Moreland Road, Coburg

The Bellcord

MELBOURNE TRAM MUSEUM

Journal of the Melbourne Tram Museum
Number 48 — December 2020

Front cover

D2 class 5019 in Moreland Rd waiting at Sydney Rd as a train crosses the newly elevated Upfield railway line that runs parallel to Sydney Rd (November 2020). See article on page 3.

Photo: Mal Rowe

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Museum News

The museum has been closed since mid March due to the Coronavirus (COVID-19) pandemic. Dependent on government advice, the museum may reopen to the public in the early months of 2021. A Covid-safe plan will be in place to protect the health of visitors and volunteers. The date of the first open day will be announced on our website and social media accounts.

Museum shop

The museum shop will be open on Saturday 5 and 12 December, between 10 am and noon. Details available on our website.

Seasons greetings

Merry Christmas and Happy New Year to all museum members and supporters. Thank you to all who have assisted the museum during 2020.

Museum committee 2020-21

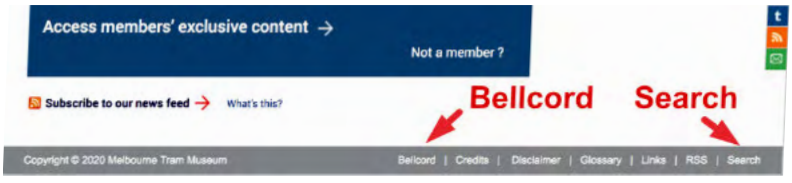
This year's committee members are:

Rod Atkins (*Chairman*)
Kevin Taig (*Deputy Chairman*)
Mike Ryan (*Secretary*)
Carolyn Cleak (*Treasurer*)
Adam Chandler
Shana De La Rue
Warren Doubleday
Russell Jones

Looking for tramway history?

The museum's website contains numerous articles on tramway history and the search function is a helpful way to locate your topic of interest.

The search tab is in the lower right corner of the homepage and searches all website content including all issues of *The Bellcord*. Direct access to *The Bellcord* is also available from an adjacent tab.



Melbourne Tram Museum website homepage

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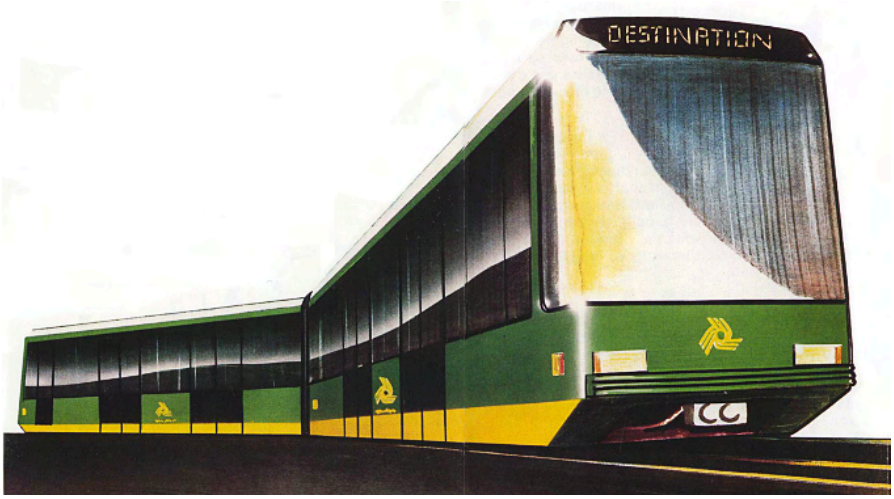
Upfield Light Rail: A Flawed Proposal



RIGHT: Artist's impression of the Light Rail Vehicle proposed for the Upfield line that was included in a MTA promotional brochure (1989).
Melbourne Tram Museum collection

