Plans, Chicago and North Western Railroad Company. Bridges and Buildings. Files, DM&E Engineering Department, Brookings, South Dakota.

Track Charts: Rapid City, South Dakota, to Winona, Minnesota. DM&E Engineering Department, Brookings, South Dakota.

Appendix A:

The Chicago and North Western Railroad:
An Historic Chronology of the Development of the Line in
Minnesota and South Dakota

The Chicago and North Western Railroad:
An Historic Chronology of the Development of the Line in Minnesota and South Dakota

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Records indicate that the Chicago and North Western Railroad (C&NW) in Minnesota and a portion of the line in South Dakota was originally built as the Winona & St. Peter Railroad. The W&StP was constructed for the "stated purpose of benefiting the people of Minnesota by providing a means for the farmers who settled in Minnesota Territory to get their produce to a profitable market." The line also made it possible "for settlers to move to the vast prairies of South Dakota and the line across Minnesota became primarily a funnel to deliver immigrants to the Dakotas."[1]

1851 The Treaty Traverse des Sioux was signed near St. Peter, Minnesota, which opened up settlement of the area.

The Treaty of 1851 ceded the Black Hills and surrounding land to the Sioux.

1855 The Territory of Minnesota chartered The Transit Railroad Company (TRC) to build from Winona through St. Peter, Minnesota, to a point on the Big Sioux River on March 3.

The U.S. Government undertook the first official reconnaissance of the Black Hills region in Dakota Territory.

1857 March 3, Congress enacted a Federal Land Grant to the Territory of Minnesota to finance railroad construction of specific companies.

Mapmaker G.K. Warren explored the Black Hills region that resulted in the first "routes" map to the area.

1858 Grading of the TRC began; financial crisis halts construction one year later.
Minnesota granted Statehood.

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[1] Joe Follmar, "The C&NW Across Minnesota," *North Western Lines* 23 (Winter 1996): 23. This chronology includes the history of Minnesota and South Dakota, both inextricably linked to the C&NW.

1859 June 2, court-appointed receivers sold the Chicago, St. Paul and Fond du Lac Rail-Road Company (established in 1855) to a group of affiliated investors. The successor firm, The Chicago & North Western Railway Company, chartered by the State of Illinois on June 7, acquired the assets of the bankrupt line.

1860 The TRC sold under foreclosure to the State of Minnesota on June 23. The State then owned a fifty-mile, raised earthen pathway between Winona and Rochester.

1861 The State's interest in the TRC was purchased by the Winona, St. Peter & Missouri River Railroad Company, but the line was never built. Hardships as the result of the Civil War discouraged efforts to attract interested investors.

Dakota Territory established.

1862 On March 10, the legislature of Minnesota transferred the charter of the Winona, St. Peter & Missouri River Railroad Company to the Winona & St. Peter Railroad.

The W&StP was incorporated on June 10. The new charter required that 10 miles of track had to be completed by the new line by January 1, 1863.

On December 6, the W&StP track was completed to Stockton, approximately 11 miles west of Winona.

1863 443,314.7 acres of Federal land in Minnesota and [South] Dakota were granted to finance the construction of the W&StP line.

By an act of the Legislature of the State of Illinois, the Chicago and North Western Railway Company (C&NW) was recognized as an existing corporation.

1864 The W&StP constructed its first brick shop buildings in Winona, Minnesota.

The Chicago & North Western merged with the Galena and Chicago Union Railroad on June 2. Known as "The Great Consolidation."

The W&StP reached Rochester, Minnesota.

1865 The Chicago and North Western's route included 860 miles of line. The company claimed to be the "longest carrier in America."

The Civil War ended.

1866 On July 13, 640 acres (within 20 miles of completed right-of-way) were awarded to the W&StP by the State of Minnesota by Congressional approval. This was the final land grant to a state for railroad construction in the United States.

The W&StP line reached Owatonna, where it connected with the Minnesota Central Railroad.

1867 The W&StP, in addition to the La Cross, Trempealeau & Prescott Railroad, was sold to the Chicago & North Western on October 1. The development of the W&StP trackage continued under its own corporate name and operated as a proprietary road. The Winona, Mankato & Northern RR, as a subsidiary line, was created to construct the line into Mankato.

The W&StP reached Waseca.

1870 The W&StP reached Mankato.

1871 The W&StP reached St. Peter.

On October 8 the Chicago fire destroyed C&NW's property causing disruption of business and loss of income.

Congress granted an extension of the previous March 3 deadline (which stipulated as a part of the land grant that the W&StP had to complete the line to the Big Sioux River), to September 3, 1873.

1872	The W&StP reached New Ulm.
	The W&StP reached Dakota Territory at Gary.
1873	The W&StP was completed to Lake Kempeska, Dakota Territory, on August 18. Even though the land grant extended only to the Big Sioux River, the W&StP built its line to the west of its banks.
	The Panic of 1873, a four-year nationwide economic depression, began.
1874	W&StP trains stopped operations west of New Ulm due to extensive work load.
	Gold discovered in the Black Hills of Dakota Territory; prospectors poured into the area.
1876	Marvin Hughitt became general manager of the C&NW.
	Battle of Little Big Horn.
	A grasshopper plague and a severe drought temporarily halted settlement in the fertile prairies of Minnesota and Dakota.
1877	Hughitt made a personal exploration of the [South] Dakota Territory and initiated a plan to extend the C&NW railroad from Tracy, Minnesota, to the Black Hills.
	Surrender of the majority of Sioux and Cheyenne in the Black Hills region.
	Black Hills made a part of Dakota Territory.
1877-78	Several branch lines of the W&StP were constructed in Minnesota.

1878 Due to poor economic conditions Minnesota settlers had removed ties along the W&StP for firewood. Prairie fires had destroyed bridges along the line in Minnesota.

The W&StP was forced to pull back its tracks to the east of the Big Sioux River. As a result, Watertown was established as a county seat and the former town of Kampeska was abandoned.

1879 The Chicago & Dakota Railway Company was established by the C&NW to build a line from Tracy, Minnesota, east to the [South] Dakota border on May 6.

The Dakota Central Railway Company was established by the C&NW to build a line from the [South] Dakota border west to the Missouri River at Pierre. Unlike the W&StP, the Dakota Central did not receive public lands to help off-set the cost of construction. The C&NW financed the new mileage through bond and stock issues. Its Western Town Lot Company developed properties, often profitably.

As a result of the new railroad development, the original main line of the W&StP to Watertown became a branch line and Tracy, Minnesota, became an important Division terminal.

Grading and track construction progressed to Aurora, [South] Dakota Territory and pushed west through to the new communities of Brookings and on to a winter camp located at Volga.

Surveyors completed field work 175 miles west of the Missouri River by fall.

1880 The Great Dakota Land Boom began, with the C&NW as a major catalyst.

Would-be farmers and families flocked west as the Dakota Central constructed new line.

Arlington, Lake Preston, and DeSmet, [South] Dakota Territory, were platted by C&NW's Western Town Lot Company.

June 25, the first train crossed the James River Bridge at the site of "Ragtown", later renamed Huron by C&NW's president Hughitt.

C&NW surveyors plated the Missouri River terminus at Pierre. (Pierre was planned as a transfer point with riverboats on the Missouri and as the point from which goods could be freighted across western Dakota to the Black Hills until the line extended west). Trackage reached Pierre.

1880-81 Record snowstorms buried the Dakotas. The C&NW had to make cuts in the deep snow; they helped to save the immigrant population by delivering corn and fuel oil during the months of October through May.

1882 The commencement of a bridge program to replace numerous deteriorated trestle spans in the area of Stockton Hill quarry in Minnesota.

1883 Winona, Minnesota, machine shops and engine house destroyed by fire on April 11.

1884 Federal ruling prohibited any railroad lines from crossing the Sioux Reservation from Eastern Dakota Territory to get to the Black Hills.

The C&NW assumed the assets of the Fremont, Elkhorn & Missouri Valley ("Elkhorn") Railroad, an eastern Nebraska shortline, which gave the company direct access to western Dakota.

1886 Winona building campaign, including a roundhouse and associated buildings, completed.

1889 A Congressional act opened a transportation corridor through the Sioux reservation, setting the stage to link eastern South Dakota and the Black Hills by rail.

South Dakota granted Statehood.

1893 Wall Street Panic, a devastating financial three-year period of economic depression, began in May.

1895 One-quarter of the nation's railroads were in bankruptcy.

1900 Construction of a new main line from Mankato to New Ulm, called the Mankato and New Ulm Railway (M&NU), was completed on May 29.

The W&StP, along with the M&NU, merged into the Chicago & North Western Railroad. The line west of Tracy, Minnesota, was renamed the Dakota Division with headquarters at Huron, South Dakota.

1903 On February 28, the C&NW officially took control of the "Elkhorn" Railroad.

1904 Pierre, instead of Mitchell, declared the official State Capitol of South Dakota.

1905 A temporary wood trestle was constructed across the Missouri River between Ft. Pierre and Pierre.

1906 Construction of the C&NW from Pierre to Rapid City began on the Pierre, Rapid City and North Western Railway (PRC), a subsidiary line.

1907 The Missouri River drawbridge linking Pierre to Ft. Pierre was completed. This project was undertaken by the Pierre & Ft. Pierre Bridge Railway, a subsidiary of the C&NW.

The 44.8 mile segment of line from Wasta to Philip was completed.

The first train operated on the Pierre, Rapid City and Northwestern Railway over the newly completed Missouri River bridge on July 11.

Panic of 1907.

Public service on the C&NW commenced between Pierre to Rapid City and on to Deadwood, South Dakota, on July 14.

1910 Marvin Hughitt resigned the presidency of the C&NW.

1917 World War I began.

1919 World War I ends.

Operations of the nation's rail lines were under control and direction of the United States Railroad Administration.

On April 30, the C&NW acquired the railway and property of the following proprietary companies: Pierre, Rapid City and North Western Railway Company, and the Pierre and Fort Pierre Bridge Railway Company.

1920 The C&NW regains jurisdiction of their rail line.

1920s An increase in automobile traffic on a new highway system took a toll on passenger train business. During a 12 year period (1920-1932), passenger revenues declined by a total of 73%.

1922 Shopmen's Strike occurred on July 1. Nearly all of the shop crafts employees and foremen stopped work (similar strikes occurred on all rail lines across the U.S.). Over 12,000 employees of the C&NW participated for nearly 2 1/2 months. Work resumed on September 17, 1922.

1924 After struggling with the South Dakota Railroad Commission, the C&NW won the right to discontinue two Sunday trains that operated between Huron and Pierre.

To cut expenses, the C&NW began operating mixed trains (freight and passenger).

1929 Stock Market Crash.

1931 The C&NW drastically reduced tariffs in South Dakota for carload lots of hay, straw and feed grains; cattle were often transported free of charge to save their owner's investments.

1934 Severe drought in Minnesota and South Dakota.

1935 The C&NW sought protection from creditors in bankruptcy court.

1939 Reorganization of the C&NW on December 15.

1943 On December 27, the President of the U.S., acting through the Secretary of War, took possession and control of the railroads in order to avoid a threatened interruption of vital transportation service.

1944 Government control of the railroads ended on January 18.

The C&NW emerged from bankruptcy on June 1 and reincorporated under the laws of Wisconsin.

During and after the war years, the C&NW retired 137 coal and water facilities, 249 small town depots, 659 shop buildings and 1,344 "minor structures."

1947 The Interstate Commerce Commission approved the C&NW application for authority to construct an 18-mile extension in South Dakota across the state line into Wyoming to serve "extensive deposits of bentonite and processing plants now being erected or to be erected, at the site."

1949 Beginning in 1949, an average of 450,000 annual passenger train miles were cut from operation on the C&NW line.

1950s	The C&NW was in serious financial trouble.
1956	Permanent retirement of steam and the adoption of dieselization on May 11.
	Beginning in 1956, the C&NW greatly reduced its long-distance passenger service, including trains between Mankato, Minnesota, and Huron, South Dakota.
1957	On November 5, the C&NW filed a petition with the South Dakota Public Utilities Commission to create a "central agency" system to eliminate unneeded stations throughout the state.
1970	On October 5, a leveraged buyout of the C&NW by its employees occurred. Northwest Industries (a holding company) entered into an agreement with the North Western Employees Transportation Company (NETCO) to sell all assets of the C&NW ($19 million and assumption of $340 million in company debt).
1972	NETCO renamed the Chicago and North Western Transportation Company.
1973	The C&NW begins the Coal Line Project in the Powder River Basin in southeastern Wyoming, for the lucrative trade in low-sulphur, subbituminous coal.
1981	The C&NW begins negotiations to reduce its amount of trackage. The deteriorated tracks between Pierre and Rapid City were put up for abandonment; the State of South Dakota objected to plan.
	The ICC gave approval to the Coal Line Project on July 24.
1983	The C&NW notifies the ICC that the PRC line could be subject to abandonment.
	Construction of the Coal Line Project in Wyoming began on June 27.

1984 A prairie fire touched off by a welder's torch destroyed seven bridges near Wall forcing diversion of eastbound trains from the Black Hills. The line reopened later that year.

1985 South Dakota Sen. Larry Pressler spearheaded negotiations between the C&NW and L. B. Foster Inc., a Pittsburgh-based railway equipment and shortline concern. The company, affiliated with the Dakota, Minnesota and Eastern Railroad, agreed to a $26 million purchase price for the track and other assets.

1986 The Rapid City, South Dakota, to Winona, Minnesota, trackage was officially sold to the Dakota, Minnesota and Eastern Railroad (DM&E), Brookings, South Dakota, on September 4.

On September 5, the DM&E operated its first train out of Huron. The former C&NW roundhouse and shops in Huron become the line's maintenance base.

Appendix B:

Minnesota Open Deck Pile Trestles

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
192.70	491	MN	Open Deck Pile Trestle	1926	n/a	No	n/a	n/a
147.25	M 1643	MN	Open Deck Pile Trestle	1927	n/a	No	n/a	n/a
151.41	M1657	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
158.74	M 1691	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
159.50	M 1698	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
160.80	M 1700	MN	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1944
152.30	M 1663	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
154.21	M 1675	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
144.90	M 1625	MN	Open Deck Pile Trestle	1931	No	No	A	n/a
152.80	M 1665	MN	Open Deck Pile Trestle	1931	Yes	Yes	n/a	1931-1949
160.35	M 1699	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
161.47	M 1701	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
248.42	1347	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
258.90	1375	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
158.94	M 1694	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
260.30	1376	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
214.85	544	MN	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
31.70	M 78	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.80	M79	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
47.01	M 121	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
144.52	M 1622	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
151.63	M 1658	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
154.98	M 1679	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
158.84	M 1693	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
152.08	M 1661	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
153.38	M 1668	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
44.10	M 111	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
213.90	541	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
34.85	M 90	MN	Open Deck Pile Trestle	1941	Yes	Yes	AA	1941-1949
41.85	M 106	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
45.45	M 115	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
51.90	M 133	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
127.83	MA 311	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
150.53	M 1650	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
237.59	1319	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
237.76	1320	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
69.90	M 177	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
154.51	M 1677	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
42.50	M 107	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
146.85	M 1641	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
244.20	1333	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
46.40	M 117	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1943-1949
197.50	505	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
259.80	1374.5	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
267.10	1392	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
271.29	1398	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
234.45	1312.5	MN	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
144.21	M 1617	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
195.66	498	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
235.90	1315	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
265.20	1387	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
268.47	1394	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
263.63	1384	MN	Open Deck Pile Trestle	1950	n/a	No	n/a	n/a
36.30	M 93	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
98.94	M 239	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
204.29	524	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
243.42	1332	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
247.35	1342	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
250.05	1353	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
43.10	M 108	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
93.69	M 228	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
171.14	451	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
181.66	468	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
238.31	1321	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
238.65	1322	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
248.06	1345	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
263.86	1385	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
46.10	M 116	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
95.30	M 231	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
127.96	MA 312	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
145.85	M 1637	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
146.70	M 1641	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
267.90	1393	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
29.40	M 71	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
44.60	M 112	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.80	M 130	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.84	M 131	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
172.20	453	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
29.90	M 74	MN	Open Deck Pile Trestle	1959	n/a	No	n/a	n/a
84.10	M 205	MN	Open Deck Pile Trestle	1960	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
237.07	1317	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
261.80	1380	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
264.70	1386	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
265.55	1388	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
269.82	1397	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
242.12	1330	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
245.30	1337	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
263.42	1383	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
35.70	M 92	MN	Open Deck Pile Trestle	1964	n/a	No	n/a	n/a
44.50	M 111.5	MN	Open Deck Pile Trestle	1966	n/a	No	n/a	n/a
152.20	M 1662	MN	Open Deck Pile Trestle	1968	n/a	No	n/a	n/a
118.08	M 286	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
146.33	M 1640	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
244.60	1334	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
251.72	1357	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
34.90	M 91	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
153.98	M 1672	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a
45.70	M 115.5	MN	Open Deck Pile Trestle	1971	n/a	Yes	n/a	n/a
151.72	M 1659	MN	Open Deck Pile Trestle	1971	No	No	n/a	n/a
120.25	M 291	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
128.53	MA 316	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
128.72	MA 317	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
129.40	MA 322	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
150.96	M 1654	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
32.45	M 83	MN	Open Deck Pile Trestle	1974	n/a	No	n/a	n/a
45.40	M 113.5	MN	Open Deck Pile Trestle	1975	n/a	No	n/a	n/a
128.90	MA 319	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.15	MA 321	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949

Appendix C:

Minnesota I-Beam Bridges

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
016.10	M 41	MN	I-Beam	1902	Yes	Yes	A, C	1902-1949
016.75	M 45	MN	I-Beam	1902	No	No	n/a	n/a
013.05	M 29	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
013.40	M 30	MN	I-Beam	1903	Yes	Yes	A, C	1941-1949
016.90	M 46	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
019.50	M 53	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
027.80	M 66	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
016.30	M 42	MN	I-Beam	1905	No	No	n/a	n/a
016.40	M 43	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
016.50	M 44	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
063.40	M 161	MN	I-Beam	1907	Yes	Yes	A, C	1907-1949
103.30	M 249	MN	I-Beam	1908	Yes	Yes	A, C	1908-1949
147.90	M 1645	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
167.10	444	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
258.63	1371	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
272.85	1399	MN	I-Beam	1909	Yes	Yes	A	1909-1949

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
031.87	M 80	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.30	M 122	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.40	M 123	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.90	M 125	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
177.78	462	MN	I-Beam	1910	Yes	Yes	A	1910-1949
198.01	506	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
203.39	520	MN	I-Beam	1910	No	No	n/a	n/a
166.50	442.75	MN	I-Beam	1911	Yes	Yes	A, C	1911-1949
253.20	1359	MN	I-Beam	1912	Yes	Yes	A, C	1912-1949
076.10	M 188	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
168.63	446	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
207.71	531	MN	I-Beam	1913	Yes	Yes	A, C	1916-1949
030.90	M 76	MN	I-Beam	1914	Yes	Yes	A, C	1914-1949
097.12	M 235	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
207.46	530	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
206.73	528	MN	I-Beam	1918	Yes	Yes	A, C	1918-1949

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.45	527	MN	I-Beam	1919	Yes	Yes	A, C	1919-1949
093.40	M 227	MN	I-Beam	1940	Yes	Yes	A, C	1940-1949
046.50	M 118	MN	I-Beam	1946	Yes	Yes	A	1946-1949
046.55	M 120	MN	I-Beam	1966	n/a	No	n/a	n/a

Appendix D:

Minnesota Through Plate Girders

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
015.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A,C	1898-1949
015.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A,C	1901-1949
007.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
008.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A,C	1908-1949
013.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
006.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A,C	1912-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A,C	1915-1949
049.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
049.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
071.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A,C	1919-1949

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A,C	1924-1949
040.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A,C	1930-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n/a	n/a

Appendix E:

Minnesota Deck Plate Girders

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
015.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A,C	1898-1949
015.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A,C	1901-1949
007.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
008.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A,C	1908-1949
013.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
006.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A,C	1912-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A,C	1915-1949
049.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
049.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
071.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A,C	1919-1949
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A,C	1924-1949
040.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A,C	1930-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n/a	n/a

Appendix F:

Minnesota Truss Bridges

Minnesota Truss Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
246.85	1641	MN	Double Intersection Warren Deck Truss	1902	Yes	Yes	A, C	1902-1949
162.80	M 1703	MN	Tringular Lattice Through Truss	1913	Yes	Yes	A, C	1913-1949
206.20	526	MN	Deck Plate Girder Triangular Lattic Through Truss	1919, 1920	Yes	Yes	A, C	1919-1949

Appendix G:

Minnesota Culverts

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
168.30	445	MN	Single Stone Box Culvert	1871	Yes	Yes	A	1871-1949
011.75	M 25	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
018.20	M 48	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
018.80	M 51	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
020.40	M 55	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
038.15	M 96	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
043.50	M 109	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
080.20	M 196	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
177.40	460	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
183.50	473	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
207.80	532	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
055.10	M 138	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.50	M 140	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.90	M 142	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
171.90	452	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
173.30	455	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
178.40	463	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
198.80	507	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
226.20	567	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.40	M 139	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
055.60	M 141	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
056.05	M 143	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
056.10	M 144	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
100.80	M 244	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
102.10	M 246	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
196.10	501	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
027.50	M 65	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
056.20	M 145	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
056.60	M 146	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
067.90	M 170	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
093.85	M 229	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
116.55	M 281	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.65	M 282	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
117.20	M 284	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
059.90	M 152	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
060.40	M 153	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
064.70	M 165	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
066.20	M 168	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
077.30	M 191	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
078.10	M 192	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
078.75	M 194	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
105.45	M 252	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.10	M 274	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
115.50	M 276	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.90	M 278	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
116.80	M 283	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
118.80	M 287	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
119.10	M 288	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.30	M 289	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
120.60	M 293	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
020.95	M 56	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
022.20	M 59	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
065.40	M 166	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
074.40	M 184	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
075.40	M 186	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
083.60	M 204	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
084.90	M 207	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
085.10	M 208	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
092.20	M 224	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
094.40	M 230	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
095.70	M 232	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
095.80	M 233	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
096.20	M 234	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
097.90	M236	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
098.45	M 237	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
099.25	M 240	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
112.40	M 266	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
123.50	M 301	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
193.80	495	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
197.40	504	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
202.10	517	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
217.30	548	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
010.25	M 22	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
015.45	M 37	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
015.87	M 40	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
037.25	M 95	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
059.80	M 151	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
082.50	M 202	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
091.10	M 221	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
092.75	M 225	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
107.25	M 256	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
197.30	503	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
205.75	525	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
211.90	539	MN	Single Stone Box Culvert	1898	No	No	n/a	n/a
038.55	M 97	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
039.50	M 100	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
123.30	M 300	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.60	438	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.80	439	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
193.50	494	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
198.90	508	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
008.25	M 16	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
009.50	M 20	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
041.05	M 105	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
085.80	M 209	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
086.35	M 210	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
088.98	M 219	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
092.90	M 226	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
101.20	M 245	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
107.50	M 257	MN	Single Stone Box Culvert	1900	No	No	n/a	n/a
110.60	M 263	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.10	M 265	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
113.90	M 271	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
114.55	M 273	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
180.40	465	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
182.10	469	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
187.50	480	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
191.80	489	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
194.20	496	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
195.90	500	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.60	521	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.90	522	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
209.25	534	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
222.10	561	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
239.80	1326	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
021.45	M 57	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
054.10	M 136	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
061.60	M 156	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
073.50	M 183	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
109.90	M 262	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
164.10	436	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
170.10	449	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
174.90	457	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
181.30	466	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.60	470	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.70	471	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.25	472	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
184.12	474	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
184.90	475	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
185.50	476	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
191.10	487	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.50	488	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
199.50	510	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
219.30	554	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
221.20	559	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
033.80	M 88	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
169.20	448	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
227.70	1302	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
236.20	1316	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.20	1324	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.62	1325	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
245.80	1338	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
245.90	1339	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.25	1340	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
017.80	M 47	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
038.95	M 98	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
100.50	M 243	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
186.20	477	MN	Single Stone Box Culvert	1903	No	No	n/a	1903-1949
216.20	546	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
268.95	1395	MN	Cast-Iron Pipe Culvert	1903	Yes	Yes	A	1903-1949
079.30	M 195	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
253.76	1361	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
256.40	1366	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
043.75	M 110	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
053.50	M 134	MN	Single Stone Box Culvert	1905	No	No	n/a	n/a

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
057.90	M 148	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
068.10	M 171	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
089.75	M 220	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
220.38	557	MN	Cast-Iron Pipe Culvert	1905	Yes	Yes	A	1905-1949
257.30	1368	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
082.10	M 201	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
084.80	M 206	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
150.60	M 1651	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
151.80	M 1660	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.50	M 1664	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
154.30	M 1676	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
155.60	M 1682	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
269.19	1396	MN	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
143.60	M 1614	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
158.72	M 1690	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
122.40	M 298	MN	Concrete Box Culvert	1909	Yes	Yes	A	1909-1949
024.15	M 61	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
157.50	M 1686	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
225.95	566	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
245.20	1336	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
251.30	1356	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
253.90	1363	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
105.60	M 253	MN	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949
249.40	1351	MN	Single Stone Box Culvert	1913	Yes	Yes	A	1913-1949
192.30	490	MN	Concrete Box Culvert	1916	Yes	Yes	A	1916-1949
222.70	562	MN	Concrete Box Culvert	1923	Yes	Yes	A	1923-1949
029.80	M 73	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
030.50	M 75	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949

Appendix H:

Minnesota Arches

Minnesota Arches

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
14.70	M 33	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.14	M 35	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
14.25	M 32	MN	Stone Arch	1882	Yes	Yes	A, C	1882-1949
15.30	M 36	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
40.10	M 102	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
102.80	M 248	MN	Stone Arch	1884	No	Yes	n/a	n/a
129.55	MA 324	MN	Stone Arch	1887	Yes	Yes	A, C	1874-1949
54.80	M 137	MN	Stone Arch	1892	Yes	Yes	A, C	1892-1949
212.25	540	MN	Stone Arch	1904	Yes	Yes	A, C	1904-1949
223.50	564	MN	Stone Arch	1905	Yes	Yes	A, C	1905-1949
24.45	M 62	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
25.90	M 63	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
266.50	1391	MN	Stone Arch	1908	Yes	Yes	A, C	1908-1949
40.90	M 103	MN	Stone Arch	1910	Yes	Yes	A,C	1910-1949
165.90	442	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
221.81	560	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949

Minnesota Arches

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
119.75	M 290	MN	Concrete Arch	1915	Yes	Yes	A	1915-1949
224.80	565	MN	Stone Arch	1919	Yes	Yes	A, C	1919-1949

Appendix I:

Minnesota Miscellaneous Bridge Types

Minnesota: Miscellaneous Bridge Types

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
147.80	M 1644	MN	Concrete and I-Beam	1908	Yes	Yes	A, C	1908-1949
7.35	M 14	MN	Timber Frame Bridge	1909	Yes	Yes	A	1909-1949
13.50	M 30.5	MN	Wood Stringer Bridge	1962	n/a	No	n/a	n/a

Appendix J:

Minnesota Buildings

Minnesota Buildings

listed by year built

Mile Post	Name	State	Historic Use	Current use	Year Built	Retains Integrity	NRHP Eligibility	NRHP Criteria	Period of Significance
179.90	Winon & Saint Peter Freight Depot	MN	depot	storage	1887	Yes	Listed	A	1887-1929
165.20	Chicago A & North Western Depot, New Ulm (DM&E Building 909)	MN	passenger depot	office	1895	Yes	Listed	A	1895-1929
179.80	Chicago & North Western Depot, Sleepy Eye	MN	passenger depot	museum	1902	Yes	Listed	A	1902-1941
102.50	Chicago & North Western Passenger Station, Waseca (DM&E Building 904)	MN	passenger station	office	1912	Yes	Yes	A	1912-1949
253.70	Tyler Grain Building	MN	grain storage	not in use	ca. 1910	Yes	Yes	A	ca. 1910-1949

Appendix K:

