# Historic Context and National Register Evaluation of New Mexico Department of Transportation Bridges

## October 2003

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**New Mexico Department of Transportation**

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# LIST OF ACRONYMS & ABBREVIATIONS

| | |
|---|---|
| **AASHO** | American Association of State Highway Officials |
| **AASHTO** | American Association of State Highway and Transportation Officials |
| **Assembly** | Territorial Assembly |
| **BPR** | Bureau of Public Roads |
| **CSWR** | University of New Mexico, Center for Southwest Research |
| **F.A.P.** | Federal Aid Project |
| **FHWA** | Federal Highway Administration |
| **HPD** | State of New Mexico, Office of Cultural Affairs, Historic Preservation Division |
| **ICC** | Interstate Commerce Commission |
| **NBI** | National Bridge Inventory |
| **NLGR** | National League for Good Roads |
| **NMGRA** | New Mexico Good Roads Association |
| ***NMHJ*** | *New Mexico Highway Journal* |
| **NMNBI** | National Bridges Inventory for New Mexico |
| **NMSHD** | New Mexico State Highway Department |
| **NMDOT** | New Mexico Department of Transportation |
| **NRHP** | National Register of Historic Places |
| **OPR** | Office of Public Roads |
| **OPRI** | Office of Public Road Inquiries |
| **ORI** | Office of Road Inquiries |
| **RFD** | rural free delivery |
| **SHPO** | State Historic Preservation Office |
| **State Archive** | New Mexico State Records Center & Archives |
| **Territory** | Territory of New Mexico |
| **U.S.** | United States |
| **VCHP** | Van Citters: Historic Preservation, LLC |
| **Wheelmen** | League of American Wheelmen |

Please note that throughout the context, the NMDOT is referred to in the context as the New Mexico State Highway Department, as it was named until the late 1980s. Likewise, the American Association of State Highway and Transportation Officials (AASHTO) is referred to as the American Association of State Highway Officials, as it was named until 1973.

# ACKNOWLEDGMENTS

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# EXECUTIVE SUMMARY


The New Mexico Department of Transportation (NMDOT) contracted with Parsons Brinckerhoff, Human Systems Research, and Van Citters: Historic Preservation, LLC (VCHP) to complete a survey of their system bridges throughout New Mexico to provide recommendations for eligibility to the National Register of Historic Places. The project was intended to provide a base for future work that would be completed under Section 106 of the National Historic Preservation Act of 1966, as amended.

The VCHP project team developed a historic context and methodology to aid in the evaluation process. The NMDOT gave the team an electronic copy of their national bridge database, which included 4,161 bridges. Using existing NMDOT national database fields and adding survey fields, the team created a survey database of 961 bridges dating from 1927 through 1974, which are under NMDOT maintenance responsibility. Two hundred fifty-six bridges in the database were constructed in 1953 or earlier (thus being 50 years old or older); 144 of them were under NMDOT maintenance responsibility and were field-surveyed to provide recommendations on National Register of Historic Places eligibility under Criteria A and C. Early in the project, the NMDOT and the State of New Mexico, Office of Cultural Affairs, Historic Preservation Division (HPD) determined that, as a statewide survey, it was only feasible to analyze the bridges at the national and state level of significance. Local research under Criterion A was considered beyond the project's scope.

One hundred and forty-four bridges were field-surveyed by the project team and included in the new database. Of these, 67 were recommended eligible for the National Register of Historic Places (NRHP), because they retained integrity and were associated with a specific period of bridge construction in New Mexico, or were on an important route (identified by HPD and NMDOT), or represented "the distinctive characteristics of a type, period, or method of construction" (NRHP 1991, 17).

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# 1.0 INTRODUCTION

The NMDOT initiated this project in an effort to identify bridges that meet the criteria for eligibility to the NRHP. Because the NMDOT receives federal funds, many of their projects are subject to the provisions of the National Historic Preservation Act of 1966, as amended, which requires the identification and evaluation of historic properties [Section 110] and consultation with the State Historic Preservation Officer (SHPO) [Section 106] if these properties have the potential to be affected.

Although a survey of bridges was completed in 1987, the State of New Mexico, Office of Cultural Affairs, Historic Preservation Division (HPD) requested that the NMDOT re-survey their bridges. This survey is meant to satisfy the requirements of Section 110 and to pave the way for a streamlined Section 106 process between the NMDOT and HPD. As such, the document is intended to serve as a management tool for the NMDOT to identify which bridges constitute eligible properties and as a reference for cultural resource management professionals.

# 2.0 HISTORIC CONTEXT

The history of New Mexico bridge building, as it relates to historic bridges under NMDOT maintenance responsibility, begins with the coming of the railroad. While the railroad competed with highway development in the east, in New Mexico it actually spurred the development of roads. As the railroad came into the Territory of New Mexico, roads were needed to get supplies to railroad construction sites and products (from farms and mines) onto the trains and into the regional economy, as well as to enable communication throughout the state. The most important part of road construction during the territorial and early statehood periods was the construction of bridges. Without bridges to cross the dramatic topography of New Mexico, teams and wagons could not transport goods to the railroads.

The early focus in New Mexico was on "getting the road through," which entailed quick grading of roads, adding spillways and dips at crossings where a bridge was not absolutely required, and constructing bridges where essential. When New Mexico achieved statehood, national funds began to flow into the state to aid in the development of roads, and the United States (U.S.) as a whole began to focus on creating a system of roads that would connect at state lines. Although a true Interstate system was not initiated until 1956, most of the highways that were developed after 1912 were planned with an eye toward standardization and interconnectivity within each state and across state lines.

Concrete was introduced into New Mexico bridge building during the Territorial period, but timber remained the primary bridge construction material until the 1950s. Concrete began to be used for bridges during the 1930s and then after World War II, but it was not until the 1950s and the construction of the Interstate system that concrete and steel bridges became common.

## 2.1 1903–1912: Development of Roads in Territorial New Mexico

Prior to the arrival of the railroad in 1880, the economy of the Territory of New Mexico (Territory) consisted primarily of agriculture and mercantile trade. New Mexican imports arrived principally via early east/west transcontinental trails, such as the Santa Fe Trail (Figure 1), or along established north/south Spanish trade routes, such as El Camino Real. The road system of this era was comprised predominantly of well-worn prehistoric Indian and early Hispanic paths and more recent Anglo trails, consisting of little more than ruts, which had served as primitive exploration, trade, and stage routes. Many of these underdeveloped "roads" were located in the dry streambeds of sandy arroyos, which were the paths of least resistance (NMSHD 1936:54).

The dramatic topography of New Mexico with its steep mountains, bluffs, mesas, deep arroyos with abrupt and sheer drops in elevation, and wide muddy rivers, is such that large-scale settlement could not occur until bridges were constructed over main waterways and large arroyo crossings. Until bridges were established, canyons and arroyos with precipitous edges could only be traversed by trails that led around them. Rivers also posed a problem with their high-speed flows, muddy beds, and quicksand whereby travelers could be swept away or become mired.

**Figure 1: Bridge on the Santa Fe Trail after 1914 repairs**

Source: French 1914

During Spanish colonial and early Territorial periods, the primary method of travel was horse and wagon. While those on horseback could traverse rough and steep terrain, hitching a wagon to a team made even minor crossings a problem as the team was stripped of its ability to climb and tackle rough areas with ease. The arduous nature of travel, the slow speed, and the rough country through which settlers were traveling contributed to the overall slow growth rate of the economy, which was altered dramatically when the railroads pushed into New Mexico.

During the late 1800s, the eastern U.S. was developing at an astonishing rate and there was a great hunger for expansion across the continent. Developing and conquering the West was promoted as Manifest Destiny, and the concept thrust settlers into the hinterlands. A series of military forts was the first sign of U.S. encroachment into the Territory. The forts were placed strategically at the margin of settlement to provide protection for early settlers. In the late 1800s, although the U.S. Army was still fighting Apaches in western New Mexico and Arizona, the railroad began to push into the Territory. The desire to conquer the West was reflected by the rapid expansion of railroad construction and development in the U.S., with track-miles growing from under 9,000 in 1850 to nearly 200,000 by 1900 (Nerhaugen 2001).

The nature of New Mexico's primitive road system changed in 1880, when the railroad penetrated into and through the Territory, bringing interaction with regional and national economies. This was further enhanced by the fact that New Mexico was positioned between the economies of the east and west coasts. New Mexico benefited greatly from the new railway routes through the introduction of new technologies, life-styles, and economic interest in the Territory. The railroads served as the major communication link, providing New Mexicans with a quick means of interaction with the rest of the U.S. For the first time, news and mail were only days if not hours old when they reached the Territory.

The railroads also brought people: tourists, health seekers, speculators and homesteaders could now travel from the east or west coast to the New Mexico hinterlands with greater speed and increased comfort. As economic activity increased in the Territory, so did the geographical area affected by the new economy. New roads thrust farther inland to facilitate settlement and development.

During the mid-1800s railroads dominated the economy and stifled the development of roads in the settled part of the U.S. (Sutter 1996:286); however, because the New Mexico Territory was late to develop with respect to the eastern states, the railroads actually spurred the first era of organized road and bridge construction and administration in the Territory. In fact, prior to the Federal Aid Road Act in 1916 most of the expenditures for public highways in New Mexico were for bridges (NMSHD 1936:54). Consequently, as the railroads moved through New Mexico and the automobile became popular, a sense of urgency developed to build bridges and roads to provide a connection between communities, to rail lines, and as a means of local communication within the Territory (French 1914:15).

A need for locally produced raw materials, horse teams, and labor came with railroad operation; the railroads required timber for ties and trestle construction, firewood and coal for steam production, and men for labor. This need was filled by new timber industries at Zuni, Dawson and Capitan; coal mines at Gallup and Raton; and copper mines in the southwestern part of the Territory (Meinig 1971:69). These raw materials required transportation to railheads generating a major need for bridges, since loaded wagons had great difficulty crossing many of the topographic barriers of New Mexico. As the economy of New Mexico and the Territory's need for efficient routes and bridges were growing, a national movement spurring the development of "good roads" was just beginning.

### 2.1.1 Good Roads Movement

An Albuquerque bicycle dealer/automobile enthusiast, R. L. Dodson, who brought the first automobile to town in 1897, was the local manifestation of a movement that was occurring throughout the country. Bicyclists were promoting the new means of travel and the need for "good roads" (Fitzpatrick and Caplin 1975:51). The Good Roads Movement was begun in the late 1880s by middle– and upper–class bicyclists who found the poor condition of American roads an impediment to their new hobby. To promote their cause, they formed a national activist group, the League of American Wheelmen (Wheelmen) (Weingroff 1993:1–2). To increase support, the Wheelmen attempted to impress upon farmers the importance of good roads to their livelihood, as roads were a primary means by which crops were transported to railheads and sent to distant markets. In general, farmers were in opposition to the Wheelmen's proposal. The farmers were concerned about increased taxes, losing control of rural roads, and the meddling of "city folks" (Sutter 1996:286).

During this period, just as New Mexico was beginning to develop and formalize roads and their administration, the poor condition of U.S. roads became a popular topic in national print. In the 1893 *North American Review*, New York Governor Roswell Flower wrote in his essay "How to Improve Our Roads":

> The circulation of literature on road construction, the agitation of the subject by the newspaper press, the efforts of highway leagues and wheelmen, all tend gradually to dissipate existing ignorance and prejudices. A complete revolution cannot be expected in

> a short time, but the success which has already been attained by advocates of good roads should certainly encourage them to persevere in their praiseworthy work (Flower 1893:630).

During the 1890s, the Wheelmen distributed upwards of five million copies of pamphlets, nationally, concerning road improvement. The most famous of these, *The Gospel of Good Roads: A Letter to the American Farmer,* appeared in 1891 (*Manufacturer and Builder* 1891:238). In the pamphlet, the author, Isaac B. Potter, did much to alienate farmers by creating a fictitious farmer called "Hubmire," who was portrayed as being backward, unreasonably conservative, and ignorant because he would not recognize the effect of poor roads on the nation. Rather than acknowledge the economic and community-related concerns of the farmers, the Wheelmen's rhetoric used condescension in an effort to intimidate them. As a result, the farmers were uncooperative and slow to forget (Sutter 1996:287).

While farmers would not provide support for the movement, bicycle manufacturers, represented by Colonel Albert Pope of Columbia Bicycles, did. They worked at the federal, state, and local levels to promote road improvement legislation. Their work led to the formation of the National League for Good Roads (NLGR) in 1892. That same year, the first NLGR meeting took place in Chicago and drew more than 1,000 attendees (Weingroff 1996a:1). Progress continued the following year with the establishment of the Office of Road Inquiries (ORI), a federal agency. General Roy Stone, who had served as vice president of the NLGR, became the head of the new federal agency, providing continuity in leadership and continuation of the good roads quest.

The focus on more organized attempts at road administration continued in New Mexico with the establishment of the New Mexico Good Roads Association (NMGRA) in 1909 (New Mexico Good Roads Association 1913:cover) (Figure 2). The NMGRA's objectives were:

- To arouse sentiment for road improvement throughout the State of New Mexico;
- To strive for wise, equitable and uniform road legislation;
- To aid in bringing about efficient road administration in the state;
- To seek continuous maintenance of all roads, the classification of roads according to traffic requirements, payment of road taxes in cash and the adoption of the principle of state aid and supervision; and
- To promote the principle of national aid in the construction of a great system of federal highways (New Mexico Good Roads Association 1913:123–124).

**Figure 2: The New Mexico Good Roads Association 1913**

Source: New Mexico Good Roads Association 1913

By the time the Good Roads Movement moved into New Mexico, the rhetoric was greatly toned down and was based primarily on facts concerning transportation costs, taxes, and cooperation. The NMGRA Chapter was keenly aware of the need for funds for road and bridge construction and saw the farmers as a large voting block that could help to leverage the required funds. The NMGRA was much more respectful of the New Mexico farmer than earlier language of the Wheelmen had been to farmers in the Midwest and East. Rather than alienate them, the NMGRA provided information for farmers to ponder (Lester 1913:1).

At the October 9, 1913, NMGRA meeting in Albuquerque, Mr. Frances Lester gave a very passionate speech in which he stated that the farmers of southern New Mexico had been paying an inadvertent “sand and mud tax that amounts to over $10.00 a year for every man.” He was alluding to the fact that they were, in effect, paying for poor road conditions with higher transportation costs and delays (Figure 3). During his speech, he explained that the poor condition of the roads in the farming areas of Dona Ana County were costing farmers eight times more than would otherwise be needed to transport their crops to market. He stated, “We are tired of dragging our buggies and wagons and horses through deep sands and impassable mud holes and are determined that broken bridges and stalled teams shall be a thing of the past” (Lester 1913:2).

**Figure 3: Crossing the Rio Puerco in 1911; typical example of road conditions in New Mexico**

Source: Courtesy National Archives [7092]

His major objective was to get the NMGRA to promote the upcoming bond election of November 1913. He stated:

> A vote for this bond issue is a vote to borrow money at less than 5 percent and invest it in highways that will pay dividends of over 25 percent per annum; and it is a vote to put these dividends directly into the pockets of our common people (Lester 1913:4).

The dividends were to be indirectly paid by increased tourism and cheaper shipping costs of New Mexico products, as the local economy would prosper from increased transportation activity. To promote the need for good roads, he encouraged the association to "print pamphlets in both languages" [English and Spanish] and to "concisely set forth the arguments for affirmative action, and an organized distribution of the pamphlets throughout the state before and on election day" (Lester 1913:4). The fact that Lester would mention printing the pamphlets in English and Spanish provides insight into how important votes of the large Hispanic population of New Mexico were; a large enough voting block that it was critical to recognize the language difference and print separate pamphlets.

### 2.1.2 Rural Free Delivery

As the railroads were moving into the New Mexico Territory, a combination of Federal forces were developing in the background which were soon to have a substantial effect on New Mexico bridge and road development as well. The 1896 introduction of rural free delivery (RFD), an experiment to provide farmers with free mail delivery, and the 1899 requirement that the RFD routes be maintained were the major factors that removed maintenance of rural roads from local hands, or farmers, to a more centralized organization (Sutter 1996:288). The Roswell-Torrance Auto Mail Line was one of the first automobile mail routes in the Territory and was most likely spurred by Laws of 1905, Chapter 7, which provided for the construction of public highways (Bryan n.d.; French 1914:1). Operations began on the 101-mile road in 1906, and it was designed to allow speeds of up to 20 miles per hour, although the pace surely slowed at bridges, which were somewhat precarious on this early mail route (Figure 4).

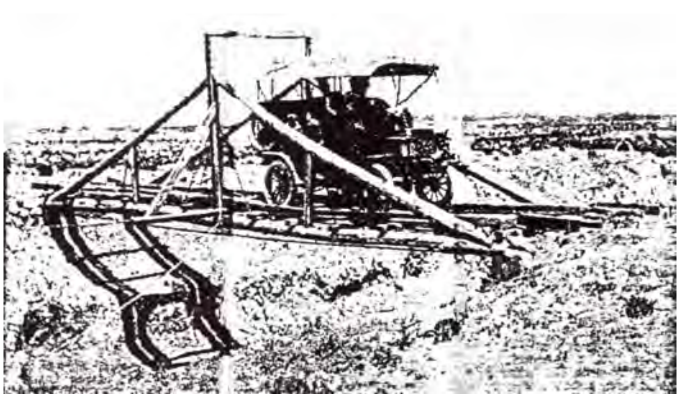


**Figure 4: Early timber truss makeshift bridge**

Source: *Albuquerque Tribune*, "Historic Mail!" No date.

The ORI had been established in 1893, and the new RFD aided the ORI Good Roads program by creating a sense of importance for the systematic development of good roads and continually reminding farmers throughout the country that without good roads, there would be no mail delivery (Sutter 1996:289). The need for well-maintained roads to provide communication served as a major impetus for the farmers to support governmental agency road improvement, which the Wheelmen with their volatile rhetoric had not.

### 2.1.2 Federal Government and Road Administration

The ORI became the U.S. Office of Public Road Inquiries (OPRI) in 1899, an agency within the Department of Agriculture. The OPRI sponsored Good Roads trains, which were federally funded promotional tours that traveled the country from 1901 to 1903 to promote the development and construction of improved roads. At each stop, road-building techniques were demonstrated using equipment borrowed from construction machinery manufacturers (Weingroff 1993:3). Shortly after the OPRI tours, Good Roads Associations began to appear at the local level in states and territories.

In 1904, OPRI compiled road statistics for U.S. states and territories and reported that of the more than two million miles of rural public roads in existence, 108,283 miles were surfaced with gravel, 38,622 miles were paved with stone, shell, or sand; and 1,997,908 miles were dirt (Kaszynski 2000:27). For example, New Mexico had 15,326 miles of roads, but only 2 miles were improved. The maximum spent on road improvements in New Mexico was $10.80 per mile: the fifth lowest amount in the country (Rae et al. 1987:7).

The OPRI was renamed the Office of Public Roads (OPR) in 1905, when it had an annual budget of $50,000, and 10 employees. The OPR was a predecessor of the Federal Highway Administration. Its first director was Logan Waller Page, who was a driving force for modern road construction. He had served as a geologist and testing engineer for the Massachusetts Highway Commission in 1893 and the chief of tests for the OPRI. Page was a man of the Progressive Era and firmly believed that "fact- and data-based technicians" would solve the problems of society. Under his leadership, OPR revived Good Roads trains, developed experimental roads to test construction methods and materials, and increased its outreach schedule from 150 lectures in 1905 to 1,132 by 1912 (Weingroff 1993:3–4; 1996b:1).

While the federal government was formalizing OPR, the automobile became an integral part of the U.S. economy, dramatically increasing the demand for better roads. Between 1908 and 1916, with the availability of the mass-produced Ford Model T, among others, the number of motor vehicles in the country increased from 500,000 to nearly 2.5 million. With this increase in motor vehicle traffic, even the best-constructed early roads began to disintegrate under the constant pounding and unprecedented vehicle speeds and weights. This resulted in a revived impetus for the state and local governments to improve road and highway systems (Kaszynski 2000:27). During this period in New Mexico, the Laws of 1907, Chapter 49, created the office of the Territorial Engineer and the Laws of 1909, Chapter 42, created the Territorial Road Commission. The New Mexico State Engineer, James A. French, later wrote:

> As in many other states, the advent of motor-driven vehicles was probably the most important determining factor in the centralization of road building in New Mexico and its prosecution along systematic lines (French 1914:14).

### 2.1.3 Congress, Railroads, and Growth of the Trucking Industry

During the period when the government was formalizing federal agencies to address road issues, there was major turmoil surrounding the railroad industry. This turbulence ultimately caused significant erosion in the economic stability of the railroads and served to strengthen the need for highways. It began with a series of Congressional acts that were passed in quick succession. These acts served to regulate the industry and to provide the Interstate Commerce Commission (ICC) significant latitude and control over freight rates. Prior to the acts that were passed between 1903 and 1917, railroads could set their own freight rates, provide rebates to shippers and generally run at a high profit. The following Congressional acts served to bankrupt many of the major railroads by 1917:

1) Elkins Act of 1903 disallowed rebates on freight rates from railroads to favored shippers engaged in interstate commerce and made deviations from published rates a misdemeanor.
2) Hepburn Act of 1906 expanded ICC power to regulate railroads and authorized the ICC to set maximum rates. The Hepburn Act resulted in a series of fast appeals in the federal courts, and the courts accepted ICC rulings until evidence was amassed to the contrary—which, in effect, made the railroads guilty until proven innocent.
3) Mann – Elkins Act of 1910 removed federal courts from the process that resulted from the Hepburn Act. It also empowered the ICC to suspend proposed rate increases and prevent railroads from charging more for short hauls than long hauls.
4) Adamson Act of 1916 mandated an 8-hour day on the railroads as of January 1, 1917, which substantially increased labor costs of the railroads. No rate increase was granted by the ICC to make up for the increased costs (Kohn 1991:3, 103, 152, 204).

No major rate increases were granted by the ICC in the ten years between 1907 and 1917. The railroads applied to the ICC for rate increases in 1911, 1913, 1914, and 1917, but they were only granted minor increases in 1914 (Poole 1999:8). While the Congressional acts and the ICC were putting a stranglehold on the railroad industry, the independent trucking industry was growing exponentially. Nationally, by the late 1920s, the independent trucker accounted for two thirds of the three million trucks on the road; the remaining one third were owners with five or fewer trucks (Goddard 1994:86). The three primary reasons for growth of independent trucking were as follows:

1) The industry did not require significant amounts of money or skill to enter;
2) The government had not yet set standards; and
3) Trucking has an inherent flexibility of movement, which the railroads could not match (Goddard 1994:86).

