Van Duzen River Bridge (Alton Bridge)
Spanning Van Duzen River on California State Highway 101
Alton vicinity
Humboldt County
California

HAER No. CA-129

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Western Regional Office
National Park Service
U.S. Department of the Interior
San Francisco, California 94102

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HISTORIC AMERICAN ENGINEERING RECORD

Van Duzen River Bridge (Alton Bridge)

HAER No. CA-129

Location:	Spanning the Van Duzen River on California State Highway 101 Alton vicinity, Humboldt County, California UTM: 10 402887.4487745 Quad: Fortuna, California
Date of Construction:	1924-1925
Engineer:	Harlan D. Miller Bridge Department California Division of Highways
Present Owner:	California Department of Transportation District 1 1656 Union Street Eureka, California 95501
Present Use:	Highway bridge
Significance:	The Van Duzen River Bridge, also known as the Alton Bridge, was determined eligible for listing in the National Register of Historic Places in 1986. It represents a transitional design in the evolution of concrete arch bridges, and is the earliest surviving bridge designed under the direction of Harlan D. Miller, California's second state bridge engineer and the man most responsible for providing engineering design and aesthetic direction for California bridges between 1924 and 1940.
Report prepared by:	John W. Snyder Chief Architectural and Historic Studies California Department of Transportation 1120 N Street Sacramento, California 95814

PART I. HISTORICAL INFORMATION

The Van Duzen Bridge crosses the Van Duzen River just south of Alton in Humboldt County. The river was originally called Van Dusen's Fork of the Eel River, being so named in January 1850 after a member of the Gregg party of gold prospectors. The river appears on an 1853 map as "vandusen's Fork." Popular usage changed the "Fork" to "River" and the U.S. Geological Service adopted that name. The Van Duzen River enters the Eel River just downstream from the subject bridge. In 1862, S. R. Perry named the nearby town of Alton after his home town in Illinois. In the 1880s, that name was applied to the post office, and later to the station of the Eel River and Eureka Railroad, forerunner of the present Eureka Southern Railroad, forerunner of the present Eureka Southern Railroad. By the 1890s, the town was fast developing as an agricultural center and, by 1904, boasted several hundred inhabitants. Today, the depot and most commercial buildings are gone, and Alton is little more than a few houses located at the junction of Highways 101 and 36.

The Van Duzen River Bridge consists of four-beam reinforced concrete T-beam approach spans carried on reinforced concrete four-pile bents; and reinforced concrete continuous single-rib, open spandrel arch spans over the river channel. Structurally, abutment 1 and arch piers 2 and 4 are supported by spread footings, which arch piers 3 and 5 are carried on timber piles. The bridge's thirteen spans total 788 feet in length, and are 24 feet wide. While originally a two-lane bridge, today the structure carries a single lane of northbound Highway 101 between its concrete window-type railings. Designed in 1923-24 under the direction of acting bridge engineer Harlan D. Miller, the bridge was erected by contractors Bordwell and Zimmerman of Napa for the California Division of Highways at a cost of $106,241.02.

The Van Duzen River Bridge replaced a county bridge built in 1901 by the San Francisco Bridge Company. This earlier bridge consisted of two steel Camelback truss spans with wooden trestle approaches, and carried a narrow, 16-foot roadway. By the early 1920s, the steel spans were badly corroded from the salt-laden coastal air, and the wooden deck and approach spans were rotted. This bridge was on approximately the same alignment as the present bridge, necessitating its removal prior to construction. As will be seen, this early removal was to aggravate later construction problems. Contractors removed the old bridge by dynamiting the supporting cylinder piers (also known as lally columns), dropping the steel spans on their sides in the riverbed, where they were cut up by torch. The contractors salvaged the floor stringers for use as falsework bracing for the new bridge. The steel cylinder piers were simply buried in the river bed. This initial work--constructing a detour and removing the old bridge--took place between May 12, 1924 and June 1, 1924.