Minnesota Eligibility Summary

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
6.10	M 9.5	MN	Through Plate Girder	1940	Yes	Yes	A, C	1940-1949
6.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A, C	1912-1949
6.50	M 12	MN	Through Plate Girder	1906	Yes	Yes	A, C	1906-1949
7.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A, C	1904-1949
7.35	M 14	MN	Timber Frame Bridge	1909	Yes	Yes	A	1909-1949
8.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A, C	1904-1949
8.25	M 16	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
9.50	M 20	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
10.25	M 22	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1891-1949
10.50	M 23	MN	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
11.05	M 24	MN	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
11.75	M 25	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
12.00	M 26	MN	Through Plate Girder	1910	Yes	Yes	A, C	1910-1949
12.40	M 27	MN	Through Plate Girder	1913	Yes	Yes	A, C	1913-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
12.80	M 28	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
13.05	M 29	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
13.40	M 30	MN	I-Beam	1903	Yes	Yes	A, C	1941-1949
13.50	M 30.5	MN	Wood Stringer Bridge	1962	n/a	No	n/a	n/a
13.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A, C	1910-1949
14.25	M 32	MN	Stone Arch	1882	Yes	Yes	A, C	1882-1949
14.70	M 33	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A, C	1901-1949
15.14	M 35	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.30	M 36	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
15.45	M 37	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
15.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A, C	1898-1949
15.87	M 40	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
16.10	M 41	MN	I-Beam	1902	Yes	Yes	A, C	1902-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
16.30	M 42	MN	I-Beam	1905	No	No	n/a	n/a
16.40	M 43	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
16.50	M 44	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
16.75	M 45	MN	I-Beam	1902	No	No	n/a	n/a
16.90	M 46	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
17.80	M 47	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
18.20	M 48	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
18.80	M 51	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
19.50	M 53	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
20.40	M 55	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
20.95	M 56	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
21.45	M 57	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
22.20	M 59	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
24.15	M 61	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
24.45	M 62	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
25.90	M 63	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
27.50	M 65	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
27.80	M 66	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
29.40	M 71	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
29.80	M 73	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
29.90	M 74	MN	Open Deck Pile Trestle	1959	n/a	No	n/a	n/a
30.50	M 75	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
30.90	M 76	MN	I-Beam	1914	Yes	Yes	A, C	1914-1949
31.10	M 77	MN	Through Plate Girder	1910	Yes	Yes	A, C	1910-1949
31.70	M 78	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.80	M 79	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.87	M 80	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
32.45	M 83	MN	Open Deck Pile Trestle	1974	n/a	No	n/a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
33.10	M 85	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.25	M 86	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.45	M 87	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.80	M 88	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
34.40	M 89	MN	Through Plate Girder	1907	Yes	Yes	A, C	1907-1949
34.85	M 90	MN	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
34.90	M 91	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a
35.70	M 92	MN	Open Deck Pile Trestle	1964	n/a	No	n/a	n/a
36.30	M 93	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
36.75	M 94	MN	Through Plate Girder	1904	Yes	Yes	A, C	1904-1949
37.25	M 95	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
38.15	M 96	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
38.55	M 97	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
38.95	M 98	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
39.50	M 100	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
40.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A, C	1930-1949
40.10	M 102	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
40.90	M 104	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
41.05	M 105	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
41.85	M 106	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
42.50	M 107	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
43.10	M 108	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
43.50	M 109	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
43.75	M 110	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
44.10	M 111	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
44.50	M 111.5	MN	Open Deck Pile Trestle	1966	n/a	No	n/a	n/a
44.60	M 112	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
45.40	M 113.5	MN	Open Deck Pile Trestle	1975	n/a	No	n/a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
45.45	M 115	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
45.70	M 115.5	MN	Open Deck Pile Trestle	1971	n/a	No	n/a	n/a
46.10	M 116	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
46.40	M 117	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1943-1949
46.50	M 118	MN	I-Beam	1946	Yes	Yes	A	1946-1949
46.55	M 120	MN	I-Beam	1966	n/a	No	n/a	n/a
47.01	M 121	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
47.30	M 122	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
47.40	M 123	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
47.90	M 125	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
49.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A, C	1919-1949
49.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A, C	1916-1949
50.80	M 130	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.84	M 131	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
51.90	M 133	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
53.50	M 134	MN	Single Stone Box Culvert	1905	No	No	n/a	n/a
54.10	M 136	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
54.80	M 137	MN	Stone Arch	1892	Yes	Yes	A, C	1892-1949
55.10	M 138	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
55.40	M 139	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
55.50	M 140	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
55.60	M 141	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
55.90	M 142	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
56.05	M 143	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
56.10	M 144	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
56.20	M 145	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
56.60	M 146	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
57.90	M 148	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
59.80	M 151	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
59.90	M 152	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
60.40	M 153	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
61.60	M 156	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
63.40	M 161	MN	I-Beam	1907	Yes	Yes	A, C	1907-1949
64.70	M 165	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
65.40	M 166	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
66.20	M 168	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
67.90	M 170	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
68.10	M 171	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
69.90	M 177	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
71.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A, C	1919-1949
73.50	M 183	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
74.40	M 184	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
75.40	M 186	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
76.10	M 188	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
77.30	M 191	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
78.10	M 192	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
78.75	M 194	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
79.30	M 195	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
80.20	M 196	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
82.10	M 201	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
82.50	M 202	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
83.60	M 204	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
84.10	M 205	MN	Open Deck Pile Trestle	1960	n/a	No	n/a	n/a
84.80	M 206	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
84.90	M 207	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
85.10	M 208	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
85.80	M 209	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
86.35	M 210	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
88.98	M 219	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
89.75	M 220	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
91.10	M 221	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
92.20	M 224	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
92.75	M 225	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
92.90	M 226	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
93.40	M 227	MN	I-Beam	1940	Yes	Yes	A, C	1940-1949
93.60	M 228	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
93.85	M 229	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
94.40	M 230	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
95.30	M 231	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
95.70	M 232	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
95.80	M 233	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
96.20	M 234	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
97.12	M 235	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
97.90	M 236	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
98.45	M 237	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
98.94	M 239	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
99.25	M 240	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
100.50	M 243	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
100.80	M 244	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
101.20	M 245	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
102.10	M 246	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
102.80	M 248	MN	Stone Arch	1884	No	No	n/a	n/a
103.30	M 249	MN	I-Beam	1908	Yes	Yes	A, C	1908-1949
105.45	M 252	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
105.60	M 253	MN	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949
107.25	M 256	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
107.50	M 257	MN	Single Stone Box Culvert	1900	No	No	n/a	n/a
109.90	M 262	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
110.60	M 263	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.10	M 265	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.40	M 266	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A, C	1916-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A, C	1908-1949
113.90	M 271	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
114.55	M 273	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
115.10	M 274	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
115.50	M 276	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.90	M 278	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
116.55	M 281	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.65	M 282	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.80	M 283	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
117.20	M 284	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
118.08	M 286	MN	Open Deck Pile Trestle	1969	n/a	No	n./a	n/a
118.80	M 287	MN	Single Stone Box Culvert	1896	No	No	n./a	n./a
119.10	M 288	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.30	M 289	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.75	M 290	MN	Concrete Arch	1915	Yes	Yes	A	1915-1949
120.25	M 291	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
120.60	M 293	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
122.40	M 298	MN	Concrete Box Culvert	1909	Yes	Yes	A	1909-1949
123.30	M 300	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
123.50	M 301	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
127.83	MA 311	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
127.96	MA 312	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a
128.53	MA 316	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
128.72	MA 317	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
128.90	MA 319	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.15	MA 321	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.40	MA 322	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
129.55	MA 324	MN	Stone Arch	1887	Yes	Yes	A,C	1874-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n./a	n/a
143.60	M 1614	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
144.21	M 1617	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
144.52	M 1622	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
144.90	M 1625	MN	Open Deck Pile Trestle	1931	No	No	n/a	n/a
145.85	M 1637	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
146.33	M 1640	MN	Open Deck Pile Trestle	1969	n/a	No	n./a	n/a
146.70	M 1641	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a
146.85	M 1641	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
147.25	M 1643	MN	Open Deck Pile Trestle	1927	n/a	No	n./a	n/a
147.80	M 1644	MN	Concrete and I-Beam	1908	Yes	Yes	A,C	1908-1949
147.90	M 1645	MN	I-Beam	1909	Yes	Yes	A,C	1909-1949
150.53	M 1650	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
150.60	M 1651	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
150.96	M 1654	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
151.41	M 1657	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
151.63	M 1658	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
151.72	M 1659	MN	Open Deck Pile Trestle	1971	n/a	No	n./a	n/a
151.80	M 1660	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.08	M 1661	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
152.20	M 1662	MN	Open Deck Pile Trestle	1968	n/a	No	n./a	n/a
152.30	M 1663	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
152.50	M 1664	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.80	M 1665	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
153.38	M 1668.	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
153.98	M 1672	MN	Open Deck Pile Trestle	1970	n/a	No	n./a	n/a
154.21	M 1675	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
154.30	M 1676	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
154.31	M 1677	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
154.98	M 1679	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
155.60	M 1682	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
157.50	M 1686	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
157.81	M 1687	MN	Through Plate Girder	1919	Yes	Yes	A,C	1919-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
158.72	M 1690	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
158.74	M 1691	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
158.84	M 1693	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
158.94	M 1694	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
159.50	M 1698	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
160.35	M 1699	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
160.80	M 1700	MN	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1944
161.47	M 1701	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
162.80	M 1703	MN	Triangular Lattice Through Truss	1913	Yes	Yes	A,C	1913-1949
164.10	436	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
164.60	438	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.80	439	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
165.90	442	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
166.10	442.5	MN	Through Plate Girder	1896	Yes	Yes	A, C	1896-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
166.50	442.75	MN	I-Beam	1911	Yes	Yes	A, C	1811-1949
167.10	444	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
168.30	445	MN	Single Stone Box Culvert	1871	Yes	Yes	A	1871-1949
168.63	446	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
169.20	448	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
170.10	449	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
171.14	451	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
171.90	452	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
172.20	453	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
173.30	455	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
174.90	457	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
177.40	460	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
177.78	462	MN	I-Beam	1910	Yes	Yes	A	1910-1949
178.40	463	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
179.90	464.5	MN	Through Plate Girder	1940	Yes	Yes	A	1940-1949
180.40	465	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
181.30	466	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
181.66	468	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
182.10	469	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
182.60	470	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.70	471	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.25	472	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.50	473	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
184.12	474	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
184.90	475	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
185.50	476	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
186.20	477	MN	Single Stone Box Culvert	1903	No	No	n/a	1903-1949
186.76	477.75	MN	Through Plate Girder	1932	Yes	Yes	A	1932-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A, C	1917-1949
187.50	480	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
191.10	487	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.50	488	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.80	489	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
192.30	490	MN	Concrete Box Culvert	1916	Yes	Yes	A	1916-1949
192.70	491	MN	Open Deck Pile Trestle	1926	n/a	No	n/a	n/a
193.50	494	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
193.80	495	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
194.20	496	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
195.66	498	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
195.90	500	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
196.10	501	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A, C	1924-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
197.30	503	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
197.40	504	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
197.50	505	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
198.01	506	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
198.80	507	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
198.90	508	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
199.50	510	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
202.10	517	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
203.39	520	MN	I-Beam	1910	No	No	n/a	n/a
203.60	521	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.90	522	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
204.29	524	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
205.75	525	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A, C	1919-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.45	527	MN	I-Beam	1919	Yes	Yes	A, C	1919-1949
206.73	528	MN	I-Beam	1918	Yes	Yes	A, C	1918-1949
206.98	529	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
207.46	530	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
207.71	531	MN	I-Beam	1913	Yes	Yes	A, C	1916-1949
207.80	532	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
209.25	534	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
211.90	539	MN	Single Stone Box Culvert	1898	No	No	n/a	n/a
212.25	540	MN	Stone Arch	1904	Yes	Yes	A, C	1904-1949
213.90	541	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
214.85	544	MN	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
216.20	546	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
217.30	548	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
219.30	554	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A, C	1917-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A, C	1915-1949
220.38	557	MN	Cast-Iron Pipe Culvert	1905	Yes	Yes	A	1905-1949
221.20	559	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
221.81	560	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
222.10	561	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
222.70	562	MN	Concrete Box Culvert	1923	Yes	Yes	A	1923-1949
223.50	564	MN	Stone Arch	1905	Yes	Yes	A, C	1905-1949
224.80	565	MN	Stone Arch	1919	Yes	Yes	A, C	1919-1949
225.95	566	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
226.20	567	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
227.70	1302	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
234.45	1312.5	MN	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
235.90	1315	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
236.20	1316	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
237.07	1317	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
237.59	1319	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
237.76	1320	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
238.31	1321	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
238.65	1322	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
239.20	1324	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.62	1325	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.80	1326	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
242.12	1330	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
243.42	1332	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
244.20	1333	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
244.60	1334	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
245.20	1336	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
245.30	1337	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
245.80	1338	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
245.90	1339	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.25	1340	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.85	1341	MN	Double Intersection Warren Deck Truss	1902	Yes	Yes	A, C	1902-1949
247.35	1342	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
248.06	1345	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
248.42	1347	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
249.40	1351	MN	Single Stone Box Culvert	1913	Yes	Yes	A	1913-1949
250.05	1353	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
251.30	1356	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
251.72	1357	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
253.20	1350	MN	I-Beam	1912	Yes	Yes	A, C	1912-1949
253.76	1361	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
253.90	1363	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
256.40	1366	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
257.30	1368	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
258.63	1371	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
259.80	1374.5	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
259.90	1375	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
260.30	1376	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
261.80	1380	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
263.42	1383	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
263.63	1384	MN	Open Deck Pile Trestle	1950	n/a	No	n/a	n/a
263.86	1385	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
264.70	1386	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
265.20	1387	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
265.55	1388	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
266.50	1391	MN	Stone Arch	1908	Yes	Yes	A, C	1908-1949
267.10	1392	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
267.90	1393	MN	Open Deck Pile Trestle	1956	n/a	No	N/A	n/a
268.47	1394	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
268.95	1395	MN	Cast-Iron Pipe Culvert	1903	Yes	Yes	A	1903-1949
269.19	1396	MN	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
269.82	1397	MN	Open Deck Pile Trestle	1967	n/a	No	n/a	n/a
271.29	1398	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
272.85	1399	MN	I-Beam	1909	Yes	Yes	A	1909-1949

Appendix L:

Excerpts from the *Manual of the American Railway Engineering Association*, Edition of 1921.

MANUAL

OF THE

American Railway Engineering Association

Definitions, Specifications
and Principles of Practice

FOR

RAILWAY ENGINEERING

EDITION OF 1921

Published by
AMERICAN RAILWAY ENGINEERING ASSOCIATION
431 South Dearborn Street
CHICAGO, ILLINOIS

WOODEN BRIDGES AND TRESTLES.

[1] DEFINITIONS.

General

WOODEN TRESTLE.—A wooden structure composed of upright members supporting simple horizontal members or beams, the whole forming a support for loads applied to the horizontal members.

FRAME TRESTLE.—A structure in which the upright members or supports are framed timbers.

PILE TRESTLE.—A structure in which the upright members or supports are piles.

BENT.—The group of members forming a single vertical support of a trestle, designated as pile bent where the principal members are piles, and as framed bent where of framed timbers.

POST.—One of the vertical or battered members of the bent of a framed trestle.

PILE.—(See definition under subject of Piles and Pile Driving.)

BATTER.—A deviation from the vertical in upright members of a bent.

CAP.—A horizontal member upon the top of piles or posts, connecting them in the form of a bent.

SILL.—The lowest horizontal member of a framed bent.

MUD-SILL or SUB-SILL.—A timber bedded in the ground to support a framed bent.

INTERMEDIATE SILL.—A horizontal member in the plane of the bent forming the cap of a lower section and the sill of an upper section.

SWAY BRACE.—A member bolted or spiked to the bent and extending diagonally across its face.

LONGITUDINAL STRUT OR GIRT.—A stiffening member running horizontally, or nearly so, from bent to bent.

LONGITUDINAL X BRACE.—A member extending diagonally from bent to bent in a vertical or battered plane.

SASH BRACE.—A horizontal member secured to the posts or piles of a bent.

[1] Adopted, Vol. 6, 1905, pp. 35, 36, 42, 55-67; Vol. 7, 1906, pp. 683, 684; Vol. 11, Part 1, 1910, pp. 178, 228; Vol. 16, 1916, pp. 894, 1179; Vol. 21, 1920, pp. 1281, 1434.

STRINGER.—A longitudinal member extending from bent to bent and supporting the track.

JACK STRINGER.—A stringer placed outside of the line of main stringers.

BRIDGE TIE.—A transverse timber resting on the stringers and supporting the rails.

INNER GUARD RAIL.—A longitudinal member, usually a metal rail, secured on top of the ties inside of the track rail, to guide derailed car wheels.

GUARD TIMBER.—A longitudinal timber placed outside of the track rail, to maintain the spacing of the ties.

PACKING BLOCK.—A small member, usually wood, used to secure the parts of a composite member in their proper relative positions.

PACKING SPOOL OR SEPARATOR.—A small casting used in connection with packing bolts to secure the several parts of a composite member in their proper relative positions.

DRIFT BOLT.—A piece of round or square iron of specified length, with or without head or point, driven as a spike.

DOWEL.—An iron or wooden pin, extending into, but not through, two members of the structure to connect them.

SHIM.—A small piece of wood or metal placed between two members of a structure to bring them to a desired relative elevation.

FISH-PLATE.—A short piece lapping a joint, secured to the side of two members, to connect them end to end.

BULKHEAD.—Timbers placed against the embankment side of an end bent to retain the embankment.

[1]PILES AND PILE DRIVING.

PILE.—A member usually driven or jetted into the ground and deriving its support from the underlying strata, and by the friction of the ground on its surface.

The usual functions of a pile are: (*a*) To carry a superimposed load; (*b*) To compact the surrounding ground; (*c*) To form a wall to exclude water and soft material, or to resist the lateral pressure of adjacent ground.

HEAD OF PILE.—The upper end of a pile.

FOOT OF PILE.—The lower end of a pile.

BUTT OF PILE.—The larger end of a pile.

TIP OF PILE.—The smaller end of a pile.

BEARING PILE.—One used to carry a superimposed load.

[1]Adopted, Vol. 10, 1909, p. 565; Vol. 16, 1915, pp. 894, 1179; Vol. 21, 1920, pp. 1282, 1434.

SCREW PILE.—One having a broad-bladed screw attached to its foot to provide a larger bearing area.

DISC PILE.—One having a disc attached to its foot to provide a larger bearing area.

BATTER PILE.—One driven at an inclination to resist forces which are not vertical.

SHEET PILES.—Piles driven in close contact in order to provide a tight wall, to prevent leakage of water and soft materials; or driven to resist the lateral pressure of adjacent ground.

PILE DRIVER.—A machine for driving piles.

HAMMER.—A weight used to drive piles.

DROP HAMMER.—One which is raised by means of a rope and then allowed to drop.

STEAM HAMMER.—One which is automatically operated by the action of a steam cylinder and piston supported in a frame which rests on the pile.

LEADS.—The upright parallel members of a pile driver which support the sheaves used to hoist the hammer and piles, and which guide the hammer in its movement.

PILE CAP, HOOD OR BONNET.—A block used to protect the head of a pile and to hold it in the leads during driving.

RING.—A metal hoop used to bind the head of a pile during driving.

SHOE.—A metal protection for the point or foot of a pile.

FOLLOWER.—A member interposed between the hammer and pile to transmit blows to the latter when below the foot of the leads.

[1]SPECIFICATIONS FOR TIMBER PILES.

RAILROAD HEART GRADE.

1. This grade includes white, burr, and post oak; dense pine, Douglas fir, tamarack, Eastern white and red cedar, chestnut, Western cedar, redwood and cypress.

2. Piles shall be cut from sound trees; shall be close grained and solid, free from defects, such as injurious ring shakes, large and unsound or loose knots, decay or other defects, which may materially impair their strength or durability. In Eastern red or white cedar a small amount of heart rot at the butt, which does not materially injure the strength of the pile, will be allowed.

3. Piles must be butt cut above the ground swell and have a uniform taper from butt to tip. Short bends will not be allowed. A line drawn

[1]Adopted, Vol. 10, 1909, pp. 537, 541, 542, 603-611.

from the center of the butt to the center of the tip shall lie within the body of the pile.

4. Unless otherwise allowed, piles must be cut when sap is down. Piles must be peeled soon after cutting. All knots shall be trimmed close to the body of the pile.

5. The minimum diameter at the tips of round piles shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum diameter at one-quarter of the length from the butt shall be 12 inches and the maximum diameter at the butt 20 inches.

6. The minimum width of any side of the tip of a square pile shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum width of any side at one-quarter of the length from the butt shall be 12 inches.

7. Square piles shall show at least 80 per cent. heart on each side at any cross-section of the stick, and all round piles shall show at least 10½ inches diameter of heart at the butt.

Railroad Falsework Grade.

8. This grade includes red and all other oaks not included in Railroad Heart grade, sycamore, sweet, black and tupelo gum, maple, elm, hickory, Norway pine or any sound timber that will stand driving.

9. The requirements for size of tip and butt taper and lateral curvature are the same as for Railroad Heart grade.

10. Unless otherwise specified piles need not be peeled.

11. No limits are specified as to the diameter or proportion of heart.

12. Piles which meet the requirements of Railroad Heart grade except the proportion of heart specified will be classed as Railroad Falsework grade.

PILE DRIVING—PRINCIPLES OF PRACTICE.[1]

(1) A thorough exploration of the soil by borings, or preliminary test piles, is the most important prerequisite to the design and construction of pile foundations.

[1] Adopted, Vol. 12, 1911, Part 1, pp. 279, 307; Vol. 16, 1916, pp. 894, 1181.

(2) Soil consisting wholly or chiefly of sand is most favorable to the use of the water jet.

(3) In harder soils containing gravel the use of the jet may be advantageous, if sufficient volume and pressure be provided.

(4) In clay it may be economical to bore several holes in the soil with the aid of the jet before driving the pile, thus securing the accurate location of the pile, and its lubrication while being driven.

(5) In general, the water jet should not be attached to the pile, but handled separately.

(6) Two jets will often succeed where one fails. In special cases a third jet extending a part of the depth aids materially in keeping loose the material around the pile.

(7) Where the material is of such a porous character that the water from the jets may be dissipated and fail to come up in the immediate vicinity of the pile, the utility of the jet is uncertain, except for a part of the penetration.

(8) A steam or drop hammer should be used in connection with the water jet, and used to test the final rate of penetration.

(9) The use of the water jet is one of the most effective means of avoiding injury to piles by overdriving.

(10) There is danger from overdriving when the hammer begins to bounce. Overdriving is also indicated by the bending, kicking or staggering of the pile.

(11) The brooming of the head of the pile dissipates a part, and in some cases all, of the energy due to the fall of the hammer.

(12) The steam hammer is usually more effective than the drop hammer in securing the penetration of a wooden pile without injury, because of the shorter interval between blows.

(13) Where shock to surrounding material is apt to prove detrimental to the structure, the steam hammer should always be used instead of the drop hammer. This is especially true in the case of sheet piling which is intended to prevent the passage of water. In some cases also the jet should not be used.

(14) In general, the resistance of piles, penetrating soft material, depending solely upon skin friction, is materially increased after a period

of rest. This period may be as short as fifteen minutes, and rarely exceeds twelve hours.

(15) Where a pile penetrates a soft yielding material and bears upon hard stratum at its foot, its strength should be determined as a column; omitting the resistance, if any, due to skin friction.

(16) Unless the record of previous experience at the same site is available, the approximate bearing power may be obtained by loading test piles. The results of loading test piles should be used with caution, unless their condition is fairly comparable with that of the piles in the proposed foundation.

(17) In case the piles in a foundation are expected to act as columns, the results of loading test piles should not be depended upon unless they are sufficient in number to insure their action in a similar manner; and unless they are stayed against lateral motion.

(18) Before testing the penetration of a pile in soft material where its bearing power depends principally, or wholly, upon skin friction, the pile should be allowed to rest for 24 hours after driving.

(19) Where the resistance of piles depends mainly upon skin friction it is possible to diminish the combined strength, or bearing capacity, of a group of piles by driving additional piles within the same area.

(20) Where piles will foot in a hard stratum, investigation should be made to determine that this stratum is of sufficient depth and strength to carry the load.

(21) Timber piles may be advantageously pointed, in some cases to a 4-inch or 6-inch square at the end.

(22) Piles should not be pointed when driven into soft material.

(23) Shoes should be provided for piles when the driving is very hard, especially in riprap or shale. These shoes should be so constructed as to form an integral part of the pile.

(24) The use of a cap is advantageous in distributing the impact of the hammer more uniformly over the head of the pile, as well as in holding it in position during driving.

*PILE RECORD FORM.

Size 8½x11 or 8x10½ Inches. Form M. W. 701.

North and South Railroad.

Pile Record of Bridge..

LOCATION..

Weight and Kind of Hammer.............................**Date**.............**19**....

Bents Numbered from North or East End **Piles numbered from Left to Right**

Date	Bent No.	No. of Pile	Size of Pile			Kind of Wood	[illegible]	Base rail to Ground	Total Penetrat.	Av. Last Five Blows		Kind of Soil	Remarks
			Tip End	Butt End	Length					Drop of Ham'r	Penetrat.		

*Adopted, Vol. 12, Part 1, 1911, pp. 278, 307.

*SPECIFICATIONS FOR WORKMANSHIP FOR PILE AND FRAME TRESTLES OF UNTREATED MATERIAL TO BE BUILT UNDER CONTRACT.

Site.

1. The trestle to be built under these specifications is located on the line of ..... Railway at ..... County of .....State of .....

General Description.

2. The work to be done under these specifications covers the construction of a..... track wooden trestle about ..... feet long and an average of ..... feet high.

General Clauses.

3. The contractor shall furnish all necessary labor, tools, machinery, supplies, temporary staging and outfit required. He shall build the complete trestle ready for the track rails, in a workmanlike manner, in strict accordance with the plans and the true intent of these specifications, to the satisfaction and acceptance of the Engineer of the Railway Company.

4. The workmanship shall be of the best quality in each class of work. Details, fastenings and connections shall be of the best method of construction in general use on first-class work.

5. Holes shall be bored for all bolts. The depth of the hole and the diameter of the augur shall be as specified by the Engineer.

6. Framing shall be accurately fitted. No blocking or shimming will be allowed in making joints. Timbers shall be cut off with the saw; no axe to be used.

7. Joints and points of bearing, for which no fastening is shown on the plans, shall be fastened as specified by the Engineer.

8. The Engineer or his authorized agents shall have full power to cause any inferior work to be condemned, and taken down or altered, at the expense of the contractor. Any material destroyed by the contractor on account of inferior workmanship or carelessness of his men must be replaced by the contractor at his own expense.

9. Figures shown on the plans shall govern in preference to scale measurements. If any discrepancies should arise or irregularities be discovered in the plans, the contractor shall call on the Engineer for instructions. These specifications and the plans are intended to coincide, and if any question arises as to the proper interpretation of the plans or specifications, it shall be referred to the Engineer for a ruling.

*Adopted, Vol. 8, 1907, pp. 397-400, 442-450.

10. The contractor shall, when required by the Engineer, furnish a satisfactory watchman to guard the work.

11. On the completion of the work, all refuse material and rubbish that may have accumulated on top and under and near the trestle, by reason of its construction, shall be removed by the contractor.

Detail Specifications.

12. Piles shall be carefully selected to suit the place and ground where they are to be driven. When required by the Engineer, pile butts shall be banded with iron or steel for driving, and the tips shod with suitable iron or steel shoes. Such shoes will be furnished by the Railway Company.

13. Piles shall be driven to firm bearing, satisfactory to the Engineer; or until five blows of a hammer weighing 3000 lb., falling 15 feet (or a hammer and fall producing the same mechanical effect), are required to cause an average penetration of ½ inch per blow, except in soft bottom, where special instructions will be given.

14. Batter piles shall be driven to the inclination shown by the plans, and shall require but slight bending before framing.

15. Butts of all piles in a bent shall be sawed off to one plane and trimmed so as not to leave any horizontal projection outside of the cap.

