GILLESPIE DAM BRIDGE
Spanning Gila River on Old US 80 Highway, south of Gillespie Dam
Arlington vicinity
Maricopa County
Arizona

HAER AZ-69
AZ-69

HAER
AZ-69

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
SANTA FE SUPPORT OFFICE
National Park Service
U.S. Department of the Interior
2968 Rodeo Park Drive West
Santa Fe, NM 87505

HISTORIC AMERICAN ENGINEERING RECORD

GILLESPIE DAM BRIDGE HAER No. AZ-69

(page 1)

Location: Spanning the Gila River at Old US 80 Highway; 1.2 miles south of Arlington
Section 28, Township 2 South, Range 5 West
Maricopa County, Arizona
UTM: 12.335120.3677868

USGS Quadrangle: Spring Mountain, Arizona (7½ Minute Series)

Construction Date: 1926-1927

Designers: Ralph A. Hoffman, Bridge Engineer, Arizona Highway Department
R.V. Leeson, Consulting Engineer, Topeka Bridge & Iron Works

Builder: Lee Moor Contracting Company, El Paso, Texas

Present Owner: Maricopa County Department of Transportation

Present Use: Two-lane vehicular bridge

Significance: Prior to completion of this bridge in 1927, traffic on the Pikes Peak Ocean-to-Ocean Highway at this point was often halted by flooding on the Gila River. The Gillespie Dam Bridge was thus strategically important to Arizona transportation in that it finally allowed all-weather travel over this vital transcontinental route. Technologically, the bridge is noteworthy as one of the longest vehicular structures in the state. Arizona's longest bridges have historically been built over the Gila. In fact, more effort and money was spent building—and maintaining—bridges over the Gila than any other river in the state. Of the five longest vehicular structures in the state in 1927 (Antelope Hill, 1,765 feet; Gillespie Dam, 1,660 feet; Tempe, 1,508 feet; Sacaton, 1,486 feet; and Florence, 1,430 feet), four spanned the Gila. Of these, the Gillespie Dam Bridge was the only steel structure. Several multiple-span vehicular through trusses were erected in the state in the 1910s and 1920s, but through attrition only two exist today—the Gillespie Dam Bridge and the Boulder Creek (Wickenburg) Bridge. In almost unaltered condition today, the Gillespie Dam Bridge is one of the most important examples of early bridge construction in Arizona.

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July 2006

This documentation of the Gillespie Dam Bridge in Arizona was produced by Fraserdesign of Loveland, Colorado, for the Maricopa County Department of Transportation (MCDOT), under a subcontract agreement with Archaeological Consulting Services of Tempe, Arizona. The structure was listed in the National Register of Historic Places in 1981 for its contribution to Arizona commerce and transportation. It has been documented for the Historic American Engineering Record as part of MCDOT's fulfillment of its Section 110 responsibilities and as part of an ongoing public education program administered by Maricopa County. Archival research and photographic recordation of the bridge were undertaken by Clayton B. Fraser, Principal of Fraserdesign, in June 2006. The research for this project has involved four principal archival sources—the Bridge Section and the Real Estate Section of ADOT, the Arizona State Library and the Phoenix Public Library, all located in Phoenix. Additionally, this documentation relies in part on the Arizona Historic Bridge Inventory, produced by Fraserdesign in 2004, for much of its overview information.

Between 1848, when much of Arizona territory was acquired from Mexico by the Treaty of Guadalupe Hidalgo, and 1863, when the Arizona Organic Act partitioned Arizona from New Mexico Territory, the region was crossed by two major overland routes. Both had been developed by the military and both traversed Arizona from east to west. The northern route followed Lieutenant Edward Beale's 1857 survey along the 35th parallel for a wagon road between Fort Smith, Arkansas, and the Colorado River. With camels as pack animals, Beale's troops crossed the region as they charted a wagon road between Fort Defiance in New Mexico Territory, westward to the Colorado River. In 1859 Beale's expedition returned to construct a 10-foot-wide track, largely by clearing vegetation and loose rocks from the route they had scouted two years earlier. Called Beale's Road, this route was used by hunters, trappers and military troops before construction of the Atlantic and Pacific Railroad along the same route in the early 1880s.

The southern route generally followed the Gila River across Arizona from New Mexico to the Colorado River at Yuma. It was first used and mapped by the military in 1846, when Brig. Gen. Stephen Kearney's Army of the West traveled westward from St. Louis to California during the Mexican War. Shortly after, Capt. Phillip Cooke led the Mormon Brigade over Kearney's path, improving the trail as he went to accommodate the troop's supply wagons. Cooke's route deviated from Kearney's in eastern Arizona, where it veered southward away from the upper stretches of the Gila. Cooke's Brigade built the road into Arizona from the Mexico border, following the San Pedro River northwesterly, then extending west to the settlement of Tucson. From there the men trailed north along the Santa Cruz River and west along the Gila River to the Yuma Crossing of the Colorado River. Known as Cooke's Wagon Road or simply as the Gila Trail because it largely paralleled the Gila River, this route was later made popular by those traveling to California in search of gold. Other secondary routes—no more than trails, really—developed in the region through intermittent use. But it was the two main lines that carried most of the traffic through Arizona in the region's early years.

At the point where the Gila Trail crossed the Colorado River, John Gallatin had built a toll ferry in 1849, supplanting earlier Indian-operated ferries at this point. Louis Jaeger started his own ferry service there a year later, after the Indians exacted their own toll on Gallatin by scalping him. A small settlement called Jaegerville soon developed on the California side of the ferry. In December 1850 the U.S. Army established a small encampment, called Fort Yuma, a mile upriver. The town of Colorado City was platted on the Arizona side of the river four years later. This community changed names three times in its formative years—to Arizona, Yuma City and Arizona City, successively—before its incorporation in 1871 as Yuma. In addition to its role as a port for riverboats that plied the Colorado River, Yuma served as a funnel for overland travelers between southern California and the East. Thousands of immigrants traveled westward on foot, in wagons or by horseback across the Gila Trail, and the Butterfield Overland Stage followed the trail through Yuma on its route between St. Louis and San Francisco. The arrival of the Southern Pacific to Yuma, with the construction of the new railroad bridge over the Colorado, further bolstered the small city's role as a Southwestern transportation nexus.

Meanwhile, in the Salt River Valley some 180 miles east, another colony was growing around an agriculturally based economy. The origins of Anglo settlement in central Arizona date from 1867. That year William John "Jack" Swilling, flamboyant Confederate army officer, prospector, Indian fighter and entrepreneur, formed the Swilling Irrigation Canal Company with John Y.T. "Yours Truly" Smith, the post sutler at Fort McDowell. They opened the Swilling Ditch by clearing an ancient Hohokam Indian canal. In the following years the company supplied water to a growing number of farms that sprang up along the ditch's length. Three years after the inception of the Swilling Ditch, the townsite of Phoenix was platted. Phoenix grew steadily with the rest of the Central Valley during the 1870s and 1880s. The city's future as Arizona's central metropolis was guaranteed when in 1889 the Arizona Territorial Capital was relocated to Phoenix from Prescott. Although not directly on the Gila Trail, Phoenix was close enough to connect to it by a relatively short wagon road to the south. The Gila Trail thus served to link Phoenix with Yuma and points west; eventually the northern swing through Phoenix became the main line through common use.

For almost 50 years following the establishment of Arizona Territory in 1863, the territorial government accomplished relatively little in the way of road and bridge construction. Instead, the Territorial Assembly relied on other entities—primarily the counties and private toll road companies—to provide the infrastructure for overland travel. In 1866 the Assembly turned over responsibility for building roads and bridges to the individual counties by authorizing the county boards of supervisors to establish road districts. The districts could then appoint overseers to manage road work. For construction, the county boards were empowered to issue bonds and levy road taxes. In 1871 the Assembly transferred even more autonomy to the counties, giving them the ability to incorporate toll road operators themselves. With this, the county administrators possessed the tools needed to pursue active road and bridge programs. They rarely used them well.

Maricopa County could afford to undertake modest road improvement and bridge construction, and in 1877 the Territorial Assembly authorized the county to issue $15,000 in bonds to finance construction of four wagon roads. Planning and funding to this extent was atypical among Arizona's counties in the 19th century, however. Seldom following premeditated plans, county supervisors authorized the surveying and clearing of roads and construction of bridges as needed, usually in response to urgent local petitions. In the sparsely populated areas outside of major cities, road work was uneven, and relatively few vehicular bridges of note were erected before the turn of the century. Most of these earliest county-built structures tended more to the flimsy than the substantial. Generally made up of wood stringer spans laid over timber pile bents or crude concrete abutments and piers, these makeshift bridges displayed limited utility and questionable capacity. Though inexpensive to build, many of these wooden spans required frequent maintenance to prevent their collapse from floods or structural failure. Only a few proved to be permanent. For longer spans, the counties erected kingpost or queenpost pony trusses, with timber compression members and wrought iron tension rods. These tended to last longer, but not by much.

During the 1870s and 1880s the Territorial Legislature seemed content to leave road and bridge construction to the individual counties. Between 1877 and 1881 the territory issued bonds totaling only $70,000 to fund road construction. In an uncharacteristic act of largesse, however, the Thirteenth General Assembly in 1885 appropriated $15,000 toward construction of a bridge over the Gila River at Florence in Pinal County. This, along with a $12,000 appropriation for a wagon road, prompted Territorial Governor Conrad Zulick to comment that the expenditure of funds on road and bridge work represented a "wanton misappropriation of public funds."[1] The bridge was constructed that year; in 1905 the legislature authorized a $19,000 bond issue to fund repairs to the Florence Bridge. But other than these tentative steps, the territorial government made only minimal impact on overland transportation in Arizona. Indeed, no territorial organization or staff had even been established to administer roads and bridges.

Construction of the Florence Bridge marked a watershed event in Arizona bridge history. Not only was it the first wagon bridge undertaken by the territory, it was probably the earliest all-metal wagon truss in Arizona. The structure consisted of two 180-foot Pratt spans, with an extensive timber trestle over an island and slough. Consuming 30 tons of iron and 174,000 feet of lumber, the Florence Bridge was soon followed by other wagon trusses. Apache County built a pinned Pratt truss over Clear Creek south of Winslow. Navajo County built a Pratt through truss to carry the Winslow-Holbrook road over Chevelon Creek and another truss over the Little Colorado River. Similarly, Greenlee County built a four-span Pratt through truss over the Gila River at Duncan to replace an earlier wood structure. Virtually all of these early metal trusses built by the counties featured relatively modest dimensions, standard Pratt configurations and prefabricated, pin-connected detailing.

[1]As quoted by Jay J. Wagoner, *Arizona Territory 1863-1912: A Political History* (Tucson: University of Arizona Press, 1970), 239.

After the turn of the 20th century, it became apparent that many major road and bridge projects were beyond the capacity of the individual counties. Further, the counties were building roads on a piecemeal basis, without regard to the roads in adjacent counties. This tended to create an uneven patchwork of dissimilar routes, making travel difficult for all but a few destinations. To fund the development of regional highways, the Territorial Assembly in March 1909 levied a property tax varying from 5 to 25 mills. (A mill is .001 or 1/1,000th of a dollar. A five mill tax is equivalent to five dollars per one thousand dollars.) The 5 mill tax was fixed in counties in which no highway work was contemplated; the higher rates were applied proportionately to counties in which work was to be undertaken. In force until June 1912, this tax raised about $519,000, much of it generated in Maricopa County.

The Assembly also created the office of the territorial engineer to administer the design and construction of territorial roads. Appointed by the governor, the position carried a two-year term. James B. Girand was Arizona's first (and only) Territorial Engineer. His staff consisted of a clerk and a draftsman. Soon after his appointment, Girand began the planning and construction of several territorial highways in Arizona. The strategy was to link the county seats and more populous towns through a network of graded roads, which would vary in width from 16 to 24 feet, according to terrain and traffic. "Inadequate and crude as the law is," Girand stated in 1911, "much progress has been made in establishing a system of highways, which, if continued, will result in this department being the most important of all, from the standpoint of revenue."[2] In connection with this highway construction, Girand supervised construction of a handful of bridges over key crossings on the territorial network. Curiously, none of these bridges resembled each other even remotely.