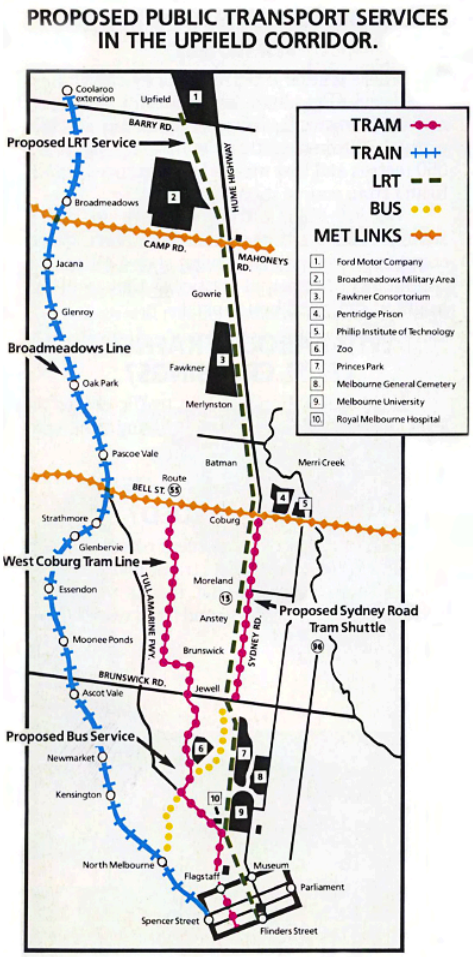
In 1988, a Light Rail (LR) line was proposed between the city and the Melbourne suburb of Upfield. It was one of three options announced by the Metropolitan Transit Authority (MTA) to address the deteriorating Melbourne to Upfield railway line. The term LR suggested lighter construction and operational costs than 'heavy' railways, but faster travel times than street tramways.

The Upfield LR project was to follow on from the recently completed Port Melbourne and St Kilda LR conversions, details of which were included in *The Bellcord* (*December 2018 edition*). The LR proposal was preferred because it would amalgamate the parallel train and tram lines and so reduce costs. It was promoted as a quicker and more convenient service than a railway that carried too few people and cost too much to run.

The LR proposal encountered opposition from many groups and did not proceed due to broader government difficulties. Today both the railway and tramway remain. The recent elevation of a 2.5 km section of the rail line to remove four level crossings and the projected reconnection of the line to the Craigieburn line at Somerton suggest the railway is here to stay.

So what were the details of the LR proposal and why was it unsuccessful?

RIGHT: Upfield bound Hitachi electric train at Coburg Station (1989).
Photo: Weston Langford



ABOVE: Map from MTA promotional brochure (1989).
Melbourne Tram Museum collection

Parallel lines

The Melbourne to Upfield railway and the North Coburg tramway both have their origins in the late 1880s. They were built to service the burgeoning industrial and residential areas of Brunswick and Coburg and run parallel approximately 200 metres apart for about six kilometres.

The tramway provides direct access to the city and has been heavily patronised from its first years, even when patronage on many other tram lines declined between the late 1940s and the 1990s. Originally operated as the Brunswick cable tramway with connecting horse tram, it was converted to an electric tramway in two stages: the horse tramway in 1916 and the cable tramway in 1936.

In contrast, the railway's circuitous route to the city and low frequency service could not attract the same level of patronage. To reduce the railway losses, train services were progressively withdrawn and passengers directed to the North Coburg tram and connecting bus to Upfield.

In 1958 Sunday evening trains were withdrawn and in 1971 all Sunday trains were withdrawn. Then from 1981 the railway was closed every evening. It was only with railway privatisation in 1999 that evening and full Sunday services were restored, albeit at low frequency.

Solutions

Many politicians called for the closure of the Upfield line. In 1979-80, the wide-ranging and controversial Lonie Transport Inquiry recommended the closure of numerous other rail and tram lines. These were hotly disputed and the Upfield railway survived.

in 1982, the Cain Labor government came to office bringing a new approach to unprofitable suburban railway lines — conversion to LR. The MTA proposed three options for the Upfield line, including minor or major railway upgrades. But amalgamating the duplicated train and tram services in the so-called Upfield Corridor was its preferred solution.

