

pert knowledge of fine lumber. He declined the offer, but agreed to take the log, cut it into veneering and pay what it proved to be worth. It proved to be worth \$7,000, and this sum was paid for it. Any one who can determine the causes and identify these variants in standing timber has a certainty of profitable and enjoyable employment.—EDITOR.]

The Bridgeport Improvement on the New York, New Haven & Hartford.

The Bridgeport viaduct, now in course of construction for the new high-level line of the New York, New Haven & Hartford Railroad, eliminating some 25 grade-crossings, bettering the alignment and grades of the road and including a large new station, is a notable example of good engineering design, carried out under somewhat difficult conditions, with thorough attention to detail and by the use of sufficient means to accomplish the desired end, even though the necessary cost run into the millions. There are, however, no frills; simply good construction, using, with true economy, the best materials and workmanship for the purpose, as befits the permanent nature of the work.

The city of Bridgeport, with its 70,000 inhabitants, is one of the busiest Connecticut hives of industry, its business center lying along the estuary known as Pequonnock River, nearly parallel to which, running north and south, is the principal business street of the town—Main street. The New York, New Haven & Hartford Railroad approaches Bridgeport from the west by a tangent running nearly due east. Just before reaching the river it turns abruptly at the Main street crossing by a sharp

on the east side of the river, it has been found practicable to shift over the present tracks far enough to entirely clear the line of the new structures. These temporary changes are now finished, (the improvement was begun two years ago and the western portion, from the extreme left of the sketch, Fig. 1, to Main street, was finished one year ago, as described in the *Railroad Gazette* of March 1, 1901); but a year must elapse before the new line east of Main street can be opened and the present tracks and station removed, so as to afford a clear site for the proposed new station, which will be located just north and a little to the east of the present building, occupying a space of about 120 x 180 ft., or half an acre. An open square will be left where the old station now stands, thus widening Water street east of Fairfield avenue. The new station will face south on the square, from which a broad flight of steps will lead to the second floor of the station at the new track level. The north front of the proposed station will be approached by a driveway on

the street, gradually rising (supported by an outside retaining wall) to the high grade and then extending as a fifth track to the East freight yard. This siding will serve several large manufacturing concerns situated in the vicinity of its starting point. At the station a track on each side of the four main tracks will extend eastward to the river, where each will switch into its nearest main-line track. These extra tracks will be used by the Naugatuck Division, the trains therefrom arriving on the west track (nearest to the station) and leaving from the east track, access to which will be had by passageways carried under the main-line platforms. The Berkshire Division, single track, which is also to be brought in over a pier-supported viaduct, will connect with the west Naugatuck (receiving) track just south of the station, and will then continue as a "ramp track" by a descending grade to an oblique undercrossing (18 ft. clearance), there uniting with tracks leading through it (under main line) from the present freight house on Water street,

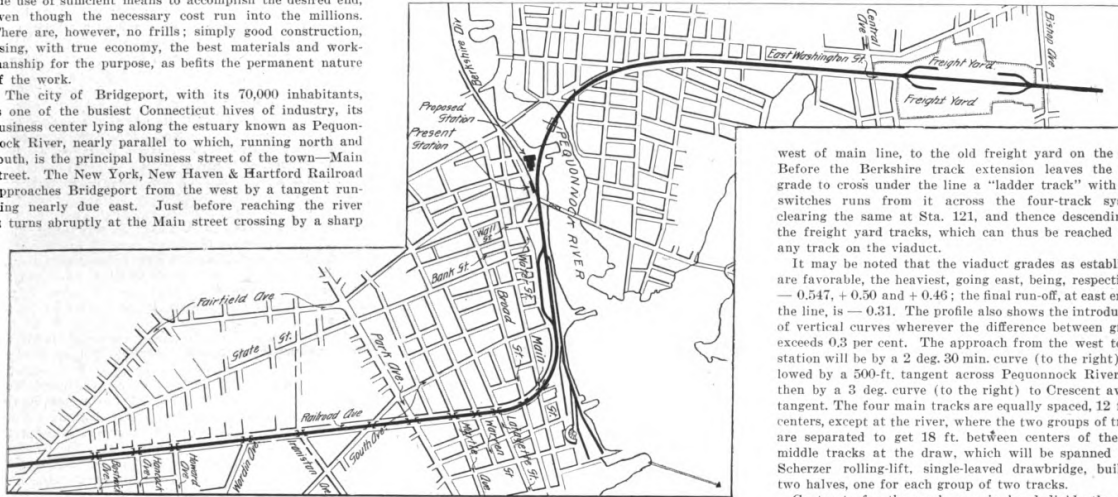


Fig. 1.—Bridgeport, Connecticut; Sketch of the Line of the New York, New Haven & Hartford Railroad.