One of the first territorial bridges undertaken by Girand was a replacement structure for the trusses over the Gila River at Florence. In November 1909 Girand designed a multiple-span, concrete girder structure and advertised for competitive bids. He rejected all the bids as too high and undertook construction of the bridge himself, using convict labor from the nearby territorial prison. In March a small force of prisoners began the excavation for the foundations. The crew was increased to 36 men in April, when full-scale construction began, and averaged 55 men as the work continued on the bridge throughout the rest of the year. The new Florence Bridge was completed in December 1910.

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[2]J.B. Girand, "Arizona Roads," *Arizona*, July 1911, 2. Girand continued:

> Nearly one thousand miles of roads have been surveyed and mapped, running through various counties, as follows: Cochise, Gila, Graham, Maricopa, Pima, Pinal, Yavapai and Yuma, and nearly one hundred miles of road have been actually built and in use, and in addition thereto, three bridges have been or are being constructed, across the more important streams of the territory. Already scores of letters of praise have been received, commending the good work being done, and while as usual, public enterprises of this character meet with opposition, still, as a whole, the better element is body and soul with this work and it will be crowned with success.

By the time Arizona was admitted to the Union on February 14, 1912, the territorial government had built over 243 miles of highway at an average cost of $2,500 per mile. Additionally, 1,812 linear feet of bridges over 100 feet in length were constructed, totaling $144,000 in cost. Girand estimated that an additional 740 miles of trails and graded county roads would soon be improved to form highways, "completing the great east and west and the north and south roads."[3] Thus, surveys and construction had been undertaken on almost a thousand miles of roads in the three years since the territory had taken an active role in highway construction.

With statehood, the territorial engineer was retitled state engineer and Girand was replaced by Lamar Cobb. Little else changed, as road construction continued using the same basic administrative process. In fact, several road and bridge projects begun under Girand—including the massive Tempe Bridge over the Salt River—were taken over by Cobb without interruption. The major difference lay in the level of activity. Less than $200,000 were spent on road and bridge construction throughout the territory in the year that Girand took office. Six years later in 1915, over $500,000 were spent by the counties alone. Despite this progress, the state's roads were in dismal condition under the county administration. Cobb despaired in his first report to the state legislature:

> I have been over a great many roads in every county in the state except two, and I have not found a foot of properly graded and protected mountain road or road in a rolling county that was not constructed under the direction of the (territorial) engineer department. There are a few miles of graveled road in Graham, about ½ mile in Yuma and several miles of caliche road in Maricopa. I know of no other improved roads in the state, outside of the cities, towns or special road districts, though I may have missed a half mile or so elsewhere.[4]

The legislature directed Cobb to delineate a network of state highways encompassing some 1,500 miles of route that would link the major towns [see *Figure 1*]. Cobb was cognizant of the need for continuity between his office and the office of the territorial engineer that had preceded him. In 1914 he wrote:

> When this administration assumed office, a tentative State Highway System had been adopted, consisting of a road from Yuma to Clifton and one from Douglas to the Grand Canyon. The routes

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[3]The east-west territorial highway largely followed the Gila Trail through southern Arizona, beginning at the Colorado River in Yuma and extending eastward, but now it followed the river's north side and branched north to Phoenix and Mesa. East of Mesa the road followed the Apache Trail to Roosevelt Dam and wound through the mountains to Globe, looping southward to Duncan, at the state's eastern border. The north-south road began at Douglas and extended northward to the Grand Canyon through Tucson, Florence, Phoenix, Prescott and Flagstaff.

[4]Arizona State Engineer, *Report of the State Engineer of the State of Arizona: July 1, 1909, to June 30, 1914* (Phoenix: Arizona State Press, 1914), 72.

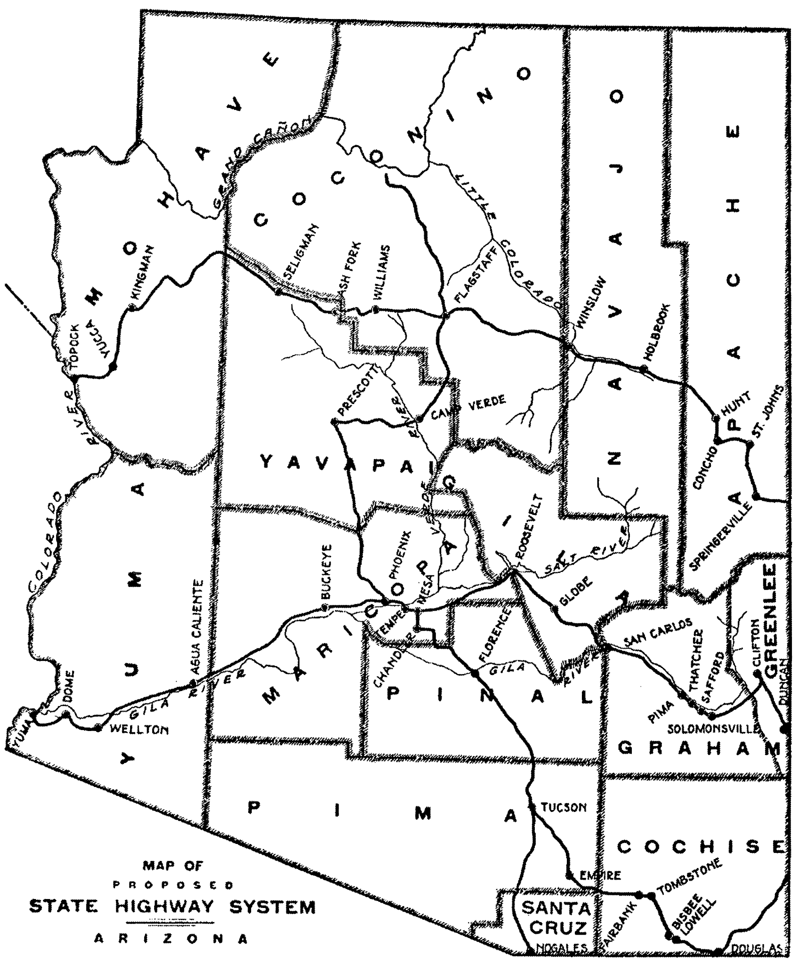

Figure 1. Map of proposed state highway system of Arizona, 1912

selected had become fixed to a certain extent by the construction of several units of their length and, though not meeting with entire approval, they had also become fixed in the public mind as the State Highways. It was, therefore, thought best not to make any changes in their location as it would undoubtedly lead to others by succeeding administrations, resulting in State Highways "that would start nowhere and end nowhere," thus defeating one object of the State Road appropriation – a State system of roads composed of coordinating county units connecting every county seat in the State. The mileage of roads improved with the State Road Fund is small considering the total mileage of the proposed system and their completion with the present annual Road Fund is far removed; however, the worst places between counties and those bearing the greatest amount of traffic are gradually being improved by permanent construction, so, even without additional means, they will be put in much better condition year by year and some day be completed.

The value of this department to the taxpayers of the State cannot be measured by the roads that have been built under its administration, for the examples of proper road construction it furnishes in every county is of greatest value to officials charged with the expenditure of county road funds. The Boards of Supervisors in eight of the fourteen counties have called upon this office for advice relative to road and bridge construction, four for plans and specifications, and four for our engineers to locate or superintend county road construction covering expenditures of approximately $100,000. Since the creation of this department, there has been a marked improvement in the type of road work in every county in the State which is largely attributable to the demonstration work done by this office.[5]

[5] *Report of the State Engineer*, 5-6.

"This improvement is shown both in location and construction," Cobb continued, "however, the former, which is of the greatest importance, has not received the consideration it should have. Few county roads are now located in natural water courses, grades exceeding 10% are rare and more attention is being given to protecting ditches and other drainage; However, their drainage openings are as a rule entirely too small, as for instance a 36 inch culvert to carry the water necessitating a 50 foot railroad bridge."[6]

During his first two years in office, Cobb undertook several important road and bridge construction projects. Without question the largest of these was the Tempe Bridge, under construction when Arizona became a state. The Tempe Bridge was an eleven-span, concrete-arch structure, built using prison labor and opened to traffic in September 1913. Spanning the Salt River at the state's most heavily trafficked river crossing, the Tempe Bridge was unquestionably Arizona's most historically important bridge.

In 1913 the Arizona Good Roads Association published the state's first book of road maps and travel information. "At this time, trips to every part of the state are made by automobiles," the guide stated optimistically, "and while some difficulties are encountered in the remote sections, principally owing to lack of travel, these are rapidly being eliminated."[7] During the 1914-1916 biennium, Cobb continued work on the state's road system. With the state and the counties undertaking the construction, improvements to the roads were made incrementally in relatively small segments. The principal difference between the entities lay in the amount of money spent. As funds allocated by the state for road and bridge work increased steadily—from $294,000 in 1912 to $487,000 in 1916—the amount of construction administered by the counties themselves almost quadrupled from $309,000 to $1.5 million over the same four-year period.

The pace of road and bridge construction may have quickened in Arizona with statehood, but the state's efforts still fell far short of its needs. Like much of the West, Arizona had been slow to embrace the automobile, largely due to the poor condition of its roads. Outside of the major cities, the roads and bridges were markedly underdeveloped, and Arizona ranked last in the nation in terms of its public road system. Even the major routes in the state were little more than wagon tracks, troubled by steep, rocky grades in the mountains and shifting sand in the desert.

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[6] *Ibid.*, 6.

[7] Arizona Good Roads Association, *Illustrated Road Maps and Tour Book* (Prescott: Arizona Good Roads Association, 1913 (Reprint Phoenix: Arizona Highways Magazine, 1978)), 6. The guide continued:

> A system of State Highways is now under construction: the counties of Yavapai, Mohave and Coconino are about to construct good roads within their boundaries with money from county bond issues and cash taxes; and in many parts of Arizona new roads are being located and old highways improved. Therefore, it will be but a short time until the whole State is gridironed with travelable roads, giving easy and comfortable access to the scenic, agricultural and industrial sections of this rich commonwealth.

The first auto in Arizona was reportedly brought into Tucson by Dr. Hiram Fenner around the turn of the century. This was soon followed by cars in Phoenix; by 1913 some 646 vehicles were registered in Maricopa County. As in other states, the Good Roads Association took root in Arizona in the early 1900s. The good roaders were responsible for the promotion of road improvement throughout the state, both through volunteer betterment efforts and lobbying the state legislature. Though they ostensibly represented the entire state, the good roaders tended to concentrate their efforts more in the urban areas, particularly Phoenix and Tucson.

The groups' efforts began to show results in the 1910s with the paving of Central Avenue and construction of a major multiple-span concrete bridge over the Salt River in Phoenix. This was followed by smaller-scale paving projects in Tucson, Bisbee and Flagstaff. "The lesson to be drawn is manifest," *Arizona* magazine stated in 1916. "Good roads do not 'grow' in Arizona, nor elsewhere, and the fact that Arizona is getting them is license to regard them as one of our best and most promising 'manufactures,' even though they are not made in a big mill building and sent out on freight cars. Besides all their virtues in highways there is an economic consideration in the pay rolls they maintain and the attendant business they develop during construction—home money, paid to home people, and kept chiefly in home circulation."[8]

In their lobbying for road and bridge construction, the good roaders were soon joined by a number of out-of-state groups advancing the concept of transcontinental highways. Capitalizing on the incipient demand for long-distance auto travel, these quasi-public organizations began forming in the 1910s to promote specific transcontinental or transregional routes in America. The most famous of these early proto-highways was the Lincoln Highway, established in 1912 as the country's first coast-to-coast road between New York and San Francisco. Formed at about the same time was the National Old Trails Highway between Baltimore and Los Angeles. Several other named highways also took root during this formative period, so that by 1922 a myriad of transcontinental roads had been routed across America. Among these were the Old Spanish Trail between Tallahassee and Los Angeles; the Dixie Overland Highway between Savannah and San Diego [*see Figure* 2]; and the Midland Trail between Washington, D.C., and Los Angeles. Most extended east-west, but a few—the King of Trails Highway between Winnipeg and Brownsville, Texas; the Jackson Highway between Chicago and New Orleans and the Jefferson Highway between Winnipeg and New Orleans—ran south-north.

Highways in name only, these early routes typically followed existing roads. They were designated, promoted and intermittently maintained by local commercial and governmental organizations along their routes. The sponsoring associations often published trail guides and newsletters extolling the virtues of their particular routes. Additionally, the trail associations marked their routes by painting insignias on posts, rocks, telephone poles and any other roadside objects that would stand still.

