The Pennsylvania Improvements Through Piqua, Ohio

The Work Includes a New Station and Second Track on Revised Grade, Eliminating Eight Street Grade Crossings

The improvement work recently completed by the Pittsburgh, Cincinnati, Chicago & St. Louis on a six-mile section of line on the Indianapolis division, extending through Piqua, Ohio, 73 miles west of Columbus, is unusually comprehensive, as it effects important economies in the handling of a heavy through traffic, increases the permanency of construction on this section and adds greatly to the facilities for handling both freight and passenger business in a town of 13,000 inhabitants.

EXTENT OF THE IMPROVEMENTS

The operating conditions of the engine district from Columbus to Bradford, 84 miles, are improved by the addition of a second track in the only remaining single-track section in that district, and the reduction of grade from a maximum of 1 per cent uncompensated to 0.7 per cent compensated, the ruling grade on the division. The standard of construction is raised by the widening and thorough drainage of two long cuts, the replacement of an old low level bridge over the Great Miami river and the construction of steel concrete subways over all streets. In addition to the advantages enjoyed by the town as well as the railway in the separation of grades at streets, a new passenger station has been provided, the freight station has been enlarged, and the local freight yard and industry tracks improved. The railway has met the entire expense of the improvement, including damages to personal property.

This six-mile section forms a part of the main line of the Pan Handle from Pittsburgh to Chicago, and also of the line from Columbus to Indianapolis, which forms part of an alternate route from Pittsburgh to St. Louis. The westbound traffic consists largely of coal from the Pittsburgh division and the Norfolk & Western at Columbus and the eastbound business includes meat, merchandise and stock from Chicago and the west and empty coal cars. The average train movement is about 85 trains per day.

In addition to the Pennsylvania trains, the old single track line handled the passenger and local freight trains of the Cincinnati, Hamilton & Dayton between the connection of the Piqua & Troy Branch just west of the passenger station and the Cincinnati, Hamilton & Dayton junction, about a mile east of the station. Under the old arrangement these trains in order to reach the center of Piqua used the Piqua & Troy Branch and the Pennsylvania between Troy and Piqua Junction instead of the C. H. & D. main line on the east side of the Miami river. These movements increased the total for that portion of the Pennsylvania's line to about 97. This operating arrangement had to be terminated when the Pennsylvania tracks were elevated through Piqua on account of the inability of the C. H. & D. to secure ordinances from the city for the elevation of its branch line tracks up to the Pennsylvania connection. A new station was therefore built near the junction and all C. H. & D. through trains now use its main line.

The tonnage rating on the Columbus-Bradford district was limited to 1,700 tons in both directions by the old grade through Piqua and on account of delays in this single-track section it frequently required 16 hours for the run with a full tonnage train. As soon as the first track on the new grade was put in service it was possible to add 200 tons to this rating and cut the running time for westbound traffic and later, similar economies were effected for eastbound traffic when the second track was put on the new level.

All construction work has been handled without interference to traffic. To facilitate the work through town the center line was shifted to the north an average of about 32 ft. The improvements involved the handling of 460,000 cu. yd. of grading; the placing of 40,000 cu. yd. of concrete in bridge substructures, retaining walls, etc.; the erection of three arch culverts, a five-span deck plate girder structure over the Great Miami river and solid floor bridges over eight streets; and the laying, ballasting and surfacing of about 20 miles of new main, side and yard tracks.

GRADING

By laying a continuous 0.7 per cent compensated grade line from the ends of the improvement down to the river crossing, the cuts at both ends were deepened enough to furnish the necessary material for filling across the valley on the higher level. When the plans were made it was expected that the C. H. & D. would elevate its branch line, and on this basis the quantities of excavation and embankment were balanced, allowing 10 per cent for waste. On account of the change in plans, about 20,000 yd. from the west cut intended for the C. H. & D. connection was used to widen the fill for yard tracks.

