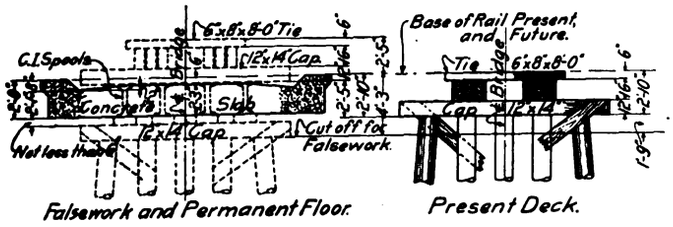
REINFORCED CONCRETE SLAB BRIDGE.

The Minneapolis, St. Paul & Sault Ste. Marie has adopted concrete slab bridges, reinforced by the "mushroom" system, for a number of highway crossing locations. This system of reinforcement, patented by C. A. P. Turner, consulting engineer, Minneapolis, has been in use for sometime in building construction, but has not been widely adopted for railway bridge construction. Two bridges built in the town of Amherst, Wis., are typical of these structures. The details of the Lincoln street bridge are shown in the accompanying illustration.

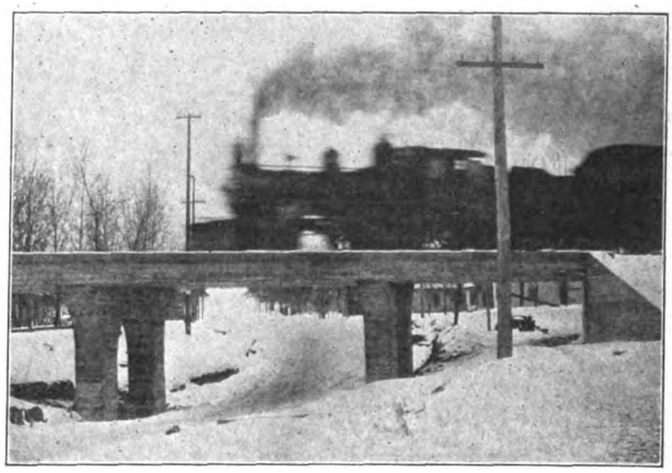
The street is crossed on a skew of 47 deg. and 40 min., the abutments and piers being parallel at an angle with the center line of the street. The piers consist of two reinforced concrete



Old Pile Trestle and Method of Replacing with Concrete Slab Bridge.

columns 3 ft. square spaced 12 ft. center to center, connected at the top by a concrete beam. The footings are spread to 7 ft. square and are reinforced in four directions, as shown in the drawing. The columns are reinforced by six 1⅛-in. round rods set vertically and banded spirally by ⅜-in. round rods on 3-in. pitch. The columns are 14 ft. 3 in. high from top of footings to bottom of slab, and the corners are chamfered to a depth of 3 in. The transverse beams, which have a minimum depth of 2 ft. below the slab, are arched between columns and are carried out beyond the columns on the curved lines shown in the accompanying cross section. The beams are reinforced in the upper plane by five 1-in. round rods, and in the lower plane by eight 1⅛-in. round rods bent up for shear reinforcement, and five 1⅛-in. rods bent down for surface reinforcement over the arch. In addition to this, there are ⅜-in. stirrups spaced 12 in. center to center between column reinforcements.