[8] "Good Roads in Arizona." *Arizona*, April 1916, 10.

The roads often overlapped confusedly as they zigzagged across the country. This was especially true in the West, where there were often several highways but relatively few route choices available. Two of these early booster-sponsored highways crossed Arizona. Across the northern part of the state, the old Beale's Road was followed by the National Old Trails Highway, also designated as the Santa Fe Highway. Joined by the National Park to Park Highway, this road formed the major east-west route through the state's northern tier of counties.

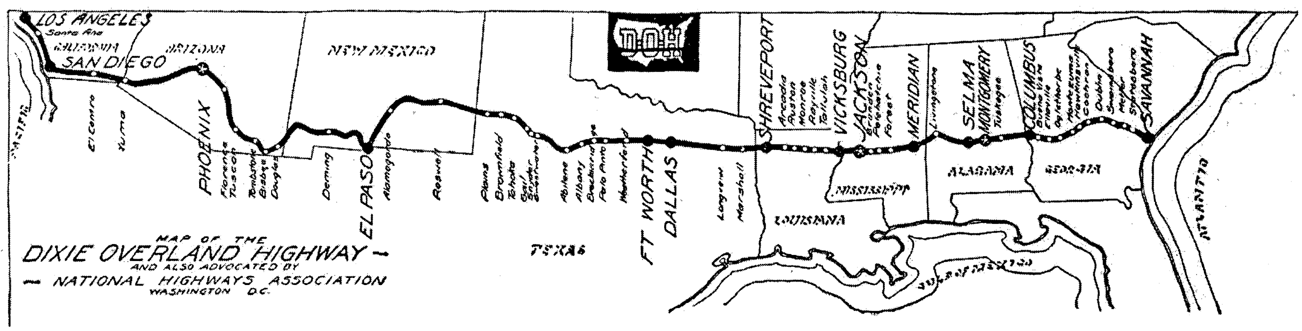

Figure 2. Map of Dixie Overland Highway, by National Highways Association, circa 1920

In southern Arizona, the old Gila Trail was incorporated into the Pikes Peak Ocean-to-Ocean Highway. Formed during a convention held in Phoenix in 1911 by delegates from Arizona, New Mexico and California, the highway was designed to allow year-round travel between the Atlantic and Pacific coasts. All or part of this route was later overlaid in Arizona by other named highways such as the Borderland Route, the Dixie Overland Highway, the Old Spanish Trail, the Bankhead Highway, the Lee Highway and the Atlantic Pacific Highway. This road touched Douglas, Benson, Tucson, Florence, Phoenix and Yuma on its way across Arizona. Known locally as the Phoenix-Yuma Highway, the section of the route through western Arizona carried some of the heaviest traffic in the state. Towns along the highway that had been established to serve the Southern Pacific Railroad eventually evolved into highway towns, sprouting motor courts, diners and service stations to ply the car-bourne trade. Dome, Wellton, Agua Caliente and Buckeye straddled the road between Yuma and Phoenix, all benefitting from the auto traffic along the highway [see *Figure 3*].

Despite their active promotion for their highways, none of these early organizations had the financial wherewithal to undertake actual large-scale construction. Road and bridge construction in Arizona was still the responsibility of the counties—and to a lesser extent, the state—in the 1910s.

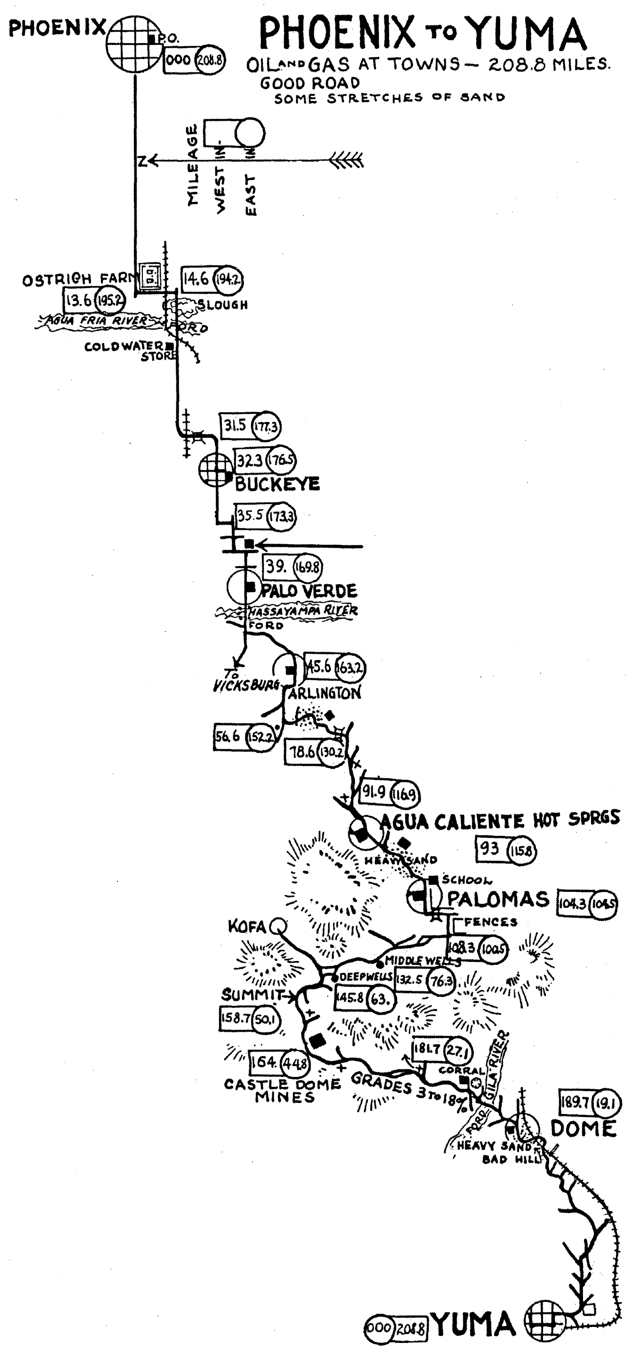

Figure 3. Map of Phoenix-Yuma Highway, 1913

Upkeep of the Ocean-to-Ocean Highway between Phoenix and Yuma was shared by Maricopa and Yuma Counties, with predictably uneven results. Territorial Engineer James Girand had surveyed a 202-mile route between the two cities, with the counties sharing the engineering cost, but had not undertaken any substantial construction on the route. Little changed during the first two years of Lamar Cobb's tenure as state engineer. In 1914-1915 Yuma County undertook repairs of the highway east of Yuma. At this time the state undertook construction of a major bridge over the Gila River east of Wellton.

Cobb had first surveyed sites for the Yuma County bridge at Antelope Hill and the nearby town of Dome in 1912 and selected the former for a bridge. The next year his office designed a multiple-span concrete structure comprised of 15 girder spans supported by massive bull-nosed concrete piers. The longest of these spans extended 65 feet; the bridge's overall length was almost 1,000 feet, not including the timber trestle approaches on the ends. In December Cobb advertised for competitive bids to build the immense structure.

Opting instead to use prison labor, the state rejected all bids. Cobb then redesigned and rebid the project when it became apparent that not enough prison manpower would be available. In May 1914 Perry Borchers was hired to build the bridge. But Borchers was in over his head. He began construction in June but soon defaulted, and after floods damaged the partially completed structure that winter, the state once again undertook the project with prison laborers. The Antelope Hill Bridge was finally completed and opened to traffic on August 18, 1915, with a gala picnic attended by thousands of well-wishers.

The Antelope Hill Bridge was one of the longest highway bridges undertaken to date by the State of Arizona. As it was nearing completion, the Office of Indian Affairs erected a long-span steel truss that carried the Ocean-to-Ocean Highway over the Colorado River at Yuma. The major river crossings on the route's western end had thus been addressed, but the state had yet to make improvements to the eastern section of the Phoenix-Yuma Highway. In 1914 Cobb commenced work on the section between Arlington and Agua Caliente, "on account of this section being the worst part of the road."[9] Highway engineers were faced with a choice of courses to take: the southern route through Woolsey Park and Point of Rocks (which was then in common use), or the northern route by way of Fourth of July Butte and Yellow Medicine Wash. According to Cobb:

> It was found that both routes presented many difficulties and disadvantages. The southern route would have required a great deal of heavy rock work to get through Woolsey Wash and past the Point of Rocks. It also ran for many miles through the silt bottom land of Cottonwood Wash and the Gila River—the poorest kind of material for road purposes—and the outlook for obtaining anything better for surfacing was very discouraging, as there was nothing suitable that would give a shorter average haul than about ten miles. There were also many large and unconfined washes to cross.
>
> The northern route ran through a somewhat rougher country and was a few miles longer, but the material was, in the main, of a suitable character for surfacing, and there was a great deal less drainage to be looked after. For these reasons it was decided upon as being the one that would prove most economic eventually.[10]

Most of the roadwork in this area involved the rugged stretch of the highway between Lowdermilk and Yellow Medicine Washes. In this three-mile section the crew graded the road and built two small-scale steel bridges.

The highway followed the north side of the Gila River all the way from Antelope Hill to Phoenix, thus avoiding the need to build another costly bridge over the river. In 1915-1916 the highway department built a multiple-span concrete girder bridge on the highway over the Agua Fria River at Coldwater, and a timber-pile bridge over the Hassayampa River at the town of Hassayampa. But it became increasingly evident that, rather than follow north of the Gila, the better route to take would be south of the river, along the original Gila Trail. "The greater portion of the [northern] route followed the bottom lands along the Gila River and was on light, silty soil which would have required expensive surfacing," stated Cobb's successor, Thomas Maddock, in 1920. "The floods of Thanksgiving, 1919, and those of the latter part of February, 1920, submerged a large portion of the located line and demonstrated beyond question that this location

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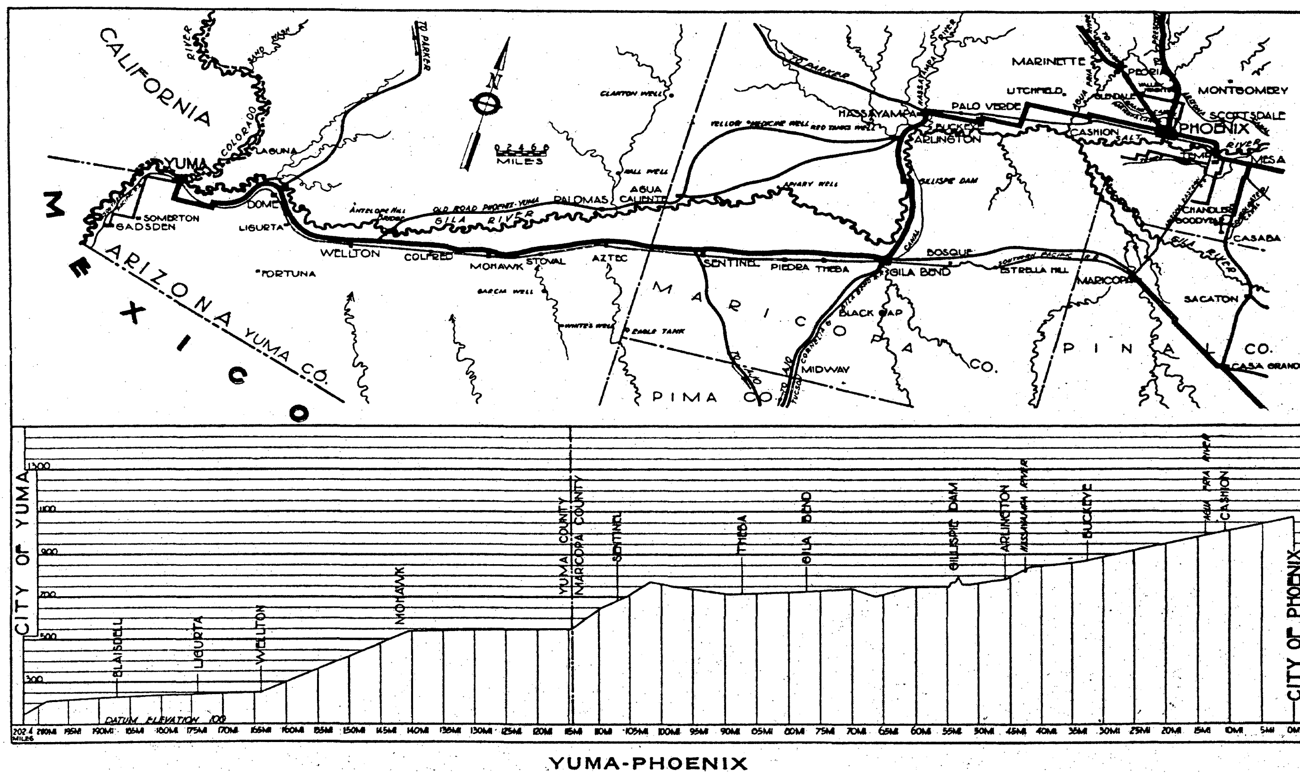
[9] State of Arizona, State Engineer, *Second Report of the State Engineer to the State Highway Commission: 1914-15 and 1915-16* . (Phoenix: The McNeil Company, 1916), 395.