Beginning on June 2, 1924, the contractor's crew drove piles to support the falsework necessary for the construction of the new bridge, completing this work on June 18, 1924. Excavation for the south abutment took from June 19, 1924, to July 7, 1924. On this latter date, the contractor began excavation for pier 1 and also began placing the south arch centering. Much of the pier 1 excavation was done by dragline, but it finally proved necessary to construct a cofferdam of sheet piling, with cross struts placed by a diver. The crew then pumped the cofferdam dry and leveled the bottom by hand. They later used this same technique for the pier 2 excavation.

The first rain of winter occurred on August 16, 1924. On August 30, concrete work began, with the pouring of the pier 1 footing. For this and all subsequent concrete work, the contractor had to construct their own aggregate plant at the downstream (west) side of the bridge. Using a dragline scraper, they moved gravel from the river bed to a hopper. From there, they ran it over a grizzly where the smaller gravel dropped through to a conveyor and the larger particles moved on to a crusher and then to another conveyor. This second conveyor carried the material to a washing and screening plant, which separated sand from gravel, and washed and graded both. Water for the concrete came directly from the river. Cement, shipped by rail to Alton from the Golden Gate Portland Cement Company's plant at Cement, California [a site that is still visible from Interstate Highway 80 near Fairfield], was stored in a waterproof barn and then hauled by truck to the job as needed. The contractor trucked lumber for forms and falsework from the Pacific Lumber Company's mill at nearby Scotia.

Bordwell and Zimmerman used two methods of concrete placement. For the south abutment and the two river piers, they dumped concrete from the mixer into dump cars, pushing these by hand over a light industrial railroad, which they had built for this purpose, to the point of placing. For the arch rings and spandrel columns, they constructed a 100-foot-tall elevating tower. In use, they loaded concrete from the dump cars into a skip bucket, hoisted this to the top of the tower hy a gas engine, and then chuted the concrete to the point of placing.

It was during concrete placement that the full force of the north coast winter began to be felt. On November 20, 1024, flood conditions, combined with the battering of large drift material, washed the falsework from beneath the south and middle arches, as well as form beneath the south half of the north arch, causing the crown of the recently-poured north and south arches to deflect, though not seriously. This same flood also destroyed the elevating tower, necessitating construction of a new one, and, in its early stages, washed out the detour bridge.

When the detour bridge washed out, traffic was diverted along the south bank of the Van Duzen River to the Eel River, across the Eel on Weymouth Bridge to Grizzly Bluff, and then back across the Eel again, on the East Ferry Bridge to Fortuna. This detour was in effect for two days, when the East Ferry Bridge washed out. Traffic was then detoured from Grizzly Bluff to Ferndale, then back across the Eel River to Fernbridge and on to Fortuna. This last just one day, when the Weymouth Bridge washed out. Clearly, nature seemed to be getting out of hand.

Construction continued throughout the winter, and the State opened the new bridge to traffic on March 12, 1925. Five weeks later, on April 19, the Van Duzen River reached its highest level for the winter, but the new hridge sustained no damage. On April 24, 1925, the contractor's forces completed all work.

Harlan D. Miller

Harlan Dewey Miller was born in Ohio on May 5, 1880. He was graduated from the Case School of Applied Science in Cleveland in 1904, with two degrees in Civil Engineering. His early career included employment with the J. P. Cowing Company, Contractors, of Cleveland; with the bridge department of the New York Central Railroad; and with the New York State Engineer's Office. After four years in the latter position, Miller was appointed head of the bridge department in New York, responsible for the plans of some 300 highway bridges. In 1915, he was sent to San Francisco to take charge of the New York State Engineer's exhibit at the Panama-Pacific International Exposition. Later that year, he became a partner in the Cleveland-based firm of Watson, Davis and Miller, and opened an office in San Francisco. Construction and, hence, engineering work was still booming as an aftermath of the 1906 earthquake and fire, and the International

Engineering Congress was also held in San Francisco that year. One of Miller's first proposals was for the transbay bridge connecting San Francisco and Oakland; this was the first such proposal to be found acceptable by the War Department. In 1919, the State of California appointed him Assistant Bridge Engineer with the California Highway Commission. On November 1, 1924, he was formally appointed to the position of Bridge Engineer, having performed that duty since February 1, when his predecessor had resigned.