16. Piles injured in driving, or driven out of place, shall either be pulled out or cut off, and replaced by new piles.

Caps.

17. Caps shall be sized and brought to a uniform thickness and even bearing on piles or posts. The side with most sap shall be placed downward.

Posts.

18. Posts shall be sawed to proper length for their position (vertical or batter), and to even bearing on cap and sill.

Sills.

19. Sills shall be sized at the bearing of posts to one plane.

Sash and Sway Braces.

20. Sash and sway bracing shall be properly framed and securely fastened to piles or posts. When necessary, filling pieces shall be used between the braces and the piles of a bent on account of the variation in size of piles, and securely fastened and faced to obtain a bearing against all piles.

Longitudinal Braces.

21. Longitudinal X braces shall be properly framed and securely fastened to piles or posts.

Girts.

22. Girts shall be properly framed and securely fastened to caps, sub-sills, intermediate sills, posts or piles, as the plans may require.

Stringers.

23. Stringers shall be sized to a uniform depth at supports. The edges with most sap shall be placed downward.

Jack Stringers.

24. Jack stringers, if required on the plans, shall be neatly framed on caps, and their tops shall be in the same plane as the track stringers.

Ties.

25. Ties shall be sized to a uniform thickness and shall be placed with the rough side upward. They shall be spaced regularly and cut to even length and line, as called for on the plans.

Guard Timbers.

26. Guard timbers shall be framed as called for on the plans, laid to line and to a uniform top surface. They shall be firmly fastened to the ties as required.

Bulkheads.

27. Bulkheads shall be of sufficient dimensions to keep the embankment clear of the caps, stringers and ties, at the end bents of the trestle. There shall be a space of not less than 2 inches between the back of the end bent and the face of the bulkhead. The projecting ends of the bulkhead shall be sawed off to conform to the slope of the embankment, unless otherwise specified.

Time of Completion.

28. The work shall be completed in all its parts on or before ..... 19....

Payments.

29. Payments will be made under the usual regulations of the Railway Company.

[1]USE OF GUARD RAILS AND GUARD TIMBERS FOR WOODEN BRIDGES AND TRESTLES.

(1) It is recommended as good practice to use guard timbers on all open-floor bridges, and same should be so constructed as to properly space the ties and hold them securely in their places.

(2) It is recommended that the guard timber and the inner guard rail, when used, shall be so spaced in reference to the track rail that a derailed truck will strike the inner guard rail without striking the guard timber. The inner guard rail should not be higher nor more than one inch lower than the running rail.

(3) It is recommended as good practice in the installation of inner guard rails to extend them beyond the ends of the bridges for such distance as is required by local conditions, but that this distance, in any case, be not less than 50 feet; that inner guard rails be fully spiked to every tie, and spliced at every joint; that the inner guard rails be some form of metal section; and that the ends be beveled, bent down, or otherwise protected against direct impact with moving parts of equipment.

(4) It is recommended as good practice to use inner guard rails on all open-floor and on the outside tracks of all solid-floor bridges and similar structures longer than 20 feet in main-line tracks, and on similar bridges and structures in branch-line tracks on which the speed of trains is 20 miles per hour or more.

[2]USE OF LAG SCREWS IN TRESTLE CONSTRUCTION.

(1) Lag screws require greater care than ordinary bolts and nuts to properly install, but are cheaper on account of ease of general maintenance.

(2) Lag screws, where properly applied, hold ties from bunching equally as well as bolts and nuts, and better than daps, in guard timbers.

(3) If the lag screws are tightened after timber has shrunk, there is less cost of maintenance than with bolts and nuts.

(4) Use of lag screws renders unnecessary the dapping of guard timbers, and, therefore, decreases cost of trestles without impairing quality.

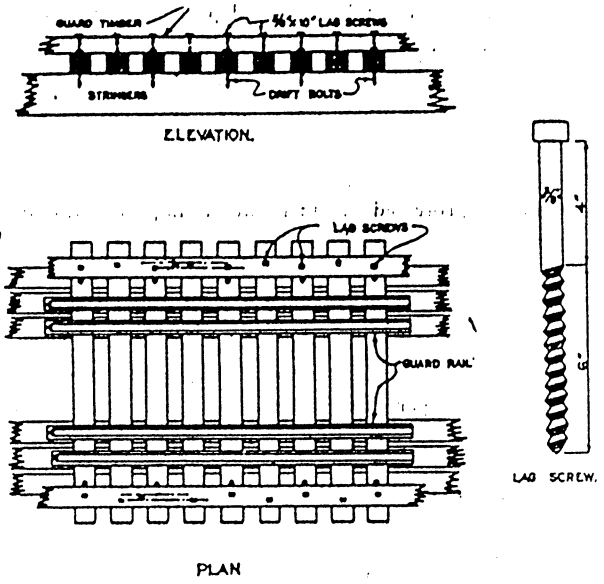
[1]Adopted, Vol. 14, 1913, pp. 652, 653, 1136-1143; Vol. 15, 1914, pp. 403, 1036-1044; Vol. 21, 1920, pp. 1285, 1434.

[2]Adopted, Vol. 19, 1918, pp. 584, 608, 1225.

(5) Surfacing (sizing) ties and guard timbers is better construction than dapping.

(6) For proper application of lag screws, holes in guard timbers should be bored with auger bits $\frac{1}{16}$ in. less in diameter and holes in ties $\frac{1}{4}$ in. less in diameter than the nominal size of lag screws used.

(7) Lag screws must be screwed in, not driven.



NOTE.—Ties and guard timbers to be sized one dimension. Omit dapping of guard timbers and ties. Use lag screws in every tie. Holes to be bored for lag screws one inch deeper than penetration of lag screw. Holes to be bored $\frac{1}{16}$ in. smaller than diameter of lag in guard timber, and $\frac{1}{4}$ in. smaller than diameter of lag in ties. Lag screws must not be driven but screwed to position. Fasten alternate ties to stringers. Lag screws to be staggered 2 in. in guard timbers.

*SPECIFICATIONS FOR METAL DETAILS USED IN WOODEN BRIDGES AND TRESTLES.

Wrought-Iron.

1. Wrought-iron shall be double-rolled, tough, fibrous and uniform in character. It shall be thoroughly welded in rolling and be free from surface defects. When tested in specimens of the form of Fig. 1 or in full-sized pieces of the same length, it shall show an ultimate strength of at least 50,000 lbs. per square inch, an elongation of 18 per cent. in 8 in., with fracture wholly fibrous. Specimens shall bend cold, with the fiber, through 135 degrees, without sign of fracture, around a pin the diameter of which is not over twice the thickness of the piece tested. When nicked and bent, the fracture shall show at least 90 per cent. fibrous.

Steel.

2. Steel shall be made by the open-hearth process and shall be of uniform quality. It shall contain not more than 0.05 per cent. sulphur. If made by the acid process it shall contain not more than 0.06 per cent. phosphorus; and if made by the basic process, not more than 0.04 per cent. phosphorus. When tested in specimens of the form of Fig. 1, or full-

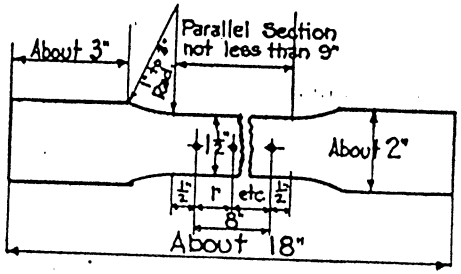


FIG. 1.

sized pieces of the same length, it shall have a desired ultimate tensile strength of 60,000 lbs. per square inch. If the ultimate strength varies more than 4000 lbs. from that desired, a retest shall be made on the same gage, which, to be acceptable, shall be within 5000 lbs. of the desired ultimate. It shall have a minimum percentage of elongation in 8 inches of $\frac{1{,}500{,}000}{\text{ultimate tensile strength}}$; and shall bend cold without fracture 180 degrees flat. The fracture for tensile tests shall be silky.

Cast-Iron.

3. Except where chilled iron is specified, castings shall be made of tough gray iron, with sulphur not over 0.10 per cent. They shall be true to pattern, out of wind and free from flaws and excessive shrinkage. If

*Adopted, Vol. 7, 1906, pp. 692-694, 719-724; Vol. 11, 1910.

tests are demanded, they shall be made on the "Arbitration Bar" of the American Society for Testing Materials, which is a round bar 1¼ inches in diameter and 15 inches long. The transverse test shall be made on a supported length of 12 inches, with load at middle. The minimum breaking load so applied shall be 2900 lbs., with a deflection of at least 1/10 inch before rupture.

Bolts.

4. Bolts shall be of wrought-iron or steel, made with square heads, standard size, the length of thread to be 2½ times the diameter of bolt. The nuts shall be made square, standard size, with thread fitting closely the thread of bolt. Threads shall be cut according to U. S. standards.

Drift Bolts.

5. Drift bolts shall be of wrought-iron or steel, with or without square head, pointed or without point, as may be called for on plans.

Spikes.

6. Spikes shall be of wrought-iron or steel, square or round, as called for on the plans. Steel wire spikes, when used for spiking planking, shall not be used in lengths more than 6 inches; if greater lengths are required, wrought or steel spikes shall be used.

Packing Spools or Separators.

7. Packing spools or separators shall be of cast-iron, made to size and shape called for on plans. The diameter of hole shall be ⅛ inch larger than diameter of packing bolts.

Cast Washers.

8. Cast washers shall be of cast-iron. The diameter shall be not less than 3½ times the diameter of bolt for which it is used, and its thickness equal to the diameter of bolt. The diameter of hole shall be ⅛ inch larger than the diameter of the bolt.

Wrought Washers.

9. Wrought washers shall be of wrought-iron or steel, the diameter shall be not less than 3½ times the diameter of bolt for which it is used, and not less than ¼ inch thick. The hole shall be ⅛ inch larger than the diameter of the bolt.

Special Castings.

10. Special castings shall be made true to pattern, without wind, free from flaws and excessive shrinkage; size and shape to be as called for by the plans.

"RELATIVE ECONOMY OF REPAIRS AND RENEWALS OF WOODEN BRIDGES AND TRESTLES.

It is good practice to repair wooden bridges and trestles by parts until such time as the general condition of the structure requires entire renewal.

"COMPARATIVE MERITS OF BALLAST DECK AND REINFORCED CONCRETE TRESTLES.

(1) While in certain locations there is little probability of fire loss in creosoted ballast deck timber trestles, yet due to the very nature of the material used the reinforced concrete trestle has a decided advantage.

(2) The concrete structure is slightly superior to the timber structure for bridging waterways subject to flood currents, or wide fluctuations in elevation of water surface.

(3) Although the concrete trestle may possibly afford better service qualities than the wooden trestle, the matter is so intangible in character as to preclude a definite statement of relative merit.

(4) Where selection of type of trestle is optional and not influenced by other considerations, neither type of trestle has the advantage of the other in the matter of appearance.

(5) Notwithstanding the fact that the two materials are, with certain limitations, equally suitable for the construction of trestles, the use of concrete is more in accord with the theory of conservation of natural resources and industrial economy.

(6) Adoption of either type should be the result of carefully weighing, for each individual bridge, the greater economy of the timber trestle against the several advantages of the concrete not susceptible of mathematical demonstration.

(7) Creosoted timber trestles are more economical than concrete, except when the cost of the concrete structure is less than one and one-half times the cost of the wooden structure.

"Adopted, Vol. 16, 1915, pp. 891, 1179.
"Adopted, Vol. 19, 1918, pp. 592, 603, 1223

"WORKING STRESSES PERMISSIBLE FOR STRUCTURAL TIMBERS (Pounds per Square Inch)

Species	Bending.				Compression.					
	Allowable stress in extreme fiber.				Allowable stress parallel to grain. "Short Columns."				Allowable stress perpendicular to grain.	
	Damp or wet location (docks, piling, and soil (bridges and open sheds)	Outside, not in contact with soil (bridges and open sheds)	Under shelter in a dry location (factories and warehouses)	All locations	Allowable horizontal shear stress.					
					Wet location		Dry location		Wet location	
						Outside location		Outside location		Outside location
Cedar, western red	750	800	750	80	650	700	700	700	125	150
Cedar, northern white	600	650	600	70	450	500	550	550	100	140
Chestnut	700	850	950	90	600	700	800	800	150	200
Cypress	900	1100	1300	100	800	1100	1100	1100	225	250
Douglas fir—										
No. 1 structural	1100	1400	1600	100	900	1100	1200	1100	225	250
No. 2 structural	900	1100	1300	90	800	900	1000	900	200	225
Rocky Mountain region	700	900	1100	85	700	800	800	800	200	225
Fir, balsam	600	750	900	70	500	600	700	700	100	125
Gum, red	800	900	1100	100	650	750	800	800	150	200
Hemlock, western	900	1100	1300	75	800	900	900	900	200	225
Hemlock, eastern	800	900	1100	70	600	700	700	700	200	225
Hickory	1200	1500	1900	140	1000	1200	1500	1500	350	400
Larch, western	900	1100	1200	100	800	1000	1100	1100	200	225
Maple, sugar or hard	1000	1300	1500	150	900	1100	1200	1200	300	375
Maple, silver or soft	700	900	1000	100	600	700	800	800	200	250
Oak, white or red	1000	1200	1400	125	800	900	1000	900	300	375
Pine—										
Southern yellow (dense)	1100	1400	1600	125	900	1100	1200	1100	225	250
Southern yellow (sound)	900	1100	1300	105	650	750	900	900	200	225
Eastern white	750	800	900	85	650	750	750	750	125	150
Western white	800	1000	1100	85	700	800	800	800	150	175
Norway	800	1000	1200	70	750	900	1000	1000	125	150
Redwood	800	1000	1200	85	650	750	800	800	125	150
Spruce, red, white and Sitka	800	900	1100	85	650	750	800	800	125	150
Spruce, Engelmann	500	650	750	70	450	550	600	600	100	140
Tamarack, eastern	900	1100	1200	95	800	900	1000	1000	200	225

[a] Adopted, Vol. 21, 1920, pp. 1337, 1434.

[a]SPECIFICATIONS AND CLASSIFICATION AND GRADING RULES FOR LUMBER AND TIMBER TO BE USED IN THE CONSTRUCTION AND MAINTENANCE OF WAY DEPARTMENTS OF RAILROADS.

Structural Timber.

Definitions.

Axis.—The line connecting the centers of successive cross-sections of a stick.

Corner.—The line of intersection of the planes of two adjacent longitudinal surfaces.

Cross-Section.—A section of a stick at right angles to the axis.

Edge.—Either of the two narrower longitudinal surfaces of a stick.

Face.—The surface of a stick which is exposed to view in the finished structure.

Full Length.—Long enough to "square" up to the length specified in the order.

Girth.—The perimeter of a cross-section.

Heartwood.—The older and central part of a log, usually darker in color than sapwood. It appears in strong contrast to the sapwood in some species, while in others it is but slightly different in color.

Out of Wind.—Having the longitudinal surfaces plane.

Side.—Either of the two wider longitudinal surfaces of a stick.

Solid.—Without cavities; free from loose heart, wind shakes, bad checks, splits or breaks, loose slivers and worm or insect holes.

Sound.—Free from decay.

Springwood.—The inner part of the annual ring formed in the earlier part of the season, not necessarily in the spring, and often containing vessels or pores.

Square-Cornered.—Free from wane.

Straight.—Having a straight line of an axis.

Summerwood.—The outer part of the annual ring formed later in the season, not necessarily in the summer, being usually dense in structure and without conspicuous pores.

True.—Of uniform cross-section. Defects are caused by wavy or jagged sawing or consist of trapezoidal instead of rectangular cross-sections.

Names for Varieties of Structural Timber.

Cedar covers White Cedars: Thuya occidentalis, Maine to Minnesota and northward; Chamæcyparis thyoides, Atlantic Coast from Maine to Mississippi; Chamæcyparis lawsoniana, along the coast line of Oregon; Libocedrus decurrens, Cascades and Sierra Nevada of Oregon and California. Red Cedars: Thuya gigantea, Washington to North-

[a] Adopted, Vol. 22, 1921, pp. 494, 1072.

ern California and eastward to Montana; Juniperus virginiana, throughout United States. Western Red Cedar; Thuja plicata.

CYPRESS (Taxodium distichum) covers bald cypress, black, white and red cypress, from swamp and overflow land along the coast and rivers of the Southern States.

DOUGLAS FIR.—The term "Douglas Fir" covers the timber known as yellow fir, red fir, Western fir, Washington fir, Oregon or Puget Sound fir or pine, Northwest and West Coast fir.

HEMLOCK covers Southern or Eastern hemlock; that is, hemlock from all states east of and including Minnesota.

IDAHO WHITE PINE covers the variety of white pine from Western Montana, Northern Idaho and Eastern Washington.

NORWAY PINE covers what is known also as "Red Pine" and Banksian (Pinus Banksiana).

OAK.—Under this heading three classes of timber are used: (a) White Oak, to include White Oak, Burr Oak and Post Oak; (b) Red Oak, to include Red Oak, Scarlet Oak, Black Oak and all bastard oaks; (c) Chestnut Oak, to include only Chestnut Oak.

REDWOOD includes the California wood usually known by that name.

SOUTHERN YELLOW PINE.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as longleaf pine (Pinus palustris), shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla) and pond pine (Pinus serotina).

SPRUCE covers Eastern spruce; that is, the spruce timber coming from points east of and including Minnesota.

TAMARACK covers the timber known as "Tamarack," or "Eastern Tamarack," from states east of and including Minnesota.

WESTERN HEMLOCK covers hemlock from the Pacific Coast.

WESTERN LARCH covers the species of Larch or Tamarack from the Rocky Mountains and Pacific Coast regions.

WESTERN PINE covers the timber sold as white pine coming from Arizona, California, New Mexico, Colorado, Oregon and Washington. This is the timber sometimes known as "Western Yellow Pine," or "Ponderosa Pine," or "California White Pine," or "Western White Pine."

WESTERN OR SITKA SPRUCE covers spruce timber from the Pacific Coast.

WHITE PINE covers the timber which has hitherto been known as white pine, from Maine, Michigan, Wisconsin and Minnesota.

Classification Terms.

LUMBER is the product of the saw and planing mill not further advanced in manufacture than by sawing, resawing and passing lengthwise through a standard planing machine, crosscutting to length, and end matching.

Lumber is classified as yard lumber, shop or factory lumber and structural timber. Different grading rules apply to each class of lumber.

YARD LUMBER is lumber that is less than six inches in thickness and is intended for general building and construction purposes. The grading of yard lumber is based upon the use of the entire piece, except when a stated amount of waste to remove defects is provided in the classification of the material under consideration.

SHOP OR FACTORY lumber is intended to be cut up for use in further manufacture and is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a given minimum size and quality.

STRUCTURAL TIMBER is lumber that is six inches or over in thickness and width. The grading of structural timber is based upon the strength of the piece and the use of the entire piece.

Yard lumber is classified roughly as finishing and construction lumber. There is no sharp line between finishing and construction lumber. The medium grades may be used for either purpose.

FINISHING is yard lumber of the higher grades in which appearance, perfection of the surface and finishing qualities are primarily the basis on which the grade is determined. The higher finishing grades are more suitable for "natural" or transparent finishes while the lower finishing grades are smooth and free from serious defects and are particularly adapted to the use of paint.

CONSTRUCTION LUMBER is yard lumber which is graded primarily upon the basis of its strength as affected by defects, and its fitness for general construction purposes.

STRIPS are yard lumber less than two inches thick and under eight inches wide. Strips are usually manufactured into matched and patterned lumber.

BOARDS are yard lumber less than two inches thick and eight inches or over wide.

PLANKS are yard lumber two inches and under four inches thick and eight inches and over in width.

SCANTLINGS are yard lumber two inches and under six inches thick and under eight inches wide.

HEAVY JOISTS are yard lumber that is four inches and under six inches thick and eight inches and over wide.

DIMENSION includes all yard lumber except boards and strips; that is, yard lumber two inches and under six inches thick and of any width.

MANUFACTURED lumber is classified as rough, surfaced and worked.

ROUGH lumber is undressed lumber left as it comes from the saw.

SURFACED lumber is lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E), or a combination of sides and edges (as S1S1E, S2S1E, or S1S2E).

WORKED lumber is lumber which has been run through a matching machine, sticker or moulder. Worked lumber may be matched, shiplapped or patterned. Patterned lumber is usually matched or shiplapped.

MATCHED lumber is lumber that is edge dressed and shaped to make a close tongue and groove joint at the edges or ends when laid edge to edge or end to end.

SHIPLAPPED lumber is lumber that is edge dressed to make a close rabbeted or lap joint when laid edge to edge.

PATTERNED lumber is worked lumber that is shaped to a patterned or moulded form.

Definitions of Defects and Blemishes.

The terms "Defect" and "Blemish" as applied to wood usually imply the idea of imperfections. These are not always detrimental.

DEFECT.—Any irregularity or want occurring in or on wood that may lower some of its strength value.

BLEMISH.—Any mark or formation of wood structure marring the appearance.

The presence of a defect or blemish may or may not be detrimental to the value of the material, depending upon the character of the defect or blemish and the use of the material.

Knots.

KNOT.—The hard mass of wood formed in a trunk of a tree at a branch with the grain distinct and separate from the grain of the trunk.

KNOTS shall be classified according to size, form and quality.

The average of the maximum and minimum diameters shall be used in measuring the size of knots unless otherwise stated.

In all grades of material all knots should be sound and tight unless otherwise specified.

PIN KNOT.—One not over ⅜ of an inch in diameter.

SMALL KNOT.—One between ⅜ and ¾ of an inch in diameter.

STANDARD KNOT.—One between ¾ and 1½ inches in diameter.

LARGE KNOT.—One over 1½ inches in diameter.

ROUND KNOT.—One whose maximum diameter is not over one and one-half times as great as its minimum diameter.

OVAL KNOT.—One having its maximum diameter one and one-half to three times as great as its minimum diameter.

SPIKE KNOT.—One sawed in a lengthwise direction whose maximum diameter is over three times as great as its minimum diameter.

SOUND KNOT.—One which is solid across its face, and is as hard as the wood surrounding it and shows no indications of decay.

UNSOUND OR ROTTEN KNOT.—One not as hard as the wood surrounding it or one in which decay has started.

TIGHT KNOT.—One so fixed by growth or position that it will firmly retain its place in the piece.

LOOSE KNOT.—One not held firmly in place by growth or position.

LIVE KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood.

ENCASED KNOTS.—One whose growth rings are not intergrown and homogeneous with the growth rings of the surrounding wood. The encasement may be partial or complete.

WATERTIGHT KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood on one face of the piece, and which is sound on that face.

PITH KNOT.—Sound knot except that it has a pith hole in the central growth ring. The hole rarely exceeds ¼ of an inch in diameter.

Holes.

HOLES in wood may extend partially or entirely through the piece. They are enumerated as knot, dog, picaroon, bird, insect (including pin, shot, spot, grub worms, etc.) metal and wooden rafting pin holes, through pitch pockets and the like.

When holes are permitted, the average of the maximum and minimum diameters at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

WOODEN RAFTING PINHOLES sometimes appear on river timber which has been rafted when holes have been bored in the solid wood for securing the timber, and a solid plug or pin driven in the hole, completely filling it. These defects must be treated and considered the same as Knot Defects. Ordinary Metal Rafting Pin, Cant Hook or Chain Dog-hole is not considered a defect.

GRUB WORM HOLES are usually from about ⅛-inch to ⅜-inch in width, and vary in length from about 1 inch to 1½ inches and are caused by grubs working in the wood.

PIN WORM HOLES are very small holes caused by minute insects or worms. These holes are usually not over ⅛-inch in diameter, the wood surrounding them is sound and does not show any evidence of the worm hole having any effect on the wood other than the opening.

SPOT WORM DEFECTS (also known as Flagworm Defects) are caused, like pin worm holes, by minute insects or worms working on the timber during the growth. The size of the hole is about the same as Pin-worm holes, but the surrounding wood shows a colored spot as evidence of the blemish. This spot is usually sound and does not affect the strength of the piece.

Checks.

CHECK is a separation of the wood cells along a radial plane of the tree due to unequal shrinkage during

SURFACE CHECK is a shallow check occurring on the surface of a piece.

END CHECK is one occurring on an end of a piece.

THROUGH CHECK is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

HEART CHECK is one starting at the pith and extending towards but not to the surface of a log and is not necessarily due to seasoning.

STAR CHECK is the combination of several heart checks occurring together.

HONEYCOMBING is checking occurring in the interior of a piece; often the checks are not visible on the surface. On a cross-section they usually appear as slits, or as open pockets whose width may appear very large in proportion to the radial length.

ORDINARY season checks such as occur in lumber properly covered in yard, or season checks of equal size in kiln-dried lumber shall not be considered defects.

Shakes and Splits.

SHAKE is a cylindrical separation of the wood following in general the annual layers (rings) of growth. Thus any shake is a ring shake.

ROUND SHAKE is one completely encircling the pith.

CUP SHAKE is one that does not completely encircle the pith.

THROUGH SHAKE is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

PITCH SHAKE.—A clearly defined seam or opening between the grain of the wood and may be either filled or not with granulated pitch.

SPLIT is a lengthwise separation of the wood due to tearing apart of the wood cells in rough handling, felling the tree or similar causes. It may run in any direction across the end of a piece.

PITH is the small soft core occurring in the center growth ring of a log. In some woods it is large enough to mar the surface of the piece on which it appears. The wood immediately surrounding the pith often contains small checks, shakes or numerous pin knots and is often discolored; any such combination of defects and blemishes is known as Heart Center.

Pockets.

PITCH POCKET.—A well defined opening between the annual layers of growth usually containing more or less pitch, either solid or liquid. Bark may also be present in the pocket. On an edge-grain surface they appear as narrow open seams, and on flat grain surface they vary in appearance from narrow open seams to oval cavities sometimes called "Scab Pitch Pockets." On either surface they are known as very small, small, medium or large, depending upon their size.

VERY SMALL PITCH POCKET.—One not over ⅛ of an inch in width and not over 2 inches in length.

SMALL PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ¼ of an inch provided a maximum limit of length of four inches decreases to two inches proportionately as the width increases.

MEDIUM PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ⅜ of an inch provided a maximum limit of length of nine inches decreases to three inches proportionately as the width increases.

LARGE PITCH POCKET.—One whose width or length exceeds the sizes stated as permissible for a medium pitch pocket.

BARK POCKET is a patch of bark partially or wholly enclosed in the wood. It may result from wood and bark forming over a place where the tree has been injured. As a defect it is measured in the same manner as a Pitch Pocket.

Streaks and Discolorations.

PITCH STREAK.—A well defined and conspicuous accumulation of pitch in the wood cells. It is usually not considered an important blemish unless both springwood and summerwood appear saturated. They are known as small, medium or large depending upon their size with respect to the piece they are in.

SMALL PITCH STREAK.—One whose area does not exceed the product of one-twelfth the width by one-sixth the length of the face on which it occurs.

MEDIUM PITCH STREAK.—One whose area does not exceed the product of one-sixth the width by one-third the length of the face on which it occurs.

LARGE PITCH STREAK.—One whose area exceeds the product of one-sixth the width by one-third the length of the face on which it occurs.

PITH FLECK is a narrow streak, usually brownish, up to several inches in length on the face of a piece resulting from the larvæ of an insect having burrowed in the growing tissue or cells of the tree.

BIRD PECK is a small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. It usually resembles a carpet tack in shape with the point towards the bark and it is usually accompanied by a discoloration extending along the grain and usually to a smaller extent around the layers of growth. A section through the discoloration produced by the bird peck produces what is commonly known as "Mineral Streak."

GUM SPOT OR STREAK is an accumulation of gum-like substance occurring as a small patch or streak in the piece. It may occur in conjunction with a bird peck or other injuries to the growing wood.

DISCOLORATIONS on or in lumber are enumerated as weather, sticker, water or fungus (such as blue stain, etc.) stain, brown stain, kiln burn and similar color changes due to a combination of temperature, moisture, chemicals, etc. Discoloration may follow insect attack, bird peck, etc. Well defined di[illegible]

LIGHT DISCOLORATION is paler than the medium discoloration and occurs in approximately one-fourth of the stained stock.