[10] *Ibid.*

was not feasible."[11] Flooding along the Gila River had washed out a large portion of the highway between Wellton and Agua Calinete. Moreover, the Antelope Hill Bridge had become an embarrassment to the department, washing out with almost every major flood.

By 1920 the highway department had decided to re-route the road [see *Figure 4*]. According to Maddock, "The survey for a complete highway from Phoenix to Yuma has been made. In view of the floods in the winter of 1919-1920 and the desire of the Yuma Highway Commission to connect with both Phoenix and Ajo, also in realization of the necessity for a highway from the Capital of the State to Ajo, this survey was run on the south side of the Gila River from Yuma to Gila Bend, thence in a northerly direction through the area proposed to be irrigated from the Gillespie Dam, now under construction, and thence to Arlington."[12]



■ Figure 4. Map of proposed Phoenix-Yuma Highway, 1920

[11]State of Arizona, State Engineer, *Fourth Biennial Report of the State Engineer to the Governor of the State of Arizona: 1918-1920* (Phoenix: Republican Print Shop, 1921), 56.

[12]*Ibid.*, 78.

Adoption of the southern route meant that the highway would have to cross the Gila River at some point west of Phoenix. The solution for a Gila River crossing came from an unlikely source—agriculturalist Frank A. Gillespie. A native of Oklahoma, Gillespie had established the Gillespie Land and Irrigation Company to acquire thousands of acres of agricultural land between the Gila River and the town of Gila Bend. The lifeblood of his ranching and farming domain flowed through a system of irrigation canals branching from the Enterprise Canal, built in 1886. The canal's headgate was situated on the Gila River about 45 miles southwest of Phoenix, at a narrow pass between the Buckeye Hills and the Gila Bend Mountains.

Here earlier irrigators had built a diversion dam of earth, rocks and brush to impound water on the Gila River and divert its flow into the canal. Built in 1894, the Peoria Dam had washed out in 1900 and was replaced in 1906. In place of this latter structure, Gillespie proposed building a substantial concrete dam. To design the immense structure, he hired former Arizona Territorial Engineer James Girand. Girand delineated a multiple-arch structure, 1,768 feet in length and 56 feet tall that would span the river at the existing masonry intake for the canal. Construction commenced in 1919; the Gillespie Dam was completed in 1921 for a cost of about $3 million.

Situated as it was in a relatively constricted stretch of the river, this crossing had long been in use on the old Gila Trail before the road was rerouted north of the Gila River in the early 1910s. Before the advent of automobiles, stagecoaches had used the ford south of the present-day dam. In a setup worthy of a bar joke, the *WPA Guide* described one perilous crossing at high water:

> On one occasion two nuns, a gambler, and a soldier hung on the outside and upstream side of the coach in order to counterbalance the flood current. As the story goes, this stratagem, plus the driver's goading of his struggling horses, the nuns' praying, the gambler's cursing, and the soldier's shouted encouragement, brought the coach safely to the opposite shore.[13]

The Arizona Highway Department [AHD] could not rely on the historic ford for use on a major transcontinental route, so engineers had to devise another means to cross the Gila here. A bridge would have been prohibitively expensive. "We doubt that any bridge crossing of the Gila River," stated Maddock, "from its junction with the Salt to its confluence with the Colorado, can be secured for less than between three and four hundred thousand dollars."[14] As early as the summer of 1919, Maricopa County had proposed building a vehicular bridge across the dam, using the arch piers to support the bridge superstructure. The county offered to pay $3,300

[13]*The WPA Guide to 1930s Arizona* (reprint ed., Tucson: University of Arizona Press, 1989), 218. The *Guide* relates another story about the killing here of a bandit named, ironically, Innocente Valenzuela. Valenzuela and two accomplices had murdered and robbed the superintendent of the Vulture Mine, who was on his way to Phoenix. The posse caught the robbers at the Gila River ford and killed Valenzuela.

[14]*Fourth Biennial Report of the State Engineer*, 78.

(later increased to $4,842) to defray the cost of extra foundation piles under the piers of the dam. The cost of the bridge itself would apparently be borne by the state. The offer was so insignificant that it received little serious consideration, however, either from the dam company or from the highway department. It was quickly shelved.

AHD instead opted to build a concrete apron onto the downstream toe of the Gillespie Dam, the construction of which would cost some $125,000. The apron was built soon thereafter, and autos began driving behind the dam sometime in 1922. Automobiles could drive over the apron unassisted during low water, but when the Gila was in full flow, several cars would be chained together in a makeshift train and pulled across the dam by a truck [*see HAER Photos AZ-69-31 and AZ-69-32*]. When the Gila was flooded, traffic across the apron stopped altogether.[15]

The Arizona Highway Department had intended from the start that the Gillespie Dam apron act as a temporary crossing, with a permanent bridge to follow. AHD engineers had begun planning for a concrete bridge here even before the dam was completed. For this crossing, Maddock envisioned a reinforced concrete girder structure, similar to other bridges the state had built at Antelope Hill, Florence and Coldwater. These long-span structures offered several advantages over comparably scaled steel girders or trusses. As illustrated by the Antelope Hill Bridge, however, they were prey to critical structural shortcomings.

This star-crossed structure began to fail almost immediately after its completion, revealing a dangerous and expensive weakness of the state's large concrete spans. These concrete bridges were demonstrably stronger and more stable under load than their steel truss counterparts. Their poured-in-place superstructures could carry traffic well enough, but their substructures proved woefully inadequate to withstand the changeable desert rivers. As a result, the bridges collapsed in whole or in part when the piers toppled over in flood. In January 1916 floods washed away almost two miles of approach grading and widened the river's channel at the north end of the Antelope Hill Bridge by approximately 300 feet. To correct this, the State Legislature in March 1917 appropriated $50,000 to build an extension onto the north end. The new construction consisted of five additional concrete girder spans and an extensive timber trestle approach. Completed in autumn 1918, the bridge carried traffic more-or-less as intended until a flood a week after Thanksgiving, 1919, destroyed some 500 feet of the north approach and shifted some of the concrete piers on the extension.

[15] "Open Gila Bridge at Gillespie Dam Today." *Arizona Gazette*, 1 August 1927. As described by the article, the crossing on the dam was sometimes only slightly less perilous than the original ford here:

> Water was almost constantly running over the apron, and even in normal weather automobiles had to splash through several inches of water. In flood time the crossing was often most spectacular and sometimes dangerous, owing to the great rush of water over the dam, only a few feet away, and the necessity of plunging through a swirling torrent that was often above the axles of the cars.

Further flooding three months later dropped about 300 more feet of trestle, the north abutment and the northernmost girder. Worse, the flood caused several of the piers on the extension, already damaged by the previous flood, to further shift downstream. "The Antelope Hill Bridge is located at a point where it is impossible to control the river and keep it under the bridge at any reasonable cost," complained State Bridge Engineer Merrill Butler in 1921. "Foundation conditions are bad and a permanent extension would necessarily be long and costly with the strong possibility that the same situation would again develop in a few years." Butler concluded prophetically, "The foregoing, together with the apparent need for expensive repairs to two of the existing piers, should mitigate against anything except some form of temporary construction."[16]

Actually, the Antelope Hill Bridge suffered from at least three major engineering shortcomings, which combined to make it a maintenance nightmare. First, the bridge was poorly situated on a sweep of the river that was prone to extensive flooding. Second, the piers were poorly founded on spread footings instead of driven piles and were provided with insufficient scour protection. Finally, without shore rectification works to constrict and guide the river, the Gila was allowed to shift channels unchecked, putting unbearable pressure on the bridge's north spans and approaches. All these problems could have been addressed properly during initial construction. Engineers had learned to cope with similar problems of far greater magnitude on the Missouri River 40 years earlier. But the deceptively placid nature of the Gila River at normal stage did not prepare the engineers for its radical character change in flood.

Another perennial problem for the state was the Agua Fria River Bridge at Coldwater, built about the same time as the Antelope Hill Bridge. In 1915 Cobb designed the bridge with 37 concrete girder spans, supported by concrete column bents. Construction began in December. Three months later, heavy flooding forged a new channel on the opposite side of an island about 1,000 feet upriver from the bridge site. Rather than re-design the bridge to accommodate the shift in channel, the engineers continued building it as drawn, now only over a dry streambed, and attempted to re-divert the river back into its earlier bed by filling the new channel. When the bridge's west approach washed out the first winter, the legislature appropriated funds for reconstruction and channel work. This lasted until the Thanksgiving flood of 1919, when seven spans and both approaches collapsed. Subsequent floods carried away five additional spans. As the state tried to keep up with the repairs, the approaches washed away with every flood. "The location and foundation conditions are both extraordinarily poor," stated Merrill Butler, "but the bridge is on a main highway, a road of great economic importance, and in a section where no better site can be found within a reasonable distance."[17]

[16]*Fourth Biennial Report*, 66-67. Within two years, AHD had rerouted the road to bypass the Antelope Hill Bridge entirely. The bridge was replaced in 1929 with the Dome Bridge. It now stands in ruins, with several of its concrete girder spans washed away.

[17]*Fourth Biennial Report of the State Engineer*, 68. Like the Antelope Hill Bridge, the Coldwater Bridge was eventually abandoned by the highway department as unsalvageable.

Cobb and his successors experienced significant problems with other multiple-span concrete structures, including the Tempe Bridge and the Florence Bridge. The Tempe Bridge underwent substantial repairs after the Thanksgiving 1919 flood. Parts of the Florence Bridge on the Gila River were carried away with almost every flood, prompting Arizona Senator Marcus Smith in 1916 to characterize the hapless structure as "a monument to the treachery of the river."[18] During a downpour just before Christmas 1914, the river actually washed away approaches on both sides of the concrete structure, isolating it in the middle of the roaring channel.[19]

Highway department engineers seemed poised to repeat their mistakes with the Gillespie Dam Bridge, planning a series of long-span concrete girders for this crossing. For additional advice, they contacted consulting engineer R.V. Leeson. Leeson, who was affiliated with the Topeka Bridge & Iron Works, had designed several concrete structures for the state and even served briefly as state engineer in 1918-1919. He recommended that the highway department drop the girder design in favor of a series of long-span steel trusses. With spans of up to 200 feet in length, the truss design would reduce the number of piers by almost two-thirds from the girder configuration. Given that most of the Gila River bridge failures in Arizona had historically involved catastrophic pier scour and settlement, this reduction was significant.

In April 1925 AHD contracted for a set of exploratory borings at the proposed crossing site. Some 29 holes were drilled at that time, the first three to determine the best location for the bridge and subsequent borings to ascertain pier locations. They determined that the best line for the bridge lay parallel with the Gillespie Dam, 600 feet downstream from the dam apron. "In view

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[18]"Erosion and Overflow, Gila River, Ariz.," 16 March 1916, in U.S. Senate, 64th Congress, 1st Session, Calendar No. 239, Report No. 262, 4.

