

The Melbourne Tramways Trust.

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DRAINAGE REPORT

ON

NORTHERN CABLE TRAMWAYS.





# The Melbourne Tramways Trust.

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## ENGINEER'S REPORT

ON

## DRAINAGE.

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# Melbourne Tramways Trust.

ENGINEER'S OFFICE,

MELBOURNE, *March 1st, 1887.*

TO THE CHAIRMAN, WORKS COMMITTEE,

TRAMWAYS TRUST.

SIR,—In pursuance of instructions, I have the honor to submit the following report on the systems of drainage which have been carried out by the Tramways Trust in conjunction with the work of Tramway construction:—

1. The \*accompanying plans and tabular statements give the position, capacity, drainage, area and cost, together with full particulars of each drain constructed or proposed to be constructed up to date.
2. In dealing with drainage questions generally, as applied to the construction and working of Cable Tramways, it may at the outset be stated that a Cable Tramway must have thorough drainage; without it, cables and running gear are rendered unworkable, and the best constructed Tramways are useless.
3. This principle established it is evident that the Tramways now running, as well as those constructed by the Trust, are kept clear of water for a depth of three feet three inches (3ft. 3in.) below the street level.
4. All municipal drainage intercepted has been carried below the level of the bottom of the Tramway, and in flat localities the substituted works have had to extend in some instances over one (1) mile from the point of interception before an outfall could be secured.
5. The drainage of the Municipalities through which the Tramways are laid down, are simple surface drainage systems excepting where a few isolated sewers have been constructed.
6. The surface drains are open pitched channels constructed alongside and running parallel with the kerb, and the water is conveyed across the intersecting streets in culverts, pipes, or by the continuation of the open channel. The capacity of the drains may have been sufficient to carry off the rainfall of their respective drainage areas at the time they were constructed, but the subsequent rapid development of the City and Suburbs, and the improvements effected to the streets have evidently caused a largely increased proportion of the rainfall to flow into the channels, and the result has been that many of the drains are subject to periodical overflowing and the streets are flooded.
7. In constructing Cable Tramways over twenty-five (25) miles of streets with such drainage systems it is apparent that extensive drainage works were required, necessitating a large capital expenditure.
8. The drainage area of the Tramway proper, represented by a strip of street seventeen (17) feet wide, for the length of the Tramway is about two (2) acres per mile, and the rainfall over this area could be carried off under the ordinary conditions of efficient Municipal drainage at a cost not exceeding £200 per mile of track. As against this it may be stated that in the drainage of portions of the Carlton Cable Tramway, in the Cities of Melbourne and Fitzroy, an expenditure has been incurred of £9,375 in a little over one half mile of track.
9. It is needless here to follow in detail the drainage works carried out by the Trust, or to draw comparisons between the cost of the various works, as all this data is already set forth in the accompanying statements.
10. The proposals for the drainage of the Tramways have emanated from the writer, and each drain has been designed from a careful survey and complete investigation of the drainage area and available outfall, nor has there been a proposal submitted which required any expenditure beyond that absolutely necessary to construct the Tramways in such a manner that when completed by the Trust they could be taken over by the Tramway Company and made to run without interruption so as to meet the requirements of the public traffic.
11. The plans, after being approved of by the Trust, were forwarded in each case to the local Authority in accordance with Section 19 of the Tramways Act, and all proposals have so far been accepted by the local Councils without alteration, excepting those relating to the Cities of Melbourne and Fitzroy.
12. In the former City the Acting City Surveyor increased the sectional area of many of the proposed drains (vide tabular statements), and in the City of Fitzroy a fair and equitable arrangement was made with the Council for the drainage of portion of the Collingwood and Carlton lines.† Particulars of the agreement are in the possession of the Secretary.
13. The drainage expenditure on the Northern Cable Lines when completed will amount to £41,743, and on the authorised Southern Cable Lines to £6,500, making a total expenditure of £48,243, or at the rate of £1,462 per mile of track.
14. The total estimated cost of the drainage for the present authorised Horse Tramways will amount to about £2,000.

I have the honor to be,

Sir,

Your Obedient Servant,

GEO. S. DUNCAN,

ENGINEER.

\* Plans not attached.

† Vide note on tabular statement, pages 5 and 9.