curve of nearly 90 deg. of arc up the west bank of the river, between it and Water street to the station; thence by a 4-deg. curve the line crosses the river over a primitive type of swing drawbridge and strikes another tangent, also running about due east, with East Washington avenue contiguous to it on the north and Crescent avenue on the south. The offset between the two parallel tangents is about one mile. The Berkshire Division (formerly the Housatonic Railroad), also on the west bank of the Pequonnock River, comes in above the present station, where its tracks are dead-ended. Around the "railroad center" thus, doubtless, inherited from earlier independent roads the business center of the city has clustered and it was, therefore, not deemed wise to

about a 3 or 4 per cent. grade to a spacious plateau or concourse, where carriages can turn and stand. The final details of the station building are not yet fully matured, but its cost will be not far from \$175,000. The structure will be of brick and stone, with a tower and other architectural features, and will present a very handsome and imposing appearance; it will be provided with every convenience for passengers, including subway crossings to reach the different track platforms.

Returning to the viaduct improvement, the western finished portion was described in the *Railroad Gazette*, as just mentioned. On the map, Fig. 1, the streets which were bridged on this part of the line are indicated by marks which show the position of the abutments. This

west of main line, to the old freight yard on the east. Before the Berkshire track extension leaves the high grade to cross under the line a "ladder track" with slip-switches runs from it across the four-track system, clearing the same at Sta. 121, and thence descending to the freight yard tracks, which can thus be reached from any track on the viaduct.

It may be noted that the viaduct grades as established are favorable, the heaviest, going east, being, respectively, — 0.547, + 0.50 and + 0.46; the final run-off, at east end of the line, is — 0.31. The profile also shows the introduction of vertical curves wherever the difference between grades exceeds 0.3 per cent. The approach from the west to the station will be by a 2 deg. 30 min. curve (to the right), followed by a 500-ft. tangent across Pequonnock River, and then by a 3 deg. curve (to the right) to Crescent avenue tangent. The four main tracks are equally spaced, 12 ft. on centers, except at the river, where the two groups of tracks are separated to get 18 ft. between centers of the two middle tracks at the draw, which will be spanned by a Scherzer rolling-lift, single-leaved drawbridge, built in two halves, one for each group of two tracks.

Contracts for the work now in hand divide the same into three sections, as follows: The first section, from Main street to the river (Sta. 100 to 142), let to Dwight & Daly; the second section, including river work and as far as Noble avenue on the east side (Sta. 142 to 152), awarded to J. J. O'Brien & Co., and the third section, from Noble avenue to Central avenue (Sta. 152 to 204), to John C. Sheehan & Co. These contracts do not include steel structure, of which only the drawbridge is now under contract, awarded to the Pennsylvania Steel Co. All the work is performed under the general specifications of the railroad company, with such local modifications as are necessary, and is in charge of Mr. R. M. Berrian, Assistant Engineer of Construction, to whom many features of the design are due, under approval of C. M. Ingersoll, Jr., Chief Engineer.

The embankment retaining walls, of third-class ma-

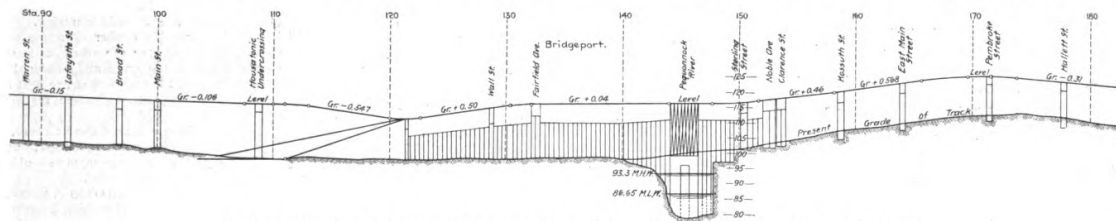


Fig. 2.—Profiles of Old and New Lines—Bridgeport Improvement, New York, New Haven & Hartford.

radically change the existing main line location, although the connecting curves of the offset are materially lightened and ample space is saved for the proposed new station by making the new line cross the river some 250 ft. southeast of the present bridge. A bad reversed kink in the present main line, half a mile south of the station will also be straightened by sacrificing a part of the freight yard, which is to be extended, while a new yard of 15 tracks (opened March 30) has been provided on the east side of the city between Central and Bishop avenues.

