

THE USE OF SECTION MOTOR CARS ON THE SAN PEDRO, LOS ANGELES & SALT LAKE.

An example of the economies secured by the use of motor cars for section forces is afforded by the experience of the San Pedro, Los Angeles & Salt Lake last summer. Although light motor cars have been used for inspection purposes by the superintendent, engineer maintenance of way, roadmasters and foremen of bridges and buildings for about eight years, section motor cars were first provided last year. Four Fairbanks, Morse & Company cars were bought and were placed in the hands of foremen, some of whom were white and some Japanese, and none of whom had had any previous experience with gasoline engines or motor cars. No attempt was made to pick out men to run them. As was to be expected, there has been some irregularity in their performance, partially due to the fact that they have not been continuously in the hands of the same men. The variations, however, have been such as may be readily understood and no difficulty is anticipated in reducing the performance to a fair degree of regularity.

The cars are being used on grades as high as 3.6 per cent. and it is found that they will carry a gang of five or six men with their tools up such a grade with a little pumping on the part of the men, the engine itself being not quite strong enough to climb the hill alone with this load. Reports of their performance are made monthly to the roadmaster and the division engineer, from which the following figures are taken. It will be noted that the cars average about 22 miles per gallon of gasoline and that the total cost of operation has averaged \$1.48 per 100 miles. The reports are posted daily by the foremen and summaries are made at the end of the month.

As a result of the experience with these cars authority has been granted to equip three branch lines throughout with motor cars. These branches aggregate 101 miles and have heretofore been divided into 11 sections. With the motor car but seven sections will be required, thus relieving four foremen with their hand cars, push cars and some tools. It is estimated that it will cost about \$1,500 to equip the seven sections with motor cars, and that the total cost of operating them for the first five

months will bring this amount up to \$1,800. The saving in wages, hand and push cars and tools will offset this expense, and after five months the annual saving in wages alone without reducing the number of laborers is estimated at a trifle over \$3,000. In addition to this, the local officials believe that they will get more efficient track work.

ERECTION OF ROCK ISLAND BRIDGE OVER IOWA RIVER, COLUMBUS JUNCTION, IOWA.

The Chicago, Rock Island & Pacific has recently completed the reconstruction of a bridge over the Iowa river about 300 ft. south of the junction of the Iowa and Cedar rivers, near Columbus Junction, Iowa, in which the erection of the steel work was handled by a new and original method. This work was described in a recent number of the *Rock Island Employees' Magazine*, from which the following information is taken:

The old bridge consisted of six 150-ft. through latticed trusses and one 58-ft. deck plate girder over the channel of the river proper, with a series of 66-ft. deck plate girders on the approaches. The girders on the approach spans were supported on stone masonry piers. Three of the piers supporting the truss spans were also of stone and were constructed over 40 years ago. These piers were in such bad condition that they had to be replaced. The other piers supporting the truss spans were of concrete and were constructed about six years ago.

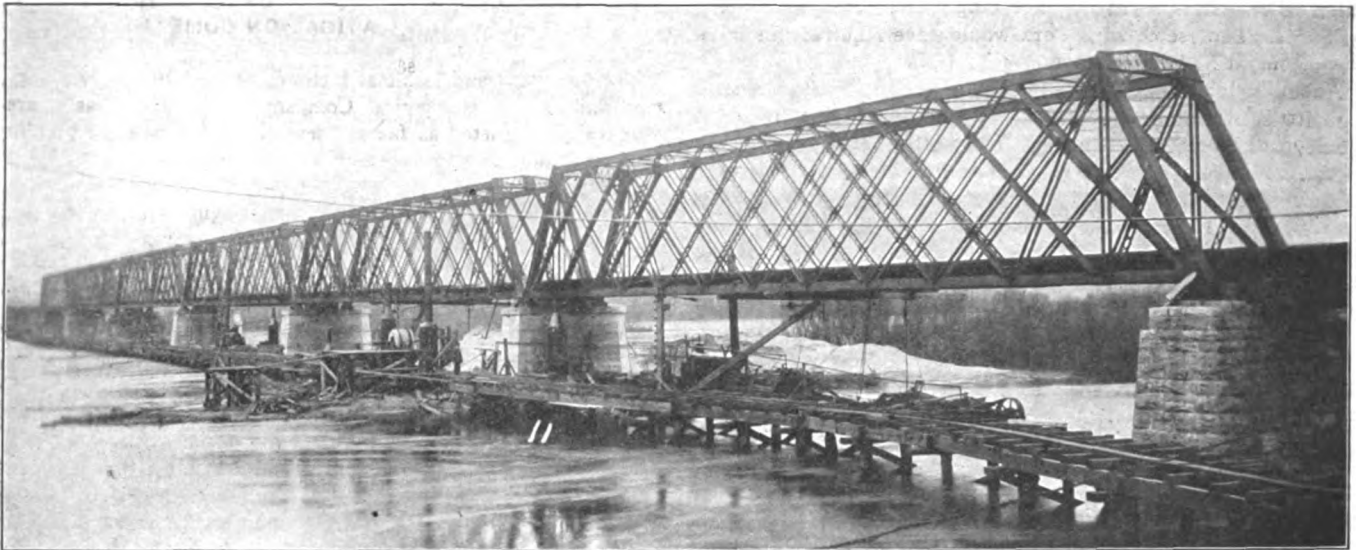
Although the through truss spans were in good condition, they were constructed several years ago and were not designed for the present day heavy traffic. For this reason their renewal became necessary and they were replaced by 11 deck plate girder spans, two of which were 75 ft. long, six 78 ft. long, and three 103 ft. long. These various lengths of girders were necessary in order to utilize the existing concrete piers. Six new concrete piers were built between the old ones in addition to the stone piers rebuilt, requiring in all 1,700 yds. of concrete.

