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tions indicate plainly that the worm has destroyed the valves. It is also known that the regulating valves at the upper and lower ends of Pedro Miguel Locks will have to be removed and replaced with steel valves.

In Fig. 3, pieces *A* and *B* show sections of one of the lock gate sill timbers originally installed in January, 1914, and removed in March, 1922. The timber shown was part of the intermediate gate sill in the west chamber of the upper lock at Miraflores. It is known that similar replacement must be made at Pedro Miguel Locks when maintenance work starts there next fall. Pedro Miguel Locks are used between Gatun Lake level (85 ft. above sea level) and Miraflores Lake (54 ft. above sea level).

Some action of the teredo has also been noted at the Atlantic locks, but not to such an extent that is has required the removal and replacement of the greenheart sill timbers.

The result of our experience with teredo and greenheart at the Pacific locks indicates that the shipworm will live and thrive in greenheart timber in sea water, in the brackish water of Miraflores Lake, 54 ft. above sea level and even in timbers located in upper Pedro Miguel Locks where the water is supposedly fresh (85 ft. above sea level) and fed by Gatun Lake.

Strengthening Truss Bridge Over Tracks at Chicago

Corrosion of Old Bridge Carrying Heavy Traffic Necessitates Reinforcement in Advance of Building New Structure

TEMPORARY reinforcement of trusses in the Jackson Boulevard bridge over the tracks approaching the Chicago union station has been carried out recently on account of extensive deterioration of the bridge and pending its reconstruction within the next few years.

This structure consists of a 64-ft. half-through plate girder span and a 213½-ft. pin-connected through truss span, both built in 1888. The structure is so located that smoke and gases from locomotives standing in the station caused extensive corrosion in members of the truss span. There are two 21-ft. roadways with an intermediate truss and two 8-ft. sidewalks outside of the outer trusses. In addition to very heavy automobile traffic, there is a large number of heavy mail trucks going to and from the Union Station. Since this street is a city boulevard it is not used by heavy commercial trucks, but for a large part of the day the structure is loaded from end to end with two rows of pleasure vehicles on each roadway and when the river span is open for passage of a vessel these vehicles stand as close together as possible on the approach span.

An inspection of the bridge, during which the minimum reduced section of each member was calipered, showed reductions in section of from 30 to 60 per cent, so that when calculations were made excessive stresses were found to exist in chords and diagonals. The live-load used in these calculations was 100 lb. per square foot on roadways and sidewalks.

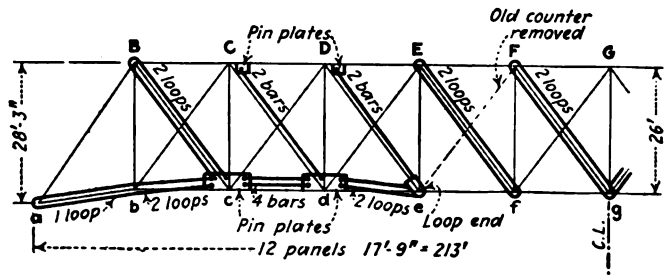


FIG. 2—REINFORCEMENT OF MIDDLE TRUSS

A new viaduct will be built at this point in connection with the new Union Station work and probably will be completed within the next two or three years. The north half of the existing structure will be removed when the new viaduct is started and the entire traffic of Jackson Boulevard will be carried by the south roadway until the first section of the new bridge is completed, and in service. Somewhat more extensive repairs were made, therefore, to the south roadway on account of the additional traffic which will be carried during construction of the new bridge. But on account of the short remaining life of the present structure only those members having a calculated stress which greatly exceeded safe working values were reinforced. For the same reason pairs of 4 x 18-in. timbers were bolted to the steel floor stringers for strengthening them, as a substitute for the more expensive method of renewing with steel members.