Road acts were being passed concurrently with the early 1900s railroad acts, and shortly after the first road act was passed the ICC and Congress realized the extent of the effect of the acts regarding the railroad industry in that many railroads had gone out of business. With the Transportation Act of 1920, Congress, as an appeasement to the surviving railroads, instructed the ICC to set minimum freight rates. The Transportation Act was intended to ensure that railroads would receive an adequate income, while the ICC was granted more authority over entry, exit, and consolidation of the railroad industry (Kohn 1991:106).

Railroads had traditionally charged freight based on the value of the shipment rather than the true cost to transport, whereas truckers' fees were based solely on cost to move the product. As truckers began to ship expensive items, the railroad industry began to realize an increased loss of income (Goddard 1994:87). Setting minimum rates resulted in further weakening the railroads because the emerging trucking industry was able to skim much of the high-value, short-haul freight business.

In addition, during this period, the nature of cities was changing. Whereas during the railroad heyday freight had been shipped from a central core within cities, during the 1910s and 1920s businesses and manufacturers began to look for less expensive land on the outskirts of town. Truckers began to truck the goods from the new locations to railheads. While the railroad industry initially welcomed truckers in their role as short haulers, because short hauls were expensive for railroads to handle, the trucking industry eventually cut deeply into railroad industry profits when they began to ship directly from manufacturer to destination (Goddard, 1994:88). This shift in the transportation of products in turn increased awareness and the need for good roads:

> Just as ominous to railways should have been the popularity of the federal roads program, which in 1921 led Congress to declare as national policy that smooth-surfaced roads would link every county seat in the nation—that era's equivalent of pledging to land a man on the moon (Goddard 1994:91).

In New Mexico during the early part of the twentieth century, the growth of the trucking industry further strengthened the need for good roads and thrust bridge development into the forefront as a critical need. With the burgeoning trucking industry providing short-haul services to railheads, there was much more commercial traffic and these vehicles were heavier than ever before, requiring better roads and stronger bridges.

### 2.1.4 Territorial New Mexico Bridges and Roads

During the Territorial period, New Mexico was on the brink of a road and bridge development explosion. While road building had been a slow process in the East, with the convergence of events in a short span of time, road and bridge development in New Mexico was exponential. Some of the factors that affected their development include:

- The Homestead Act of 1862 facilitated settlement.
- The Railroads had bisected the Territory.
- The Railroads created a need for raw materials in order to build and maintain them.
- Railroads provided new markets for farm products.
- Automobiles became a necessity throughout the nation and more common in New Mexico.
- Congress was regulating the railroad industry, which provided momentum to the trucking industry.

As the railroad brought greater exposure to the national economy and resulted in the shift from horses and wagons to mechanical forms of transportation, New Mexico was beginning to conceive of road building projects, through the Good Roads Movement and the rising need for a better system of roads. The increased public awareness of roads and vehicles may have spurred Territorial Governor Miguel Otero to purchase the first "official" government motor vehicle for the Territory in 1904 (Kammer 1996:E-15). A number of doctors in Albuquerque also owned cars, and by 1910, motor vehicles had become common on the town streets (Stamm 1999:137).

The first public authorization of record for a road in the Territory occurred when the New Mexico Territorial Assembly (Assembly) approved the Territorial Road Act of 1903. The legislation was an attempt to associate the Territory "with the Good Roads movement now so popular throughout neighboring states of the West" and to provide work for prison labor (Gilroy 1936:8). The Territorial Road Act provided for funding and engineering assistance to New Mexico counties, which formerly had been responsible for roadwork projects without oversight of the Territorial government. This increasingly became a major problem as counties did not have engineers on staff and were not prepared for the engineering tasks required for road and bridge building. In addition, in response to petitions signed by citizens of Santa Fe and San Miguel counties, the act specifically authorized the construction of a "Scenic Route" through the mountains from Santa Fe to Las Vegas with an appropriation of $5,000. The counties were required to hire and pay a competent engineer to survey and design the route. The Santa Fe State Penitentiary Commissioners oversaw the construction of the road, and convicts provided the labor (Figure 5). This use of prison labor for New Mexico highway construction continued until the early 1920s. Both ends of this first route were constructed, but the project was never completed (NMSHD 1936:54, 67; Miller 1911:5).

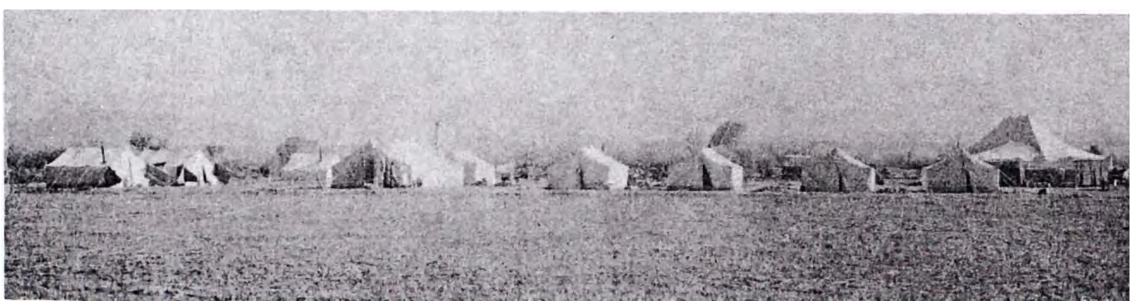


**Figure 5: Camp for convict crews during Territorial road construction**

Source: NMSHD 1972

In 1905, the Assembly designated construction of a new route by authorizing establishment of "El Camino Real" which ran along the old Santa Fe Trail from the Colorado state line to Santa Fe, and then south along the old Camino Real to the Texas state line north of El Paso. This twentieth century El Camino Real, which came to be known as U.S. 85, eventually became the principal north-south artery through the Territory (NMSHD 1936:57) (Figure 6).

**Figure 6: El Camino Real**

Source: NMSHD 1972

As with the 1903 Scenic Route, penitentiary commissioners were responsible for construction of El Camino Real, with the use of convict labor and the authorization to employ an engineer whose salary and expenses were to be paid by the counties in which the work was completed. The appropriation for El Camino Real construction was $10,000 and was enhanced by a general property tax levy of one-fourth mill (a mill being equal to a tenth of one cent, or a thousandth of one dollar). The counties were responsible for obtaining rights-of-way and constructing all bridges along the route under the supervision of the penitentiary project engineer. Cities and towns along the route were required to construct and maintain improvements within their incorporated limits (NMSHD 1936:57). However, the allocation of $10,000 was not adequate to complete the project. Preliminary work was begun in 1903, and in 1914, State Engineer French stated that this highway was "undoubtedly … destined to become, in the near future, the most popular route between the Atlantic and the Pacific in the West" (French 1914:8).

In the same year the NMGRA was formed, 1909, the Assembly established the Good Roads Commission [later known as the Territorial Roads Commission]. Concurrently, the Assembly appropriated $10,000 of road construction funds to be used conditionally for bridges (Sullivan 1910:165; NMSHD 1936:63). The Territorial Roads Commission consisted of the Territorial Governor, the Territorial Commissioner of Public Lands, and the Territorial Engineer. The three-person Territorial Roads Commission was given the responsibility of overseeing the repair, construction, and maintenance of highways built with Territorial monies; surveying county road needs; and cooperating with the boards of county commissioners (French 1914: 8–9). Prior to 1909, "bridges had received but scant attention and those built had been of the simplest and cheapest types" (NMSHD 1936:17). Most of these Territorial bridges were simple, timber beam, and makeshift in nature, with some built solely of wood wheel troughs supported by utility poles (Figure 7). Several years later, State Engineer James French commented that the 1909 Legislative action had "marked the commencement of road construction as a Territorial undertaking" (French 1914:8–9).

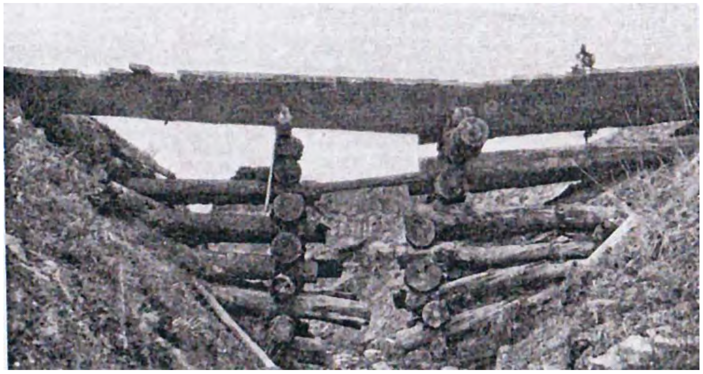


**Figure 7: Territorial timber bridge**

Source: NMSHD 1972

The policy of the Territorial Roads Commission was to establish a system of roads as economically as possible and to construct the most difficult portions. The intention was to encourage the counties to fill in the gaps using their own funds; however, under Chapter 43 of the Laws of 1909, the Territorial Engineer was to review projects involving the construction of county bridges and roads, whose cost was greater than $1,000 (NMSHD 1936:58; Sullivan 1910: 143). The Assembly also authorized the Territorial Engineer to review plans, specifications, drawings, and contracts issued by county officials for bridges and roads, and to make necessary changes to the documents. Nevertheless, the actual construction document preparation and initial engineering was still in the hands of the county commission. During this period, and with an increasing amount of technical information available from the OPR, the Territorial Engineer began to introduce a degree of coordination and uniformity in road and bridge construction. Territorial Engineer Sullivan's approach to road building was quantity as opposed to quality in an effort to construct as many miles as possible for the available funding, although he focused on constructing sturdy bridges that would withstand traffic and weathering (Sullivan 1910:171–172).

During the first two years of the Territorial Roads Commission [1909–1911], Territorial Engineer Sullivan oversaw the survey and platting of more than 500 miles of potential roads and use of convict labor for construction of 150 miles of new road and repair of 200 miles of existing roads. His staff researched and designed new routes, selected old roads for improvement and built new macadam, sand-clay, and gravel roads. Simply graded roads cost from $15 to $50 per mile. Sandy lengths were improved through "macadam" by mixing sand, water and clay in "proper proportions" and spreading the mixture on the roadbed in layers, and then covering that with a thin layer of gravel at a cost of $300 to $2,000 per mile; gravel roads were slightly cheaper. In the mountains, grades were kept to less than 9 percent and rockwork brought the price per mile up to $1,000 or more (Sullivan 1910:166–167).

The first highways built under the review of the Territorial Engineer were the scenic highway, which ran from Raton to the Colorado state line, and the road that ran from Roswell to Carrizozo. The Raton-Colorado route connected wtih a similar road built by the State of Colorado and created an 18-foot-wide pass to serve as a vital link to southeastern Colorado. This route was blasted out of mountainsides of solid rock in many places. Prior to construction of the road, it was a significant undertaking to take a team and wagon from Raton to Trinidad, Colorado, and the path was virtually impossible to traverse by automobile. After construction of the road through the pass, travel could be completed in an hour and twenty minutes. The Roswell-Carrizozo route also had major economic ramifications for its region. This route formed a vital link between the Atchison Topeka & Santa Fe Railroad at Roswell and the Southwestern Railroad [which eventually became the Southern Pacific Railroad] at Carrizozo. Besides linking two large railroad systems, it facilitated the transportation of agricultural products of the Hondo and Bonito river valleys to more distant markets (Sullivan 1910:172–173).

As the Territorial Roads Commission and Territorial Engineer began to oversee the development and construction of a road system in New Mexico, general bridge construction was still being overseen by counties, which were ill-equipped to design and provide construction administration for the structures. The Territorial Roads Commission focused on developing quality bridges and specified that bridges be built of timber, stone, or concrete, with a minimum width of 16 feet (NMSHD 1936:63). In search of an expedient, low-cost way to provide necessary bridges, some counties purchased manufactured bridges from contractors. Manufactured bridges had entered the marketplace soon after the arrival of the railroad, which facilitated the transport of their components. These prefabricated iron or steel truss bridges were sold through catalogues that were provided to county governments. Examples of companies that fabricated bridges included the Midland Bridge Company of Kansas City, Missouri; the Missouri Valley Bridge & Iron Company of Leavenworth, Kansas; and the Pueblo Bridge Company of Pueblo, Colorado (French 1914:36).

While the prefabricated bridges were expedient, many New Mexico counties were reluctant to spend the larger sums required to purchase them. Manufactured bridges were also problematic in that a bridge sold to a county government might not match the specific needs of a bridge site. The size, design, and price depended on vague specifications drawn up by New Mexico county officials unfamiliar with bridge building and were interpreted by contractors in another state who did not know the complexities of New Mexico topography. In later years, professional engineers disparaged manufactured bridges installed by counties for being poorly built, poorly aligned, and not sized correctly for traffic loads (Rae et al. 1987:7–8).

During the first year of the Territorial Roads Commission, Territorial Engineer Sullivan reviewed plans for nine bridges, including a two-span, reinforced-concrete, arch bridge over the Gallinas River at Las Vegas (Figure 8) and the Barelas and Alameda steel truss bridges over the Rio Grande near Albuquerque. County bridges that were approved included a bridge across the Vermejo River near Dawson and a bridge over Raton Creek at Raton. In his *Second Biennial Report*, Territorial Engineer Sullivan completed the first effort to list the major bridges of New Mexico (Sullivan 1910:146).

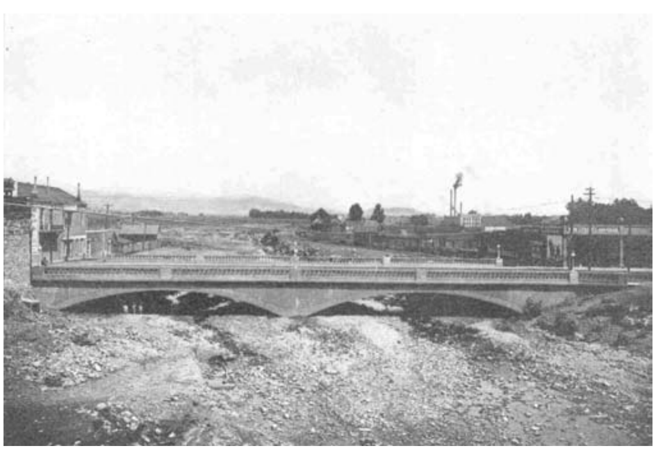


**Figure 8: Gallinas River Bridge (1910)**

Source: Sullivan 1910

Sullivan's successor, Charles Miller, who had served as Sullivan's assistant, documented in a letter to Governor William C. McDonald the continued policy of the Territorial Engineer to use allocated road funds to construct as many miles of road as possible for the available capital. In his letter, he outlines that 450 miles of "road" have been opened for public travel and clarifies that this does not mean 450 miles of road have been constructed:

> the idea has been to open up the country by cutting down the grades on the steep hills, shortening the roads, providing sufficient drainage, etc., over a large extent of country in order to induce public travel to go over same, rather than to build fine, expensive highways for only a short distance … (Miller 1911:2).

During this period, the Territorial Roads Commission and the Territorial Engineer were working to quickly develop a system of traversable roads, while primarily relying on the counties to provide for construction of bridges.

## 2.2 1912–1917: Statehood and the State Highway Commission

In 1912, the Territory of New Mexico was officially admitted to the U.S. as the forty-seventh state. With this new status, the Legislature passed the New Mexico Highway Act of 1912 and enacted an automobile license law with fees in order to raise additional funding for road and bridge construction projects. The first New Mexico license law required a flat fee of $10, and an additional fee of $1 for issuance and 50 cents to cover the cost of collection (NMSHD 1936:64). The New Mexico Highway Act also created the State Highway Commission, which consisted of Governor William C. McDonald, Land Commissioner Robert P. Ervien, and State Engineer James A. French (French 1914:9).

The new commission was based on the framework of the Territorial Road Commission, but with broader powers and more defined duties. The goals of the State Highway Commission included the establishment of the first state highways, the formulation of rules and regulations governing methods of construction, and improvement and maintenance of all highways receiving state aid. The State Highway Commission established a state road fund through the annual levy of one mill on every dollar of taxable property; in addition, the license fees contributed to the fund. The commission also required the formation of individual county road boards, appointed by the State Highway Commission. The county road boards assumed responsibility for all road and bridgework carried out within their respective county with the oversight of the State Highway Commission. By the end of 1912, all 26 county boards had been organized, and the State Highway Commission assumed its advisory role (French 1914:8–9).

The State Highway Commission and French worked to further the notion of quantity over quality for roadwork. French determined that the roads over the mesas were "generally in fair condition," the roads in irrigated districts were the "first needing attention," and that in connecting mesa and valley roads, construction through sand "wastes" and mountains was necessary. In improving these roads, French used cheaper local materials found within reasonable hauling distances, including earth, clay, sand, and gravel. French wrote, "I believe the materials noted, when properly selected and used in properly constructed roads, present an economic solution of the road-building problem in this State," that being the great mileage of road work possible (Figure 9). Though more sophisticated pavements were available, such as bituminous macadam (a paving material comprising bituminous-coated course aggregate), concrete, and vitrified brick, the expense ruled them out for New Mexico (French 1914:16–17).

**Figure 9: Grading of Glorieta Pass**

Source: French 1914

During French's tenure, consideration was given to the directness of routes and the benefits to the more populated areas of the state. In addition, standard plans and specifications for earth and gravel, clay, and sand roads were developed, and the engineer specified that structures for rivers and arroyo crossings should be built for permanence (French 1914:18). Many of the Territorial crossings for side ditches, small drainages, and shallow streams were managed by dips in the road and spillways; only in a few places, where they were deemed essential, were bridges constructed (Roser 1951:34). During French's tenure, a greater focus was placed on constructing bridges at crossings throughout the state to provide for roads that were more efficient.

### 2.2.1 State Engineer James A. French

French was a native of Washington, D.C. and graduate of Georgetown University. He developed a reputation as an excellent civil engineer on various Western projects, including the Elephant Butte Reclamation Project, which he completed just prior to his appointment to the position of New Mexico State Engineer. As a member of the State Highway Commission, State Engineer James French began his successful campaign to improve New Mexico roads. French held the position of State Engineer from 1912 to 1918, and then again from 1922 to 1924. During his tenure, he made dramatic improvements to the existing New Mexico road system, which he deemed "deplorable" in his first *Biennial Report to the Governor*. According to James A. French, "Up to [the establishment of the State Highway Commission], very little had been accomplished in systematic road building due to the sparsely settled condition of the state, to the general misuse of county road funds, and to the lack of a central, or state, organization" (French 1914:13). Immediately upon the organization of the State Highway Commission, its members outlined a tentative state highway system, connecting county seats and other populous towns and communities.

**Figure 10: James A. French**

Source: New Mexico Good Roads Association 1913

### 2.2.2 Changes in the Bridge Design and Construction Process

The year after the State Highway Commission was established, Legislature's Session Law of 1913, Chapter 32, provided for the construction of bridges (French 1914:8). The State Highway Commission was concerned with the "geological formations" in the state, the lack of bridges and roads, and the great mileage of roadwork necessary to facilitate inter-county communication. State Engineer French stated, "the demand for improvements permitting through traffic [are] immediate and urgent" (French 1914:16–17).

Under the 1913 law, construction of bridges that were funded by county levies was to be guided by county road boards, and construction of bridges under state monies provided by the new law was to be overseen by county commissioners. French found that bridge construction inspection and supervision were actually less expensive when conducted by his staff than by county commissioners. He and his office were able to work on bridge construction and administration through loopholes in the 1913 law, and he strove to change the 1913 policy. In addition, he organized his office so that J. W. Johnson was charged with designing and overseeing the construction of highways and H. K. Morgans assisted with designing bridges (French 1914:10). This was the first reorganization of highway engineers that separated bridgework from roadwork. French stated that:

> the methods previously followed in bridge building had been slipshod and unsatisfactory, and I determined to remedy these conditions as far as possible, by permitting only men skilled in bridge engineering to design bridges and supervise their construction. However, the present laws of the state are faulty, and it has been only by taking advantage of legal technicalities that this office has been able to assist the various counties (French 1914:10).

French also believed that one of the greatest faults in the 1913 bridge law was that bridge companies could design the bridges for which they were providing construction bids. He was aware that the standardized bridges offered in catalogues made no compensation for the fact that "each and every bridge site requires a special study, no two being alike, and in construction, different types of both substructure and superstructure are demanded" (French 1914, 11). Under this approach the bridge companies, in order to be competitive, would provide a design of the least expensive construction so they would be the lowest and therefore successful bidder. This left the counties with cheaply constructed bridges that were not well suited for the site or longevity (French 1914:10).

Under French's approach to the management of bridge construction, after the county received the construction documents and selected the contractor, the county road board employed the State Engineer as Project Supervisor. The State Engineer's office would then inspect and approve the project and the county road board would provide compensation to the contractor (French 1914:31).

State Engineer French followed the Territorial Engineers' focus on constructing as many roads as possible for the available funding, and providing the funding required to construct well-built, permanent bridges. French believed New Mexico would benefit from higher standards and better bridges by shifting the responsibility of bridge construction to his department. Toward this end, he began working to allow his staff to design and oversee the construction of bridges. However, he was only able to truly establish centralizing bridgework after passage of the Highway Act of 1917 through which bridges were deemed part of a "highway" and capital to building them was no longer provided by special levies or funds (Dwyre 1946:22).

After the Highway Act of 1917, State Engineer French required that bridge requests be submitted to his office for an accurate survey and map of the location, as well as for the preparation of plans and specifications. French and his department strove to design the appropriate bridge using the suitable type for the individual crossing site. Construction documents were produced by his office and provided to counties for use as a basis for bidding each project. As engineers, they performed rudimentary cost/benefit analyses, taking into account the climate, topography, and issues specific to each site. French's engineers compiled basic climatic data for each region and cooperated with railroad bridge designers to analyze the climate and topography to try to quantify water run rates through ephemeral streams and arroyos as a means of ensuring that each bridge design would be appropriate for its site (French 1914:31).

French's department typically designed bridges over perennial streams using concrete and steel, as solid foundations worked well for this application (French 1914:17, 32). Perennial streams are geomorphologically mature: in other words they are "in balance" and have just sufficient energy to transport their loads. They neither erode nor deposit, and as such have a minimal effect on a bridge structure (Lobeck 1939:223).

