

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE
(Bridge No. 82)
Grand Canyon National Park
On the north leg of wye in the Grand Canyon railyard, spanning Bright Angel Wash
Grand Canyon Village
Coconino County
Arizona

HAER AZ-100-A
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PHOTOGRAPHS

COLOR TRANSPARENCIES

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

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Location: On the north leg of wye in the Grand Canyon railyard, spanning Bright Angel Wash, Grand Canyon National Park, Grand Canyon Village, Coconino County, Arizona.

Grand Canyon Railway, Bridge at Milepost 63.5, North Leg of Wye (Bridge No. 82) is located at latitude: 36.056163, longitude: -112.141802. The coordinates represent the approximate center of the guardrail above the center bay on the west portal. It was obtained in March 2022 via Google Maps. The location has no restriction on its release to the public.

Date of

Construction: 1926

Engineer/

Builder: Atchison, Topeka & Santa Fe Railway Company

Original

Owner: Atchison, Topeka & Santa Fe Railway Company

Present

Owner: Grand Canyon National Park, National Park Service

Significance: Grand Canyon Railway, Bridge at Milepost 63.5, North Leg of Wye was one of five wooden box culverts constructed by the Atchison, Topeka & Santa Fe Railway Company (ATSF or Santa Fe) for its Grand Canyon Railway (GCRy) subsidiary during the 1926 reconstruction and realignment of the wye located west of the Grand Canyon railyard. The structure crosses Bright Angel Wash on the north wye leg and lies just northwest of the contemporaneous stone-clad powerhouse and Fred Harvey laundry, built by the Santa Fe with local limestone in keeping with the Rustic architecture style envisioned for Grand Canyon National Park, which had been established in 1919. The skewed, three-bay creosoted wooden box culvert, which is also historically referenced as a bridge, was based on a common railroad design of the mid-nineteenth to early-twentieth century for short crossings, especially for dry tributaries in western climates. The structure is one of three extant wooden box culverts in the Grand Canyon railyard wye and is a contributing feature to the Grand Canyon Village National Historic Landmark District.

Description: Grand Canyon Railway, Bridge at Milepost 63.5, North Leg of Wye (Bridge No. 82) is a skewed, three-bay wooden box culvert that spans Bright Angel Wash at milepost 63.5 on the north wye leg in the Grand Canyon railyard.¹ (The structure will be referred to as Bridge No. 82 for the purposes of this report.) Located at the northeast corner of the wye near the connection with the GCRy main track, Bridge No. 82 is also close to the intersection of Village Loop Bypass and Victor Street and just northwest of the former Fred Harvey laundry (now the park's purchasing and receiving building) and the powerhouse.

The three bays are nominally 4' wide by 3' tall, between four wooden side walls composed of 3" x 8" horizontally laid planks nailed together. At the ends of the walls the planks are stepped at 4" intervals. On the west end of the south abutment, there is a visible diagonal row of date nails near the ends of the wall that are stamped "26", noting the year of construction (see figures 16a-b). Timber guardrails (timber ballast retainers) measuring 30'-long span the three bays at an approximate 30-degree skew parallel to the wye tracks. The guardrails are composed of two timbers stacked over the bays following the skew angle; the lower member is 3" x 8", with an 8" x 8" header on top. The header is in two pieces with a lap connection. A timber brace has been added on the north bay near the front of the west portal as the interior walls are leaning to the south (see Figure 14).

The 4" x 10" wooden plank flooring is laid horizontal to the walls. A 2" x 4" apron is nailed to the outer edge of the plank floor, following the angle of the skew. The roof is comprised of 8" x 8" cross timbers with an 8" x 10" timber notched into the walls on every fifth timber, in order to take up the thrust of the side walls. The center bay north wall of the culvert measures 55'-10" at the base, and 47'-7 ¾" at the top. There is ballast fill atop the structure, measuring approximately 46'-6" across and 5'-6" vertically from the base of rail to the floor of the culvert. Riprap is stacked against the edges of the ballasted embankment where Bright Angel Wash passes through. A railroad tie retaining wall sits just outside the southeast corner of the culvert. The wye track consists of Standard gauge 90-lb. rail, rolled by Colorado Steel & Iron Co., crossing above at a skewed angle to meet the Grand Canyon Railway mainline just west of the throat of the railyard.

¹ The structure is first mentioned in ATSF field notebooks as "First Bridge on East Leg of Wye" in 1928; the name has been adapted to the current nomenclature. The Grand Canyon Railway National Register nomination identifies the structure as a "ballast deck bridge on the north leg of the wye" and counts it as Bridge No. 82; it is illustrated in Photo No. 23. While officially listed as a bridge, the actual structure type is a wooden box culvert, as shown in the Santa Fe Standards (see footnotes 41-42 and figures 21-22). Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, "Closeout of First Bridge on East Leg of Wye," Feb 22, 1928, Grand Canyon National Park Museum Collection, GRCA 119850; Al Richmond, "Grand Canyon Railway," National Register of Historic Places Registration Form, listed August 23, 2000, Section 7: 3 and 19.

Recent inspection reports from 2016-2021 have determined the following deficiencies:

- The north and center timber walls are leaning approx. 8";
- Stream debris has accumulated in the channel of the south bay;
- The guardrail or timber ballast retainer leans approx. 2";
- There are decayed ceiling timbers near the center of the south bay; and
- There is damage to the downstream apron on the edge of the flooring.

Due to these deficiencies, the park and Xanterra Corporation, the concessioner operating the Grand Canyon Railway, have been discussing the eventual replacement of Bridge No. 82 since 2016. Engineers have given the structure a Priority 3 rating, meaning the conditions could become structurally unsound and may no longer meet safety requirements necessary to allow for continued railroad service. Xanterra intends to replace the three-bay skewed wooden culvert with a pipe and fill bridge in cooperation with Grand Canyon National Park.²

History: The Grand Canyon Railway completed a branch line from Williams, Arizona, to the Grand Canyon in September 1901. The precursor Santa Fe & Grand Canyon Railroad was first conceived as a venture to extract copper ore from nearby mines and was the first railroad to bring tourists to see the splendors of the Grand Canyon. Construction began in 1897-99 with the completion of track from Williams on the Santa Fe Pacific mainline as far north as Anita. However, the venture was unsuccessful due to the failure to economically win the ore. The original partners declared bankruptcy and sold to the Santa Fe Pacific Railroad, which purchased the unfinished 56-mile route as a means to recoup the cost of the secondhand rail it had advanced to the venture. The Santa Fe System then completed the final 8 miles to the South Rim of the Grand Canyon.³ P.F. Randall and James Bell Girard had served as chief engineer and assistant for the Santa Fe & Grand Canyon Railroad when they constructed the original route from Williams to Anita in 1900-1901. Santa Fe field engineers had completed the line to Grand Canyon Village by September 1901.⁴

The Santa Fe Pacific Railroad Company reorganized into the Atchison, Topeka & Santa Fe Railway (ATSF or Santa Fe) on July 1, 1902, headquartered in Los Angeles. The renamed subsidiary Grand Canyon Railway began to see "ATSF" initials on all its locomotives, passenger, and freight cars.⁵ While a smaller

² Koppers Railroad Structures, Inc., "Detailed Bridge Inspection Report: Grand Canyon Railway Main Line, North Leg Wye Bridge," 2021; Martin/Martin Consulting Engineers, "Bridge Evaluation Report: Grand Canyon Railway, Milepost 63.5, North Wye Bridge," 2015, 2016, 2017; Grand Canyon Railway, LLC, "Routine Maintenance of Box Culvert under WYE track," August 2016.

³ Gordon Chappell, "Grand Canyon Railway: Project for a New Century—the 20th," *CRM* 22, no. 10 (1999): 15-16.

⁴ Richmond, "Grand Canyon Railway," 8-22 to 8-23.

⁵ Gordon S. Chappell, "The Grand Canyon Depot and Railroad Yard, 1901-1984," Draft, National Park Service,

revenue source for the railway, freight traffic served local ranching, water supply, small scale mining, and logging interests.⁶

Passenger tourist traffic steadily increased on the line after the ATSF purchased a 20-acre plat at “Grand Canyon Station”, where passengers accessed a small board-and-batten depot located near the original Bright Angel Hotel, just west of the axis of the tail of the original wye. James Thurber had constructed the Bright Angel Hotel in 1896, later selling it to Martin Buggeln, before the ATSF acquired the property in 1905. Thurber originally brought tourists to the site via stage and wagon using the Flagstaff-Grand Canyon Road. Buggeln worked with the railway, giving them a cut of his profits in exchange for terminating the line at his hotel. It was around this lodge and other neighboring buildings along the South Rim at the terminus of the Grand Canyon Railway that Grand Canyon Village would eventually develop.⁷

In the beginning the rail facilities serving the Grand Canyon included the mainline track, a wye, and a north and south siding at the end of the line.⁸ As seen in Figure 1, the original wye layout was symmetrical and oriented 90 degrees from the mainline, measuring 836' in circumference on a 79-degree arc; the tail end extended 561'.⁹ After the railroad completed construction of the upscale El Tovar hotel in 1905, the Santa Fe expanded the railyard to eleven tracks to accommodate more passenger coaches. A stable spur was added to serve livery stables built southeast of the wye in 1908, and the tail of the wye was extended south to add a short spur that served as a garbage platform, which became known as a garbage spur. Water facilities including contact and filter beds, septic tanks, and a cistern began to appear inside the wye by 1910. As passenger traffic grew from 15,000 in 1906 to 23,500 in 1909, visitor services greatly improved with the completion of a rustic new log depot at the northeast end of the yard—closest to El Tovar—in 1910.¹⁰

Western Regional Office, San Francisco, 1984, unpaginated, Grand Canyon National Park Museum Collection, GRCA 87730. [Page 9 of the PDF available from the GRCA Museum; this pagination will be followed for later citations of this document.]

⁶ Richmond, “Grand Canyon Railway,” 8-24.

⁷ A competitor was the Grandview Hotel, constructed by Pete Berry in 1897. It was accessed via a stage and wagon road from Flagstaff to the South Rim in the vicinity of Grandview Point—12 miles to the east. Although Berry offered a free stagecoach from the railhead to Grandview, visitation fell off significantly once the ATSF built the upscale El Tovar Hotel near the Bright Angel location, where the village would eventually develop. Ellen Brennan correspondence with author, April 27, 2022; Michael Anderson, “Bright Angel Hotel & Lodge,” <https://grcahistory.org/sites/south-rim/bright-angel-lodge/>, accessed May 2022.

⁸ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 16, 25.

⁹ Grand Canyon Railway Company, “Station Grounds & Vicinity,” Drawing No. 98-6318, May 12, 1905, Grand Canyon National Park Museum Collection, GRCA 111795.

¹⁰ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 20-22. For more information on the history of utilities in and around the rail yard, see: Kate McConnell, “Grand Canyon Village Utilities,” HAER No. AZ-76, Historic American Engineering Record (HAER), National Park Service, U.S. Department of the Interior, 2006.

As the Grand Canyon Railway entered the Grand Canyon Station area, the mainline paralleled the Bright Angel Wash, a low-lying area which gently slopes westward away from the South Rim (see figures 12a-b). ATSF crews first cut a ditch along the southern edge of the main track ca. 1905, necessitating crossings at Track 23 (the stable spur) and the north leg of wye (see descriptions below). As the drainage continued west, it crossed under the main track west of the south end of the original wye. Here the Santa Fe built Bridge B-64 at Milepost 62.3 in 1916, which is extant (see Figure 19).¹¹ Curiously, the drainage was rarely shown on railway maps. On one ATSF 1937 map where it did appear, it was called a “water course”; the NPS Park Engineer labeled it an “open surface ditch” on his 1944-45 map.¹²

T-Rail Bridges

The Grand Canyon Railway built several T-rail bridges for short crossings over Bright Angel Wash as it developed the Grand Canyon Station rail facilities in the 1910s. By 1910-12, GCRy maps begin to show T-rail bridges on both the north and south legs of the wye (see figures 2-4).¹³ After the Santa Fe built a stable spur to connect from the coach yard to a livery stable located southeast of the wye in 1908, a fourth T-rail bridge was constructed to cross Bright Angel Wash (see Figure 5).¹⁴ While the other three spans were 10'-long, single-span T-rail bridges, the bridge closest to the current location of Bridge No. 82 was a 29'-0" long, four-span T-rail bridge supported on timber piles with a wooden walkway and handrails. The bents were spaced 8'-0" apart in the two center spans and 6'-8" apart at the timber pile abutments. The deck was composed of eighteen 29'-long T rails or secondhand running rails of 65-pound weight placed contiguously and used like stringers to support the track. The bridge had a ballasted deck and can be seen in the background of historical photographs depicting the construction of the powerhouse in 1925 (see Figure 6). These T-rail bridges were commonly used for short railroad spans in the late nineteenth and early twentieth century.¹⁵

¹¹ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 105.

¹² Atchison, Topeka, and Santa Fe Railway Co., “Grand Canyon Pipe Line and Building Map,” Drawing No. CECL 1-21496, Sheet 1 of 2, Nov. 30, 1937, Grand Canyon National Park Museum Collection, GRCA 107669; C.M. Carrel, “Base Map, South Rim, Grand Canyon National Park,” 1944-45, Sheet 7 of 24, Grand Canyon National Park Museum Collection, GRCA 107612.

¹³ The third T-rail bridge on the spur parallel to the south wye appears in the ATSF notebook: Atchison, Topeka, and Santa Fe Railway Coast Lines Field Engineers Notebook, “Ravine Section Br. So. Leg Y Grand Canyon,” Sept. 9, 1918, Page 2 of 4, Grand Canyon National Park Museum Collection, GRCA 119850.

¹⁴ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 22; Grand Canyon Railway Company, “Pro Tents for Employees of Transportation Department at Grand Canyon,” Drawing No. 113-7495, April 30, 1912, Grand Canyon National Park Museum Collection, GRCA 34990.

¹⁵ Atchison, Topeka, and Santa Fe Railway Coast Lines Field Engineers Notebook, “Ravine Section East Leg Y Grand Canyon,” Oct. 16, 1918, Page 1 of 3, Grand Canyon National Park Museum Collection, GRCA 119850; “Walk and Handrail for Existing Ballasted Deck T-Rail Bridges,” July 1952. [From Atchison, Topeka, and Santa Fe Railway Co., *The Chief Way Reference Series, System Standards, Volume One* (Dallas: Kachina Press, 1978), 101.]