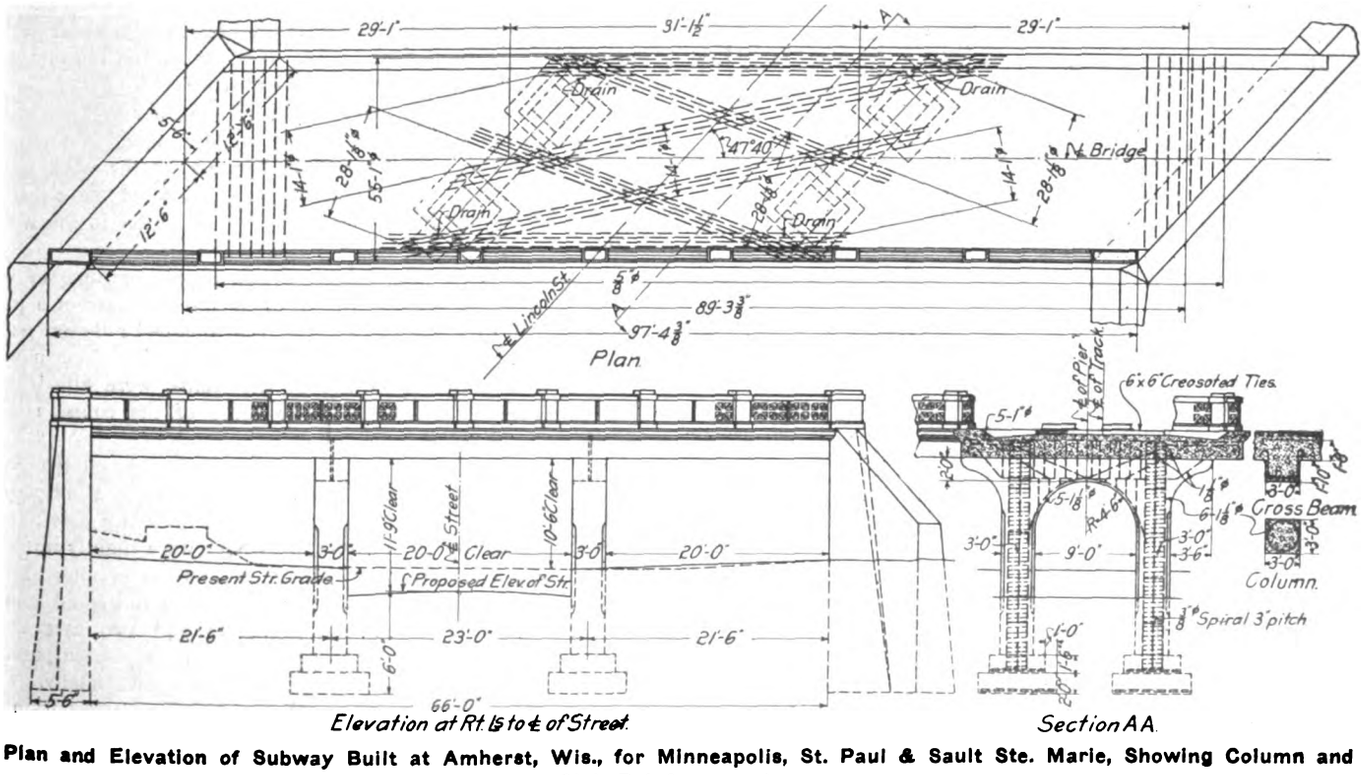
The floor slab is reinforced in four directions, in accordance with the usual "mushroom" design, the rods being crossed over each column in the piers. The reinforcement parallel to the center line of track consists of 1-in. round rods spaced 4 in. center to center, and that perpendicular to the center line of tracks of ⅝-in. rods spaced 12 in. center to center. The diagonal reinforcement connecting alternate pier columns consists of 1⅛-



Mushroom System Reinforced Concrete Slab Subway on Minneapolis, St. Paul & Sault Ste. Marie.

in. round rods for the shorter lengths and 1-in. rods spaced 6 in. center to center for the longer lengths. The central span is 31 ft. 1½ in., and the two sidewalk spans are 29 ft. 1 in. Drainage is carried in troughs built in the upper surface of the slab on either side of the ties to outlets over each pier. The clearance over the street level is 11 ft. 9 in., and between railings 16 ft.

A similar bridge over Wilson street was built first. In this case turnouts were installed and a temporary pile trestle was driven alongside the old structure, over which trains were operated during the construction of the new bridge. In building



Plan and Elevation of Subway Built at Amherst, Wis., for Minneapolis, St. Paul & Sault Ste. Marie, Showing Column and Slab Reinforcement.

the Lincoln street bridge, however, traffic was maintained over the structure during the reconstruction work. To accomplish this, the jack stringers, guard rails and long ties were removed and the deck of the original pile bridge was jacked up about 2½ ft., run-offs being provided at both ends by cinder fills. The track was blocked up in this position on cast iron spools as shown in the accompanying sketch. These spools were 2 ft. 3 in. long and 10 in. in maximum diameter, placed so as to not interfere seriously with the slab reinforcement. They were concreted into the floor slab and allowed to remain in the position shown. The forms for the concrete slabs were built on the old trestle, effecting a saving in the cost of false work. This hump in the track made it necessary to operate carefully over the bridge during construction, but traffic was never interrupted.

These bridges were built under the direction of Thomas Greene, chief engineer, and C. N. Kolk, principal assistant engineer.

TRAIN ACCIDENTS IN SEPTEMBER.[1]

Following is a list of the most notable train accidents that occurred on railways of the United States in the month of September, 1912:

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	Kil'd.	Inj'd.
6.	Balt. & O.	Cincinnati.	xc.	P. & F.	2	7
7.	Rutland	Bennington.	bc.	P. & F.	3	12
8.	Trinity & B. V.	Hillsboro.	bc.	P. & F.	0	16
8.	Penn.	Harrisburg.	xc.	P. & F.	1	0
10.	Penn.	Latrobe.	rc.	P. & F.	2	6
11.	West'n Md.	Shaw.	bc.	F. & F.	1	18
15.	N. Y. C.	E. Rochester.	rc.	F. & F.	3	5
20.	Louisv. & N.	Kiserton.	xc.	P. & F.	0	24
†22.	Pitts., S. & Nor.	Nile, N. Y.	bc.	P. & F.	3	32
26.	Kan. City So.	Kansas City.	bc.	P. & F.	2	3

Derailments.