RIGHT: B2 class 2102 departing Flinders St terminus with a destination showing Upfield Railway Station (1995).
Photo: George Bishop

Upfield LR Proposal

- *Convert 12.5 km of railway line between Brunswick Rd and Upfield Station, including removal of railway signalling and conversion of 23 level crossings to traffic light control.*
- *Add five new raised stopping places to the existing ten stations.*
- *Operate partially low floor Light Rail Vehicles (LRVs) at 2½ minute intervals during peak periods and 5 minute intervals between peak periods.*
- *Abandon the rail connection to North Melbourne Station and replace it with connecting bus.*
- *Replace the North Coburg tram with a 10 minute shuttle bus along Sydney Rd between Brunswick Rd and Bell St. (Later changed to a shuttle tram.)*
- *Connect to the existing tram network by one of three options:*
  - *West Coburg tramline at Royal Park Station;*
  - *Royal Pde tramline using the abandoned inner circle railway tunnel south of Brunswick Rd;*
  - *Royal Pde tramline with new track along Park St (preferred option).*
- *Capital cost of $65.3 m, after applying a saving of $25 m for use of the abandoned rail reservation through Flemington and North Melbourne by the Western Bypass (later CityLink). Capital costs for the minor and major rail upgrade options were proposed as $70 m and $78.8 m respectively.*

Artists impression of the low-floor variant of the B2 proposed in 1989-90. Art work by Phil Belbin for John Dunn/ABB

Light Rail Vehicles

An order for 130 B2 class Light Rail Vehicles (LRVs) had been placed with Commonwealth Engineering (Comeng) in 1985 to operate a number of new lines — the Port Melbourne, St Kilda and Upfield LR lines and the East Burwood and Bundoora extensions. The first B2 was delivered in September 1988 for the St Kilda LR.

During 1989-90, Comeng proposed that the second half of the B2 order be built to a 60% low-floor design. It began construction of the first body shell, shown in the above Phil Belbin illustration prepared for John Dunn and ABB. This artwork appears to have influenced the artist's impression of the Upfield LRV shown on page 3.

A decision to proceed with this low-floor design was soon reversed. The body shell was scrapped and the order for the remaining high-floor B2 LRVs completed by 1994.

Estimates based on the 1988 Upfield railway and North Coburg tram timetables are that a round trip on the LR between the city and Upfield would have taken at least 100 minutes. To provide the advertised 2½ minute peak period frequency, more than 40 LRVs would have been required.

Brunswick Depot

The Upfield LR was to be operated by Brunswick Depot. Details of the depot's track connection to the LR reservation have not been located, but the photograph and site plan on the next page show that building such a connection would have been straight forward.

The installation of an extra road (track) to accommodate more trams would have been possible in the depot's staff car park. In fact, an extra road was installed in the car park in 2005 and further roads are expected soon.

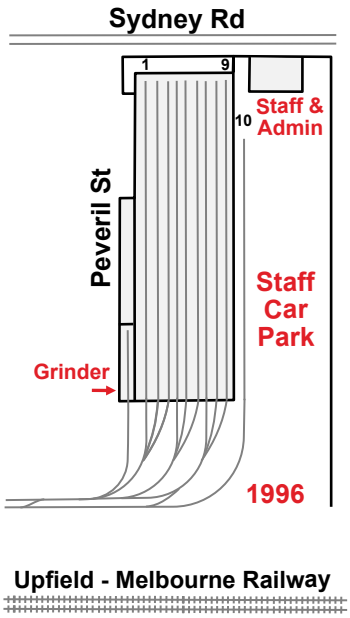
RIGHT: Brunswick Depot from the Upfield railway reservation (1992). Photo: Weston Langford

Opposition

The earlier Port Melbourne and St Kilda LR conversions proceeded amid community opposition to the loss of the railway's disability access and the loss of direct rail connection to Flinders St Station. Lessons learned from this campaign informed the Upfield LR protests.