[19]"Gila Pours Around Both Bridge Ends," *Arizona Republican*, 24 December 1914. The newspaper reported with tongue in cheek about the first wooden structure at Florence, illustrating the precarious nature of bridging the Gila:

> The flanking at both ends of the new state bridge at Florence by the angry Gila reminds old-timers that once there was a wooden bridge there that promised to become the longest structure of the kind in the world. That championship would have been achieved if they had not run out of lumber. When the bridge was constructed, it was made long enough to fit the river. But when a flood came and cut around one end of the bridge and gave evidence of a permanency of channel, another span was built to accommodate it. Thus flood after flood made a new span necessary at one end or the other until the bridge had stretched across a considerable part of Pinal county.
>
> It looked for a time as if the counties of Pima and Maricopa would be called upon to help support this thriving and growing bridge. But before it extended beyond the boundaries of Pinal, other floods came and washed out the new spans at either end and finally took all the structure away except the middle span, which stood there for years, a monument to the failure of man to bridge the universe.

of the many bridge failures on this stream," the highway department reported in December 1925, "much time and care was taken in securing adequate data and preparing a design which would be proof against the terrific floods and yet be an economical structure within the means of the funds available."[20]

With Leeson's assistance, AHD bridge engineer Ralph A. Hoffman designed the multiple-span structure. "The plans are designed under modern specifications for live load and heavy trucks for bridges on the Federal Aid Highway system," the highway department stated. "The concrete floor and its supports being designed for two 15 ton trucks abreast on the bridge with an additional allowance of 30 per cent for impact. In this floor alone there is a total of 930 cubic yards of concrete and 75 tons of reinforcing steel, enough to build complete a fair size bridge."[21] As delineated by Hoffman in September 1925, the bridge was comprised of nine truss spans—five 200-foot trusses over the river's channel at the bridge's center, flanked by two 160-foot trusses at each end. The trusses supported a 19-foot-wide concrete roadway, with the deck carried at the trusses' lower chord level and the steel truss webs extending over the roadway on both sides. The bridge was engineered to carry a live load of 64 pounds per square foot of roadway. The dead load of the 200-foot trusses was 3,400 pounds per foot of span; dead load of the 160-foot spans, 3,060 pounds.

Reflective of engineering standards of the time, the spans were configured as Parker trusses with riveted connections. The Parker truss type had been patented in 1870 by Charles H. Parker, a mechanical engineer working for the National Bridge and Iron Works of Boston. It was characterized by vertical members and polygonal upper chords that acted in compression and straight-line lower chords and diagonals acting in tension. In this it resembled the venerable Pratt truss and was, in fact, generally regarded by civil engineers as a Pratt subtype. AHD engineers referred to the spans on the Gillespie Dam Bridge as "Pratt curved top chord" trusses.[22] J.A.L. Waddell, in his influential *Bridge Engineering*, gave the Parker only passing mention in his discussion of truss types, stating: "[The Pratt's] chords are not necessarily parallel but may be inclined. This latter form is frequently known as the Parker truss."[23]

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[20]"Arizona's Largest Steel Highway Bridge." *Arizona Highways* I:19 (December 1925), 6. The article continued:

> The Gillespie Dam Highway Bridge over the Gila River. . . will be the longest steel bridge in the state. It might be said to be the longest permanent highway bridge in the state system being exceeded in length only by the bridge over the same stream at Anteloppe Hill near Wellton. The latter bridge is a combination of 910 feet of concrete spans and 855 feet of timber trestle.

[21]*Ibid.*

[22]"Gila River Bridge near Gillespie Dam, Important Link in Phoenix-Yuma Highway, Open to Traffic." *Arizona Highways* III:10 (October 1927).

[23]Waddell, J.A.L. *Bridge Engineering* (New York: John Wiley and Sons, 1916), 469.

The inclined upper chords afforded a degree of efficiency in long-span trusses, where bending moment stresses at mid-span greatly exceeded the sheer stresses at the ends. The Parker's drawback was that, unlike the straight-chorded Pratt truss, the polygonal chords necessitated different-length verticals and diagonals at each panel, increasing its fabrication cost somewhat. Because trusses were generally priced on the basis of their superstructural steel weight—essentially sold by the pound—the lighter overall weight of a polygonal-chord truss more than offset the slight increase in fabricating costs in spans greater than 160 feet.

The Parker trusses on the Gillespie Dam Bridge employed typical rigid-connected detailing with sizable gusset plates—either ⅜" or ½" thick—at the chord connections. The 200-foot spans were subdivided into ten equal-length panels, the 160-foot spans into eight panels. The upper chords and inclined endposts on the 200-foot spans consisted of two 15-inch-deep, back-to-back channels, covered by a continuous half-inch-thick steel plate and joined by bar lacing underneath. The verticals were similarly configured, with two eight-inch channels laced together front-to-front by steel straps. The lower chords were made up of two 15-inch back-to-back channels connected by steel batten plates; the diagonals were two five-inch angles with batten plates. The struts were comprised of four angles with lacing, with knee-braced A-frames at the portals. Single angles were to be used for both upper and lower lateral braces and strut braces. The members of the 160-foot spans were scaled proportionately to the 200-foot spans.

Field-bolted to the gusset plates at the lower chord panel points were I-beam floor beams, 28 inches deep. These carried six parallel lines of 18-inch I-beam stringers. The reinforced concrete deck that was to be poured over the stringers was to be lined on both sides by integrally poured concrete curbs and steel pipe handrails. The trusses were supported on their four corners by built-up steel bearing shoes with cast steel pins. The expansion shoes, located on the trusses' east ends, featured cast steel rollers housed in nests enclosed from the elements by steel angle aprons. The fixed bearing shoes, located on the trusses' west ends, were similarly configured and anchor-bolted to the abutments and piers. As the final step, Hoffman specified that all of the steelwork was to be painted with one shop coat and two field coats of paint.

The most critical aspect of the bridge's design was the substructure. AHD described the piers and abutments of the Gillespie Dam Bridge:

> The deepest pier foundation is approximately 45 feet below the stream bed and rests on a compact caliche hard pan. The conditions found by drill tests are favorable to the use of steel sheet piling and open dredging. These two piers of about this same depth and contain approximately 500 cubic yards of concrete each. The other piers vary in depth below stream bed from 20 to 30 feet. All piers are of gravity type with but little reinforcing steel for dowels at the construction joints. The abutments are of the U-type with a pier for the support of the span and reinforcing wings tied by reinforced concrete ties in the earth fill, making an economical type for the height which on the east end of the bridge is approximately 35 feet from grade to the bottom of foundations.[24]

[24] *Ibid.*

Three months after Hoffman completed the construction drawings for the Gillespie Dam Bridge, AHD moved to build the immense structure. With funding for the construction earmarked under Federal Aid Project 64-B, the highway advertised for competitive bids late in 1925. Eleven contractors submitted proposals for the project. On January 11, 1926, The highway department let the contract to the lowest bidder, the Lee Moor Construction Company of El Paso, Texas. AHD resident engineer R.C. Perkins, who had formerly functioned as the Maricopa County highway engineer, would supervise the work. On February 12, a Lee Moor crew began excavating for the piers. Pier Nos. 1 through 5 and and 10 were founded on solid bedrock. Pier Nos. 6 through 8 were founded on hard caliche—an unconsolidated gravel bed that floored the river's main channel. To found the shallower piers, the men used Wakefield sheet piling with steel shoes. The deeper piers required either steel sheet piling or open timber crib cofferdams to protect the excavations from the river. Even with that, water was a problem at Pier Nos. 6 and 7, the deepest piers on the structure. The Lee Moor crew was forced to install 12-inch Byron Jackson deep well pumps and 16-inch centrifugal pumps to dewater these two holes. With capacities of 3,600 and 4,500 gallons per minute, respectively, these pumps operated continuously for five weeks while the excavation and pier construction were underway.

The concrete piers had been completed, and the men were erecting the steel trusses when the Gila River flooded in February 1927. With water washing as much as six feet over the crest of the dam, the downstream apron was rendered impassable for days, stranding cars on both sides of the river. Lee Moor suffered extensive losses of material and equipment; the bridge's completion was pushed back by two months. The contractor regrouped and completed the bridge superstructure later that spring. With the trusses in place, the men poured the concrete for the monolithic deck that summer. The final aspects of the construction involved installation of the guardrails and field-painting the steelwork.

On August 1, 1927, the Gillespie Dam was opened to vehicular traffic. The Arizona Highway Department opened the bridge unceremoniously, simply pulling aside the barricades shortly after sunrise and letting cars drive across the span without fanfare. "The new state bridge over the Gila river on the Phoenix-Yuma road, the longest bridge of its type in the state, was opened to traffic yesterday morning," the *Arizona Republican* reported. "The opening of the new bridge, which required 18 months to build, will make the Phoenix-Yuma road an all-year road and will eliminate the lining up of traffic on both sides of the Gila river during flood periods in the stream as in the past."[25]

[25] "New Bridge at Gillespie Dam Open to Travel," *Arizona Republican*, 2 August 1927. At this time the *Arizona Gazette* reported:

> In the building of the new structure every possible care was taken to make it capable of withstanding the heaviest of floods. Each pier and the abutments for the bridge extend down through the loose sand to bed rock, some of the piers thereby being over 40 feet in length, according to the highway department. The precautions which have been taken will assure travel over the highway in every season of the year, and trips will no longer be delayed during flood periods owing to high water.

Costing $320,000 to build, the Gillespie Dam Bridge was immense. The structure consumed approximately 1,200 tons of superstructural and reinforcing steel and 3,200 cubic yards of concrete. Excavation for the substructure involved moving some 5,600 cubic yards of earth. When completed, it was distinguished as Arizona's longest highway bridge and the bridge with the state's deepest foundations.

As planning was underway for the Gillespie Dam Bridge in 1924 and 1925, the highway department was undertaking sweeping changes to the state's highway system. The public was by then becoming disaffected with the highway associations and their transcontinental roads. No fewer than 250 registered highways then vied for travelers' attention. The highway markings were often inconsistent and intermittent, the guidebooks misleading and confusing, and the highways themselves often little more than dirt tracks. Moreover, they were often routed, not in the straightest line over the best roads possible, but in lengthy meanders to connect dues-paying municipalities. "The harmless tourist in his flivver doesn't know whether he is going or coming," travel writer William Ullman stated, "whether he is a hundred miles from nowhere or on the right road to a good chicken dinner and a night's lodging." When the Pikes Peak Ocean-to-Ocean Highway Association rerouted its road from San Francisco to Los Angeles, the editor of the *Reno Evening Gazette* (one of the towns abandoned by the association) complained bitterly:

> The public is learning this fact—that transcontinental highway associations, with all their clamor, controversy, recriminations and meddlesome interference, build mighty few highways . . . In nine cases out of ten these transcontinental highway associations are common nuisances and nothing else. They are more mischievous than constructive. And in many instances they are organized by clever boomers who are not interested in building roads but in obtaining salaries at the expense of an easily beguiled public.[26]

In 1925 the American Association of State Highway Officials [AASHO], with the approval of the Bureau of Public Roads, instituted a plan for a national numbering system for the nation's highways. As a replacement for the often confusing naming system for highways, a uniform system of numbers would be instituted. Under this scheme east-west highways would be given even-numbered designations; north-south highways, odd-numbered. Diagonal highways would receive special designations. Three-digit numbers were assigned to relatively short-distance connector routes. The highways would be marked uniformly with a shield bearing the route's number, the letters "US" and the state's name in black on a white background.

The U.S. highways in Arizona followed predictable patterns. The Ocean-to-Ocean Highway across the southern part of the state was incorporated into US 80, the transcontinental route between Savannah and San Diego [*see Figure* 5]. The National Old Trails Highway that cut

[26]Quoted by Richard F. Weingroff, "From Names to Numbers: The Origins of the U.S. Numbered Highway System," *AASHTO Quarterly*, Spring 1997.

across the state's northern tier became part of US 66 between Chicago and Los Angeles. The original territorial North-South Highway became part of US 89 between Provo and Phoenix. And the route that meandered across the center of the state from Springerville to Ehrenberg by way of Globe and Phoenix later became part of US 60, a transcontinental road that began at Norfolk, Virginia, and extended through Arizona to Los Angeles.