In order to provide for handling the traffic at points where the new construction strikes the existing line, the present double track, starting from the Main street curve, is thrown over to the westward, carried part of the way on a temporary embankment, supported by a substantial grillage of old ties and then (along Water street) by a temporary trestle over portions of the new pier foundations already built. This change having been made, the remaining portions of the piers will be finished to the new high level, so that, by opening to travel two or three of the new tracks, the temporary line can be abandoned and Water street trestle, in front of the present station, and

portion of the line lies in the middle of a straight street, as shown, the longitudinal retaining walls being 66 ft. apart, outside to outside, and beginning near Main street crossing, the solid fill with retaining walls is continued to Sta. 121 (stations are 100 ft. apart), where the open viaduct begins, consisting of heavy steel plate-girders carried on masonry piers, every fourth pier coming to the girder-grade and the intermediate low piers supporting built steel columns, spaced 6 ft. on centers and about 9 ft. high, for the floor system between the high-grade piers. This construction extends to the river (Sta. 142). Crossing the river (Sta. 142 to 148) all piers, of course, are built up to the high level and on the east side (Sta. 148 to 154) the open viaduct again continues until it reaches the solid embankment, with its heavy retaining walls, as before, crossing several streets with a minimum head room of 12 ft., and ending near Central avenue (Sta. 204). Thus the entire viaduct improvement covers 185 stations, or a distance of 3½ miles of four-track main line. Additional tracks are also provided as follows, working backward from Sta. 204: On Crescent avenue, east of the river, at about half way of the embankment, the high retaining wall jogs inward and a "ramp track" for freight starts from a level with

sorry, about 4 ft. thick, 3 ft. under the coping, are laid with vertical face and the back battered 4 in. to the foot. The coping, 16 x 30 in., and faces of bridge abutments are of second-class masonry, and bridge seats and parapets of first-class, fine pointed. The stone used is a good quality of granite, obtained from Mine Hill and Millstone quarries, Connecticut; Dunsmuir, Vermont, and Monson and Linwood, Massachusetts. Street openings are crossed by plate girders, or by deck or half-through bridges, according to head room requirements.

The piers for the steel viaduct are spaced 44 ft. 6 in. on centers, west of the river (Sta. 121 to 142) and 46 ft. east of the river (Sta. 148 to 154). The river piers vary from 55 to 39 ft. on centers and on the east side, where several streets are crossed obliquely, skew-piers are built on sidewalk curb line, and, in some cases, in center of street. All the piers are built of first-class granite masonry and of different lengths, according to the number of tracks carried, the longest being 60 ft.; their uniform width is 5 ft. 6 in. on coping (2 ft. thick), and 4 ft. 6 in. under coping, for land piers, and 6 ft. on coping and 5 ft. under coping for river piers. Faces of piers have a uniform batter of 1 in. to the ft. The foundations for piers consist of spruce piles, set about 2 ft.

on centers and driven to hard bottom. The pile-heads under land piers have a filling of concrete around them above the piles; from that level the concrete base starts, with a 3 ft. footing block and 12 in. offset, and then on a batter of 4 in. to the foot to the ground surface, where the granite courses begin, with 12 in. offset. Sheet piling, tongued and grooved (three-ply plank) is driven around land pier foundations, notwithstanding which much costly pumping was required along the Water street front, and a further difficulty was here met with, the made ground along this section having been formerly filled in over mud of a very liquid character. For about 1,000 ft. it was, therefore, necessary to drive a bulkhead of sheet piling, 27 ft. deep, to retain the earth and prevent the mud from flowing, the sheeting being reinforced by two lines of 9 x 16 in. walings, braced by inclined piling. As a further precaution, inclined brace piles were also driven between the vertical piles supporting the piers along this "dock front." As the present main line here leaves but little room for working, only a short piece at the west end of each pier could at first be built. At this point, however, the temporary trestle is now ready for chang-

high enough sunk at low water to the piles (which have been previously filled 6 ft. deep about their heads with rip rap and coarse gravel and a diver sent down to level same and leave pile heads clear), and the caissons are then flooded sufficiently to hold the work in place until additional masonry can be laid. The caisson for the large pier for the rolling-lift drawbridge, the pier being 59 x 80 ft., is a mammoth affair, and, as illustrating the expensive nature of such work, it is estimated that this pier and its caisson will cost about \$85,000. It will have a heavy stone facing wall, 6 ft. thick all around, the interior to be filled in with concrete, in which the iron work framing will be imbedded; also there will be formed therein pockets or pits (with connecting 24 in. chain) for the bridge counterweights to sink into when the bridge is lifted, the whole design being very carefully and thoroughly worked out.

