connecting the inner rail of one track with the inner rail of the other track.

TABLE II.—GAUGES, GROOVES, SUPERELEVATION AND DISTANCE BETWEEN TRACKS ON TRAMWAY CURVES.

Radius.	Girder Rail.		T Rail.			Distance between Centres for Double Track.		Superelevation, 12 Miles per Hour.	
	Weight.	Gauge of Road.	Weight.	Gauge of Road.	Width of Groove.			Through Reserves.	On Roadway.
Feet.	Lbs.	Ft. Ins.	Lbs.	Ft. Ins.	Inches.	Ft.	Ins.	Inches.	Inches.
50	Girder rails not to be used under 100 feet radius		80 and 60	4 $9\frac{3}{8}$	$1\frac{11}{16}$	12	10	$4\frac{1}{2}$	2
55			80 and 80 or 60 and 60	4 $9\frac{5}{16}$	$1\frac{5}{8}$	12	8	,,	$1\frac{13}{16}$
60				4 $9\frac{1}{4}$	$1\frac{9}{16}$	12	4	,,	$1\frac{11}{16}$
66			,,	4 $9\frac{3}{16}$	$1\frac{1}{2}$	12	2	,,	$1\frac{1}{2}$
70			,,	4 $9\frac{1}{8}$	$1\frac{7}{16}$	12	0	,,	$1\frac{7}{16}$
75			,,	4 $9\frac{1}{8}$	$1\frac{7}{16}$	11	11	,,	$1\frac{5}{16}$
80			,,	4 $9\frac{1}{16}$	$1\frac{3}{8}$	11	10	,,	$1\frac{1}{4}$
85			,,	4 $9\frac{1}{16}$	$1\frac{3}{8}$	11	9	,,	$1\frac{3}{16}$
90			,,	4 9	$1\frac{5}{16}$	11	8	,,	$1\frac{1}{8}$
100	109	4 $8\frac{15}{16}$	,,	4 $8\frac{15}{16}$	$1\frac{1}{4}$	11	6	,,	1
110	,,	,,	,,	4 $8\frac{7}{8}$	$1\frac{3}{16}$	11	6	,,	$\frac{7}{8}$
120	,,	,,	,,	4 $8\frac{7}{8}$	$1\frac{3}{16}$	11	2	,,	$\frac{13}{16}$
132	,,	,,	,,	4 $8\frac{13}{16}$	$1\frac{1}{8}$	11	1	4	$\frac{3}{4}$
150	,,	,,	,,	4 $8\frac{13}{16}$	$1\frac{1}{8}$	11	0	,,	$\frac{11}{16}$
165	,,	,,	,,	4 $8\frac{3}{4}$	$1\frac{1}{16}$	11	0	,,	$\frac{5}{8}$
180	,,	,,	,,	4 $8\frac{3}{4}$	$1\frac{1}{16}$	11	0	,,	$\frac{9}{16}$
198	,,	,,	,,	4 $8\frac{3}{4}$	$1\frac{1}{16}$	10	10	$2\frac{3}{4}$	$\frac{1}{2}$
Chs. $3\frac{1}{2}$	,,	,,	,,	4 $8\frac{11}{16}$	1	10	9	,,	$\frac{7}{16}$
4	,,	,,	,,	4 $8\frac{11}{16}$	1	10	8	$2\frac{1}{8}$	$\frac{3}{8}$
$4\frac{1}{2}$	100	4 $8\frac{9}{16}$	,,	4 $8\frac{5}{8}$	$\frac{15}{16}$	10	7	,,	$\frac{5}{16}$
5	,,	,,	,,	4 $8\frac{5}{8}$	$\frac{15}{16}$	10	6	$1\frac{5}{8}$	$\frac{5}{16}$
$5\frac{1}{2}$	,,	,,	,,	4 $8\frac{5}{8}$	$\frac{15}{16}$	10	5	,,	$\frac{1}{4}$
6	,,	,,	,,	4 $8\frac{5}{8}$	$\frac{15}{16}$	10	4	$1\frac{3}{8}$	$\frac{1}{4}$
$6\frac{1}{2}$	,,	,,	,,	4 $8\frac{5}{8}$	$\frac{15}{16}$	10	4	,,	$\frac{1}{4}$
7	,,	,,	,,	4 $8\frac{9}{16}$	$\frac{7}{8}$	10	4	,,	$\frac{3}{16}$
8	,,	,,	,,	4 $8\frac{9}{16}$	$\frac{7}{8}$	10	2	$1\frac{1}{8}$	$\frac{3}{16}$

Expansion joints are made at intervals in long lengths of straight track and at quick changes of gradient.

At earth connections to rails for lightning arresters, potential

boxes, etc., the two rails are cross-bonded, the nearest rail having a half 36-inch cable bond fixed for the earth connection.

The double trolly-wire is of 3/0 gauge circular section hard-drawn copper, supported about every 110 feet by span wire or bracket arms with double insulation between the trolly-wire and wooden poles or arms, and treble insulation between the ears and direct attachments to boulders. The lightning arresters of the usual pattern are used and connected with the trolly-wire about every $\frac{1}{2}$ mile, the earth wire being bonded to the track. Recording test boxes for the purposes of ascertaining the line voltage have been erected at The Spit balloon loop, and also where section insulators have been placed.

A potential wire of No. 12 S.W.G. runs from The Spit balloon loop to the junction of the line with the Manly-Brookvale tramway at Raglan Street, where a potential box is installed to enable connection to be made to the rail.

The trolly-wire is divided near Condamine Street into two independent sections with "air-gap" section insulators.

The power, three-phase, is transmitted at 6,000 volts direct from Ultimo power-house via Ridge Street substation, from which it is carried on poles overhead to The Spit, where it is connected with a submarine cable across Middle Harbour to the Manly side. It then continues overhead on poles as far as the substation situated in Condamine Street. The 6,000 volts three-phase current is then transformed down and converted to the standard tramway voltage between 550 and 600 volts.

The transmission-line consists of three 1/0 bare wires, erected on cross arms. A barbed lightning-arrester wire is strained over them from the tops of the poles.

Where the overhead transmission-line changes to the submarine, the wires are anchored to steel towers which are of sufficient height to allow temporary cables being erected across the harbour clear of the ordinary ferry boats and smaller shipping, in the event of a breakdown on the submarine cable.

TRAMCAR FERRY.

A free vehicular and passenger ferry punt, under the control of the Public Works Department, carries passengers across Middle Harbour from one tramway service to the other[1]; but to transfer

[1] "Vehicular Ferries in New South Wales." Minutes of Proceedings Inst. C.E., vol. clxxxvii, p. 292.