MEDIUM DISCOLORATION is a shade most commonly found and which occurs in approximately one-half of the stained stock.

HEAVY DISCOLORATION is darker than the medium discoloration and occurs in approximately one-fourth of the stained stock.

DECAY is disintegration of the wood substance due to the action of certain kinds of fungi. A few of the rot-producing fungi which start in the standing tree do not seem to seriously develop after the tree is cut into lumber.

RED HEART of the pines, spruces, Douglas fir and some other conifers, and peck of cypress and incense cedar are produced by fungi of this type. Decay may be classified as incipient and advanced decay.

INCIPIENT DECAY is the early stages of decay, usually detected by a discoloration of the wood which seems to be firm and solid.

ADVANCED DECAY or rot is noticeable as a decided softening or breaking down of the wood.

WATER STAIN, or what are sometimes called scalded or burnt spots, usually caused by timber lying in the water under certain conditions before it is sawed, and burnt spots where timber is improperly piled while green, are not considered defects, as they do not affect the strength of the piece.

"SAP"—SAPWOOD is the alburnum of the tree—the exterior part of the wood next to the bark. Sapwood is not considered a defect except as provided herein.

SOUND HEART.—The term "Sound Heart" is used whenever that part of the piece which was originally the central part or core of the tree is sound and solid, not decayed.

CROSS GRAINED WOOD is that in which the wood cells or fibers do not run parallel with the axis or sides of a piece. It may be classified as spiral, diagonal, wavy, dip, curly and interlocked grain. The slope of the grain can be determined by observing the direction of surface checks, resin ducts, pores of the wood, annual layers of growth, etc. A drop of stained liquid such as ink tends to elongate in the direction of the grain when placed on a smooth surface of the piece.

SPIRAL GRAINED WOOD is that in which the fibers take a more or less winding or spiral course, such as occurs in a twisted tree. It may be detected on the flat grain (plain sawed or tangential) surface.

DIAGONAL GRAINED WOOD is that in which the fibers extend at an angle (i. e., diagonally) across a piece as a result of sawing at an angle across the annual layers of growth. It may appear on either the radial or tangential surface.

WAVY GRAINED WOOD is that in which the fibers take the form of waves or undulations as indicated by the wavy surface of the split piece. It may appear on either the radial or tangential surface.

DIP GRAINED WOOD is that which has one wave or undulation of the fibers such as occurs around knots, pitch pockets, etc.

CURLY GRAINED WOOD is that in which the fibers are distorted so that they take a curled direction as in "Birdseye Wood." These patches may vary up to several inches in diameter.

INTERLOCKED GRAIN is wood that shows spiral grain in one direction for a number of years and then the slope of the grain in the succeeding annual layers of growth turns in a reverse direction around the tree, then later reverses back, etc.

Distortions and Crooks.

CROSS BREAK is a separation of the wood cells across the grain. It may be due to tension resulting from unequal longitudinal shrinkage or mechanical stresses.

COMPRESSION FAILURE is a wrinkling or buckling of the wood cells extending in a more or less irregular plane across the grain. It is due to longitudinal crushing or compression.

COLLAPSE is a caving in of the surface of a piece. It sometimes occurs in streaks giving the surface a corrugated appearance, and is often due to the flattening of the cells when drying wet wood at high temperatures.

WARPING is any variation from a true or plane surface. It includes crook, bow, twist or any combination of these.

CROOK is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest departure from a straight line. It is known as slight, small, medium and large.

Unless otherwise specified, the different degrees of crook based on a piece four (4) inches wide and 16 feet long shall be as follows:

SLIGHT CROOK, a departure of one (1) inch.

SMALL CROOK, a departure of 1½ inches.

MEDIUM CROOK, a departure of 2 inches.

LARGE CROOK, a departure of over 2 inches.

For wider pieces it shall be ⅛-inch less for each additional 2 inches of width.

Shorter or longer pieces shall have the same limits for curvature.

BOW is a deviation flatwise from a straight line drawn from end to end of a piece, measured at the point of greatest distance from a straight line.

CUPPING is the curvature of a piece across the grain or width of a piece.

TWISTING is the turning or winding of the edges of a piece so that four corners of any face are no longer in the same plane (i. e., it is the twisting of an edge around the axis of the piece).

WANE is bark or the lack of wood from any cause on the edge of a piece

SPECIFICATIONS.

Defects of Manufacture, Applicable to All Timber and Lumber.

1. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

2. In structural timber defects of manufacture have usually been omitted, being of minor significance.

3. Imperfect manufacture in dressed stock, such as torn grain, loosened grain, slight skips in dressing, wane, broken knots, mismatched, insufficient tongue or groove for flooring, ceiling, drop siding, etc., shall be considered defects, and will reduce the grade according as they are slight or serious in their effects on the use of the stock.

4. Torn grain consists of a part of the wood having been torn out in dressing. It occurs around knots and curly places and is of four distinct characters: slight, medium, heavy and deep. Slight torn grain shall not exceed 1/32-inch in depth; medium 1/16 and heavy 1/8-inch. Any torn grain heavier than 1/8-inch shall be termed deep.

5. Loosened grain consists in a point of one grain being torn loose from the next grain. It occurs on the heart side of the piece and is a serious defect, especially in flooring.

6. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of cut and, as usually found, should not be classed as torn grain, and shall be considered a defect only when it unfits the piece for use intended.

7. Pieces of Flooring, Drop Siding or Partition with 3/16-inch or more of tongue; and pieces of Ceiling with 1/8-inch or more of tongue; and pieces of Ship Lap with 3/16-inch of lap will be admitted in any grade.

8. Pieces of Flooring, Drop Siding, Ceiling or Partition having not less than 1/16-inch tongue will be admitted in No. 2 Common. Pieces of Ship Lap having less than 3/16-inch and not less than 1/8-inch lap shall be admitted in No. 2 Common.

Standard Sizes.

1. In the absence of a special agreement between buyer and seller for each order, the following sizes shall be standard for all lumber and timber.

2. "Rough timbers sawed to standard size" means that they shall not vary over one-quarter (1/4) inch scant from the nominal size specified. For instance, a 12x12-inch timber shall measure not less than 11¾x11¾ inches.

3. "Standard Dressing" means that not more than 1/4-inch shall be allowed for dressing each surface. For instance, a 12x12-inch timber, [illegible] measure 11¾x11¾ inches.

Dimension S1S1E.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
2	1⅝	4	3⅝
2½	2⅛	5	4⅝
3	2⅝	6	5⅝
4	3⅝	7	6⅝
5	4⅝	8	7½
...	...	9	8½
...	...	10	9½
...	...	12	11½
...	...	14	13½
...	...	16	15½

Standard lengths are multiples of two feet, 4 to 24 feet, inclusive, but lengths shorter than 10 feet shall not be included in miscellaneous or mixed shipments except by agreement.

Common Boards and Strips.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1 R	⅞	4	3⅝
1 S 1 S	⅞	6	5⅝
1 S 2 S	⅞	8	7½
1¼	1 1/16	10	9½
1½	1 5/16	12	11½

Dressed Finishing Lumber S1S

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
⅜	5/16	4	3⅝
½	7/16	5	4⅝
⅝	9/16	6	5⅝
¾	⅝	7	6⅝
1	⅞	8	7½
1¼	1⅛	9	8½
1½	1⅜	10	9½
2	1¾	12	11½
2½	2⅛	14	13½
3	2⅝	16	15½

The standard lengths are [illegible] of one [illegible]

Flooring.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	...	...	....
1/2	...	...	....
5/8	...	...	....
		Tongue and Groove	
3/4	11/16	3	2 3/8
1	13/16	4	3 1/4
1 1/4	1 1/16	5	4 1/4
1 1/2	1 5/16	6	5 1/4
2	1 5/8	6 Factory	5 1/8
2 1/2	2 1/8	...	....
		Splined	
3	2 5/8	6	5 1/2
3 1/2	3 1/8	7	6 1/2
4	3 5/8	8	7 1/2
...	...	9	8 1/2
...	...	10	9 1/2
...	...	12	11 1/2
		Shiplap	
...	...	6	5
...	...	7	6
...	...	8	7
...	...	9	8
...	...	10	9
...	...	12	11

Standard lengths are multiples of one foot from 4 to 20 feet. Five per cent. of 8 or 9 foot lengths is allowed in mixed length shipments of "B and Better" and in addition five per cent. of 6 or 7 feet in C, D and No. 1 Common, and in addition five per cent. of four or five feet in No. 2 Common, No. 3 Common, 4 to 20 feet inclusive.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Ceiling.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/16	5	4 1/4
...	...	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot, from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better" Ceiling and in addition five per cent. of 6 or 7 feet in No. 1 Common, and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Partition.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/16	5	4 1/4
3/4	11/16	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot.
Same percentage of short lengths is allowed as in ceiling.

Grooved Roofing.

Nominal thickness one (1) inch, actual thickness 13/16-inch.

Nominal Width Inches	*Actual Width Inches*
8	7 1/2
10	9 1/2
12	11 1/2

Roofers.

Roofers shall be made of No. 2 boards, 13/16-inch machine run, center matched and of nominal widths 6 or 8 inches as specified.

Fencing.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1	13/16	3	2 5/8
1 1/4	1 1/16	4	3 5/8
1 1/2	1 5/16	5	4 5/8
...	...	6	5 5/8

Drop Siding, D&M.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
5/8	9/16	3	2¼
¾	11/16	4	3¼
1	¾	5	4¼
1¼	...	6	5¼
1½	...	...	...

Drop Siding, Worked Shiplap and Rustic.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch.

Nominal Width Inches	*Actual Width Inches*
6	5⅛
8	7⅛
10	9⅛

Standard Lengths are multiples of 2 feet from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better Drop Siding," and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

Shiplap.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch, ⅜-inch lap.

Nominal Width Inches	*Actual Width Inches*
4	3⅛
6	5⅛
8	7⅛
10	9⅛
12	11⅛

Bevel Siding.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
½ ¼ E	7/16 and 3/8	4	3½
.....	.....	5	4½
.....	.....	6	5½
⅝ ¼ E	9/16 and 7/16	...	...
¾ ¼ E	.....	8	7¼
.....	.....	10	9¼
.....	.....	12	11¼

Standard lengths are multiples of one foot, from 4 to 20 feet. Five per cent. of 8 or 9 feet is allowed in mixed shipments of "B and Better," Bevel Siding, and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition, five per cent. of 4 or 5 feet in "No. 2 Common."

The above percentage of short lengths is customary, and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

General Instructions on Grading Timber and Lumber.

1. No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The combinations and evaluations of defects are numerous and the interpretation of classification in grading lumber must be left to practical common sense. The general features of these classes are given by the following description of grades.

2. All lumber is graded with special reference to its suitability for the use intended.

3. With this in view each piece is considered and its grade determined by its general character, including the sum of all its defects.

4. Inspection of lumber is not an exact science and a reasonable variation of opinion between inspectors should be recognized; therefore, a variation of not more than 5 per cent. upon reinspection should not disturb the original inspection.

5. The enumerated defects herein described in any grade are intended to be descriptive of the coarsest piece such grades may contain.

6. In construing and applying these rules, the defects allowed are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

7. In case of a piece of lumber which lies so close to the boundary line between two grades that there is doubt as to which grade it belongs in, it shall be given the lower grade.

8. A shipment of any grade must consist of a fair average of that grade and shall not include an unfair proportion of the better or poorer pieces that would pass in that grade. A shipment of mixed widths shall contain a fair assortment of each width. A shipment of mixed lengths shall contain a fair assortment of each length.

9. Defects in lumber are to be considered in connection with the size of the piece, and for this reason wider and longer pieces will carry more defects than smaller pieces in the same grade. Defects in flooring, ceiling, partition, casing and base, drop siding and rustic are based on a piece 4 inches wide and 12 feet long, except where otherwise specified.

10. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or condition will prohibit a reinspection for the adjustment of claims, except with the consent of all parties interested.

11. What is known as "Yard Lumber," such as Dimension, Common Boards and Finish, etc., is graded from the face side, which is the best

side, except that lumber which is dressed one side only is graded from the dressed side.

12. Factory lumber, which is used for the manufacture of doors, sash, etc., and must show both sides, is always graded from the poorer side. The grade is determined by the quantity of suitable cuttings obtainable in each piece.

13. All dressed lumber shall be measured and sold at the full size of rough material used in its manufacture.

14. All lumber one inch or less in thickness shall be counted as one inch thick.

15. The term "Vertical Grain" is here used as synonymous with edge grain, rift sawed or quarter sawed. The term "Flat Grain" is synonymous with slash grain or plain sawed.

Structural Grades for Bridge and Trestle Timbers.

Southern Yellow Pine and Douglas Fir Specifications.

Density Requirements.

Shall contain only Southern Yellow Pine or Douglas Fir timbers graded in two grades by the following density rules:

Density Rule for Southern Yellow Pine.

1. Dense Southern Yellow Pine shall show on either one end or the other an average of at least six annual rings per inch or eighteen rings in three inches as measured over the third, fourth and fifth inches of a radial line from the pith, and at least one-third (⅓) summerwood for girders not exceeding 20 inches in height, and for columns 16 inches square or less. For larger timbers the inspection shall be made over the central three inches on the longest radial line from the pith to the corner of the piece. Wide ringed material excluded by the above will be accepted, provided the amount of summerwood, as above measured, shall be at least 50 per cent.

2. The contrast in color between summerwood and springwood shall be sharp, and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

3. In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over three inches of an approximate radial line beginning at the edge nearest the pith in timbers over three inches in thickness and on the second inch (on the piece) nearest to the pith in timbers three inches or less in thickness.

4. In dimension material containing the pith but not a five-inch radial line, which is less than two by eight inches in section or less than eight inches in width, that does not show over sixteen square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material which does not show a five-inch radial line, the inspection shall apply to the three inches farthest from the pith.

5. The radial line chosen shall be representative. In case of a disagreement between purchaser and seller as to what is a representative radial line, the average summerwood and number of rings shall be the average of the two radial lines chosen.

Density Rule for Douglas Fir.

1. Dense Douglas Fir shall show, on either one end or the other, an average of at least six annual rings per inch and at least one-third summerwood measured over three inches on a line located as described hereinafter. Coarse-grained material excluded by this rule shall be acceptable provided the amount of summerwood measured as described shall be at least one-half. Material in which the proportion of summerwood is not clearly discernible shall not be accepted.

2. Any timber whose least dimension is less than five inches shall not show the pith (heart) on the inspection end; pieces whose least dimension is five inches or more may contain the pith.

3. When the least dimension is five inches or more, the pith being present, the line over which the rate of growth and per cent. of summerwood measurements shall be made shall run from the pith to the corner farthest from the pith. To find the beginning of the three-inch line, measure a distance of one-half the least dimension of the piece, less two inches, from the pith. This distance may be expressed as follows:

$$a = \tfrac{1}{2}\, d - 2,$$

where a = distance in inches from pith to beginning of three-inch line.
d = least dimension of piece in inches.

4. When the rings are very irregular it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the three-inch line must not be changed.

5. For all pieces where the pith is not present the center of the three-inch line shall be at the center of the end of the piece, and the direction of the three-inch line shall be at right angles to the annual rings.

6. If a radial line of 3 inches cannot be obtained, the measurement shall be made over the entire radial line that is available.

General Requirements.

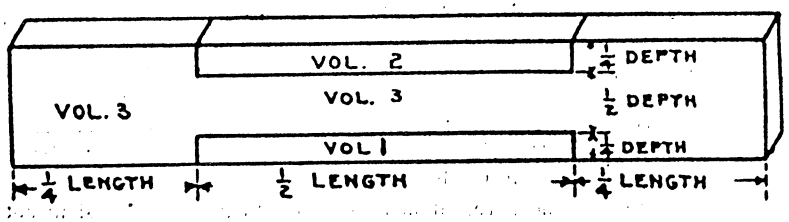
1. Shall consist of lumber well manufactured, square edges and sawed standard size.

2. When the timbers 4x4 inches and larger are ordered sized, they will be ½ inch less than nominal size, either S1S1E or S4S, unless otherwise specified.

3. Structural timbers shall be sound and free from rotten or unsound knots, knots in clusters, decay, round or ring shakes occupying more than one-fourth (¼) the least dimension on either end of a timber (a round or ring shake shall be measured on its vertical projection), injurious diagonal grain or other defects that will materially impair its strength. Shakes shall not show on any face of the timber.

4. Knots limited in size and position as hereinafter provided will be permitted if so fixed by growth or position that they will retain their place in the piece as at time of manufacture.

5. For the limitation of knots in beams in size and location, a beam shall be considered as divided into three volumes as shown below:



Measurement of Knots.

1. In beams, the diameter of a knot on the narrow or horizontal face shall be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

2. In columns, the mean or average dimension of a knot on any face shall be taken as its diameter.

3. Beams shall not have diagonal or spiral grain in Volumes 1 and 2 with slope greater than 1 in 20; in posts the angle shall not be greater than 1 in 15.

4. Posts and beams have different restrictions as to knots and angle of grain and must be listed accordingly in bills of material.

No. 1 Structural.

1. No. 1 Structural timbers shall be of Dense Southern Yellow Pine or Dense Douglas Fir, and shall meet the General Requirements for Structural Grades.

2. This grade shall not have tight pitch pockets over six (6) inches long or over ⅛ inch wide or wane exceeding one (1) inch on one corner or over one-sixth (1/6) the length of the piece.

3. Loose knots larger than one-half (½) inch shall not be permitted.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall show not less than 85 per cent. of heart on each side of the four sides measured across the sides anywhere in the length of the piece.

2. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger in diameter than one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches in a face over six (6) inches. Knots within the center half of the length of a beam shall not exceed in the aggregate the width of the surface of the beam in which they occur.

3. Beams shall not have knots in Volume 3 larger in diameter than one-fourth the width of the face in which they occur, with a maximum for any one knot of 3 inches in diameter.

4. When beams are of two spans length and so marked in bill of materials, Volumes 1 and 2 on inspection shall be considered as extending between points located one-eighth (⅛) the length of the beam from each end.

5. The inspector shall place his stamp on the edge of the beam or stringer to be placed up in service.

Caps and Sills.

1. Caps and Sills shall show 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Caps and Sills shall be free from knots larger than one-fourth (¼) the width of the surface in which they occur with maximum for any one knot of 3 inches in diameter. Knots shall not be in groups.

Posts.

1. Posts shall show not less than 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Posts shall not have knots larger than one-fourth (¼) the least dimension of the posts nor larger than three inches. Knots shall not be in groups.

Longitudinal Struts or Girts.

1. Longitudinal Struts or Girts shall show all heart on one surface; the other surface and two sides shall show not less than 85 per cent. of heart, measured across the face or side anywhere in the length of the piece.

2. Longitudinal Struts or Girts shall be free from knots over two inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

1. Longitudinal Cross Braces, Sash Braces and Sway Braces shall show not less than 85 per cent. heart on two faces.

2. Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Ties and Guard Timbers.

1. Ties and Guard Timbers shall show one side all heart; the other side and two edges shall show not less than 75 per cent. heart, measured across the surface anywhere in the length of the piece.

2. Ties and Guard Timbers shall be free from any large knots or other defects which will materially injure their strength; and where surfaced the remaining rough face shall show all heart.

No. 2 Structural.

1. No. 2 Structural Timbers shall meet the General Requirements for Structural Grades, and shall include timbers not passing the No. 1 Grade because of having less density than is required or greater defects than are permitted.

2. This grade shall not have pitch pockets longer than twelve (12) inches or over ⅛ inch wide or wane exceeding two (2) inches on one corner or the equivalent on two or more corners of 10x10 timbers, with wane in proportion on small or large sizes.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger than as follows:

2. If of Dense Southern Yellow Pine or Dense Douglas Fir, one-third (⅓) the width of the face of the beam in which they occur, up to and including nine (9) inches, nor larger than three (3) inches in a face over nine (9) inches.

3. If not of Dense Southern Yellow Pine or Dense Douglas Fir, one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches, in a face over six (6) inches.

4. Knots in the center half of the length of a beam shall not exceed in the aggregate twice the width of the surface of the beam in which they occur.

5. Beams shall not have knots in Volume 3 larger in diameter than one-third (⅓) the width of the face in which they occur.

6. Loose knots larger than one-half (½) the size of knots allowed above shall not be permitted; beams shall not have loose knots, in Volume 3, larger than one and one-half (1½) inches.

Caps and Sills.

Caps and Sills shall be free from knots larger than one-half (½) the width of the face in which they occur with a maximum for any one knot of three (3) inches in diameter. Knots shall not be in groups.

Posts.

Posts shall not have knots, if of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-third (⅓) of the least dimension of the post, nor larger than four inches; if not of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-fourth (¼) the least dimension of the post, nor larger than three (3) inches.

Longitudinal Struts or Girts.

Longitudinal Struts or Girts shall be free from knots over 2 inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Specifications for Timber to be Treated.

1. Specifications for timber to be treated are the same as for untreated timber, except that no restriction is to be placed upon the amount of sap wood allowed in the timber which is to be treated.

2. Many varieties of timber can be used, if treated, that would not be satisfactory to use in the untreated state on account of being subject to rapid decay if they are not treated.

Commercial Timber and Lumber Grades.

TIMBER.

Selected Common.

1. Selected Common shall be sound, strong timber, well manufactured and free from defects that materially impair its strength. Must be suitable for high-class construction purposes, free from shake, splits, loose or rotten knots. Will allow sound and tight knots, if not in clusters and which in no case shall exceed in diameter one-sixth the width of the face in which such knots occur up to and including 12x12-inch; and further providing that such sound and tight knots in 14x14-inch and larger shall in no case exceed 2½ inches in diameter.

2. The select common grade also will allow tight pitch pockets, not over six inches in length, wane not to exceed one inch on one corner and not exceeding one-sixth the length of the piece.

3. White sap or a slight amount of sound stained sap on the back shall not be considered a defect in this grade.

NOTE.—Commercial Timber and Lumber Grades here given apply to Southern Yellow Pine, Douglas Fir, White Pine, Western Pine, Idaho White Pine, Norway Pine, Spruce, Tamarack and Redwood products.

No. 1 Common.

1. No. 1 Common Timber 6x10 inches and larger shall be sound stock well manufactured and free from defects that will materially weaken the piece. Occasional slight variation in sawing allowed, provided such variation will not reduce size of stick below standard for dressed lumber.

2. Ten by ten-inch timbers may have a 2-inch wane on one corner or the equivalent on two or more corners, checks and season checks not extending over one-eighth the length of the piece. Smaller and larger timbers may have wane in proportion. In addition will allow large sound and tight knots, which approximately should not be more than one-fourth the width in diameter of any one side in which they may appear, spike knots, stained sap one-third the width and slight streak of heart stain extending not more than one-fourth the length of the piece.

No. 2 Common.

No. 2 Common Timbers will admit large, loose or rotten knots; a 10x10-inch may have a 3-inch wane on one corner or the equivalent on two or more corners, larger and smaller sizes in proportion; shake or rot that does not impair its utility for temporary work.

Dimension Plank, Joists, Scantling and Small Timbers.

Selected Common.

1. Selected Common shall be sound, strong lumber well manufactured and free from defects that materially impair the strength. Must be suitable for high-class construction purposes and free from shake, loose or rotten knots.

2. Will allow occasional variation in sawing, sound and tight, small and standard knots and tight pitch pockets not over 6 inches in length.

3. Twelve inches and wider may contain, in addition to the above, a couple of large knots not to exceed 2 inches in diameter when well placed, a slight amount of sap admissible.

No. 1 Common.

1. No. 1 Common must be sound stock, well manufactured and suitable for all ordinary construction purposes without waste and must be sound and tight-knotted stock.

2. Will admit knots which in a 2x4 or 3x4 piece may be approximately 1½ inches; in a 2x6-inch or 3x6-inch piece, 2 inches; in a 2x8-inch or 3x8-inch or 2x10-inch or 3x10-inch piece, 2½ inches; and one-fourth the width of the piece in 12 inches and wider; spike knots that do not materially weaken the piece; wane not over one-fourth the thickness of the piece 1 inch wide on face up to 6 inches, and 1½ inches wide on face of 8 inches and wider, extending not more than one-third the length of the piece or a proportionate amount for a shorter distance on both edges; in any case one side and two edges should provide a good nailing surface and in no case shall wane extend over one-half the side of the piece.

3. Pith knots or small defective knots which do not weaken the piece more than the knots above allowed are admitted, solid pitch, pitch pockets, sap stain, a limited number of worm holes well scattered, limited torn grain, seasoning checks, splits in ends, not exceeding in length the width of the piece, firm red heart, heart shakes that do not go through.

4. May contain crook of 1½-inch in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length longer or shorter than 16 feet of No. 1 Common Dimension may contain crook in proportion to the above.

No. 2 Common.

1. This grade shall consist of lumber suitable for a cheaper class of construction than No. 1 Common.

2. Will admit large, coarse sound knots, which in a 2x4 and 3x4-inch piece should not be larger than 2½ inches in diameter; in 2x6 or 2x8 or 3x6 or 3x8-inch pieces, 3 inches, and in 2x10 or 3x10 or wider pieces one-third the width of the piece in diameter, spike knots, smaller, loose, hollow or rotten knots that do not weaken the piece more than the knots aforesaid, worm holes well scattered, large pitch pockets, rotten streaks, small amount of fine shake, split not to exceed one-quarter the length of the piece, heart and sap stains in any amount, decayed sap, wane if leaving a fair nailing surface.

3. May contain crook of 2 inches in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length shorter or longer than 16 feet may contain crook in proportion to the above.

4. Miscut 2-inch Common which does not fall below 1½ inches in thickness or ⅛ inch scant in width from standard size, shall be admitted in No. 2 Common, provided such pieces are in all other respects as good as No. 1 Common at point of miscut.

5. A very serious combination of above defects must not be permitted in any one piece.

No. 3 Common.

1. No. 3 Common will include all pieces falling below No. 2 Common which are sound enough to use for cheap building material by wasting 25 per cent. of each piece or one-third of number of pieces in any one item of a shipment but it must not be more than ½ inch scant of standard finished width nor ⅜ inch scant of standard finished thickness. This grade will admit a greater degree of all the imperfections allowed in No. 1 and No. 2 Common, but shall not admit useless culls.

Boards, Ship Lap and D & M.

Selected Common.

Selected Common shall be square edged, well manufactured. Will admit sound tight knots not over 1 inch in diameter in 4-inch and 6-inch, not over 1½ inches diameter in 8-inch, medium sized tight pitch pockets not over 6 inches in length, two pith knots, the equivalent of one split not to exceed in length the width of the piece, torn grain, pitch pockets, slight shake, sap stain, seasoning checks, firm red heart, small amount of slightly stained sap. These boards must be of a sound, strong character.

No. 1 Common.

1. No. 1 Common will admit any two of the following or their equivalent of combined defects:

2. Sound and tight knots approximately 1½ inches in diameter in 4 and 6-inch; 2 inches in diameter in 8 and 10-inch; 2½ inches in 12-inch and not over 3 inches in diameter in widths over 12 inches.

3. Pitch pockets, seasoning checks, one straight split not longer than the width of the piece, sap stain, slight streak of heart stain, pith knots, torn grain, slight shake, firm red heart, wane ½ inch deep on edge not exceed-

ing 1 inch in width on face and extending not over one-third the length of the piece, a limited number of pin worm holes well scattered.

4. These boards must be firm, sound and suitable for use in ordinary construction except finishing purposes without waste.

5. No. 1 Common Ship Lap or D & M or Barn Siding shall be graded by rules governing No. 1 Common Boards except as to wane which shall not be so deep as to extend into the tongue or one-half the thickness of the top lip on the groove in D & M, or over one-half the thickness of the lap in Ship Lap on the face side; pieces of Ship Lap with ⅛ inch of lap will be admitted in any grade.

No. 2 Common.

1. No. 2 Common will admit large coarse knots not necessarily sound, approximately 2 inches in diameter in 4 and 6-inch stock; 2½ inches in 8 and 10-inch and one-third the width of the piece in 12-inch and wider, spike knots, solid heart or sap stain, solid pitch or pitch pockets, a limited number of well scattered worm holes, splits one-fourth the length of the piece. Small amount of fine shake, wane 2 inches wide if it does not extend into the opposite face, or through heart shakes over one-half the piece or through rotten streaks when firm, ½ inch wide over one-fourth the length of the piece or its equivalent of unsound red heart or combination of defects equivalent to the above but a serious combination of above defects in any one piece not permitted.