The work east of the river, consisting chiefly of embankment and retaining walls, the same as previously described, calls for no special remark. Generally the ordinary excavation reaches a good hard bottom for the walls, though a few hundred feet of piling may be re-

fore the whole design can be carried out in its entirety. Nevertheless, the city of Bridgeport, which has waited over 12 years for this great improvement, is to be congratulated upon the splendid public benefit which it is so soon to receive.

Moral Discipline.*

BY B. S. JOSSELYN, *Manager of the Kentucky & Indiana Bridge & Railroad Company.*

A man's private life must be beyond reproach in order that he may get the best service out of his subordinates. Like produces like, and those directly in charge of men influence them by the character of their acts, and even by their thoughts. You can not sow corn and reap wheat.

I am of the firm conviction that a higher standard of morals is necessary in those having charge of men. A superior officer, whose thoughts dwell upon carnal

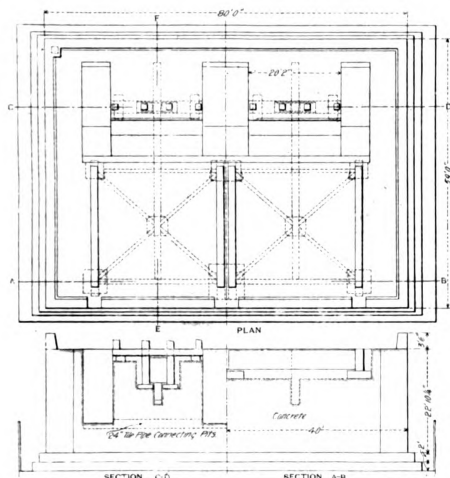


Fig. 3.—Plan and Sections of Caisson for River Pier.

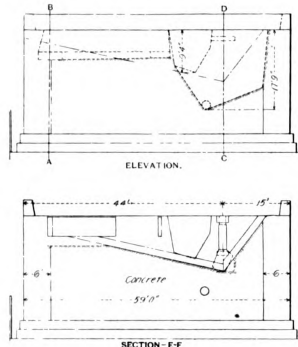


Fig. 4.—Elevation and Section of Pier for Lift Bridge.

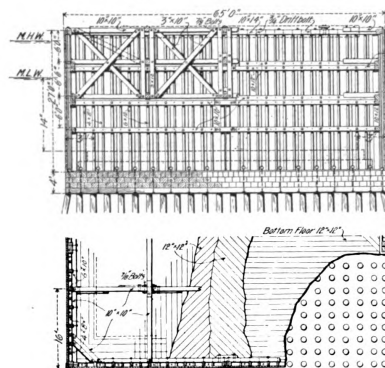


Fig. 5.—Details of Caisson.

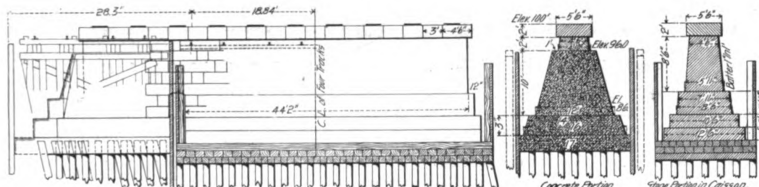


Fig. 6.—Piers South of the Passenger Station.

ing to main line, so that the remaining easterly parts of the piers can be built; but these extend so near to the river that caissons will be required, the same as for the river piers, as will be presently described. The westerly portions of the piers were built with a concrete base and in the easterly end a facing of granite is inserted. The upper part of this easterly face is left "toothed;" when the balance of the pier is built (after change of tracks) the same will be carried up (in caisson) wholly of stone, with the west end also left "toothed," and on removal of caisson sides and sheeting the upper part of the gap between the two sections of the pier will be filled up by fitting in and keying cut granite stones, so getting a good bond and making a very neat job. Piers 8 to 22, inclusive, are thus to be spliced.

The bottom of Pequonnock River, beneath some 15 ft. of soft mud, is found to be a very hard gravel, into which piles are driven as far as they will go, and cut off at grade 65 for the drawbridge rest-piers, and at grade 69 for the other piers; grade 93 is high-water mark and low water is at grade 86. Land pier piles are cut off at grade 82. The track grade (Elev. 116) is 23 ft. above mean high water.

Open caissons are used for the river piers, the bottoms or masonry platforms consisting, for the smaller piers, of three layers of 12 x 12 in. hard pine timber, the first course laid transversely, the second diagonally, and the top longitudinally, and for the drawbridge pier four courses, including a second diagonal layer, all drift bolted at each intersection with $\frac{3}{8}$ -in. square drift bolts, 18 in. long.