# RICHMOND CABLE TRAMWAY.

Drain.	Dimensions.	Fall.	Length.	Area Drained.	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
Terminal Pit, Spencer St.	9in. pipe	$\frac{1}{130}$	Yards. 330			Melbourne	300	For Drainage of Tramway only
Spencer Street Curve ...	9in. pipe	$\frac{1}{300}$	160			do.	150	Do. do.
King Street West ...	Culvert 6ft. x 2ft.	$\frac{1}{110}$	94	33 acres	3 in.	do.	1600	This Culvert is located at the lowest level in the City, and during high tide the carrying capacity is reduced to 1 in. of rainfall per hour; the dimensions were fixed conjointly by the Acting City Surveyor and Trust Engineer
King Street East ...	Culvert 6ft. x 2ft.	$\frac{1}{110}$	50	66 acres	1½ in.	do.		
Between King Street and William Street	9in. pipe		120			do.	50	For Drainage of Tramway only
Market Street ...	3 18in. pipes	Level	40	20 acres	1 in.	do.	150	To provide for Drainage intercepted by Tramway construction, in lieu of two 18in. pipes
Between Market Street and Queen Street	6in. pipe		80				50	For Drainage of Tramway only
Queen Street ...	2 18in. pipes	$\frac{1}{300}$	92	8 acres	1¼ in.	do.	300	To provide for Drainage intercepted by Tramway construction, in lieu of open channel
Elizabeth Street ...	6in. pipe						15	For Drainage of Tramway only
Swanston Street ...	6in. pipe						15	Do. do.
Near Exhibition Street...	6in. pipe	$\frac{1}{45}$	24				30	Do. do.
Jolimont ...	2 15in. pipes 6in. pipe	$\frac{1}{200}$	66 66	25 acres	½ in.	do.	200	Extension and lowering of existing pipes to provide for intercepted drainage and Tramway drainage
Hoddle Street ...	12in. pipe	$\frac{1}{250}$	44	3½ acres	¾ in.	do.	40	Do. do.
Angle Sheave Pit ...	12in. pipe		80			Richmond	150	For Drainage of Tramway only
Rotherwood Street ...	6in. pipe	$\frac{1}{100}$	30			do.	20	Drainage of Tramway only
Union Street ...	6in. pipe	$\frac{1}{100}$	30			do.	20	do.
Lennox Street ...	6in. pipe	$\frac{1}{100}$	30			do.	20	do.
*Church Street ...	6in. pipe	$\frac{1}{300}$	330			do.	200	do.
*Griffith Street ...	6in. pipe	$\frac{1}{770}$	154			do.	200	do.
*Gardner Street...	6in. pipe	$\frac{1}{200}$	60			do.	50	do.
*White Street ...	6in. pipe	$\frac{1}{132}$	60			do.	50	do.
Terminal Pit, Richmond	9in. pipe	$\frac{1}{60}$	22			do.	15	do.

## SUMMARY OF EXPENDITURE.

City of Melbourne	.....	£2,900.
City of Richmond.....	.....	£725.
		<u>£3,625.</u>

\* NOTE.—The Corporation sewer was made use of as an outfall for these drains, the Council granting the use of it unconditionally.



# SPENCER STREET AND FITZROY CABLE TRAMWAY

## (COLLINS STREET AND GISBORNE STREET).

Drain.	Dimensions.	Fall.	Lengths.	Area Drained.	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
Terminal Pit, Spencer St.	9in. pipe	$\frac{1}{100}$	Yards. 66			Melbourne	£ 80	Drainage of Tramway only.
King Street West ...	2 15in. pipes	$\frac{1}{200}$	55	11 acres	1 in.	do.	144	To provide for drainage intercepted by Tramway construction, in lieu of 1 15in. pipe.
King Street East ...	Culvert 2ft. 6in. x 15in.	$\frac{1}{200}$	75	40 acres	$\frac{3}{8}$ in.	do.	219	To provide for drainage intercepted by Tramway construction, in lieu of 2 15in. pipes.
William Street ...	2 15in. pipes	$\frac{1}{200}$	66	15 acres	$\frac{3}{4}$ in.	do.	88	To provide for drainage intercepted by Tramway construction, in lieu of 1 15in. pipe.
Russell Street ...	Culvert 3ft. 6in. x 1ft. 10in.	$\frac{1}{200}$	66	10 acres	4 in.	do.	129	To provide for drainage intercepted by Tramway construction, in lieu of culvert same sectional area. The Engineer of the Trust proposed 2 12in. pipes, which would have carried more than 1in. per hour rainfall, but culvert as put in was required by the Acting City Surveyor.
Spring Street West ...	18in. pipes	$\frac{1}{100}$	66	2 acres	6 in.	do.	114	To provide for drainage intercepted by Tramway construction, in lieu of 1 12in. pipe. The Engineer of Tramway Trust proposed laying down 1 12in. pipe, which would have carried $2\frac{1}{2}$ in. per hour rainfall, but 18in. pipe was required by the Acting City Surveyor.
Spring Street East ...	2 18in. pipes	$\frac{1}{100}$	100	18 acres	$1\frac{1}{4}$ in.	do.	249	To provide for drainage intercepted by Tramway construction, in lieu of open drain.
Drainage for Crown Pulleys, &c.						do.	40	Drainage of Tramway only.
North Carlton Tramway						do.	2500	Not yet constructed