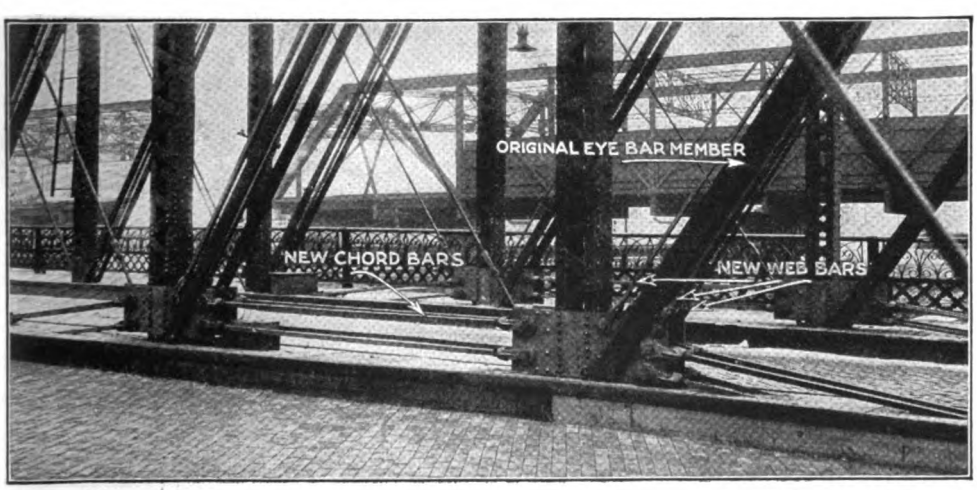


FIG. 1—BOTTOM CHORD AND WEB REINFORCEMENT IN MIDDLE TRUSS
The original eyebar chord is under the floor.

Part of the bottom-chord reinforcement is shown in Fig. 1, this work being above the floor while the original bottom chord, composed of eyebars, is below the floor. The location and arrangement of reinforcing members in the middle truss is shown in Fig. 2 and details of typical examples are given in Fig. 3. In the middle truss (Fig. 2) the work is as listed below, and this is duplicated at the other end of the truss.

Chord Reinforcement

a—b, One loop, 2⅛-in. bars, both ends looped.

b—c, Two loops with 1⅞-in. bars; loop at *b* and pin ends in plates at *c*.

c—d, Four bars 1⅞-in. with pin ends in plates.

d—*e*, Two loops, with 1⅞-in. bars; pin ends at *d* and loop at *e*. Web reinforcement.
B—*c*, Two loops with 1⅜-in. bars; loop at *B* and pin ends at *c*.
C—*d*, Two 2-in. bars with pin ends.
D—*e*, Two 2-in. bars with pin ends at *D* and loops at *e*.
E—*f*, Two loops of 1½-in. bars.
F'—*g*, Two loops of 1⅞-in. bars.

Truss reinforcement consisted of loop rods wherever space was available for placing these loops on the truss pins, the bars and loops being connected and adjusted by turnbuckles. In two panels of the middle truss the old counters were removed to provide room for placing the new loops on the pins. At some panel points an alternative method was made necessary by the position of the chord eyebars. This method consisted of riveting pin plates to the truss posts for the connection of flat yokes carrying the new chord bars. At some of the top-chord panel points also it was necessary to rivet pin plates to the chords for the attachment of yoke ends on the diagonal bars. These various connections are shown in Figs. 2 and 3.

Jacking Posts—In addition to the reinforcement of the trusses it was found necessary to renew the timber bents supporting the east end of the south truss, owing to the crushing of the caps under load. This timbering was placed under the span in 1917 to form an extension of the masonry pier when the bridge was shifted southward about 5 ft. to line up with the new bascule span built across the river at that time.

Restricted space under the bridge made it impossible to place jacking bents at panel points and the method adopted was to raise the trusses by means of steel jacking posts connected to the end posts, as shown in Fig. 4. It will be noted that bar loops were used to connect the jacking point with the pin at the first panel point of the bottom chord in order to provide against bending the end post. Four 50-ton jacks were used under the post, the jacks being mounted on temporary timber bents placed close against the bridge pier. The calculated load of the middle truss was about 140 tons.