Community groups supported by the Public Transport Users Association, the Brunswick, Coburg and Broadmeadows councils and unions convened public meetings and issued press releases. Their reasons for opposing the LR conversion included:

- the loss of accessible trains for those who cannot board trams.
- the loss of the rail connection to North Melbourne Station. In addition, the proposed use of the Upfield rail reservation for the Western Bypass (later CityLink) was unacceptable to many.
- the loss of the heavily patronised North Coburg tram line. While this route regularly experienced traffic congestion along Sydney Rd, it was still one of the most patronised tram routes in Melbourne.
- the safety concerns of replacing 23 sets of railway level crossing gates or barriers with traffic lights. In the first year, the new Port Melbourne and St Kilda LR had already experienced motor vehicle collisions at their three traffic-light-controlled level crossings. (Two additional level crossings were installed when the Beacon Cove precinct was developed — now three of the five crossings are protected by boom gates.)
- the Upfield Heritage Study recommended preservation of many of the railway buildings and their equipment during the LR conversion. The report noted that the Upfield railway was the last working example of nineteenth century railway operational practices. Such preservation would add to the financial costs of the LR option.



ABOVE: Brunswick Depot site plan based on Don Storey's track map (1996).

ABOVE: Poster from Save the Upfield Line Campaign (1989).
State Library Victoria

Proposal abandoned

As opposition campaigns proceeded, the world economy took a severe downturn and Victoria was significantly impacted. The recession was far deeper than expected, slowing projects such as the Upfield LR. By late 1992 the Kennett coalition government swept to power with plans for a shakeup of public transport across the state. These plans did not include an Upfield LR.

In January 1993, the new transport minister, Alan Brown, announced radical proposals for rail and tram closures including the privatisation of some lines. The Upfield and Williamstown railways were to be fully closed by April and another 15 suburban rail and tram lines closed after 8pm, replaced by buses. The North Coburg tram route was not on this list.

Outcomes

Following temporary reprieves and compromises, in April 1995 the government agreed to retain and upgrade the Upfield railway line. After a temporary shut down in 1997 for construction of the raised CityLink roadway above the line, the promised upgrade proceeded over 1997-98. This completed the installation of automatic signalling, removed all hand-operated level crossing gates and duplicated a section of single track.

In 2020, a 2.5 km section through Coburg has been elevated, Moreland and Coburg stations rebuilt and the old station buildings and a signal box preserved. While patronage has significantly increased in recent years, the low service frequency remains due to network constraints.

The North Coburg tram continues to operate on the same route as it has since 1936 and traffic congestion along Sydney Rd is still a major concern. Several proposals have been formulated to address this congestion, but little has been implemented to date.

The main development for the North Coburg line has been the allocation of higher capacity trams. From October 1990 Brunswick Depot began receiving its allocation of 20 B2 class trams. Once destined for the Upfield LR, these articulated vehicles took up service on Sydney Rd. A further capacity upgrade began in late 2013 with the arrival of the first of 21 low-floor D2 class trams.

RIGHT: Z3 class 207 in Cameron St at the entrance to Brunswick Depot. A city bound train descends the ramp from the newly elevated section of the Upfield railway. (November 2020)
Photo: Mal Rowe

This was the location proposed for the connecting track between Brunswick Depot and the ground-level Upfield LR.

RIGHT: D2 class 5007 after departing the Bakers Rd, North Coburg terminus that can be seen in the background (2019).

Photo: Mal Rowe

For 30 years the North Coburg line has been operated by vehicles once described as LRVs. Nevertheless, the route remains a street tramway and still terminates at Bakers Rd, North Coburg — the original terminus of the first North Coburg electric tram in 1916.

My thanks to Mal Rowe for his assistance.

Geoff Brown

References:

Destination City Ed 5, Cross, Budd & Wilson (1993)
Melbourne Electric Tramways Gunzel Notes, Don Storey (2020)
Melbourne Transit Authority promotional brochure (1989).
Transit - News and Views, PTUA (1987-90)
Upfield Railway Heritage Study, Andrew Ward & Assoc.(May 1990)
Upfield - Train or Light Rail? Warren Doubleday, NewsRail (June 1989)
Weston Langford Railway Photography website (2020) [Altered white balance & minor cropping]

Complimentary copy of cable tram paper

A paper entitled 'Melbourne's cable trams – A major nineteenth century engineering achievement' has been published in the *International Journal for the History of Engineering & Technology, Vol 89* (formerly *Transactions of the Newcomen Society*). A free copy is available to readers of *The Bellcord* by emailing Miles Pierce at *milwen@ozemail.com.au*

This updated paper is based on an earlier version that was researched and written by Miles Pierce with assistance from Robert Green, Warren Doubleday, Brian Weedon and several others at the Melbourne Tram Museum. It includes adjustments and additions following peer review.