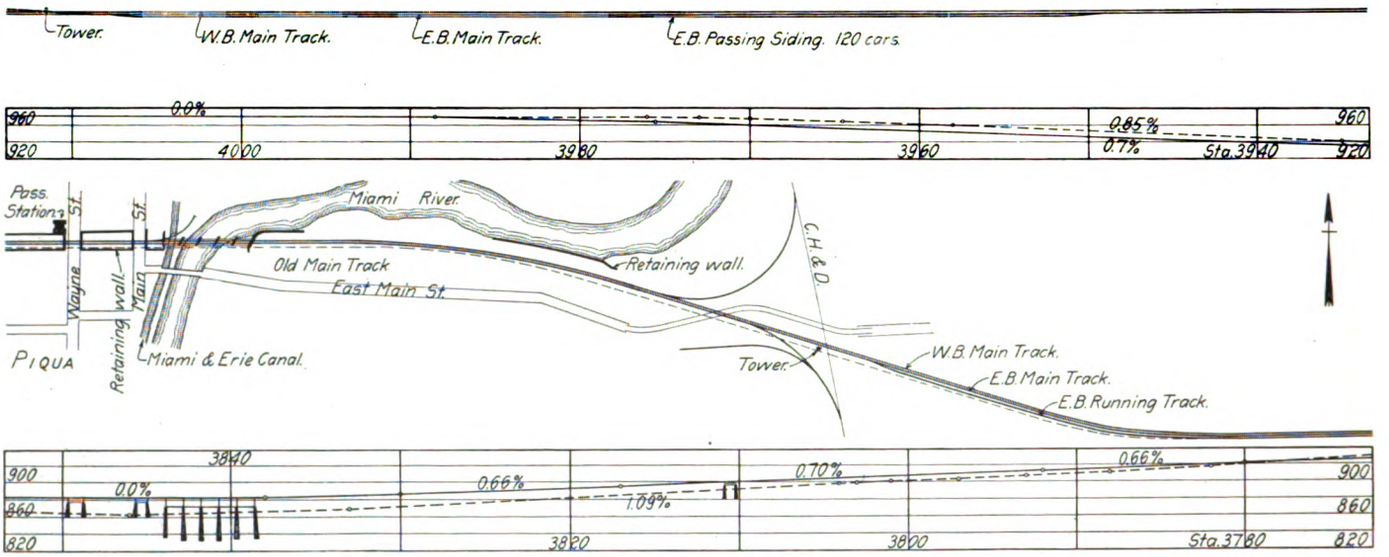
The cuts are about 7,000 and 9,000 ft. long, respectively, and were lowered a maximum of about 9 ft. They were widened to carry three tracks in order to allow the excavation to be handled without interference to traffic and to provide for a future additional track. The roadway section in these cuts provides for a distance of 17 ft. from the center line of the outside track to the toe of the slope. The banks were sodded during the first season's work, but this did not prove entirely satisfactory on account of the height of the slopes which exceeded 25 ft. in many cases. Where the banks showed any indications of being wet, trenches 2 ft. deep were dug vertically or diagonally down the slope and filled with riprap stone to provide an open drain to the side ditches. These bank drains have been very successful in keeping the slopes in good condition.

Tile drains 6 in. to 18 in. in diameter were laid in one side ditch in each cut and a similar line of 6 in. to 12 in. tile in the other ditch. Bell end vitrified pipe was used for these drains laid with 1-in. open joints and covered with cinders or loose stones. Catch basins were provided at intervals of about 800 ft. These drains lead to open riprapped ditches. The effect of one of the large drains was clearly shown in the east cut, which had a width of only 9 ft. from the center line of tracks to toe of slope. After one-half of the new cut was finished the side drain was laid, with the result that a temporary cinder ballasted track in that cut was easily kept in condition and the remaining half was noticeably drier when it was excavated. The slopes were finished and the ditches dug by an American ditcher.

The new double-track fill is about 2½ miles long, with a maximum height near the river of about 19 ft. The standard top width is 37 ft., providing a shoulder of 12 ft. from center of track. The material handled was mostly clay, requiring an allowance of 10 per cent for shrinkage on the shoulders. A speed limit of 10 miles per hour was enforced on the new fill and 20 miles an hour was allowed after it became thoroughly compacted. The main track is laid with 100-lb. rail on oak ties with four rail anchors per rail. The roadbed is surfaced with 6 to 8 in. of cinders on which 12 in. of gravel ballast is placed.