Instead of following the general practice of supporting the old bridge and erecting the new one on false work, a new plan was adopted, in order to eliminate the heavy cost of the

MOTOR CAR PERFORMANCE ON S. P. L. A. & S. L.

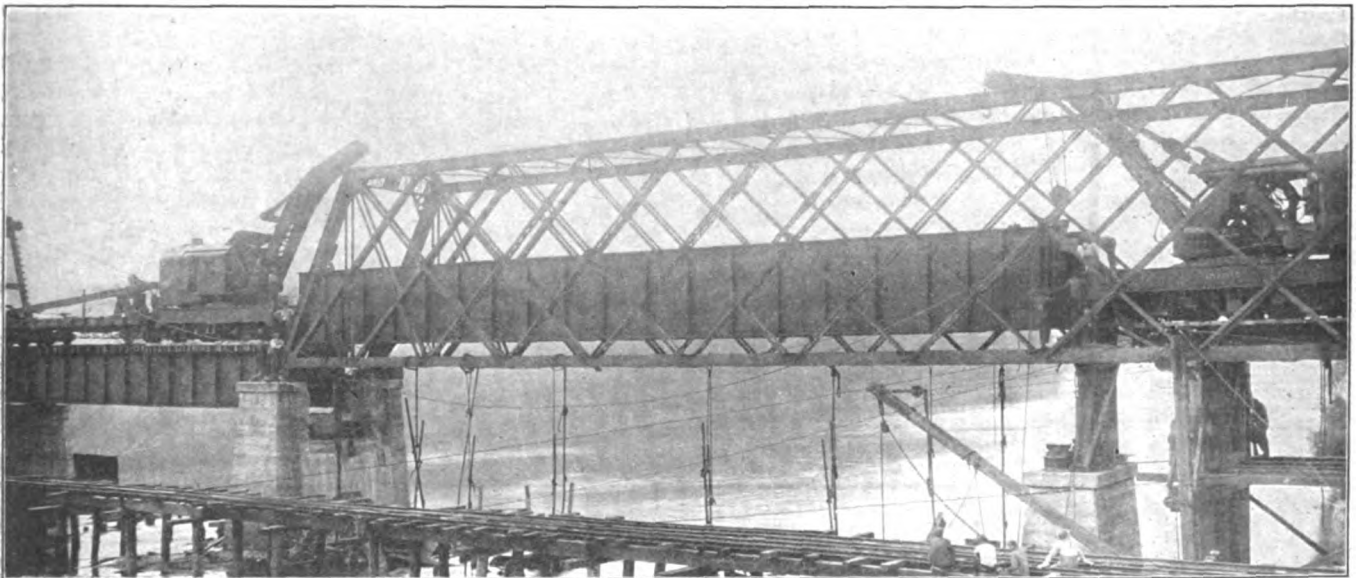
JULY, 1911.

Car No.	Days in Use.	Miles Run.	Miles per gallon.		Cost per 100 miles, oil and gasoline.	Supplies, other than oil and gaso.	Repairs, labor and material.	Total cost per 100 miles.	Delays.	Remarks.
			Gasoline.	Lub. oil.						
5770.....	14	243	20.25	243	\$1.12	.....	.....	\$1.12	.....	Gasoline, \$0.20 per gal.
5617.....	28	641	23.31	427	.94	.....	.....	.94	.....	Lubricating oil, \$0.30 per gal.
5624.....	29	265	22.08	265	1.03	.....	.....	1.03	.....	
Average.....	..	383	22.31	328	\$1.00	.....	.....	\$1.00	.....	
AUGUST, 1911.										
5770.....	31	294	17.29	98	\$1.50	\$1.82	.....	\$2.11	.....	Excessive oil used.
3476.....	31	407	16.28	136	1.47	.....	.....	1.47	.....	Excessive oil used.
5617.....	31	304	23.38	347	.95	.....	.....	.95	.....	
5624.....	31	302	25.17	302	.91	.....	.....	.91	.....	
Average.....	..	327	19.51	166	\$1.22	\$0.14	.....	\$1.36	.....	
SEPTEMBER, 1911.										
5770.....	30	341	24.36	248	\$0.95	\$1.68	.....	\$1.45	.....	Supply items are spark plugs and 15 cells, dry batteries.
3476.....	30	250	25.00	286	.92	.91	.....	1.28	.....	
5617.....	30	413	22.94	300	.98	.....	.....	.98	.....	
5624.....	30	294	24.50	336	.92	1.82	.....	1.53	.....	
Average.....	..	325	24.04	288	\$0.95	\$0.34	.....	\$1.29	.....	
OCTOBER, 1911.										
5770.....	31	489	23.29	301	\$0.97	.....	\$3.60	\$1.71	.....	Cleaning engine.
3476.....	31	428	23.78	311	.95	.....	3.60	1.79	.....	Cleaning engine.
5617.....	31	184	19.37	245	1.17	.....	13.63	8.58	18 days	Damaged in collision. Fault of foreman.
5624.....	31	346	24.71	346	.91	\$1.82	.....	1.44	.....	8 cells, dry batteries.
Average.....	..	362	23.15	305	\$0.97	\$0.13	\$1.44	\$2.54	18 days	
NOVEMBER, 1911.										
5770.....	30	480	23.29	384	\$0.92	\$1.37	.....	\$1.20	.....	Supply items are 1 spark plug and 20 cells, dry batteries.
3476.....	27	509	25.45	407	.87	.....	.....	.87	.....	Dirty spark plug.
5617.....	30	588	22.62	314	.99	1.82	.....	1.30	10 min.	
5624.....	20	405	27.00	432	.82	2.47	.....	1.43	.....	
Average.....	..	496	24.47	373	\$0.91	\$0.29	.....	\$1.19	10 min.	
Average for 5 months..	..	379	22.70	292	\$1.01	\$0.18	.....	\$1.48	.....	