The Lost Loops of the PMTT

RIGHT: PMTT 44 running in at Malvern Depot during the depot's centenary celebrations (30 May 2010). This maximum traction car was restored by Bendigo Tramways and transported to Malvern for the centenary.

Photo : Mal Rowe

Note the destination 'Esplanade' (St Kilda) referenced in the article.

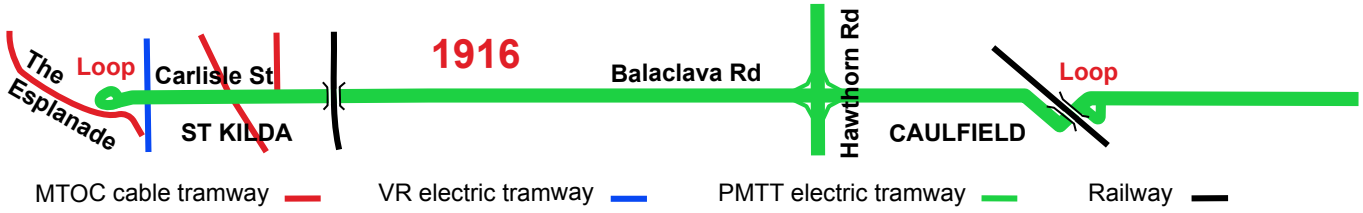
The Prahran and Malvern Tramways Trust (PMTT) was arguably Melbourne's preeminent tramway trust. From the outset, it saw a need to serve the growing local population with better transport for work, school and leisure activities throughout its catchment area. Its network was constructed to maximise these services.

The Trust's initial route connected the new area of Malvern with the city via High St to the Prahran railway station, the Chapel St cable tram and, a little later, the St Kilda Rd cable tram. In addition, it filled the suburbs with houses made more attractive by improved public transport. Graeme Breydon captured these two features of the PMTT in the title of his brief history of the Trust, *Feeding and Filling*. However, it would be a mistake to see the PMTT as simply an extension of tram services into newer suburbs.

One helpful way to view the PMTT system is described in Chapter 11 of Ian Brady's book, *Prahran & Malvern Tramways Trust – Melbourne's Foremost Municipal Tramway*. He sees the mature PMTT as centred around a mainline running from Cotham Rd in the north to Glenhuntly Rd in the south via Glenferrie Rd and Hawthorn Rd. Branches either side of this mainline run east and west to connect with cable trams, railway stations, schools, shops … and leisure destinations to generate traffic and revenue outside working and school hours.

BELOW: Location of the PMTT's terminating loops in St Kilda and Caulfield (1916), based on Don Storey's track maps and notes.

These leisure destinations included St Kilda Beach, Caulfield Racecourse, Point Ormond and even Booroondara Cemetery in Kew when graveside visits were a regular event after church on Sunday. Two of these destinations required bespoke trackwork to accommodate the crowds.



ABOVE: Looking westward towards Luna Park, the Palais and St Kilda foreshore. The terminus loop, cafe and The Esplanade/Carlisle St intersection are in the centre of the photograph (1946).

Photo: State Library Victoria

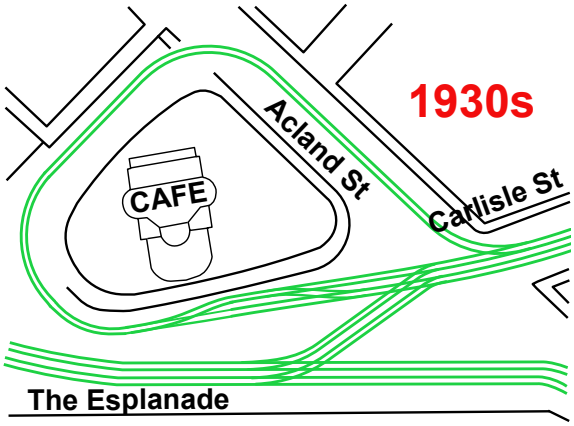
Luna Park loop

The PMTT reached St Kilda Beach in April 1913 displaying the destination 'Esplanade' – the same name used by the cable trams since 1891. Luna Park had been open for one year, the beach was very popular and the original Palais Cinema opened in 1914. The passenger traffic was large when the sun went down or the movies concluded. Everyone wanted to get home immediately.