The excavation was made almost entirely by two Marion steam shovels, models 60 and 70, and the material was handled by a standard gage and a narrow gage outfit. The grading was planned to avoid the necessity of hauling the material across the old river bridge on account of the interference to traffic that would have resulted. Some trestle was driven west of the river between the street crossings, but the lighter fill on both sides and the big fill adjacent to the river on the east side were made by spreading and raising tracks. Some very good records were made in handling this filling material by keeping the dump in good condition and anticipating as far as possible, other causes

of delay. The standard gage outfit of two 10-car trains with an average haul of about 1½ miles handled an average of 1,200 yd. per day for eight months, working a single shift. The best month's record was about 41,000 cu. yd. The 15-yd. Western dump cars were used in this outfit, averaging 12 to 13 cu. yd. loaded. The narrow gage outfit, using 20-ton dinkies and 3-yd. cars, handled as high as 1,300 yd. per day, 17,000 yd. in two weeks, and 30,000 yd. in one month. Three trains of 15 cars each were used in this outfit, the haul being about two miles.



Plan and Profile of New Two-Track Line on Revised Grade Through Piqua, Ohio

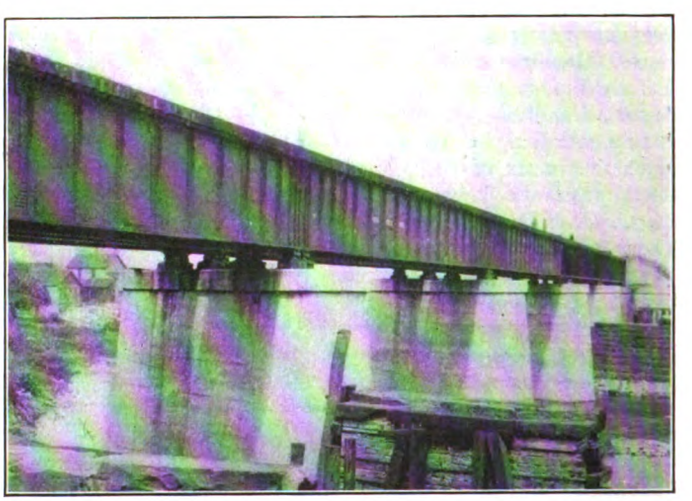
BRIDGES AND RETAINING WALLS

The new river bridge replaces a through truss structure on stone piers and abutments built in 1888. The two river spans, each 138 ft. long, and the approach deck girder span over the Miami and Erie canal, did not provide a sufficient waterway for the floods to which the river is subject and the new bridge was accordingly increased in length to five 105-ft. deck plate girder spans. The danger from floods is further decreased by the raised grade, the old tracks being only about 5 ft. above high water. Prior to the disastrous floods in the spring of 1913, the river channel was changed at the curve above the bridge and the bank protected by levees on the north side and a retaining wall 300 ft. long on the south side connecting to the east abutment of the new bridge. The piers are skewed about 30 deg. to bring them in line with the current.

High Water at the Old Miami River Bridge in the Spring Floods of 1913 Showing Piers in Place for the New Structure

The excavation for the piers was made by two McMyler cranes, one with a 1-yd. orange peel bucket and the other with a 1-yd. clam shell bucket. The footing piles under the east abutment and the three easterly piers were driven by one of the cranes with suspended leads in which a No. 2 Vulcan steam hammer was operated. The west pier and the west abutment are founded on limestone, which is only 2 ft. below low water at the pier site, although it dips so rapidly to the east that it was not reached by 15-ft. piles at the next pier. The piers were built in coffer-dams with steel forms above the footings. The maximum height is 47 ft. Three 85-lb. rails were provided in the nose of each pier as ice breakers.

The concrete in the east abutment and the three easterly piers was placed from a mixer plant about 60 ft. east of the abutment. The sand and stone were dumped through a trestle in the old line which had been driven to replace a section of the old fill adjacent to the new abutment and piers. From the storage bins under this trestle, the proper proportions of the materials were loaded into an automatic dumping car which was hauled up to the ½-yd. Ransome mixer. The concrete was handled to the forms in buckets by the locomotive crane. The west pier and the west abutment were placed from a portable plant which was also used

