19, 1972. Available at Region 3 Office, Colorado Department of Transportation, Grand Junction, Colorado.

Benson, Cade L. "Highway in Harmony with Its Environment." *Civil Engineering - ASCE*, September 1976.

Bureau of Outdoor Recreation. *The Selection of a Highway Route: Choices and Values: A Report on the "Red Buffalo: Section of the Interstate Highway 70 in Colorado*, January 1968.

"Centric Corp. Builds Bridges a New Way." *The Denver Post*, October 17, 1976.

Colorado Department of Highways. "Cast in Place Girder Form Traveler Miller Creek Bridge," 1977. Colorado Department of Transportation, Environmental Library.

———. "Concrete and Wood Retaining Walls," 1974. Colorado Department of Transportation, Environmental Library.

———. "Engineers on US 6," c 1970. Colorado Department of Transportation, Environmental Library.

———. "Gore Creek Joint Closure," 1977. Colorado Department of Transportation, Environmental Library.

———. *I-70 in a Mountain Environment: Vail Pass Colorado*. Prepared for the United States Department of Transportation, Federal Highway Administration Office of Development, 1978.

———. "I-70 under Construction near Vail Village," 1977. CDOT Library Archives.

———. "Precast Girders on Gore Creek," 1977. Colorado Department of Transportation, Environmental Library.

———. "Precast Retaining Wall," 1975. Colorado Department of Transportation, Environmental Library.

———. "Richard Lamm, Colorado Governor, at Vail Pass Dedication.," 1978. Colorado Department of Transportation, Public Relations.

———. "Steel Box Girder Black Gore Creek," 1977. Colorado Department of Transportation, Environmental Library.

———. "Steel Box Girder Closeup Black Gore Creek," 1977. Colorado Department of Transportation, Environmental Library.

———. "Vail Pass Archaeologists," 1975. Colorado Department of Transportation, Environmental Library.

———. "Vail Pass Jute Netting," n.d. Colorado Department of Transportation, Environmental Library.

———. "Vail Pass Trout Habitat," n.d. Colorado Department of Transportation, Environmental Library.

Colorado Department of Transportation. *100 Years of Colorado State Transportation History*. Denver: Colorado Department of Transportation Public Relations, 2010.

Colorado Division of Highways. "Award for Vail Pass Construction," February 19, 1976. CDOT Library Archives.

———. *Draft Environmental Statement Administrative Action for Project I 70-2(19) Vail Pass*, April 1972.

———. *Final Environmental Statement Administrative Action for Project I 70-2(19) Vail Pass*, September 1972.

———. *Through the Colorado Rockies: Interstate Colorado 70*. Denver: Colorado Department of Highways, c 1970.

Colorado Encyclopedia. "Vail Pass." Accessed October 7, 2018. https://coloradoencyclopedia.org/article/vail-pass-0#page-title.

"Colorado Ski History Timeline." *Colorado Ski Authority*, 2016.

Cousins, Bruce, Bob Cox, Linda Gaines, and John Hanna. *Interstate 70 Routing Project Economics vs. Aesthetics*, 1967.

"Design Boosted Costs Nationwide." *Fort Lauderdale News*. August 28, 1988.

Ditmer, Joanne. "Vail Pass Road, Bicycle-Hike Path Are Truly Environmental Jewels." *The Denver Post*, August 9, 1979.

E. Lionel Pavlo Engineering Co. *Interstate Highway Location Study : Dotsero to Empire Junction, State Project No. HPS-1-(20)*. Prepared for Colorado Department of Highways, 1960.

Federal Highway Administration. "Contributions and Crossroads - Timeline." *Federal Highway Administration, U.S. Department of Transportation*, n.d. https://www.fhwa.dot.gov/candc/timeline.cfm.

———. "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System." *Environmental Review Toolkit | FHWA*. Accessed August 5, 2018. https://www.environment.fhwa.dot.gov/env_topics/historic_pres/highways_list.aspx.

Federal Highway Administration, U.S. Department of Transportation. "Highway History." *Federal Highway Administration, U.S. Department of Transportation*, n.d. https://www.fhwa.dot.gov/infrastructure/mcdonaldtoll.cfm.

"FHWA History." *Federal Highway Administration, U.S. Department of Transportation*, September 12, 2012. https://www.fhwa.dot.gov/about/.

Henson, Henrie H. "Construction Difficulties on I-70 Vail Pass Segmental Concrete Bridges." U.S. Department of Transportation, Federal Highway Administration, August 1979.

Johnson, William N., and R. Scott Fifer. "Water-Quality Considerations for Highway Planning and Construction of the Vail Pass Project." *Transportation Research Record* 717 (1979): 40.

Keane, Melissa, and Simon Bruder. *Good Roads Everywhere: A History of Road Building in Arizona*. Phoenix, Ariz.: Arizona Department of Transportation, March 2004.

Kinstlinger, Jack. "The Start of Something Big." ???, no. January 1979 (January 1979): 16–17.