Improvements to the Wye

The Santa Fe undertook a year-long project to install heavier rail and reduce curvature on the GCRy mainline from Williams to Grand Canyon beginning in 1924. The railway continued to make improvements to its rail and utility facilities at Grand Canyon Village to accommodate larger locomotives and longer trains through 1926. The ATSF also began working with National Park Service Landscape Engineer Daniel Hull and NPS concessionaire partner, the Fred Harvey Company, on a comprehensive plan to guide development of the recently designated Grand Canyon National Park.¹⁶ The effort culminated in the “Grand Canyon National Park General Plan [for] Community Development,” completed in 1924.¹⁷ This major undertaking by the ATSF included providing additional car storage track, upgrading and extending other tracks in the yard, and the construction of the rustic stone-clad powerhouse and Fred Harvey laundry building east of the wye and south of the main track. In order to lessen the degree of curvature on the wye while ensuring the north leg still connected to the throat of the railyard, ATSF engineers moved the centerline of the tail to the west and the end of the tail further south. The Santa Fe also constructed a new powerhouse spur (Track 37) as well as a storage track and garbage spur at the tail. The improvements involved laying 8,734' of new track, removing 4,449' of old track, and increasing the weight of rail from 85 lbs. to 90 lbs./yard.¹⁸

Wooden Box Culverts

ATSF crews began surveying and estimating cut and fill in spring 1925 under Authority for Expenditure No. X-9-25. Contractor W.J. Burton of Los Angeles began excavating limestone and grading, with 511 cubic yards of excavated rock used in the rustic stone veneer of the powerhouse.¹⁹ The major upgrade to the wye included the construction of three wooden box culverts on the north leg and two more on the powerhouse spur. ATSF company forces—also known as the bridge gang—erected the timber box culverts, typically prior to the track crew laying the ballast over top and completing the grading for the track (see figures 7-8).²⁰

¹⁶ The Fred Harvey Company was a concessionaire partner of both the ATSF across its system and the NPS at Grand Canyon. It operated the park's hotels, as well as restaurants and hotels by contract with the ATSF at many of the railroad's stations between Chicago, Los Angeles, and elsewhere. That direct relationship impacted the influence of the two companies on Grand Canyon park development.

¹⁷ Michael P. Scott, Gordon Chappell, Robbyn Jackson, Jamie Donahoe, Susan Begley, and Ethan Carr, “Grand Canyon Village, Grand Canyon National Park,” National Historic Landmark Nomination, designated February 18, 1997, 55-56.

¹⁸ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 79-86.

¹⁹ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 83; Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, “Yard Changes at Grand Canyon,” Oct 13, 1925.

²⁰ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 116; ATSF Notebook, “Closeout of First Bridge on East Leg of Wye,” Feb 22, 1928, Grand Canyon National Park Museum Collection, GRCA 119850.

Santa Fe company forces completed five box culverts in 1926 as detailed in the surviving engineer's field reports. A summary of the work on the five wooden bridges is below (see figures 10-11a-b). Note that the reports refer to the north leg as the "east leg" and are subject to legibility.

- **First Bridge on East [North] Leg of Wye (now known as Bridge No. 82)**—Work consisted of placing a three-bay, 4' x 3' x 56'-5" box on the North Leg of Wye (Track 33) at a 30-degree skew angle. Work was done by company forces according to ATSF Standard Plan CECL #1944. The notebook specified that the "Bridge was placed on ground prior to grading for track." Materials included: 3" x 8" creosoted timbers for sides and centers; top and bottom of bridge are 3" x 10" and 4" x 10" timbers (field work showed 8" x 8" roof timbers with an 8" x 10" every fifth member). Guardrails are 6" x 8", no strap iron used; eight ¾" x 14" drift bolts used through guardrails.²¹
- **Second Bridge on East [North] Leg of Wye**—Work consisted of placing a 2' x 2'-2" x 33'-2" creosoted wood box under the track. Work done by company forces. As the notebook includes total calculations for excavation and backfill, it appears that this culvert was inserted after the roadbed was constructed.²² The box culvert is extant and is located at latitude/longitude: 36.055748, -112.142562 at the east portal (see Figure 17).
- **Wood Box on Tail of Wye**—Work consisted of building a 3' x 3'-1" x 69'-2" top and 78'-4" bottom length creosoted pine box before the embankment was placed. The notebook location sketch shows the box culvert running beneath the tail of wye (Track 31) and one storage track. (The 1938 map shows it running under three tracks, including the adjacent garbage spur Track 41; it also noted the length at 80'-6".) Box built by company forces. Material included: 6" x 7-½" side timbers, 7" x 16" top decking and 4" x 10" flooring.²³ The box culvert is extant and is located at latitude/longitude: 36.050813, -112.144323 at east portal (see Figure 18).
- **First Bridge on Powerhouse Spur**—Work consisted of placing 2' x 2' x 31'-7" creosoted box under Track 37. Work done by company forces. Although not shown on any maps, according to a notebook sketch it would

²¹ ATSF Notebook, "Closeout of First Bridge on East Leg of Wye."

²² Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, "Closeout of Second Bridge on East Leg of 'Y'," Feb 27, 1928.

²³ Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, "Close out of 3'-0" x 3'-1" Creo. Box on Tail of Wye," March 1, 1928, 2 pages. [48-49]

have been located between the tail of wye and the powerhouse, in alignment with the drainage through the second box culvert on the wye.²⁴

- **Second Bridge on Powerhouse Spur**—Work consisted of placing a 1' x 2' x 136' creosoted wood box on ground prior to grading for Track 37. The notebook's section drawing shows the culvert sitting extremely off center, 109.85' from the canyon (north) side and 25'-8" from the south. The section in the notebook shows the culvert sloping away from the rim and emptying into Bright Angel Wash, somewhere east of the powerhouse; however, this structure does not appear on any other map or notebook, so its exact whereabouts is uncertain.²⁵

After the new wye was put into service in late 1926, the track gang removed the original 1901 wye track and retired the old T-rail bridges.²⁶

The Santa Fe completed construction of the rustic powerhouse in 1926 and the Fred Harvey laundry in 1927, both located just to the east of the skewed box culvert, Bridge No. 82. The ATSF completed a powerhouse spur (Track 37) from Track 35, parallel to the tail of wye in 1928 which served as both a garbage spur and a water delivery track. In 1938, the railway extended Track 37 and connected it with the old stable spur (Track 23). This new link (which paralleled the north wye) was the last new track built by the ATSF at Grand Canyon Station.²⁷

Other Bridges on the Grand Canyon Railway

Bridge No. 82 is the northernmost extant bridge on the Grand Canyon Railway line from Williams.²⁸ As previously noted, the other bridge across Bright Angel Wash within the park is Bridge No. 79 at Milepost 63.2, located further west on the main track near the intersection of the south wye. Originally called Bridge B-64 when built in 1916, it is a three-span, 28'-4"-long ballast deck bridge sitting on concrete abutments and piers (see Figure 19).²⁹ According to the National Register nomination, most of the fifty-six bridges listed are “pile and frame” or

²⁴ Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, “Drainage Area for Proposed Opening—Power House Spur, & East Leg of Wye at Grand Canyon,” July 19, 1927, 3 pages; “Closeout of 1st Bridge on Power House Spur,” Feb 27, 1928.

²⁵ The somewhat illegible field notebook page appears to show this culvert being 75' from the end of the spur, but that location is in conflict with a 29'-long, open deck T-rail bridge over Bright Angel Wash that is called out on the 1938 map. This long, narrow box culvert must be a separate drainage into the wash closer to the powerhouse. Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, “Closeout of Second Bridge on Power House,” Spur Feb 27, 1928; Atchison, Topeka, and Santa Fe Railway Company, “Grand Canyon Station Plat,” Drawing No. CECL 1-21497, Jan. 10, 1938, Grand Canyon National Park Museum Collection, GRCA 107608.

²⁶ Atchison, Topeka, and Santa Fe Railway Company System Field Engineers Notebook, “North Leg of Old Wye,” March 27, 1928.

²⁷ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 121.

²⁸ Richmond, “Grand Canyon Railway,” 7-1 to -19.

²⁹ Bridge No. 79 (B-64) is located at latitude/longitude: 36.056378, -112.145732.

timber stringer bridges supported on either timber pile bents or concrete piers and abutments, typical of Santa Fe standards. Half of these bridges are open deck and the other half have a ballasted deck. The nomination also mentions that the GCRy has sixty-one culverts of concrete or wood construction, however Bridge No. 82 is the only one included in the inventory.³⁰ Neither of the other two extant box culverts described in this report are mentioned. More research is needed to determine how many other wooden culverts remain on the line.

Ironically, after the ATSF invested in the improvements to the wye and yard, rail passenger traffic—which had been steadily rising in from 56,075 in 1920 to 68,267 in 1925—peaked at 70,382 in 1927.³¹ The Grand Canyon Railway, which was the main way to travel to the Grand Canyon “in comfort” until the late 1920s, was beginning to face new competition from other modes of transportation.³² As automobile, bus, and air travel become more popular, rail passenger totals plummeted to 34,549 in 1931, forcing the GCRy to cut regular service from Williams to Grand Canyon from two trains to one train a day in 1932. There was a slight bump in traffic after service was suspended from 1942-46 during World War II. The railway converted from steam to diesel power in 1954-55 and by 1955, regular daily service only ran from late spring to early fall.³³ Rail passenger revenues continued to decrease until the Santa Fe finally ended passenger service on the Grand Canyon Railway on July 30, 1968.³⁴

While most histories of the Grand Canyon Railway focus on passenger service to the park, freight remained an important component of the railway’s business up until its demise. Weekly freight trains continued through the 1960s for shipments of uranium, cattle and sheep, and one car of fuel oil and one car of gasoline weekly for the Fred Harvey Company.³⁵ Water trains were also integral to the railway’s relationship to Grand Canyon National Park. Until the Trans-Canyon Water Line was built in the mid-1960s, most of the park’s potable water arrived by train. The ATSF maintained a sizeable fleet of potable water tank cars for this and similar operations in other desert areas on its system. Unlike most mid-twentieth century tank cars, which did not get much bigger than about 10,000 gallons, the largest water cars were 16,000 gallons in capacity. The current GCRy uses at least two historic, riveted, large-capacity, ex-ATSF water tank cars as auxiliary steam locomotive tenders and mobile water storage tanks today.³⁶

³⁰ Richmond, “Grand Canyon Railway,” 8-23.

³¹ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 81, 111.

³² Richmond, “Grand Canyon Railway,” 8-25.

³³ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 81, 147, 162.

³⁴ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 177-78.

³⁵ Chappell, “The Grand Canyon Depot and Railroad Yard, 1901-1984,” 178-180.

³⁶ David Vago correspondence with author, April 21, 2022.

Despite the freight business mentioned above, the railway discontinued all service to the Grand Canyon depot on May 20, 1969. The abandonment order allowed for the removal of several tracks in the coach yard but did not include the main track and the wye. Subsequently, the ATSF and NPS entered into an agreement to demolish the 1910 freight house and other utility buildings in June 1971. The partners agreed to share the cost of removing several tracks from the yard in 1974, including Track No. 37. Along with removal of the powerhouse spur, the two box culverts erected on the powerhouse spur in 1926 were demolished.³⁷

GCRy's mainline track, seven of the yard tracks, and the wye remained dormant in Grand Canyon Village for the next fifteen years. A privately owned venture financed by Max Biegert chartered a new Grand Canyon Railway in 1989, based in Flagstaff. The revitalized railway renewed regular passenger service from Williams to the South Rim of the Grand Canyon beginning in September 1989. Xanterra Corporation, the successor to the Fred Harvey Company, took over ownership of the Grand Canyon Railway in the early 2000s, which continues service to this day using both steam and diesel locomotives (see Figure 14).³⁸

Timber Culvert Context

While stone was the predominant material for early railroad culverts, the use of timber culverts was also commonplace for short spans over small creeks and washes from the mid-nineteenth to early twentieth century, particularly in the west due to aridity.

A 1981 Bureau of Land Management survey of the Central Pacific Railroad's Promontory Route in Utah (active from 1869-1942) found several examples of surviving wooden box culverts that appear to have been built to Southern Pacific standards from the late 1890s to early 1900s. These examples vary from the GCRy in that some have vertical redwood staves, while others featured creosoted wing walls and aprons.³⁹

Railroad engineers sometimes viewed wooden box culverts as serving the purpose of "cheap temporary construction" beneath a ballasted roadbed. In some cases, timber culverts were constructed before a more permanent structure—such as iron pipe—could be placed through it without disturbing the embankment. The Chicago, Milwaukee & St. Paul Railway 1889 standard design specified using "heavy timbers (12" x 12", 10" x 12", or 8" x 12") for the side walls, and cross-

³⁷ Chappell, "The Grand Canyon Depot and Railroad Yard, 1901-1984," 187-192.

³⁸ Richmond, "Grand Canyon Railway," 7-20; Chappell, "Grand Canyon Railway: Project for a New Century," 17.

³⁹ Anan S. Raymond, and Richard E. Fike, *Rails East to Promontory: The Utah Stations*, Bureau of Land Management. Utah Cultural Resource Series No. 8. 1981, Special Edition Reprint 1994, figures 94-103, available at: <http://www.npshistory.com/publications/blm/cultresser/ut/8/sec3.htm>, accessed March 2022; Southern Pacific Railroad, "Common Standard Creosoted Box Culverts 3 ft. x 4 ft.," Oct. 11, 1905, California State Railroad Museum.

timbers for the roof, with every fifth or sixth timber being notched down so as to take up the thrust of the side walls and planks for the flooring” (see Figure 20).⁴⁰ Such a design is very similar to that found at the Grand Canyon.