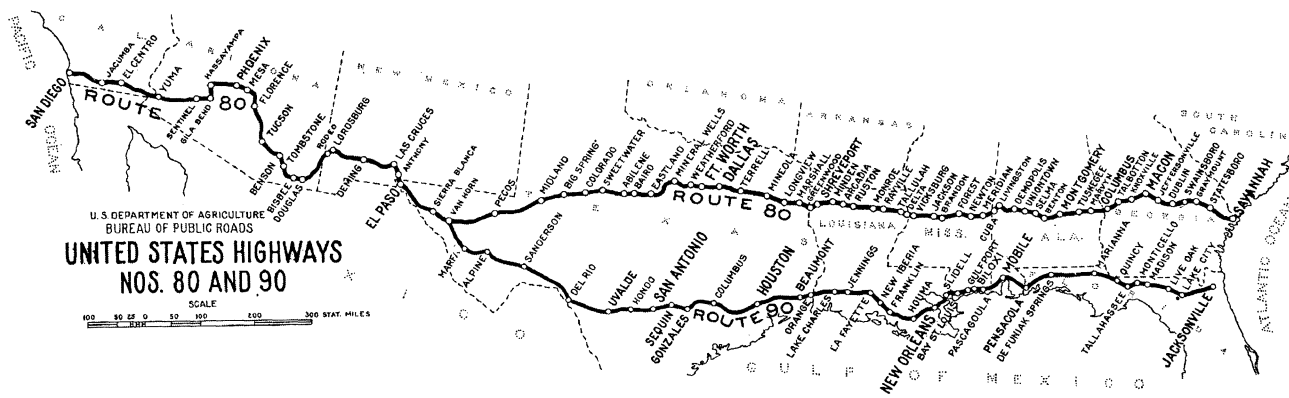

Figure 5. Map of U.S. Highways 80 and 90 by Bureau of Public Roads, circa 1925

AHD began marking the new route designations soon thereafter. By the time the Gillespie Dam Bridge was completed in 1927, it had already been incorporated into U.S. Highway 80. Nicknamed the "Broadway of America," U.S. 80 became alternately known as the "All-Year Southern Route" and the "Scenic Sunshine Route," as its promoters touted the transcontinental highway's year-round driveability. In Arizona it developed into a major interstate and intrastate route, with sections—Gila Bend to Yuma, Tucson to Casa Grande—among the most heavily trafficked highways in the state.

During the 1920s and 1930s the highway department made incremental improvements to the road—rerouting sections, improving grading, applying oil surfacing, paving with asphalt, building new drainage structures. A year-and-a-half after completion of the Gillespie Dam Bridge, AHD completed the Dome Bridge over the Gila River. Located near the Antelope Hill Bridge, this long-span steel suspension structure replaced the earlier bridge as the last major link on U.S. 80 in Arizona. The Dome Bridge carried mainline traffic until its replacement in 1968. The Gillespie Dam Bridge had also carried mainline traffic without interruption until a route realignment in 1956 moved the road. At that time the bridge reverted to county road status, under which it now functions. Beginning in the mid-1970s U.S. 80 itself was superseded, section by section, by Interstate Highways 8 and 10. By 1991 the highway had been replaced in its entirety in the Southwest. Remarkably, other than relatively minor modifications to the portal struts, the Gillespie Dam Bridge remains essentially unaltered and undamaged by the Gila River.

Construction of the Gillespie Dam Bridge marked the completion of an important link in the Phoenix-Yuma Highway. The highway had been, from the start, characterized by extensive re-routings, uneven maintenance and repeated bridge failures, because its planning, construction and maintenance had been dictated by expediency. In this, it was emblematic of early road and bridge construction in Arizona. Chronically short of funds, the governing bodies of the counties, the territory and the state have been forced to defer long-term planning for immediate construction and repair. Nowhere was this more apparent than at the state's major bridges. The early engineers avoided building bridges when they could, and when they could not, they often eschewed permanency for low initial construction costs. In a 1927 Arizona Highways article notable for its apologetic tone, AHD bridge engineer Ralph Hoffman explained recent bridge failures:

> The fault (for bridge failures) cannot be laid at the door of the engineer, although he is not infallible, he can only go as far as the funds provided will permit. The State spends millions to build surfaced roads making them passable in all kinds of weather and leaves an unprotected gap here and there for the reason that the engineer is trying to make his money cover as much mileage as possible.[27]

In their early planning of the Gillespie Dam Bridge, AHD engineers seemed destined to repeat the mistakes made on previous bridges. Had this bridge been built as a multiple-span concrete girder structure as originally intended, it would likely have collapsed under the force of Gila River floodwaters. The Gillespie Dam itself later did collapse, breached in a January 1993 flood and left in its failed state. In its long-span truss configuration and concrete piers and abutments, the Gillespie Dam Bridge represents a breakthrough of sorts for Arizona bridgebuilding. For the first time on a major span, the state highway department eschewed shallow spread footings and extended the substructure to bedrock. This is the success of the Gillespie Dam Bridge.

The trusses have experienced a degree of wear over the structure's 80 years of service, with rusting of the web members and impacting of the rollers in the expansion bearing shoes. But the concrete piers and abutments, which have borne the brunt of the Gila River, have apparently remained structurally intact. Relatively few bridges from the 1920s remain in service on Arizona's highway system, and only a handful of spans over the Gila River still stand from this period. The Gillespie Dam Bridge is distinguished among these for its scale, its superstructural and substructural configuration, and its high level of structural integrity. A pivotal component on a vital transcontinental route, the Gillespie Dam Bridge is one of the most important examples of early bridge construction in Arizona.

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[27]Hoffman, R.A. "Lack of Finances Held Responsible for Washing Away of Bridges in Flood Times," *Arizona Highways* III:1 (January 1927).

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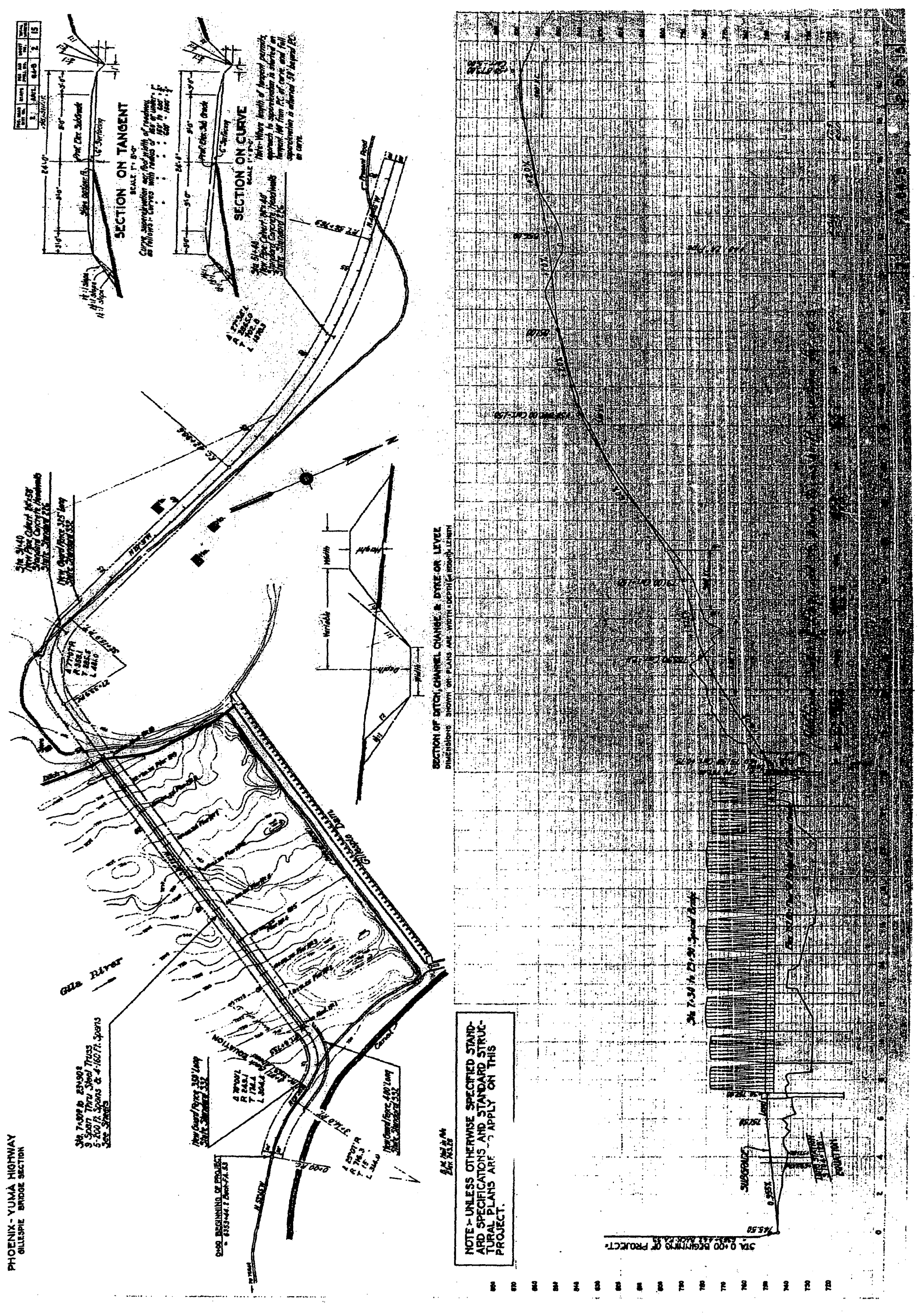