Litvak, Dianna. "Freeway Fighters in Denver, 1948-1975." University of Colorado at Denver and Health Sciences Center, 2007.

Lowdermilk, Robert H. "Meeting the Challenges of Environmental Restrictions in the Vail Pass Project (Abridgement)." *Transportation Research Record* 717 (1979): 18–19.

Marriott, Paul Daniel. *The Preservation Office Guide to Historic Roads*. Washington, D.C.: Center for Preservation Education and Planning, 2010. www.historicroads.org/documents/GUIDE.pdf.

"Michigan Freeway Wins Scenic Highway Award." *The Herald-Press*. October 22, 1963.

Milhollin, Austin B. "Environmental Constraints on the Vail Pass Project." *Transportation Research Record* 717 (1979): 2–5.

Milhollin, Austin B., and Cade L. Benson. "Structure Design and Construction on the Vail Pass Project." *Transportation Research Record* 717 (1979): 30–35.

Miller, Charles H. "U.S. Forest Service Involvement in and Overview of the Vail Pass Project." *Transportation Research Record* 717 (1979): 14–17.

Murillo, Juan A. "Modern Bridge Construction and Engineering Services." In *Managing Innovation: Cases from the Services Industries*, edited by Bruce R. Guile and James Brian Quinn. Washington, D.C.: National Academies, 1988.

Murillo, Juan A., James W. Englert, and Paul R. Steiljen. "Concrete Box Girders." In *Bridge Inspection and Rehabilitation: A Practical Guide*. Hoboken, N.J.: John Wiley & Sons, Inc, 1993.

National Park Service. *Lincoln Highway: Special Resource Study, Environmental Assessment*. Washington, D.C.: National Park Service, U.S. Department of the Interior, 2004.

National Register of Historic Places, Multiple Property Documentation Form. "Historic and Architectural Resources of the Lincoln Highway in Nebraska." Statewide, Nebraska.

Philpott, William. *Vacationland: Tourism and Environment in the Colorado High Country*. Seattle: University of Washington Press, 2014.

Podolny Jr., Walter. "An Overview of Precast Prestressed Segmental Bridges." *PCI Journal*, n.d. http://www.pci.org/uploadedFiles/Siteroot/Publications/PCI_Journal/1979/DOI_Articles/jl-79-january-february-4.pdf.

Prosence, Richard E. "Building I-70: The Story of the Development of Interstate Route 70 Between the Utah-Colorado State Line and the Continental Divide in Western Colorado," n.d.

Royston, Hanamoto, Beck & Abey (landscape architects) and Livington & Blayney (planners). *The Vail Plan*. Vail, Colo.: Town of Vail, 1973.

Seibert, Peter W. *Vail: Triumph of a Dream*. Boulder, Colo.: Mountain Sports Press, 2003.

Simonton, June. *Vail: Story of a Colorado Mountain Valley*. Dallas, Tex.: Taylor Publishing Company, 1987.

Subcomittee on Curved Girders: Joint AASHO-ASCE Committee on Flexural Members. "Survey of Curved Girder Bridges." *Civil Engineering - ASCE* 43, no. 2 (February 1973): 54–55.

Tang, Man-Chung, Khaled M. Shawaaf, and Juergen L. Plaehn. "Cast-In-Place Segmental Bridges in the Vail Pass Project." *Transportation Research Record* 717 (1979): 36–39.

"The National Environmental Policy Act of 1969, as Amended," January 1, 1970. https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/Req-NEPA.pdf.

"The Trailblazers: Brief History of the Direct Federal Highway Construction Program." *Federal Highway Administration*, September 2017. http://www.fhwa.dot.gov/infrastructure/blazer01.cfm.

"Those Vail Pass Bridges: Money Wasted." *Louisville Times*, April 20, 1983. Colorado Historic Newspapers Collection.

U.S. Department of Transportation, Federal Highway Administration. *America's Highways, 1776-1976: A History of the Federal-Aid Program*. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1976.

"Vail Pass Awards," April 8, 1980. CDOT Library Archives.

"Vail Pass Highway Design Wins Award." *Louisville Times*, November 2, 1978.

Weingroff, Richard F. "Addressing the Quiet Crisis: Origins of the National Environmental Policy Act of 1969." *Federal Highway Administration*, June 27, 2017. https://www.fhwa.dot.gov/highwayhistory/nepa/index.cfm.

———. "History of Scenic Road Programs." *Federal Highway Administration*, June 27, 2017. https://www.fhwa.dot.gov/infrastructure/scenichistory.cfm.

———. "Public Roads." *Federal Highway Administration, U.S. Department of Transportation*, February 6, 2018. https://www.fhwa.dot.gov/publications/publicroads/06mar/07.cfm.

Wiley, Marion C. *The High Road*. Prepared for the Colorado Division of Highways, 1976.

Wynkoop, Steve. "Vail Pass...a New Look in Highways." *Denver Post*, October 13, 1974.

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