The platforms were rafted and assembled on the water and the framed sides of the caisson attached by rods hung from the plates and hooked over eyebolts in the flooring to permit easy detachment; sufficient interior cross bracing is also provided. The outer sheathing of 3 or 4 in. plank is calked with oakum. The caissons are floated to site and when the masonry has been laid

quired in one place along Crescent avenue. By leaving openings in the six or seven street-bridge abutments one of the old main line tracks is conveniently put to use for bringing in trainloads of granite and other materials.

The Portland cement concrete used on the work is of very superior quality. Alpha and Lehigh brands of cement are largely used, in proportion of 1 part cement, 3 of sharp sand and 6 of clean coarse gravel. The concrete mixer in use is of the rotary box type, 24 men and a small engine turning out 125 cu. yds. of concrete a day, and the same is moved to site over a narrow gauge track on which run push cars, ingeniously devised by Mr. Rollins, the contractors' superintendent. These cars carry the filled boxes, which have two leaved hinged bottoms; after the derrick has dumped their contents the swinging bottoms are automatically closed by inclined side pieces on the push cars, as the boxes are lowered on them for the return trip.

The estimates of material and quantities give a comprehensive idea of the magnitude of the undertaking. These show 150,535 cu. yds. of grading, more than one-quarter of which consists of dredging for the piers south of the station; 3,867 cu. yds. of first-class masonry; 24,630 cu. yds. of second class, and 38,355 third class. There are 26,113 piles, including 3,640 over 50 ft. long; 1,845 M. ft. of timber and 173 tons of iron in grillage; 28,000 sq. yds. of granite and macadam pavement, and 7,000 linear ft. of curbing. It is estimated that, in round numbers, the whole outlay for viaduct, bridges, embankments, track changes, etc., including the proposed new station and its accessories, will not be far from \$1,000,000, the most of which (about three-quarters) is now under contract. Not much before August, 1903, can the new road-bed and track be sufficiently completed to permit the removal of the temporary tracks that now are obliged to occupy the space reserved for the proposed station; so that at least two years must pass be-

pleasures, either in licentiousness, strong drink or opiates of any kind; or who finds pleasure in gambling, the repeating of "smutty" yarns, or kindred excitement or pastime, is not fitted to mould the minds of those under him in a way that will produce the results expected by our superior officers, for they are all evil and can not fail to produce inharmonious and discord of every kind. What we want is to produce good and satisfactory results in our business and home affairs, and that can only be done by sowing only that which is good and pure.

The necessity for a higher standard of efficiency and morals in railroad service is becoming more apparent each day. A man who is "blear-eyed" or nervous from dissipation can not put the same cheerful energy into himself, his work or into his men, as one whose head is clear and who is giving his entire strength to his work. A morbid mind produces a morbid body and morbid thoughts. You can not get right out of wrong, or wrong out of right thoughts or acts. And it is also well to remember that old adage, "You can catch more flies with molasses than with vinegar."

A man that is light-hearted by feeling that his superior is pleased with his work and is his best friend, is worth a dozen men who feel that they are being "raw-hided" at every turn, whether they do their work well or not. Discipline should never be administered in the heat of passion or in the spirit of vindictiveness; but in a kind, dignified and loving manner that will cause the man to feel sorry for his work poorly done; and cause him to feel that there is a bond of brotherly love existing between the two; that his superior has his best interests at heart, and is not lying in wait to give him the worst of it. I have long since ceased to derive satisfaction from anything that can be gotten out of a man's hide. Love and charity is always the best plan, for like produces like. More charity and less vindictiveness and driving is wanted in the handling of men. The Golden Rule can be used to much better advantage in any legitimate business than the travesty thereon, which says "Do others, or they will do you."

I have been in railroad service for 30 years, and in direct charge of men of different classes for 19 years. For 16 years of that time it was my practice to handle men in a "czar" fashion, and I must admit with indifferent results. For the last three years I have endeavored to direct the work of my subordinates through the principle of love and charity, and have accomplished infinitely more in the shorter than in the longer period. Some may say, "That is well and good in theory, but will not work in practice"; but love and charity are not sentiment, they are the Law of God, and when theory has been put into practice, it no longer remains a theory, but a fact.

Everything to-day is being reduced to a science; should it be considered impossible to put into practice on railroads the teachings of 2,000 years ago by sowing as we wish to reap? This plan, if persevered in, will surely bring about harmony instead of discord, good and efficient service instead of bad, employees will have a unity of purpose, will love one another, and selfishness,

*A paper read at the annual meeting of the Central Association of Railroad Officers at Put-in-Bay, July 22. Condensed.