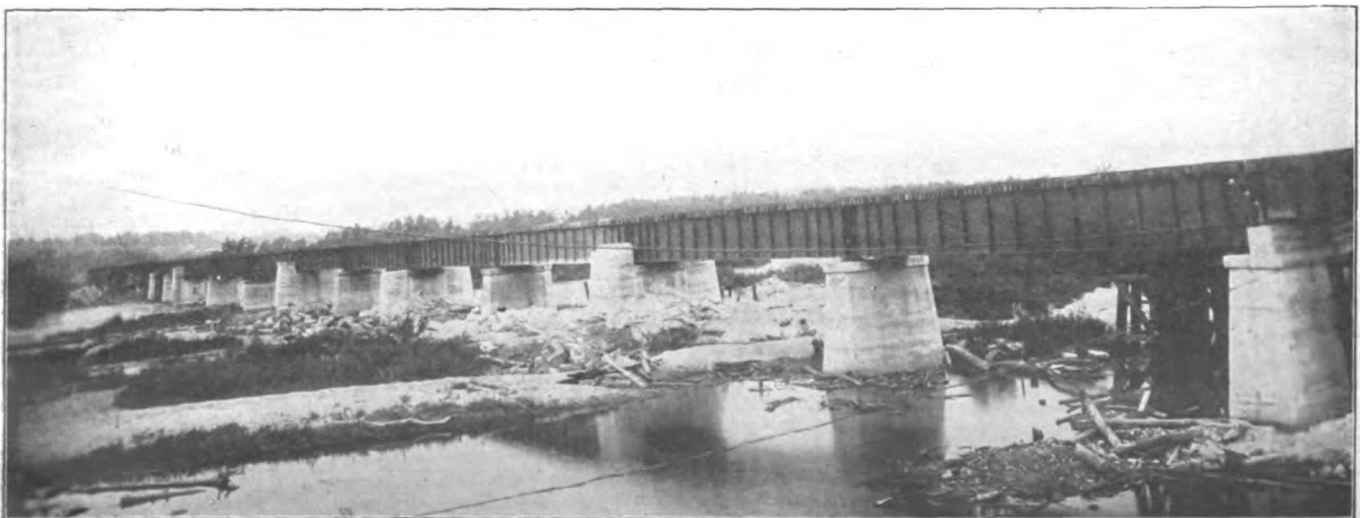
Copyright, J. G. Baker, Columbus Jct., Iowa.

Old Rock Island Bridge at Columbus Junction, Iowa.



Copyright, J. G. Baker, Columbus Jct., Iowa.

Lowering 103-ft. Girders Into Place With Steam Wrecking Cranes.

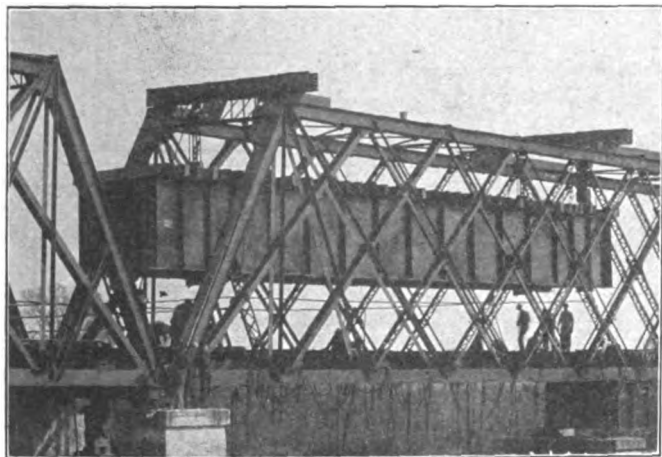


Copyright, J. G. Baker, Columbus Jct., Iowa.