To meet this demand, the PMTT acquired a block of land immediately north of the terminus where Carlisle St meets The Esplanade. In March 1916 it opened a loop here to store several trams ready to depart with the homebound crowds as they arrived.

It also built a café in the middle of the loop to generate more revenue to help cover the cost of the land. The café was designed by Carlo Catani, who is also remembered as the landscape designer for other parts of St Kilda including Catani Gardens.

The loop at The Esplanade may have been used as a terminus for trams at other times, but its main function was for parking trams awaiting the crowds. When the original Palais Cinema burnt down and was replaced in 1927 with the current building, its close to 3,000 seat capacity resulted in a challenging crowd to get home.



RIGHT: Track layout of the St Kilda terminus loop and cafe in the 1930s, based on M&MTB track maps. Until 1925 the track along The Esplanade carried cable trams and was not connected to the electric lines in Carlisle St.

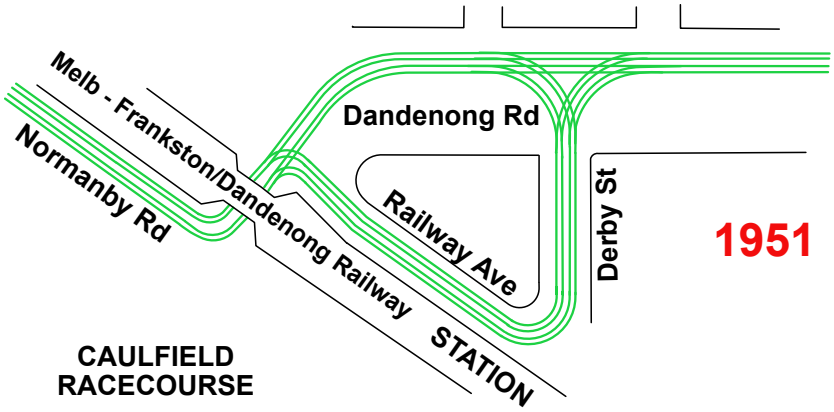
RIGHT: W2 class 379 in front of the loop cafe awaiting departure to Kew (c1960).
Photo: Ron Scholten collection

The café was sold in 1937 and the loop was closed in 1960, being removed two years later.

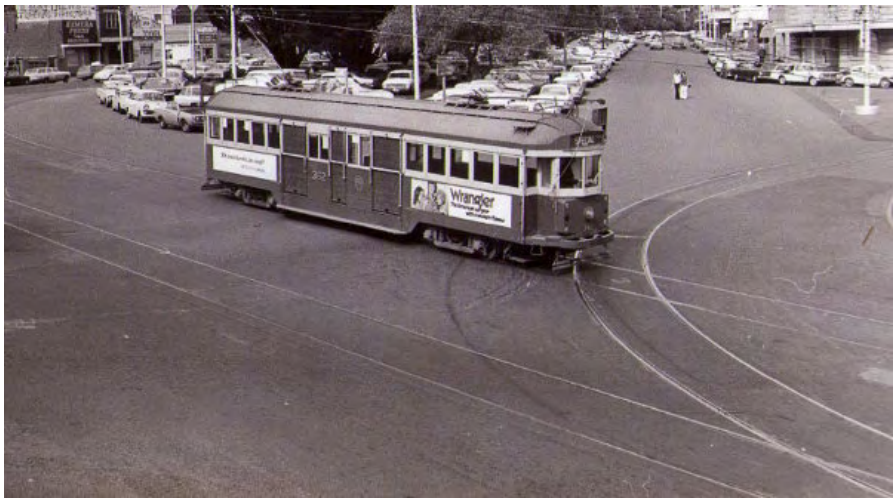
Caulfield Racecourse loop

The PMTT reached Caulfield Racecourse in late 1913, and the intense traffic after the last race led to the construction of a loop with double track which opened in June 1914.