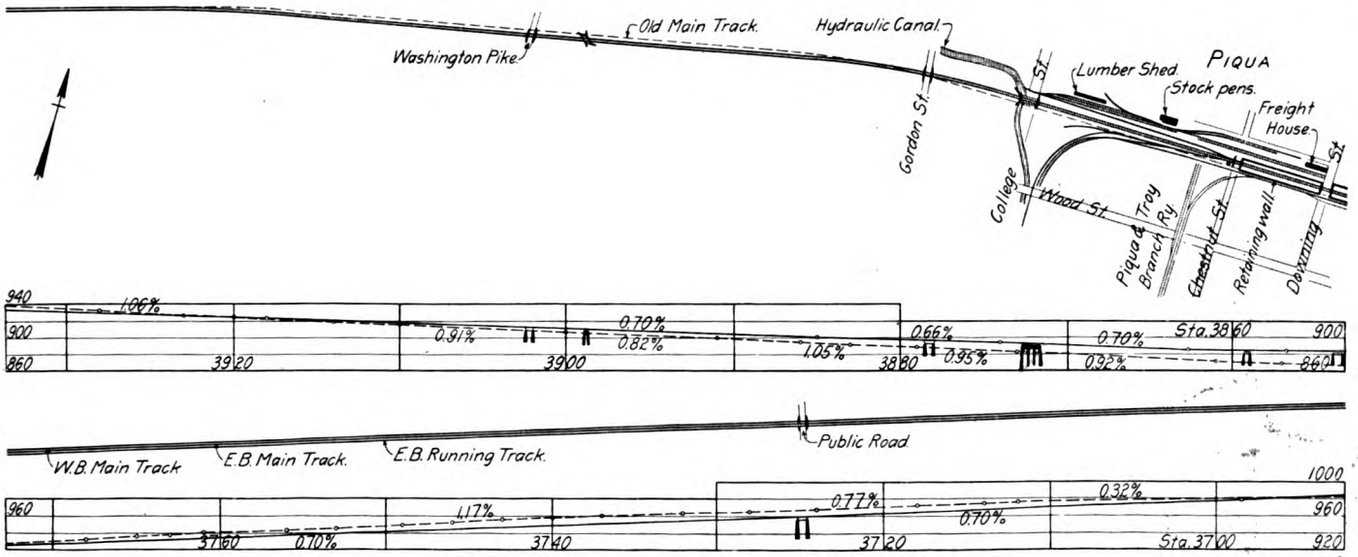


The New Miami River Bridge

for a large part of the retaining walls and subway abutments through town.

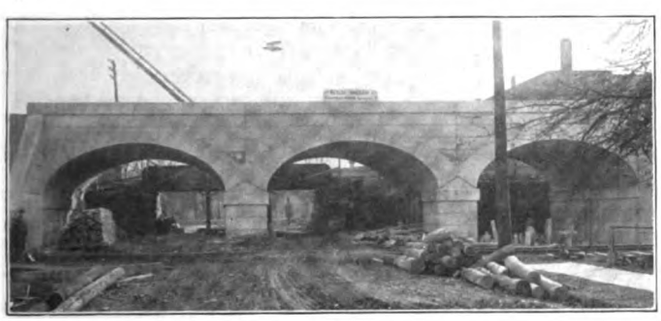
The six existing streets and highways crossing the line within the limits of this improvement were carried under the elevated tracks in subways and similar provision was made near the west end of the work for two new streets which it is expected will

It was necessary in only one case to depress the street grade, and in this instance the tracks were carried on a temporary trestle, while the excavation for the street was made with a Thew shovel to an approach grade of 4 per cent. This required the handling of 16,000 yd. of material. A total of 4,700 ft. of retaining wall was built, the longest continuous wall being along



Plan and Profile of New Two-Track Line on Revised Grade Through Piqua, Ohio

be opened. With one exception, these structures consist of concrete abutments and steel columns on the curb lines supporting steel trough decks filled with concrete. The exception is a three-span arch bridge over a street and a canal from which the city takes its water supply. The possibility of adding third and fourth tracks later was considered in designing all subways, either by building the abutments wide enough to carry the additional tracks or by providing for an extension of the substructure. The over-



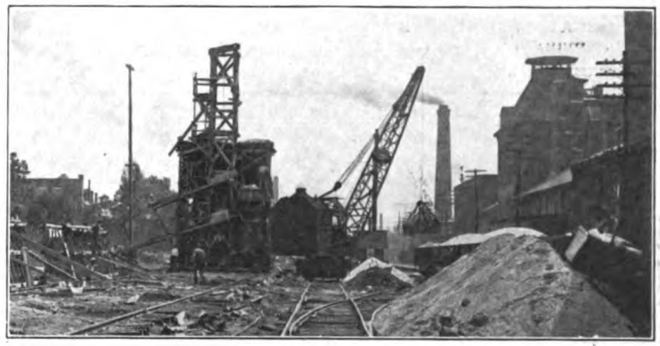
Three-Span Arch Bridge Over College Street and a Small Canal

head clearance under these subways is 13 ft. at four streets, 15 ft. at three streets, and 17 ft. at the other streets.