However, engineers were presented with major design issues at arroyo crossings, the most numerous type of features they would have to cross to create a road system in New Mexico. Geomorphologically, arroyos are young streams. Theoretically, the load carrying power of a young stream is proportional to as much as the sixth power of the water velocity (Gilbert's Sixth Power Law). This means that if the water velocity is doubled, the size of particles comprising the load may be increased up to sixty-four times. The stream load is the amount of rock, sand, silt, and eroded material that can be transported downstream. The character of the load particles is very important, as large particles create huge amounts of stream floor and bank erosion. This type of stream not only cuts down its valleys but also exhibits virility in the development of tributaries, which occurs through erosion (Lobeck 1939:193). The State Highway Engineer had to take special care when designing crossings over ephemeral streams and arroyos (Figure 11).

**Figure 11: Typical bridge crossing at arroyo – Nogal Canyon**

Source: French 1914

Permanent concrete or stone culverts were used at small arroyo crossings. However, bridges over medium-sized and large arroyos were difficult to design. In such arroyos, water velocities are unpredictable and hard to measure: maximum flow can occur minutes after a cloudburst and subside quickly, making direct measurement difficult, unless someone was onsite during the event. It was important for engineers to design for maximum flow in order to ensure stability of the structure they were designing. In 1923, New Mexico engineers asked local inhabitants to go to arroyos shortly after a rainstorm and take photographs of the flow so the NMSHD could use the flow information to develop their designs (Fulton 1923:3). To design for maximum flow and the forces of erosion, NMSHD designed longer bridges to secure solid foundations at the abutments, and if they were required, intermediate piers were designed with deep pile foundations (French 1914:18, 32).

During his first service as State Engineer, French was prolific in bridge building. Between 1912 and 1914, seventy-two bridges were built in New Mexico. Forty-five were wooden trestle and varied from five to one hundred feet in length. Other types included steel spans, steel spans with wooden trestle approaches, steel I-beams, and short-span, concrete-slab bridges (French 1914:33). From 1914 to 1916, one hundred eight bridges were built: ninety-four were timber, thirteen were steel, and one was concrete (French 1916:26).

### 2.2.3 Federal Road Act of 1916 and Its Impact on New Mexico

Four years after New Mexico became a state, Congress responded to the public demand for good roads by passing the first Federal Aid Road Act of 1916, which authorized $75 million to be spent on road construction over five years, with an allocation of $5 million the first year. The act was set into motion by the American Association of State Highway Officials (AASHO), who were working to coordinate highway planning and construction at the national level. In 1915, Thomas H. MacDonald headed a small AASHO group to draft a federal aid bill for national road construction to submit to Congress, which included funding for RFDs and a limit of $10,000 per mile. The AASHO proposal became the basis of the act that was passed (Kaszynski 2000:53–54).

The Federal Aid Road Act funds were provided for post road upgrades and apportioned based on land area, population, and post road mileage for each state. State highway agencies were the recipients of the funds, prepared the plans, and oversaw construction and maintenance, but all work was subject to federal approval and inspection. The federal share of project costs was 50 percent up to $10,000 per mile. As well as providing funding to states, the act authorized $10 million to construct roads on federal lands (Weingroff 1993:5).

Many states, including New Mexico, waited for their regular legislative session of 1917 to ratify the new law. The New Mexico Legislature agreed to the provisions of the Federal Aid Road Act by creating the Highway Act of 1917 (NMSHD 1936:59). The Highway Act:

1) Continued the State Highway Commission, but it became bipartisan;
2) Renamed the State Engineer the State Highway Engineer;
3) Authorized NMSHD to enter into contracts with the federal government;
4) Pledged the state to raise the money to match the federal aid on a 50-50 basis;
5) Provided a statewide property tax of one mill on each dollar and one-half of the net receipts from motor vehicle licenses;

6) Provided more centralized control for bridge design and construction; and
7) Specified "not less than twenty per cent of all funds accruing to the state road fund be used for maintenance" (French 1918:9, 108–116; NMSHD 1936:60).

After the Highway Act was passed, 6,500 miles of New Mexico roads were selected for improvement and state roads were designated numbers from 1 to 66. Whereas 108 bridges had been constructed in the two years prior to the act, 260 bridges and 1,200 culverts were built in New Mexico in the first year after the act. By 1920, the state highway system included 83 numbered roads with 7,587 improved miles (French 1918:9).

As new roads began to be constructed, the demand for new and better technologies, testing, and experimentation became a growing preoccupation of road and bridge engineers around the nation, as a means of building roads that would withstand the wear and tear of growing automobile and trucking industry traffic. By 1918, the Bureau of Public Roads (BPR), the 1918 successor to the OPR [which had been renamed the Office of Public Roads and Rural Engineering in 1915], began testing impact forces of various wheel loads on an experimental road farm in Virginia (Kaszynski 2000:54; Weingroff 1996a:3). In New Mexico, the State Highway Commission began to cooperate with national organizations and other states to conduct experiments for the advancement of highway construction methods and materials by carrying out materials surveys, investigations, and tests (Burks1924:5).

New Mexico financed part of its 50 percent contribution to federal aid projects through one-half the proceeds of the motor vehicle license fees and the continued one mill levy (French 1918: 113–114). Counties were responsible for half of New Mexico's contribution, which they could collect through a mandatory 3-mill levy. In 1919, the state levy for roads was raised from one to one-and-a-half mills (NMSHD 1936:64). County commissioners were required to apply to the State Highway Commission for their share of state aid money, to designate where the improvements should go, and to satisfy the commission as to the ability of the county to meet its share of the cost (NMSHD 1936:58–59).

In addition to the above, the Highway Act defined that "necessary bridges, culverts and other appertaining structures on any highway shall be considered a part of such highway" (NMSHD 1936:63). From this point, bridges became a component of highway construction projects. They were no longer funded separately through levying taxes or developing specific bridge funds.

French's approach to road building and construction administration greatly improved construction contracting, and his wide, practical engineering and consulting background brought a new level of professionalism to NMSHD. He worked to gain control of road and bridge construction and inspection, plan and specification production, and finally bidding procedures, which were codified and standardized during his tenure.

French worked to change major flaws in the existing state laws via the New Mexico State Highway Act of 1917. After 1917, French worked on professional procedures of bidding and contract administration. As State Highway Engineer he added:

- Public advertisement for projects that were out for bid;

- Standardization of bid forms and requirements;
- Public bid openings;
- The right of the State Engineer to reject any and all bids received;
- Bid Bonds;
- Construction contracts between the State and the contractor;
- Payment requirements: Estimated payments would be paid monthly up to 85 percent completion. The final 15 percent was paid at time of completion. NMSHD would then pay on certification of the pay estimate by the State Highway Engineer. This general process is in effect today throughout the construction industry; and
- Eminent Domain Power: Rights-of-way could be acquired by eminent domain as a last resort.

During French's tenure the nature of the work environment for construction contractors changed:

> The Highway Department considered it to be their duty to get the roads built at the lowest possible cost and they did not give a ---- how many men went broke in the process (Moore 1924:13).

## 2.3 1917–1918: World War I

In April 1917, just as State Highway Commission activities were moving into high gear with the 1916 Road Act funds, the U.S. entered World War I. Throughout the nation, men who had been involved in the development of highways were sent to war in Europe, construction materials became less available, and a shortage of national railroad cars hampered the shipping of materials that were available. While causing a down in construction, the war also resulted in damage to U.S. roads. Because railroads were unable to keep up with military shipping, the trucking industry, which was growing as a result of the ICC restrictions on the railroad industry, seized the opportunity to secure interstate shipping. As trucks expanded their routes and number of trips, the roads in the states that did not have road maintenance funds quickly deteriorated (Weingroff 1996c:1). That Highway Act in New Mexico set aside 20 percent of the road funds for road maintenance. Combined with a population density that was lower than in the east, this resulted in New Mexico enduring the war with state roads in good repair.

The road damage in the U.S. during the war caused highway officials to consider whether roads should be designed to accommodate vehicles, or whether vehicles should be designed to accommodate roads. The entire issue of the June 1918 BPR magazine (see Page 1918) was devoted to the catastrophic road breakups caused by heavy wartime trucking. The question prompted the creation of new national principles and policies for highway improvement; weight became a critical factor in rural highway design (Jenkins 1967). This topic also drove AASHO to take a lead in the preparation of specifications for highway construction. Ultimately, roads were designed to accommodate vehicles, but with limitations. By 1931, New Mexico had incorporated a load limit of 18,000 pounds per axle with a calculation for loads on consecutive axles and limits of 800 pounds per square inch for rubber tires and 500 pounds per square inch for metal tires. NMSHD Bridge Engineer E. B. Van de Greyn reported that the limits protected bridges, which were being constructed at the time to accept "15-ton loading" (Van de Greyn 1931:34)

In 1918, in an effort to respond to the issues that the burgeoning interstate trucking industry was creating for roads, BPR began publishing the magazine *Public Roads*, a forum for sharing new technology and developments in the road building industry. In the first issue, May 1918, the BPR director, Logan Waller Page, explained the purpose and goals of the new publication:

> It will be our earnest effort—always with the support and cooperation of the highway organizations of the States—to present matters of special interest to those directly concerned with the construction and maintenance of roads, to bring to all the progress of road improvement throughout the country, [and] to discuss its problems and record its results (Page 1918).

Another unexpected result of World War I was a U.S. war surplus program. As part of its postwar demobilization process, the federal government distributed surplus trucks and machinery to state highway departments. As the government distribution continued, *Public Roads* ran articles on how to care for the equipment and convert it to civilian highway use. Under this program, New Mexico received 313 trucks and 29 cars; the trucks were adapted for use in bridge construction, mainly to transport derricks and pile driver rigs (Gillett 1920:52–54). The new equipment allowed NMSHD to drive 40- to 60-foot piles into riverbeds and facilitated repair of piers or bents of beam bridges and deck widening when necessary (Kammer 1996:E–28). The state also received items such as tents, wagons, harnesses, barbed wire, dynamite, concrete mixers, rollers, graders, hoists, and miscellaneous tools amounting to over $1.5 million (Gillett 1920:52). The equipment reflected the overall paradigm shift that was occurring in the industry, moving from construction completed by hand with horse-drawn vehicles to mechanization.

At the end of World War I, the need for changes in the federal aid highway program became evident. Funding expressly set aside for RFDs and the $10,000 per mile limitation of earlier federal acts, which were originally progressive, were now considered hinderances. Road construction methods and techniques had changed, road and bridge design was beginning to become standardized, construction materials were more permanent in nature, and more roads were being built. This resulted in funding for new, permanent roads running across state lines with larger economic implications than earlier rural post roads. Construction costs of these new roads were also much higher than in the past because they used new standards and materials that were more permanent. The new highway construction methods and economy that developed at the end of World War I marked the beginning of a new era in road development in the U.S.

## 2.4 1918–1931: Highway Standardization and Testing

Chapter 99 of the 1919 Session Laws of New Mexico effectively divorced county highway design, construction, and maintenance from the purview of the state. Under this new law, the State Highway Commission was responsible for maintaining and constructing primary roads, including main highways and connectors between all principal towns and cities, and responsibility for secondary and tertiary county roads was returned to the counties. Under

Chapter 154 of the 1919 Session Laws, the state levy for roads was increased from one-half mill to one and one-half mills. In order to meet the fiscal requirement for road construction under the federal aid program, the legislature passed Chapter 168, which authorized a mandatory property tax of three mills on each dollar in counties where federal aid roadwork was occurring during 1919, 1920, and 1921 (Conroy 1936:11; Gillett 1920:9).

To generate additional monies for the road fund, New Mexico also created a gasoline tax in 1919. New Mexico was the third state to impose a gasoline tax to support road construction. By 1928, many other states had joined the taxation bandwagon. The average tax rate was 3.04 cents per gallon, and by 1930, these state taxes had raised $490 million in highway revenues (Kaszynski 2000:59).

Materials and methods research became a primary consideration for road and bridge building during the late 1910s and 1920s. The national Highway Research Board, a division of the National Research Council, was formed in 1920 with two goals: to prepare a comprehensive national program for highway research to assist existing organizations in coordinating their activities, and to serve as a clearinghouse for information on current research. The *Proceedings of the Fourth Annual Meeting of the Highway Research Board 1924* reported the discussion of such topics as the use of calcium chloride as an accelerator and curative agent in concrete highways and the character of bituminous materials for surface treatment on earth and gravel roads (Upham 1925:109).

The Federal Highway Act of 1921 expanded the role of the federal government in road planning and served as the beginning of a national highway system by ensuring that roads would link from state to state. The act was spurred by the BPR and AASHO, who worked closely to coordinate planning for a network of national highways. The act provided a funding source for road construction, and it sought a balance between rural and urban needs through allocating up to 60 percent of the funds for highways that ran across state lines, but limiting state-to-state road construction to three-sevenths of the total state highway mileage. In addition, although the federal government would provide funding, highways constructed with federal aid in any given state could not exceed seven percent of the total road mileage in that state. Through the mechanisms put in place with the Federal Highway Act of 1921, federal aid to states increased to an average of $75 million per year during the 1920s (Kaszynzki 2000:54, 59).

Under the Federal Highway Act of 1921 seven percent rule, the New Mexico highway system could qualify for up to 3,332 federal aid project (F.A.P.) miles. Originally, federal aid to states was limited to 50 percent of the construction cost, as long as the total cost did not exceed $20,000 per mile (a figure that did not include bridges with a clear span of 20 feet or more). However, because there were large areas of nontaxable federal lands in the western states, Congress expanded federal participation in so-called public land states which increased the allotted federal aid in New Mexico to $24,603 per mile—a substantial difference from the 1904 allotment of $10.80 per mile (NMSHD 1936:62; Rae et al. 1987:7).

During the 1920s, in an address to highway engineers and officials, Dr. Glenn Frank spoke about the importance of highways and their effect on the national economy. In his speech he highlighted five points that were “directly attributable” to the work of highway engineers:

1) Saved rural communities from the isolation that starved men's souls and shrivel[ed] their spirits;
2) Reduced the narrow provincialism of American towns and cities by linking them up with other towns and cities;
3) Rendered the parcel post service possible;
4) Made possible a reduction in the cost of getting farm products to, and finished products from, railroad shipping points;
5) Made the educational and cultural influences of America available to wider and wider areas (Erwin 1954:15).

Dr. Frank's five points expressed how important the highways were in linking communities and providing a timely communication network. An important factor in the further development of highways and community links was the development of bridges. As more highways were constructed throughout New Mexico, there was a steady increase in bridge building.

The Bridge Engineering and Structural Division of NMSHD was established in 1922 in response to the increase in bridge construction and the necessity to update the methods of bridge design and construction (Figure 12). This new division was tasked to locate, map, plan, and inspect all bridge crossings throughout the state, as well as to record and manage all information relating to ongoing and past projects. French stated, "This method insures more accurate preparation of plans, avoids delays and confusion and furnishes a basis whereby a check on all proceedings is had when required" (French 1923:9).

**Figure 12: Pecos River bridge failure in 1924**

Source: Jarvis 1924

The NMSHD issued its first official publication of *Standard Specifications for Road and Bridge Construction* sometime during the late 1910s or early 1920s. During the 1920s, although U.S. highway engineers were turning to standardization where possible, they felt that standardization was not practical for complex bridge types. Parts of such structures, however, could be standardized, and simple structures, such as girders, slabs, beams, trusses and culverts, should be standardized (Ames 1925:11). State Engineer French alluded to a revision of the specifications in his 1923 *Report of the State Highway Engineer of New Mexico.* The revisions were accomplished after the "thorough study of conditions throughout the state, specifications of other State Highway Departments, private interests, and those of the U.S. Bureau of Public Roads were investigated" (French 1923:9). With such data, a complete set of revised specifications was produced, covering "all proceedings entering into and pertaining to Highway construction and maintenance" (French 1923:9).

The revised 1923 *Standard Specifications for Road and Bridge Construction* included twenty-three pamphlets, four of which were about bridge design and illustrate the prominent bridge types then in use: No. 30 Concrete Bridges; No. 31 Timber Bridges; No. 32 Steel Bridges; and No. 33 Arch Bridges. Forty-four Standard Plans were produced for different bridge and feature types. These Standard Plans were devised to be “economical to construct, have the least amount of material possible, and yet be of the best design to care for the conditions encountered” (French 1923:10). The standard plans included those listed on Table 1 as well as others for miscellaneous structures.

**Table 1: 1923 Standard Plans for Bridges and Related Features**

Source: French 1923, 10-13.

| Structure Name | No. of types | Standard plan numbers |
|---|---|---|
| Concrete abutments | 40 | F-18, F-19, F-20, F-23, F-24, F-26, SF-11, SF-12, SF-13, SF-14 |
| Reinforced concrete bents | 3 | F-25, F-27, F-28 |
| Concrete box culverts | 90 | C-1, C-2, C-3, C-4, C-5, C-6, C-7, C-8, SC-11, SC-12, SC-13, SC-14 |
| Standard steel truss bridges | 2 | BS-1, BS-2 |
| Siphons | 2 | S-1, S-2 |
| Spillways | 2 | D-3, D-4 |
| Reinforced concrete pipe culverts | 3 | M-16 |

During 1923, Standard Plans were used to construct 87 bridges, 1,258 pipe culverts, 5,500 linear feet of spillways, and 136 box culverts (French 1923:13). During this period, French’s Bridge Engineer, W. J. Fulton, constructed many spillways and culverts at shallow washes and arroyos and focused on constructing bridges with a significant roadbed and load-carrying capacity at larger watercourses. Many of these small arroyo bridges were constructed of timber with concrete sills; no railing, but one-foot high felloes (to keep vandals from using the railings as firewood); extra spans to eliminate abutments and contraction of the waterway; and a brush and rock dam downstream to eliminate scouring (Fulton 1923:3).

**Figure 13: "Economical bridge" on the Lamy-Encino road**

Source: Fulton 1923

Following the national trend to emphasize research and standardization of specifications and design during the early 1920s, French and his assistant G. D. Macy brainstormed the idea of using and augmenting the information from the State Engineer’s biennial reports to produce a journal. The purpose of the journal was to keep NMSHD employees informed of the many new road developments occurring in the state, as well as new technologies. The result was the 1923 publication of the *New Mexico Highway Journal* (*NMHJ*), the progenitor of the current *New Mexico* magazine.

In addition to a publication to keep staff up-to-date on highway issues and the trend toward research and standardization, in 1924, NMSHD established a materials testing laboratory. New Mexico was one of many states that established testing laboratories in the 1920s in response to rigid requirements by the Bureau of Public Roads (Burks 1924:5–6). The August 1924 *NMHJ* article titled "The New Road Materials Testing Laboratory" read:

> If [an engineer] is building a public highway, he must know the abrasion resisting qualities of the gravel that is available in the nearby stream beds. He must know the compression strength of that gravel when compounded with cement, sand and water, and built into a roadway for public travel … When bridges and culverts are to be built, [the engineer] must know the tensile, compression, shear and torsion strengths of beams, columns, rods, wire ropes, plates, bolts and other materials. He must know these things with a fine degree of accuracy and he must make preliminary tests until he is absolutely certain that the materials available or purchased meet specifications (Burks 1924:5).

The new laboratory was equipped with Olsen road materials testing machines such as a cementation briquette former, a standard ball grinding mill, and an automatic impact tester for macadam rock. By 1928, the laboratory included the study of subsoils, surfacing aggregates, concrete, steel, corrugated metal culvert pipe, asphalt, and creosote. It had tested materials involved in 85 F.A.P.'s totaling 1,000 miles (Campbell 1928:6–7).

During the 1920s push for standardization, roads were classified into categories, prompted in part by the beginnings of federal aid apportionments. Under federal aid, roads were defined as primary, secondary or tertiary—primary roads being state highways or roads funded under the Federal Highway Act (NMSHD 1936:55).

Also during the 1920s, road surface types in New Mexico were standardized and divided into categories:

- Graded only
- Caliche
- Gravel
- Crushed stone
- Cement concrete

Most 1920s F.A.P.s resulted in graded gravel roads rather than the hard-surfaced, asphalt and concrete roadways that characterized the late 1930s and 1940s. In keeping with the sense of urgency and approach of the Territorial Engineers at the turn of the century to link communities and resources in New Mexico, the BPR emphasized constructing serviceable roadways and providing bridges that were indispensable links for "getting the roads through," rather than completing high-grade, quality roadways (Kammer 1996:E-28).

Although most road projects were constructed with gravel surfacing, concrete became an increasingly common construction material in the U.S. during the 1920s, and concrete paving was introduced to New Mexico during this period. As with the rest of the nation, New Mexico was also learning the benefits of concrete paving. In December 1923, the *NMHJ* featured an article titled "Concrete Pavement Construction" and reported that 66 miles of paved highway between Santa Fe and Albuquerque, "of an older type of concrete construction," had stood up well to traffic. This project, F.A.P. No. 36, included a concrete portion that was 18 feet wide with a thickness of nine inches, which tapered to six inches for the last two feet from the side of the road. Four-foot gravel shoulders were built after the concrete was placed in order to give the roadway an effective width of 26 feet (Bail 1923:4).

During the mid-1920s, New Mexico began to realize the effects of tourism on the road system. Although NMSHD had experimented with concrete road sections, most the roads in the state were constructed of lower-quality materials that required higher maintenance. These materials did not stand up well to increased traffic. In 1923, the *Albuquerque Herald* reported that 48,000 tourist vehicles had passed through Albuquerque, and that same year State Engineer French stated that:

> The biggest problem we will have in New Mexico the coming few years, is to hold the improved roads we have constructed, in shape under the continuous stream of tourist traffic which is constantly increasing, so that the cheapest and most efficient maintenance methods will require careful study (French 1923:38).

By the end of the 1920s, the NMSHD constructed U.S. 66 through New Mexico. The highway ran from Chicago to Los Angeles connecting many of the main streets of rural America. In 1926, New Mexico's portion of U.S. 66 was 507 miles in length, connecting Glenrio, Tucumcari, Santa Rosa, Romeroville, Santa Fe, Albuquerque, Los Lunas, Correo, Grants, and Gallup. Because the highway was essentially a linking of local roads, a campaign began in the late 1920s to straighten the route to an east-west alignment through Albuquerque. This became a reality and by 1937 the road had been shortened to 399 miles, largely due to the efforts of Governor Clyde Tingley, who was responsible for obtaining a significant amount of New Deal funding for New Mexico (Kammer 1996:E-38).