Date.	Road.	Place.	Cause of Derailm't.	Kind of Train.	Kil'd.	Inj'd.
1.	Wab., Pitts. T.	Rockdale.	washout.	F.	2	0
†1.	Chicago & N. W.	Lyndhurst.	washout.	P	6	24
†2.	Mo. & No. Ark.	Shirley.	d. track.	P.	1	8
2.	C., St. P., M. & O.	Camp Douglas.	flood.	P.	3	29
5.	Southern	Holton, Ga.	unx.	P.	1	6
8.	Balt. & Ohio	Colfax, W. Va.	derail.	F.	1	1
8.	N. Y. C.	Fort Plain.	d. truck.	F.	2	0
10.	N. Y., Chi. & St. L.	Erie.	unx.	P.	0	35
12.	New York Central	Morton, N. Y.	ms.	P.	1	16
21.	Texas & Pac.	Hawkins.	unx.	P.	0	40
†25.	Southern	Plainville, Ga.	unx.	P.	3	23

Other Accidents.

Date.	Road.	Place.	Cause of Accident.	Kind of Train.	Kil'd.	Inj'd.
29.	Great Nor.	Helena.	Fall of rock in tunnel.	F.	1	3

The trains in collision at Cincinnati, Ohio, on the 6th were eastbound passenger No. 20 and a yard engine. The passenger train was just entering the yard. Two trespassers on the passenger train were killed and seven other persons were injured. The collision was due to failure to protect the yard engine.

The trains in collision near Bennington, Vt., on the evening of the 7th were a northbound passenger and a southbound milk train. Both engines and several cars of both trains, including one passenger coach, were wrecked. The engineman and the fireman of the passenger train were killed and the other engineman was fatally injured. Ten passengers and two trainmen were injured. The collision was due to neglect of the men in charge of the passenger train who forgot, overlooked or ignored the schedule of the milk train.

The train wrecked at Hillsboro, Tex., on the night of the 8th was northbound passenger No. 8. Entering the station at moderate speed, it ran over a misplaced switch and into the head of a work train standing on the sidetrack. Both the passenger and the work train engines were oil burners and the oil in the tenders took fire; and the combustible parts of the engines and the front end of the mail car were destroyed by fire. Sixteen passengers were injured, none seriously.

The train which was wrecked at Harrisburg, Pa., about 1:15 a. m. on the 8th was a westbound express, carrying no passengers. It approached the station at very high speed, in disregard of all signals, and the signalman, seeing that the runner was not in control of his engine, turned the train to a side track, where it 'collided with some empty passenger cars. The engine was completely turned around and overturned, and the engineman, Wilbert Stone, was fatally injured. The reports say that before his death he said that he must have fallen asleep. It is said also that the fireman had had to awaken the engineman near Lancaster, 36 miles east of Harrisburg. Stone is reported as having been a man of quiet, steady habits. He had made his regular run on this train on the 6th, sleeping in the bunk room at Harrisburg from 2 a. m. to 10 a. m. He was in bed during the middle of the day on the 6th, as well as all of that night, and until nearly noon of the 7th. He was at home the afternoon of the 7th, going on duty about 9 o'clock that evening, when, apparently, he was in good physical condition.

The trains in collision near Latrobe, Pa., on the 10th were the second section of westbound passenger No. 21 and a freight engine. One engineman and one trainman were killed and two firemen and four passengers injured. The cause of the collision was a failure of block working. Immediately preceding the passenger train was a freight train, which was drawn by one engine and assisted by a pusher engine at the rear. The pusher engine was cut off to take coal, after which it followed the freight train very slowly on account of foggy weather, but did not overtake it. When the freight train stopped west of the block signal station just west of Latrobe, one of the brakemen, seeing that the pusher engine was not with the train, displayed markers on the rear end of the caboose, thus indicating that the train was complete. When the signalman in the tower saw the markers, he reported the block clear, and the passenger train was admitted under a clear signal. It overtook and ran into the pusher engine about one mile east of Latrobe.

The trains in collision near Shaw, W. Va., on the 11th, were a westbound work train and an eastbound freight. A foreman was killed and 3 trainmen and 15 laborers on the work train were injured; one of them fatally. The cause of the collision was the failure of an operator to deliver an order to the work train.

The wreck at East Rochester, N. Y., on the morning of the 15th, was due to a freight train running into the rear of a preceding freight in a dense fog. The wreck fouled adjacent main tracks and a third freight train ran into it. One fireman and two trespassers, riding on one of the trains, were killed, and five employees were injured. The cause of the collision was excessive speed under a caution signal.

The train which was wrecked at Kiserton, Ky., on the 20th, was southbound passenger No. 37. It ran over a misplaced switch and into the head of a work train. Twenty passengers, three trainmen, and one express messenger were slightly injured.

The trains in collision at Nile, N. Y., on the evening of the 22nd, were a southbound passenger, running at full speed, and a northbound freight train. Both engines and two cars were wrecked. Two passengers were killed and twenty-seven passengers and six employees were injured, the engineman fatally. The cause of the collision was the failure of the passenger train to wait at Friendship, in accordance with a despatcher's order.

The train derailed near Lyndhurst, Wis., on the 1st, was

[1] Abbreviations and marks used in Accident List:

rc, Rear collision——bc, Butting collision——xc, Other collisions——b, Broken——d, Defective——unf, Unforeseen obstruction——unx, Unexplained——derail, Open derailing switch——ms, Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc. ——boiler, Explosion of locomotive on road——fire, Cars burned while running——P. or Pass., Passenger train—F. or Ft., Freight train (including empty engines, work trains, etc.)—Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.