A review of the Atchison, Topeka & Santa Fe Railway System’s wooden and timber box standard drawings from 1915 and 1932 show designs that are similar but vary slightly from those seen on the GCRy wye. The nine-sheet sets showed creosoted timber boxes varying in size from 1' x 1' to as large as 4' x 6'. The 1915 standards specified that wooden boxes may be used where the height from the bottom of rail to top of floor is 10' or less, with a 1'-6" minimum fill height above the culvert. For the heights greater than 10', concrete boxes or pipes were required. The box culvert design was similar to those at Grand Canyon in that it featured 3" x 8" plank walls, set back 4-½" at the ends, and every fifth roof timber was staggered and notched into the wall. It also differed in that it delineated 6" x 8" vertical holdbacks bolted behind the abutments, which are not found here (see Figure 21).⁴¹ The 1932 timber culvert standards increased the maximum height to 15', again with varying minimum fill heights above the culvert. Bridge No. 82 measures 5'-6" from bottom of rail to top of floor, just within the 5'-1½" minimum for a 4' x 3' culvert. As in 1915, the 1932 drawing shows 6" x 6" vertical holdbacks bolted behind the retaining wall (see Figure 22).⁴² Interestingly, the ATSF did not even bother to include timber box culverts in its 1978 *System Standards* book. Only concrete culverts were specified by the railway, although it did continue to include ballasted deck and open deck timber pile bridges like those found further south on the Grand Canyon Railway.⁴³

Conclusion

The Bridge at Milepost 63.5, North Leg of Wye and the two other contemporaneous culverts found on the wye represent rare surviving examples of standard railroad creosoted wooden box culverts built by the Atchison, Topeka and Santa Fe Railway on the Grand Canyon Railway in 1926. They remain contributing elements to the Grand Canyon Village National Historic Landmark District, as reminders of when taking the train was the main mode of transportation for tourists visiting the South Rim of the Grand Canyon.

⁴⁰ Walter L. Webb, *Railroad Construction: Theory and Practice: A Textbook for the Use of Students in Colleges and Technical Schools* (New York: J. Wiley, 1908), 216.

⁴¹ Atchison, Topeka, and Santa Fe Railway System, “Standard 4' x 3' Wooden Box,” Drawing No. CES-5234, August 1915. Kansas Historical Society, Topeka, KS. The drawing noted that it superseded CES-1944, which was specified in the 1928 ATSF Notebook, “Closeout of First Bridge on East Leg of Wye.”

⁴² ATSF Ry. System, “Standard 4' x 3' Treated Timber Box,” Drawing No. CES-5283, Sheet 7 of 9, Feb. 1932, Springer Archives and Library, Temple, TX.

⁴³ The three volumes are a collection of standard drawings from signage to structures on the Santa Fe dating from 1911 to 1970. Atchison, Topeka, and Santa Fe Railway Co., *The Chief Way Reference Series, System Standards, Volume One* (Dallas: Kachina Press, 1978).

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_____. "Ravine Section Br. So. Leg Y Grand Canyon." Sept. 9, 1918, Page 2 of 4. Grand
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_____. "Closeout of First Bridge on East Leg of Wye." Feb 22, 1928. Grand Canyon National
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_____. "Closeout of Second Bridge on East Leg of 'Y'." Feb 27, 1928. Grand Canyon National
Park Museum Collection, GRCA 119850.

_____. "Closeout of 1st Bridge on Power House Spur." Feb 27, 1928. Grand Canyon National
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- _____. "North Leg of Old Wye." March 27, 1928. Grand Canyon National Park Museum Collection, GRCA 119850.
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- _____. "Station Grounds & Vicinity." Drawing No. 98-6318, May 12, 1905. Grand Canyon National Park Museum Collection, GRCA 111795.
- _____. "Location of Pro. Gasoline Storage Tank." Drawing No. 100-7090, Sept. 2, 1910. Grand Canyon National Park Museum Collection, GRCA 111795.
- _____. "Showing Location of Pro. Double Toilet to Serve Section House at Grand Canyon." Drawing No. 100-7437, January 9, 1912. Grand Canyon National Park Museum Collection, GRCA 111791.
- _____. "Pro. Tents for Employees of Transportation Department at Grand Canyon." Drawing No. 113-7495, April 30, 1912. Grand Canyon National Park Museum Collection, GRCA 34990.
- _____. "Wye Tail at Canyon." Drawing No. 100-10378, April 20, 1922. Grand Canyon National Park Museum Collection, GRCA 111756.
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Historian: Christopher H. Marston, HAER Architect, 2022

Project

Information: The Historic American Engineering Record (HAER) is a long-range program that documents and interprets historically significant engineering sites and structures throughout the United States. HAER is part of Heritage Documentation Programs (Scott Keyes, Program Manager), a division of the National Park Service, United States Department of the Interior. In consultation with the Arizona State Historic Preservation Office (Kathryn Leonard, SHPO), Grand Canyon National Park (Ed Keable, Superintendent) agreed to sponsor the documentation of the Grand Canyon Railway, Bridge at Milepost 63.5, North Leg of Wye Recording Project in 2021 as mitigation prior to its removal and replacement. Todd A. Croteau, HAER Architect, completed the measured drawings and the large-format photographs. Christopher H. Marston, HAER Architect, wrote the historical report. GRCA staff assisting the project include Kim Besom, Museum Curator; Ellen Brennan, Cultural Resources Program Manager; Douglas Joseph, Asset Manager; Mark Wilson, Concessions Management Specialist. Special thanks to David Vago, GRCA Historical Architect.

Related

Documentation: HAER No. AZ-76, Grand Canyon Village Utilities

Illustrated Appendix

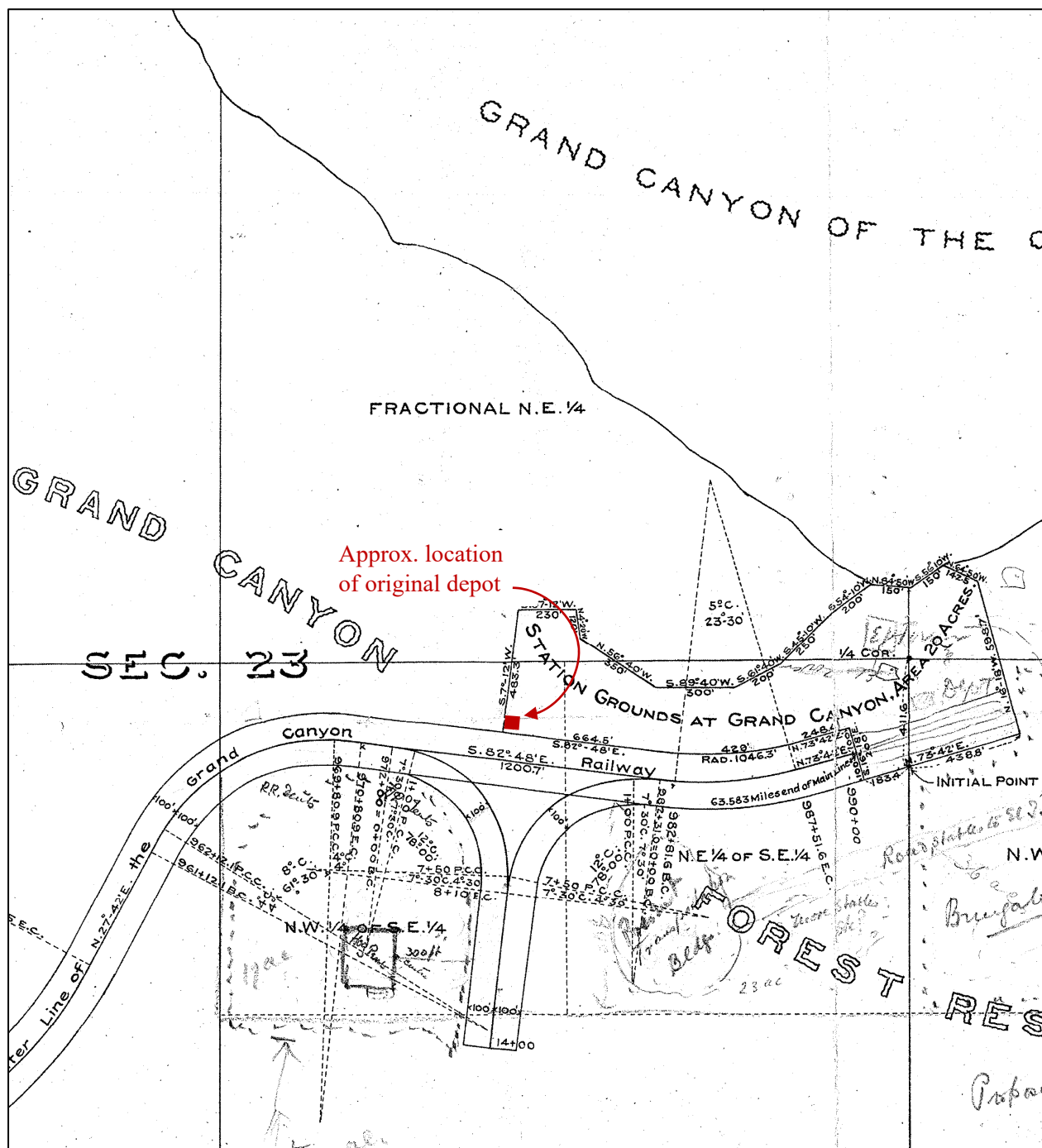


Figure 1. Map showing original 200'-wide right-of-way and the symmetrical wye at Grand Canyon Station. Detail from "Map Showing Land Required by The Grand Canyon Railway Company," Drawing No. 59-5461, July 5, 1904. Grand Canyon National Park Museum Collection, GRCA 108551.

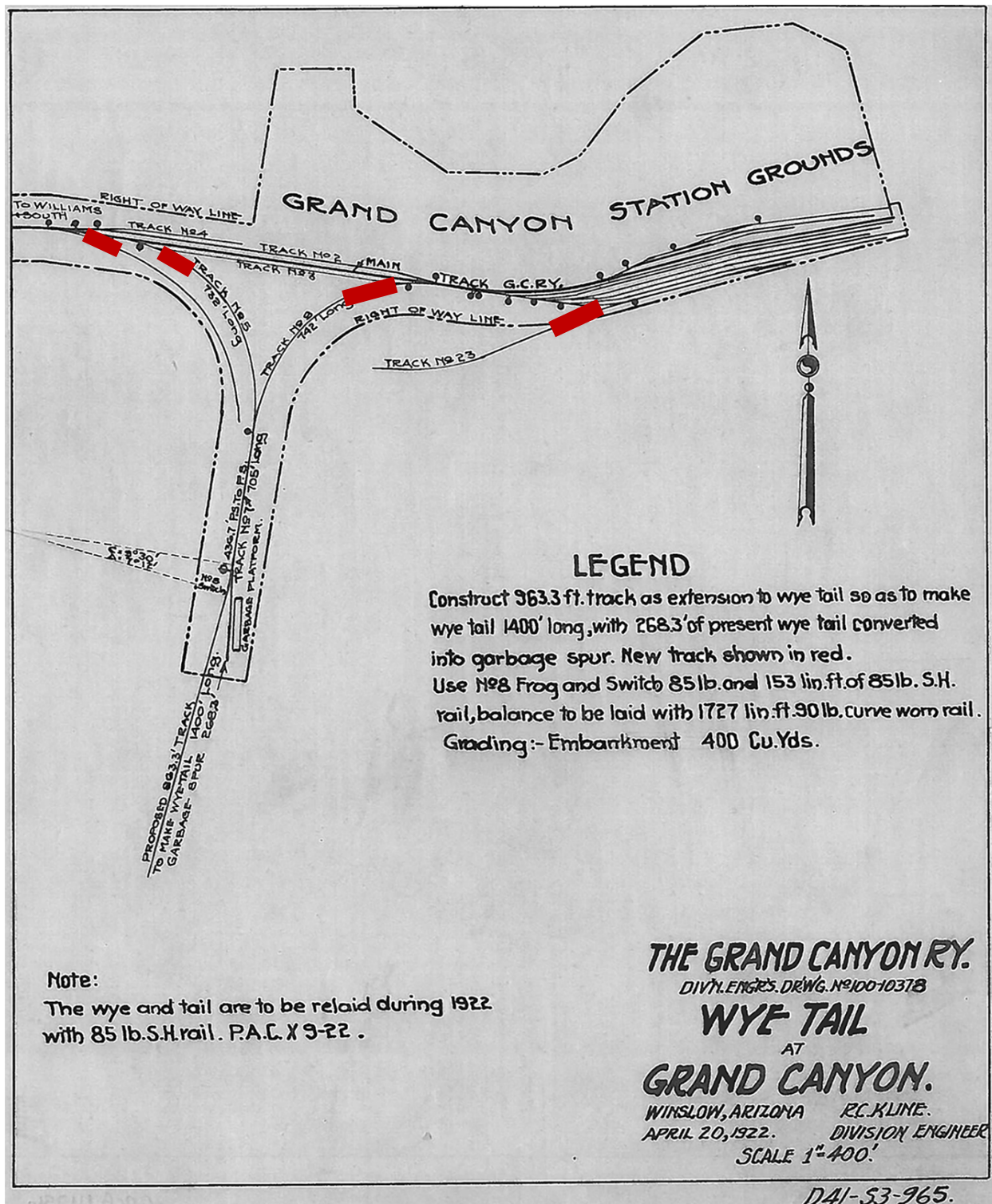


Figure 2. Map of original wye and spurs prior to 1925 realignment. The author has added the approximate location of the four T-rail bridges built ca. 1910-1912. "Wye Tail at Canyon," Drawing No. 100-10378, April 20, 1922. Grand Canyon National Park Museum Collection, GRCA 111756.