Completed Bridge Over Iowa River.

false work and the danger of its being carried away or injured by floods. The use of false work would have required this work to be done at low water stage.

As many rivets as could safely be spared from the floor system of a truss were cut off in advance, and the top laterals and one portal were removed. Two heavy steel beams with steel pins from which block and tackle could be suspended were then placed on top of the trusses over the locations of the ends of the girders to be placed, as shown in the smaller photograph. Two sets of blocks were suspended from each beam. The girder span to be placed was riveted up and placed on two flat cars with half the track ties in position on it. When everything was in readiness a train, consisting of an engine, a flat car arranged so that the lines from each set of blocks could be attached, two cars loaded with the span to be placed, and a derrick car, was run on to the bridge. The cars holding the girders were spotted so that these girders were directly above their final location, and block and tackle were hooked on to each end of the girders. Lines from these blocks were attached to the flat car next to the engine, which had been moved ahead three or four car lengths. The engine then moved slowly forward lifting the span clear of the cars, which were then shoved out of the way. The girders were held suspended by the engine until the track and floor system of the old bridge were removed. All



Copyright, J. G. Baker, Columbus Jct., Iowa.

Lowering Girders Into Place by Block and Tackle.

the remaining rivets in the floor system were taken out. Two runner lines from the derrick car were then hitched to a floor beam and it was raised clear of the bottom chord of the trusses, when both the floor beam and stringers were quickly dropped into the river and recovered later. After the floor system was out of the way, the girder span was lowered into place by the engine, the rails laid on the ties and traffic resumed. The best time made in placing one of the shorter spans was 1 hour and 25 minutes from the time the track was blocked until traffic was resumed. Because of their great weight, the 103-ft. girders were placed by two wrecking cranes, as shown. The longest time required in placing one of these girders was three hours. In placing these 11 new spans and taking down the eight old ones, no train was delayed, although it was necessary to handle a traffic of from 10 to 15 trains during working hours.

When the girders which replaced the truss spans had been set the trusses were braced and supported from the new girders to provide for wind stresses until they could be taken down piece by piece by the derrick car. The practicability of this method, as compared with false work, is shown by the fact that three of the trusses were replaced during the highest flood stage of the river, at a time when false work would have been torn out by the ice and drift. The handling of this steel work was all done by company forces under the general direction of J. B. Berry, chief engineer, and I. L. Simmons, bridge engineer.

NEW SEATTLE TERMINALS; OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY.

The new yard and terminal facilities of the Oregon-Washington Railroad & Navigation Company at Seattle, Wash., are practically completed as far as they will be built at the present time, and most of them are now in regular service. They were made necessary by the inauguration of train service into Seattle by the Oregon-Washington Railroad & Navigation Company on January 1, 1910. The establishment of regular independent train service by the Harriman Lines between Seattle and Portland forms the closing chapter in the history of the efforts of this system to enter the Puget Sound territory, which had been previously occupied exclusively by the Hill Lines. This contest had reached the stage where the O. W. R. R. & N. had started the construction of its own line and had completed 3,000 ft. of tunnel in Tacoma when negotiations were consummated for the perpetual joint use of the Northern Pacific tracks from Portland to Tacoma and the temporary use of their tracks from Tacoma to Seattle. Since that time a new track has been built jointly by the O. W. R. R. & N. and the Chicago, Milwaukee & Puget Sound from Tacoma to Black River Junction, nine miles from Seattle, and a line was built independently by the Harriman line from Black River Junction to Seattle.

Because of this entrance into Seattle entirely new freight and passenger terminals were necessary. The arrangements for the joint use of the Northern Pacific tracks were not concluded until about December 21, 1909, and passenger service was inaugurated on January 1, 1910. This gave but ten days to make preparations to handle the engines and equipment. The land for terminal facilities had been secured before an entrance into the city had been decided on. A temporary terminal was hurriedly provided. A frame enginehouse, boilerhouse and sandhouse were erected and a small coach-cleaning yard was equipped. A temporary passenger station was erected on the site of the proposed permanent local freight station. When the first train entered these temporary facilities were ready and remained in operation until replaced by the permanent structures. In the two years since the inauguration of this service a complete terminal layout has been built and today modern passenger and freight stations and a freight yard, with engine house coal chute, storehouse and other buildings, have been completed. Six passenger trains and several freight trains now enter and leave Seattle daily over the O. W. R. R. & N.

The most prominent feature in the Seattle improvements is the new passenger station which was opened on May 20, 1911. This station faces north on Jackson street and is directly across Fourth avenue from the Northern Pacific-Great Northern station. The building is of concrete and steel construction, with brick curtain walls, and white artificial stone trimmings. It is three stories high above the street, while the track level is depressed 24 ft. below the street. The general waiting rooms are located on the first floor, while the second and third floors are devoted to offices. The C. M. & P. S. uses this station under arrangements made subsequent to its completion. Additional details of the station, together with plants showing the track layout, were given in the *Railway Age Gazette* of January 21, 1910.