Miller initiated several changes that had a significant effect on the subsequent design of highway bridges in California. He centralized the bridge department in Sacramento. Along with design responsibility for state highway bridges, he also delegated responsibility for supervision of bridge construction to the bridge department, a task previously performed by district engineers. This provided for more uniform design and construction methods. Perhaps the most notable change was the requirement that <u>all</u> bridges on state highways be designed by the bridge department. Prior to this time, it had been the policy of the Highway Commission to require the counties to construct the bridges on state highways. Understandably, this earlier policy had resulted in bridges of widely varying types and capacities; the poorer counties resorted to bridges of light design, which soon proved inadequate. Some counties hired consulting engineers for this purpose, while others relied on the skills of the county engineer. Either way, the result had often been a bridge designed by an engineer with little or no experience in bridge design.

Prior to Miller's term as bridge engineer, most bridges were built at right angles to the stream crossed, and without horizontal or vertical curves on the bridge. While this simplified the design and lowered the costs, it also often resulted in poor general alignment and dangerously sharp approach curves. Under Miller's direction, it became the aim of the bridge department to make the alignment and riding qualities of the bridges and their approaches equal the current highway standards. While this often complicated design work, the final result--skewed or curved bridges--justified the efforts.

The foregoing changes were all significant from an engineering standpoint. But perhaps the most visible effect of Miller's role as bridge engineer was--and remains--the consideration given to design aesthetics. Miller believed that California's bridges should be substantial, but that artistic beauty should not be sacrificed. His designs were recognized in their own periods as possessed of beauty and boldness. End post and railing details were given careful attention. And where the sheer size of a bridge tended to indicate a monumental character, the general lines and details, as seen in elevation, received great attention, in order to assure the design respected and emphasized this characteristic.

Harlan D. Miller died in Sacramento on October 19, 1926, after a lengthy illness. Yet, in the brief period in which he served as bridge engineer for the California Highway Commission, he brought changes which had a far-reaching effect on state highway bridge design. The consideration of design aesthetics which he set forth resulted not only in notable bridges during his tenure--the Van Duzen River Bridge, the Truckee River Bridge at Polaris, Dog Creek Bridge, Charley Creek Bridge, and Slate Creek Bridge, all in Shasta County; the Douglas Memorial Bridge over the Klamath River (destroyed in 1964-65 winter floods); and the Donner Summit Bridge, to name a few--but also formed the basis for engineering and design practices which resulted in the bridge department assuming a nationally-recognized position as designers of progressive, award-winning bridges, such as the famous Bixby Creek Bridge of 1932. Indeed, the use of the skewed or curved bridges mentioned earlier would ultimately have a great influence on such structural types as the box girder and single-column bent, in use in today's state highway bridges.

Just prior to Miller's death, when it hecame apparent that he would not survive his illness, the California Highway Commission voted to designate the Dog Creek Bridge, then under construction in the Sacramento River canyon in Shasta County, as the Harlan D. Miller Bridge. The hridge was a 400-foot reinforced concrete structure with a 234-foot central arch and was 125 feet high. In naming the hridge, the Commission chose this spectacular structure on the state highway system as typical of Miller's work as a hridge engineer. This bridge was ultimately removed from the state highway system in 1957 and hypassed in 1974 (though it remains extant). On August 28, 1974, Senate Concurrent Resolution No. 140 renamed Bridge Number 6-27, adjacent to the Dog Creek Bridge on Interstate Highway 5, in honor of Miller.