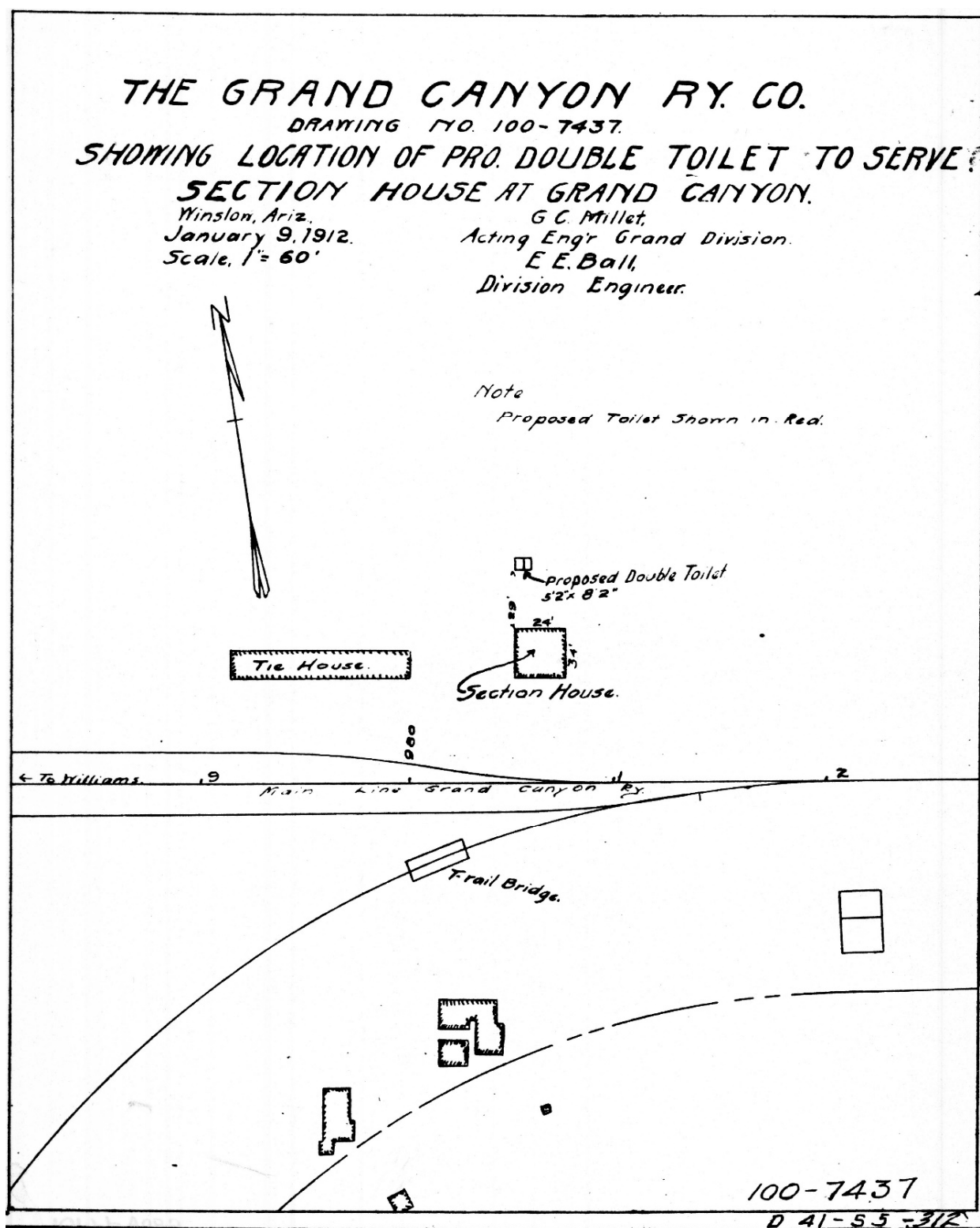


Figure 3. 1912 Map showing first bridge on the original north (east) wye as a T-rail bridge, near the current location of Bridge No. 79. GCRy Drawing No. 100-7437, January 9, 1912. Grand Canyon National Park Museum Collection, GRCA 111791.

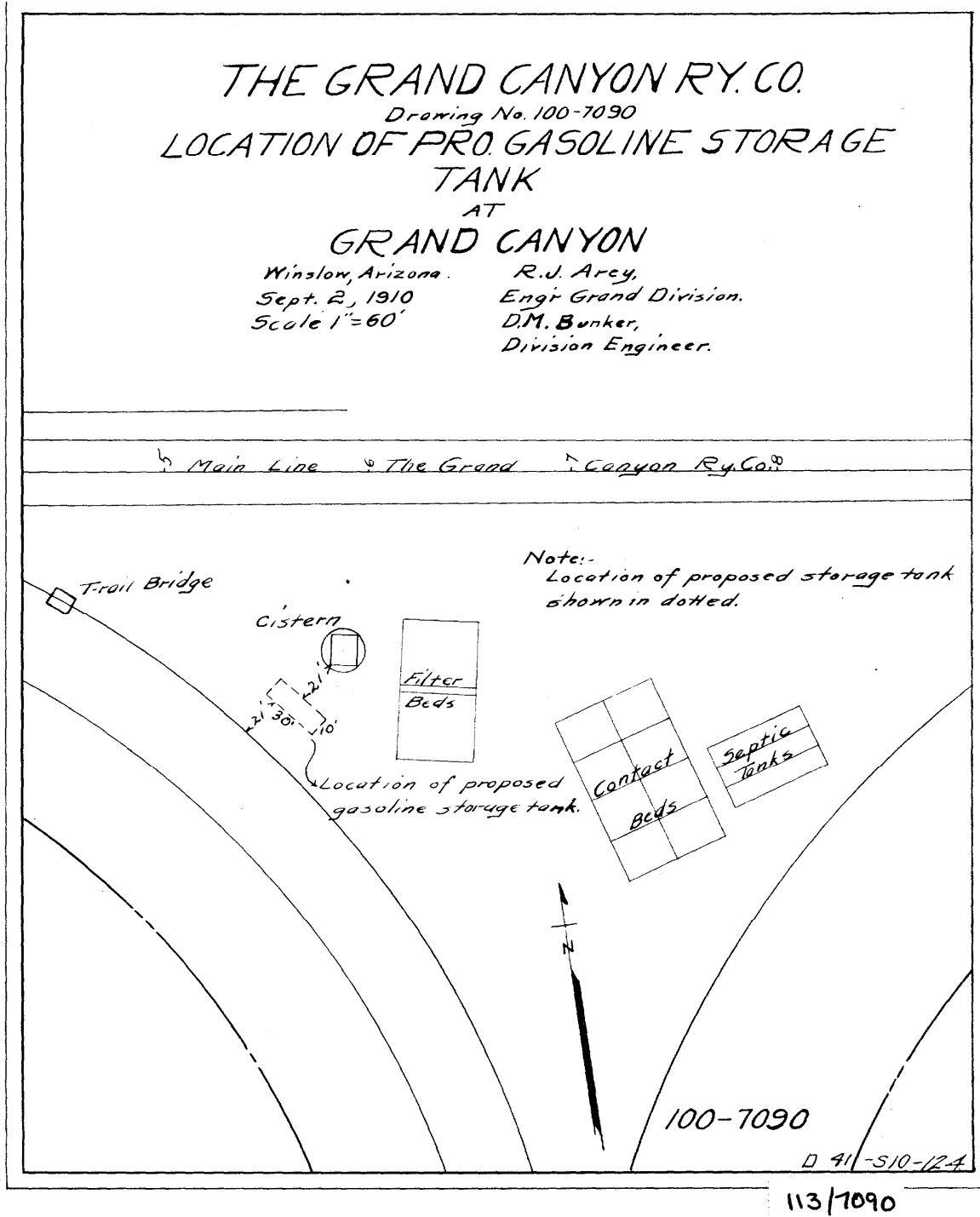


Figure 4. 1910 Map showing a second T-rail bridge over Angel Wash on the original south wye, as well as some of the utility structures that occupied the interior of the wye. A third T-rail bridge existed on the spur that is parallel to the south (west) wye, just off the map. GCRy Drawing No. 100-7090, Sept. 2, 1910. Grand Canyon National Park Museum Collection, GRCA 111795.

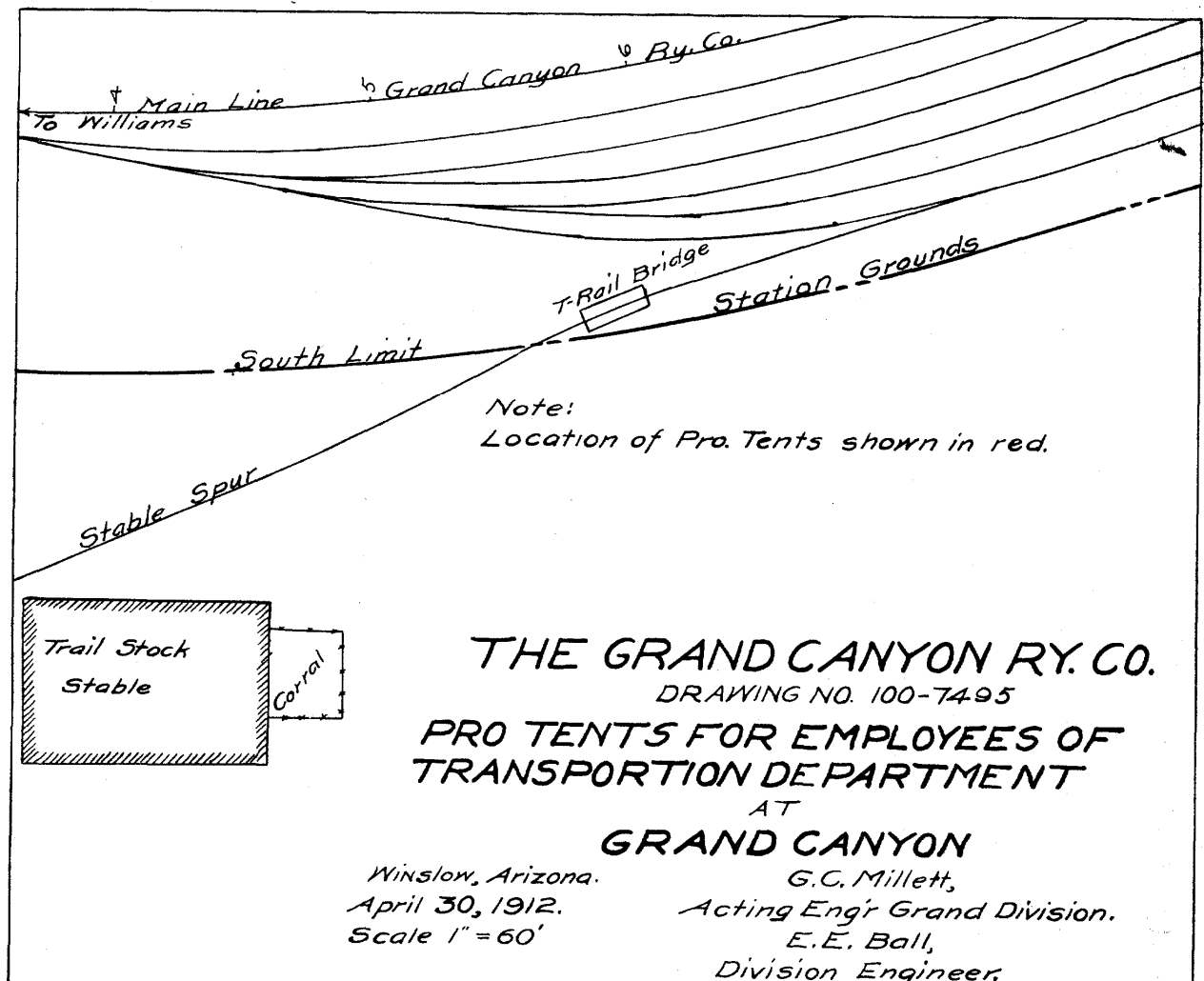


Figure 5. A fourth T-rail bridge on the Stable Spur further east near the original rail yard. GCRy Drawing No. 113-7495, April 30, 1912. Grand Canyon National Park Museum Collection, GRCA 34990.

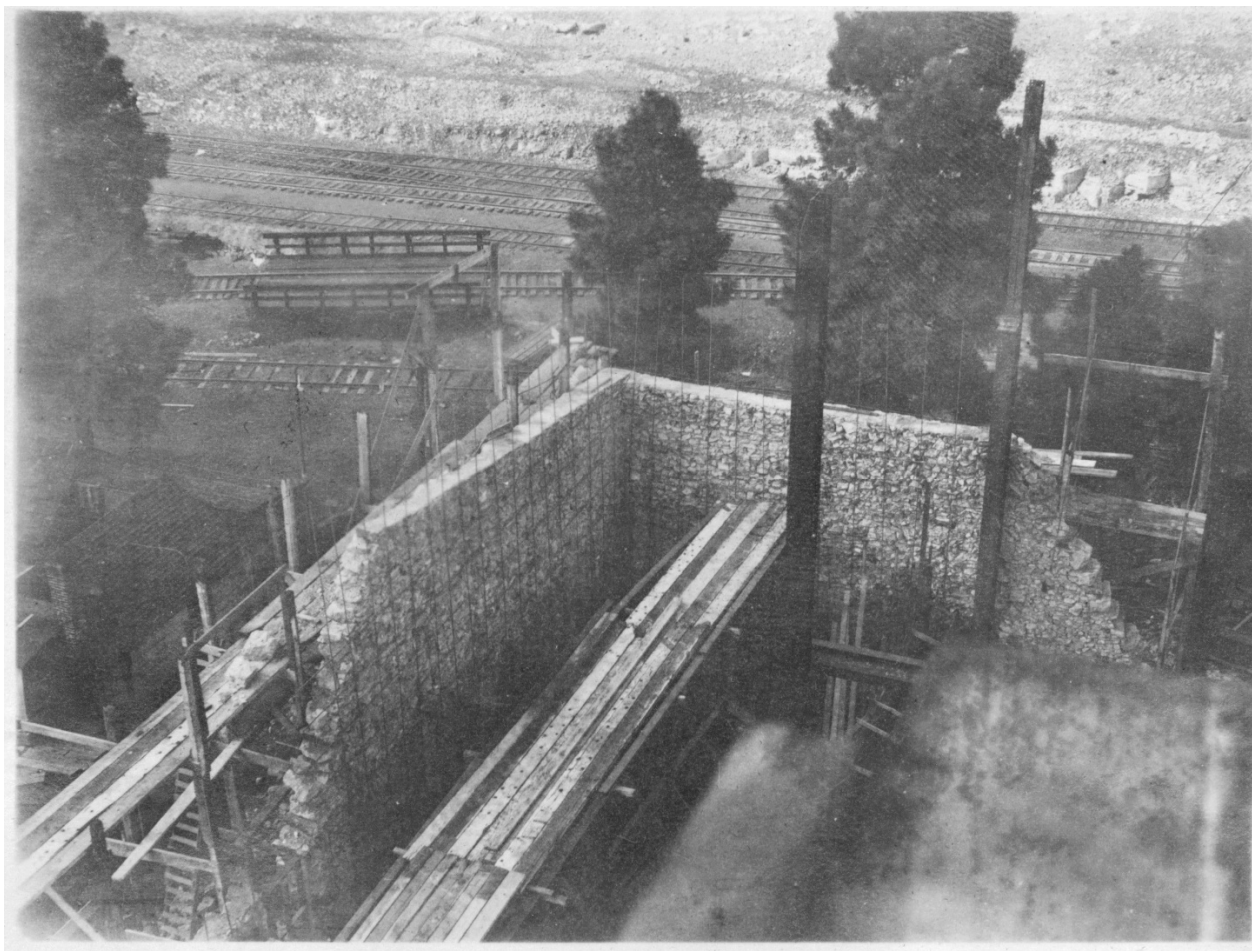


Figure 6. 29'-long T-rail bridge on the original north leg of wye with the construction of the rustic stone wall of the powerhouse in the foreground. August 11, 1925. James L. Morris photo, Grand Canyon National Park Museum Collection, GRCA 61004.