The maximum street width is 66 ft., and with one exception the crossings are practically at right angles. The longest trough span is 44 ft. A line of 10-in. clay tile is laid in each trough and in some of the deeper ones, two lines are used in order to save concrete and reduce the dead load. A 3-in. layer of concrete was placed first, on which the tiles were laid, the concrete being tamped solidly around them. The top of the troughs were covered with concrete to a minimum depth of 2 in., and the upper surface of this concrete was waterproofed, four processes being used, namely; Sarco, Johns Manville, Barrett and Erhart. The edges of the trough decks were finished with concrete copings. The arch bridge has three spans of 37 ft. 6 in. each, the arch rings being five-centered. The concrete is reinforced with Clinton wire mesh. The fill over the haunches was made with cinders.

the south bank of the river east of the bridge where a 300-ft. wall containing 6,000 yd. of concrete was placed.

A large part of the walls and subway abutments through town were placed with a mixing plant operating on a 10-ft. gage-track between the walls as shown in one of the accompanying illustrations. This plant was equipped with a storage bin for sand and stone above the 1 yd. Ransome mixer and a 40-ft. tower in which the concrete was elevated for chuting to place. The boiler, hoisting engine and mixer engine, were located on the opposite end of the car from the tower, serving as a counterweight. The sand and stone were handled direct from gondola cars alongside to the storage bins over the mixer by a locomotive crane which was also used to place bags of cement on the charging platform, handle the sections of wall forms and excavate for the footings under the walls. The plant could be moved eas-



Portable Mixer Outfit Used in Placing Concrete Retaining Walls, and the Derrick Car Used to Handle Material from Cars to Hopper Bins

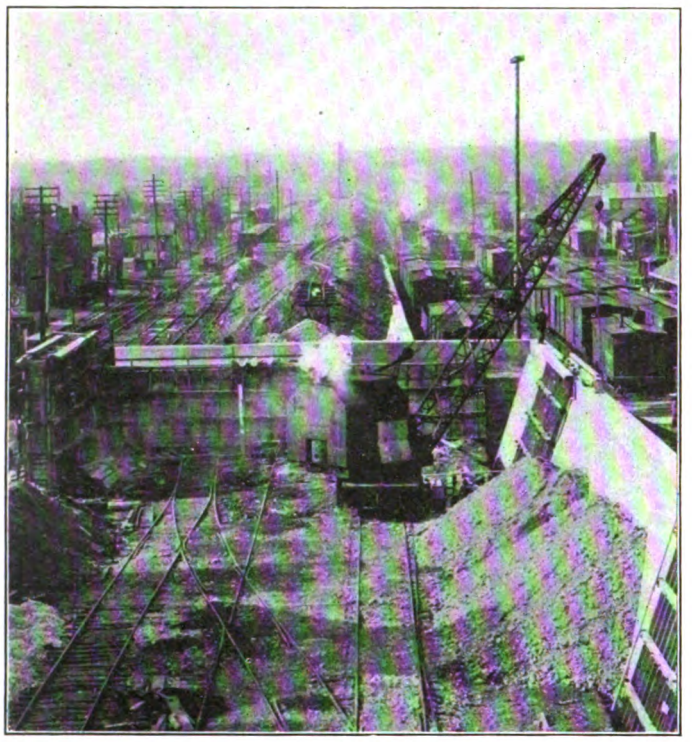
ily to keep the length of chute at a minimum. This plant placed as much as 150 yd. of concrete in a single shift and averaged 35 yd. of concrete and 25 yd. of excavation every working day for the entire season. The plant was operated by a crew of 8 to 10 men with a labor charge of about $35 per day.

A stationary mixer plant was used during the winter for some of the walls. The storage bins were provided with steam coils

and the plant was well housed in to allow work to be carried on in cold weather. About 2,200 yd. of concrete was placed during one month with this plant.