2. A knot hole 2 inches in diameter will be admitted provided the piece is otherwise as good as No. 1 Common.

3. Miscut 1-inch Common Boards which do not fall below ¾ inch in thickness shall be admitted in No. 2 Common, provided the grade of such thin stock is otherwise as good as No. 1 Common.

No. 3 Common.

No. 3 Common will admit of stock below the grade of No. 2 Common that is suitable for cheap sheathing. The general appearance is coarse. It will admit large coarse knots without restrictions as to size, loose knots, unsound knots, knot holes, pitch pockets, solid pitch, very wormy pieces, shake, heart or sap stain, decayed sap, decayed streaks, well scattered small rotten spots, split, blue sap, wane, but a serious combination of above defects in any one piece not permitted. It should cut 75 per cent. of lumber as sound as No. 2 Common.

No. 4 Common.

1. No. 4 Common shall include all pieces that fall below the grade of No. 3 Common, excluding such pieces as will not be held in place by nailing, after wasting one-fourth the length of the piece by cutting into two or three pieces.

2. The predominating defect characterizing this grade is red rot. Other defects are numerous large worm holes, several knot holes, or pieces that are extremely coarse knotted, wany, shaky or badly split, extremely cross-checked.

No. 5 Common.

No. 5 Common is the lowest grade and admits of all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

Thick Common Lumber.

Common lumber, 1¼ inches and thicker, shall be graded the same as 1-inch lumber.

Rough Stock for Finish.

1. Finish must be evenly manufactured and shall embrace all sizes from 1 to 2 inches inclusive in thickness by 3 inches and over in width.

2. One, 1¼ and 1½-inch finishing lumber unless otherwise ordered shall measure when dry not more than ⅛ inch scant in thickness and 2-inch not more than ⅛ inch scant in thickness when seasoned.

3. Stock width shipments of "C" and "Better," either rough or dressed on one or two sides, shall be accepted as standard where not more than 20 per cent. of any shipment is ¼ inch scant on 8-inch widths and under; ⅜ inch scant on 9 or 10-inch; and ½ inch scant on 11 and 12-inch and wider when seasoned; pieces narrower than the above and pieces in excess of 20 per cent. of the shipment that are of the minimum measurement given, should be measured as of the next lower standard width and not reduced in grade.

4. Standard lengths are 8 to 20 feet; and in shipments of mixed lengths, 5 per cent. of 8 feet in grade of "C" and "Better," shall be admitted. The above percentage of short lengths is customary and in the interest of conservation will be included as far as practicable in all shipments of mixed lengths.

5. Wane and other defects that will dress out in working standard sizes are admissible.

6. Finishing lumber ordered rough if thicker than count thickness for dry or green stock, may be dressed to such count thickness, and when so dressed, shall be considered as rough.

7. Rough finish shall be graded on the best side, but the reverse side must not be more than one grade lower.

8. Subject to the foregoing provisions, Rough Finishing Lumber shall be graded according to the rules applying to Dressed Finishing Lumber.

9. When like grade on both faces is required, special contract must be made.

Dressed Finishing Lumber.

Selected Flat Grain.

1. Selected Flat Grain shall be finishing lumber free from all sap or defects on face and edges and shall be selected for beauty and character of grain.

2. "A" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides up to and including 12 inches in width, must show one face practically clear of all defects, except that it may have such wane as would dress off if surfaced four sides; 13-inch and wider "A" Finishing will admit two small defects or their equivalent. "B" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides, up to and including 10 inches in width in addition to the equivalent of one split in end which should not exceed in length the width of the piece, will admit any two of the following or their equivalent of combined defects: slightly torn grain, three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, 5 per cent. of sap stain or firm red heart; wane not to exceed 1 inch in width, ¼ inch in depth and one-sixth the length of the piece, small seasoning checks.

3. Eleven-inch and wider "B" Finishing will admit three of the above defects or their equivalent, but sap stain or firm red heart shall not exceed 10 per cent.

4. "C" Finishing up to and including 10-inch in width will admit in addition to the equivalent of one split in end which should not exceed in length the width of the piece, any two of the following, or their equivalent of combined defects: 25 per cent. of sap stain, 25 per cent. firm red heart, two standard pitch streaks, medium torn grain in three places, slight shake, seasoning checks that do not show an opening through, two standard pitch pockets, six small pitch pockets, two standard knots, six pin knots, wane 1 inch in width, ½ inch in depth and one-third the length of the piece. Defective dressing or slight skips in dressing will also be allowed that do not prevent its use as finish without waste. Eleven-inch and 12-inch "C" Finishing will admit one additional defect or its equivalent. Pieces wider than 12 inches will admit two additional defects to those admitted in 10-inch or their equivalent, except sap stain which shall not be increased.

Selected Flat Grain.

Pieces otherwise as good as "B" will admit of twenty worm holes.

Special Finish.

In case both sides are desired, "A," "B" or "C" grade, or free from all defects, special contract must be made. Defective dressing or slight skips in dressing on the reverse side of Finishing are admissible.

MOULDED CASING, BASE, WINDOW AND DOOR JAMBS.

1. Moulded Casing and Base shall be worked to ¾ inch thick as per established patterns.

2. Window and Door Jambs are to be dressed, rabbeted and plowed as ordered.

GRADES A, B AND C.

1. "A" Grade must be practically free from defects on the face side and well manufactured.

2. "B" Grade shall admit the same defects as are admissible in the same widths of "B" Finishing except wane.

3. "C" Grade shall admit the same defects as are admissible in the same widths of "C" Finishing except wane.

MOULDING.

1. "B and Better" Moulding. One-third of any item may contain any one of the following defects or its equivalent: One pin knot, small pitch pockets, pitch 1 inch wide, 6 inches long, three pin worm holes, slight defects in dressing.

2. Standard lengths; 8 feet and longer, and in shipments of mixed lengths 5 per cent. of 6 or 7 feet shall be admitted, even though the number of feet of each length be specifically stated.

DROP SIDING.

1. Defects named in Drop Siding are based upon a piece manufactured from 1x6—12 feet, and pieces larger or smaller than this will take a greater or lesser number of defects, proportioned to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Drop Siding may be as follows:

3. Sixteen-foot lengths as a basis for 4-inch widths, 3-inch crook.

4. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

5. Lengths longer or shorter than 16 feet may have a proportional amount of crook.

6. In all grades of Drop Siding wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible, providing the wane does not extend into the tongue.

"A" Drop Siding.

1. "A" Drop Siding must be practically free from defects on the face side and well manufactured.

2. Slight roughness in dressing admissible.

3. A piece 14 feet or longer may have one defect located 4 feet or more from the end that can be cut out by wasting not more than 1½ inches of the length, provided balance of piece be practically free from other defects.

"B" Drop Siding.

1. "B" Drop Siding will admit any two of the following defects: Medium torn grain, three pin knots, one standard knot, 15 per cent. sap stain, 15 per cent. firm red heart, small seasoning checks, six pin worm holes or any one of the above defects combined with either three small pitch pockets or one small pitch streak.

2. A piece that is otherwise as good as "B" grade may have a defect that can be cut out by wasting not more than 2½ inches in the length of the piece, providing the defect is 4 feet or more from the end.

No. 1 Drop Siding.

1. No. 1 Common Drop Siding will admit numerous small or several medium or one large pitch pocket, one standard pitch streak and in addition sound knots not over one-half the width of the piece in the rough, a couple of small knot holes, pin worm holes or a few well scattered grub worm holes, sap stain, firm red heart, slight shake, heavy torn grain, seasoning checks that do not show an opening through, defects in manufacturing that will lay without waste. A very serious combination of above defects not permissible in any one piece.

2. Pieces otherwise as good as "B" Drop Siding may have one defect (like a knot hole) that can be cut out by wasting 2½ inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

No. 2 Common Drop Siding.

No. 2 Common Drop Siding admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

Bevel Siding.

Bevel Siding shall be graded according to the rules for Drop Siding and will admit in addition slight imperfections on the thin edge, which will be covered by the lap when laid 2½ and 4½ inches to the weather.

Rustic Siding.

Rustic Siding shall be graded according to the rules for Drop Siding.

Flooring.

Special.

1. Defects named in Flooring are based upon a piece manufactured from 1x4—12 feet long, and pieces larger or smaller than this will take a greater or lesser number of defects proportioned to their size on this basis, except that standard knots shall not exceed 1¼ inches in diameter in 3-inch flooring.

2. The amount of crook permissible in No. 1 Common and Better Flooring may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook.

7. Standard Matched Flooring to be surfaced two sides with scored back.

8. Center Matched Flooring (S2S and C. M.) shall be required to come up to grade on one side only, and the defects admissible on the reverse side of standard match shall be allowed.

Grades A, B, C, D, and No. 1 Common Edge or Vertical Grain.

Grades A, B, C, D, No. 1 Common, No. 2 Common, No. 3 Common or No. 3 Sheating, Flat Grain.

Grade "A" Edge Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade shall be well milled on face, must have perfect edges and be practically free from all defects on the face side. Bright sap showing not more than one-third of face half the length of piece will be admitted.

Grade "B" Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following or their equivalent of combined defects: Five per cent. sap stain, 15 per cent. firm red heart, three pin knots, one standard pitch streak, slight torn grain, small seasoning checks.

Grade "C" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following defects or their equivalent or combined defects. Fifteen per cent. sap stain, 25 per cent. firm red heart, six pin knots, two standard knots, small pitch pockets, two standard pitch pockets, two standard pitch streaks, twelve pin worm holes, slight shake that does not go through, seasoning checks that do not show an opening through, medium torn grain or other machine defects that will lay without waste.

2. A piece 12 feet or longer otherwise as good as "B" may have a defect that can be cut out and the piece laid with a loss of not more than 2½ inches in its length, providing the defect is 4 feet or more from the end of the piece.

Grade "D" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit the following defects or their equivalent of combined defects: Sap stain, firm red hearts, sound knots not over one-half the cross-section of the piece in the rough and any one point throughout its length, three pith knots, pitch, pitch pockets, a limited number of pin worm holes, well scattered, shake that does not show an opening through, loosened or heavy torn grain or other machine defects that lay without waste.

2. Pieces otherwise as good as "B" Flooring may have one defect (like a knot hole) that can be cut out by wasting 20 inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

3. It is generally understood that this grade will admit such defects or combination of defects as will not impair its utility for cheap floors.

4. No. 1 Common Flooring is the combined grade of C and D Flooring and will admit all pieces that will not grade "B" and are better than No. 2 Common Flat Grain Flooring.

5. Flat Grain Flooring shall take the same inspection as Edge or Vertical Grain, except as to requirement of angle of the grain.

No. 2 Common Flooring.

1. Admits all pieces that will not grade as good as "D" Flooring that can be used for cheap floors without waste of more than one-fourth the length of any one piece.

2. Pieces of flooring having not less than ⅛ inch tongue will be admitted in No. 2 Common.

No. 3 Common or No. 3 Sheathing.

Admits all pieces that cannot be used as No. 2 Common Flooring but are still available as cheap sheathing or lathing without waste of more than one-fourth the length of any one piece.

Ceiling.

1. Defects in Ceiling are based upon a piece manufactured from 1x4—12 feet long and pieces larger or smaller than this will take a greater or lesser number of defects, proportionate to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Ceiling may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook. In all grades of Ceiling wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible providing the wane does not extend into the tongue.

7. Ceiling may be specified either as Edge or Vertical Grain or Flat Grain. The inspection will be the same for either kind.

"A" Ceiling.

"A" Ceiling must be practically free from defects on the face side, well manufactured, will admit of slight roughness in dressing, through close pitch pockets, each not to exceed 2 inches in length, or one sound and tight smooth pin knot, or the equivalent of combined defects.

"B" Ceiling.

1. "B" Ceiling will admit of any two of the following defects or their equivalent of combined defects: Slight torn grain, three pin knots, two small or one standard knot, three small pitch pockets, any two of which may be open, one standard pitch pocket, one small pitch streak, small seasoning checks, 15 per cent. sap stain, 15 per cent. firm red heart, six pin worm holes.

2. A piece otherwise as good as No. 2 may have a defect that can be cut out and the piece laid with a waste of not more than 2½ inches in length, providing the defect is 4 feet or more from the end of the piece.

No. 1 Common Ceiling.

1. No. 1 Common Ceiling will admit the following defects or their equivalent of combined defects: Heavy torn grain, sound knots not over one-half the cross-section of the piece in the rough, pitch, pitch pockets, seasoning checks that do not show an opening through, a sap stain, firm red heart, slight shake, defects in manufacture that will lay without waste, a limited number of pin worm holes well scattered.

2. Pieces otherwise as good as "B" Ceiling may have one defect (like a knot hole) that can be cut by wasting 2½ inches of the length of the piece, providing both pieces are 10 inches or over in length after cutting out such defects.

No. 2 Common Ceiling.

1. No. 2 Common Ceiling admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

2. Pieces of Ceiling having not less than ⅛ inch tongue, will be admitted in No. 2 Common.

Partition.

Grades "A," "B," No. 1 Common and No. 2 Common. Partition shall be graded according to Ceiling rules and must meet the requirements of the specified grades on the face side only, but the reverse side shall not be more than one grade lower, and shall not cause waste in No. 1 Common and Better.

Specifications for Construction Oak.

General Instructions.

Those who are not familiar with the anatomy of the oak tree should, when reading over these rules, take into consideration that the rule describes the poorest piece that goes into the grade and that a large per cent. is above the grade described.

Definition of Oak for Construction Purposes.

1. The term "Construction Oak" means all such products of oak in which the strength and durability of the timber is the controlling element in its selection and use. The following is a list of products which are recommended for consideration as "Construction Oak."

2. Firsts are to be sound and free from heart shakes and checks, but may have other defects as follows:

Construction Oak.

Trestle and Bridge Timbers.—Mud Sills, Stringers, Caps, Posts, Bracing, Bridge Ties, Struts, Guard Rails, Girts, Sash and Sway Braces.

Docking and Platform Timbers.—Mud Sills, Posts, Bracing Caps, Stringers, Joists, Dock and Platform or Flooring Plank and Wales.

Platform or flooring plank can be either square-edged or matched.

Framing for Building.—Mud Sills, Posts, Girders, Framing Joists, etc.

Bridge and Crossing Plank.—Railroad Crossing Plank, Bridge Floor Planking.

Sheet Piles.—Same as Crossing Plank, except may contain an unlimited amount of heart.

Round Piling.

Stock Guards.

Track or Bumper Posts.

Standard Names for Construction Oak.

Unless specifically mentioned, the terms "White Oak" and "Red Oak" include the following:

"White Oak."	"Red Oak."
White Oak	Red Oak
Chestnut or Tanbark Oak	Pin Oak
Burr or Mossy Cup Oak	Black Oak
Rock Oak	Water Oak
Post or Iron Oak	Willow Oak
Overcup Oak	Spanish Oak
Live Oak	Turkey Oak
Basket or Cow Oak	Black Jack or Barn Oak
Swamp Post Oak	Shingle or Laurel Oak
Yellow or Chinquapin Oak	Scarlet Oak

The term "Mixed Oak" means any kind of oak.

Specifications for Structural Oak Timbers.

General Requirements.

(1) Except as noted, all Structural Timbers shall be White Oak, to be sound timber and sawed specified sizes, free from ring shakes, crooked grain, rotten knots, large knots in groups, rot, dote, wane in amounts greater than allowed in these specifications.

Boxed Hearts.

(2) Boxed Hearts are permitted in pieces of 5 by 5 inches square and larger. The center of the heart should be boxed as near the center of the piece as practical, and not to exceed 30 per cent. of the pieces can have the center of the heart nearer than 1½ inches from any face; 20 per cent. may show one heart face, corner or edge, not to exceed 75 per cent. of the length of the piece.

Wane.

1. The term 20 per cent. of number of pieces or amount shipped refers to each item and size of each car shipped.

2. Pieces 5x5 to 8x8 inches square may show 1 inch wane, side measurement, on any two corners or edges, and this wane not to exceed more than 25 per cent. of the length of the piece singly, or 50 per cent. in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 50 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

3. Pieces over 8x8, including 12x12 inches square, may show 1½ inch wane, side measurement, edge of any two corners or edges, and this wane not to exceed more than 33⅓ per cent. of the length of the piece singly or 66⅔ per cent. in aggregate. In the absence of wane on all of the length of the piece as above described, not to exceed 20 per cent. of the number of pieces may have this defect.

4. Pieces over 12 by 12 inches square may show 1¾ inch side measurement, any two corners or edges, and this wane not to exceed more than 40 per cent. of the length of the piece singly, or 80 per cent. in aggregate, in the absence of wane on all corners, excepting one, the corner may contain wane 80 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

5. In event that pieces have two faces as wide as above described and two faces narrower, the proportion of the amount of wane is admissible.

6. Pieces 1 inch to 5 inches thick, not exceeding 8 inches wide, are governed by defect specifications above mentioned, with the exception that they shall not contain wane, and not to exceed 20 per cent. of pieces 2 inches and thicker may show sound heart on one face; pieces under 2 inches thick must be free of heart. Pieces 8 inches and wider may contain wane as per paragraphs b and d.

7. Rough sizes of Structural Timber shall not vary more than ¼ inch from specified size. Dressed sizes shall be ½ inch less than nominal size after dressing.

Bridge, Dock, Crossing Plank.

1. Lengths, cut to order.
   Widths, cut to order.
   Thickness, cut to order.

2. Sizes cut to order, probably 2 inches, 3 inches and 4 inches thick, 6 inches, 8 inches, 10 inches and 12 inches wide, 12 feet, 14 feet and 16 feet long.

3. This product is intended to work full one good sound face, and this face side must be square edge. Sound knots, small pin and spot worm holes no defect on face side.

4. Must be free from rot and shake; practically square edges, admitting 1 inch of wane on each edge of reverse face, running two-thirds the length. Sound hearts on one side, rafting pin holes, knot holes or grub holes not exceeding 2 inches in diameter admitted.

Sheet Piles.

Same as Ties, except that it may contain sound heart in heart check.

Stock Guards.

To be governed by specifications for Construction Oak.

Track End or Bumping Posts.

To be governed by specifications for Structural Timbers.

Classification and Grading Rules for Cypress Lumber and Shingles.

General Instructions.

Cypress lumber shall be graded according to the following rules and specifications, bearing in mind that as no arbitrary set of rules and specifications can be maintained in every case each must be left to the common sense and best judgment of the inspector.

1. Lumber shall be manufactured and shipped in standard lengths and thickness.

2. Tank, 1st and 2d and worked partition shall be graded from the poorer side.

3. Select lumber, flooring, ceiling, bevel siding and finishing shall be graded from the better or finished side, but the reverse side should in no case be more than one grade lower.

4. All lumber shall be tallied surface or face measure, the tally counted up, and the one-quarter or one-half added to the total where the lumber is one and one-quarter or one and one-half inches thick, and 2 inches and thicker to be multiplied by the thickness.

5. In the measurement of all lumber, fractions exactly on the one-half foot are to be given alternately to the buyer and seller; the fractions below the one-half foot are to be dropped, and all fractions above one-half foot are to be counted to the next higher figure on the board rule.

6. In "line boards," pieces 14 feet and longer shall be given the advantage in grade; pieces 12 feet and shorter shall be reduced in grade.

7. Recognized defects in cypress are knots, knot holes, shakes, splits, wane, wormholes, stained sap and peck.

Standard Lengths.

1. Random standard length stock may be furnished in odd as well as even foot lengths, but there shall not be to exceed 20 per cent. of odd lengths in any one item.

2. Tank stock and No. 1 barn shall be 8 feet and longer.

3. 1st and 2d and select shall be 10 to 20 feet.

4. Finish flooring, ceiling partition, bevel and drop siding shall be 10 to 20 feet.

5. Moldings and battens of all sizes 6 to 20 feet, in both odd and even foot lengths, but not exceeding 10 per cent. of 6, 7, 8 and 9 foot lengths.

6. No. 2 barn, 6 feet and longer.

7. Cull or peck, 4 feet and longer.

Standard Finished Sizes of Cypress.

1. Lumber shipped in the rough (except 8/4 inch No. 1 and No. 2 "Dimension," which grades may be ¼ inch under or ¼ inch over the size specified, both in thickness and width) shall be of sufficient thickness to S2S to standard thickness, as follows:

2. 4/4 Lumber S1S or S2S shall be ⅞ inch thick.

3. 5/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅛ inches thick.

4. 6/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅜ inches thick.

5. 6/4 Peck, No. 1 and No. 2 barn and finishing lumber S1S or S2S shall be 1⅝ inches thick.

6. 8/4 Lumber, except No. 1 and No. 2 barn dimension S1S or S2S, shall be 1¾ inches thick.

7. 8/4 No. 1 and No. 2 barn or dimension S1S or S2S, shall be 1⅝ inches thick.

8. 10/4 Lumber S1S or S2S, shall be 2¼ inches thick.

9. 12/4 Lumber S1S or S2S, shall be 2¾ inches thick.

10. All lumber S1E takes off ⅛ inch. S2E, ½ inch.

11. All flooring shall be S2S and CM.

12. 4/4 Flooring shall be ⅞ inch by 2¼ inch, 3¼ inch, 4¼ inch, 5¼ inch face.

13. 5/4 Flooring shall be 1⅛, 6/4 shall be 1⅜, by same widths as 4/4.

14. 3/8 Ceiling shall be worked ⅜ inch, S1S only.

15. 1/2 Ceiling shall be worked ½ inch, S1S only.

16. 5/8 Ceiling shall be worked ⅝ inch, S1S only.

17. 3/4 Ceiling shall be worked ⅞ inch, S1S only.

18. Widths of ceiling to be same as flooring, unless otherwise specified. Ceiling up to ¾ inch face to have one bead on one edge and ceiling wider than 3¼ inch face to be beaded center and edge.

19. Partition to be finished the same as ceiling, but on both faces.

20. Drop siding shall be worked ¾ inch by 3¼ inch, 4½ inch, 5¼ inch, 7¼ inch, 9¼ inch face, S2S and CM or shiplapped.

21. Bevel siding or bevel cribbing shall be worked ½ inch less in width than the rough strip measure.

Tank Stock.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 5 inches and wider, 1½ inches to 4 inches thick and 8 feet and over in length. Pieces up to 7 inches shall be free from sap. Pieces 7 inches to 13 inches may have one inch of sound sap on one edge, not to exceed half the length and half the thickness of the piece. Pieces 14 inches and wider may have 1 inch of sound sap on both edges not to exceed half the length and half the thickness of the piece. In all widths sound knots that do not impair usefulness for tank purposes may be admitted.

First and Second Clear.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 8 inches and wider, 1 inch to 4 inches thick and 10 feet and over in length. Pieces 8 to 10 inches may have 1 inch of bright sap on each edge, or its equivalent on one or both edges, otherwise they must be clear. Pieces 10 inches and under 12 inches may have 1½ inches of bright sap on each edge or 3 inches on one edge, and may have one standard knot or its equivalent. Pieces 12 inches wide may have 2 inches of bright sap on each edge, or 4 inches on one edge and may have one standard knot; or, in lieu of sap, may have two standard knots or their equivalent. Pieces wider than 12 inches may admit of defects as specified above in proportion as width increases. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece. Pieces 12 inches and less in width, free from other defects, may have bright sap across one face at one end, but this sap shall not exceed in length one-tenth of the length of the piece. In pieces 13 inches and wider bright sap is not a defect.

Selects.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the better side, but the reverse side shall not be of a lower grade than No. 1 shop or No. 1 barn.

2. Shall be 7 inches and wider, but will not be furnished wider than 12 inches; shall be 1 inch to 4 inches thick, 10 feet and longer. Pieces 10 inches and under in width shall admit two standard knots or their equivalent and an additional standard knot or its equivalent for every two inches in width over 10 inches. Pieces free from other defects, 10 inches and over in width, to admit pin wormholes on one edge one-tenth the width of the piece. Bright sap is not a defect in this grade. Slight wane on pieces 10 inches and over in width is allowed on one edge not over 3 feet in length. When no other defect appears, slight amount of stained sap may be allowed. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece.

Selected Common Tank Stock.

Shall be 4 inches wide, or wider, 1½ inches and 2 inches thick, 8 feet and over in length. Sound sap no defect in this grade, but must be free from unsound knots or other defects that extend through the thickness of the piece, and must be square edged to work the full length of the piece.

No. 1 Barn or Dimension.

Shall be specified widths only, shall be 3 inches and wider, 1 inch and thicker, 8 feet and over in length, admitting sap, bright or stained, shake, season checks, knots, pin wormholes a small amount of peck on one side and one edge, or very slight peck on both sides and both edges of pieces comparatively free from coarse defects; which defects, however, shall not be sufficient to seriously impair the strength, or prevent the use of each piece for "common" purposes in its full length and full width.

No. 2 Barn or Dimension.

Shall be specified widths, 3 inches and wider, 1 inch and thicker, 6 feet and over in length, admitting all the defects allowed in No. 1 barn, but same may be larger and coarser, and in addition will admit peck on both sides; however, the defects shall not be sufficient to prevent the use of each piece in full length and full width for low-grade fencing and other very common purposes.

Cull or Peck.

May be random or specified widths 3 inches and wider, 1 inch to 4 inches thick, 4 feet and over in length. Shall admit all pieces below the grade of No. 2 boxing, and shall also admit the product of that part of the log known as "pecky;" however, each piece shall have sufficient strength and nailing surface to permit its use as a low-grade boxing, crating, sheathing and foundation material.

Finishing.

1. Shall be specified widths 4 inches and wider, 1 inch to 2 inches thick, 10 feet and over in length, and shall be graded from the better side, A, B and C, but the reverse side should not be more than one grade lower. All grades of finish, rough or S1S or S2S may vary ¼ inch from the width specified.

2. "A" Finish.—Pieces 4 inches and 5 inches wide shall be clear of sap, knots and other defects. Pieces 6 inches wide may have 1 inch of bright sap, or, in lieu of sap, one small sound knot. Pieces 7 inches and 8 inches wide may have 2 inches of bright sap, or, in lieu of sap, one small sound knot. Pieces 9 inches and 10 inches wide may have 3 inches of bright sap, or, in lieu of sap, two small

sound knots, or 1½ inches of bright sap and one small sound knot. Pieces 12 inches wide may have 4 inches of bright sap, or, in lieu of sap, one standard knot, or two small sound knots, or two inches of bright sap and one small sound knot. Pieces 14 inches or wider may have more defects in proportion as the width increases.

3. "B" Finish.—Pieces 4 inches, 5 inches and 6 inches wide may have 2 inches of bright sap and one or two small sound knots, or in lieu of knots may have all bright sap. Pieces 7 inches and 8 inches wide may have 3 inches of bright sap and two small sound knots, or in lieu of knots may have all bright sap. Pieces 9 inches and 10 inches wide may have 4 inches of bright sap and one standard knot or three small sound knots, or in lieu of knots may have all bright sap. Pieces 12 inches wide may have 6 inches of bright sap and one standard or four small sound knots, or in lieu of knots may have all bright sap. This grade will not be furnished wider than 12 inches.

4. "C" Finish.—All widths in this grade shall admit small sound knots, stained sap, pin worms and other defects except shake; but none that will prevent the use of same in its full width and length as a paint grade, and will admit pieces containing one coarse defect which can be removed by making two cuts with a waste of not to exceed 5 per cent. in the one piece removed, but which pieces are otherwise "B" grade or better. This grade will not be furnished wider than 12 inches.

5. "D" Finish.—All widths will admit sound knots, stained sap, pin worms, slight shakes and other defects; but none that will prevent the use of same in its full width and length as a common paint grade. This grade will not be furnished wider than 12 inches.

Siding.

1. Siding shall be 4 inches and 6 inches in width, 10 feet to 20 feet in length, and graded from the finished side, A, B, C and D.

2. "A" Siding.—May have one inch of bright sap on thin edge and may contain one small sound knot.