### 2.4.1 Bridge Design and Construction

By the mid-1920s, as a result of testing and the push for standardization, the drill rig became a common sight along New Mexican highways. The drill rig provided investigative soil borings at proposed bridge sites. The NMSHD designed and built a drill rig not only to obtain information on the depth of rock, but also to obtain core borings to characterize soil and log the strata for bearing capacity and pile penetration. Up to that time, small hand augers or simple steel bars had been driven down as far as possible to test the ground. As a result, gravel was often mistaken for clay, and clay for rock. This sort of confusion in preliminary surveying had sometimes caused comprehensive revisions in bridge design to the extent that the first contractor had to be released and the contract re-let in accordance with the new and improved bridge design (Klein 1925:6–11).

Though steel and concrete bridges were becoming more plentiful (Figure 14), timber remained a mainstay. Throughout the 1920s, however, vandalism of timber bridges became a maintenance issue for NMSHD. People were using components of the wood structures as firewood. The vulnerability of this bridge type continued to be exploited into the 1940s. Through vandalism or accidents, the timber structures were easily burned, and they were taken apart or deteriorated naturally (Fulton 1923:3).

**Figure 14: Concrete F.A.P. bridge in 1925**

Source: Klein 1925

In the mid-1920s, significant effort was made to coat highway bridge timber and piling with creosote, a wood preservative made from an oily liquid obtained from coal tar. Previously, railroad engineers had determined that creosote-treated timbers had an extended life of 40 years, which was approximately double that of untreated timber. Increasingly, NMSHD engineers turned to creosote timber bridges to “get the road through” because timber bridges were easy to construct and could be inexpensively widened as load and traffic requirements increased. They found that the solid, creosote-treated beams shipped from the Northwest permitted a relatively inexpensive, low-maintenance bridge (Rae et al. 1987:14; Kammer 1996:E-28). The first creosote bridge in New Mexico was a trestle bridge built across the Rio Grande at Fort Selden in 1925 (see Figure 15 — a typical timber bridge). It consisted of nine 31-foot spans and a 20-foot roadway width. Over the next three years, New Mexico built more than a million dollars’ worth of bridges coated with creosote (Rae et al. 1987:13).

**Figure 15: Early standard plan timber bridge – Lincoln County**

Source: Van de Greyn 1930

During the 1920s and throughout the U.S., suspension bridges were considered an economical choice for spans up to 300 feet. Two such bridges were constructed in New Mexico, one near Abiquiu and the other at Otowi. In 1924, a suspension bridge was constructed across the Chama River near Abiquiu with a main span of 150 feet, approach spans of 50 feet, an eight-foot road width, and with the capacity for a five-ton dead load. The structure caused a sensation, inspiring locals to "frame excuses for errands to Abiquiu and Espanola just to 'try out the new bridge'" (*NMHJ* August 1924:27). Shortly thereafter, the second suspension bridge opened over the Rio Grande at Otowi, and it was considered "the latest practice in this type of bridge" (Campbell 1924:7). The floor and trusses of the bridge were constructed of wood, with the entire timberwork coated with asphalt, a preservative believed to add 5 to 10 years of life to the wood (Figure 16).

**Figure 16: Otowi Bridge**

Source: Campbell 1924

**Figure 17: Logan Bridge**

Source: Erwin 1954

The steel arch bridge was also used by NMSHD in 1922 when it constructed a 734-foot-long structure over the Canadian River at Logan with steel two-hinged arches resting on steel piers with concrete foundations. The arched bridge was designed to carry a 15-ton live load, and when it was opened was described as the NMSHD's "most notable achievement" (Kammer 1996:E-31).

### 2.4.2 Bridge Maintenance

E.B. Van de Greyn, who served as NMSHD Bridge Engineer from the late 1920s to the early 1950s, spearheaded a survey of all New Mexico bridges with 10 foot spans or greater. The division numbered, photographed and compiled data for each bridge. Van de Greyn proposed keeping the files up to date by filing a report form for each bridge when repairs and changes were made (Van de Greyn 1930:32–33). NMSHD found that the survey saved engineers a considerable amount of time in determining estimates for widening or strengthening bridges.

## 2.5 1931–1941: New Deal Highway Programs

During the early 1930s, the U.S. suffered from the Dust Bowl and the Great Depression. The Great Depression was a major economic decline that began in 1929 and lasted through the 1930s. It began with a catastrophic collapse of stock prices on the New York Stock Exchange in October of 1929 and a continuing steady decline of stock prices. By 1933, almost half the banks in the U.S. had failed and 25 percent of eligible workers were unemployed. Combined with a general loss of confidence in the U.S. economy this situation led to reduced spending, which in turn resulted in reduced production, employment, and tax revenues for federal and state governments. The combination of these factors generated a continued downward economic spiral. The Depression resulted in a steady increase in unemployment and economic malaise throughout the 1930s, which was further exacerbated by the Dust Bowl.

The Dust Bowl was a phenomenon that arose from a combination of the settlement that was encouraged by the Homestead Act of 1862 and climate. In the Homestead Act, settlers were allowed to lay claim to 160 acres of land. In the western portions of the Midwest and farther west, the arid climate meant that 160 acres would not support the level of farming required to make a living. In 1904, the Kincaid Act increased the homestead acreage to 640. However, because it was difficult to economically farm the land, much of the acreage was used for grazing until World War I. When the U.S. entered the war, the need for wheat rose. The Midwest farms used newly available, mechanized machinery to tame the land and plant the wheat that had been envisioned with the Homestead Act. After years of raising wheat, the soil became depleted and crops began to fail. At that point, livestock were turned out to graze in the wheat fields and their hooves further broke up the soil. In 1934, unusually strong winds picked up the pulverized soil from 16 million acres across the Midwest, creating dust blizzards and leaving 20-foot sand dunes in their path (White et al. 1979:329). The Dust Bowl added to unemployment, created a transient population, and worsened the already poor economy.

To recover from the effects of the Dust Bowl and the Great Depression, the U.S. government responded with numerous acts of Congress intended to put money back into the economy and the hands of the poor. This resulted in a number of fiscal vehicles for road construction, including the Emergency Construction Act and the National Recovery Act. Under these acts, specific categories of roads were funded.

Three categories of federally funded roads had already been created during the 1920s quest for highway construction standardization and testing: primary, secondary, and tertiary. Although roads were classified, New Mexico did not fully use the categories until relief act funding began to flow, as funding was provided through the following categories:

1) Primary System
    a. Federal aid highways
    b. Primary state highways
2) Secondary System: state highways not included in the primary system

3) Tertiary System: all other roads and streets that are not considered primary or secondary (NMSHD 1936:55).

### 2.5.1 Emergency Construction Act of 1931

In 1931, Congress passed the Emergency Construction Act, which provided $80 million in federal aid loans to states for highway construction (Figure 18). The act required that the loan be repaid to the federal government over a five-year period, beginning with fiscal year 1933, through deductions from regular federal aid appropriations to states. The allotment to New Mexico under this advance was $1,303,288 (Conroy 1936:13).

In 1932, the federal government enlarged the loan program with the sum of $120 million. This was administered in a manner similar to that of the first emergency loan and the government intended it to be repaid over a 10-year period beginning in 1938. Subsequently, these advance loans were converted to direct grants by revoking the repayment provisions. A second Emergency Construction Act was passed which amended the Federal Highway Act of 1921 by removing cost limitations per mile, permitting construction on federal roads in municipalities without restrictions, and allowing for exceeding the federal funding seven percent rule upon completion of ninety percent of the state's federal aid system roads (Conroy 1936:13).

**Figure 18: El Camino Real (U.S. 85) in 1932, a typical road completed with Emergency Construction Act funds**

Source: *New Mexico* [magazine] June 1932

### 2.5.2 National Recovery Act of 1933

The National Recovery Act of 1933 authorized $300 billion to states as a direct grant for highway construction. Of this amount, $400 million was allocated as the First National Recovery Highway Construction Grant. New Mexico received $5,792,935 under the First National Recovery Highway Construction Grant for highway construction. At least 50 percent of the funding was to be allocated for primary roads outside municipal areas, 25 percent for extensions of primary roads into and through municipalities, and 25 percent for the state secondary or feeder road network. New Mexico additionally received $326,203 for main highways crossing reservations and federal lands. The act also provided for federal participation in preliminary surveys, plan development, and estimates, and it required that one percent of the funds be used for landscaping and roadside improvements (Conroy 1936:13-14; Macy 1934:19–20).

During 1933, NMSHD completed a total of 550 miles of roadwork using fifty percent of the National Recovery Act funds set aside for the seven percent federal aid system. At the time, this was the largest number of road miles constructed during one year in New Mexico. An additional 350 miles of highway were built under the secondary highway program (Macy 1934:19–20) (Figure 19).

**Figure 19: Road construction during the 1930s**

Source: *New Mexico* [magazine] August 1932

In late 1933, in response to the droughts that caused the Dust Bowl, the NMSHD incorporated a federal drought-relief highway program that was intended to provide farmers with work through the winter. The projects under this program were called Drought Relief Projects, and they were funded when states made an application to the federal government to receive an emergency appropriation from the Public Works Administration. In New Mexico work through this funding vehicle amounted to $291,000 (Conroy 1936, 13). In 1934, the state improved 500 miles of secondary roads in the six counties that qualified for drought relief: Union, Harding, Quay, Curry, Lea, and Roosevelt. These relief projects were constructed using direct labor rather than contracting as hiring directly would ensure that the men would not be unemployed during the lengthy process of preparing plans, advertising for bids, and negotiating the contract (Macy 1934:20).

### 2.5.3 Hayden-Cartwright Act of 1934 and the Emergency Relief Act of 1935

In 1934, Congress passed the Hayden-Cartwright Act, which appropriated an additional $200 million for primary and secondary highways, adding appropriations for roads on public lands, national parks, and national forests. New Mexico received $2,941,700 under this act (Conroy 1936:14).

The following year, Congress passed the Emergency Relief Act, in which $800 million was designated for highway construction and railroad grade crossing elimination and protection. The funds were allocated through the Works Program. In New Mexico $2,871,396 was allocated for highway construction and $1,725,286 allocated for railroad grade crossing elimination and protection. Not more than 50 percent of these funds were to be used for construction on primary federal aid highways, 25 percent for construction on highways in metropolitan areas, and 25 percent for construction on secondary or feeder roads. Between 1931 and 1936, a total of 3,705 miles of state roads were constructed with federal aid funding (Conroy 1936:14–19).

Most roads in New Mexico were unimproved or only partly graded; however, gravel or crushed stone surfaces were becoming more common. During the 1930s, oil processing, rock asphalt, and concrete were just beginning to be used to surface the highways (Conroy 1936, 19; Campbell 1932:41–43). A national issue at the time was classifying road surface types for statistical purposes, and there was substantial discussion about the definitions of road types. The types of surfacing available in New Mexico during this period included (and were deemed "practically the same as those used in other states"):

- Primitive
- Unimproved
- Graded and drained earth
- Gravel or stone
- Bituminous surface-treated
- Mixed bituminous mat
- Bituminous penetration
- Bituminous concrete or sheet asphalt
- Concrete
- Brick
- Mixed bituminous
- Bituminous mat
- Bituminous mat with rock asphalt seal (NMSHD 1938:2–6).

Not all the types listed were used in construction of roads in New Mexico. Table 2 shows the types and total miles constructed in the state.

**Table 2: New Mexico Roads in 1938**

Source: NMSHD 1938:6

| **Road Type** | **Miles of road constructed** |
|---|---|
| Primitive | 36,419.9 |
| Unimproved | 12,570.8 |
| Graded and drained | 6,293.2 |
| Gravel or stone | 3,283.6 |
| Bituminous surface-treated | 268.3 |
| Bituminous mat (partial control) | 961.0 |
| Bituminous mat (precise control) | 1,268.7 |
| Bituminous mat with rock asphalt seal | 273.8 |
| Bituminous penetration | 99.3 |
| Bituminous concrete | 56.2 |
| Concrete | 74.7 |

### 2.5.4 AASHO Bridge Standards

The first edition of the AASHO's *Standard Specifications for Highway Bridges* was published in 1931. Since the advent of the motor vehicle, traffic speeds had increased dramatically and, by 1932, had reached 45 to 65 miles per hour. Reacting to the new standards, the *NMHJ* published an article titled "Trends in Highway Bridge Construction" defining four specific trends and technologies in the construction of bridges:

1. Building wider roadbeds on new bridges and widening those of old bridges to upgrade for the increased speeds of vehicles. The original standard had been 16- to 18-foot roadways for two-lane traffic on bridges; this was upgraded to 10-foot traffic lanes, creating a 20-foot width from curb to curb.

2. Providing improved alignments and grades to allow for higher vehicle speeds and better sightlines.

3. Using higher design loads for new bridges and increasing the load capacities of old bridges wherever possible.

4. Redesigning curbs and handrails to incorporate higher curbs and stepped curbs to protect railings. NMSHD worked to set the rail post back as far as possible from the curb face. On earlier bridges, truss spans had been damaged by trucks colliding with truss members (Van de Greyn 1932:36–38).

In 1931, Van de Greyn believed that many of the 1,800 bridges in New Mexico were inadequate to handle the gross vehicle weights used by the 1930s trucking industry. He believed that federal aid funds were sorely needed in New Mexico to modernize bridges. The state devoted a portion of its New Deal federal aid to strengthen, replace, or move older, deficient structures. In some cases, iron and steel trusses were moved to secondary or tertiary roads where heavier truckloads were not expected. During the 1930s, NMSHD also added many concrete bridges and steel spans with reinforced concrete floors (Van de Greyn 1931:34).

In addition, prior to Van de Greyn's tenure as Bridge Engineer, many arroyo crossings, which had been considered small and shallow, were constructed of concrete spillways as a means of stretching the highway budget and providing a greater number of crossings with the available funding. These crossings were considered both time consuming for the traveler, who had to wait for water flows to drop before crossing, and dangerous to those who did not realize the nature of arroyos and the sudden intensity of unexpected flows that could come down the channels from upstream. In the 1930s, Van de Greyn lobbied to construct bridges at these spillway crossings. He believed that the greater expense was merited to improve safety and that the gasoline tax and license fees would cover the cost (Van de Greyn 1931:34).

During the 1930s, Van de Greyn began his systematic survey of the existing bridges and culverts in New Mexico. Simple structures were documented on a "note" sheet, while more complex structures, such as trusses, girders, or multiple-span structures, were recorded on a special bridge sheet, Form No. 5. NMSHD noted in a 1938 report that there was a "definite length span which determines the classification as between culverts and bridges" but does not identify what that dimension was. The bridge survey data included:

1) Location by station and name of stream;
2) Type: truss, girder, I-beam, arch, culvert, etc.;
3) Materials: steel, timber, masonry, concrete, etc.;
4) Clear span or spans;
5) Width between curbs or clearance between railings where there is a roadway only. Width of sidewalks and paving, and clearance between railing where there are no curbs;
6) Maximum distance to stream bed or flow line below roadway surface of bridge;
7) Posted load limits, construction dates, etc;
8) Brief descriptions of important bridges consisting of two or more spans to clarify the above data;
9) Conditions; and
10) Sketches that showed dangerous alignments or grade conditions of bridge approaches (NMSHD 1938:11).

## 2.6 1941–1945: World War II

The onset of World War II halted much of the highway construction activity in New Mexico. Construction projects became limited to those funded by federal aid allocations approved for strategic network construction. Assistance from the Defense Highway Act of 1941 allowed New Mexico to build access roads to mines, timberlands, military installations, and airfields. One such strategic defense project was F.A.P. No. DA-RM 66, a section completed on State Highway Route No. 53 between Grants and the Navajo Fluorspar Mine. Although there were strategic construction projects in New Mexico, highway expenditures fell significantly during this period, from $2.6 billion in 1938 to $1.6 billion in 1944 (Rae et al. 1987:19). State Highway Engineer B. Dwyre forecast this decrease in spending:

> It is almost definite that funds will not be available for any future construction work financed strictly with state funds until after the war. Dependent as we are entirely upon gasoline tax and motor vehicle license fees for our revenue with which to operate the Highway Department, we are going to be obliged to retrench sharply in order to come within the limits of the funds which will be available (*NMHJ* July 1942:29).

As steel, tar, and asphalt shortages began to limit nonessential construction, bridge projects and maintenance were deferred. In the few projects that were carried out, NMSHD officials became very resourceful in their use of building materials. For example, in renovating the Howe-design timber truss bridge over the Pecos River at Terrero, contractors used steel hangers from other truss bridges that had been scrapped and salvage rail for the lower chords of the structure (Kammer 1996:E-39).

In addition, during the war there was much wear and tear on the existing NMSHD infrastructure. Kirtland Field contributed greatly to the traffic in the Albuquerque Highway District, both during and after the war. Many bridges in the Albuquerque Highway District were strengthened in 1945 and 1946 because they were in "a greatly weakened condition owing to heavy war traffic" (Dwyre 1946:35). The Deming Highway District also reported the repair of several bridges in 1945, which were most likely damaged by the increase in war traffic moving minerals from the area (Dwyre 1946:35). By the end of World War II, because of the focus on strategic projects, limited funding, and increased traffic, many of the highways and bridges of New Mexico required maintenance.

## 2.6 1945–1956: Post War Highway Construction

After World War II, road and bridge building and maintenance resumed, with highway spending reaching all-time highs. During 1947 and 1948, NMSHD expedited the contracting for the construction of 1,053 miles of road. Two hundred twelve miles of road were constructed or improved with wider rights-of-way and paved surfaces. Dwyre reported "higher standards [were] used in the construction of highways during this period than had been used in the past" (Dwyre 1948:12).

During the same period, a record $16 million was awarded for road construction and improvement, with another $4 million spent on maintenance. The largest single contract, $1,753,826, was awarded to the Skousen-Hise Contracting Company to construct 8 miles of divided highway on U.S. 66 between Albuquerque and Moriarty. Other work during this period included a new highway through Las Vegas, a divided highway at Raton, and improvements to U.S. 66 through Tucumcari (*NMHJ* February 1951:33; *NMHJ* March 1951:35).

**Figure 20: U.S. 66 in Tijeras Canyon prior to reconstruction**

Source: Healy 1944

By 1956, New Mexico had 62,836 miles of public road; 11,702 miles were state roads, and 7,141 of those miles were paved. At the time, there were 327 miles of four-lane highways (Wilson 1956:9).

### 2.6.1 Postwar Bridge Work

After the war, the NMSHD Bridge Department was concerned with keeping industrial and agricultural transportation moving. Before the war, untreated timber bridges had been adequate for the trucking industry, but by the end of the war these bridges had become "expensive maintenance problems" because they were deteriorating and not properly sized for postwar traffic (Van de Greyn 1948:96).

Because of limited supplies, delays in the delivery of materials, and difficulty in obtaining creosote treated timber and piling from 1945 to 1948, the postwar economy caused the Bridge Division to make some changes in their approach to bridge design and contracting methods. For spans of 25 to 33 feet, the Bridge Division began using reinforced concrete slab bridges on steel-bearing piles (Van de Greyn 1948:93). Scarcity of construction materials also created opportunities for creative contracting methods; in two instances structural steel and reinforcing bar were ordered by the NMSHD in advance and bids for the actual construction were taken just prior to the steel delivery. Using this method, the contractor could start work immediately after contract award (Van de Greyn 1948:93).

By the early 1950s, bridge designers began constructing structures with wider roadbeds and larger live load capacities, especially on primary highways. Primary system bridge roadbed widths ranged from 26 to a maximum of 30 feet. The minimum roadbed for primary roads was 30 feet. In an effort to bring the bridge roadbed and highway roadbeds into closer alignment, NMSHD began to widen existing bridges. During 1953, the bridge crew of the NMSHD Roswell Maintenance Division widened 25 timber bridges from a roadbed width of 20 feet to 28 feet. Four concrete bridges were also widened from a roadbed width of 20 feet to 28 feet in that district (Erwin 1954:44).

Fifty treated-timber bridges and thirty-one concrete and steel bridges were contracted for construction in New Mexico between 1949 and 1954 (*NMHJ* July 1954:37–39). Though treated timber was still suitable for many crossings, precast concrete deck bridges were being used in areas where short spans were allowable. Although timber bridges had typically been used for this type of crossing in the past, they had "advanced to the point where it became uneconomical to continue their use … where short span bridges are permissible" (*NMHJ* January 1954:28).

The New Mexico State Highway Department's *Standard Specifications for Road and Bridge Construction* was revised in 1954 (Erwin 1954:13). In 1955, bridges constructed using concrete were becoming more common and NMSHD reported that timber bridges were "almost a thing of the past" (Wilson 1956:84). Steel piling filled with concrete and capped with concrete beams began to replace timber piling and caps. Timber stringers were replaced by precast concrete girders and slabs (Figure 21).

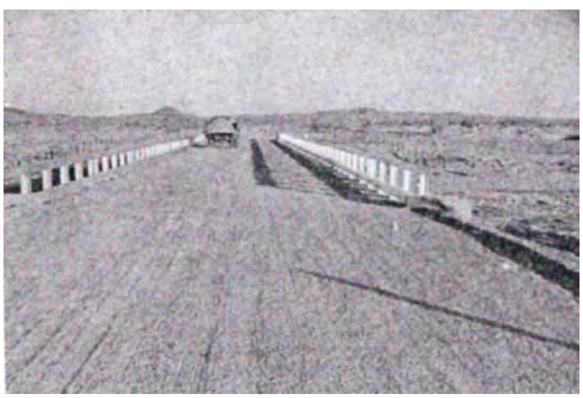
Precast concrete slab bridges differ from conventional bridges in how the concrete slabs are formed. In conventional construction, short-span concrete slab bridges are formed entirely from bridge end to bridge end on supporting false-work. Forms and reinforcing steel are placed prior to pouring the concrete. In contrast, the precast concrete bridges are built by casting concrete into small units (3 feet by 25 feet) on the ground (site-cast) adjacent to the bridge project site. The units are cured and then hoisted by cranes and placed on constructed piers. An additional approach taken by bridge engineers was to design continuous concrete slab decks using earth as a form. Soil was placed under the deck area, forms were set directly on the soil, and concrete then cast into the forms. This method eliminated expensive false-work and shoring. After the concrete deck had cured, the soil was removed and was placed in the embankment adjacent the bridge (Wilson 1956:55-58; *NMHJ* July 1954:37–39).