Once again, the principal purpose of the loop was to store trams waiting for the post-race crowds. The northern half of that loop was removed in April 1983 as part of the re-alignment of Dandenong Rd through the area. Tram storage for race days is still provided in a small siding in Dandenong Rd.



RIGHT: Track layout of the Caulfield loop based on M&MTB track maps (1951).



RIGHT: W2 class 362 approaching the Caulfield railway bridge using part of the Caulfield loop that was abandoned in 1983. The tram is crossing the curves to Railway Ave which were retained (1970s).
Photo: Ron Scholten collection

RIGHT: Trams line up in Railway Ave awaiting the conclusion of a race meeting (1969).

Photo: Mal Rowe

Terminus loops

Those familiar with the Sydney Tramways often ask why Melbourne did not use terminus loops as often as Sydney. The answer is probably rooted in history. Sydney's first trams were steam hauled, often with multiple bogie trailers. Terminal loops were particularly useful for turning the 'train' around. By contrast, Melbourne's cable trams were easy to shunt by hand on a pair of crossovers – and a loop would have been more troublesome for cable operation.

I acknowledge with gratitude my dependence on Ian Brady's book, *Prahran & Malvern Tramways Trust – Melbourne's Foremost Municipal Tramway (2011),* for much of the detail in this article.

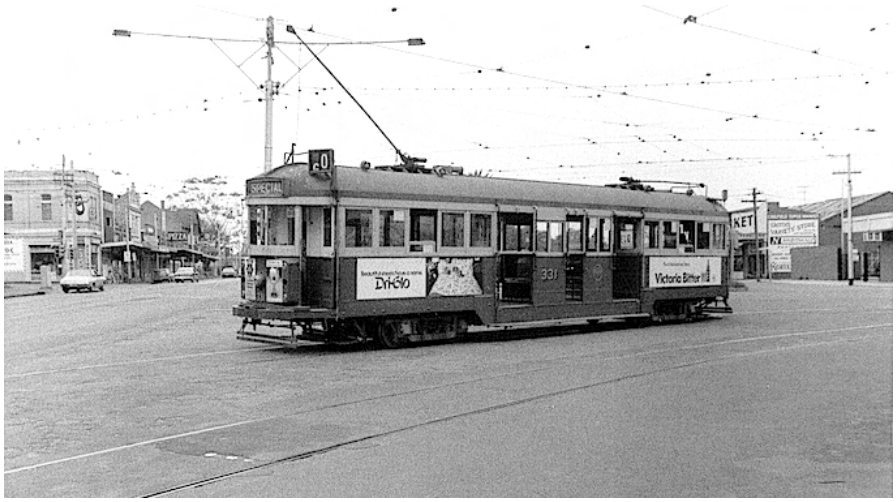
I also acknowledge my use of Graeme Breydon's history of the PMTT, *Feeding and Filling*, first published in the Tramway Museum Society of Victoria's 'Running Journal' (June 1970) and then as a booklet.

Mal Rowe

Both books are available for purchase from the museum shop. Editor

RIGHT: W2 class 331 turning from Dandenong Rd into Derby St using curves that was abandoned in 1983 (1970s).

Photo: Ron Scholten collection

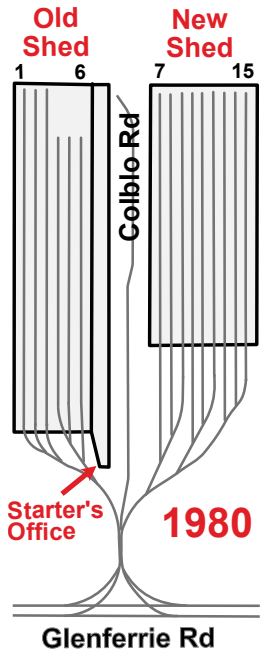


The Role of Depot Starter

ABOVE: Malvern Depot's 'old shed' at night (March 1974).
Photo: Richard Youl

After driving trams and buses, I became a Relief Depot Starter at several depots and eventually a full time Depot Starter at Malvern between 1977 and 1980.