3. "B" Siding.—May have any amount of bright sap, or, if not all bright sap, may have three small sound knots, shake, split or pin worm holes not exceeding in damage the three small knots as above, and may have slight wane on the thin edge. In the absence of other defects a small amount of stained sap will be permitted.

4. "C" Siding.—May have one to 5 knots, the whole not aggregating over 3 inches in diameter, or knots, splits or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have small amount of stained sap and pin worm holes not exceeding in damage the five small knots above described.

5. "D" Siding.—May have stained sap and pin worm holes, or may have other defects that will not cause a waste to exceed one-third the piece.

Flooring and Ceiling.

1. Shall be specified widths, 10 feet to 20 feet in length and graded from the finished side, or, if both sides are finished, it shall be graded from the better side, A, B, C and D.

2. "A"—May have bright sap on one edge one-fourth its width, otherwise must be clear.

3. "B"—May have one-half of its face bright sap if otherwise clear, or, in lieu of sap, may contain two small sound knots, or may have a split not to exceed 9 inches at one end.

4. "C" (10 to 20 feet)—May have all bright sap, or may have one to five knots, the whole not aggregating over 3 inches, or knots or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have three pin worm holes, or may have check or split at one end, not to exceed 10 per cent. of the length.

5. "C" (4 to 9 feet)—May have all bright sap, small sound knots, stained sap, pin worm holes and other defects except shake, but none that will prevent the use of each piece the full length.

6. "D"—May have stained sap and pin worm holes, or may have unsound knots or other defects that will not cause a waste to exceed one-third the piece.

Partition.

Shall be same widths and lengths as flooring and ceiling, but shall be graded from the poorer side, A, B, C and D, same grading to apply as in flooring and ceiling.

Pickets.

1. Shall be graded No. 1 and No. 2.

2. 1 inch by 1 inch shall be Headed and S4S. to ⅞ inch by ⅞ inch.

3. 1¼ inches by 1¼ inches shall be Headed and S4S to 1⅛ inches by 1⅛ inches.

4. 1½ inches by 1½ inches shall be Headed and S4S to 1⅜ inches by 1⅜ inches.

5. 1 inch by 3 inches shall be Headed and S4S to ¾ inch by 2½ inches.

6. No. 1—Shall be well manufactured, bright sap no defect, and may contain one small sound knot.

7. No. 2—Shall admit stained sap, sound knots, pin worm holes, slight shake, and pickets thrown out of the No. 1 grade because of poor manufacture.

Battens.

1. Battens, both flat and OG, are not moldings. Same are invariably used with "common" lumber and shall, therefore, be graded No. 1 barn and better, admitting all defects allowed in No. 1 barn, but none that will prevent the use of each piece in full length for batten pur-

poses. Three-eighths-inch battens shall be 1 inch strips S2S to ⅛ inch by 2½ inches and resawed, or 1 inch by 2¼ inches to 3 inches S2S and resawed. Unless otherwise specified, ⅜-inch or flat battens shall be S2S only and resawed.

2. OG battens shall be manufactured in the sizes and pattern shown in the Universal Molding Book.

Shingles.

1. **Bests.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, to be all heart and free of shake, knots and other defects.

2. **Primes.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, admitting tight knots and sap, but free of shake and other defects, but with no knots within 8 inches of the butts.

3. This grade may contain shingles clipped two-thirds of the width and one-eighth of the length on the point.

4. **Star-a-Star.**—A random width shingle, 3 inches and wider, 14 inches to 16 inches long, otherwise the same as primes.

5. **Economy.**—Dimensions, 4, 5 and 6 inches, each width separately bunched, admitting sap and sound knots; may have slight peck 5 inches from butts, imperfections on points no objection and admitting 14-inch shingles.

6. **Clippers.**—All shingles below the above grades which are sound for 5 inches from butts, wormholes and slight peck excepted, random widths 2½ inches and wider.

7. The count of manufacture of shingles, of all grades, is based on 4,000 linear inches in width, making 1,000 standard shingles, consequently there would be only 667 6-inch shingles packed and counted as 1,000 standard shingles; 5 inches dimension being counted in like proportion.

8. In making re-inspection of shingles, one bundle out of 20 bundles, taken at random, shall be cut open, the results of this investigation to form the basis of arriving at the grade of the entire shipment.

Classification and Grading Rules for Hemlock Lumber.

Sap.

White or bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

Water Stain.

In hemlock will often be found streaks or patches of red or brown discolorations, sound and firm, the presence of which does not weaken the wood, nor detract seriously from its utility. Water stain should not be confused with rot, being firm and strong, while rot is soft [illegible] wood

Standard Sizes for Hemlock.

Rough Lumber.

Piece Stuff.

Standard lengths for Rough Piece Stuff are 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 22 and 24 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is 1⅞ inches.

Boards.

Standard lengths for Rough Boards are 4, 6, 8, 10, 12, 14, 16, 18 and 20 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is ⅛ inch.

Dressed Lumber.

Piece Stuff.

Standard sizes for Piece Stuff S1S1E are: 1¼x3¼, 1¼x5¼, 1¼x7¼, 1¼x9¼, 1¼x11¼.

Boards.

The standard thickness for inch lumber S1S is ⅛ inch.

Flooring, Ceiling, Shiplap, Drop Siding.

Standard widths are: 3¼, 5¼, 7¼, 9¼ and 11¼ in. face. Standard thickness is ⅛ in.

Estimated Weights of Hemlock Lumber.

Per M Feet, Shipping Dry

3 in. Plank, Rough	3,000
3 in. Plank and 4x4 to 8x8, S1S1E	2,700
3 in. Plank, S4S or D & M	2,500
4x10 to 12x12, Rough	3,500
4x10 to 12x12, S1S1E	3,200
4x4 to 8x8, Rough	3,000
Thick D & Better, S1S	2,500
Thick D & Better, S1S1	2,200
2 in. Piece Stuff, S1S1E	2,200
2 in. Piece Stuff, Rough or S1E	2,500
2 in. Piece Stuff, S4S or D & M	2,000
1 in. Boards, Rough	2,400
1 in. Boards, S1S or S2S	2,000
1 in. Clear and Select, S1S	2,000
Shiplap, D & M, or Drop Siding	1,800
1x6 Well Tubing, Beveled Edges	1,800
Sheathing Lath	1,500
Lath	500
32 in. Lath	300

Grading Rules.

Thick D and Better.

1. Thick D and Better shall be 4 in. wide and wider, 1¼ in., 1½ in. and dimension thickness.

2. This grade shall have sound, square edges, and be of grade of Inch D Stock and Better on the face side, and not below the grade of Inch No. 1 Common on the back of the piece.

Boards and Strips.

There are six grades made in Boards and Strips:

Inch Clear and Select.	No. 2 Common.
Inch D Stock.	No. 3 Common.
No. 1 Common.	No. 4 Common.

Inch Clear and Select.

1. Inch Clear and Select should be 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long.

2. This grade is especially adapted for interior finish and only the face, or best side, is expected to show, although some attention should be given to the back of the piece.

3. The face shall show no wane, but the back may show such an amount of wane or other defects as will not interfere with the use of the piece for finishing purposes.

4. No shake or season check shall be allowed on the face side, but a very little tight shake and checks that are not deep may appear on the back of the piece.

5. This grade will admit on the face side several tight pin knots not over ⅜ in. in diameter. In a 4 or 6 in., 12 ft. and longer piece, not more than three knots are admissible, and proportionately more in a wider piece.

6. A 10 or 12 in. piece, 12 ft. and longer, will not admit of more than three sound, firmly set knots, not to exceed ¾ in. in diameter. Narrower and shorter pieces will admit of fewer large knots, but not a combination of large knots and other defects.

7. Pieces 12 ft. and longer are admissible that will, with not more than 10 per cent. of waste, produce two clear cuts, each four feet long or longer.

Inch D Stock.

1. Inch D Stock shall consist of Boards and Strips below the grade of Clear and Select 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long, and must be of a sound and water-tight character.

2. All knots must be sound and firmly set. Red knots must not exceed 1¼ in. in diameter, and spike knots must not exceed in length one-fourth the width of the piece. Black knots must not exceed ¾ in. in diameter, and must be especially well set.

3. A 6-in. strip 12 ft. long shall not contain more than three defects of the extreme sizes. A wider or longer piece may contain relatively more of these defects, and narrower and shorter pieces relatively less. The general appearance of the piece must be taken into consideration.

4. No shake shall be allowed in this grade, but slight season checks and water stain shall not be considered defects.

5. This grade shall be suitable for sound Drop Siding, Ceiling and Flooring, and shall have a smooth appearance, especially on the edges.

Inch No. 1 Common.

1. The grade of No. 1 Common in Boards or Strips includes stock of a generally sound character.
2. Some shake is admissible.
3. Numerous knots, whether red or black.
4. Some water stain of a firm character.

Inch No. 2 Common.

1. Boards or Strips will admit of considerable shake.
2. Black, unsound knots.
3. Two or three good-sized knot holes, or more of small ones.
4. Streaks, or patches of discoloration, showing partial decay.
5. This grade can be safely recommended for general building purposes.

Inch No. 3 Common.

1. The defects may consist of excessive shake.
2. Very coarse, unsound knots.
3. Some soft rot.
4. Some cross checks.

Inch No. 4 Common.

4 In. and Wider, 4 Feet and Longer.

This grade includes all serviceable lumber below the grade of No. 3.

Piece Stuff or Dimension.

No. 1 Dimension.

1. The grade of No. 1 Dimension will admit of shake that will not materially affect the strength of the piece.

2. Also knots, either black or red, that are well located and fairly sound.

3. Or some slight cross checks or sound water stain.

4. This grade, while admitting the above defects, must at the same time retain the element of strength required for any building purpose.

No. 2 Dimension.

1. The grade of No. 2 Dimension includes stock not good enough to be classed as No. 1, and the defects admissible are of the same gen-

eral character as the defects found in No. 1, except that they are more pronounced.

2. Considerable shake, large unsound knots, loose knots, knot holes and cross checks are all admissible in this grade, but not a serious combination of these defects in any one piece.

Merchantable.

The grade of Merchantable is a combination of No. 1 and No. 2, consisting of approximately 50 per cent of each.

No. 3 Dimension.

1. The defects are excessive shake, numerous knot holes, coarse, rotten knots, or considerable rot.

2. This grade can be recommended for cheap, light construction.

No. 4 Dimension.

2x4 and Wider, 4 Feet and Longer.

This grade includes all serviceable Dimension below the grade of No. 3.

CLASSIFICATION OF THE USES OF LUMBER.

1. Bridge and Construction Timber.

A. Combination and Howe Truss Spans.

1. Compression members.
2. Tension members.
3. Diagonals subject to reversal of stress.
4. Floor beams.
5. Stringers.
6. Ties.
7. Guard timbers.
8. Railing.
9. Stiffeners.
10. Splices.
11. Nailing strips.
12. Grillage.
13. Deck plank.
14. Bridging.

B. Pile and Frame Trestles.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Cross bracing.
6. Sash bracing.
7. Longitudinal bracing.
8. Girts.
9. End plank.
10. Stringers.
11. Ties.
12. Guard timbers.
13. Planking for ballasted deck.
14. Railing.

C. Falsework.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Stringers.
6. Truss timbers.
7. Centering.
8. Lagging.
9. Bracing.
10. Wedges.
11. Scaffolding.

D. Concrete Forms.

1. Dimension lumber.
2. D. & M. planks.
3. Bracing.

E. Tanks and Supports.

1. Piles.
2. Sills.
3. Posts.
4. Caps.
5. Bracing.
6. Joists.
7. D. & M. flooring.
8. Staves.
9. Rafters.
10. Roof.
11. Ladders, etc.
12. Frost-box material.

F. Docks and Wharves.

1. Piles.
2. Timber sheet piling.
3. Timber in cribs.
4. Caps.
5. Stringers.
6. Bracing.
7. Guard timber.
8. Ties.
9. Plank decking.
10. Mooring posts.
11. Fenders and wales.
12. Warehouse. (See II.)

G. Coaling Stations and Ore Stations.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Bracing.
6. Stringers.
7. Joists.
8. Bin lining.
9. Rafters.
10. Flooring.
11. Chutes.
12. Decking.
13. Coal pockets or bins.
14. Roofing.

2. Frame Buildings.

A. Station Buildings, Passenger, Freight, Platform Shelters.

1. Piles.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
   (a) Pine.
   (b) Fir.
   (c) Maple or oak.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.

14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
    (a) Mouldings.
    (b) Stairs.
    (c) Doors.
    (d) Windows.
25. Partitions.
26. Shelving.

B. Engine House.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Pit timbers.
10. Studding.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

C. Machine Shops.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Studding.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Truss timbers.
16. Purlins.
17. Rafters.
18. Roof boards.
19. Shingles.
20. Door and window frames
21. Outside finish lumber.
22. Inside finish lumber.
23. Millwork.
24. Sleepers.

D. Section Houses.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.

15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

E. Miscellaneous Small Buildings.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

F. Warehouses.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

G. Ice Houses.

1. Piling.
2. Sills.
3. Caps.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sleepers.
9. Sub-flooring.
10. Finish flooring.
11. Studding.
12. Sheathing.
13. Furring.
14. Siding.
15. Ceiling.
16. Lath.
17. Truss timbers.
18. Purlins.
19. Rafters.
20. Roof boards.
21. Shingles.
22. Door and window frames.
23. Outside finish lumber.
24. Inside finish lumber.
25. Millwork.

3. Ties.

A. Cross-Ties.

B. Switch Ties.

4. Miscellaneous Roadway Material.

A. Crossing Plank.

B. Platforms.

1. Posts.
2. Caps.
3. Sills.
4. Stringers.
5. Joists.
6. Bridging.
7. Planking.
8. Railing.
9. Steps.
10. Skids.

C. Stock Guards.

1. Posts.
2. Ties.
3. Wing fences and aprons.
4. Slats.
5. Fillers.

D Signs and Posts.

1 Posts.
2. Bracing.
3. Sign boards.
4. Moulding.

E. Fencing, Including Snow Fence.

1. Posts.
2. Bracing.
3. Stringers.
4. Fence boards.
5. Gate material.
6. Stakes.

F. Culverts and Drains.

1. Sills.
2. Bracing.
3. Timbers.
4. Planking.
5. Grillage.

G. Stock Pens.

1. Posts.
2. Sills.
3. Fencing.
4. Studding.
5. Sheathing.
6. Rafters.
7. Roof boards.
8. Shingles.
9. Outside finish lumber.

H. Poles.

I. Conduits.

J. Bumping Blocks.

K. Cross-arms.

COMMITTEE VIII.

MASONRY.

[1] DEFINITIONS.

ABUTMENT.—A supporting wall carrying the end of a bridge or span and generally sustaining the pressure of the abutting earth.

ARCH MASONRY.—That portion of the masonry in the arch ring only, or between the intrados and the extrados.

ARRIS.—The external edge formed by two surfaces, whether plain or curved, meeting each other.

BATTER.—The slope or inclination of the face or back of a wall from a vertical plane.

BENCH WALL.—The abutment from which an arch springs.

CEMENT.—A material of one of the two classes, Portland and natural, possessing the property of hardening into a solid mass when mixed with water.

CEMENT, NATURAL.—Natural cement is the finely pulverized product resulting from the calcination of an argillaceous limestone at a temperature only sufficient to drive off the carbonic acid gas.

CEMENT, PORTLAND.—Portland cement is the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

CENTERING.—A temporary support used in arch construction. (Also called centers.)

COPING.—A top course of stone or concrete, generally slightly projecting, to shelter the masonry from the weather, or to distribute the pressure from exterior loading.

CULVERT.—A covered passage for water under a roadway or embankment.

DOWELS.—Metal bars used to connect two sections of masonry. (See definition of "Dowel" under "Stone and Brick Masonry.")

EXTRADOS.—The outer or convex surface of an arch.

FINAL SET.—A stage of the process of setting marked by certain hardness. (See Cement Specifications.)

[1] Adopted, Vol. 7, 1906, pp. 596-601, 619; Vol. 12, Part 1, 1911, pp. 478, 579; Vol. 16, 1916, pp. 794, 1176; Vol. 19, 1918, pp. 721, 1227; Vol. 21, 1920, pp. 84, 1354.

Inspection.

19. The work of erection shall at all times be subject to the inspection and acceptance of the Engineer.

Engineer.

20. The term "Engineer," as used herein, shall be understood to mean the Chief Engineer of the Railway Company, or his accredited representative.

"GENERAL SPECIFICATIONS FOR STEEL RAILWAY BRIDGES

For Fixed Spans Less Than 300 Feet in Length

1920

NOTE.—The purpose of the Committee which wrote these specifications was to formulate specific and detailed rules for the design and manufacture of bridges, as a guide to both the designer and the shop, rather than to confine the specifications to a statement of principles or to limit them to rules defining the duties of the contractor. The intention was to describe the best general practice for standard American and Canadian railways, and to advance somewhat the causes of good design and workmanship. The requirements of light and branch railways and foreign practice have not been considered.

The Clearance Diagram in these specifications is intended to be applied to New Construction Work only. It provides for the future development of motive power to a width of eleven feet.

Information to Be Given Bidders.

		Article
1.	What is the live load to be used?	20
2.	Is the bridge on a tangent or curve?	13
	If on a curve, what is the superelevation of the outer rail and what is the degree of the curve?	
3.	What is the rate and the direction of grade on the bridge?	93
4.	What are the conditions at the site?	2
	Furnish plans showing the general dimensions necessary for designing the structure:	
	Length of spans	
	Types of spans	
	Number and spacing of tracks	
	Angle of skew	
	Type of floor	
	Limiting under-clearance	
5.	Shall the work be "Punched Work" or "Reamed Work?"	206
6.	What size of rivets shall be used?	59
7.	What kind of shop paint will be approved?	269
8.	Will other than two pilot nuts and two driving nuts be required for each size of pin?	256

"Adopted, Vol. 21, 1920, pp. 491, 1414.

(1) Proposals and Drawings.

Definitions of Terms.

1. The term "Engineer" refers to the Chief Engineer of the Company or his subordinates in authority. The term "Inspector" refers to the inspector or inspectors representing the Company. The term "Company" refers to the Railway Company or Railroad Company party to the contract. The term "Contractor" refers to the manufacturing or fabricating contractor party to the contract.

Proposals.

2. Bidders shall submit proposals to conform with the terms in the letter of invitation. The proposals preferably shall be based upon plans and specifications furnished by the Company showing the general dimensions necessary for designing the structure, the stresses and the general or typical details. Invitations covering work to be designed or erected by the Contractor shall state the general conditions at the site, such as track spacing, character of foundations, old structures, traffic conditions, etc.

Drawings to Govern.

3. Where the drawings and the specifications differ, the drawings shall govern.

Patented Devices.

4. The Contractor shall protect the Company against claims on account of patented devices or parts proposed by him.

Drawings.

5. After the contract has been awarded and before any work is commenced, the Contractor shall submit to the Engineer for approval duplicate prints of stress sheets and shop drawings, unless such drawings shall have been prepared by the Company. The tracings of these drawings shall be the property of and be delivered to the Company after the completion of the contract. Shop drawings shall be made on the dull side of the tracing cloth, 24 by 36 inches in size, including margins. The margin at the left end shall be 1½ inches wide, and the others ½-inch. The title shall be in the lower right-hand corner. No changes shall be made on any approved drawing without the consent, in writing, of the Engineer.

6. The Contractor shall be responsible for the correctness of his drawings, and for shop fits and field connections, although the drawings may have been approved by the Engineer.

7. Any material ordered by the Contractor prior to the approval of the drawings shall be at his risk.

(2) General Features of Design.

Materials Used.

8. Structures shall be made wholly of structural steel except where otherwise specified. Cast steel preferably shall be used for

shoes and bearings. Cast iron may be used only where specifically authorized by the Engineer.

Types of Bridges.

9. The different types of bridges may be used as follows:

Rolled beams for spans up to 35 feet.
Plate girders for spans from 30 feet to 125 feet.
Riveted trusses for spans from 100 feet to 300 feet.
Pin-connected trusses for spans from 150 feet to 300 feet.

Number of Trusses.

10. Unless otherwise specified, double-track through bridges shall have only two trusses or girders, and four-track bridges three.

Dimensions for Calculation.

11. The dimensions for the calculation of stresses shall be as follows:

SPAN LENGTH.

For trusses and girders, the distance center to center of end bearings.

For floor beams, the distance center to center of trusses or girders.

For stringers, the distance center to center of floor beams.

DEPTH.

For riveted trusses, the distance between centers of gravity of chord sections.

For pin-connected trusses, the distance center to center of chord pins.

For plate girders, floor beams and stringers, the distance between centers of gravity of flanges, but not to exceed the distance back to back of the flange angles.

Spacing of Trusses, Girders and Floorbeams.

12. The width center to center of girders or trusses shall be not less than one-fifteenth of the effective span, and not less than is necessary to prevent overturning under the assumed lateral loading. Panel lengths shall not exceed 1½ times the width c. to c. of trusses or girders.

Clearances.

13. If the alinement is straight, clearances shall be not less than shown on the diagram, Fig. 1. If the alinement is curved, the width of the diagram shall be increased so as to provide the same minimum clearances for a car 80 feet long, 14 feet high and 60 feet center to center of trucks, allowance being made for curvature and superelevation of rails. The height of rail shall be assumed as 6 inches.

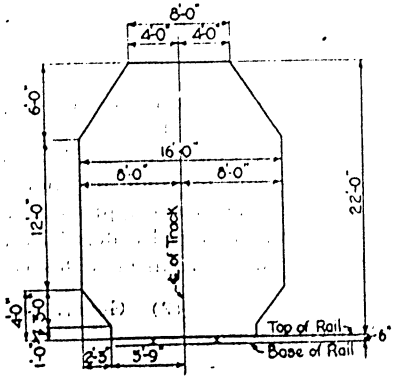


FIG. 1.

Deck Spans on Curves.

14. Deck spans on curves shall have the center line of the span placed, usually, so as to bisect the middle ordinate of and be parallel with the chord of the curve.

Skew Bridges.

15. In skew bridges without ballasted floors, the ends of stringers or girders for each track shall be square with the track.

Ambiguity of Stress.

16. Structures shall be designed so as to avoid, as far as practicable, ambiguity in the determination of the stresses.

(3) Loads

Loads.

17. The structures shall be proportioned for the following loads:

a. The dead load.
b. The live load.
c. The impact or dynamic effect of the live load.
d. The lateral loads and forces.
e. The centrifugal force, including impact.
f. The longitudinal force.

Stresses due to these loads and forces shall be shown separately on the stress sheets.

18. Members shall be proportioned for that combination of stresses which gives the maximum total stress, except as otherwise provided.

Dead Load.

19. The dead load shall consist of the estimated weight of the entire suspended structure. Timber shall be assumed to weigh 4½ pounds per foot B. M., ballast 120 pounds per cubic foot, reinforced concrete 150 pounds per cubic foot, waterproofing 150 pounds per cubic foot, and rails and fastenings 150 pounds per linear foot of track. If ballast is used, it shall be assumed level with the base of rail and the weight of the ties shall be neglected. Ballasted floors shall have at least 6 inches of ballast under the ties.

Live Load.

20. The minimum live load for each track shall be as shown in Figs. 2 and 3, except as modified in Article 21.

The loading that gives the larger stresses shall be used.

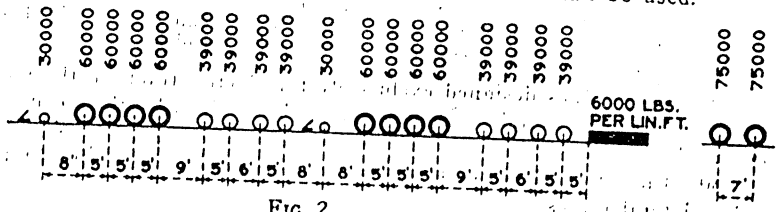


FIG. 2.

21. In special locations, where the conditions limit the loading to light engines, a lighter loading, as stipulated by the Engineer, may be used, but not in any case lighter than three-fourths of that specified in Article 20.

22. Other live loadings shall be proportional to the loading specified in Article 20 with the same wheel spacing.

Multiple Tracks.

23. In calculating the maximum stresses due to live load and centrifugal force when two, three or four tracks are simultaneously loaded, use the following percentages of the specified live load:

For two tracks, loaded, 90 per cent.
For three tracks, loaded, 80 per cent.
For four tracks, loaded, 75 per cent.

Floors.

24. Wooden ties shall be designed for the maximum wheel load specified distributed over three ties and with 100 per cent. impact added. The fiber stress shall not exceed 2,000 pounds per square inch. The ties shall be not less than 10 feet in length. They shall be placed with openings not to exceed 4 inches in width and shall be secured against bunching. The maximum dap of ties shall be 1¼ inches.

25. Floors consisting of beams transverse to the axis of the structure shall be designed for a uniform live load of 15,000 pounds per linear foot for each track, when the minimum live load specified in Article 20 is used. When heavier loadings are used, this uniform load shall be increased proportionately.

26. Floors consisting of longitudinal beams shall be designed for the wheel loads specified.

27. In ballasted floor bridges, the live load shall be considered as uniformly distributed laterally over a width of 10 feet.

Impact.

28. The dynamic increment of the live load shall be added to the maximum computed live load stresses and shall be determined by the formula,

$$I = S \frac{300}{300 + \frac{L^2}{100}}, \text{ in which}$$

I = impact or dynamic increment to be added to the live-load stress.
S = computed maximum live-load stress.
L = the length in feet of the portion of the span which is loaded to produce the maximum stress in the member.

29. For bridges designed exclusively for electric traction, the impact stresses shall be taken as one-half of those given by the formula in Article 28.

30. Impact shall not be added to stresses produced by longitudinal or lateral forces.

Eccentricity of Load on Curves.

31. For bridges on curves, provision shall be made for the increased load carried by any truss, girder or stringer due to the eccentricity of the load.

Lateral Forces.

32. The lateral (or wind) force shall consist of a moving load equal to 30 pounds per square foot on 1½ times the vertical projection of the structure on a plane parallel with its axis (but never less than 200 pounds per linear foot at the loaded chord, and 150 pounds per linear foot at the unloaded chord), and a moving load of 700 pounds per linear foot applied 8 feet above the base of rail.

33. If a moving load of 50 pounds per square foot on 1½ times the vertical projection of the unloaded structure on a plane parallel with its axis produces greater stresses than the lateral force defined in Article 32, it shall be provided for.

34. In calculating the stresses in viaduct towers due to lateral force, the viaduct shall be considered as loaded on either one or both tracks, with empty cars weighing 1,200 pounds per linear foot.

35. The lateral bracing between compression chords or flanges shall be capable of resisting a transverse shear in any panel equal to 2½ per cent. of the total axial stress in the chords in that panel.

Centrifugal Force.

36. On curves, the centrifugal force (assumed to act 6 feet above the rail) shall be taken equal to a percentage of the live load including impact according to the following table:

Degree of Curve	0° 20′	0° 40′	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
Percentage	2½	5	7½	10	10	10	10	10	10	10	10	10	10	10
Speed in miles per hour	80	80	80	65	53	46	41	38	35	33	31	29	28	27

Longitudinal Force.

37. Provision shall be made in the design for the effect of a longitudinal force of 20 per cent. of the live load on one track only, applied 6 feet above the top of the rail. In structures (such as ballasted deck bridges of only three or four spans) where, by reason of continuity of members or frictional resistance, the longitudinal force will be largely directed to the abutments, its effect on the superstructure shall be taken as one-half that specified above.

(4) Unit Stresses and Proportioning of Parts.

38. The several parts of structures shall be so proportioned that the unit stresses will not exceed the following, except as modified in Articles 46 and 47:

	Pounds per sq. inch
Axial tension, net section	16,000
Axial compression, gross section	$15{,}000 - 50\frac{l}{r}$
but not to exceed	12,500

l = the length of the member in inches.
r = the least radius of gyration of the member in inches.

Tension in extreme fibers of rolled shapes, built sections and girders, net section	16,000
Tension in extreme fibers of pins	24,000
Shear in plate girder, webs, gross section	10,000
Horizontal shear in flange angles of girders	4,000
Shear in power-driven rivets and pins	12,000
Bearing on power-driven rivets, pins, outstanding legs of stiffener angles, and other steel parts in contact	24,000

The above mentioned values for shear and bearing shall be reduced 25 per cent. for countersunk rivets, hand-driven rivets, floor-connection rivets, and turned bolts.