**Figure 21: Construction of pre-cast concrete bridge**

Source: Erwin 1954

In 1955, six short-span bridges with precast concrete deck units were built. This number increased to fifteen in 1956. A 1956 chart of the "Number and Cost of Various Bridge Structures on Highway Projects Placed Under Contract" reveals the five bridge deck types of the period:

- Steel and concrete bridges
- Cast-in-place, reinforced concrete slab bridges
- Cast-in-place, reinforced concrete, rigid frame bridges
- Bridges with precast concrete deck units
- Precast concrete girder bridges



Twenty-one precast concrete bridges were constructed during 1955 and 1956, three bridges on the primary system and eighteen on secondary and other highways. Fourteen steel and concrete bridges were built in the same two-year period (Wilson 1956:55–58).

**Figure 22: Pre-cast concrete bridge after construction**

Source: Erwin 1954

## 2.7 1956–1977: The Interstate System

President Eisenhower signed the Federal Aid-Highway Act of 1956 on June 29, 1956, which authorized the development of the interstate highway system. The new system included the design and construction of 41,000 miles of high-quality roads to tie the nation together. The Interstates were to be completed by 1975; 90 percent of the funding was to be provided by a one cent federal user fee charged per gallon of gasoline, and 10 percent of the costs was to be borne by the states through which the highways run. This user fee supports the Highway Trust Fund, which was created by the Highway Revenue Act of 1956 (Cox and Love n.d.:3–4; Weingroff 1993:8; 1996d:1). The interstate system was designed to accommodate the traffic loads that were anticipated 20 years after design of the highway began. This was the first highway system that included:

1) Fully controlled access to the road;
2) No intersections or traffic signals;
3) Grade separation at traffic and railroad crossings (which resulted in the construction of 55,000 bridges throughout the U.S.);
4) Divided highways with at least four traffic lanes (two each way);
5) Shoulders and curves engineered for safe travel at high speeds; and
6) The elimination of blind hills (Cox and Love n.d.:4).

According to the "New Mexico Highways Report to the People" of 1956, New Mexico had 11,702 miles of state road: 1,008 were interstate, 2,885 federal aid primary, 5,043 federal-aid secondary, and 2,766 other state roads. The report enthusiastically supported the new federal act, stating, "the New Mexico State Highway Department welcomes the opportunity to participate in building the network of roads so essential to the nation's defense and the expanding economy" (NMSHD 1956:3).

### 2.7.1 President Eisenhower

President Eisenhower was a strong advocate for the development of a national interstate system. As a young officer in 1919, he participated in the first transcontinental army motor convoy, taking nearly two months to drive from Washington, D.C. to San Francisco. During the trip, he learned the value of good roads (Figure 23). The convoy experienced the woes known to early motorists, including an endless series of mechanical difficulties, vehicles stuck in mud or sand, and trucks and other equipment crashing through wooden bridges (Weingroff 1996e:5).

**Figure 23: Lt. Col. Dwight Eisenhower and Major Brett Sereno on the U.S. Army's motor convoy**

Source: Courtesy of the New Eisenhower Library

During World War II, Eisenhower had also seen the efficient German *autobahn* (highway) network and recognized its value. Given these experiences, he was committed to providing good highways for the U.S. and stated, "The old convoy had started me thinking about good, two-lane highways, but Germany had made me see the wisdom of broader ribbons across the land" (Weingroff 1996e:6).

President Eisenhower's desire for an interstate system combined with earlier U.S. highway developments led to the creation of the Interstate. As early as 1944, Congress called on the states and the BPR [known as the Public Roads Administration from 1939 to1949] to designate a national highway system, and by 1947 individual states and the BPR had selected most of the routes. In 1954, states were asked to make a careful inventory of their highways and to estimate the cost of improving them to a standard that would accommodate the traffic demands forecasted to 1975, in anticipation of creating a true interstate system in the U.S. (NMSHD 1958:1-2) (Figure 24).

**Figure 24: NMSHD Bridge Section in 1954 – the group that first planned Interstate bridges**

Source: *New Mexico*, July 1954

### 2.7.2 New Mexico Interstates

As a result of the 1954 survey, the NMSHD anticipated passage of the Federal Aid-Highway Act of 1956 and began advanced preparations for a long-range expansion program. All NMSHD divisions stepped up production to prepare plans for interstate projects so that contracts could be bid as soon as the Federal Aid-Highway Act was made law. The first Interstate project in New Mexico, under the new act, was contracted on September 28, 1956, and five other Interstate projects were under contract by the end of the year. In late 1956, BPR reported that New Mexico ranked first in the nation in terms of the percentage of contracted federal funds under the provisions of the Federal Aid-Highway Act (Wilson 1956:11).

In 1957, New Mexico began construction of its interstate highways. I-40 was designed to cross the state from east to west following the general alignment of U.S. 66 from Tucumcari to Gallup. I-25 was designed to cross the state from north to south following the general alignment of U.S. 85 (El Camino Real) from Raton south to Anthony. The first section of interstate that was constructed in New Mexico was 10 miles east of Clines Corners adjacent to U.S. 66. Between 1958–1960, NMSHD constructed 168 miles of discontinuous sections of Interstate highway, 176 miles of primary highways and 400 miles of secondary highways in New Mexico (NMSHD 1965).

### 2.7.3 Bridges and New Mexico Interstates

The grade separation standards of the new Interstate system required the construction of the largest number of bridges per mile of road that had ever been built. The standards included a mandatory grade separation at every entrance/exit of the highway, railroads, or connection with a different road to provide intersection safety. These grade separations included bridges crossing the highway at on- and off-ramp cloverleafs, interchanges, and railroad crossings. This resulted in the construction of a large number of bridges, and to reduce their overall cost, Interstate bridge designs were often standardized with slight modifications to adapt the bridge to a specific site.

**Figure 25: Railroad grade separation during construction**

Source: Reynolds 1969

Interstate bridge construction typically relied on steel in combination with reinforced concrete slabs and precast concrete beams (Rae et al. 1987:20). During the late 1950s and through the 1960s, new bridge construction on I-25 and I-40 consisted of four types, which had become the predominant bridge types:

- Steel I-Beam
- Concrete Slab
- Precast Concrete Girder
- Steel Plate Girder

In 1964, NMSHD set a record for new highway work undertaken. Road construction contracts during the year totaled nearly $57.4 million, a 23 percent increase over the best previous year. Included in the contracts were 280 miles of Interstate at a cost of $38.3 million. Construction completed during the year added 188 miles of improvement to the Interstate system, bringing it up to 40 percent complete (Reynolds 1964:1).

The Rio Grande Gorge Bridge project was developed concurrently with the Interstate system. The three-span, 1,200-foot-long bridge is a lightweight steel truss, ranging from 20 to 100 feet deep, with a concrete deck and 105-foot-high concrete piers. The 28-foot roadway has a four-foot-wide sidewalk on either side and consists of 29,000 square feet of decking. The $2 million bridge was dedicated in 1965 by Governor Jack Campbell and the following year, the American Steel Institute awarded its "First Prize for Long Span Bridges in 1966" to the bridge (*Denver Post* 1965; Kammer 1996:40).

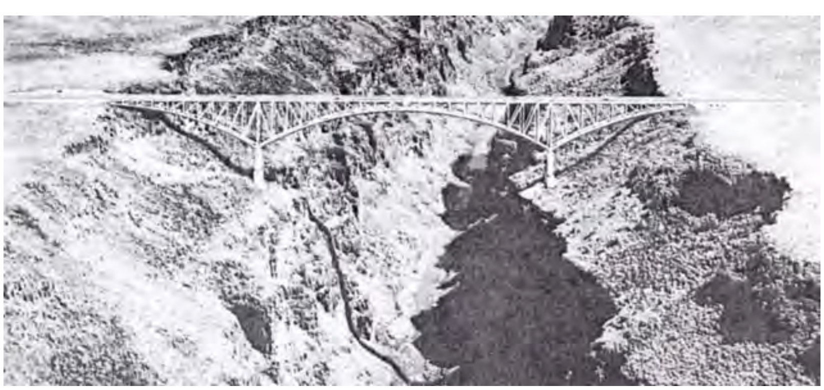


**Figure 26: Rio Grande Gorge Bridge**

Source: NMSHD 1963

By 1969, highway construction contracts amounted to $61.2 million (Reynolds 1969:1). By the end of the year, 80 percent of the interstate was either complete or under construction. Completed projects included a stretch of I-25 between Las Vegas and Raton, the I-10 Deming bypass, and the last link of I-40 in the Albuquerque area between Coors Boulevard and Nine-Mile Hill. Bridges included thirty-five precast, pre-tensioned concrete bridge beams; twelve continuous concrete slabs; and one welded-plate girder bridge with steel stringers (Reynolds 1969:1).

By 1970, existing timber bridges were still being maintained, but no new timber structures were being constructed. Treated timber bridges constructed from the 1920s to the early 1950s remained on older highways such as U.S. 80, U.S. 60, U.S. 285, U.S. 54, and U.S. 666 (NMSHD 1970).

By 1970, the total road mileage in New Mexico was 67,326 miles with 4,358 miles of primary routes (Reynolds 1970:74; NMSHD 1970). By 1971, 86 percent of the Interstate system in New Mexico was complete, with the remaining 14 percent under contract; more than $62 million worth of contracts were awarded with 203 miles of new and improved highways and bridges (Reynolds 1971:5–7).

**Figure 27: Interstate construction during the 1970s**

Source: Reynolds 1971

As in the past, technology continually developed and challenged NMSHD engineers. During 1971, there was another revision of the standard specifications for roads and bridges in New Mexico and a training program for bridge inspectors began. The training program was held in accordance with the National Bridge Standards of the U.S. Department of Transportation (Reynolds 1971:9). In the spirit of State Engineer James French, who had strived for high standards, New Mexico was one of the first states to initiate such a program.

**Figure 28: Interstate road shortly after construction in late 1960s**

Source: Reynolds 1969

## 2.8 Conclusion

The development of modern roads in New Mexico began with the railroad, which spurred the construction of roads to farms and mines. These roads were built to transport supplies for the construction of the railroad and products for distant markets, as well as to ensure communication throughout the state. Bridges were critical to road construction during the territorial and early statehood periods, as without bridges to cross the dramatic topography of New Mexico, teams and wagons could not have easily transported goods. Throughout the early periods of road development in New Mexico the focus was on “getting the road through.” This demanded timely grading of roads, construction of spillways and dips at minor and remote crossings, and building of bridges only where essential.

After New Mexico became a state, federal funding became available for the development of roads, and throughout the country engineers were working toward a system of roads that would connect at state lines. Although a true Interstate system was not funded until 1956, most of the highways that were developed in New Mexico after statehood were designed with an eye toward standardization and interconnectivity throughout the state and across state lines. Concrete began to be used for bridge construction during the Territorial period and became common on F.A.P.s, but timber remained the primary bridge construction material in New Mexico until the 1950s. It was not until the 1950s and the development of the Interstate that concrete and steel bridges became the common and primary bridge materials.

# 3.0 NRHP EVALUATION OF BRIDGES

This chapter describes the methodology that was used to conduct the survey and to determine eligibility for this project. It is also intended for use in future survey efforts.

## 3.1 Project Methodology

### 3.1.1 Research and Historic Context

To develop the historic context, research was conducted at the New Mexico State Records Center & Archives (State Archive), the University of New Mexico Center for Southwest Research (CSWR), the State of New Mexico Office of Cultural Affairs, Historic Preservation Division, and the NMDOT Library. While material was obtained at the State Archive and CSWR, the vast majority of information was gathered from the NMDOT Library's extensive collection of Biennial Reports of the State Highway Engineer, New Mexico Highway and Bridge Specifications, *New Mexico Highway Journals*, other reports issued over the years by the NMDOT, and historic publications of the Bureau of Public Roads.

### 3.1.2 National Bridges Inventory Database

In June 2001 the NMDOT provided Van Citters: Historic Preservation, LLC (VCHP) with the National Bridges Inventory for New Mexico [NMNBI] which was prepared in accordance with *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*, U.S. Department of Transportation, Federal Highway Administration (FHWA), Report No. FHWA-PD-96-001, December 1995. In February 2002, the VCHP project team received an updated version of the NMNBI. This database included over 120 fields of information for the 4,161 bridges in the state. It also included an added field, sufficiency rating (which is a measure of the overall adequacy of the bridge), which was not in the 2001 database. Comparative analysis of the two NMNBI databases resulted in the identification of 13 bridges that were in the June 2001 database but not in the February 2002 database. A list of these "missing 13" was provided to the NMDOT at the time of discovery and is identified in Appendix A.

Because the NMNBI database includes thousands of bridges throughout the state, it was determined early in the project that it would be cost-prohibitive and unwieldy to field survey every bridge. In order to identify which bridges would become the focus of this project, the team conducted data queries in the NMNBI.

In analyzing the various database fields for queries, it became clear that only 14 of the fields (9 bridge and 5 location data fields) were found to be relevant to this project:

- Maintenance Responsibility — Field 21
- Year Built — Field 27
- Historic Significance — Field 37
- Type — Field 43
- Number of Spans — Field 45

- Length of Maximum Span Field 48
- Total Length of Bridge Field 49
- Year Reconstructed Field 106
- Sufficiency Rating no field number
- Structure Number Field SN

For purpose of location, the following fields were added:

- County Field 3
- Place Field 4
- Facility Carried Field 7
- Detailed Locale Field 9

### 3.1.2.1 NMNBI Queries

A query of the 2002 NMNBI was then prepared. This query included a number of criteria:

**Elimination of Bridges Constructed after 1953**
Field 27 [Year Built] was used to eliminate bridges that were younger than 49 years old. The project team expanded the date to 1953 (from the original project proposal of 1951) in order to provide the NMDOT with information that would be current through December 2003. It is important to note, however, that certain post-1953 bridges that were eliminated may be eligible for the NRHP under Criteria Consideration G, a property achieving significance within the past 50 years (e.g., the Rio Grande Gorge Bridge, which is listed on the State and National registers).

Evaluation of bridges that were constructed after 1953 was beyond the scope of this project. Although post-1953 bridges were eliminated from survey, in order to serve as a tool for future survey efforts, the project database includes all structures constructed up to and including 1973 that are under the maintenance responsibility of the NMDOT.

**Elimination of Culverts and Tunnels**
At the onset of this project, discussions took place between the NMDOT, HPD, and VCHP regarding the inclusion of culverts in the field survey. However, the research of standard plans for culverts revealed that they are basic functional structures without construction methods or features that would make them eligible for listing on the NRHP. Throughout historic periods of highway and bridge development in New Mexico, timber or concrete box culverts and metal or concrete pipe culverts served as minor drainage and water crossings at roadways. There appeared to be nothing outstanding about the standard plan construction or engineering, and there were no significant historic patterns of use or development. Therefore, these structures were eliminated from field survey consideration in this project.

It is possible, however, particularly since the NMNBI treats all culverts as equal in Field 43A [Primary Material], that the identification of special or unique culverts will occur on a case-by-case basis by NMDOT employees or their contractors in the field. For example, the

Civilian Conservation Corps or Works Progress Administration, who focused on hand installation and design detailing, may have constructed many of these special culverts during the 1930s.

**Elimination of Railroad Bridges, Pedestrian Bridges, and Tunnels**

Evaluation of tunnels, railroad bridges, and pedestrian bridges was beyond the scope of this project. The NMDOT Bridge Maintenance Section informed the project team that if a bridge had a sufficiency rating of "0", its use was one of the above two bridge types. Tunnels were identifiable through their own code under Field 43 [Bridge Type of Design and/or Construction].

**Elimination of Bridges That Are Not NMDOT Maintenance Responsibility**

The goal of this project was to identify NRHP-eligible bridges to aid NMDOT in its Section 106 compliance process, and as such, bridges that are outside NMDOT jurisdiction were beyond the scope of the project. Many bridges in the database are the responsibility of cities and counties; those entities maintain bridges and construct upgrades. Field 21 [Maintenance Responsibility] was used to eliminate those bridges for which the NMDOT does not have primary maintenance responsibility. The following types of bridges were not documented as part of this survey as a result of adding the NMDOT maintenance responsibility filter:

| | |
|---|---|
| Type Code 105 | concrete box beam – multi |
| 106 | concrete box beam – single |
| 309 | steel truss thru – deck |
| 506 | prestressed concrete box beam |
| 811 | masonry arch deck |

Some of the more architecturally detailed bridges or underpasses in the state are under city or county maintenance responsibility and, as a result, were also not a part of this survey effort. When invited by a city or county to participate in a project that involves public or federal monies to rehabilitate or replace a bridge, the NMDOT will work to see that such bridges are evaluated for National Register of Historic Places eligibility on a case-by-case basis.

**Elimination of Bridges That Were Reconstructed after 1953**

Field 106 [Year Reconstructed] was used to eliminate bridges that were constructed prior to 1954, but reconstructed after 1953. A bridge that has been reconstructed typically has an unidentifiable remnant of the original bridge incorporated within the new structure.

The definition of NMNBI Field 106 is:

> For a bridge to be defined as reconstructed, the type of work performed, whether or not it meets current minimum standards, must have been eligible for funding under any of the federal aid funding categories. The eligibility criteria would apply to the work performed regardless of whether all State or local funds or Federal-aid funds were used (FHWA 1995).

Work that may be eligible for federal funding, but which the FHWA and NMDOT does not consider reconstruction, includes:

- Safety feature replacement or upgrading (for example, bridge rail, approach guardrail, or impact attenuators).
- Painting of structural steel.
- Overlay of bridge deck as part of a larger highway surfacing project (for example, overlay carried across the bridge deck for surface uniformity without additional bridge work).
- Utility work.
- Emergency repair to restore structural integrity to the previous status following an accident.
- Retrofitting to correct a deficiency which does not substantially alter physical geometry or increase the load-carrying capacity.
- Work performed to keep a bridge operational while plans for complete rehabilitation or replacement are under preparation (for example, adding a substructure element or extra girder) (FHWA 1995).

If repair work on a bridge is minor, as defined above, Field 106 remains blank. Once the project team understood the above, they worked to confirm what effect (in terms of NRHP eligibility) a typical reconstruction had on a bridge.

In-depth research into the NMDOT Bridge Maintenance Section files and discussion with key staff in the Bridge Maintenance Section revealed that the NMDOT either substantially alters, or buries beyond recognition, incorporated remnants of an original bridge to accommodate reconstruction. Features that the NMDOT typically incorporates into new bridges include abutments, girders, piers, and pier caps. The NMDOT only reuses these features after an evaluation of condition; often the NMDOT errs on the side of safety by replacing these features with new and sound materials. If the NMDOT reuses a feature, the engineers typically design an alteration to accommodate the reconstructed bridge. For example, a bridge reconstructed to widen the roadbed may reuse existing abutments and piers but the NMDOT adds extensions to accommodate the new road width. Therefore, reconstruction of a bridge significantly compromises the integrity of design, materials, workmanship, feeling, and association to such an extent that the overall historic integrity of the bridge is lost.

Bridges reconstructed after 1953 were eliminated from consideration for survey and documentation. Applying this criterion resulted in the elimination of 26 bridges from the survey of potentially eligible bridges that are NMDOT maintenance responsibility. Two bridges reconstructed before 1954 were included in the survey as potentially eligible.

**Elimination of Duplicate Records**

The project team found bridges with identical data in the NMNBI—in other words, two records containing the same information for the same bridge. One data set was removed for each bridge that had duplicate records.

**Elimination of Bridges Already Listed on the National Register of Historic Places and/or New Mexico State Register of Cultural Properties**

The focus of this project was to make recommendations for the eligibility of NMDOT-maintained historic bridges in the state, so it was not necessary to document those already listed on these registers. The project team conducted research at HPD to determine which bridges were already listed. For a list of bridges on the State or National Registers, see Appendix B.

#### 3.1.2.2 NMNBI Query Results

The pool of bridges that were constructed or reconstructed prior to 1954 consisted of 265 bridges. Once VCHP applied the NMDOT maintenance responsibility filter, the pool was reduced to 152. Upon field investigation, VCHP discovered that a number of bridges had been reconstructed and some recently razed (under projects negotiated with the SHPO). The total number of pre-1954 bridges under NMDOT maintenance responsibility that VCHP surveyed for NRHP eligibility during this project was 144.

These bridges and the relevant database fields that are described above are in a new survey database that was provided to NMDOT with this report.

### 3.1.3 Fieldwork

One hundred and forty-four bridges that predate 1954 were field surveyed. Location information from the NMNBI database was used to map the bridges, and state and local maps were used to plan survey routes. In a number of cases, roads that incorporated the bridges were not on maps, or the bridges were not located where they were described in the NMNBI database. As a result, the project team drew sketch location maps for each bridge and added them to the new database so the bridges will be easier to find in the future. In cases where the NMNBI directions were incorrect, the team updated them in the “Detail of Locale” field in the new database. In addition, in cases where the directions could have been more specific, the project team added the information in the “Historic and Descriptive Information” field, which was an added field in the new database.

During survey, it was discovered that most bridges had plaques or tags stamped with the bridge number on guardrail posts, usually at diagonal and opposite ends of the bridge. The project team checked for these tags, especially when the location information was in doubt. At each bridge site the project team sketched the bridge layout and pertinent features, noted conditions, and photographed an oblique view, elevation, abutment detail, and other details to document the features and condition of the bridge. Descriptions of the bridge, its condition and other relevant data were written on the database form. Upon returning from the field, the team entered the collected information into the project database. Final database forms were printed on archival paper, and a CD with the database was presented to NMDOT.

## 3.2 Evaluation Tools for New Mexico Bridges

### 3.2.1 NRHP Process

In order for a property to be eligible for the NRHP, it must be significant; that is, it must represent an important part of history, architecture, archaeology, engineering, or culture and it must retain the characteristics that embody it as a representative property associated with such an aspect of the past. There are five NRHP facets used to determine whether a property is significant within a specific historic context. For purposes of surveying NMDOT bridges, the first three facets are:

1) The development of highways and bridges in New Mexico;
2) Such development was an important part of the state's history; and
3) These bridges are relevant in illustrating that history.

The remaining two facets were determined on a bridge-by-bridge basis through field evaluation and research at the NMDOT Bridge Section files. These are:

1) How a bridge illustrates its historic significance; and
2) If that bridge retains the physical features necessary to convey that significance.