PASSENGER STATION

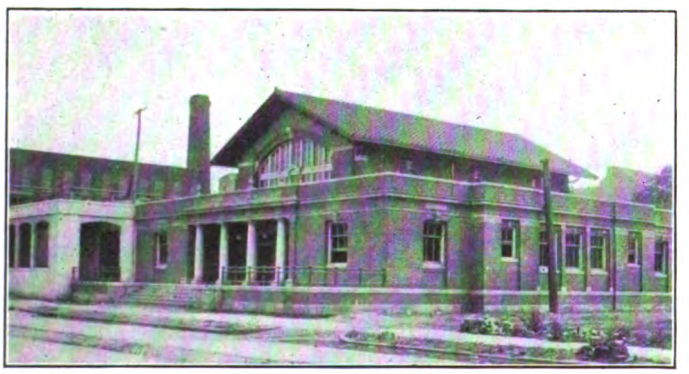
The new passenger station is a brick structure on concrete foundations with stone trim and tile roof. It is located on an important street near the center of town with its floor level about 3 ft. above the sidewalk grade. A wide terrace across the



A View Through the Town During the Construction of the Retaining Walls, Showing Sectional Forms and Derrick Car for Handling Material

front of the building connects with a passage under the track from which two stairways lead up to the platforms at track level. Additional stairways are provided at the streets on both sides of the one on which the station is located and a carriage drive approaches the rear of the station building from the opposite street.

In addition to the main waiting room the building contains



New Pennsylvania Passenger Station at Piqua, Ohio

a women's room, men's room, ticket office, baggage room and express room. A basement is provided for the furnace and coal room, and a baggage and express elevator connects the station and track levels. The floor in the waiting room is of terrazzo, the walls of brick and the arch ceiling of plaster. The building is provided with electric light and steam heat throughout. The track platforms are 20 ft. wide, of brick on a concrete base with concrete curb. Steel frame shelter sheds and a small shelter house are provided on each platform.

This improvement has been carried out under the general direction of W. C. Cushing, chief engineer, maintenance of way, and B. V. Sommerville, principal assistant engineer, Pennsylvania Lines West, Southwest System. F. H. Watts was division engineer at the beginning of the work and was later succeeded by G. R. Barry. Mr. Watts was charged with the preparation of plans and the close supervision of the construction till promoted and succeeded by Mr. Barry. E. H. May was engineer in charge. H. E. Culbertson & Co., Cleveland, Ohio, had the general contract and handled the grading. The construction of the river bridge and most of the retaining walls and subway abutments was let to the McKelvy-Hine Company, Pittsburgh, Pa.; the concrete arch and the remaining concrete work was contracted to the Hezlep Sinclair Company, Cleveland, Ohio; the steel in the river bridge and the subways was erected by the Ketler-Elliott Company, Chicago, and the sloping, ditching and track work was handled by company forces. F. L. Packard, architect, Columbus, Ohio, designed the new station, and George B. Hicks, Springfield, Ohio, had the contract for the construction of the building.

SAFETY AND SHORT TRAINS*

By Marcus A. Dow
General Safety Agent, New York Central Lines.

This bill to limit the length of trains to a maximum of 50 cars per train, has been presented and its passage urged as a measure of safety, it being the contention of the gentlemen favoring the measure that shortening the length of trains will lessen the chances of accident and reduce the number of injuries. To persons unfamiliar with the details of personal injury work and the prevention of accidents as undertaken by the railroads of today, this argument may appear reasonable, but before accepting it as a conclusion it is essential to consider a number of important facts.

In the first place, the fact must be admitted, even by those the least informed, that safety in reality rests not upon whether there are a few cars more or less in a given train, but upon the way in which that train and others on the same road are handled and operated. There is not now, nor has there ever been a well fortified argument for, nor a sincere demand to shorten the length of trains to increase safety. The Interstate Commerce Commission in all of its exhaustive studies and reports has never pointed out a single case where the number of cars in a train, nor the number of men on a train, nor the number of engines hauling a train was a factor contributing to or causing an accident.

As a matter of fact, if the proposition were fairly considered, it would seem reasonable, if not probable, that the passage of the so-called "short-train" bill will tend to increase the risk of injury rather than decrease it. The density of traffic as measured by the number of trains to handle and get safely over the road, will increase with the shortening of the train, resulting in a greater chance of confusion and increasing the chance of error. This feature, of course, becomes more important on roads where the traffic is heaviest and density of traffic is already a problem requiring the most skillful attention of expert operating men. To suddenly require all roads to multiply the number of trains they must handle without a corresponding increase in trackage and other facilities would necessarily result in confusion and increased hazard.

Much stress has been laid by the supporters of this bill upon the great sacrifice of life and limb on the railroads of this country. Admitting freely that there are far too many persons

*From an argument made by Mr. Dow before the Public Utilities Committee of the Illinois house on Monday, May 10. This committee has since taken unfavorable action on the bill.