Bearing on expansion rollers, per linear inch ..... $600d$

d = the diameter of rollers in inches.

	Pounds per sq. inch
Bearing on granite masonry	800
Bearing on sandstone and limestone masonry	400
Bearing on concrete masonry	600

39. For cast steel in shoes and bearings, the above mentioned unit stresses shall apply.

40. The diagonal tension in webs of girders and rolled beams at sections where maximum shear and bending occur simultaneously, shall not exceed 16,000 pounds per square inch.

Effective Bearing Area.

41. The effective bearing area of a pin, a bolt or a rivet shall be its diameter multiplied by the thickness of the piece, except that for countersunk rivets, half the depth of the countersink shall be omitted.

Effective Diameter of Rivets.

42. In proportioning rivets, the nominal diameter of the rivet shall be used.

Proportioning Web Members.

43. In proportioning web members of trusses, use two-thirds of the dead load stress plus one and one-sixth times the live load stress, including impact, where this sum is greater than the sum of the dead load stress and the live load stress, including impact.

Reversal of Stress.

44. Members subject to reversal of stress under the passage of the live load shall be proportioned as follows:

Determine the resultant tensile stress and the resultant compressive stress and increase each by 50 per cent. of the smaller; then proportion the member so that it will be capable of resisting either increased resultant stress. The connections shall be proportioned for the sum of the resultant stresses.

Combined Stresses.

45. Members subject to both axial and bending stresses (including bending due to floor beam deflection) shall be proportioned so that the combined fiber stresses will not exceed the allowed axial stress. In members continuous over panel points, only three-fourths of the bending stress computed as for simple beams shall be added to the axial stress.

46. Members subject to stresses produced by a combination of dead load, live load, impact and centrifugal force, with either lateral or longitudinal forces, or bending due to lateral action, may be proportioned for unit stresses 25 per cent. greater than those specified in Article 38; but the section shall not be less than that required for dead load, live load, impact and centrifugal force.

Secondary Stresses.

47. Designing and detailing shall be done so as to avoid secondary stresses as far as possible. In ordinary trusses without subpanelling, no account usually need be taken of the secondary stresses in any member whose width measured in the plane of the truss is less than one-tenth of its length. Where this ratio is exceeded, or where subpanelling is used, secondary stresses due to deflection of the truss shall be computed. The unit stresses specified in Article 38 may be increased one-third for a combination of the secondary stresses with the other stresses, but the section shall not be less than that required when secondary stresses are not considered.

Compression Flanges.

48. The gross area of the compression flanges of plate girders and rolled beams shall not be less than the gross area of the tension flanges, but the stress per square inch shall not exceed

$$14{,}000 - 200\frac{l}{b}, \text{ in which}$$

l = the length of the unsupported flange, between lateral connections or knee braces.
b = the flange width.

(5) Details of Design.

Limiting Lengths of Members.

49. The ratio of length to least radius of gyration shall not exceed 100 for main compression members nor 120 for wind and sway bracing.

50. The lengths of riveted tension members shall not exceed 200 times their least radius of gyration.

Depth Ratios.

51. The depth of trusses preferably shall be not less than one-tenth of the span. The depth of plate girders preferably shall be not less than one-twelfth of the span. The depth of rolled beams used as girders and the depth of solid floors preferably shall be not less than one-fifteenth of the span. If less depths than these are used, the section must be increased so that the maximum deflection will not be greater than if these limiting ratios had not been exceeded.

Parts Accessible.

52. Details shall be designed so that all parts will be accessible for inspection, cleaning and painting. Closed sections shall be avoided wherever possible.

Pockets.

53. Pockets or depressions which would hold water shall have efficient drain holes, or shall be filled with concrete.

Eccentric Connections.

54. Members shall be connected so that their gravity axes will intersect in a point. Eccentric connections shall be avoided if practicable, but, if unavoidable, the members shall be proportioned so that the combined fiber stress will not exceed the allowed axial stress.

Effective Area of Angles.

55. The effective area of single angles in tension shall be assumed as the net area of the connected leg plus 50 per cent. of the area of the unconnected leg. Single angles connected by lug angles shall be considered as connected by one leg.

Counters.

56. If web members are subject to reversal of stress, their end connections preferably shall be riveted. Adjustable counters shall have open turnbuckles.

Strength of Connections.

57. Connections shall have a strength at least equal to that of the members connected, regardless of the computed stress. Connections shall be made, as nearly as practicable, symmetrical about the axis of the members.

Limiting Thickness of Metal.

58. Metal shall not be less than ⅜-inch thick, except for fillers. Metal subject to marked corrosive influences shall be increased in thickness or protected against such influences.

Sizes of Rivets.

59. Rivets shall be ¾ inch, ⅞ inch or 1 inch in diameter, as specified.

Pitch of Rivets.

60. The minimum distance between centers of rivet holes shall be three diameters of the rivet, but the distance preferably shall be not less than 3½ inches for 1 inch rivets, 3 inches for ⅞-inch rivets and 2½ inches for ¾-inch rivets. The maximum pitch in the line of stress for members composed of plates and shapes shall be 7 inches for 1 inch rivets, 6 inches for ⅞-inch rivets and 5 inches for ¾-inch rivets. For angles with two gage lines and rivets staggered, the maximum pitch in each line shall be twice the amounts given above. If two or more web plates are used in contact, stitch rivets shall be provided to make them act in unison. In compression members, the stitch rivets shall be spaced not more than 24 times the thickness of the thinnest plate in the direction perpendicular to the line of stress, and not more than 12 times the thickness of the thinnest plate in the line of stress. In tension members, the stitch rivets shall be not more than 24 times the thickness of the thinnest outer plate in either direction. In tension members composed of two angles in contact, a pitch of 12 inches may be used for riveting the angles together.

Edge Distance.

61. The minimum distance from the center of any rivet hole to a sheared edge shall be: 1¼ inches for 1 inch rivets, 1½ inches for ⅞-inch rivets and 1¼ inches for ¾-inch rivets; to a rolled edge 1½ inches, 1¼ inches and 1⅛ inches, respectively. The maximum distance from any edge shall be eight times the thickness of the plate, but shall not exceed 6 inches.

Size of Rivets in Angles.

62. The diameter of the rivets in any angle whose size is determined by calculated stress shall not exceed one-fourth of the width of the leg in which they are driven. In angles whose size is not so determined 1 inch rivets may be used in 3½ inch legs, ⅞-inch rivets in 3 inch legs, and ¾-inch rivets in 2½ inch legs.

Long Rivets.

63. Rivets which carry calculated stress and whose grip exceeds four and one-half diameters shall be increased in number at least one per cent. for each additional ⅛-inch of grip. If the grip exceeds six times the diameter of the rivet, specially designed rivets shall be used.

Pitch of Rivets at Ends.

64. The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivet for a distance equal to one and one-half times the maximum width of the member.

Compression Members.

65. In built compression members, the metal shall be concentrated in the webs and flanges. The thickness of each web shall be not less than one-thirtieth of the distance between the lines of rivets

connecting it to the flanges. The thickness of cover plates shall be not less than one-fortieth of the distance between the nearest rivet lines.

Outstanding Legs of Angles.

66. The width of the outstanding legs of angles in compression (except when reinforced by plates) shall not exceed the following:

a. For stringer flange angles, ten times the thickness.

b. For main members carrying axial stress, twelve times the thickness.

c. For bracing and other secondary members, fourteen times the thickness.

Stay Plates.

67. The open sides of compression members shall be provided with lacing bars and shall have stay plates as near each end as practicable. Stay plates shall be provided at intermediate points where the lacing is interrupted. In main members, the length of the stay plates shall be not less than 1¼ times the distance between the lines of rivets connecting them to the outer flanges, and the length of intermediate stay plates shall be not less than three-quarters of that distance. Their thickness shall be not less than one-fiftieth of the same distance.

68. Tension members composed of shapes shall have their separate segments stayed together. The stay plates shall have a length not less than two-thirds of the lengths specified for stay plates on compression members.

Lacing.

69. The lacing of compression members shall be proportioned to resist a shearing stress of 2½ per cent. of the direct stress. The minimum width of lacing bars shall be 3 inches for 1 inch rivets, 2¾ inches for ⅞-inch rivets, 2½ inches for ¾-inch rivets, and 2 inches for ⅝-inch rivets. The thickness shall be made as required by Article 38, in which "l" shall be taken as the distance between connections to the main sections.

70. In members composed of side segments and a cover plate, with the open side laced, one-half the shear shall be considered as taken by the lacing. Where double lacing is used, the shear in the plane of the lacing shall be equally distributed between the two systems.

71. Lacing bars of compression members shall be so spaced that the $\frac{l}{r}$ of the portion of the flange included between their connections will be not greater than 40, and not greater than two-thirds of the $\frac{l}{r}$ of the member.

72. In connecting lacing bars to flanges, ⅝-inch rivets shall be used for flanges less than 2½ inches wide, ¾-inch rivets for flanges

from 2½ to 3½ inches wide, and ⅞-inch rivets for flanges 3½ or more inches wide. Lacing bars with at least two rivets in each end shall be used for flanges over 5 inches wide.

73. The angle of lacing bars with the axis of the member shall be not less than 45 degrees for double lacing, and 60 degrees for single lacing. If the distance between rivet lines in the flanges is more than 15 inches and a single-rivet bar is used, the lacing shall be double and riveted at the intersections.

Splices.

74. Abutting joints in compression members faced for bearing shall be spliced on four sides. The gross area of the splice material shall be not less than 50 per cent. of the gross area of the smaller member.

75. Joints in riveted work not faced for bearing, whether in tension or compression, shall be fully spliced.

Net Section at Pins.

76. In pin connected riveted tension members, the net section across the pin hole shall be not less than 140 per cent. and the net section back of the pin hole not less than 100 per cent. of the net section of the body of the member, and there shall be sufficient rivets to make the material effective.

Net Section Defined.

77. The net section of riveted members shall be the least area which can be obtained by deducting from the gross sectional area the areas of holes cut by any plane perpendicular to the axis of the member and parts of the areas of other holes on one side of the plane within a distance of four inches, which are on gage lines one inch or more from those of the holes cut by the plane, the parts being determined by the formula:

$$A\left(1-\frac{P}{4}\right), \text{ in which}$$

A = the area of the hole.
P = the distance in inches of the center of the hole from the plane.

78. In determining the net section, the diameter of the rivet hole shall be taken one-eighth-inch larger than the nominal diameter of the rivet.

Pin Plates.

79. Where necessary to give the required section or bearing area, pin holes shall be reinforced on each segment by plates, one of which on each side must be as wide as the outstanding flanges will permit. These plates shall contain enough rivets and be so connected as to transmit and distribute the bearing pressure uniformly over the full cross-section and to reduce the eccentricity of the segment to a minimum. At least one full-width plate on each segment shall extend to

the far edge of the stay plate and the others not less than 6 inches beyond the near edge.

Indirect Splices.

80. If splice plates are not in direct contact with the parts which they connect, rivets shall be used on each side of the joint in excess of the number required in the case of direct contact to the extent of two extra lines for each intervening plate.

Fillers.

81. Where rivets carrying stress pass through fillers, the fillers shall be extended beyond the connected member and the extension secured by additional rivets sufficient to develop the value of the filler.

Forked Ends.

82. Forked ends on compression members will be permitted only where unavoidable. Where forked ends are used, a sufficient number of pin plates shall be provided to make the jaws of twice the sectional area of the member and they shall be extended as far as necessary in order to carry the stress of the main member into the jaws, but shall not be shorter than required by Article 79.

Pins.

83. Pins shall be long enough to secure a full bearing of all parts connected upon the turned body of the pin. They shall be secured by chambered nuts or by solid nuts with washers. Where the pins are bored, through rods with cap washers may be used. The screw ends shall be long enough to admit of burring the threads.

84. Pin connected members shall be held against lateral movement on the pins.

Bolts.

85. Where members are connected by bolts, the turned bodies of the bolts shall be long enough to extend through the metal. A washer at least ¼-inch thick shall be used under the nut. Bolts shall not be used except by special permission.

Upset Ends.

86. Bars with screw ends shall be upset so that the area at the root of the thread will be at least 15 per cent. larger than in the body of the bar.

Sleeve Nuts.

87. Sleeve nuts shall not be used.

Expansion.

88. Provision shall be made for expansion and contraction at the rate of one inch for every 100 feet in length. The expansion ends shall be secured against lateral movement. In spans more than 250 feet in length, provision shall be made for expansion in the floor.

Expansion Bearings.

89. Spans more than 70 feet in length shall have rollers at one end. Spans of less length shall be arranged to slide on smooth surfaces.

Fixed Bearings.

90. Bearings and ends of spans shall be secured against lateral motion.

Rollers.

91. Expansion rollers shall be not less than 6 inches in diameter. They shall be coupled together with substantial side bars, which shall be so arranged that the rollers can be cleaned readily. Rollers shall be geared to the upper and lower plates.

Pedestals and Shoes.

92. Pedestals and shoes preferably shall be made of cast steel. The difference between the top and bottom bearing widths shall not exceed twice the depth. For hinged bearings, the depth shall be measured from the center of the pin. Where built pedestals and shoes are used, the web plates and the angles connecting them to the base plate shall be not less than ¾-inch thick. If the size of the pedestal permits, the webs shall be rigidly connected transversely. The minimum thickness of the metal in cast steel pedestals shall be one inch. Pedestals and shoes shall be so constructed that the load will be distributed uniformly over the entire bearing. Spans more than 70 feet in length shall have hinged bearings at each end.

Inclined Bearings.

93. For spans on an inclined grade and without hinged bearings, the sole or masonry plates shall be beveled so that the masonry surfaces will be level.

Name Plates.

94. There shall be a name plate, showing in raised letters and figures the name of the manufacturer and the year of construction, bolted to the bridge near each end at a point convenient for inspection.

(6) Floors.

Types of Floors.

95. Floors may consist of steel floor-beams and stringers, with timber cross-ties supporting the rails, or of one of the solid floor types.

Floor Members.

96. Floor members shall be designed with special reference to stiffness.

97. Specifications for plate girders shall apply to floor-beams and stringers.

Spacing of Stringers.

98. Stringers usually shall be spaced 6 feet 6 inches center to

center. If four stringers are used under one track, each pair shall be spaced symmetrically about the rail.

I-Beam Girders.

99. Rolled beams supporting timber decks shall be arranged with not more than four, and preferably not less than two beams under each rail. The beams in each group shall be placed symmetrically about the rail, and shall be spaced sufficiently far apart to permit cleaning and painting. They shall be connected by solid web diaphragms near the ends and at intermediate points, spaced not over twelve times the flange width. Bearing plates shall be continuous under each group of beams. End stiffeners shall be used if required by the provisions of Article 38.

Floor-Beam Connections.

100. Floor-beams preferably shall be square to the girders or trusses. They shall be riveted directly to the girders or between the posts of through and deck truss spans.

End Connection Angles.

101. The legs of stringer connection angles shall be not less than 4 inches in width, and not less than ⅝-inch in thickness before facing. Shelf angles shall be provided to support the stringers during erection, but the connection angles shall be sufficient to carry the whole load. Stringers in through spans shall be riveted between the floor-beams.

Stringer Frames.

102. Where two lines of stringers are used under each track in panels more than 20 feet in length, they shall be connected by cross frames.

Solid Floor Connections.

103. Solid floors shall be connected to the girders or trusses by angles not less than ⅝-inch thick if to be faced, or ½-inch thick if not to be faced; one angle on each side of the web of I-beams and one on each of the vertical members of troughs. (223)

Proportioning Solid Floors.

104. Solid floors shall be proportioned by the moments of inertia of the sections, using the net sections including the compression side.

(7) Bracing.

Design of Bracing.

105. Lateral, longitudinal and transverse bracing shall be composed of shapes with riveted connections. Lateral bracing shall have concentric connections to chords at end joints, and preferably throughout. The connections between the lateral bracing and the chords shall be designed to avoid, as far as practicable, any bending stress in the truss members.

106. When a double system of bracing is used, both systems may be considered simultaneously effective if the members meet the requirements, both as tension and compression members.

Lateral Bracing.

107. Bottom lateral bracing shall be provided in all bridges except deck plate girder spans less than 50 feet long, from which it may be omitted. Continuous steel or concrete floors will be considered lateral bracing.

108. Top lateral bracing shall be provided in deck spans and in through spans having sufficient head room.

Portal and Sway Bracing.

109. Deck truss spans shall have vertical sway bracing at each panel point. They shall also have bracing in the planes of the end posts. The end reaction of the top lateral system shall be carried through the vertical end bent to the masonry.

110. Through truss spans shall have portal bracing, with knee braces, as deep as the specified clearance will allow.

111. Through truss spans shall have sway bracing at each intermediate panel point if the height of the trusses is such as to permit of a depth of 6 feet or more for the bracing. When the height of the trusses will not permit of such depth, the top lateral struts shall be of the same depth as the chord and shall have knee braces.

Cross-Frames.

112. Deck plate girder spans shall be provided with cross-frames at each end proportioned to resist centrifugal and lateral forces, and shall have intermediate cross-frames at intervals not exceeding 18 feet.

Laterals.

113. The smallest angle to be used in lateral bracing shall be 3½ by 3 by ⅜ inches. There shall be not less than three rivets at each end connection of the angles. Angles shall be connected at their intersections by plates.

Clearance.

114. Lateral bracing beneath the track shall be low enough to clear the ties.

(8) Plate Girders.

Spacing of Girders.

115. The girders of deck bridges usually shall be spaced 6 feet 6 inches between centers, except that:

a. In single-track deck spans 75 or more feet in length, the girders shall be spaced in accordance with paragraph 12, but not less than 7 feet 6 inches between centers.

b. In bridges on curves, the girders shall be spaced as shown on the plans.

Design of Plate Girders.

116. Plate girders shall be proportioned either by the moment of inertia of their net section including compression side; or by assuming that the flanges are concentrated at their centers of gravity. In the latter case, one-eighth of the gross section of the web, if properly spliced, may be used as flange section. For girders having unusual sections, the moment of inertia method shall be used.

Flange Sections.

117. The flange angles shall form as large a part of the area of the flange as practicable. Side plates shall not be used except when flange angles exceeding one inch in thickness otherwise would be required.

118. Flange plates shall be equal in thickness, or shall diminish in thickness from the flange angles outward. No plate shall have a thickness greater than that of the flange angles.

119. Where flange cover plates are used, one cover plate of the top flange shall extend the full length of the girder. Other flange plates shall extend at least 18 inches beyond the theoretical end.

Thickness of Web Plates.

120. The thickness of web plates shall be not less than $\frac{1}{20}\sqrt{D}$, where "D" represents the distance between flanges in inches.

Flange Rivets.

121. The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer to the flange section the horizontal shear at any point combined with any load that is applied directly on the flange. One wheel load, where ties rest on the flange, shall be assumed to be distributed over 3 feet.

Flange Splices.

122. Splices in flange members shall not be used except by special permission of the Engineer. Two members shall not be spliced at the same cross-section and, if practicable, splices shall be located at points where there is an excess of section. The net section of the splice shall exceed by 10 per cent. the net section of the member spliced. Flange angle splices shall consist of two angles, one on each side.

Web Splices.

123. Web plates shall be symmetrically spliced by plates on each side. The splice plates for shear shall be of the full depth of the girders between flanges. The splice shall be equal to the web in strength in both shear and moment. There shall be not less than two rows of rivets on each side of the joint.

End Stiffeners.

124. Plate girders shall have stiffener angles over end bearings, the outstanding legs of which will extend as nearly as practicable to the outer edge of the flange angles. These end stiffeners shall be proportioned for bearing of the outstanding legs on the flange angles,

and shall be arranged to transmit the end reaction to the pedestals or distribute it over the masonry bearings. They shall be connected to the web by enough rivets to transmit the reaction. End stiffeners shall not be crimped.

Intermediate Stiffeners.

125. The webs of plate girders shall be stiffened by angles at intervals not greater than:

(a) Six feet.
(b) The depth of the web.
(c) The distance given by the formula $d = \frac{t}{40}(12{,}000 - S)$

d = the distance between rivet lines of stiffeners in inches.
t = the thickness of the web in inches.
S = web shear in pounds per square inch at the point considered.

126. If the depth of the web between the flange angles or side plates is less than 50 times the thickness of the web, intermediate stiffeners may be omitted.

127. Stiffener angles shall be placed at points of concentrated loading. Such angles shall not be crimped.

128. Intermediate stiffeners shall be riveted in pairs to the web of the girder. The outstanding leg of each angle shall not be less than 2 inches plus one-thirtieth of the depth of the girder, nor more than 16 times its thickness.

Gusset Plates in Through Girders.

129. In through plate girder spans, the top flanges shall be braced by means of gusset plates or knee braces with solid webs connected to the floor-beams and extending usually to the clearance line. If the unsupported length of the inclined edge of the gusset plate exceeds 18 inches, the gusset plate shall have one or two stiffening angles riveted along its edge. The gusset plate shall be riveted to a stiffener angle on the girder. Preferably it shall form no part of the floor-beam web.

130. In through plate girder spans with solid floors, there shall be knee-braces with $\frac{3}{8}$-inch webs, extending usually to the clearance line, at intervals of about 12 feet. Each knee-brace shall be well riveted to the floor and the girder, especially at the top, and shall have its edge reinforced by one or two angles.

Ends of Through Girders.

131. If through plate girders project two feet or more above the base of the rail, the upper corners shall be rounded. In multiple span bridges, usually only the extreme ends shall be rounded. Exposed ends of through girders shall be neatly finished with end plates.

Spans Shipped Riveted.

132. Deck plate girder spans less than 50 feet in length shall be shipped riveted complete, unless otherwise specified.

Masonry Bearings.

133. End bearings on masonry preferably shall be raised above the coping by metal pedestals.

134. Sole plates shall be not less than ¼-inch thick and not less in thickness than the flange plus ⅛-inch. Preferably they shall not be longer than 18 inches.

Anchor Bolts.

135. Anchor bolts shall be 1¼ inches in diameter and shall extend 12 inches into the masonry. There shall be washers under the nuts. Anchor bolt holes in pedestals and sole plates shall be 1⅝ inches in diameter, except that at expansion joints the holes in the sole plates shall be slotted.

(9) Trusses.

Type of Truss and Sections of Members.

136. Trusses shall have single intersection web systems and, preferably, inclined end posts. The top chords and end posts shall be made usually of two side segments with one cover plate and with stay plates and lacing on the open side. The bottom chords of riveted trusses shall be symmetrically made, usually of vertical side plates with flange angles. Web members shall be made of symmetrical sections.

Camber.

137. The length of members of truss spans shall be such that the camber will be equal to the deflection produced by the combined dead and live loads without impact.

Riveted Members in Pin-Connected Trusses.

138. In pin-connected trusses, hip verticals (and members performing similar functions) and, in single track spans, the two panels at each end of the bottom chords shall be riveted members.

Eye-Bars.

139. The cross sectional area of the head through the center of the pin hole shall exceed that of the body of the eye-bar by at least 37½ per cent. The thickness of the bar shall be not less than one-eighth of the width nor less than one inch, and not greater than 2 inches. The form of the head shall be submitted to the Engineer for approval before the bars are made. The diameter of the pin shall be not less than seven-eighths of the width of the widest bar attached.

Packing.

140. The eye-bars of a set shall be packed symmetrically about the plane of the truss and as nearly parallel as practicable, but in no case shall the inclination of any bar to the plane of the truss exceed ¼-inch per foot. They shall be packed as closely as practicable. They shall be held against lateral movement, and arranged so that adjacent bars in the same panel will not be in contact.

Gusset Plates.

141. The thickness of gusset plates connecting the chords and web members of the truss shall be proportionate to the stress to be transferred, but shall not be less than ½-inch.

Facilities for Lifting Span.

142. Provision shall be made for lifting the span at the ends.

Masonry Plates.

143. Masonry plates shall not be less than one inch thick.

(10) Viaducts.

Type of Viaduct.

144. Viaducts shall consist usually of alternate tower spans and free spans of plate girders or riveted trusses supported on bents. The tower spans usually shall be not less than 30 feet long.

Bents and Towers.

145. Viaduct bents shall be composed preferably of two supporting columns, and the bents usually shall be united in pairs to form towers. Horizontal diagonal bracing shall be placed in all towers having more than two vertical panels at alternate intermediate panel points. In double track towers, provision shall be made for the transmission of the longitudinal force to both sides.

Single Bents.

146. Where long spans are supported on short single bents, such bents shall have hinged ends, or else have their columns and anchorages proportioned to resist the bending stresses produced by changes in temperature.

Bottom Struts.

147. The bottom struts of viaduct towers shall be proportioned for the calculated stresses, but in no case for less than one-fourth of the dead load reaction on one pedestal, considered as compressive stress. Provision shall be made in the column bearings for expansion of the tower bracing.

Batter.

148. The columns usually shall have a batter transversely of one horizontal to six vertical for single track viaducts, or one horizontal to eight vertical for double track viaducts.

Depth of Girders.

149. The depth of girders in viaducts preferably shall be uniform.

Spacing of Girders.

150. In single track viaducts, the girder spacing usually shall be uniform throughout, and shall be determined by the spacing for the longest span in the viaduct, according to the rules specified for deck plate girder spans.

151. In double track viaducts, the girders under each track usually shall be spaced 6 feet 6 inches between centers, and the inner lines

of girders shall be supported by cross-girders framed between and riveted to the posts.

Girder Connections and Bracing.

152. Girders of tower spans shall be fastened at each end to the tops of the posts or cross-girders. Girders between towers shall have one end riveted, and shall be provided with an effective expansion joint at the other end. No bracing or sway frame shall be common to abutting spans.

153. If neither of the girders under a track rests directly over a tower post, bracing shall be provided to carry the longitudinal force into the tower bracing without producing lateral bending stress in the cross-girders or posts.

Sole and Masonry Plates.

154. Sole and masonry plates shall be not less than ¼-inch thick.

Anchorage for Towers.

155. Anchor bolts for viaduct towers and similar structures shall be designed to engage a mass of masonry the weight of which is at least one and one-half times the uplift.

(11) Materials.*

(a) Structural and Rivet Steel.

Process.

156. Structural and rivet steel shall be made by the open-hearth process.

Properties.

157. Test specimens of structural and rivet steel shall (except as modified in Articles 160, 163 and 164) conform to the following requirements as to chemical and physical properties:

	Structural Steel	*Rivet Steel*
Phosphorus, maximum		
Acid	.06 per cent.	.04 per cent.
Basic	.04 per cent.	.04 per cent.
Sulphur, maximum	.05 per cent.	.045 per cent.
Tensile strength, pounds per square inch	55,000 to 65,000	46,000 to 56,000
Yield point, pounds per sq. in., minimum	30,000	25,000
Elongation in 8 in., minimum, per cent	$\frac{1500000}{\text{Tens. Str.}}$	$\frac{1500000}{\text{Tens. Str.}}$
Elongation in 2 in., minimum, per cent	22	

Ladle Analyses.

158. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

*Specifications for materials conform to A. S. T. M. Standards, Serials A-7-16, A-27-16 and A-48-18 except as to the yield point requirements and Articles 178 and 179, and the footnote to Table II.

Check Analyses.

159. Analyses may be made by the Engineer from finished material representing each melt. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 157 by more than 25 per cent.

Specimen Tension Tests of Eye-Bar Material.

160. In order to meet the minimum tensile strength of full size annealed eye-bars required in Article 284, the Contractor may determine the tensile strength to be obtained in specimen tests, the range not to exceed 14,000 lb. per sq. in. and the maximum not to exceed 74,000 lb. per sq. in. The material shall conform to the requirements as to physical properties other than that of tensile strength as specified in Articles 157, 163 and 166.

Yield Point.

161. The yield point shall be determined by the drop of the beam of the testing machine.

Speed of Testing Machine.