VCHP evaluated the latter two facets using the NRHP criteria for eligibility and the seven aspects of integrity. The NRHP criteria are tools to aid in determining whether a property is significant for its association with important events or persons, for its importance in design or construction, or for potential information. The following criteria are those that were most likely to be applicable to bridges in New Mexico:

Criterion A: Event
A property that is "associated with events that have made a significant contribution to the broad patterns of our history" (NRHP 1991, 12).

Criterion C: Design/Construction
A property that embodies "the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction" (NRHP 1991, 17).

Criteria Consideration G: Properties that have achieved significance within the past 50 years
A property that "achieves significance within the past fifty years is eligible if it is of exceptional importance" (NRHP 1991, 41).

In order for a property to convey its significance, it must retain integrity. There are seven aspects of integrity:

1) Location: place where a property was constructed.
2) Design: combination of elements that create the form of a property.
3) Setting: physical environment of the historic property.

4) Materials: the physical elements combined at a specific period in time in a specific configuration to form a historic property.
5) Workmanship: physical evidence of the crafts of a particular culture during a given period.
6) Feeling: expression of the historic sense of a particular period in time.
7) Association: direct link between an important event and the historic property.

Not all aspects of integrity are weighted equally for all properties, but a property typically possesses several or most of the aspects of integrity in order to convey its significance. The aspects that are most important for bridges, in general, are design, materials, feeling, and association.

Workmanship is generally a minor aspect of integrity for bridges, as this aspect typically applies more directly to an instance where a craftsman was involved in producing architectural details. Most bridges were of standard plan or constructed by large contracting companies; the craftsmanship of pouring concrete is not as large a factor for a bridge as a hand-carved newel post might be for a Victorian home. There are exceptions, such as 1930s CCC or WPA stone/masonry structures, which have hand-constructed detailing. But, for the most part, workmanship plays a minor role in the evaluation of integrity for most of New Mexico's historic bridges.

In some cases, the setting may be important—for example, if engineers selected a certain type of bridge to cross a specific feature or if that feature itself is significant. In others, a change of location may not cause a bridge to become ineligible. Some bridges moved from their original location may still be eligible, if they retain the features that convey their significance as representative of a specific type of construction.

To determine whether a bridge retains its integrity, one must first identify the character-defining features. These are the features that relay a property's historic and architectural or engineering significance. The property must retain these features in order to retain integrity and eligibility for the NRHP.

Most of the bridges in New Mexico are simple in design; therefore, a small number of changes to the design can have a large impact on the overall integrity. The general character-defining features of bridges are their historic:

1) Bridge superstructure;
2) Alignment and width of roadbed;
3) Guardrail;
4) Abutments;
5) Piers and the pier alignment;
6) Type of construction and materials;
7) Specific detailing that makes a bridge representative of a type or that makes it unique; and
8) Original construction signage attached to bridge (such as F.A.P. signs).

In order for a bridge to retain integrity of feeling and association, the character-defining features should be intact to the extent that the overall design has not been significantly altered from the historic design. The bridge should remain representative of its period and type of construction. In cases where there are no changes to the original design, the integrity is intact. In other cases, where the character-defining features have been altered or important historic materials removed, the bridge must be assessed for its own level of integrity, as well as against the other bridges within its property type to determine if it is a representative example of that type.

### 3.2.2 Rating System

The survey and evaluation project originally intended to survey 75 structures. In determining which of the NMNBI-identified 152 bridges would be the subjects of detailed documentation and receive recommendations for NRHP eligibility, the project team developed and applied a quantitative rating system to each bridge. This rating system, which took its lead from the system developed in the bridge survey done for the NMDOT in the mid-1980s, ranked physical properties of the bridges. It was the intention of the project team, in applying the rating system, that the 75 bridges with the highest overall score would be selected for survey.

The NMDOT later determined it would survey all pre-1953 bridges. At this point, the quantitative rating system was no longer needed to determine what should be surveyed, but after the survey the rating system became a tool for NRHP analysis. The rating system provides data on whether a bridge is a good representative example of a type—in other words, whether it is the longest, oldest, or unique in some other way.

Ranking was based on the number of occurrences in the following components:

1. Type of bridge
2. Predominant material
3. Length of bridge
4. Length of maximum span
5. Oldest surviving of a type

In this quantitative rating system, the significance of individual bridges is related to the number of surviving bridges that fall under the maintenance responsibility of the NMDOT. The rating system places them in the context of the categories or fields represented in the NMNBI database and are relative to the 152 bridges that were filtered from the NMNBI and the 144 surviving examples.

In evaluating the NMNBI to develop the rating system, certain groupings of bridge attributes were identified and used to establish the rating categories. The quantitative rating system for the bridges is described below. Note that English measurements are rounded up.

1. **Bridge Type**

   Preference was given to those types of bridges with few examples of the type.

   A) 6 points: Five occurrences or fewer

- Girder and floor beam system
- Tee beam
- Box beam or girders/multiple
- Arch (deck and thru)
- Channel beam

B) 4 points: From 6 to 30 occurrences.
- Truss – thru
- Slab

C) 2 points: Over 30 occurrences.
- Stringer

**2. Predominant Bridge Material**

Preference was given to those bridges made of a less common predominant material.

A) 6 points: Five occurrences or fewer
- Pre-stressed concrete
- Pre-stressed concrete continuous
- Masonry
- Aluminum, wrought iron, cast iron

B) 4 points: From 6 to 30 occurrences
- Concrete
- Continuous concrete
- Steel continuous

C) 2 points: Over 30 occurrences
- Steel
- Wood or timber

**3. Overall Length of Bridge**

Preference was given to those with greater length, as it is likely that they are spanning drainages that are more significant.

- 6 points if length is greater than 328 feet (100 meters)
- 4 points if length is 198 feet – 328 feet (60.1 meters – 100 meters)
- 2 points if length is 99 feet – 197 feet (30.1 meters – 60 meters)
- 0 points if length is less than 98 feet (30 meters)

**4. Length of Maximum Span of Bridge**

Preference was given to those with greater span as they are greater engineering feats.

- 6 points if span is greater than 164 feet (50.0 meters)
- 4 points if span is 67 feet – 164 feet (20.1 meters – 50 meters)
- 2 points if span is 33 feet – 66 feet (10.1 meters – 20.0 meters)
- 0 points if span is less than 33 feet (10 meters)

**5. Oldest Surviving in Each Bridge Type**
Preference was given for the oldest bridge in each category of bridge type.

- 4 points to each that is the oldest in a type
- 0 points to the remaining

In addition, toward addressing the request of the NMDOT, the Sufficiency Rating of bridges was considered as an indicator of condition. Preference was given to bridges with a Sufficiency Rating of 50 or more.

- 4 points to each with a rating of 50 or more
- 0 points to each with a rating of 49 or less

### 3.2.2 Periods of Significance for New Mexico Bridges

As documented in the historic context, there are specific historic periods of highway development in New Mexico, including periods of increased funding and new programs that resulted in the building of bridges. These periods are important in identifying bridges that may be eligible for the NRHP under Criterion A or C. An abbreviated list of these historic periods is included below to provide information on how they may be used to evaluate NMDOT bridges. The discussion of the period of significance does not include information about previously listed bridges.

**1903–1912: Territorial New Mexico**
This period is characterized by the first legislative authorization of road and bridge construction and the desire to create a system of roads linking communities throughout the Territory. Roads were developed economically; bridges were constructed primarily of timber at strategic crossings to ensure links were made so that, at a minimum, the road would "get through." Counties were responsible for bridge construction during this period.

The NMNBI database has only three bridges that date to the Territorial period. While these bridges have early dates, they are either concrete or steel, which, although it is not clear in the NMNBI, suggests that these bridges have been reconstructed. The three bridges are not under NMDOT maintenance responsibility; as such, they were not surveyed as part of this effort.

**1912–1917: Statehood and the State Highway Commission**
This period is characterized by an intensified effort to construct as many miles of road as possible to link communities throughout the state. Roads were constructed economically, many spillways were constructed at small streams and arroyos as a means of providing cost-effective crossings, and funds were spent on more substantial, sturdy timber bridges only where they were required. Counties were responsible for bridgework, but the State Engineer participated in bridge design and construction through loopholes in the 1913 law.

There are no bridges from this period under NMDOT maintenance responsibility.

One steel truss bridge remains from this period, but it is not under NMDOT maintenance responsibility. It was not surveyed as part of this effort.

**1917–1918: World War I**

This period was characterized by a reduction in new construction and a primary focus on maintenance to keep roads serviceable. As the U.S. entered World War I, the boom in the trucking industry had caused an adverse effect on U.S. roads because of their weight and the increase in traffic. The roads in New Mexico fared well, because the legislature had set aside funds for road maintenance in 1917. At the end of the war, New Mexico highways benefited from U.S. Army surplus machinery and materials.

There are no bridges from this period under NMDOT maintenance responsibility.

**1918–1931: Highway Standardization and Testing**

This period was characterized by a need to connect roads between states, standardize construction, and ensure the proper characteristics of highway materials to promote stability and longevity. During this period, nationally, the first effort was begun toward development of a state-to-state system, tourism began to have an effect on New Mexican highways, and the State Engineer began to realize the importance of roads and bridges that could withstand the increased traffic. These forces galvanized New Mexico efforts in materials and methods standardization and testing.

Bridges associated with this period of significance exhibit evidence of standardization through the use of standard plans; use of sturdier materials, such as concrete or steel; and the design of trusses for specific bridge sites.

**1931–1940: New Deal Highway Programs**

The "make work" programs resulting from the Great Depression and Dust Bowl characterize this period. During this period, New Mexico bridge engineers surveyed highway bridges throughout the state, focused on strengthening existing bridges, and constructed new bridges on new roads, as well as at locations where spillways were formerly seen as adequate. Concrete was used often as a bridge-building material and many extant bridges were constructed during this period using a standard plan without New Deal funds.

Bridges constructed by the highway department and associated with this period of significance are typically of a concrete standard plan that includes reveals in concrete and attractive railings.

**1940–1945: World War II**

This period was characterized by a slowdown in construction resulting in only "strategic roads" being built. Such new roads in New Mexico were those leading to mining districts and military installations. In general, many roads and bridges suffered from a lack of funds to provide the maintenance required to repair damage caused by heavier trucks and increased traffic.

Bridges associated with this period of significance are constructed on roads that were considered important to the war effort.

**1945–1956: Post War Highway Construction**
This period was characterized by a great increase in construction. Many new roads, designed as divided highways, were built, and existing roads were widened. Concrete became a common material in bridge construction.

Bridges associated with this period of significance were typically part of realignment projects, those on larger roads, such as divided highways, or those that were widened after the war. The bridges typically have minimal detailing, and the structure is usually concrete and/or steel.

**1956–1977: Interstate System**
This period was characterized by the development of the Interstate system, which was planned at the national level to provide standardization and integration across state lines. The system provided for increased safety, while supporting greater speeds. One of the primary requirements of the new system was the necessity for grade separation, which resulted in a substantial increase in bridge construction. The primary bridge construction materials during this period were concrete and steel.

Bridges associated with this period of significance exemplify evidence of national standardization and an increased number of grade separations. As with the postwar bridges, they are primarily located on larger roads and Interstates, have minimal detailing, and are usually constructed of concrete or steel.

### 3.2.4 New Mexico Bridge Property Types

The property types identified for this project come directly from the NMDOTs NMNBI bridge database; no types were added in the interest of keeping the information from this survey consistent with the database and therefore of more use throughout the NMDOT. Although types were not changed, the names were: for example, when the NMNBI codes for material and type are combined, the resulting name is somewhat awkward, such as Type 602 "Pre-stressed or Post-tensioned Continuous Concrete Stringer/Multi-Beam Girder," was broken down into separate names as shown below. Table 3 shows the property type names used for this survey, the NMNBI database code, and the NMDOT name, based on that code.

**Table 3: Property Types**

| Primary Type | Code | NMDOT name from NMNBI code | Survey Property Type |
|---|---|---|---|
| **Arch** | 112 | Concrete arch - thru | Concrete arch |
| | 811 | Masonry arch - deck | Masonry arch |
| **Truss** | 309 | Steel truss - deck | Steel truss |
| | 310 | Steel truss – thru | Steel truss |

| Primary Type | Code | NMDOT name from NMNBI code | Survey Property Type |
|---|---|---|---|
| | 910 | Aluminum, wrought iron, or cast iron truss–thru | ▪ Aluminum truss<br>▪ Wrought iron truss<br>▪ Cast iron truss |
| **Truss** | 909 | Aluminum, wrought iron or cast iron truss–deck | ▪ Aluminum truss<br>▪ Wrought iron truss<br>▪ Cast iron truss |
| **Slab** | 201 | Concrete continuous slab | Continuous concrete slab |
| | 101 | Concrete slab | Concrete slab |
| **Stringer** | 702 | Timber stringer/multi-beam girder | Timber |
| | 102 | Concrete stringer/multi-beam girder | Concrete stringer |
| | 202 | Concrete continuous stringer/multi-beam girder | Continuous concrete stringer |
| | 502 | Prestressed or post-tensioned concrete stringer/multi-beam girder | ▪ Prestressed concrete stringer<br>▪ Post-tensioned concrete stringer |
| | 602 | Prestressed or Post-tensioned Continuous Concrete Stringer/Multi-Beam girder | ▪ Prestressed continuous concrete stringer<br>▪ Post-tensioned continuous concrete stringer |
| | 302 | Steel Stringer/Multi-Beam Girder | Steel stringer |
| | 402 | Steel Continuous Stringer/Multi-Beam Girder | Continuous steel stringer |
| **Girder** | 122 | Concrete Channel Beam | Concrete channel |
| | 104 | Concrete Tee Beam | Concrete tee |
| | 106 | Concrete Box Beam or Girders | ▪ Concrete box beam<br>▪ Concrete girder |
| | 105 | Concrete Multiple Box Beam or Girders | ▪ Concrete multiple box beam<br>▪ Concrete multiple girders |
| | 603 | Prestressed or Post-tensioned Continuous Concrete girder and floor beam system | ▪ Prestressed continuous concrete girder<br>▪ Post-tensioned continuous concrete girder |
| | 303 | Steel Girder and Floor beam System | Steel girder |
| | 403 | Continuous Steel Girder and Floor beam System | Continuous steel girder |

The following discussion of the primary types and materials listed in Table 3 is basic, and lacks details of moments, bending, fixed and rotating connections. It is meant to provide an overall sense of how each primary bridge type functions structurally. The subtypes behave structurally in a very similar way to the primary types and, therefore, are not discussed separately.

The general pattern in the development of bridges has been to create structures with large spans (the distance between two supports). The trend toward large spans has been primarily for (1) maximum efficiency in the use of material and (2) avoiding or minimizing piers or bents in the channel that is being crossed. For example, a stone bridge crossing a 50-foot-wide channel would require a significant amount of stone for two or three supports and arched spans between the stone piers, whereas a steel I-beam bridge with a deep cross-section could easily span the channel. While the stone bridge might be more aesthetically pleasing, the steel I-beam bridge would be more elegant structurally, alleviating the issue of scouring, degradation, and aggradation of the channel. Spans up to 20 feet were typical before the twentieth century. Since then spans have continued to increase through developments in concrete and steel and truss concepts and technology.

### 3.2.4.1 Arched Bridges

Arched structures are funicular, deriving their load-carrying capacity from their curved geometry. This geometry results in compressive forces acting through the material of the arch (Figure 29). A concrete or steel arch is more rigid (stable) than a masonry arch, because of the uniformity and nature of the material and because they can be designed to a specific primary loading condition. Masonry and concrete or steel arches carry loads in axial compression, but steel and concrete arches are also designed to have sufficient bending resistance to load variations. A masonry arch is more likely to fail if tension develops within the structure than a steel or concrete arch. Over time, arched structures have been built more efficiently as steel and concrete were further developed, engineers developed structural calculations that could predict how loads are carried, and the actual cross-section of material needed to ensure that the funicular loads were within the arch (thus making it stable) decreased. In arches that are more efficient the spandrel panel (the area between the extrados, or outside curve of the arch, and the flat portion of the structure above) is removed, which creates an open spandrel. Arches with open spandrels are used to reduce the dead load and collapse tendencies.

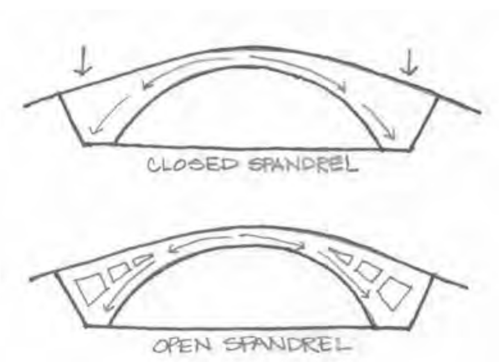



**Figure 29: Forces in an arched structure**

In the NMNBI there are two types of arch, concrete and masonry. The Logan Bridge, is a steel trussed arch originally constructed in 1922 (Figure 17). In general, arches are not a common bridge type in New Mexico and most were undertaken as municipal projects constructed from 1888 [a culvert on Hot Springs Boulevard in Las Vegas] to 1934 [Don Gaspar Bridge in Santa Fe] (Kammer 1996, F-43). Surveyors should evaluate them under Criterion A for their period of significance and Criterion C as a unique type of construction in New Mexico.

### 3.2.4.2 Truss Bridges

Trusses are structures made of jointed linear elements arranged in a triangle or combination of triangles. They have been around since the earliest of times in the form of roof supports. The Romans constructed the first known truss bridge circa 500 B.C. While architects during the Renaissance showed an understanding of how forces moved through truss structures, it wasn't until the nineteenth century that the loading and carrying capacity of this structural type were fully understood and calculated. The primary principle behind the truss is the use of triangular shapes to form a rigid frame that cannot be deformed by the application of external forces. While arches carry only compressive forces, trusses develop both compressive and tensile loading: some members will act in compression (c) and others in tension (t) depending on the configuration (Figure 30).

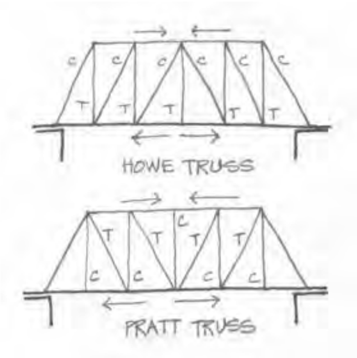



**Figure 30: Two truss types and typical forces**

As trusses became more common, various types were developed to provide for an efficient use of material and greater spans. These types were usually named after their inventors. Two common truss types are the Howe, invented by William Howe in 1840, and the Pratt, designed by Caleb and Thomas Willis Pratt in 1844. The Howe truss carries tension in its vertical members and compression in the diagonals, whereas the Pratt carries compression in its vertical members and tension in the diagonals (Figure 30). While the Howe truss was commonly used in early railroads, it began to go out of favor when the Pratt truss became known. The Pratt truss is a more efficient structure and remains in general use today (Kirby et al. 1990, 227). In addition to the Pratt truss, the NMSHD also used Warren and Parker trusses. The Warren truss was designed by James Warren in 1848 and uses diagonals in a "zigzag" pattern, and the Parker truss, designed by C. H. Parker between 1868 and 1871, is a Pratt truss with a reticulated top chord.

There are two types of truss roadways: thru or deck. A thru truss is one with the roadway running through the structure, and there two subtypes: a full through truss with members that cross perpendicularly above the roadway and a pony truss, a truss that only has two sides extending up from the road, but no members crossing at the top. A deck truss supports the roadway from below (Figure 31). Steel trusses, the primary material used for highway truss bridges in New Mexico, can span up to 150 feet.

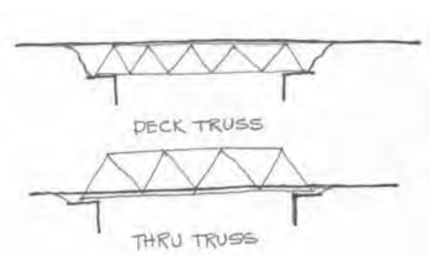



**Figure 31: Thru and deck types**

Truss bridges constructed for New Mexico highways were built using metal: primarily steel, but aluminum, wrought iron, or cast iron may have also been used. Trusses were constructed during most of the historic periods of highway development in New Mexico. Spans for these bridges vary based on material and the section of the chords, or structural members. For example, steel works well in compression and tension and as such is much more versatile than cast iron, which only performs well in compression. In addition, a steel I-beam or box beam can carry a heavier load or cross a longer span if it has a deeper section.

Trusses are more common than arches in New Mexico, but less common than concrete and timber bridge types, and are most likely to be found on smaller roads. Surveyors should evaluate them under Criterion A for their association with a period of significance and Criterion C as an important type of bridge construction in New Mexico.

### 3.2.4.3 Slab Bridges

Slabs, known structurally as plates, are rigid planar structures made of monolithic material with a thickness that is small in respect to the other dimensions. Slabs are typically constructed of concrete and are capable of carrying loads multidirectionally, making them versatile structural elements that are capable of being supported along their entire boundary or at specific points. Slabs became a common structural element for buildings and structures with the advent of modern concrete. They can be either poured in place (site cast) or made elsewhere (plant cast) and brought to the site. Slabs have typical spans ranging from 15 to 60 feet, depending on the configuration and thickness of the concrete.

The NMDOT has two types of slab bridges: simply supported and continuous. A concrete slab system that is simply supported is not as rigid as a continuous slab, as there are connection joints throughout the system (Figure 32). A continuous slab, unless it is a small span, is typically poured in place so that it will be monolithic, whereas a simply supported slab can be made of many small slabs cast at a plant.

Surveyors should evaluate these bridge types under Criterion A for their association with a period of significance and Criterion C as a representative method of bridge construction in New Mexico.