By depressing the tracks, grade crossings at Seattle boulevard, just south of the station, and of Jackson street, just north of the station, were avoided. This depression required heavy concrete work, both in the viaducts carrying Seattle boulevard and Jackson street, and in a heavy retaining wall just east of the station, supporting the west side of Fifth avenue. The adoption of a special design for this wall allowed Fifth avenue to be widened without any loss in track room below. That portion of the roadway above the tracks is supported on a concrete floor, one side of which rests on the wall and the other on reinforced concrete posts, spaced 20 ft. center to center. The sidewalk is carried by cantilever construction, extending beyond the posts. This arrangement allows one track to be laid between the line of

AN ECONOMICAL METHOD OF REPLACING TRUSSES WITH GIRDERS.

By S. T. COREY,

Chief Draftsman, Bridge Department, Chicago, Rock Island and Pacific.

The main line of the Missouri division of the Chicago, Rock Island and Pacific crosses the Iowa River about one mile east of Columbus Junction, Iowa. The first channel spans of the Warren or Thatcher combination type, resting on stone piers, were probably erected about 1868. In the early 90's these spans were replaced by six through lattice spans, each approximately 150 ft. long, on the original substructure. In 1903 it was found that these stone piers were deteriorating rapidly, and the latticed spans were therefore placed on falsework and four new concrete piers were constructed. The present bridge consists entirely of deck plate girder spans on concrete piers and is approximately 1,550 ft. long.

This article covers the replacement of the six through latticed spans by 11 girder spans. The old bridge was designed for two

also the probability that the falsework would be washed out with the first spring freshet with attendant interruption of traffic and loss of the old spans. As an alternative, it was decided to utilise the lattice trusses in the erection of the new girder spans.

Briefly, the method determined upon to erect the two 75 ft. and the six 77 ft. 9 in. spans was as follows: A girder span, completely rivetted up and with deck on, was brought in on flat trucks, being placed immediately above its final location, and then raised by block and tackle fastened to loading beams placed across the top chords of the trusses. The old floor was removed while the span was suspended and the latter was then lowered to its bearings. The loading beams were made from second-hand material.

The steel for the new superstructure was stored in the yard at Fredonia, about half a mile east of the bridge site. Here the spans were assembled on flat trucks rivetted up, and the new decks put on. This arrangement was very effective, as the work of assembly was carried on without interruption from passing trains. The traffic at this point was heavy, the maximum interval during the day



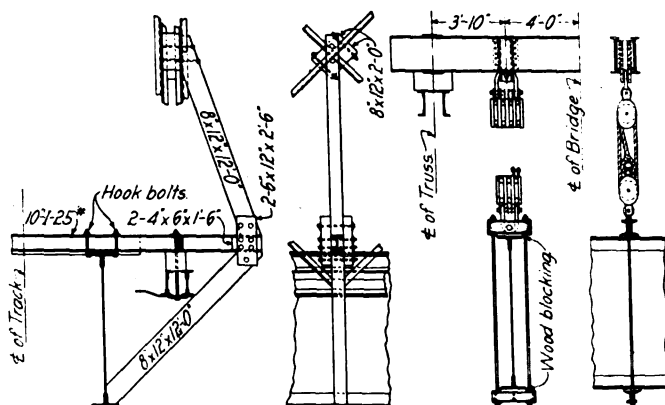
The Old Rock Island Latticed Truss Bridge over the Iowa River Near Columbus Junction, Iowa.

95½-ton engines followed by a uniform load of 3,300 lb. per lin. ft., without impact and with a unit stress of about 8,000 lb. With a unit stress of 22,000 lb. per sq. in. (including impact determined 300

from the formula $\frac{L}{L+300}$) it was found that the limiting classification

of the spans was equivalent to Cooper's E-45. The weight of the motive power had already reached the E-45 classification, and in a few cases exceeded it, and the introduction of still heavier power was imminent. The elastic limit of the steel was probably not much in excess of 30,000 lb. per sq. in., and great eccentricities existed at nearly all the chord joints.

The accompanying elevation indicates the extent of the change made. Piers 2, 3, 4 and 6 had been constructed in 1903, replacing the original stone piers. Their tops were remodelled for the reception

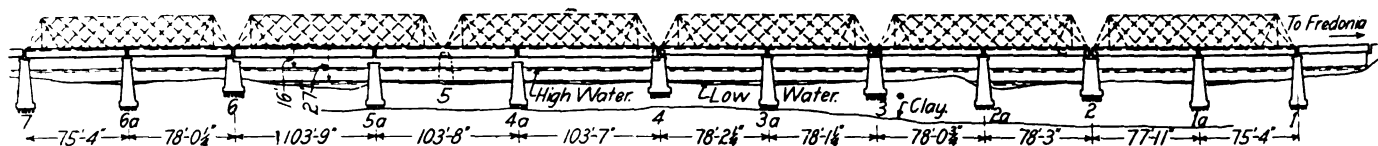


Method of Supporting Old Trusses to Defer Dismantling, and Tackle Used to Support New Girders from Old Trusses.

being about 2½ hours. The work was arranged to allow the setting of one girder span within this period. No attempt was made to make a record, and no chances were taken other than those inherent in the method used.