Figure 6. Phoenix-Yuma Highway — Gillespie Bridge Section, 1925

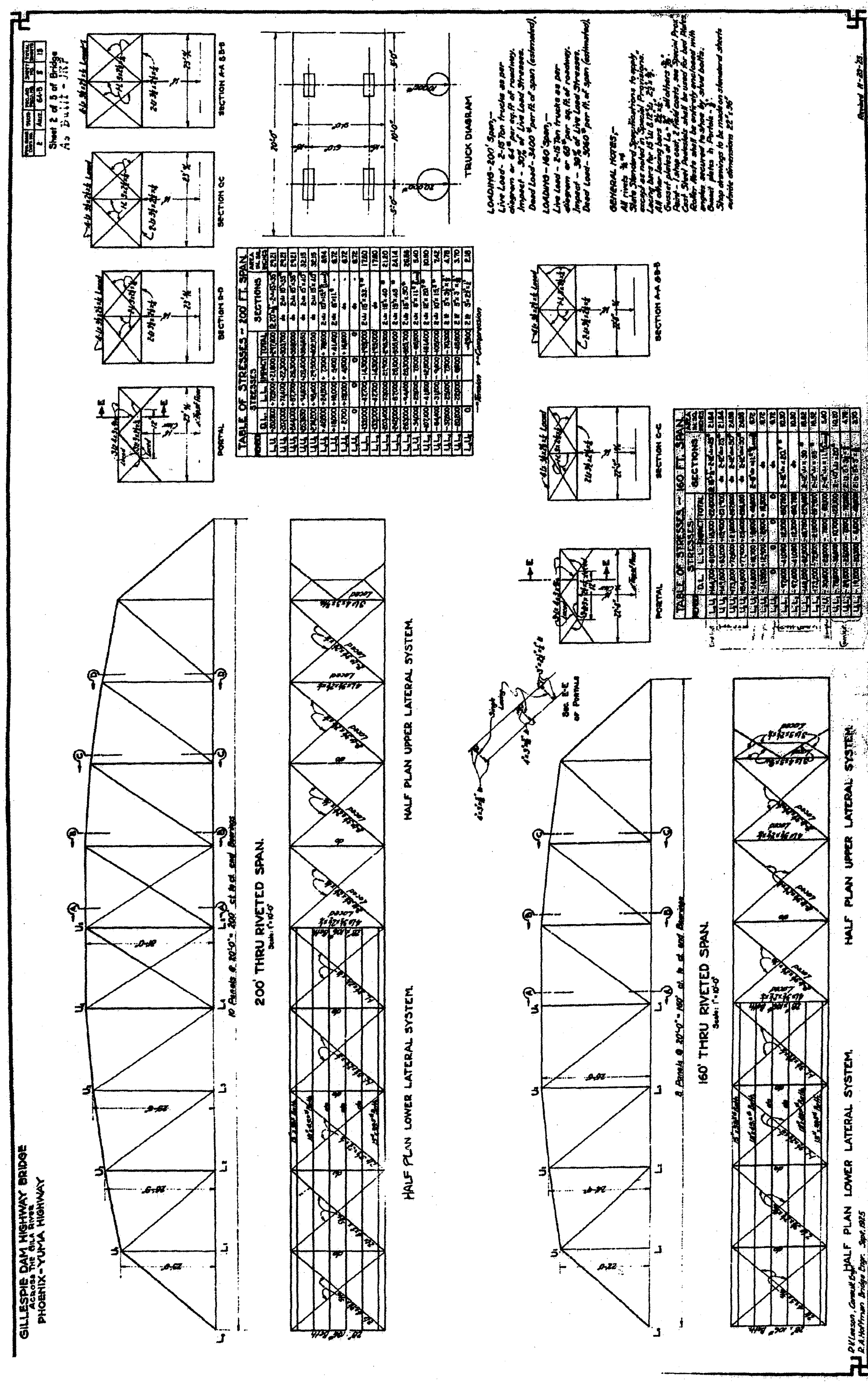
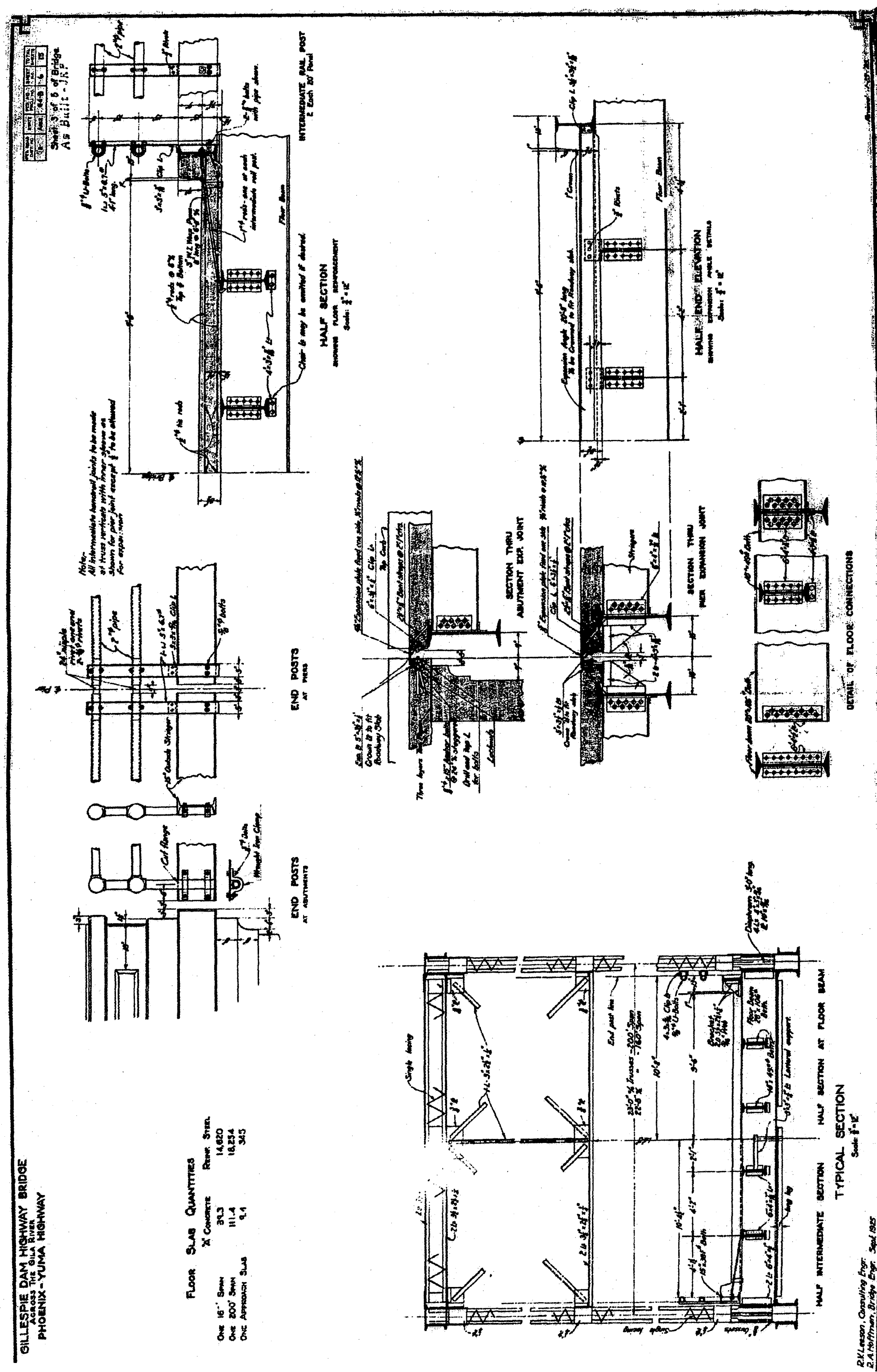


Figure 7. Gillespie Dam Highway Bridge Across the Gila River — Phoenix - Yuma Highway — Truss Sections, 11-23-1925



■ Figure 8. Gillespie Dam Highway Bridge Across the Gila River — Phoenix - Yuma Highway — Truss Details, 11-23-1925

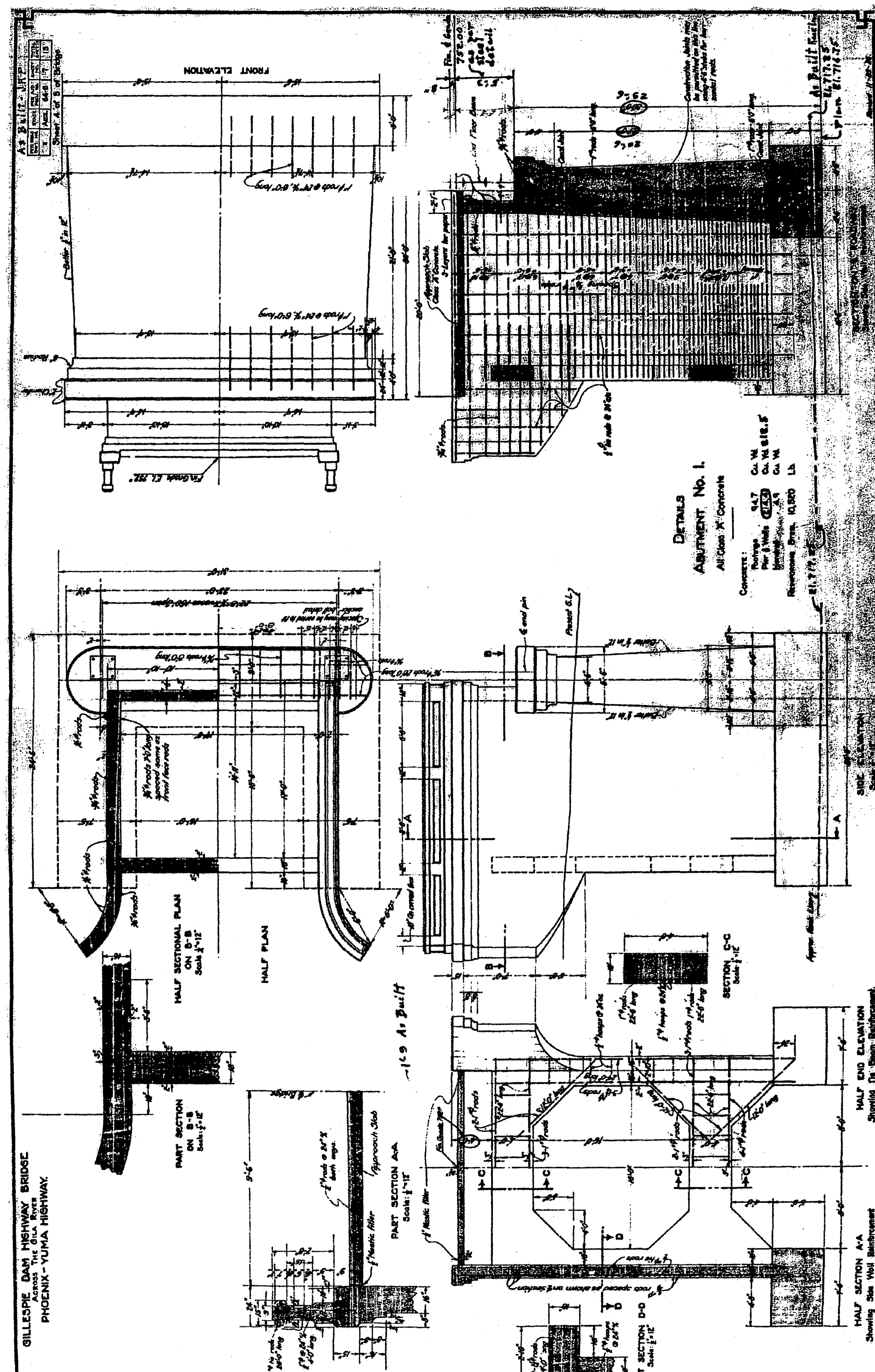
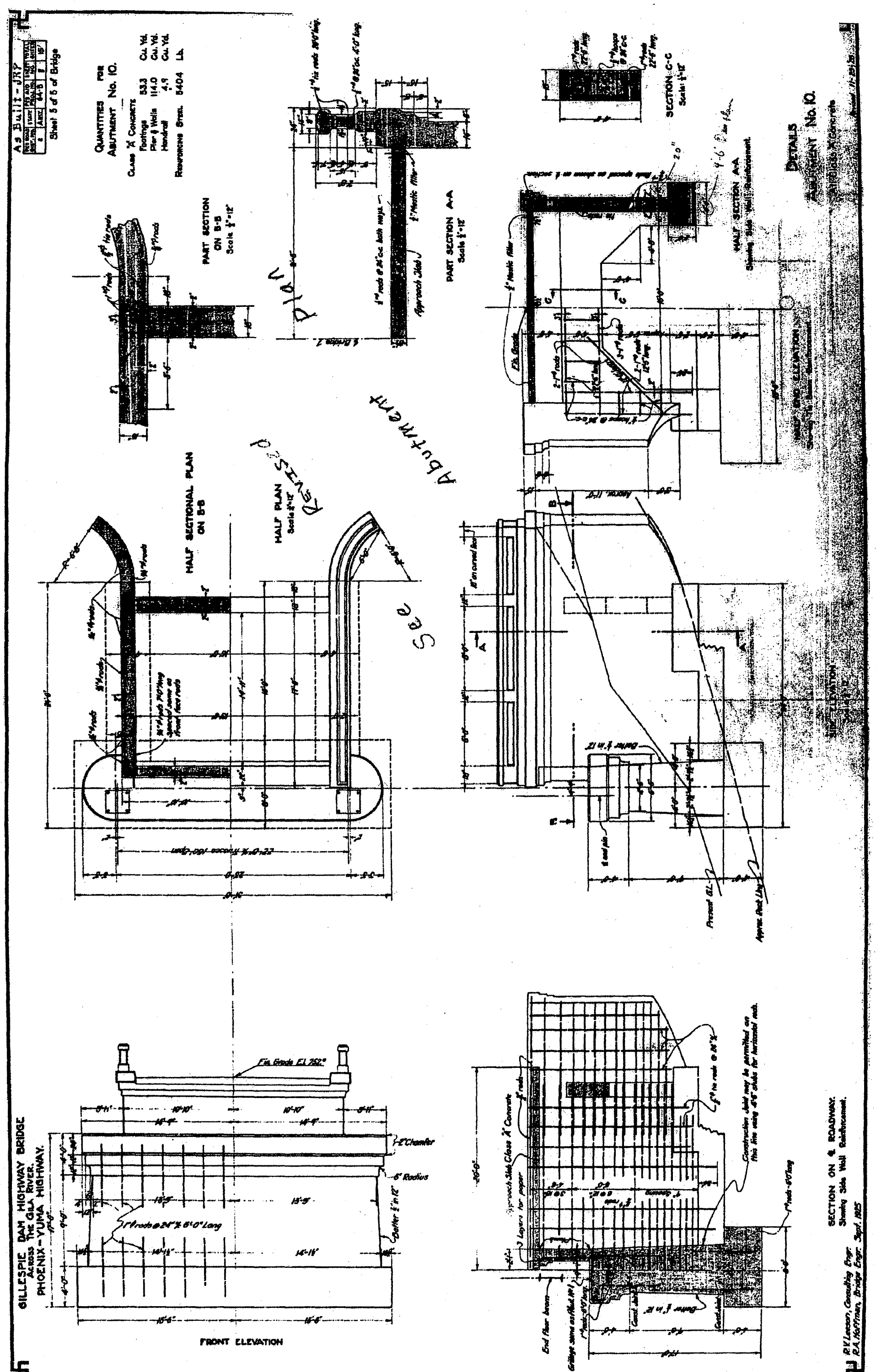
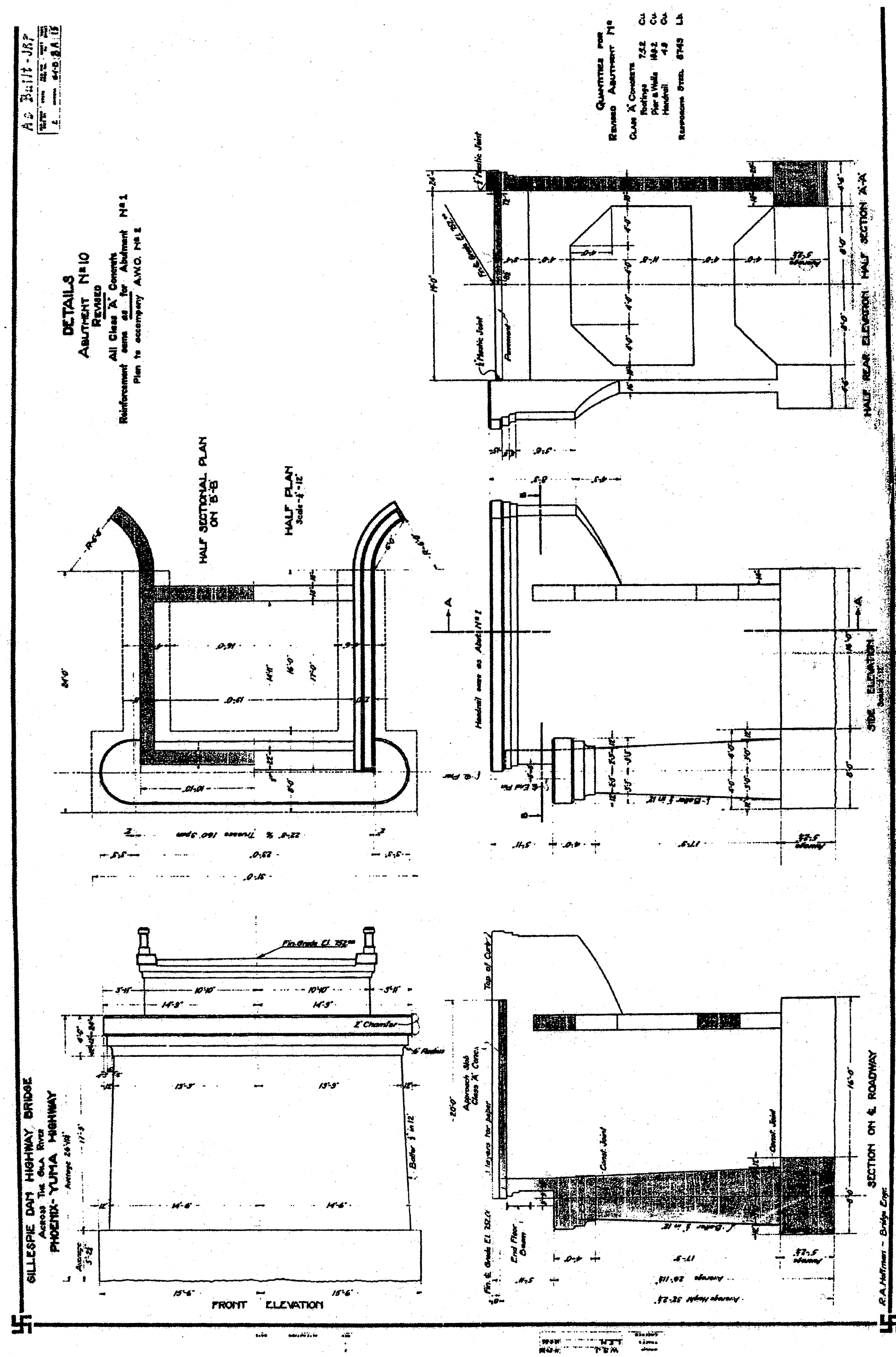