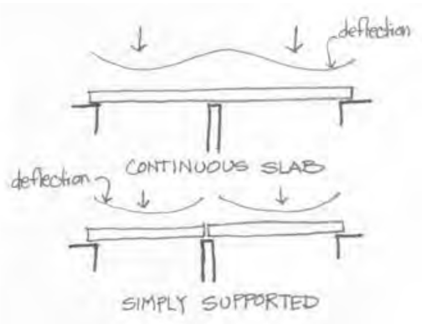
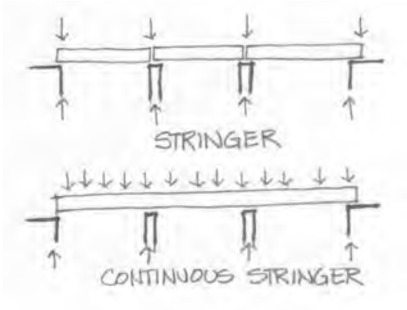



**Figure 32: Diagram of continuous slab (top) versus simple support (bottom)**

### 3.2.4.4 Stringer Bridges

Stringer bridges are simple span structures constructed with long horizontal members (beams) connecting into posts and supporting a roadbed. Some stringer bridges also incorporate girders into the structure. Stringer bridges are basic post and beam structures and are structurally very simple. Loads are carried linearly through the stringers to the posts or abutments. As with slabs, if the stringer is continuous it is more rigid than a system of stringers that span from pier to pier. Timber is the most common material used for this bridge type, but as with trusses, steel and concrete can provide much longer spans if they have a deeper section. Timber stringers can typically span from 5 feet up to 25 feet, while concrete and steel I-beam stringers easily span 50 feet. Timber and concrete both perform well in compression, but concrete performs better in tension than timber because it incorporates steel reinforcing bars that increase the tensile strength (Schodeck 1992).




Stringer bridges are very common in New Mexico and are found on all types of roads. Surveyors should evaluate them under Criterion A for their association with a period of significance and Criterion C as representative of a type of bridge constructed in New Mexico. Stringer bridges are simple structures with little detailing, and surveyors should require a substantial amount of integrity of design and materials to recommend them as eligible.

**Figure 33: Diagram for a stringer bridge**

### 3.2.4.5 Girder Bridges

A girder bridge is constructed of horizontal members that carry concentrated transverse loads. These systems are similar to the stringer bridge but are more complex structurally because the beams are carrying loads to the girders that are in turn carrying the loads to the supports (Figure 34). While similar to stringer systems, girder systems can create bridges with greater rigidity and increased resistance to lateral loading, allowing for higher loads to be carried on the structure.

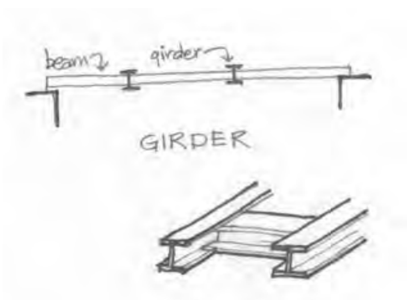



**Figure 34: Diagram of girder system**

Girder bridges are also very common in New Mexico and are found on all types of roads. Surveyors should evaluate them under Criterion A for their association with a period of significance and Criterion C as representative of a type of bridge constructed in New Mexico. As with stringer bridges, girder bridges are simple structures with little detailing and surveyors should require a substantial amount of integrity of design and materials to recommend them as eligible.

# 4.0 SURVEY RESULTS

Survey and NRHP eligibility recommendations under Criteria A and C, at the state level of significance, were undertaken on bridges that date from between 1924 (the earliest bridge in the NMNBI under NMDOT maintenance responsibility) and 1953. Recommendations for eligibility under Criterion A at the local level were beyond the scope of the survey, as it was not feasible within the project budget to conduct research in the communities in which the bridges were located.

## 4.1 Eligibility Assessment of Surveyed Bridges

The project team conducted an initial NRHP eligibility assessment for the surveyed bridges following the completion of the fieldwork and data entry for the project. The team placed those bridges with significant alterations that had resulted in a significant impact on their historic integrity (widening, for example, where historic piers were extended with historically incompatible materials) on the "not eligible" list.

For the remaining bridges, the team reviewed Bridge Maintenance Section files at the NMDOT to provide additional historic information with regard to alterations and integrity. File "Structure Report" forms and historic photographs were copied and added to the survey form (many were scanned into the database). Bridges that had undergone alterations causing a significant loss of integrity were placed on the "not eligible" list.

For the remaining bridges, the project team turned to the quantitative rating system to aid in determining NRHP eligibility under Criterion C. The quantitative rating system ranked the bridges based on their physical properties—in other words, the properties that form the design and type of the individual bridge structures and embody the "distinctive characteristics of a type, period, or method of construction" (NRHP 1991, 17). As such, the quantitative ranking of the physical properties assisted in recommendations for NRHP eligibility.

Prior to analyzing the bridges with the quantitative ranking system, the team organized the survey forms by bridge type to facilitate a comparative analysis. The overall analysis included a review of the bridge type, periods of significance, the seven aspects of integrity, and the quantitative rating score (as noted in section 3.2 of this report).

The first category of the quantitative rating used for NRHP eligibility assessment was "Oldest Surviving in Each Bridge Type." The team ran a query of the database by date of construction and type to confirm the quantitative score and then evaluated the historic integrity of the bridge. The team considered bridges that were the oldest of their type and retained integrity as NRHP eligible.

To assess NRHP eligibility of the remaining bridges, the team reviewed each of the quantitative ranking system categories: bridge type, predominant material, overall length, and length of maximum span. The team evaluated the integrity of each bridge that received the highest score in its category. If a bridge retained historic integrity, it was recommended NRHP eligible.

The team recommended a bridge as NRHP eligible, even if there were impacts to the integrity, if a specific physical property was exceptionally significant when compared wtih other bridges of the same type (length or span for example). The level of intrusion that an alteration posed was weighed against the significance of bridges that scored the highest within their type.

After reviewing those with the highest scores in individual categories, the project team then reviewed the total cumulative scores from all categories for the remaining bridges. Low-scoring bridges (12 points or less) were recommended not eligible if:

1) Alterations significantly impacted historic integrity;
2) They were not remarkable or noteworthy in the categories of bridge type, predominant material, overall length, length of maximum span, or number of spans; and
3) If there were others in the type that were more intact and therefore more representative of the bridge type and period of significance.

The last group of bridges the team evaluated was high-scoring bridges (more than 12 points). The team analyzed these by type and in comparison to the recommendations for the groups above, which had already been analyzed. Representative examples of each type that retained integrity were recommended as NRHP eligible.

HPD considered a series of the old U.S. 85 (along current NM-1) an historic route and requested that all bridges on that route be recommended as eligible.

The project team recommends 67 surveyed bridges as NRHP eligible under Criteria C at the state level of significance. A list of eligible and not eligible bridges may be found in the appendices.

**Table 4: Numbers of Bridges Surveyed**

| **PERIOD** | **NUMBER OF BRIDGES** | | | | |
|---|---|---|---|---|---|
| | Database numbers | | NRHP Recommendations | | Listed |
| | NMNBI Database (1903–71) | Surveyed in 2002** | Eligible | Not Eligible | |
| Territorial 1903–12 | 3 | 0 | | | |
| Early Highway 1912–16 | 1 | 0 | | | |
| Early Federal 1916–31 | 64 | 24 | 9 | 15 | |
| New Deal 1931–40 | 120 | 67 | 34 | 33 | 4 |
| WWII 1940–45 | 37 | 5 | 1 | 4 | |
| Post War 1945–56 | 139 | 48 | 23 | 25 | 1 |
| Interstate 1956–71 | 747 | 0 | 0 | 0 | 2 |
| Totals | 1,111 | 144 | 67 | 77 | 7 |

## 4.2 Bridges Recommended as Eligible

The following tables describe the bridges that were surveyed and recommended as eligible. No properties constructed prior to 1924 were included in this survey effort because the few existing bridges from earlier periods of significance are not under NMDOT maintenance responsibility. The bridges that were recommended eligible are grouped into tables by type within each period of significance with a representative photograph.

### 4.2.1 1918–1931 Highway Standardization and Testing

During this period, the State Engineer began to realize the importance of roads that could withstand increased traffic, both volume and vehicle weight. As such, the period was characterized by a need to standardize construction methods and ensure the proper characteristics of highway materials to provide road system stability and longevity. Concrete and steel began to be used in bridge construction, although the mainstay was timber. The advantage that steel and concrete had over timber was the span; while the outer limits for timber is 25 feet, steel I-beams typically extended 40 feet (although they could span farther if constructed of deeper sections, because span length is directly related to the I-beam section depth), and steel trusses could span 100 feet. This was a great advantage to engineers; reducing the number of supports that were constructed in a channel reduced scouring and need for ongoing bridge maintenance. Concrete piers for bridges were also a maintenance advantage, as they typically lasted longer than timber bents.

| STEEL STRINGER WITH A CONCRETE THRU-RAIL | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 8 | 1927 | Algodones | NM-313 | Marie Chavez Arroyo |
| Bridge 8, constructed in 1927, is the oldest example of a steel stringer with a concrete thru-rail. The use of concrete, steel, and standard F.A.P. design reflects the desire for standardization of highway construction. As such, it is recommended eligible under Criteria A and C, at the state level of significance, as the earliest example reflecting the move to standardization during 1918 – 1931 and for the early use of a 40-foot span steel stringer/concrete thru-rail design. | | | | | |

**TIMBER BRIDGES**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 1669 | 1929 | Derry | NM-189 | Crosses the Rio Grande |

Bridge 1669 is one of the oldest remaining standard plan timber bridges. It has been altered with a modern guardrail, gabion baskets, conduit and has been widened by 10 ft. The widening took place during the period of Post War Highway Construction, because widening was an important activity during this period and this bridge is on old US 85, it is recommended eligible under Criterion A.

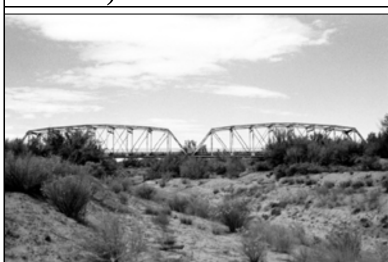
| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 2510 | 1929 | Caballo | NM-187 | Crosses Percha Creek<br>Concrete piers |

Bridge 2510 is one of the longest timber deck bridges surveyed (244 feet), has nine 27-foot spans, and is a BT series standard plan timber bridge with concrete piers. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its standard plan, reflecting the 1918 – 1931 desire for standardization (F.A.P. #107-D), U.S. 85, and the introduction of concrete piers into a timber design.

**STEEL TRUSSES**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 119 | 1929 | Aztec | US-550 | Parker Thru Truss; Animas River |

Bridge 119 crosses the Animas River and has the longest span (200 feet) of the truss bridges surveyed. It is a Parker Thru Truss with stringer approaches (bringing the total bridge length up to 357 feet) crossing the Animas River and reflects the desire for standardization in highway construction. As such, this bridge is recommended eligible under Criteria A and C, at the state level of significance, for its reflection of the 1918 – 1931 preference for standardization (F.A.P. #101-C) and its Parker Thru Truss with stringer approach design.

<table>
<tr><td colspan="6">STEEL TRUSSES - CONTINUED</td></tr>
<tr><td></td><td>No.</td><td>Date</td><td>Location</td><td>Road</td><td>Notes</td></tr>
<tr><td></td><td>1520</td><td>1929</td><td>East of Kingston</td><td>NM-152</td><td>Pratt Thru Truss; Percha Creek</td></tr>
<tr><td colspan="6">Bridge 1520 is one of the few remaining examples of a Pratt Thru Truss and has a 100-foot span. The standard truss design reflects the desire for standardization in highway construction. As such, this bridge is recommended eligible under Criteria A and C, at the state level of significance, for its reflection of the 1918 – 1931 preference for standardization, as a component of the Black Range Road (F.A.P. #148-C) and for its steel Pratt Thru Truss design.</td></tr>
<tr><td></td><td>1521</td><td>1929</td><td>East of Kingston</td><td>NM-152</td><td>Pratt Thru Truss; Percha Creek</td></tr>
<tr><td colspan="6">Bridge 1521 is one of the few remaining examples of a Pratt Thru Truss and has a 100-foot span. The standard truss design reflects the desire for standardization in highway construction. As such, this bridge is recommended eligible under Criteria A and C, at the state level of significance, for its reflection of the 1918 – 1931 preference for standardization, as part of the Black Range Road (F.A.P. #148-C) and for its steel Pratt Thru Truss design.</td></tr>
<tr><td></td><td>531</td><td>1930</td><td>Bernardo</td><td>Old NM-116</td><td>Parker Thru Truss; Rio Puerco</td></tr>
<tr><td colspan="6">Bridge 531 is the longest steel truss surveyed (567 feet) and consists of two Parker Thru Trusses (each with a 141-foot span) with timber approaches on either end. It reflects the 1918 – 1931 desire for standardization (F.A.P. #125-C) through its standard design and modern material (steel). As such, this bridge is recommended eligible under Criteria A and C, at the state level of significance, for standardization and its length, material, and double Parker Thru Truss design.</td></tr>
</table>

| STEEL TRUSSES - CONTINUED | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 4984 | 1930 | East of Valmora | NM-97 | Warren Pony Truss; Mora River |
| Bridge 4984 has the greatest number of spans (three 75-foot spans) of the trusses surveyed. It has been moved and had two of the original five spans removed, but these alterations are outweighed by its significance as an early example of the 1918 – 1931 desire for standardization and as the oldest Warren Pony Truss remaining in the state. As such, this bridge is recommended eligible under Criteria A and C, at the state level of significance, for standardization and its Warren Pony Truss design. It was originally built for $8,771. | | | | | |

| STEEL STRINGER | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1705 | 1930 | East of Akela | NM-549 | Unique bridge over railroad<br>(steel stringer in database) |
| Bridge 1705 is the oldest railroad overpass in the survey. Its structure includes steel stringers, timber bents, and concrete smoke guards. It is the earliest example of a railroad grade separation and as such is recommended eligible under Criteria A and C, at the state level of significance, for its relationship to early standardization (providing safety at crossings and standard design details, including the timber bents, smoke guards, and steel beams - F.A.P. #45 REO) ) and its method of construction. | | | | | |

### 4.2.2 1931–1941 New Deal Highway Programs

During this period, New Mexico bridge engineers focused their design efforts on strengthening existing bridges and constructing new bridges on new roads and at locations where spillways had previously been seen as adequate during the early years of statehood. Concrete was used extensively as a bridge building material on roads constructed during this period.

| **CONCRETE SLAB WITH STONE RAIL** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 5155 | 1935 | East of Placitas | NM-165 | In Cibola National Forest<br>Crosses Las Huertas Creek |
| Bridge 5155 is one of five bridges on a 3-mile stretch of unpaved road in the Cibola National Forest; presumably constructed with New Deal funds. It is a poured concrete slab with a 22-foot span and hand laid stone rails. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its relationship to the New Deal programs and the workmanship/attention to design detail reflected in the stone rails. | | | | | |
|  | 5156 | 1935 | East of Placitas | NM-165 | In Cibola National Forest<br>Crosses Las Huertas Creek |
| Bridge 5156 is one of five bridges on a 3-mile stretch of unpaved road in the Cibola National Forest; presumably constructed with New Deal funds. It is a poured concrete slab with a 25-foot span and hand laid stone rails. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its relationship to the New Deal programs and the workmanship/attention to design detail reflected in the stone rails. | | | | | |
|  | 5916 | 1935 | East of Placitas | NM-165 | In Cibola National Forest<br>Crosses Las Huertas Creek |
| Bridge 5916 is one of five bridges on a 3-mile stretch of unpaved road in the Cibola National Fores; presumably constructed with New Deal funds. It is a poured concrete slab with a 20-foot span and hand laid stone rails. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its relationship to the New Deal programs and the workmanship/attention to design detail reflected in the stone rails. | | | | | |

| **CONCRETE SLAB WITH STONE RAIL - CONTINUED** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 5919 | 1935 | East of Placitas | NM-165 | In Cibola National Forest<br>Crosses Las Huertas Creek |
| Bridge 5919 is one of five bridges on a 3-mile stretch of unpaved road in the Cibola National Forest; presumably constructed with New Deal funds. It is a poured concrete slab with a 21-foot span and hand laid stone rails. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its relationship to the New Deal programs and the workmanship/attention to design detail reflected in the stone rails. | | | | | |

| **TIMBER BRIDGES** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1646 | 1931 | Elemendorf | NM-1 | Unnamed waterway |
| Bridge 1646 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance. | | | | | |
|  | 1647 | 1931 | Elmendorf | NM-1 | Crosses the Rio Grande |
| Bridge 1647 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. However, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance. | | | | | |

| **TIMBER BRIDGES - CONTINUED** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1648 | 1931 | Near Tiffany | NM-1 | Ryan Hill Canyon |
| Bridge 1648 is one of the longest timber bridges surveyed (303 feet), has twelve spans with a 25-foot maximum span, and is a BT series standard plan timber bridge with concrete piers. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its standard plan, reflecting the 1918 – 1931 desire for standardization, association with U.S. 85, and the introduction of concrete piers into a timber design. | | | | | |
|  | 1649 | 1931 | North of San Marcial | NM-1 | Unamed waterway |
| Bridge 1649 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic mesh rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance. | | | | | |
|  | 1650 | 1931 | North of San Marcial | NM-1 | Unamed waterway |
| Bridge 1650 is a BT Series standard plan timber bridge with three 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance. | | | | | |

<table>
<tr><th colspan="6">TIMBER BRIDGES - CONTINUED</th></tr>
<tr><th></th><th>No.</th><th>Date</th><th>Location</th><th>Road</th><th>Notes</th></tr>
<tr><td></td><td>1651</td><td>1931</td><td>Near San Marcial</td><td>NM-1</td><td>Unamed waterway</td></tr>
<tr><td colspan="6">Bridge 1651 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance.</td></tr>
<tr><td></td><td>1652</td><td>1931</td><td>North of San Marcial</td><td>NM-1</td><td>Unamed waterway</td></tr>
<tr><td colspan="6">Bridge 1652 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail. The new guardrail detracts from its overall character and has altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance.</td></tr>
<tr><td></td><td>1653</td><td>1931</td><td>South of San Marcial</td><td>NM-1</td><td>Spikey Arroyo</td></tr>
<tr><td colspan="6">Bridge 1653 is a BT Series standard plan timber bridge with eight 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail and the addition of timber bents to the concrete piers. The new guardrail and bent detract from its overall character and have altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance.</td></tr>
</table>

**TIMBER BRIDGES - CONTINUED**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 1654 | 1931 | South of San Marcial | NM-1 | Crosses the Rio Grande |

Bridge 1654 is a BT Series standard plan timber bridge with four 25-foot spans. Its integrity has been impacted by the replacement of its historic rail with a new wood guardrail, the addition of timber bents to the concrete piers and a new concrete spillway. The new guardrail, bents, and spillway detract from its overall character and have altered its original standard plan design. But, because it is associated with U.S. 85 it is recommended eligible for the NRHP under Criterion A, at the state level of significance.

| | | | | | |
|---|---|---|---|---|---|
|  | 1831 | 1940 | T or C | NM-51 | Crosses Rio Grande |

Bridge 1831 is a BT series standard plan, which crosses the Rio Grande on a curve in the road. It is one of the longest timber bridges in the survey (248 feet) with ten 25-foot spans. As such, it is recommended eligible under Criteria C, at the state level of significance, for its unusual curved design and timber construction.

**STEEL TRUSSES**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 1778 | 1936 | Rio San Jose | NM-124 | Parker Pony Truss; Rio San Jose |

Bridge 1778 is a steel, 100-foot span Parker Pony Truss crossing the Rio San Jose. It retains a diamond pattern railing and is the only example of a Parker Pony Truss. As such, it is recommended eligible under Criterion C, at the state level of significance, for its steel Parker Pony Truss design.

**STEEL TRUSSES - CONTINUED**

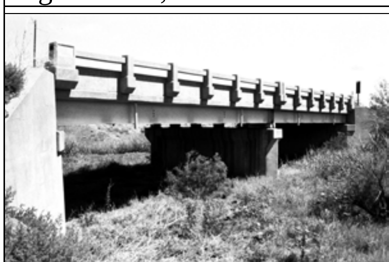
| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 2208 | 1939 | West of Reserve | NM-12 | Warren Pony Truss; Starkweather Canyon |

Bridge 2208 is a steel, 100-foot span Warren Pony Truss crossing Starkweather Canyon and constructed as a Forest Service Project. It is the only example of a Warren Pony Truss that has not been moved or altered. As such, it is recommended eligible under Criterion C, at the state level of significance, for its steel Warren Pony Truss design.