Previous to the beginning of the two and a-half hour period, the loading beams were placed in position on the top chords, blocked and lashed. Snatch blocks, rigged in pairs, with lines to be utilised in removing the old floor, were fastened to the truss diagonals. The lines, of which there were two, were operated by the derrick engine; first in one pair of blocks and then in the other, as the removal of the floor progressed.

In the yard at Fredonia, meanwhile, the suspenders, block and



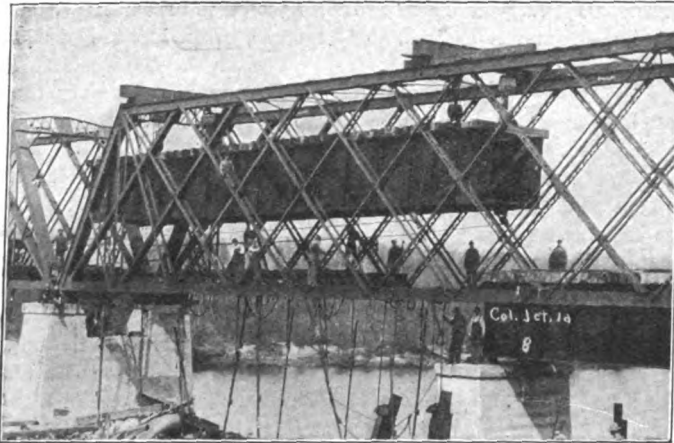
General Elevation of the Chicago, Rock Island & Pacific Bridge Over the Iowa River near Columbus Junction, Iowa.

of the new girder spans. Piers 1, 1A, 2A, 3A, 4A, 5A, 6A and 7 were built new, pier 1 replacing one of the original stone piers which had been patched up in 1903 to give a few more years' service. Pier 5, which was also part of the original substructure, was abandoned. The opening between piers 4 and 6 was divided into three equal parts rather than four, as the cost of a third pier would be somewhat greater than the cost of the additional weight of the longer spans.

The aggregate length of the truss spans was 928 ft. 9½ in., and to erect falsework under them was estimated to cost at least \$7,500, besides greatly hampering traffic during the process. There was

tackle, were fastened in correct positions on the new span, which, when loaded up, was placed between the derrick car and a work engine. After the departure of the passenger train, the two trucks were moved to the bridge site and placed in position, after which the suspension tackle was fastened to the loading beams and the lines carried back to the engine. The engine was uncoupled from the truck and backed slowly, lifting the span from the trucks and raising it as far as the truss clearance would permit. The two trucks were then uncoupled from the derrick and moved clear of the suspended span in the direction of the engine, the lines to the latter being long enough to permit the trucks to be between the end of the

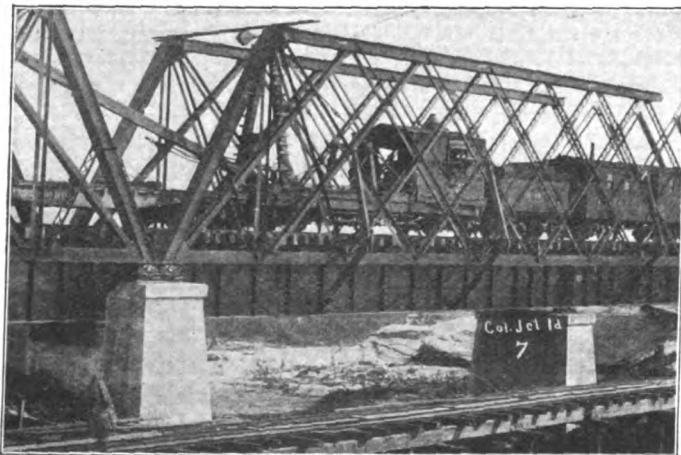
span and the engine when the former was lowered on to the masonry. The rivets in the stringer and floor beam connections had been previously cut out and bolts substituted, so that by means of the lines through the snatch blocks, these members could be removed and lowered into the river in 15 ft. of water. To facilitate recovery of the pieces, a rope long enough to reach to the surface of the water was fastened to each and attached at the other end to a float or to the bottom chord of the old truss. After completing this operation the engine slowly moved forward, and the span was



Removing the Old Bridge Floor Under One of the Short Girder Spans Suspended from the Upper Chord of the Old Trusses.

lowered to its bearing. While the rails were being laid on the new span, the bracing shown in one of the drawings was placed. The track was then made ready for traffic, the entire operation consuming about 2½ hours.

On account of the great weight and length, it was considered inadvisable to erect the 103 ft. 4 in. spans in the manner described. An investigation of the stresses resulting in the web systems of the truss spans, from the local concentrations of the loading beams



Removing the Old Truss Members Showing Bracing Used for their Support.

carrying these longer spans, showed an ample theoretical margin of safety, but the age of the old spans, the heavy load, and the possibility of unforeseen contingencies developing, made it desirable, if not necessary, to employ other means to erect these spans.

Like the short spans, the 103 ft. 4 in. spans were rivetted up complete in the yard, but the deck was not put on for the reasons that greater space under the girders would facilitate subsequent operations, and that the omission of the deck reduced the load to be

handled by about 25 tons. Two wrecking cranes, of 100 tons capacity each, were borrowed from the traffic department, and, when everything was in readiness, a span was picked up by them, one at either end, lifted a few inches above the top of rail, and moved to a point over its final position in the bridge.