162. The cross-head speed of the testing machine shall be such that the beam of the machine can be kept balanced, but in no case shall the values given in the following table be exceeded:

Gage Length of Specimen	*Maximum Cross-head Speed (in. per minute) in Determining:*	
	Yield Point	*Tensile Strength*
2 in.	0.5	2.0
8 in.	2.0	6.0

Modifications in Elongation.

163. For structural steel over ¼-inch in thickness, a deduction of one from the percentage of elongation in 8 inches specified in Article 157 shall be made for each increase of ⅛-inch in thickness above ¼-inch, to a minimum of 18 per cent.

164. For structural steel under ⅜-inch in thickness, a deduction of 2.5 from the percentage of elongation in 8 inches specified in Article 157 shall be made for each decrease of ⅛-inch in thickness below ⅜-inch.

Bend Tests.

165. The test specimens for plates, shapes, and bars (except as specified in Articles 166, 167 and 168) shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows:

(a) For material ¼-inch or less in thickness, flat on itself.

(b) For material more than ¼-inch to and including 1¼ inches in thickness, around a pin the diameter of which is equal to the thickness of the specimen.

Surface Defects.

179. Finished rolled material shall be free from cracks, flaws, injurious seams, blisters, ragged and imperfect edges, and other surface defects. It shall have a smooth finish, and shall be straightened in the mill before shipment.

Permissible Variations in Weight and Thickness.

180. The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent. from that specified, except in the case of sheared plates, which shall be covered by the following permissible variations. One cubic inch of rolled steel is assumed to weigh 0.2833 lb.

(a) When ordered to weight per square foot, the weight of each lot in each shipment shall not vary from the weight ordered more than the amount given in Table I. The term "lot" as applied to Table I means all of the plates of each group width and group weight.

(b) When ordered to thickness, the thickness of each plate shall not vary more than 0.01 inch under that ordered. The overweight of each lot in each shipment shall not exceed the amount given in Table II. The term "lot" as applied to Table II means all of the plates of each group width and group thickness.

Marking.

181. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded for shipment, be separated properly and marked for identification. The identification marks shall be stamped legibly on the end of each pin and roller. The melt number shall be marked legibly by stamping if practicable, on each test specimen.

(b) CAST STEEL.

Process.

182. Cast steel shall be made by the open-hearth or the crucible process.

Heat Treatment.

183. Castings shall be annealed.

Chemical and Physical Properties.

184. Test specimens of cast steel shall conform to the following requirements as to chemical composition and tensile properties:

Elements Considered	*Min. Ten. Strength lb. per sq. in.*	*Min. Yield Point lb. per sq. in.*	*Min. Elongation in 2 in.*	*Min. Reduction of Area*
Phosphorus not over 0.05%	60,000	30,000	22%	30%
Sulphur not over 0.05%				

TABLE I.—PERMISSIBLE VARIATIONS OF PLATES ORDERED TO WEIGHT.

ORDERED WEIGHT, Lb. Per Sq. Ft.	PERMISSIBLE VARIATIONS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF ORDERED WEIGHTS																	
	Under 48 In.		48 to 60 In., Excl.		60 to 72 In., Excl.		72 to 84 In., Excl.		84 to 96 In., Excl.		96 to 108 In., Excl.		108 to 120 In., Excl.		120 to 132 In., Excl.		132 In. or Over.	
	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.
Under 5	5	3	5.5	3	6	3	7	3	....	....	....	....	....	....	....	....	....	....
5 to 7.5, excl.	4.5	3	5	3	5.5	3	6	3	....	....	....	....	....	....	....	....	....	....
7.5 to 10 excl.	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	....	....	....	....
10 to 12.5, excl.	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	8	3	8	3	....	....
12.5 to 15, excl.	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	9	3
15 to 17.5, excl.	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3
17.5 to 20, excl.	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3
20 to 25, excl.	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3
25 to 30, excl.	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	5	3
30 to 40, excl.	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3

NOTE.—The weight per square foot of individual plates shall not vary from the ordered weight by more than 1½ times the amount given in this table.

TABLE II.—PERMISSIBLE OVERWEIGHTS OF PLATES ORDERED TO THICKNESS.

ORDERED THICKNESS, Inches.	PERMISSIBLE EXCESS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF NOMINAL WEIGHTS.								
	Under 48 In.	48 to 60 In., Excl.	60 to 72 In., Excl.	72 to 84 In., Excl.	84 to 96 In., Excl.	96 to 108 In., Excl.	108 to 120 In., Excl.	120 to 132 In., Excl.	132 In. or Over.
Under ¼	9	10	12	14	.....	.....	.....	.....	.....
¼ to ⅜, excl.	8	9	10	12	.....	.....	.....	.....	.....
⅜ to ½, excl.	7	8	9	10	12	.....	.....	.....	.....
½ to ⅝, excl.	6	7	8	9	10	13	14	16	19
⅝ to ¾, excl.	5	6	7	8	9	10	12	14	17
¾ to ⅞, excl.	4.5	5	6	7	8	9	10	12	15
⅞ to 1, excl.	4	4.5	5	6	7	8	9	10	13
1 to 1¼, excl.	3.5	4	4.5	5	6	7	8	9	11
1¼ to 1½, excl.	3	3.5	4	4.5	5	6	7	8	9
1½ to 1¾, excl.	2.5	3	3.5	4	4.5	5	6	7	8
1¾ to 2, excl.	2.5	2.5	3	3.5	4	4.5	5	6	7

NOTE.—The weight of individual plates ordered to thickness shall not exceed the nominal weight by more than 1½ times the amount given in this table.

Ladle Analyses.

185. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from drillings taken at least ¼-inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

Check Analyses.

186. Check analyses may be made by the Engineer from a broken tension or bend test specimen. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 184 by more than 20 per cent. Drillings for analysis shall be taken not less than ¼-inch beneath the surface.

Yield Point.

187. The yield point shall be determined by the drop of the beam of the testing machine. The speed of the machine shall conform to the requirements of Article 162.

Bend Test.

188. The test specimen shall bend cold through 120 degrees around a one inch pin without cracking on the outside of the bent portion.

Test Specimens.

189. Sufficient test bars from which the test specimens required by Article 192 may be selected, shall be attached to castings weighing 500 lb. or more, when the design of the castings will permit. If the castings weigh less than 500 lb., or are of such a design that test bars cannot be attached, two test bars shall be cast to represent each melt. Test bars shall be annealed with the castings they represent.

190. Tension test specimens shall conform to the dimensions shown in Fig. 6.

191. Bend test specimens shall be machined to 1 inch by ½-inch in section with corners rounded to a radius not over ⅛-inch.

Number of Tests.

192. One tension and one bend test shall be made from each annealing charge. If more than one melt is represented in the annealing charge, one tension and one bend test shall be made from each melt.

193. If the percentage of elongation of any tension test specimen is less than that specified in Article 184 and any part of the fracture is more than ¾-inch from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

194. If the results of the physical tests of any test lot do not conform to the requirements specified, the manufacturer may re-anneal such lot not more than twice and retests shall be made as specified in Article 184.

Workmanship and Finish at Foundry.

195. The castings shall conform substantially to the drawings and shall be made in a workmanlike manner. The castings shall be free from injurious defects.

Inspection at Foundry.

196. Tests and inspection shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection.

197. Castings which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

(c) CAST IRON.

Process.

198. Cast iron shall be of tough grey iron, and shall be made by the cupola process.

Finish.

199. Castings shall be true to pattern and free from excessive shrinkage. They shall be free from cracks, cold shuts, blow holes and other flaws.

Chemical Composition.

200. The sulphur content of cast iron shall not exceed the following:

Light castings	0.10 per cent.
Medium castings	0.10 per cent.
Heavy castings	0.12 per cent.

Drillings taken from the fractured ends of the transverse test bars shall be used for the sulphur determinations. One determination shall be made from each set of bars.

Classification.

201. Castings shall be classified as light, medium and heavy.

(a) Light castings are those having any section less than ½-inch thick.

(b) Heavy castings are those having no section less than two inches thick.

(c) Medium castings are those not included in either of the two classes above.

Test Bar.

202. Tests shall be made on the "Arbitration Test Bar" of the American Society for Testing Materials, as shown by Fig. 1, Serial A48-18.

Tension Tests.

203. Tension tests will be made only when specified by the Engineer and at the expense of the Company.

Number of Tests.

204. Two sets of two test bars each shall be cast from each melt in thoroughly dried green sand moulds, one set from the first iron poured and the other set from the last iron poured. Where the melt exceeds 20 tons, an additional set of two bars shall be cast from each additional 20 tons or fraction thereof.

Transverse Tests.

205. A transverse test of each bar cast shall be made. The load shall be applied at the middle, and the supports shall be spaced 12 inches apart. The load on the test bar at rupture shall be not less than the following:

Light castings	2500 pounds
Medium castings	2900 pounds
Heavy castings	3300 pounds

The deflection at rupture shall in no case be less than 0.10-inch. The rate of application of the load shall be such that a central deflection of 0.10-in. is produced in from 20 to 40 seconds.

(12) Workmanship.

Class of Work.

206. The work shall be "Punched Work" or "Reamed Work" as stipulated.

General.

207. The workmanship and finish shall be equal to the best general practice in modern bridge shops. Material at the shops shall be kept clean and protected from the weather as far as practicable.

Straightening Material.

208. Rolled material, before being laid off or worked, must be straight. If straightening or flattening is necessary, it shall be done by methods that will not injure the material. Sharp kinks and bends may be cause for rejection.

Finish.

209. Shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

Punched Work.

210. In punched work, holes in material whose thickness is not greater than the diameter of the rivets plus ⅛-inch, may be punched full size. Holes in material of greater thickness shall be drilled.

Reamed Work.

211. In reamed work, holes in material ⅞-inch thick and less, used for lateral, longitudinal and sway bracing, lacing, stay plates and diaphragms, may be punched full size.

212. Holes in other material ¾-inch thick and less, shall be sub-punched and reamed.

213. Holes in material more than ¾-inch thick shall be drilled.

Punched Holes.

214. Full size punched holes shall be $\frac{1}{16}$-inch larger than the nominal diameter of the rivets. The diameter of the die shall not exceed the diameter of the punch by more than $\frac{1}{32}$-inch. If any holes must be enlarged to admit the rivets, they shall be reamed. Holes must be clean cut, without torn or ragged edges. Poor matching of holes may be cause for rejection.

Sub-Punched and Reamed Holes.

215. In sub-punched and reamed work, the holes shall be punched $\frac{1}{16}$-inch smaller and, after assembling, reamed $\frac{1}{16}$-inch larger than the nominal diameter of the rivet. The diameter of the punch used shall be $\frac{1}{16}$-inch smaller than the nominal diameter of the rivet and the diameter of the die not more than $\frac{1}{32}$-inch larger than the diameter of the punch. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Accuracy of Punching in Reamed Work.

216. In sub-punched and reamed work, the punching shall be so accurately done that, after assembling and before reaming, a cylindrical pin ⅛-inch smaller in diameter than the nominal size of the punched hole may be entered, perpendicular to the face of the member, without drifting, in at least 75 of any group of 100 contiguous holes in the same plane. If this requirement is not fulfilled, the badly punched pieces shall be rejected. If any hole will not pass a pin $\frac{1}{16}$-inch smaller in diameter than the nominal size of the punched hole, this shall be cause for rejection.

Reaming After Assembling.

217. Reaming shall be done after the pieces forming a built member are assembled and so firmly bolted together that the surfaces are in close contact. Before riveting, they shall be taken apart, if necessary, and any shavings removed. When it is necessary to take the members apart for shipping or handling, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be permitted.

Accuracy of Reaming and Drilling.

218. When holes are reamed or drilled, 85 of any group of 100 contiguous holes in the same plane shall, after reaming or drilling, show no offset greater than $\frac{1}{32}$-inch between adjacent thicknesses of metal.

Reamed Holes.

219. Reamed holes shall be cylindrical, perpendicular to the member, and not more than $\frac{1}{32}$-inch larger than the nominal diameter of the rivets. Reamers preferably shall not be directed by hand. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Drilled Holes.

220. Drilled holes shall be ⅛-inch larger than the nominal size of the rivet. Burrs on the outside surfaces shall be removed.

Assembling for Drilling.

221. Connecting parts requiring drilled holes shall be assembled and securely held together while being drilled.

Shop Assembling.

222. The parts of riveted members shall be well pinned and firmly drawn together with bolts before riveting is commenced. The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. Surfaces in contact shall be painted. Bolts in field connection holes shall be left in place.

Field Connections.

223. Solid floor sections shall be assembled to the girders or trusses, or to suitable frames, in the shop, and the end connections made to fit. (103)

224. In reamed work, riveted trusses and skew portals shall be assembled in the shop, the parts adjusted to line and fit, and the holes for field connections drilled or reamed while so assembled. Holes for other field connections, except those in lateral, longitudinal and sway bracing, shall be drilled or reamed in the shop with the connecting parts assembled, or else drilled or reamed to a metal template.

225. In punched work, the field connections (except those in lateral, longitudinal and sway bracing) shall be reamed to metal templates.

Match-Marking.

226. Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished the Engineer.

Rivets.

227. The size of rivets called for on the plans shall be the size of the rivet before heating.

228. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

Riveting.

229. Rivets shall be heated uniformly to a light cherry red and driven while hot. Rivets, when heated and ready for driving, shall be free from slag, scale and carbon deposit. When driven, they shall completely fill the holes. Loose, burned or otherwise defective rivets shall be replaced. In removing rivets, care shall be taken not to injure the adjacent metal, and, if necessary, they shall be drilled out. Caulking or re-cupping will not be permitted.

230. Rivets shall be driven by direct-acting riveters where practicable. The riveters shall retain the pressure after the upsetting is completed.

231. When necessary to drive rivets with a pneumatic riveting hammer, a pneumatic bucker shall be used for holding up, when practicable.

Field Rivets.

232. Field rivets shall be furnished in excess of the nominal number required to the amount of 15 per cent. plus ten rivets, for each size and length.

233. Field rivets shall be carefully selected, and shall be free from fins on the under side of the head.

Turned Bolts.

234. Where turned bolts are used to transmit shear, the holes shall be reamed parallel and the bolts shall make a tight fit with the threads entirely outside of the holes. A washer not less than ¼-inch thick shall be used under each nut.

Planing Sheared Edges.

235. Sheared edges of material more than ⅝-inch in thickness and carrying calculated stress shall be planed to a depth of ¼-inch. Re-entrant cuts shall be filleted before cutting.

Lacing Bars.

236. The ends of lacing bars shall be neatly rounded, unless otherwise called for.

Fit of Stiffeners.

237. Stiffeners under the top flanges of deck girders and at all bearing points shall be milled or ground to bear against the flange angles. Other stiffeners must fit sufficiently tight against the flange angles to exclude water after being painted. Fillers and splice plates shall fit within ¼-inch at each end.

Web Plates.

238. Web plates of girders which have no cover plates may be ½-inch above or below the backs of the top flange angles. Web plates of girders which have cover plates may be ½-inch less in width than the distance back to back of flange angles.

239. When web plates are spliced, not more than ⅜-inch clearance between ends of plates will be allowed.

Facing Floor Beams, Stringers and Girders.

240. Floor beams, stringers and girders having end connection angles shall be made of exact length after the connection angles are riveted. If facing is necessary, the thickness of the angles shall not be reduced more than ⅛-inch at any point.

Finished Members.

241. Finished members shall be true to line and free from twists, bends and open joints.

Abutting Joints.

242. Abutting joints in compression members and girder flanges, and, where so specified on the drawings, in tension members shall be faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed ¼-inch.

Eye-Bars.

243. Eye-bars shall be straight, true to size, and free from twists, folds in the neck or head, and other defects. The heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of the heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the Engineer. The thickness of the head and neck shall not overrun more than $\frac{1}{16}$-inch for bars 8 inches or less in width, ⅛-inch for bars more than 8 inches and not more than 12 inches in width, and $\frac{3}{16}$-inch for bars more than 12 inches wide.

244. Eye-bars which are to be placed side by side in the structure shall be bored so accurately that, upon being placed together, the pins will pass through the holes at both ends at the same time without driving. Eye-bars shall have both ends bored at the same time.

Annealing.

245. Eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling. Proper instruments shall be provided for determining at all times the temperature of the bars.

246. Other steel which has been partially heated shall be properly annealed except where used in minor parts.

Boring Pin Holes.

247. Pin holes shall be bored true to gage, smooth, straight, at right angles with the axis of the member and parallel with each other, unless otherwise required. The variation from the specified distance from outside to outside of pin holes in tension members, or from inside to inside of pin holes in compression members, shall not exceed $\frac{1}{32}$-inch. In built-up members the boring shall be done after the member is riveted.

Boring Pins.

248. Pins larger than 9 inches in diameter shall have a hole bored longitudinally through the center of each not less than 2 inches in diameter.

Pin Clearances.

249. The difference in diameter between the pin and the pin hole shall be 1/50-inch for pins up to 5 inches in diameter, and $\frac{1}{32}$-inch for larger pins.

Pins and Rollers.

250. Pins and rollers shall be accurately turned to gage and shall be straight, smooth and free from flaws.

Screw Threads.

251. Screw threads shall make close fits in the nuts and shall be U. S. Standard, except that for pin ends of diameters greater than $1\frac{3}{8}$ inches, they shall be made with six threads to an inch.

Welds.

252. Welds in steel will not be allowed, except to remedy minor defects.

Forging Pins.

253. Pins larger than 7 inches in diameter shall be forged and annealed.

Bearing Surfaces Planed.

254. The top and the bottom surfaces of base and cap plates of columns and pedestals, except those in contact with masonry, shall be planed, or hot-straightened, and parts of members in contact with them shall be faced to fit. Connection angles for base plates and cap plates shall be riveted to compression members before the members are faced.

255. Sole plates of plate girders shall have full contact with the girder flanges. Sole plates and masonry plates shall be planed or hot-straightened. Cast pedestals shall be planed on the surfaces in contact with steel and shall have the bottom surfaces resting on masonry rough finished.

Pilot Nuts.

256. Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

(13) Weighing and Shipping.

Weight Paid for.

257. The payment for pound price contracts shall be based on the scale weight of the metal in the fabricated structure, including field rivets shipped. The weight of the field paint and cement, if furnished, boxes and barrels used for packing, and material used for staying or supporting members on cars, shall be excluded.

Variation in Weight.

258. If the weight of any member is more than 2½ per cent. less than the computed weight, it may be cause for rejection.

259. The greatest allowable variation of the total scale weight of any structure from the weights computed from the approved shop drawings shall be 1½ per cent. Any weight in excess of 1½ per cent. above the computed weight shall not be paid for by the Company.

Computed Weight.

260. The weight of steel shall be assumed at 0.2833 lb. per cubic inch.

261. The weights of rolled shapes, and of plates, up to and including 36 inches in width, shall be computed on the basis of their nominal weights and dimensions, as shown on the approved shop drawings, deducting for copes, cuts and open holes.

262. The weights of plates wider than 36 inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts and open holes. To this shall be added one-half of the allowed percentages of overrun in weight given in Article 180.

263. The weight of heads of shop driven rivets shall be included in the computed weight.

264. The weights of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10 per cent. for fillets and overrun.

Weighing of Members.

265. Finished work shall be weighed in the presence of the Inspector, if practicable. The Contractor shall furnish satisfactory scales and do the handling of the material for weighing.

Marking and Shipping.

266. Members weighing more than 5 tons shall have the weight marked thereon. Bolts and rivets of one length and diameter, and loose nuts or washers of each size, shall be packed separately. Pins, other small parts, and small packages of bolts, rivets, washers and nuts shall be shipped in boxes, crates, kegs or barrels, but the gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each package, box or crate.

267. Long girders shall be so loaded and marked that they may arrive at the bridge site in position for erection without turning.

268. Anchor bolts, washers and other anchorage or grillage materials shall be shipped in time for them to be built into the masonry.

(14) Shop Painting.

Shop Cleaning and Painting.

269. Unless otherwise specified, steel work, after it has been accepted by the Inspector and before leaving the shop, shall be thoroughly cleaned and given one coat of approved paint, applied in a workmanlike manner, and well worked into joints and open spaces. Cleaning shall be done with steel brushes, hammers, scrapers and chisels, or by other equally effective means. Oil, paraffin, and grease shall be removed by wiping with benzine or gasoline. Loose dirt shall be brushed off with a dry bristle brush before the paint is applied.

Surfaces in Contact.

270. Surfaces coming in contact shall be cleaned and given one coat of paint on each surface before assembling.

Erection Marks.

271. Erection marks shall be painted on painted surfaces.

Painting in Damp or Freezing Weather.

272. Painting shall not be done in damp or freezing weather except under cover, and the steel must be free from moisture or frost when the paint is applied. Material painted under cover in damp or freezing weather shall be kept under cover until the paint is dry.

Mixing of Paint.

273. Paint shall be thoroughly mixed before applying, and the pigments shall be kept in suspension.

Machine Finished Surfaces.

274. Machine finished surfaces of steel (except abutting joints and base plates) shall be coated with white lead and tallow, applied hot as soon as the surfaces are finished and accepted by the Inspector.

(15) Mill and Shop Inspection.

Facilities for Inspection.

275. Facilities for inspection of material and workmanship in the mill and shop shall be furnished by the Contractor to the Inspectors, and the Inspectors shall be allowed free access to the necessary parts of the premises.

Mill Orders and Shipping Statements.

276. The Contractor shall furnish the Engineer with as many copies of material orders and shipping statements as the Engineer may direct. The weights of the individual members shall be shown.

Notice of Rolling.

277. The Contractor shall give ample notice to the Engineer of the beginning of rolling at the mill, and of work at the shop, so that inspection may be provided. No material shall be rolled nor work done before the Engineer has been notified where the orders have been placed.

Cost of Testing.

278. The Contractor shall furnish, without charge, test specimens, as specified herein, and all labor, testing machines and tools necessary to make the specimen and full size tests.

Inspector's Authority.

279. The Inspector shall have the power to reject materials or workmanship which do not come up to the requirements of these specifications; but in cases of dispute, the Contractor may appeal to the Engineer, whose decision shall be final.

Rejections.

280. The acceptance of any material or finished members by the Inspector shall not be a bar to their subsequent rejection, if found defective.

281. Rejected material and workmanship shall be replaced promptly or made good by the Contractor.

(16) Full-Size Tests.

Full-Size Tests of Eye-Bars.

282. The number and size of the bars to be tested shall be stipulated by the Engineer before the mill order is placed. The number shall not exceed 5 per cent. of the whole number of bars ordered, with a minimum of two bars on small orders.

283. The test bars shall be of the same section as the bars to be used in the structure and of the same length if within the capacity of the testing machine. They shall be selected by the Inspector from the finished bars preferably after annealing. Test bars representing bars too long for the testing machine shall be selected from the full length bar material after the heads on one end have been formed and shall have the second head formed upon them after being cut to the greatest length which can be tested.

284. Full-size tests of eye-bars shall show a yield point of not less than 29,000 pounds per square inch, an ultimate strength of not less than 54,000 pounds per square inch, and an elongation of not less than 10 per cent. in a length of 20 feet measured in the body of the bar. The fracture shall show a silky or finely granular structure throughout.

285. If a bar fails to meet the requirements of Article 284, two additional bars of the same size and from the same mill heat shall be tested. If the failure of the first test bar is on account of the character of the fracture only, the bars represented by the test may be reannealed before the additional bars are tested.

286. If two of the three bars tested fail, the bars of that size and mill heat shall be rejected.

287. A failure in the head of a bar shall not be cause for rejection if the other requirements are fulfilled.

288. A record of the annealing charges shall be furnished the Engineer showing the bars included in each charge and the treatment they receive.

289. Bars thus tested which meet the requirements of the specifications shall be paid for by the Company at the same unit prices as the structures. Bars which fail to meet the requirements of the specifications, and all bars rejected as a result of tests, shall be at the Contractor's expense.

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Section 106 Evaluation
Architectural and Structural Resources
The Existing Rail Line of the DM&E Railroad
Powder River Basin Expansion Project
in South Dakota

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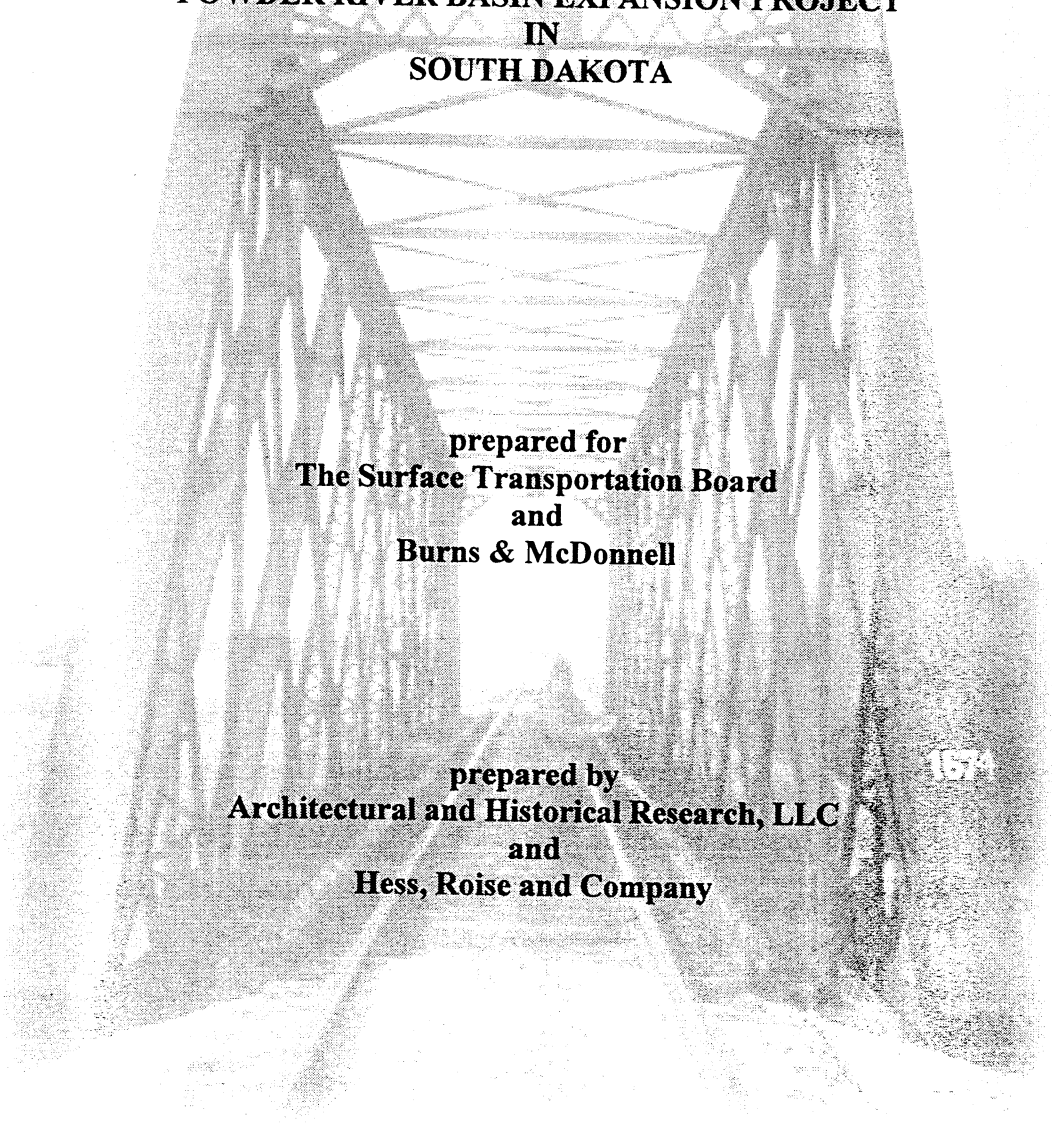
SECTION 106 EVALUATION
ARCHITECTURAL AND STRUCTURAL RESOURCES

THE EXISTING RAIL LINE
OF THE
DAKOTA MINNESOTA AND EASTERN RAILROAD
POWDER RIVER BASIN EXPANSION PROJECT
IN
SOUTH DAKOTA



prepared for
The Surface Transportation Board
and
Burns & McDonnell

prepared by
Architectural and Historical Research, LLC
and
Hess, Roise and Company

May 2000

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