Figures 7-8. Ballast laid by contractor W.J. Burton for the new north wye prior to the box culvert being constructed across Bright Angel Wash. The ballast at left is for the new powerplant wye. M.E.J. Colter photo, Grand Canyon National Park Museum Collection, GRCA 13641. Below: Similar view from the chimney top of the new powerhouse showing newly laid track of the north wye. Although outside the frame, Bridge No. 82 would have been erected by this date, Aug. 18, 1926. James L. Morris photo, Grand Canyon National Park Museum Collection, GRCA 61004.



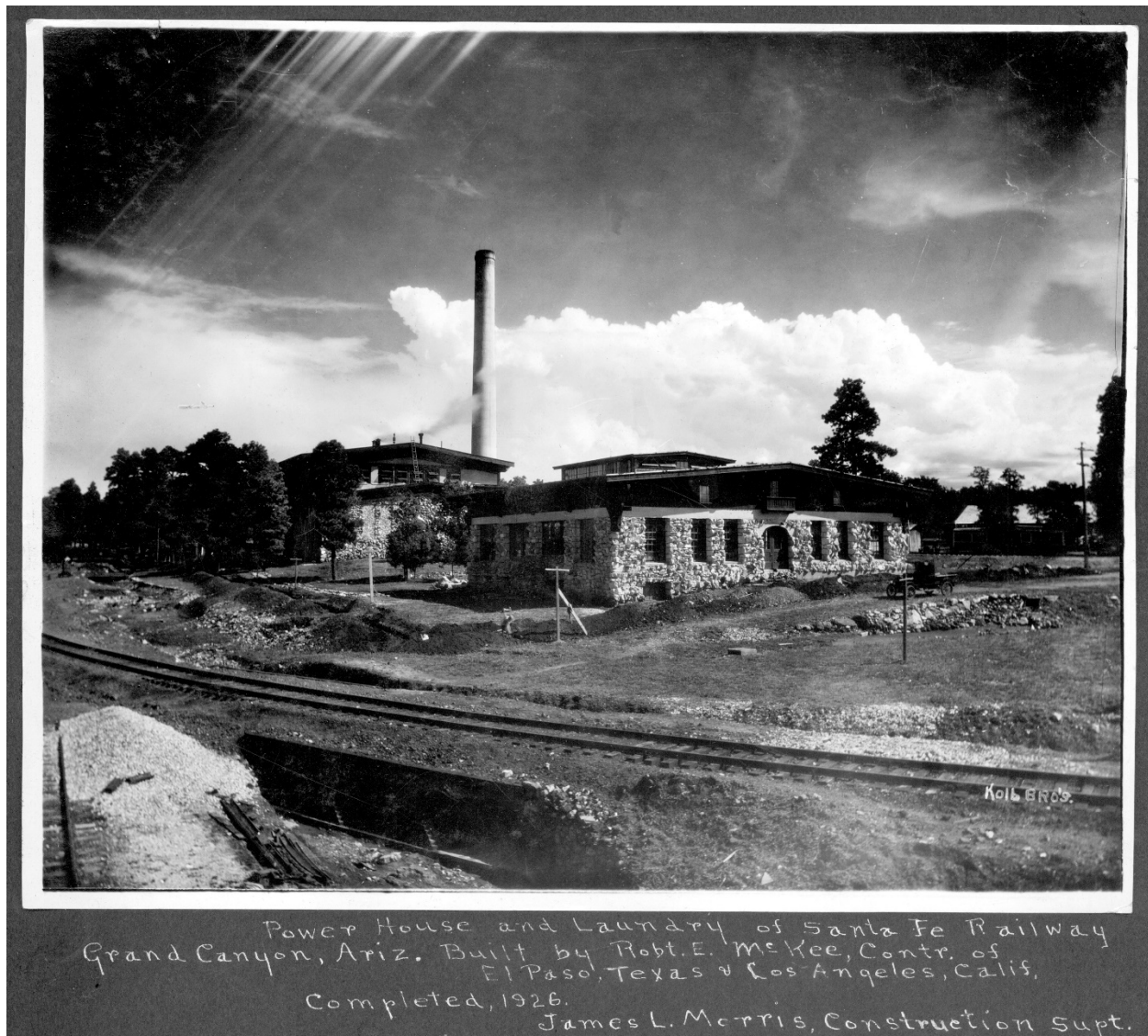


Figure 9. Newly completed skewed box culvert of Bridge No. 82 lies in front of the recently built stone clad powerhouse and Fred Harvey laundry, 1926. James L. Morris photo, Grand Canyon National Park Museum Collection, GRCA 61004.

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE
HAER No. AZ-100-A
(Page 24)



Figure 10. Map of realigned wye overlaid by the trace of the old wye. See next page for enlarged views of the outlined areas. Detail from "Grand Canyon Station Plat," ATSF Drawing No. CECL 1-21497, Jan. 10, 1938, Grand Canyon National Park Museum Collection, GRCA 107608.

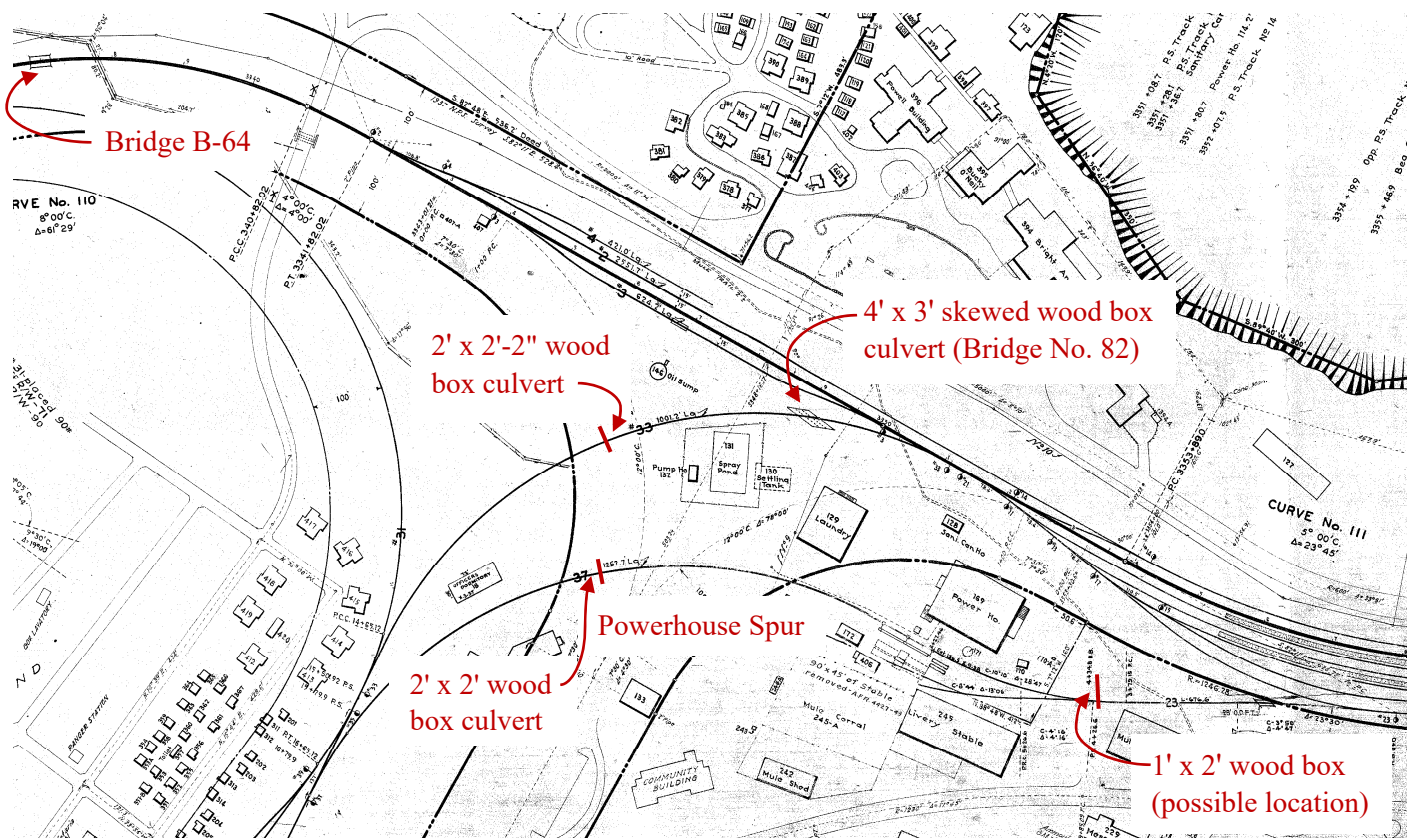
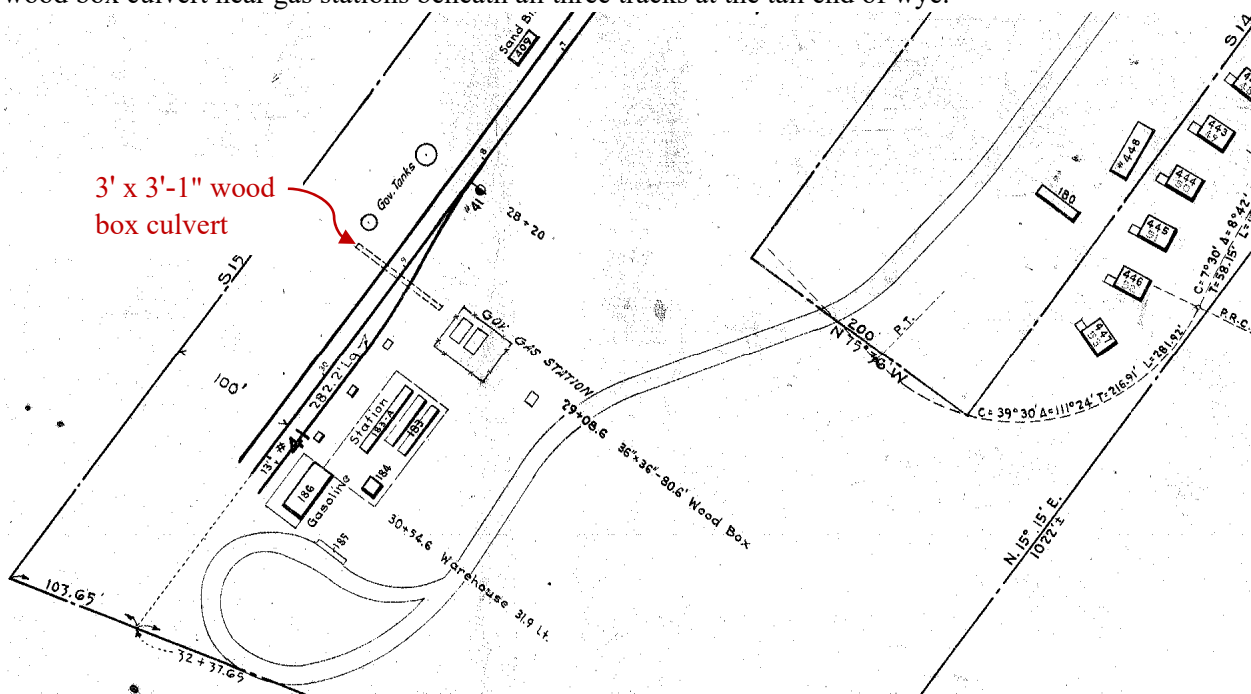


Figure 11a. Detail of 1938 map showing the skewed, three-bay culvert on the north leg of wye. Approx. location of other 1926 box culverts inserted into map. Figure 11b. Detail of 1938 map showing 3' x 3' x 80'-6" wood box culvert near gas stations beneath all three tracks at the tail end of wye.





Figures 12a-12b. Aerial view showing Grand Canyon Village at the South Rim, with the Grand Canyon Railway approaching the station as it parallels Bright Angel Wash, ca. 1933. Bridge No. 82 is at lower left in detail below. Grand Canyon National Park Museum Collection, #09543.