Span 5A-6 was the first long span to be erected, and just previous to the arrival of the cranes with the steel the top lateral bracing was removed from the truss span 6-5 to allow the boom to pass. Girder spans 6A-7 and 6-6A were already in place, and truss span 6-7 had been removed. The old stone pier No. 5 was in such bad condition that it was thought advisable to place three frame falsework piers in each aperture 5-5A and 4A-5 to relieve the stone pier and

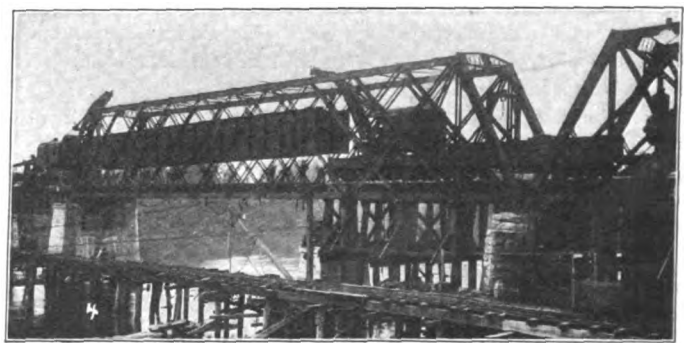


The Completed Deck Plate Girder Structure about 1,550 ft. Long.

also to allow the concentrations of the wrecker to pass directly to the ground. The piers were of the two-storey type, so the tops could be quickly pushed off when span 4A-5A was placed.

When the two cranes with the span between them had been placed in position, they were clamped securely to the track, and the span was then raised as high as the temporary top lateral bracing, which had been put in after the passage of the first crane, would allow. The old floor was removed in the same manner as previously outlined for the short spans, the span lowered to its bearing, and the deck and rails put on. The old trusses were braced in the same manner as previously described.

Piers 2, 3, 4 and 6 had to be prepared for the reception of the new superstructure, since the distance from base of rail to masonry of the truss spans was about 3 ft., while for the girder spans it



Placing One of the Long Girder Spans with Two Wrecking Cranes.

varied from 9 ft. 8 in. to 12 ft. 11½ in. Fortunately, by cutting the piers in two vertical planes parallel to the axis of the bridge and passing close to the inner edges of the truss shoes, it was possible to provide room for the girders and still leave the truss seats intact. The concrete was cut down low enough to allow about 2 ft. of new concrete to be placed for the girder seats. These were reinforced to prevent cracking and copings were put on. While this work was going on, the end stringers of the old trusses were supported by 8 in. by 16 in. timbers, spanning the notch and resting on the masonry left to carry the trusses. After the old spans were removed, these

portions were removed and capped to match the coping already constructed under the new spans.

The following cost data compiled from the erection foreman's reports do not include rent of erection apparatus and tools nor their depreciation. The total cost for engineering, including the preliminary investigations, detailing, checking and tracing the plans for the entire job amounted to \$700, and the salary of the field inspector amounted to \$960, making a total of \$1,660. Classifying inspection as engineering, this gives a percentage of approximately 2½ on \$70,000, the total cost of the work.

WEIGHTS.			
Span length.	No. of spans.	Weight each.	Weight with deck.
75 ft.	2	39 tons	58 tons
77 ft. 9 in.	6	42 tons	62 tons
103 ft. 4 in.	3	80 tons	106 tons
Total weight of new steel	...	...	570 tons
" length of new steel	...	...	926.5 lin. ft.
" weight of old steel	...	...	600 tons
" length of steel removed	...	...	928.8 lin. ft.

DISTRIBUTION OF ERECTION COSTS.

Class of work.	Total.	Cost per ton of new steel.	Cost per lin. ft. of new steel.	Remarks.
En route to site ...	\$281.35	\$0.49	\$0.30	
Changes in masonry ...	1,971.91	3.46	2.13	{ Cutting down piers 2, 3, 4 and 6. Includes falsework for rebuilding Pier 1.
Falsework ...	891.95	1.56	0.96	
Unloadings sleepers and piling... ..	45.68	0.08	0.05	
Assembling and rivetting spans ...	300.37	0.54	0.32	
Framing sleepers ...	321.98	0.56	0.35	
Erecting new steel ...	1,707.69	2.99	1.84	
Removing old spans ...	3,193.23	5.60	3.45	{ 85.32 per ton of old steel.
Removing falsework ...	201.81	0.36	0.22	
	\$8,915.97	\$15.64	\$9.62	
Add 2½ per cent ...	222.90	0.39	0.24	
	\$9,138.87	\$16.03	\$9.86	

PUNJAB ENGINEERING CONGRESS.

Colonel S. L. Craster, R.E., delivered his presidential address to the Congress at Lahore on March 5 last, as the North-Western Railway completed its 31st year at the end of 1916. Colonel Craster, as the present Agent or General Manager of the whole system, in the course of his address on engineering work in the province, gave a general retrospect of the work on the railway during that period. It was on January 1, 1886, that the Scinde, Punjab & Delhi Railway Company, with its connected State lines, was taken over by the Railway Branch of the Public Works Department. After describing, shortly, what had been done before 1886, the President divided his history into decades.

