The track was constructed in 1910, but did not carry traffic until two years later. After eight years' service, the track is in good alignment and grade, but has a tendency towards ravelling on the inside and outside of the rail, and in one or two places the slab between the gauge lines has raised. It is thought that a great deal of the success of this type of construction lies in the fact that as operation did not commence until two years after construction, the concrete had every opportunity to develop considerable strength.

Type Designed in 1912

In 1912 a large program of street railway track construction was planned, and a new design was prepared, as shown in Fig. 9. The construction is somewhat similar to the Jasper Avenue type, but in order to decrease the unit pressure on the subsoil, cross-ties and cross-girders were placed at 5-ft. instead of 10-ft. centres. It was planned to use 60-lb. steel rails alternately with wooden ties, but as the steel rails were not obtainable, wooden ties were used throughout the construction. The specifications called for two bids, one for the completed 10 and 12-ft. centre tracks with a pavement wearing surface of 1:2 mortar, and a second bid for the completed tracks ready to receive a 2-in. bituminous surfacing between the gauge lines, in the devil strip and on the outside of the rails. In this latter construction, reinforced concrete rail blocks were to be constructed to form the flange clearance and act as a shoulder for the bituminous surface. On certain streets work was started late in the fall, with the result that the concrete rail blocks were caught by the frost and had to be removed. They were replaced by a concrete slab 4-ins. thick. Before this work had been down five years, the surface was badly cracked and broken up at a number of places, especially at the joints. A slight settlement in the girders was followed by a breaking up of the concrete pavement.

TABLE 3—DIMENSIONS AND WEIGHTS, TEE RAIL SECTION (SEE FIG. 6)

k	b	d	t	o	s	θ	Wt. per Yd., Lbs.	Tons per Mile, Single Track.	System.
4¼"	4¼"	2⅜"	31/64"	49/64"	17/32"	13°-00	60	94.29	A.S.C.E.
5"	5"	2½"	35/64"	7/8"	1½"	13°-00	80	125.71	A.S.C.E.
5 3/16"	5"	2 9/16"	9/16"	57/64"	1 35/64"	13°-00	85	133.57	A.S.C.E.
5⅜"	5"	2⅝"	9/16"	59/64"	1 19/32"	13°-00	90	141.43	A.S.C.E.
5¾"	5"	2⅜"	9/16"	31/32"	1 45/64"	13°-00	100	157.14	A.S.C.E.
6⅛"	6"	2⅞"	37/64"	1"	1 25/32"	13°-00	110	172.29	A.S.C.E.
6"	5"	2⅛"	1 1/32"	0.62"	1.2"	9°-10	60	94.29	Lorain
7"	5"	2⅛"	⅜"	0.67"	1.3"	9°-10	70	110.00	Lorain
7"	6"	2½"	7/16"	0.70"	1.3"	9°-10	80	125.71	Lorain
7"	6"	3"	17/32"	0.83"	1.4"	11°-20	95	149.29	Lorain

Track Work in 1913

In 1913 a radical change was made in the track design. It was thought that the track construction did not give sufficient bearing surface, and working towards that end, the old style of girder construction was abandoned and a 6-in. slab built completely across the track area. In case of a cut, a burm 2 ft. 10 ins. wide was usually left between the base slab in the 12-ft. centres construction, but in fill the difficulty of forming this burm offset the saving of concrete. After this base had set, the tracks were assembled and bonded. Fig 10 shows the general cross-section of the 1913 construction, with the difference that a 1-in. sand cushion was placed under each tie instead of the mortar as shown, the wood blocks were not laid on the outside of the rails, and the slab between the gauge lines was reinforced.

Some of this construction showed signs of failure after four years' usage, and the most noticeable failure occurred on Alberta Avenue where there had been constructed a double line of car-tracks, built at different times. On the south track the joints were made of ordinary 4-hole splice bars and with little or no attention paid to the spacing of the ties at the joints. On the north track, the joints were made with 4-hole continuous joints as shown in Fig. 5. Both tracks were subjected to the same traffic, yet the south track, gave way at the joints, while the north track remained in good condition.

On other streets the results were more satisfactory excepting that in some places the bituminous surfacing at the outside of the rail broke away, and in a number of places the concrete slab between the gauge lines raised, due to dirt and water finding their way under the slab, through a crack just inside the gauge lines, where the slab sheared.

The cause of failure of the slab was thought to have been partly due to the giving of the sand cushion under the tie. It would seem better practice to construct a good sound support for the ties and depend on wooden ties for resilience.

Standard for 1915-6

With the experience now obtained, the track design as shown in Fig. 10 was accepted as the standard construction for 1915 and 1916, when 2.8 miles were constructed. The 6-in. concrete base of the 1913 construction was retained, but the sand cushion was replaced by 1-inch of rammed mortar under the ties, which were shimmed up with wooden shims placed near the end of the ties. Before the filler had time to set, the concrete slab between the gauge lines was poured, precaution being taken to paint the rail with an asphaltic compound to prevent the bonding of the concrete to the rail. On the outside of the rail were placed two rows of treated wood blocks with a treated wood filler strip to fill the web. In forming a base for the two blocks, the rough filler was levelled with a mortar and painted with an asphaltic paint.

In this type of construction, the ties are supported on a rigid bearing, but the wood blocks and mastic joints leave the rail free to move up and down, to give a certain resilience to the track but without affecting the adjoining pavement.

To review the condition of the various types of track work under operation: The girder type has not held up under our conditions, especially at the joints and at street intersections. In the later designs, where the bituminous surfaces were laid against the rail, it usually ravelled, but this has been overcome by the wooden rail blocks. The biggest trouble has been caused by the flanges of the wheel cracking the concrete slab just inside the gauge line. These cracks soon became large and water found its way down under the slab, with the result that hundreds of feet of this slab had to be removed.

The results from operation on our various types of track construction have certainly demonstrated the fact that it is almost impossible to construct a permanent pavement around the tee-section of rail.

Excavation

In preparing the subgrade for a street railway track, ready to receive the concrete base, it may be possible under some conditions to take out most of the rough grade with drag scrapers but under most conditions this dirt must be hauled off the streets to some suitable dumping place in dump wagons. After the rough grade is taken out the subgrade is trimmed, leaving the loose dirt from ¾ to 1¼ ins. above the final grade, to allow for settling under the roller. All soft spots should be made firm with new material. This work may be paid for on a cubic yard basis, which will include "rough grade," "fine grading," rolling and carting of all surplus materials.

Concreting

In preparing to lay concrete, consideration should be given to the selection of material, methods of mixing, methods of placing and the care or "curing" of the green concrete.

The coarse aggregate may be obtained from well-graded gravel or a hard, tough material suitable for crushing and graded to pass a 2-in. ring. The fine aggregate may be any well-graded clean sand or crusher screenings from a durable material. Our experience has shown that "pit run" gravel —that is, a mixture of coarse and fine aggregate coming direct from the pit—has too great a variation between the percentage of fine and coarse aggregate to make good concrete, and our specifications require that "only segregated materials shall be used." The cement used should conform