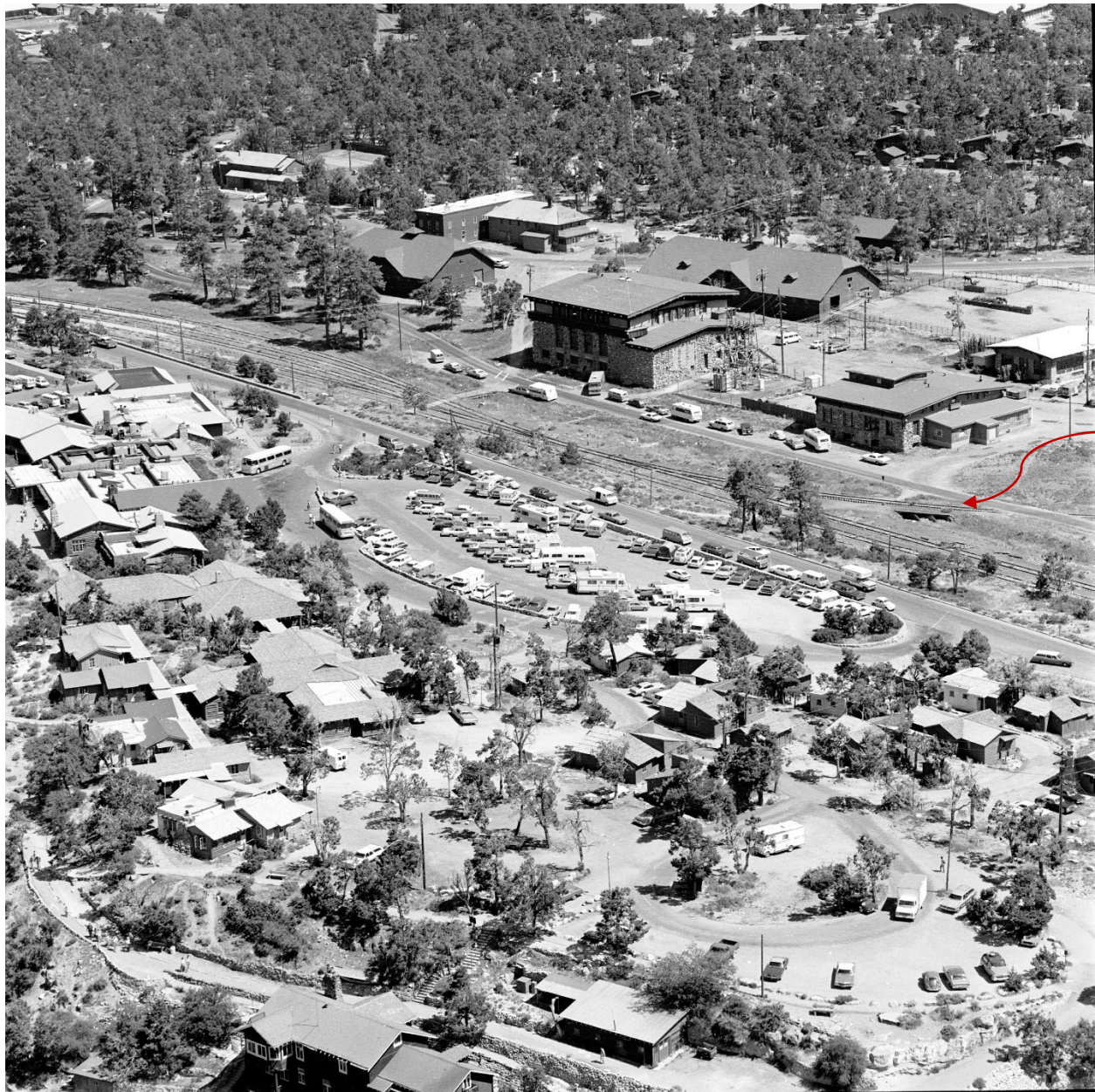


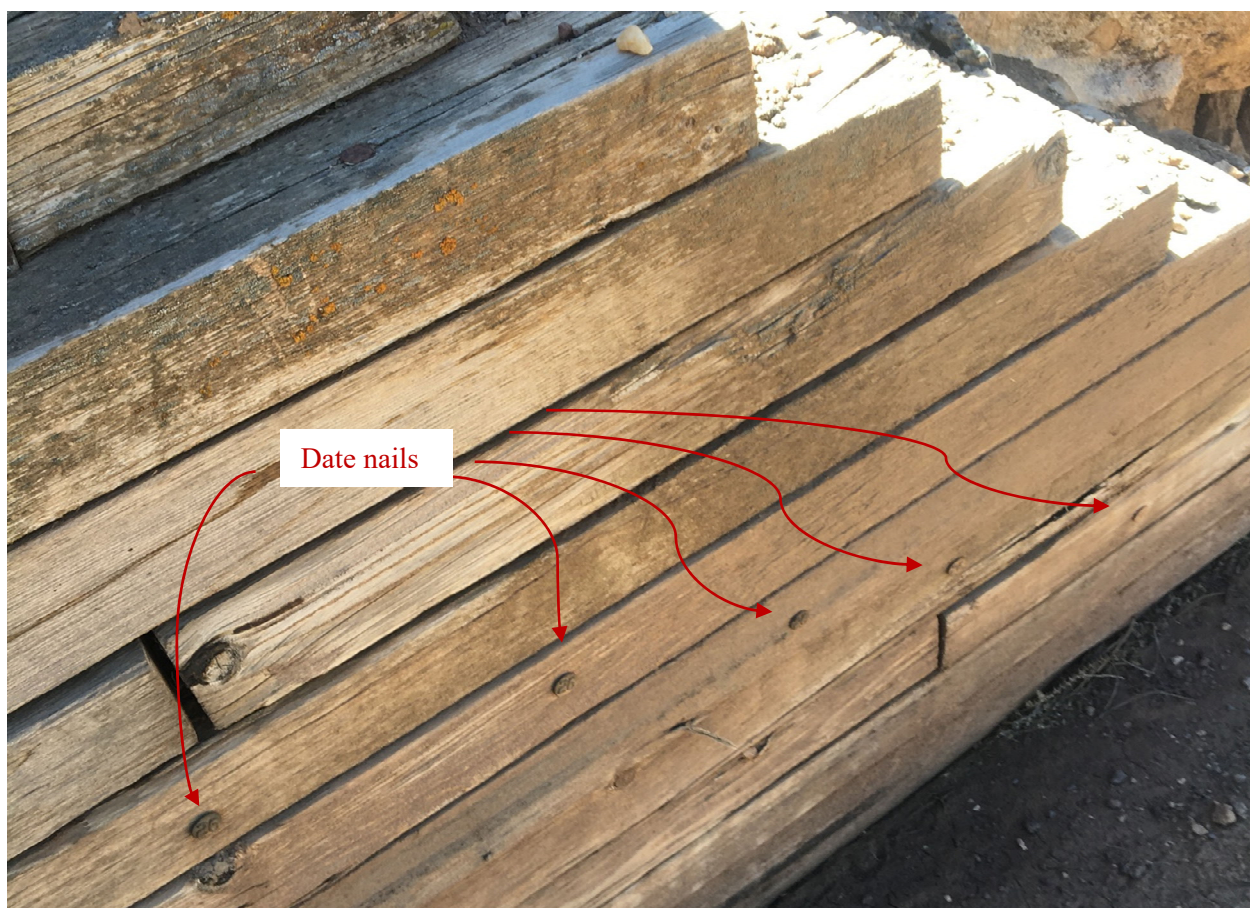
Figure 13. Aerial view of Grand Canyon Village. Bridge No. 82 is visible at far right in the GCRy right-of-way in front of the Fred Harvey laundry building (with addition), ca. 1960s-70s. Grand Canyon National Park Museum Collection, #06629e.



Figure 14. Grand Canyon Railway steam locomotive no. 4960 crosses Bridge No. 82 over the north wye leg between the railyard and the servicing area at the tail of wye. David Vago photo, March 2022.



Figure 15. View of Bridge No. 82 looking west with loaded gondolas in the background, ca. 1985-89. Grand Canyon National Park Museum Collection, # C-0951.



Figures 16a-b. Detail of date nail with “26” stamped on the head, located at west end of the south abutment. Note diagonal row of date nails along the wall. David Vago photos, April 2022.



Figure 17. 2' x 2'-2" x 33'-2" wooden box culvert beneath north leg of wye with the laundry in the distance. David Vago photo, March 2022.



Figure 18. 3' x 3'-1" x 78'-4" wooden box culvert built in 1926 located at tail of wye. David Vago photo, March 2022.



Figure 19. Bridge No. 79 (B-64), a 28'-4"-long ballast deck bridge located at Milepost 63.2. David Vago photo, April 2022.

BOX CULVERTS.

188. Wooden box culverts. This form serves the purpose of a cheap temporary construction which allows the use of a ballasted roadbed. As in all temporary constructions, the area should be made considerably larger than the calculated area (§§ 179-182), not only for safety but also in order that, if the smaller area is demonstrated to be sufficiently large, the permanent construction (probably pipe) may be placed inside without disturbing the embankment. All designs agree in using heavy timbers ($12'' \times 12''$, $10'' \times 12''$, or $8'' \times 12''$) for the side walls, cross-timbers for the roof, every fifth or sixth timber being notched down so as to take up the thrust of the side walls, and planks for the flooring. Fig. 99 shows some of the standard designs as used by the C., M. & St. P. Ry.

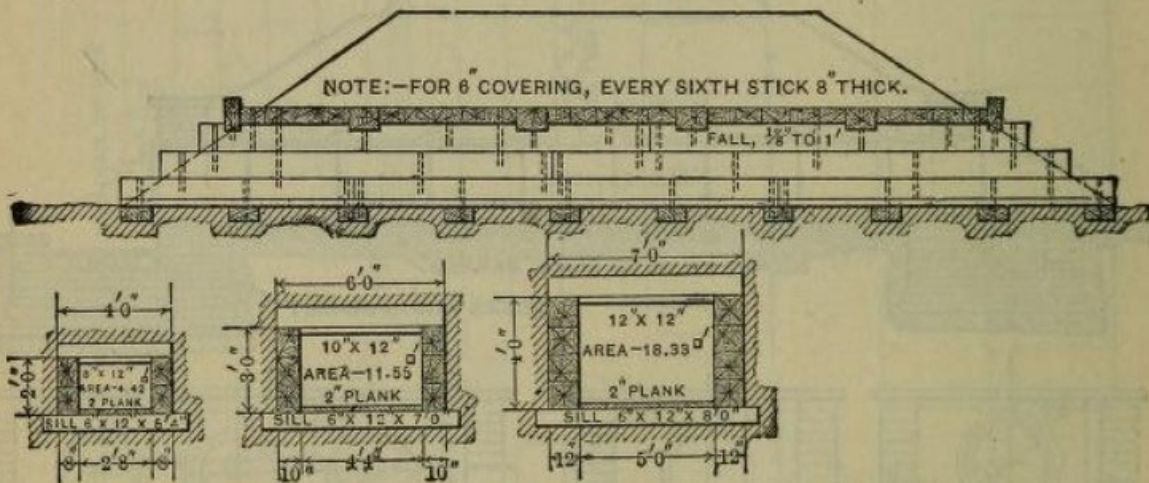


FIG. 99.—STANDARD TIMBER BOX CULVERT. C., M. & St. P. Ry.
 (Feb. 1889.)

Figure 20. Diagram for a Standard Timber Box Culvert for the Chicago, Milwaukee & St. Paul Railway, 1889. From Walter L. Webb, *Railroad Construction: Theory and Practice: A Textbook for the Use of Students in Colleges and Technical Schools* (New York: J. Wiley, 1908), 216.

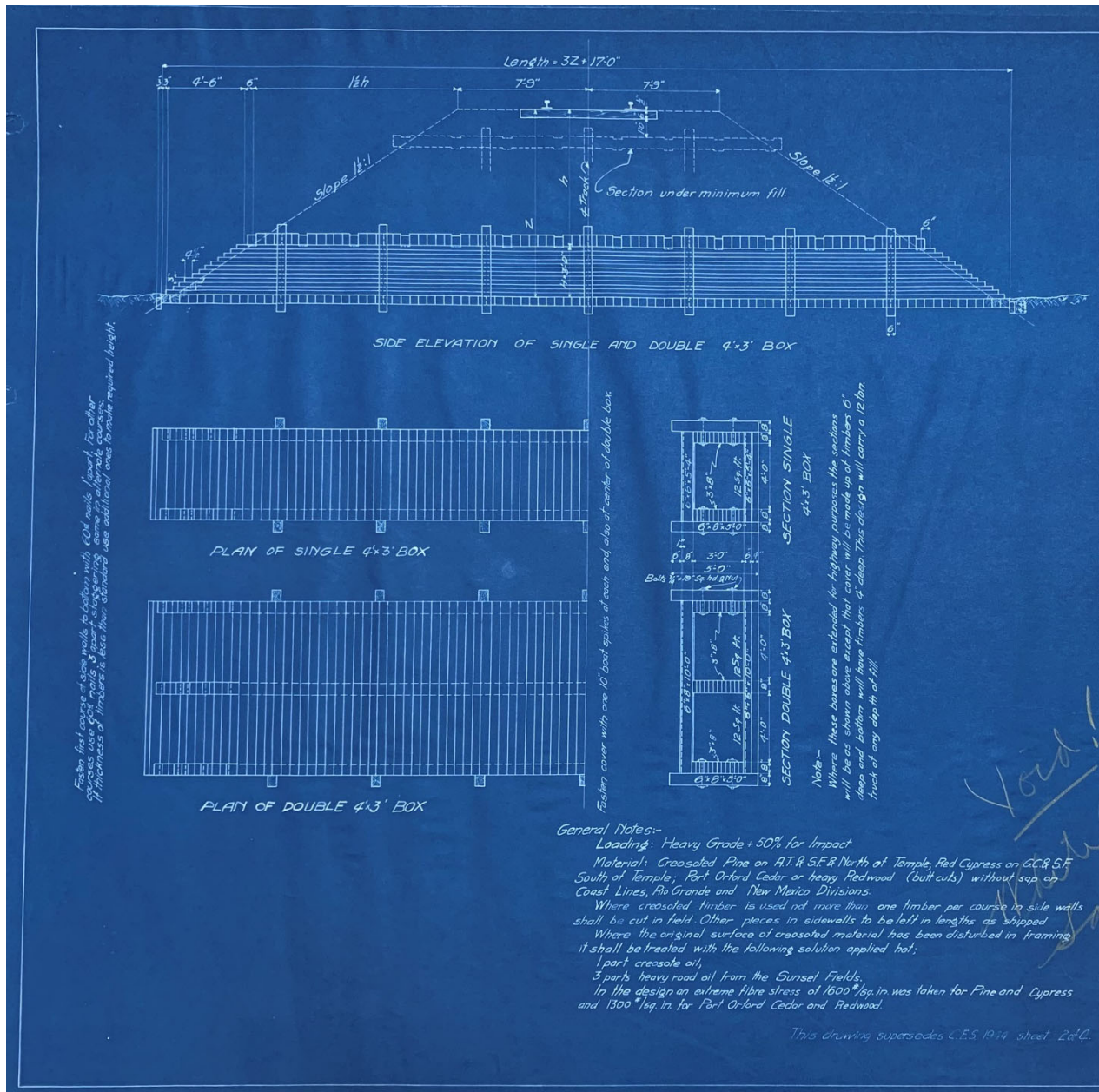
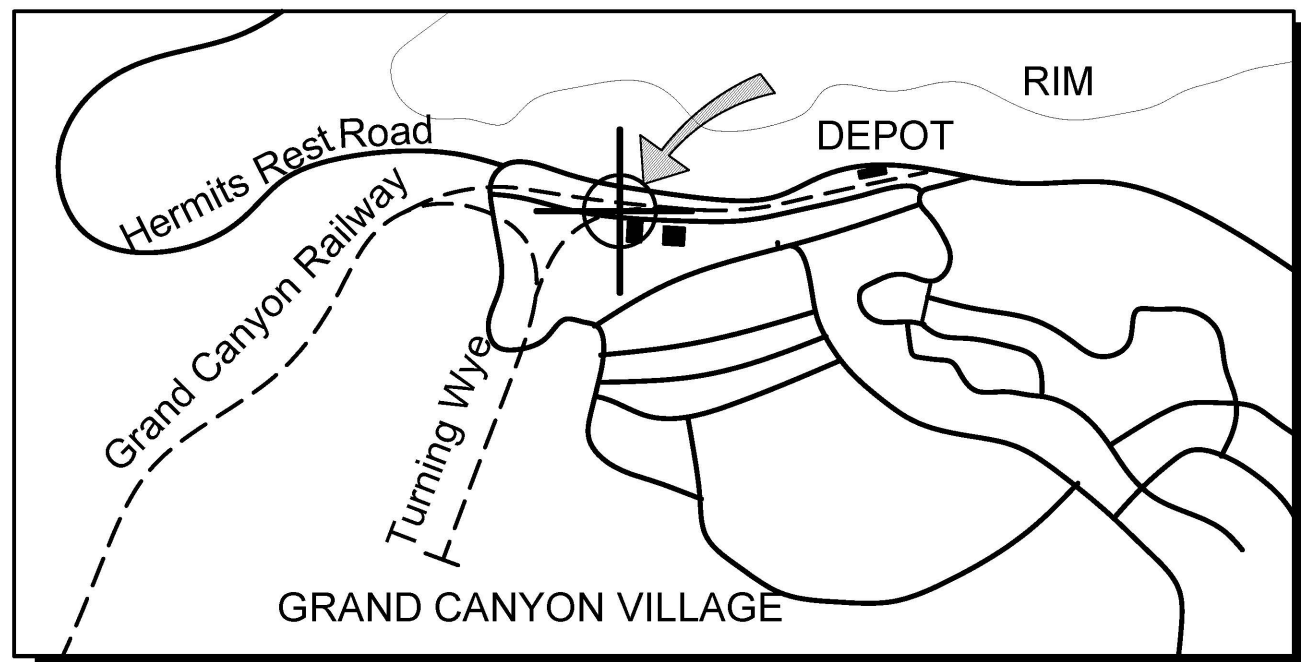