Figure 9. Gillespie Dam Highway Bridge Across the Gila River — Phoenix - Yuma Highway — Details - Abutment No. 1, 11-23-1925



■ Figure 10. Gillespie Dam Highway Bridge Across the Gila River — Phoenix - Yuma Highway — Details, Abutment No. 10, 11-23-1925



■ Figure 11. Gillespie Dam Highway Bridge Across the Gila River — Phoenix - Yuma Highway — Details, Abut. No. 10 - Revised, 1925

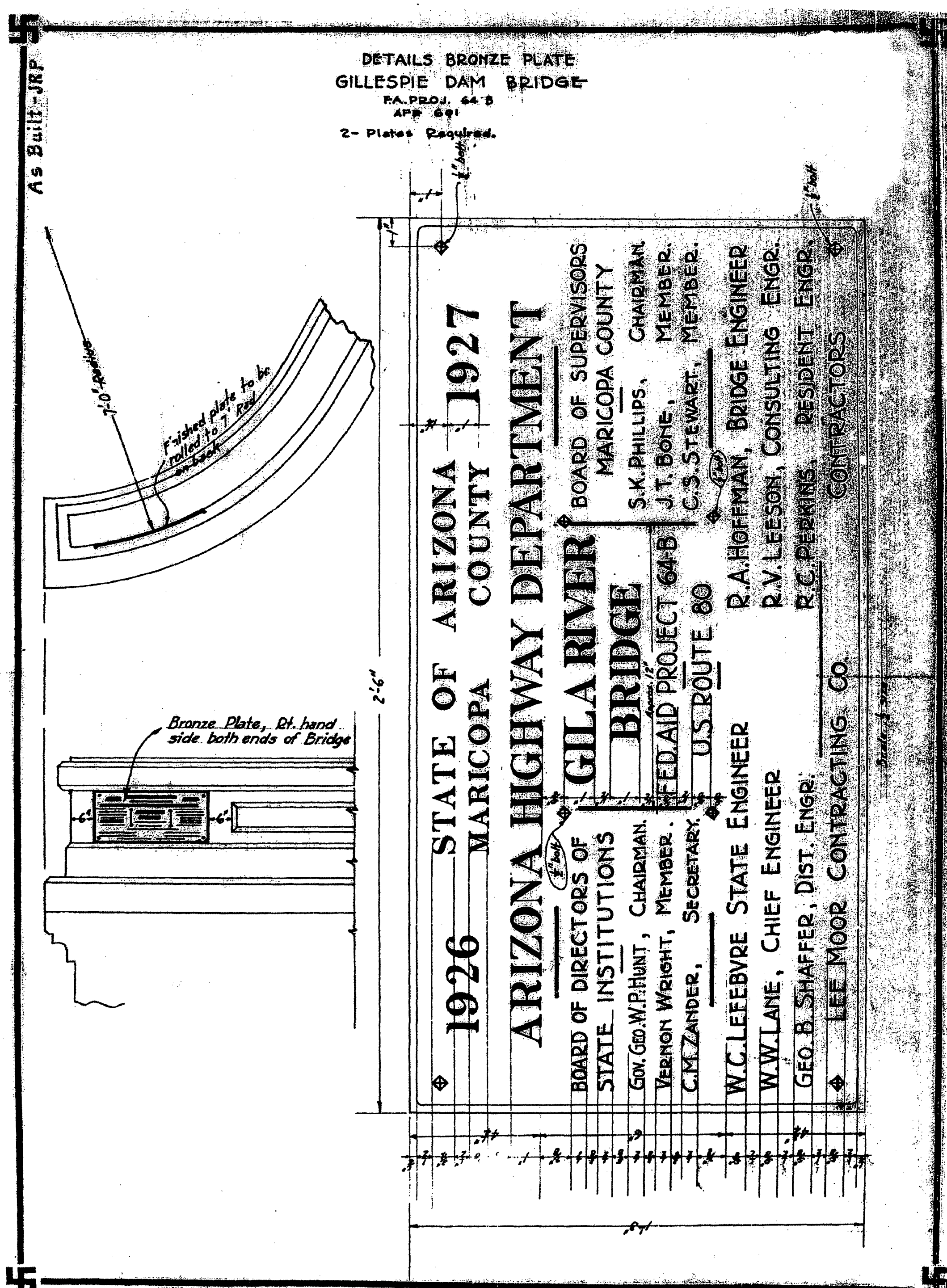
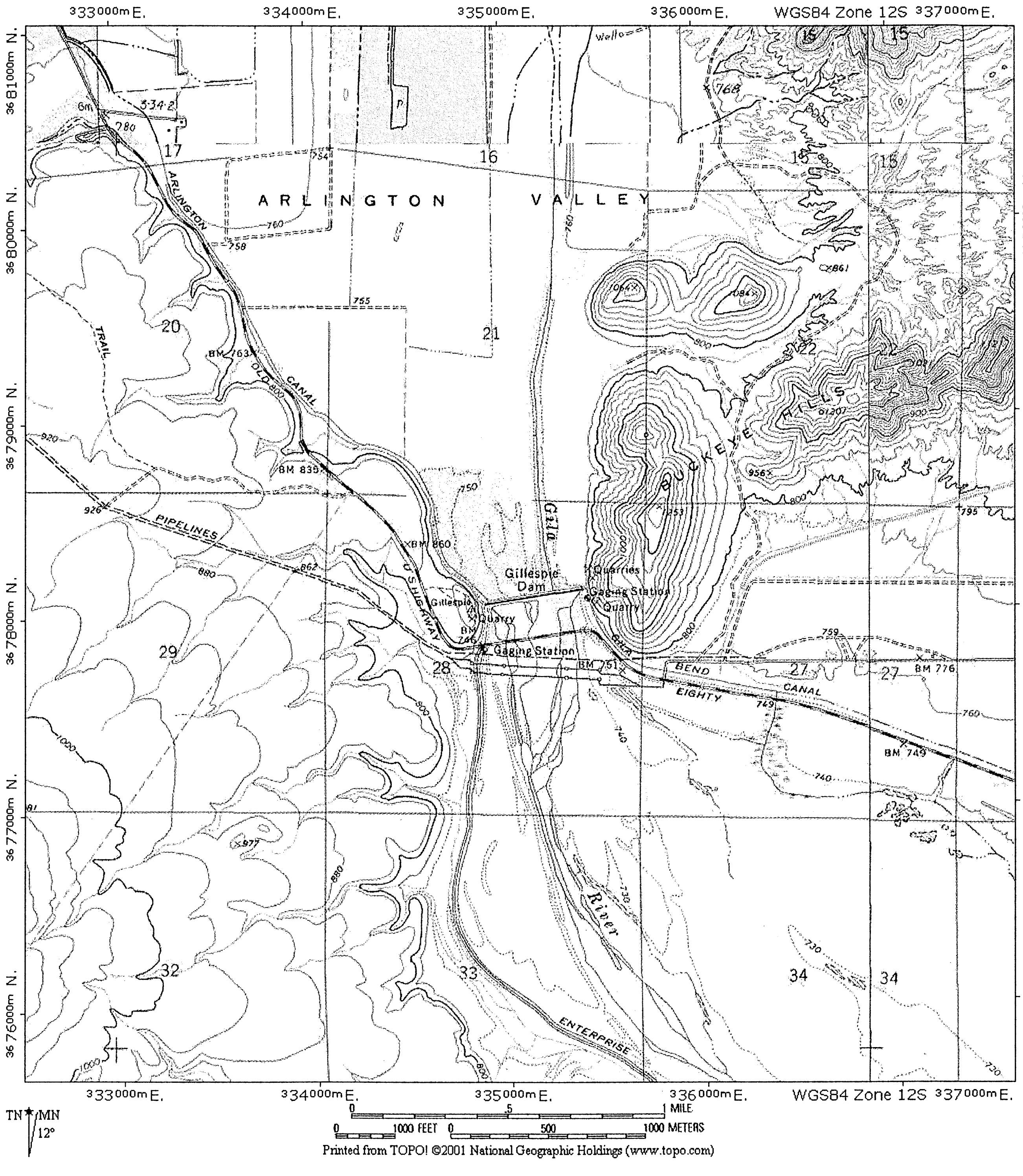


Figure 12. Details Bronze Plate — Gillespie Dam Bridge — F.A.P. Proj. 64-B, 1926



Location Map, taken from USGS 7½-minute Spring Mountain, Arizona, Map. UTM: 12.335120.3677868