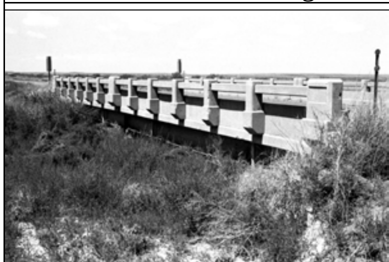
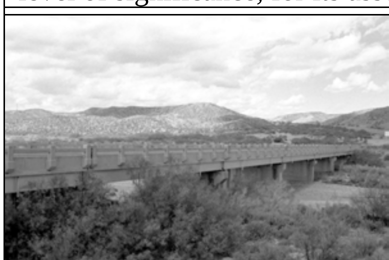
**STEEL STRINGER WITH A CONCRETE THRU-RAIL**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 1756 | 1935 | North of T or C | NM-181 | Crosses Yapple Arroyo |

Bridge 1756 is a typical example of a steel stringer bridge constructed during the 1930s. It is a standard plan with two 50-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with U.S. 85 and for its standard design.

| | | | | | |
|---|---|---|---|---|---|
|  | 1757 | 1936 | East of Newkirk | Old Route 66 | Crosses Arroyo de las Palomas |

Bridge 1757 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.P. #5 REO). It is a standard plan with two 40-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with Route 66 and for its standard design.

| **STEEL STRINGER WITH A CONCRETE THRU-RAIL - CONTINUED** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1758 | 1936 | East of Newkirk | Old Route 66 | |
| Bridge 1758 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.P. #5 REO). It is a standard plan with two 39-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with Route 66, and for its standard design. | | | | | |
|  | 1759 | 1936 | East of Newkirk | Old Route 66 | |
| Bridge 1759 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.P. #5 REO). It is a standard plan with two 40-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with Route 66, and for its standard design. | | | | | |
|  | 1791 | 1937 | South of San Marcial | NM-1 | Crosses Nogal Canyon |
| Bridge 1791 is the longest example of a steel stringer bridge constructed during the 1930s. It is a standard plan with five 39-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with U.S. 85, and for its standard design. | | | | | |
|  | 1796 | 1938 | North of T or C | NM-181 | Crosses Alamosa River |
| Bridge 1796 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.P. #167-A). It is a standard plan and is recommended eligible under Criteria A and C, at the state level of significance, for its standard design and relationship to U.S. 85. | | | | | |

| STEEL STRINGER WITH A CONCRETE THRU-RAIL - CONTINUED | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1814 | 1939 | Galisteo | NM-41 | Crosses San Cristobal Arroyo |
| Bridge 1814 is a typical example of a steel stringer bridge constructed during the 1930s under State Project 207. It is a standard plan with three 70-foot spans and is recommended eligible under Criterion C, at the state level of significance, for its standard design with exceptional 70-foot spans (typical is 40 feet). | | | | | |
|  | 1818 | 1939 | San Jose | I-25 frontage | Crosses Pecos River |
| Bridge 1818 is a typical example of a steel stringer bridge constructed during the 1930s. It is a standard plan with four 50-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with U.S. 85 and for its standard design. | | | | | |
|  | 1819 | 1939 | Cerrillos | NM-14 | Crosses railroad |
| Bridge 1819 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.G.S. 214-I). It is a standard plan with three 57-foot spans and is recommended eligible under Criterion C, at the state level of significance, for its function as a railroad grade separation and for its standard design with long span. | | | | | |

| **STEEL STRINGER WITH A CONCRETE THRU-RAIL - CONTINUED** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1834 | 1940 | Tecolote | I-25 frontage | Crosses Tecolote Creek |
| Bridge 1834 is a typical example of a steel stringer bridge constructed during the 1930s (F.A.P. # 60 - 8(3)). It is a standard plan with three 49-foot spans and is recommended eligible under Criteria A and C, at the state level of significance, for its association with U.S. 85 and for its standard design. | | | | | |
| **OTHER STEEL STRINGER BRIDGES** | | | | | |
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 1782 | 1936 | Galisteo | NM-41 | Crosses Galisteo River<br><br>Contributing element of historic district |
| Bridge 1782 is a steel stringer bridge with four 59-foot spans constructed during the 1930s. It has previously been determined a contributing element of the Galisteo Historic District. As such, this bridge is eligible for the NRHP as part of that district. | | | | | |
|  | 2502 | 1932 | Caballo | NM-187 | Palomas Creek<br>Bridge curves across creek |
| Bridge 2502 is one of the oldest and longest steel stringer bridges surveyed (254 feet). The unusual curved structure has five 49-foot spans with approaches (F.A.P. # 104). As such, it is recommended as eligible under Criteria A and C, at the state level of significance, for its association with U.S. 85 and its curved design. | | | | | |

<table>
<tr><th colspan="6">OTHER STEEL STRINGER BRIDGES - CONTINUED</th></tr>
<tr><th></th><th>No.</th><th>Date</th><th>Location</th><th>Road</th><th>Notes</th></tr>
<tr><td></td><td>1836</td><td>1940</td><td>Espanola</td><td>Paseo de Onate</td><td>Crosses Rio Grande</td></tr>
<tr><td colspan="6">Bridge 1836 is the second longest steel stringer bridge surveyed (840 feet) and is the only bridge surveyed that includes a decorative railing and sidewalk. It was one of the last highway structures completed prior to WWII, and was the basis for standard plan steel stringers constructed after the war. As such, it is recommended as eligible under Criterion C, at the state level of significance, for its design.</td></tr>
<tr><td></td><td>5445</td><td>1940</td><td>Raton</td><td>1st Street</td><td>Adjacent to twin railroad bridge</td></tr>
<tr><td colspan="6">Bridge 5445 is a distinctive bridge under NMSHTD maintenance responsibility. It is assumed to be a New Deal structure and reflects the New Deal penchant for detailing through its design, workmanship, decorative railings, pilasters, and siting. It is assumed that it was built with New Deal funds. As such, it is recommended as eligible under Criteria A and C, at the state level of significance, for its association with the New Deal and its unique design characteristics.</td></tr>
<tr><td></td><td>3221</td><td>1937</td><td>Capitan</td><td>U.S. 380</td><td>Priest Gulch</td></tr>
<tr><td colspan="6">Bridge 3221 is a steel stringer bridge 114 feet long with three spans and a maximum span of 45 feet. Although many of the features are deteriorating, the overall character of this bridge, assumed to be from the New Deal era, is intact. As such, it is recommended eligible for the NRHP under Criterion C, at the state level of significance, for its design detailing.</td></tr>
</table>

**OTHER STEEL STRINGER BRIDGES - CONTINUED**

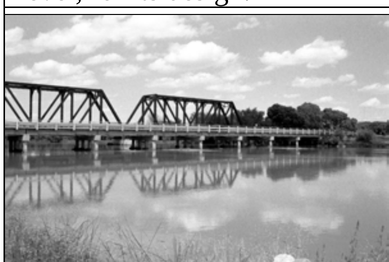
| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 2209 | 1939 | West of Reserve | NM-12 | Starkweather Canyon |

Bridge 2209 is a steel stringer bridge that is 96 feet long with two spans and a maximum span of 45 feet. It was constructed during the New Deal era and represents a type of construction that began to be used more often after World War II. Although it is deteriorating, the overall integrity is intact. As such, it is recommended eligible for the NRHP under Criteria A and C, at the state level of significance.

**CONCRETE CHANNEL BEAM AND CONCRETE T-BEAM**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 851 | 1934 | Mora | NM-434 | Crosses Mora River |

Bridge 851 is the oldest concrete channel beam bridge surveyed and has two 24-foot spans. It is the oldest remaining bridge of its type and as such is recommended eligible under Criterion C, at the state level, for its design.

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 4264 | 1941 | Hatch | NM-154 | Crosses Rio Grande Rail on existing railing |

Bridge 4264 is a concrete T-beam and is the longest of its type surveyed (476 feet). It has fourteen 34-foot spans. This bridge was part of a canal and bridge project undertaken on the lower Rio Grande from Hatch to El Paso. The International Boundary Commission (IBC) oversaw the project and developed standard plans specifically for bridges constructed under the project. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with the IBC project and its T-beam design and overall length.

### 4.2.3 1941–1945: World War II

During World War II a slowdown in construction resulted in only “strategic roads” being built. Such roads in New Mexico were those that led to mining districts and military installations.

<table>
<tr><td colspan="6">STEEL CONTINUOUS GIRDER</td></tr>
<tr><td></td><td>No.</td><td>Date</td><td>Location</td><td>Road</td><td>Notes</td></tr>
<tr><td></td><td>5629</td><td>1944</td><td>West of Reserve</td><td>NM-12</td><td>Crosses Canyon del Buey<br>Metal steel picket</td></tr>
<tr><td colspan="6">Bridge 5629 is the longest steel girder bridge (202 feet) constructed during World War II and has three spans, with the maximum at 100 feet. It was constructed under NM Forest Project 21 at a time when only strategic highway projects were undertaken. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with WWII highway construction and its steel stringer/concrete bent design.</td></tr>
</table>

### 4.2.4 1945–1956: Postwar Highway Construction

After World War II, there was a substantial increase in construction. Many new roads were built and were designed as divided highways, existing roads were widened, and concrete and steel I-beams began to serve as the primary materials in bridge construction.

<table>
<tr><td colspan="6">STEEL STRINGER BRIDGES</td></tr>
<tr><td></td><td>No.</td><td>Date</td><td>Location</td><td>Road</td><td>Notes</td></tr>
<tr><td></td><td>3499</td><td>1950</td><td>San Antonio</td><td>US-380</td><td>Crosses Rio Grande</td></tr>
<tr><td colspan="6">Bridge 3499 has the longest maximum span of any steel stringer surveyed (66 feet), is the longest of its type (865 feet) with fourteen spans, and crosses the Rio Grande. It was constructed during the post war boom in an effort to link the eastern and western portion of the state. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its length and steel stringer design characteristics.</td></tr>
</table>

**STEEL STRINGER BRIDGES**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 7536 | 1950 | East of Golondrinas | NM-161 | Mora River |

Bridge 7536 combines a timber deck and posts with steel stringers and has a 60-foot span, one of the longer spans of the steel stringers surveyed. As such, it is recommended eligible under Criterion C, for its span and steel stringer design characteristics.

| | | | | | |
|---|---|---|---|---|---|
|  | 5262 | 1953 | Questa | NM-522 | Red River |

Bridge 5262 is a steel stringer 161 feet long with four spans. It was constructed during the post war boom in northern New Mexico in an effort to connect outlying communities to Taos. The post war boom is characterized primarily by the widening and development of primary roads. As such, it is recommended eligible under Criteria A and C, because it was constructed as part of a road widening and retains its original steel stringer design.

**STEEL CONTINUOUS STRINGER**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 3492 | 1950 | South of Virden | NM-92 | Crosses Gila River |

Bridge 3492 is the longest continuous steel stringer bridge surveyed (636 feet) and has nine spans with a maximum span of 82 feet. It was constructed in the post war boom to connect Arizona and southern New Mexico and as such is recommended eligible under Criteria A and C, at the state level of significance, for its association with the post war boom, its extraordinary length, and its steel stringer design.

| **STEEL CONTINUOUS STRINGER - CONTINUED** | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 3493 | 1950 | South of La Madera | NM-111 | Crosses Rio Vallecitos |
| Bridge 3493 is 205 feet long with three spans, the maximum span of 78 feet. As such, it is recommended eligible under Criterion C, for its span and steel stringer design characteristics. | | | | | |
|  | 5237 | 1951 | East of Newkirk | Old Route 66 | Crosses Pajarito Creek |
| Bridge 5237 is 145 feet long with three spans and a maximum span of 55 feet. It is recommended eligible under Criterion A and C for its association with Route 66 and as a representative example of a 1950s steel stringer bridge on that route. | | | | | |
|  | 5231 | 1952 | Near San Jon | Old Route 66 | Crosses Plaza Larga Creek |
| Bridge 5231 is 509 feet long with twelve spans and a maximum span of 49 feet. It is recommended eligible under Criterion A and C for its association with Route 66 and as a representative example of a 1950s steel stringer bridge on that route. | | | | | |

<table>
<tr><th colspan="6">STEEL CONTINUOUS STRINGER - CONTINUED</th></tr>
<tr><th></th><th>No.</th><th>Date</th><th>Location</th><th>Road</th><th>Notes</th></tr>
<tr><td></td><td>5232</td><td>1952</td><td>Near San Jon</td><td>Old Route 66</td><td>Crosses Revuelto Creek<br>Built on a curve; guard rail attached at curb</td></tr>
<tr><td colspan="6">Bridge 5232 is 289 feet long with six spans and a maximum span of 55 feet. It is a steel continuous stringer built on a curve across Revuelto Creek on Route 66. It is recommended eligible under Criterion A and C for its association with Route 66 and as a unique example of a 1950s steel stringer bridge on that route.</td></tr>
<tr><td></td><td>5238</td><td>1952</td><td>Montoya</td><td>Old Route 66</td><td>Crosses Arroyo Laguna</td></tr>
<tr><td colspan="6">Bridge 5238 is 208 feet long with five spans and a maximum span of 45 feet. It is recommended eligible under Criterion A and C for its association with Route 66 and as an intact representative example of a 1950s steel stringer bridge on that route.</td></tr>
<tr><td></td><td>3488</td><td>1950</td><td>Manuelito</td><td>Old Route 66</td><td>Crosses railroad</td></tr>
<tr><td colspan="6">Bridge 3488 is a steel continuous stringer railroad overpass constructed during the post war boom on Route 66. It is 333 feet long, has a maximum span of 55 feet, and includes concrete bents and smoke guards. It is recommended eligible for its association with the post war boom in construction and its design features under Criteria A and C, at the state level of significance.</td></tr>
</table>

**TIMBER BRIDGES**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 3498 | 1950 | South of Belen | NM-109 | One span with timber beams<br>Crosses irrigation canal |

Bridge 3498 is a 25-foot span timber bridge constructed using standard plan BT-24. It retains integrity, including the railing, and as such is recommended eligible under Criteria C, at the state level of significance, as an example of a simple timber bridge, and one of the last of its type to be constructed in New Mexico.

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 5517 | 1952 | North of San Jon | NM-392 | Crosses Frost Creek<br>Bridge is a “timber slab” – beams are laid tight to form a slab |

Bridge 5517 is 63 feet long with three spans and a maximum span of 22 feet. It is the only “timber slab” bridge in the state. As such, it is recommended eligible under Criteria C, at the state level of significance, for its unique construction.

**CONTINUOUS CONCRETE & CONCRETE STRINGER**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 3459 | 1946 | South of Carrizozo | US-54 | Guard rail attached at curb |

Bridge 3459 is 203 feet long with six spans and a maximum span of 33 feet. It was constructed in the post war boom to connect southern New Mexico to the north. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with the post war highway construction boom and its design as a concrete stringer.

**CONTINUOUS CONCRETE & CONCRETE STRINGER - CONTINUED**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 3460 | 1946 | South of Carrizozo | US-54 | Guard rail attached at curb |
| Bridge 3460 is 153 feet long with six spans and a maximum span of 25 feet. It was constructed in the post war boom to connect southern New Mexico to the north. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with the post war highway construction boom and its design as a concrete stringer. | | | | | |
|  | 3470 | 1948 | South of Fort Sumner | NM-20 | Crosses Yeso Creek Guard rail attached at curb |
| Bridge 3470 is 147 feet long with five spans and a maximum span of 29 feet. It was constructed in the post war boom to connect the Fort Sumner area to southeastern New Mexico. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with the post war highway construction boom and its design as a concrete stringer. | | | | | |
|  | 5263 | 1952 | North of Carrizozo | US-54 | Crosses Coyote Canyon Guard rail attached at curb |
| Bridge 5263 is 148 feet long with five spans and a maximum span of 29 feet. It was constructed in the post war boom to connect southern New Mexico to the north. As such, it is recommended eligible under Criteria A and C, at the state level of significance, for its association with the post war highway construction boom and its design as a concrete stringer. | | | | | |

**CONCRETE SLAB**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 5291 | 1953 | Roswell | US 70 | Crosses North Spring River |

Bridge 5291 has a single 40-foot concrete slab span on a divided portion of U.S. 70 in Roswell. It was constructed during the post war boom in an effort to provide a link between Roswell and Ruidoso. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete slab with arched railing design characteristics.

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 5292 | 1953 | Roswell | US 285 | Crosses Hondo River |

Bridge 5292 has a single 37-foot concrete slab span on a divided portion of U.S. 285 in Roswell. It was constructed during the post war boom in an effort to link the southern and northern portions of the state. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete slab with arched railing design characteristics.

**CONTINUOUS CONCRETE SLAB**

| | No. | Date | Location | Road | Notes |
|---|---|---|---|---|---|
|  | 5264 | 1953 | South of Mosquero | NM-39 | Crosses Mosquero Creek |

Bridge 5264 is a concrete continuous slab bridge with six 33-foot spans. It was constructed during the post war boom in an effort to link ranches in the Mosquero area with New Mexico markets. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete channel beam characteristics.

<table>
<tr><td colspan="6">CONTINUOUS CONCRETE SLAB - CONTINUED</td></tr>
<tr><td></td><td>No.</td><td>Date</td><td>Location</td><td>Road</td><td>Notes</td></tr>
<tr><td></td><td>5280</td><td>1953</td><td>North of Carrizozo</td><td>US-54</td><td>Unnamed waterway</td></tr>
<tr><td colspan="6">Bridge 5280 is a concrete continuous slab with three 29-foot spans. It was constructed during the post war boom in an effort to link southern and northern New Mexico. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete channel beam characteristics.</td></tr>
<tr><td></td><td>5288</td><td>1953</td><td>North of Naravisa</td><td>NM-402</td><td>Traques Creek</td></tr>
<tr><td colspan="6">Bridge 5288 is a concrete continuous slab with six spans of 33 feet. It was constructed during the post war boom in construction an effort to link eastern New Mexico markets. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete slab construction.</td></tr>
<tr><td colspan="6">CONCRETE CHANNEL BEAM</td></tr>
<tr><td></td><td>No.</td><td>Date</td><td>Location</td><td>Road</td><td>Notes</td></tr>
<tr><td></td><td>5293</td><td>1953</td><td>Near Farley</td><td>NM-193</td><td>Hugio Creek</td></tr>
<tr><td colspan="6">Bridge 5293 is a concrete channel beam with three 25-foot spans. It was constructed during the post war boom in an effort to link ranches in the Roy area with New Mexico markets. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete channel beam characteristics.</td></tr>
</table>

| CONCRETE CHANNEL BEAM - CONTINUED | | | | | |
|---|---|---|---|---|---|
| | **No.** | **Date** | **Location** | **Road** | **Notes** |
|  | 5287 | 1953 | Near Logan | NM-102 | Crosses Tequesquite Creek |
| Bridge 5287 is a concrete channel beam with ten 25-foot spans. It was constructed during the post war boom in an effort to link ranches in eastern New Mexico with markets. As such, it is recommended eligible under Criteria A and C, for its association with the post war boom in highway construction and its concrete channel beam characteristics. | | | | | |

# GLOSSARY

| | |
|---|---|
| **abutment** | structure that supports the end of a bridge or that anchors the cables of a suspension bridge |
| **bent** | a structural framework, transverse to the length of a bridge, designed to carry lateral as well as vertical loads |
| **beam** | horizontal structural member, such as a girder, which transversely supports a load and transfers the load to vertical members |
| **cast-in-place** | Concrete poured into forms at its final location; also referred to as in-situ concrete |
| **compression** | structurally, the force that pushes together or crushes, as opposed to tension, which is the force that pulls apart |
| **funicular** | relating to a rope, especially its tension; operated by a rope or cable, especially one wound or pulled by a machine |
| **girder** | a large principal beam of steel, reinforced concrete, wood, or a combination of these, used to support other structural members at isolated points along its length |
| **grade crossing** | a place where the road or railroad crosses a railroad at the same level |
| **levy** | money raised under government authority |
| **mill** | a monetary unit equal to one thousandth of a U.S. dollar, used in accounts and calculation but not in everyday currency |
| **period of significance** | the length of time of a property's association with important events, activities, or persons, or when it attained the characteristics that qualify it for the NRHP |
| **pier** | a supporting structure that carries a bridge span; in multi-span bridges, one or more piers are usually set between two abutments |
| **precast** | A concrete member that is cast and cured in other than its final position. |

| | |
|---|---|
| **prestressed** | placed in a state of compression prior to application of service loads |
| **post-tensioned** | prestressed reinforced concrete in which tendons are tensioned after the concrete has hardened |
| **site cast** | a method of concrete construction in which members are cast horizontally at a location adjacent to their eventual position and hoisted into place after removal of forms |
| **slab** | flat, horizontal molded layer of plain or reinforced concrete, usually of uniform but sometimes of variable thickness, positioned either on the ground or supported by beams, columns, or other framework |
| **span** | the horizontal distance between supports |
| **stringer** | a horizontal structural member used to support joists or other cross members |
| **tension** | the state or condition imposed on a material or structural member by pulling or stretching |

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# APPENDIX A: PROPERTIES MISSING FROM 2002 NMNBI

| No. | County | Date | Type Code | Facility Carried | Detailed Location Information | Maintenance Responsibility | NMDOT District |
|---|---|---|---|---|---|---|---|
| **1578** | Rio Arriba | 1930 | 310 | NM 74 | 1.3 mi W of JCT NM 68 | NMDOT | 05 |
| **2613** | Quay | 1936 | 302 | CRI & P R/R | 0.4 mi E of NM 39 | Not in NBI | Not in NBI |
| **3466** | Union | 1947 | 201 | US 56 | 10.7 mi E of JCT NM 453 | NMDOT | 04 |
| **3497** | San Miguel | 1950 | 402 | NM 329 | 1.0 mi W of JCT Loop-15 | NMDOT | 04 |
| **3757** | Rio Arriba | 1940 | 702 | NM 112 | 11.3 mi N of JCT NM 96 | NMDOT | 05 |
| **4515** | Valencia | 1934 | 702 | Silva Road | 0.6 mi W NM 47 @ MP 25.4 | County | 03 |
| **4955** | San Miguel | 1947 | 201 | NM 65 | 13.3 mi W of Loop-15 | NMDOT | 04 |
| **5230** | Rio Arriba | 1950 | 702 | NM 112 | 4.9 mi S of JCT US 84 | NMDOT | 05 |
| **7690** | Quay | 1940 | 402 | CR QR-50 | 6.3 mi E of JCT 469 | County | 04 |
| **7695** | Dona Ana | 1944 | 702 | CR AO92 | 0.83 mi W NM 28 @ MP 3.79 | County | 01 |
| **7740** | Colfax | 1940 | 702 | CR AO11 | 0.7 mi N US64/87 @ MP 361 | County | 04 |
| **8110** | San Juan | 1935 | 702 | CR 3050 | 1.5 mi W US 550 @ MP 11.75 | County | 05 |
| **8928** | San Miguel | 1930 | 702 | State Park Rd | Storie Lake State Park/Las Vegas | County | 04 |

# APPENDIX B: PREVIOUSLY LISTED BRIDGES

(List includes only those that are under NMDOT maintenance responsibility)

| NMDOT No. | Date | County | Place | Feature Crossed | Facility Carried | Location Detail | Type | HPD No. | Date on NR | Date on SR |
|---|---|---|---|---|---|---|---|---|---|---|
| **1792** | 1936 | San Juan | Shiprock | San Juan River | US 64/ WBL 666 | .54 miles west of Shiprock/ US 666 | Steel Truss Thru [310] | 1666/ 575 | 7/15/97 | 5/9/97 |
| **2530** | 1933 | Bernalillo | Albuquerque | Rio Puerco | I-40 Frontage Road | 13.8 miles east of Junction I-40/ NM 6 | Steel Truss Thru [310] | 1662 | 7/15/97 | 5/9/97 |
| **2591** | 1933 | Dona Ana | Radium Springs | Rio Grande | NM 185 | 14.2 miles north of Junction US 70 | Timber stringer [702] | 574/ 1663 | 7/15/97 | 1/20/78 |
| **5272** | 1953 | Lincoln | Tinnie | Rio Hondo | NM 395 | .2 miles south Junction 70/380 | Steel Truss Thru [310] | 744 | Not listed | 8/24/79 |
| **6462** | 1965 | Taos | Taos | Rio Grande | NM 64 | 7.6 miles west of NM 522 | Steel Continuous Truss- deck [409] | 1664 | 7/15/97 | 5/9/97 |
| **7622** | 1968 | Los Alamos | Los Alamos | Los Alamos Canyon | NM 501 | .25 miles south of Junction NM 502 | Steel Arch Deck [311] | 1665 | Not listed | 5/9/97 |