Figure 21. Detail of "Standard 4' x 3' Wooden Box." ATSF Drawing No. CES-5234, Aug. 1915. Courtesy of Kansas Historical Society, Topeka, KS.

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, North Leg of Wye

(Bridge No. 82)



SCALE: 1/8" = 1'-0"

0 5 10 20 FEET

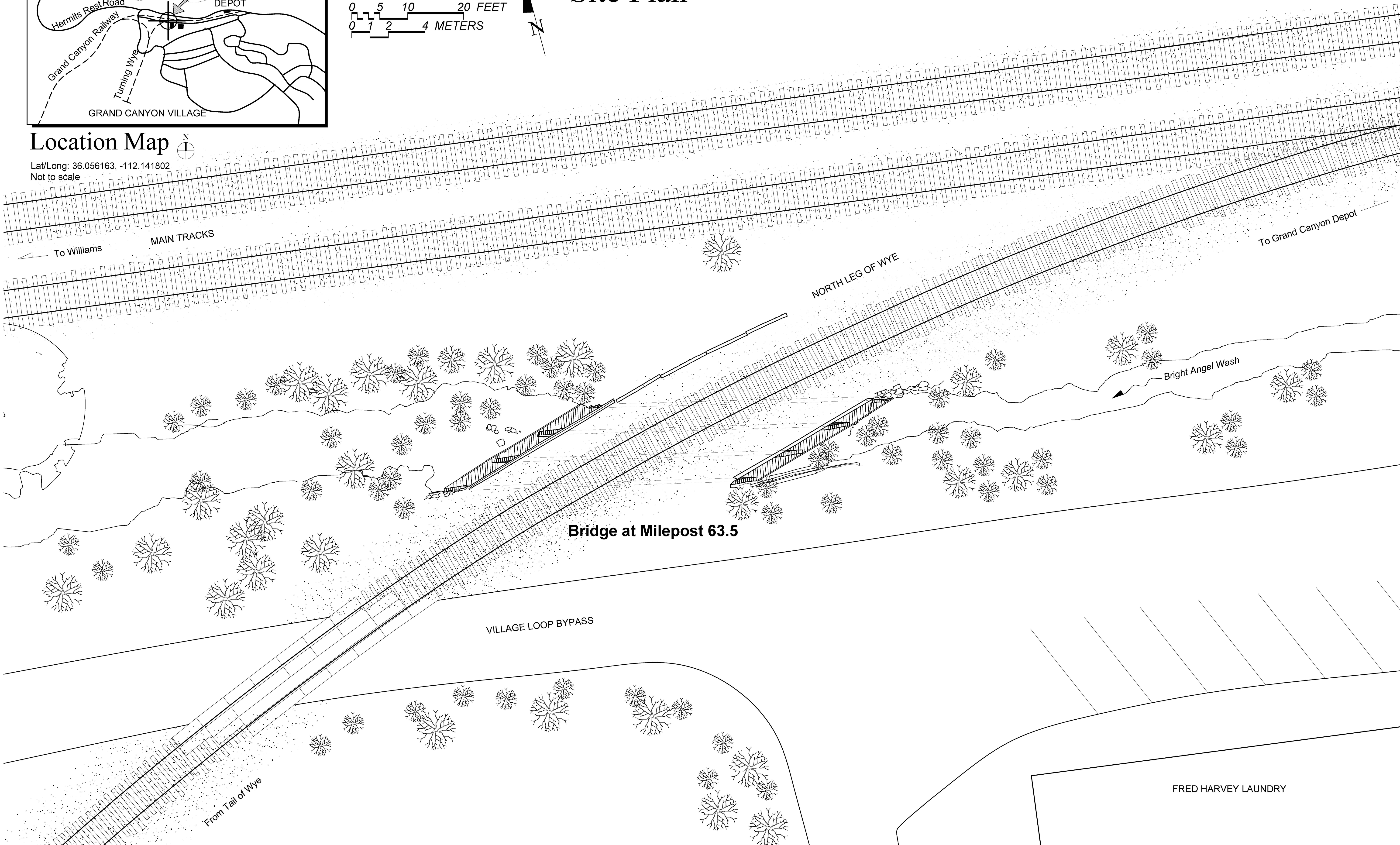
0 1 2 4 METERS



Site Plan

Location Map

Lat/Long: 36.056163, -112.141802
Not to scale



DELINEATED BY: TODD A. CROTEAU, 2022

HAPER
RECORDING PROGRAM
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE
NORTH LEG OF WYE IN THE GRAND CANYON RAIL YARD, SPANNING BRIGHT ANGEL WASH
GRAND CANYON VILLAGE
COCONINO COUNTY
ARIZONA

SHEET
1 OF 4

HISTORIC AMERICAN
ENGINEERING RECORD
AZ-100-A

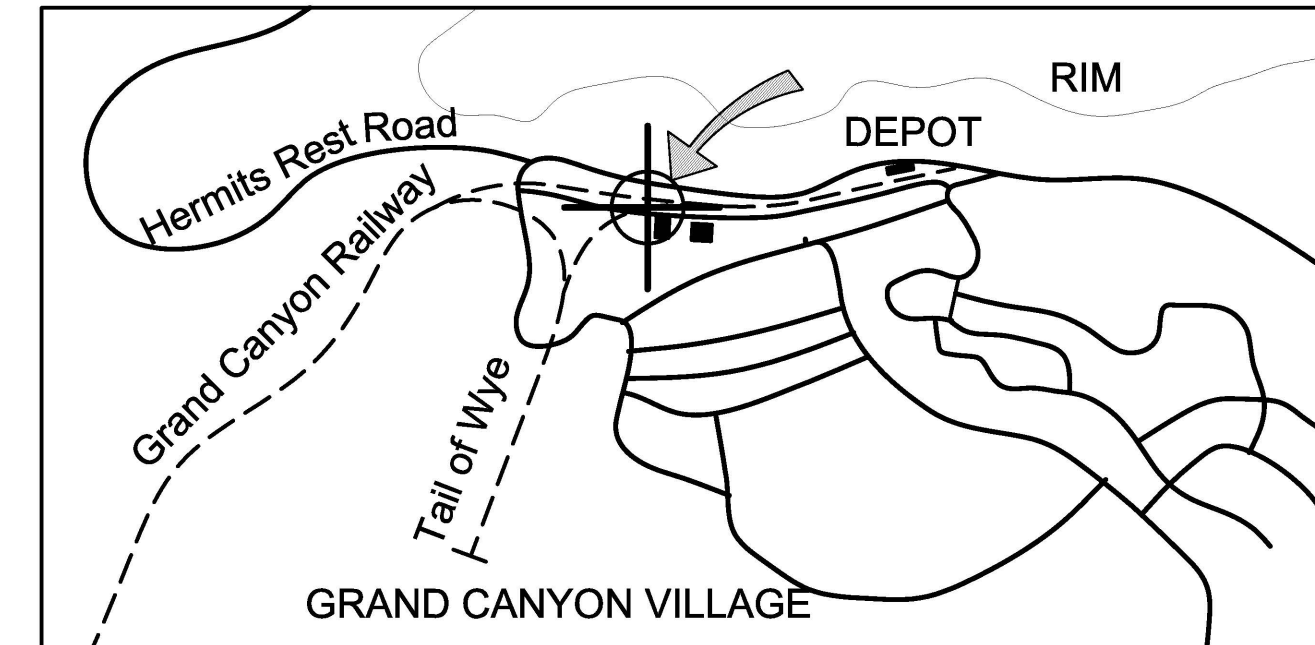
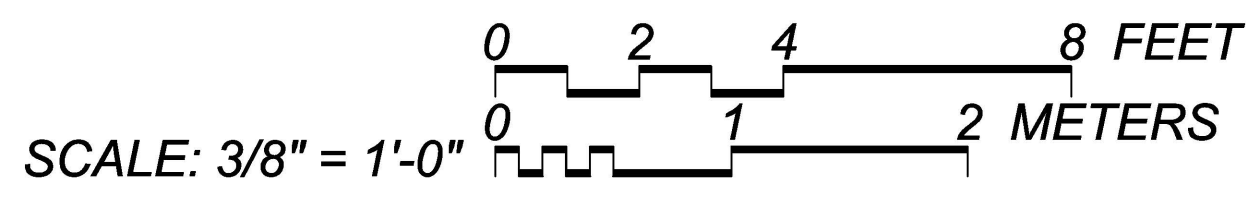
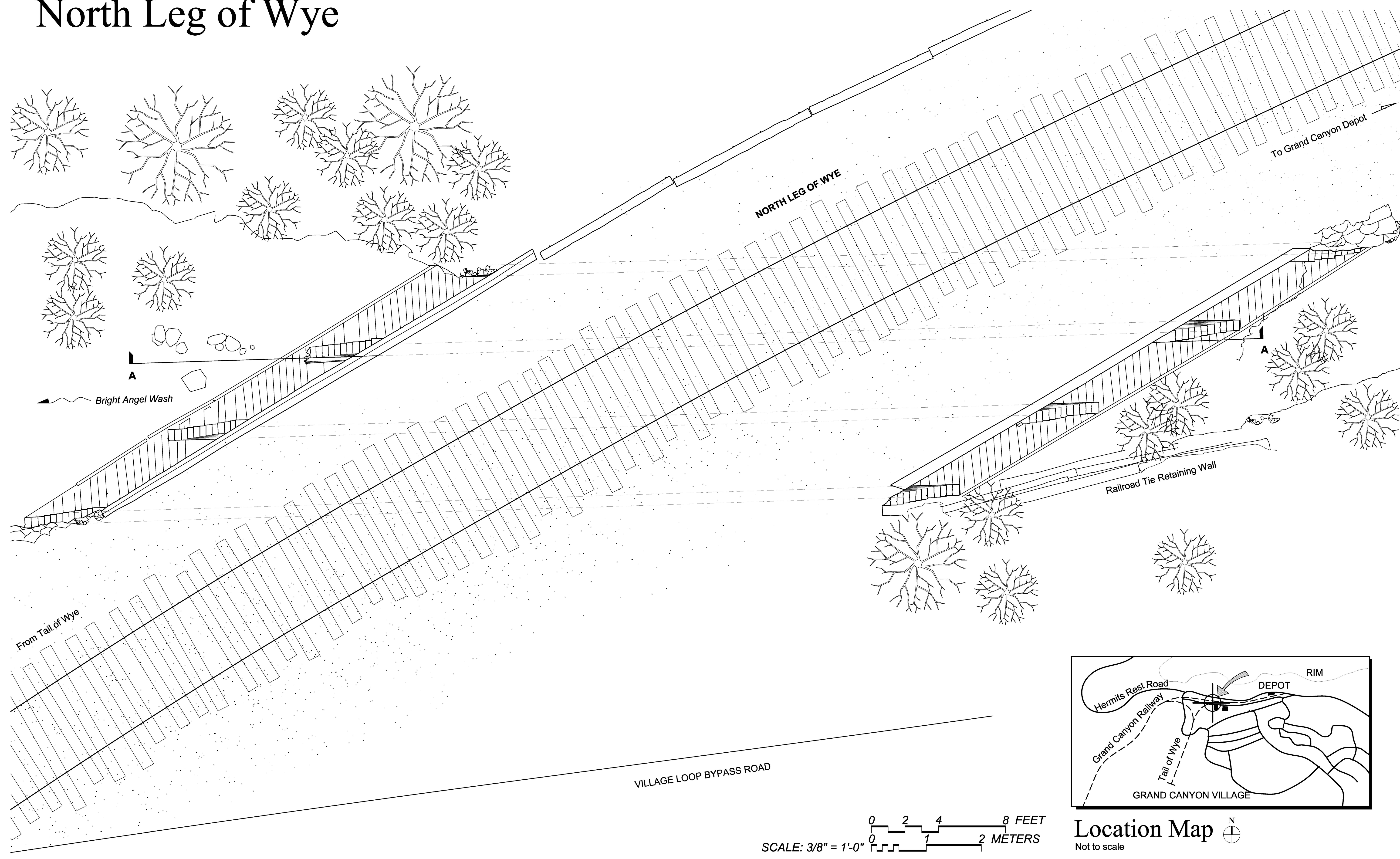
INDEX NUMBER