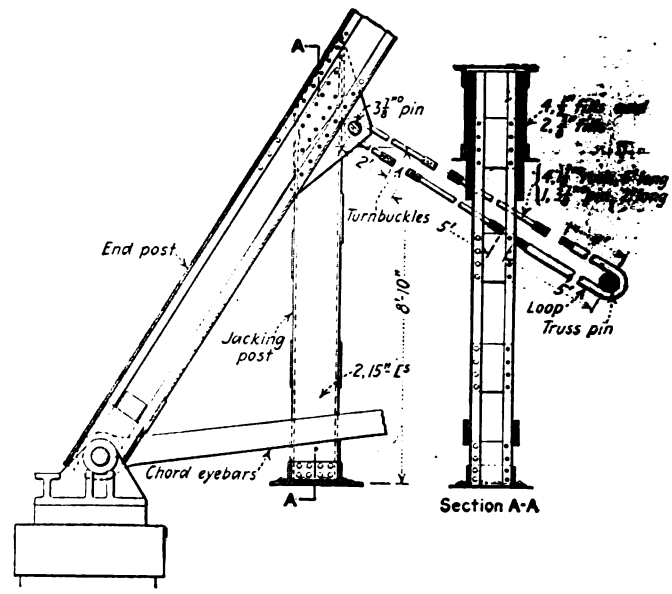


FIG. 4—JACKING POST FOR RAISING BRIDGE

This entire work was made necessary largely through postponement of the Union Station work during the war, and from its temporary character it was more or less of a makeshift, only such repairs being undertaken as were considered absolutely necessary for the safety of the structure until its renewal. The truss and floor-system reinforcing was designed by J. C. Bland,

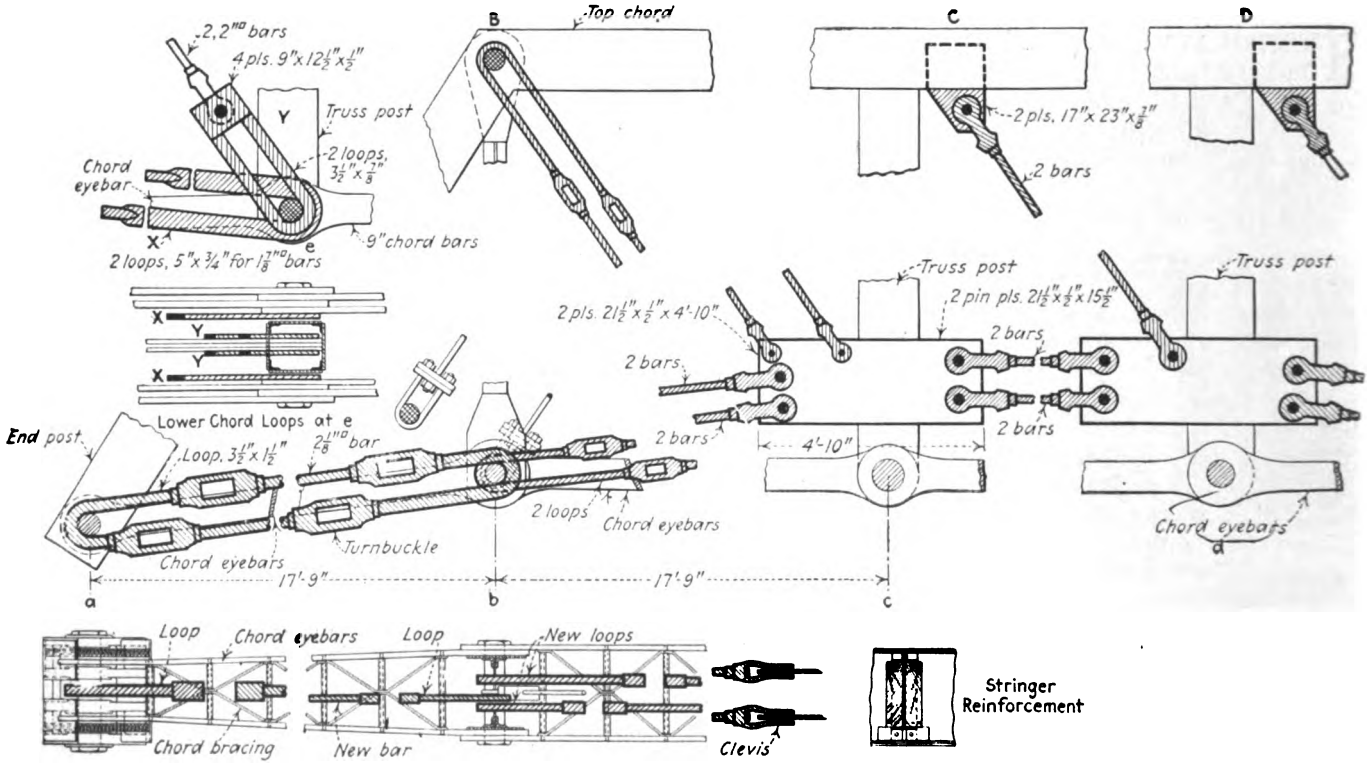


FIG. 3—DETAILS OF REINFORCING MEMBERS OF BRIDGE TRUSS

engineer of bridges and buildings, Pennsylvania R.R., Pittsburgh, Pa. The work was done by the Ferro Construction Co., Chicago, under the supervision of C. L. Barnaby, division engineer, Pennsylvania R.R. Field inspection was done and the raising apparatus designed under the direction of T. J. Skillman, chief engineer of maintenance-of-way, Pennsylvania R.R. (northwestern region), Chicago.