### SUMMARY OF EXPENDITURE.

City of Melbourne ..... £3,563.



# SIMPSON'S ROAD CABLE TRAMWAY.

## SPENCER STREET & FITZROY CABLE TRAMWAY (NORTH FITZROY SECTION).

Drain.	Dimensions	Fall.	Length.	Area Drained.	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
			Yards.				£	
Terminal Pit, Barkly St...	9in. pipe	$\frac{1}{132}$	200			Fitzroy	224	For drainage of Tramway only
Scotchmer Street ...	2 18in. pipe	$\frac{1}{264}$	400	75 acres	$\frac{1}{4}$ in.	do.	1270	To provide for drainage intercepted by Tramway construction, in lieu of open channel.
Curve—St. George's Road and Brunswick Street...	6in. pipe		6	2 acres		do.	3	For drainage of Tramway only
Cecil Street ...	9in. pipe	$\frac{1}{100}$	224			do.	160	For drainage of Tramway only
Johnston Street ...	9in. pipe		6			do.	6	Drainage of Tramway only and to connect with Sewer afterwards constructed by Council.
Moor Street ...	9in. pipe		6			do.	3	Drainage of Tramway only, to be connected with Sewer.
Gertrude Street ...	9in. pipe		6			do.	6	Drainage of Tramway only, to be connected with Sewer.
Angle, Sheave Pit ...	12in. pipe	$\frac{1}{132}$	222			do.	260	For drainage of Tramway, runs down Simpson's Road into Tramway Tunnels.

### SUMMARY OF EXPENDITURE.

City of Fitzroy ..... £1,932



# SIMPSON'S ROAD CABLE TRAMWAY.

Drain.	Dimensions.	Fall.	Length.	Area Drained.	Rainfall per hour which could be carried	Municipality.	Cost.	Remarks.
Terminal Pit and Oiling Pit ... ..	12in. pipe	$\frac{1}{100}$	Yards. 110			Richmond and Colling- wood	£ 266	For Drainage of Tramway only
Egg Shaped Sewer ...	3ft. x 2ft.	$\frac{1}{440}$	2156	20 acres	$\frac{3}{4}$ in.	Colling- wood	7550	For Drainage of Tramway, and likewise for carrying the Municipal drainage intercep- ted in Church Street, which originally was carried by Culvert 7ft. x 1ft. 1in. ; under any condition without inter- ference with existing Muni- cipal drainage, it would have been necessary to have con- structed this Sewer so as to carry the water from the Tramway Tunnels, there being no outlet for a length of fully 1 mile ; the 3ft. x 2ft. Sewer was necessary so as to carry the Municipal Drainage from Church Street, and likewise to provide for efficient cleansing.

## SUMMARY OF EXPENDITURE.

City of Richmond .....	.....	.....	.....	£200
City of Collingwood .....	.....	.....	.....	7616
				<u>£7816</u>

NOTE.—This Sewer having, owing to its length, to be made considerably larger than is necessary for draining the Tramway, in order to provide for means of cleaning it, an agreement was made with the Collingwood Council that one-third of the sectional area of the sewer should be left at the disposal of the Council in the event of its being required at a future date. This will assist in flushing the sewer.