REPRODUCED PLEASE CREDIT THE HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF DRAWING

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5 (Bridge No. 82)

Plan

North Leg of Wye

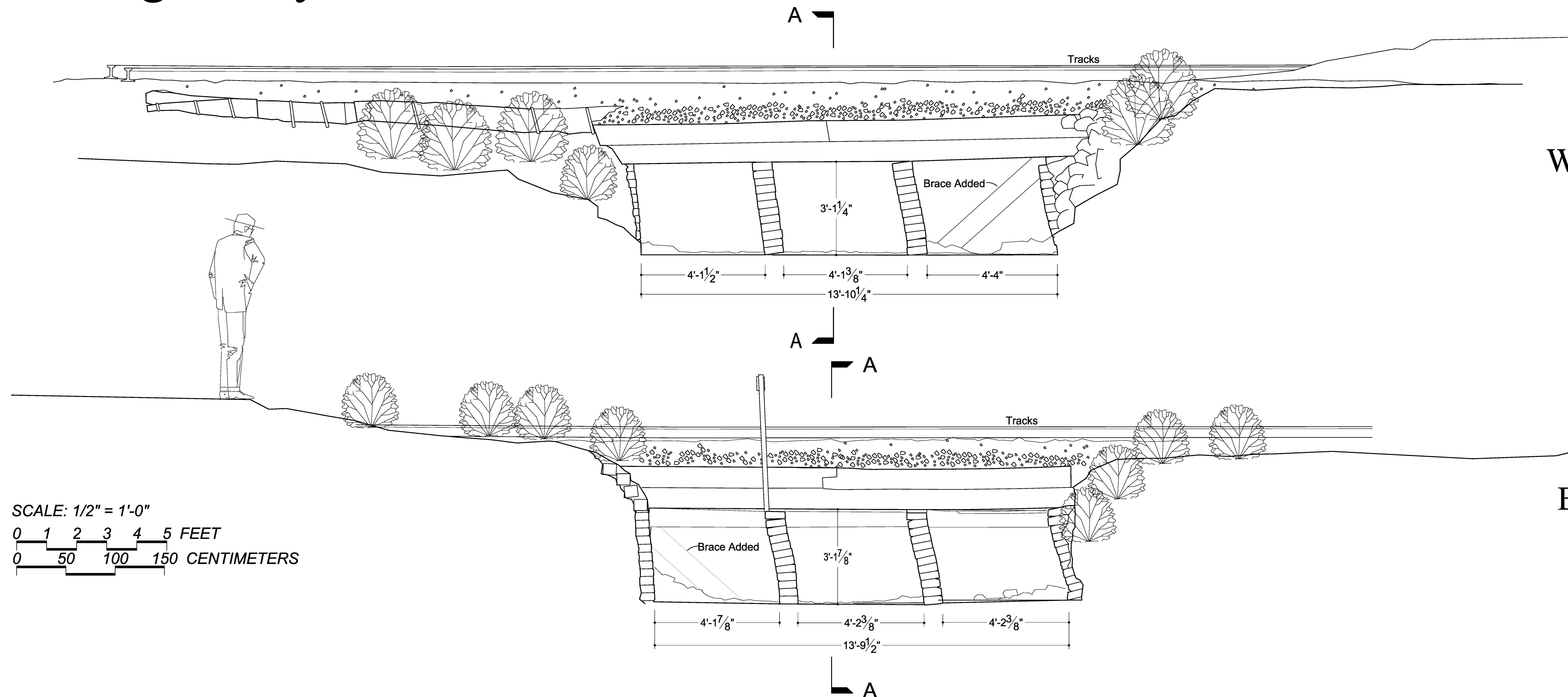


Location Map
Not to scale

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5 (Bridge No. 82)

North Leg of Wye

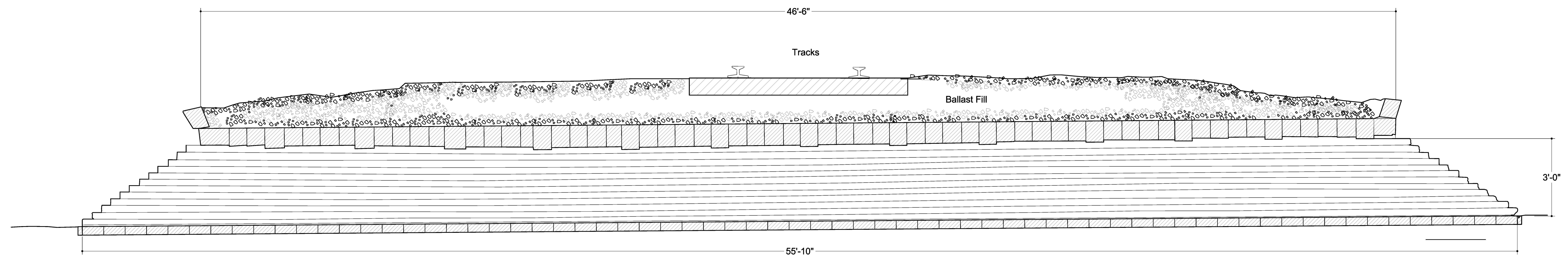
Elevations



SCALE: 1/2" = 1'-0"

0 1 2 3 4 5 FEET

0 50 100 150 CENTIMETERS



Note: Floor slopes approx. 5" over total length

Section A-A

DELINEATED BY: TODD A. CROTEAU, 2022

HAER
RECORDING PROGRAM
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE
NORTH LEG OF WYE IN THE GRAND CANYON RAIL YARD, SPANNING BRIGHT ANGEL WASH
COCONINO COUNTY
ARIZONA

SHEET
3 OF 4

HISTORIC AMERICAN
ENGINEERING RECORD
INDEX NUMBER
AZ-100-A

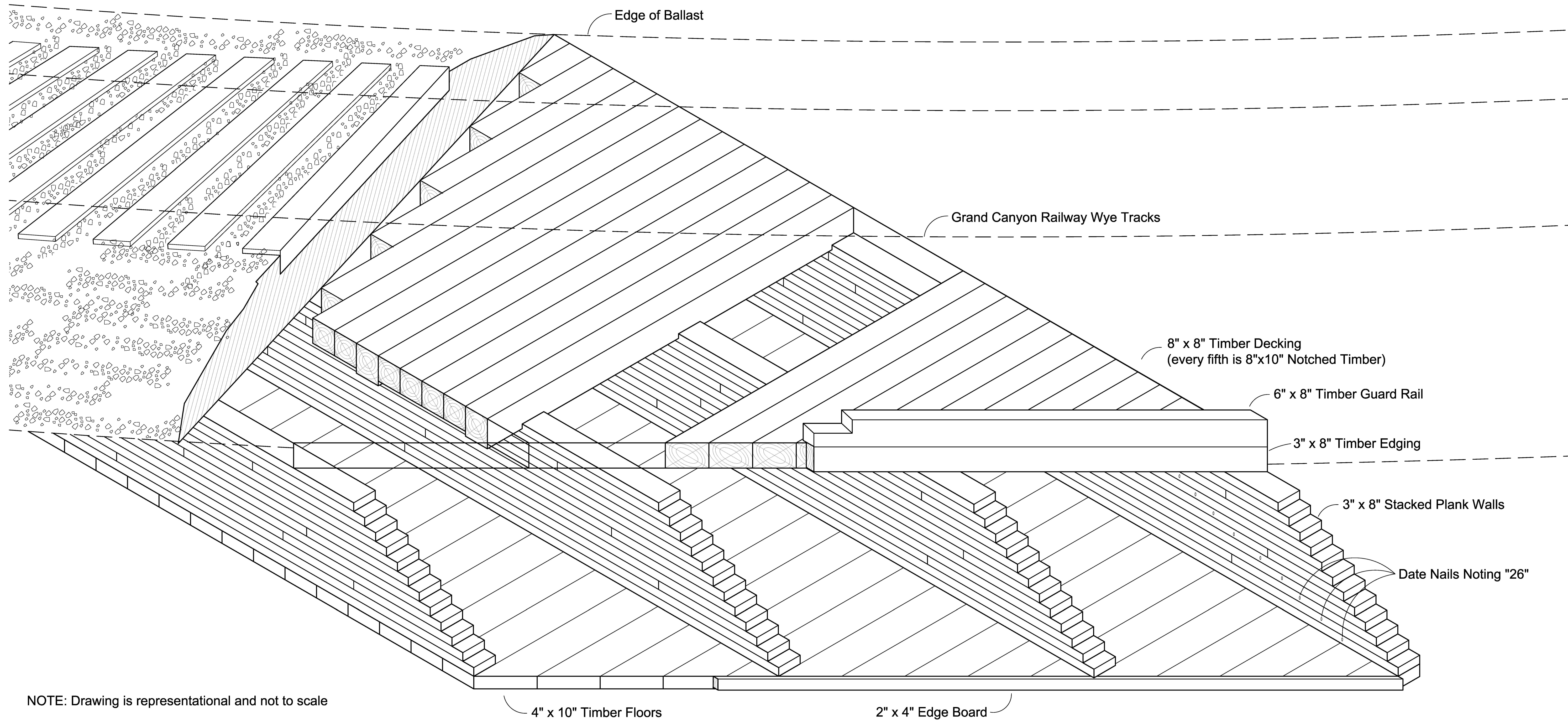
IF REPRODUCED, PLEASE CREDIT THE HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF DRAWING

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5

North Leg of Wye

(Bridge No. 82)

Construction Details



NOTE: Drawing is representational and not to scale

FUJIFILM RDP III

06482

CH 8CJR



FUJIFILM RDP11

06482

CM ACJC











FUJIFILM RDP11

06482

CM ADAR







HISTORIC AMERICAN ENGINEERING RECORD

INDEX TO PHOTOGRAPHS

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE HAER AZ-100-A
(Bridge No. 82)
Grand Canyon National Park
On the north leg of wye in the Grand Canyon railyard, spanning Bright Angel Wash
Grand Canyon Village
Coconino County
Arizona

INDEX TO BLACK AND WHITE PHOTOGRAPHS

Todd A Croteau, photographer, 2021

AZ-100-A-1	Looking south with North Leg of Wye at center and Fred Harvey Laundry Building in the background. Bridge No. 82 is visible on the right.
AZ-100-A-2	Closer view of the North Leg of Wye and Main tracks looking south with the bridge at center.
AZ-100-A-3	Looking southwest along the North Leg of Wye with the bridge at center.
AZ-100-A-4	Looking east along the North Leg of Wye towards the station with the bridge at center. Portions of Bright Angel Lodge can be seen at left on the hill and an approaching train engine is visible in the background.
AZ-100-A-5	Looking east along the tracks towards the station with the culvert at center. Bright Angel Lodge can be seen at left on the hill and the train engine is visible in the background on the tracks. The warehouse is at right with the power plant behind.
AZ-100-A-6	Looking west with the Grand Canyon Railway train crossing the bridge.
AZ-100-A-7	Looking west with the passenger cars on the bridge.
AZ-100-A-8	Looking west with the passenger cars on the bridge. Note the end car with conductor.
AZ-100-A-9	Looking west with no train on the bridge at center.
AZ-100-A-10	Detail view looking west showing the bridge structure comprised of wood planks.
AZ-100-A-11	Detail view of Bridge No. 82 looking west. Note the top beam appears to be a replacement with pressure treated wood.

GRAND CANYON RAILWAY, BRIDGE AT MILEPOST 63.5, NORTH LEG OF WYE
HAER AZ-100-A
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(Page 2)

AZ-100-A-12	Detail view looking north showing the bridge, tracks and Bright Angel Lodge in the background.
AZ-100-A-13	Looking southeast showing the bridge at center with the powerhouse and Fred Harvey Laundry behind.
AZ-100-A-14	Looking east from Bright Angel Wash through the box culvert showing the structure. Note the diagonal brace in the right span. The Fred Harvey Laundry and powerhouse are visible in the background.
AZ-100-A-15	Detail inside the center bay looking east showing the timber bents and decking above. Note every fifth timber is notched at the bent.
AZ-100-A-16	Detail of the west end of the south abutment looking south showing the timber construction. Note the diagonal row of date nails (each stamped "26" noting the year of construction).

INDEX TO COLOR TRANSPARENCIES

Todd A Croteau, photographer, 2021

AZ-100-A-17 (CT)	Looking east along the North Leg of the Wye towards the station with the bridge at center as a train engine approaches. The Fred Harvey Laundry and powerhouse are visible at right.
AZ-100-A-18 (CT)	Looking east along the tracks with the bridge at center and train in the background. The warehouse and power plant are visible at right.
AZ-100-A-19 (CT)	Looking east along the North Leg of Wye with the bridge at center and train in the background. The powerhouse and Fred Harvey Laundry are visible at right.
AZ-100-A-20 (CT)	Looking east along the North Leg of Wye with the bridge at center and train in the background. The Fred Harvey Laundry and powerhouse are visible at right.
AZ-100-A-21 (CT)	Looking east along the North Leg of Wye with the bridge at center and train in the background. The Fred Harvey Laundry and powerhouse are visible at right.
AZ-100-A-22 (CT)	Looking southeast showing the bridge at center with the Fred Harvey Laundry and powerhouse behind.
AZ-100-A-23 (CT)	Detail view looking north showing the span, tracks and Bright Angel Lodge in the background.
AZ-100-A-24 (CT)	Detail view looking west showing the bridge structure comprised of wood planks.
AZ-100-A-25 (CT)	Detail view looking west with closer detail.