When the network of lines in the Punjab and Sind were taken over they totalled 1,866 miles, and had cost £15,000,000. At the close of the year the gross earnings were £1,690,000 and the net return £802,600, exclusive of interest charges. During the first decade, the Sutlej River was spanned for the second time at Ferozepur by the Kaiser-i-Hind bridge—thus giving a direct approach to Delhi from the north-west. The Victoria bridge over the Jhelum at Haranpur was completed; the Sind-Sagar line, 350 miles long, was opened for traffic, as well as the Sind-Peshin line to the frontier, including the Mushkaf-Bolan and the Wazirabad extensions and the Lyallpur branch to serve the new Chenab Canal Colony. In native States the Rajpura-Patiala line was extended to Bhatinda and the Kashmir section of the Sialkot-Jammu line was completed. The Lansdowne bridge over the Indus at Sukkur was opened, thus doing away with a wagon ferry and completing the through route between Lahore and Karachi. At the end of the decade the mileage had increased by some 800 miles to 2,654 miles; the capital outlay to £30,000,000; the gross earnings to £2,045,000; and the net return to £830,000. "Thus, though the capital outlay had more than doubled owing to the addition of the strategic and frontier lines, the revenue had increased scarcely at all, and the prospects of the line as a commercial proposition were uninviting."

In the decade 1896-1905 the cultivated area served by the railway was quadrupled, the value of the crops quintupled, while the net canal revenue had risen from £150,000 to £910,000. This necessitated additional railway facilities, both in the newly-colonised tracts and in the Sutlej and Indus Valleys. The Southern Punjab was built by a company from Delhi to Ferozepore; from Indhiana to Ferozepore and on to McLeodgunj. The 2-ft. 6-in. gauge frontier lines were started, and two of them were opened, from Kushalgarh and Nowshera. At the end of 1905 the length of line opened was 4,099 miles; the capital outlay had risen to £42,260,200; the gross earnings to £4,572,000; and the net revenue exclusive of interest charges, to £2,170,000, or an increase of 260 per cent. in the 10 years.

In the last 11 years new railway bridges were built over the Sutlej, Beas and Ravi Rivers. The two former old bridges, as well as that over the Jumna, were converted into road bridges. 462 miles were added to the system, of which 200 miles were laid down to serve canal colonies and 56 miles, on the Lodhran Chord, to shorten the distance to Karachi. The Kalka-Simla, 2-ft. 6-in. mountain line was completed. The "Branch Line" terms offered by Government (with a guaranteed rate of interest) induced private companies to build lines south of Amritsar, between Kasur and Lodhran and around Jullundur; to the north of Lahore two branches were built. On April 1, 1916, the mileage of the North-Western open to traffic was 5,435, of which 643 miles are double track, an increase of 1,336 miles in 10 years, and, notwithstanding the war, an appreciable mileage of strategic railway will shortly be added to this administration. The total capital outlay for Imperial, native States and companies' lines to the end of last financial year was £63,654,000, the gross revenue £6,444,000 and the net £2,810,000, exclusive of interest charges. Native States and companies had received a return of practically 5 per cent., whilst the Imperial Government received 4.3 per cent. on their capital investment, or about 1 per cent. when interest charges are included.

Colonel Craster emphasised the fact that the North-Western, viewed as a dividend-paying concern, was not, on the whole, remarkable. This was not due to inefficient administration but, in great measure, to the fact that in parts it is a pioneer railway, in parts purely strategic. The growing wealth of the Provinces it serves, the rapidly increasing population and consequent exchange of commodities, make it a difficult matter for the railway to keep pace with public needs; she outgrows her equipment, first in one direction, then in another. From time to time her yards are found to be too cramped, her rails too light, her sections between stations too long, the pace at which trains can be handled safely and speedily is not satisfactory, her bridges are found too weak, her workshops and storeyards inadequate, her engines and rolling-stock, both passenger and goods, require to be modernised, her staff require to be housed decently and comfortably. These are but examples of the everyday problems awaiting solution, and be it remembered that the line, in the broadest sense, must be maintained to standard, and that from time to time, the attacks of floods must be parried or the resulting damage made good in the shortest possible time to reduce public inconvenience and loss to a minimum.

THOUSANDS OF LOCOMOTIVES IDLE AT ESSEN.—It was stated in the Prize Court on Monday that 8,000 locomotives were laid up at Essen alone last month, through wear and tear caused either by Germany's famine in lubricating oils or the employment of unsuitable and bad lubricants. The statement was contained in an affidavit by Mr. William Fuller Smith, of the War Trade Intelligence Department, who stated that the latest reports in the hands of His Majesty's Government showed the oil shortage continued to cause grave embarrassment in Germany, and the lubricating of railway engines and carriages was one of their worst problems. The German shortage of freight and travelling facilities was mainly due to this. The affidavit was read in the course of the hearing of a case in which the Crown asked for the condemnation as prize of six shiploads of lubricating oil captured at the end of their passage from America.