FIG. 5—JACKING POST CONNECTION TO END POST OF TRUSS

Somewhat similar reinforcement operations on two other Chicago bridges, one of which was a drawspan, were described in *Engineering News-Record* of May 8 and 15, 1919, pp. 913 and 956.

Transfer of Whole Town 11 Miles by Truck and Trailer

Jennings, Mich., Being Moved to Cadillac on Specially Built Structural Steel Frame of Trailer — Running Time Four Hours

HOUSES in the abandoned town of Jennings, Mich., are being transferred by truck and a specially built gigantic trailer to Cadillac, Mich., 11 miles distant. Jennings was founded about 25 years ago by the Mitchell Brothers Lumber Co. A sawmill, flooring and chemical plant gave employment to 500 men. Now the industries, families and residences are all being moved. Many plans for the transfer were considered and rejected as impractical. Finally engineers of the Acme Motor Truck Co. proposed building for the lumber company a trailer with four wheels abreast supporting a steel frame capable of carrying a 35-ton house.

There are 75 to 100 houses to move, an operation which will require three or four months' time. They vary from 24 x 30 ft. to 24 x 40 ft., and are all 1½ stories high, well-built, comfortable and arranged for convenience; and many of them have hardwood floors. Their weight varies from 15 to 35 tons. The windows are left in all of them and none has been cracked, except in passing through the city of Cadillac, when the limbs of shade trees along the streets broke one or two when the first house was brought in.

The 11-mile trip is made in about 4 hours, which includes all necessary stops to wait for traffic to pass before entering upon a stretch of road too narrow to allow passing, though the actual running speed is from 5 to 8 miles per hour. Loading and unloading and passing through the city requires a longer time, however, as it is often necessary to raise or remove the electric light and telephone wires. Up to Sept. 1 the rate of moving was about two houses every three days, although as the crew doing the work grows more accustomed to it it is probable a house a day will be brought over the road. The flooring and chemical plant will also be brought to Cadillac, which will result in an increase of from 500 to 1,000 in population and make additional homes necessary; at present a shortage of houses exists in the city.

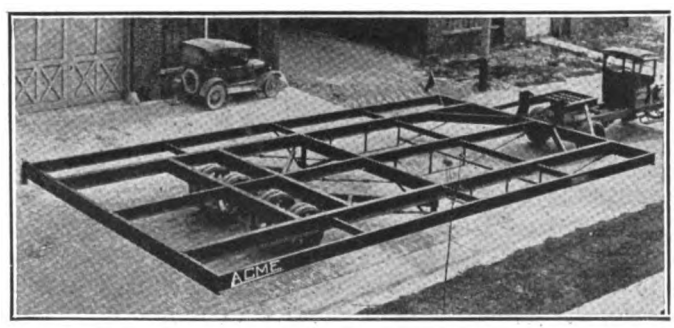
The frame of the trailer is 24 ft. wide by 42 ft. long and consists of five longitudinal members of structural steel, securely held in place by two main and four supplementary transverse beams. Diagonal cross-braces are built into the frame to distribute the stresses where excessive weaving and twisting would occur. To give added rigidity and strength to the structure, the three center longitudinal members are reinforced with large

STORY-AND-A-HALF HOUSE READY FOR 11-MILE JOURNEY

trussrods securely anchored to the member at each end and supported at equal intervals by cast-iron struts. The tension in these rods is equalized by a series of turnbuckles.

The platform at the forward end of the frame is raised 18 in. above the trailer and is constructed of channels, I-beams and plates, substantially braced with diagonal members to the forward transverse member of the trailer proper in order to eliminate side sway. This platform is connected to the trailer frame by means of heavy gusset plates and channels of sufficient strength to transfer safely approximately 25 per cent of the weight of the trailer and load to the rocking fifth-wheel mounted on the truck.

At the rear the trailer is carried on four cast-steel truck wheels, all abreast, equipped with 40 x 6 dual truck tires. The wheels are arranged in pairs, each wheel operating on tapered roller bearings supported by a tubular steel axle shaft. The shafts of each pair of wheels are bolted together at the center through a large steel casting which is supported by an extra heavy wrought-iron pipe extending through it and at right angles to the shaft. Heavy steel pillow blocks at either



STRUCTURAL STEEL TRAILER FRAME FOR TRANSPORTING HOUSES