The Van Duzen River Bridge at Alton was found to have high integrity of location, design, materials, workmanship, feeling, and association, with integrity of setting slightly compromised by the construction of a parallel highway hridge in 1952. It was also found to be clearly associated with the career of Harlan D. Miller, as one of the earliest remaining major bridges designed and built under his leadership. Finally, it embodies the distinctive characteristics of a type (single-rib, open spandrel reinforced concrete arch), period (mid-1920s), and method of construction (poured-in-place reinforced concrete). In 1987, this bridge was determined eligihle for inclusion in the National Register of Historic Places, significant under Criteria B and C at the local level.

PART II. PROJECT INFORMATION

The project which led to the preparation of this documentation will demolish and replace the historical Van Duzen River Bridge (Bridge Number 4-17R) which carries northbound Highway 101, and will widen the southbound structure (Bridge Number 4-17L). Highway 101, within the project limits, is a four-lane divided expressway, with the exception of the single-lane northbound bridge. Conversion to full freeway in the future is likely. The one-lane bridge is the only single-lane section within a 104-mile stretch of Highway 101.

The historical northbound bridge has a clear width roadway of just 21 feet, and a vertical curve which results in a stopping sight distance speed of 47 mph, both deficient under current standards. Originally constructed for two lanes of opposing traffic, the bridge was converted to two northbound lanes in 1952, following construction of the new southbound bridge. In 1974, the hridge was restricted to A single northhound lane because of a high accident rate resulting from the narrow lanes on the bridge. Although this action reduced the number of accidents, the accident rate remains at nearly twice that expected for this type of facility.

The project planning phase considered several alternatives:

> A "No-Build" alternative was considered and rejected hecause the historical bridge cannot be restored to sufficient structural integrity to continue in use. If taken out of service, the existing southbound bridge cannot be economically modified to carry both north- and southbound traffic.
>
> An alternative which would have constructed a new bridge west--downstream--of the southbound bridge was rejected hecause it would have directly impacted a National Register-eligible farmstead. In consultation with the California State Historic Preservation Office (SHPO), it was felt that these impacts would have been more significant than removal of the historic bridge. A variation of this alternative which would have widened the existing southbound would have required sufficient new right-of-way that impacts to the historic farmstead would have been the same; this variation was rejected for the reason cited above.

In an attempt to avoid impacts to all historic properties, the SHPO suggested an alternative which would have replaced the existing southbound bridge with a new structure carrying all four lanes of traffic. Studies ultimately determined that this alternative would still have had direct impacts to the historic farmstead, would have increased impacts upon riparian habitat, and would have much higher cost ($12.5 million vs. $7.2 million for the selected alternative). For these reasons, this alternative was also rejected.

The project alternative ultimately selected will result in removal of the existing northbound bridge, and construction of its replacement on the same basic alignment. The new bridge will have a 39-foot clear deck width which will provide two 12-foot traffic lanes, a 10-foot outside shoulder, and a 5-foot inside shoulder. The length of the new bridge will be approximately 800 feet. In addition, the southbound bridge will be upgraded to current design standards, including widening by 11 feet to provide a 39-foot clear deck width, and replacement of existing railings.

Because Federal funds and approvals were involved, the provisions of Section 106 of the National Historic Preservation Act of 1966 (as amended) applied. Consultation between the Federal Highway Administration, the SHPO, and the Advisory Council on Historic Preservation resulted in finding that the project would have an adverse effect on the historic Van Duzen River Bridge. Accordingly, a Memorandum of Agreement between those agencies was developed which stipulates documentation of the Van Duzen River Bridge to the standards of the Historic American Engineering Record (HAER). Consultation with the Western Regional Office of the National Park Service resulted in a determination that the appropriate level of documentation would consist of large-format archival photographs and this written historical report. Following acceptance of this documentation by HAER, copies were furnished to the SHPO, the California State Library in Sacramento, the Bancroft Library at the University of California, Berkeley, and the Humboldt County Historical Society.

PART III. SOURCES OF INFORMATION

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