## COLLINGWOOD CABLE TRAMWAY.

Drain.	Dimensions.	Fall.	Length.	Area Drained	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
			Yards.					
Terminal Pit, Plenty Road	9in. pipe					Fitzroy	£20	Drainage of Tramway only ; not yet completed
Gold Street ... ..	Culvert 3ft. x 15 in.	$\frac{1}{206}$	160	24 acres	$\frac{1}{2}$ in.	Fitzroy and Colling- wood	550	To provide for Drainage inte- cepted by Tramway construc- tion; in lieu of Culvert 2ft. x 8in.
Crown Pulley, Johnstone Street ... ..	9in. pipe					do.	7	Tramway Drainage only
Connections with Smith Street Drain ...	9in. pipes					Fitzroy	100	Tramway Drainage only

### SUMMARY OF EXPENDITURE.

City of Collingwood	.....	.....	.....	£282
City of Fitzroy	.....	.....	.....	395
				<u>£677</u>



## BRUNSWICK CABLE TRAMWAY.

Drain.	Dimensions.	Fall.	Length.	Area Drained.	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
			Yards.					
Terminal pit, Flinders St.	9 in. pipe		50			Melbourne	300	Not yet laid. For drainage of Tramway only.
Grattan Street ..	2 culverts 3ft x 15in.	$\frac{1}{125}$	130	108 acres	$\frac{1}{4}$ in.	do.	680	To provide for drainage intercepted by Tramway construction. In lieu of open channel.
Between Grattan Street and Brunswick Street	9in. pipe and culvert.		80			do.	40	Tramway drainage only, leading from Tramway tunnels into street side channels.
Drainage of Angle Sheave Pits	9in. pipe		350			Brunswick	500	At Sarah Sands. To convey drainage from Tramway tunnels only into Union Street sewer.
From Victoria Street down Sydney Road and Union Street.	3ft. barrel drain.	$\frac{1}{400}$	1800	60 acres	$\frac{1}{2}$ in.	do.	4400	To provide for drainage intercepted by Tramway construction. In lieu of 4 15in. pipes at Victoria Street, 2 12in. pipes at Albert Street, culvert, 9in. x 9in. at Glenlyon Road, 4 9in. pipes at Edward Street.
Albion Street ... ..	2ft barrel drain.	$\frac{1}{250}$	1800	30 acres.	$\frac{1}{2}$ in.	do.	3800	To provide for drainage intercepted by Tramway construction, in lieu of 3 9in. pipes and 1 12in. pipe. Not yet constructed.
Terminal Pit, Moreland Road	12in. pipe	$\frac{1}{600}$	660			do.	800	To drain Tramway only. Runs from Moreland Road to Albion Street sewer. Not yet constructed.

## SUMMARY OF EXPENDITURE.

City of Melbourne	-----	-----	-----	1,020
Borough of Brunswick	-----	-----	-----	9,500
				<u>£10,520</u>



CARLTON CABLE TRAMWAY—*Continued.*

Drain.	Dimensions.	Fall.	Length.	Area Drained.	Rainfall per hour which could be carried.	Municipality.	Cost.	Remarks.
			Yards.				£	
Johnstone St. from Gold St. to Hoddle St.	5 9in. pipes			1 acre		Colling- wood	36	Drainage of Tramway only. Connections with Tramway tunnels and sewer along- side.
Rich Street ... ..	9in. pipe		400	1 acre		do.	350	To drain Tramway only, not yet constructed.
Terminal Pit ... ..	9in. pipe	$\frac{1}{132}$	140			do.	300	Do. do.
Crown Pulleys ... ..						do.	36	Do. do.
Angle Sheave Pit ...	9in. pipe		140			Fitzroy	300	Do. do.

## SUMMARY OF EXPENDITURE.

City of Melbourne	.....	.....	.....	£4,360
City of Fitzroy	.....	.....	.....	6,975
City of Collingwood	.....	.....	.....	722
				<u>£12,057</u>

NOTE.—The following Agreement was made between the Trust and the Fitzroy Council in connection with these Drains :—

- 1.—The Trust to construct the main sewers along Fitzroy-street, Young-street, and Smith-street from the southern side of Johnston-street to the Reilly-street drain, and also to make pipe connections along Johnston-street, from Nicholson-street to Smith-street. The Trust to have authority to drain the tunnels of the Tramway into any of the sewers or pipes (whether laid by the Trust or the Council) where required.
- 2.—The Council to construct the whole of the sewers south of Johnston-street to Victoria Parade, and all the pipe connections into the sewers built by the Trust.
- 3.—The Council to construct a sewer from the intersection of Scotchmere-street to the Edinburgh Gardens, and to retain the pipes already laid.