The Depot Foreman and the Depot Starters were the day-to-day fleet managers. The Foreman and his leading hand managed the running sheds and all the servicing, repairs and cleaning. The Depot Starters managed the allocation of trams for all the shifts and monitored the sign-on of drivers and conductors, known as platform staff. The starters were constantly compiling lists of trams and planning for the next day.



Malvern Depot site plan based on Don Storey's track map (1980).

Malvern Depot

Malvern Depot has two sheds as illustrated in the accompanying site plan. The 'old shed' was built in 1910 by the Prahran and Malvern Tramway Trust and the 'new shed' was constructed by the Melbourne and Metropolitan Tramways Board in 1929. In total, there are 15 roads (tracks) and, in my time, there was a single road in Colblo Rd used for spare or changeover trams.

In 1977 Malvern had 109 cars, including some privately owned and some awaiting disposal. The running fleet was entirely W class. The older W2s were known as 'small cars' as they were 45 cms narrower but 40 cm longer than the newer W5s, SW6s, W6s and W7s, known as 'big cars'. Understanding the different dimensions was important when instructing drivers to move trams around curves or berth them close together.

Stock Board

There were no computers in the 1970s and all tram allocations were done using pencil, paper and several boards. One of these was the Stock Board, a wooden board approximately A4 size covered with clear perspex.

RIGHT: Example of a Malvern Depot Stock Board using tram numbers from my old records (c1977).
Illustration: Kevin Stanes

MALVERN DEPOT STOCK BOARD [CIRCA 1977]

1	2	3	4	5	6	COLDBLO ROAD	7	8	9	10	11	12	13	14	15
114	[385]	[482]	311				(553)*	594	833	543s	844	[106]	374	375	377
180	[438]	[492]	845	358F	(360)		(569)*	601	899	572s	378	(395)	379	387	389
164	[457]	[538]	321	362**	363		775*	819	920	832s	382	(405)	407	418	421
217	[477]	[639]	335	552	364		776*	831	924	951s	731	(835)	453	455	480
[229]	220	293	547	846	847		897*	898	941	959s	435	530	487	501	513
[272]	225	301	976	808	816		900*	919	946	961s	542	541	544	524	527
[355]	257	302	834	870	881			990	1012	1014	1016		275	624	608
[383]	292	303	869	880	887										
					888		1020								

Day In Cars	(553)	(569)	775	776	897	900	Sanders	543	572	832	951	959	961

Flat Cars	358		Oiler	362	Painter	360	Not to Run	395	405	835			

Inserted between the two layers was a page similar to the example above, showing where the 109 trams were positioned overnight. You'll notice that the layout is similar to the site plan and I've used numbers from my old records. The shaded squares indicate locations to keep clear; the two rows across the bottom indicate which trams in the above list were required for various forms of servicing or were not to be run.

Most of the tram numbers were written on the clear perspex by the starter using a stablo pencil that could be erased when details needed to be updated. The page under the perspex was mainly blank squares, except for the four privately owned single truck trams at the back of 1 Road.

As each tram ran into the depot, it was directed to its allocated position. During the day when many cars were out, the others could be rearranged.

It was our practice to use certain roads for particular purposes which I have indicated with symbols. The small cars were usually berthed on the outer roads, stored cars [ ] on 1-3 and not-to-run cars ( ) on 12. Trams needing sandboxes filled 's' were berthed on 10, washing on 8, day-in cars requiring a regular service after the AM peak * on 7, body building and painting on 6, and oil and greasing of bogies ** and wheel grinding 'F' on 5.

Each day the starter compiled a list of the trams required for servicing by consulting the Foreman's Book and the Mileage Book. The latter was a book that logged every tram's hours in service. As W class trams did not have odometers, the starter regularly updated the Mileage Book. The adjacent list of starter's duties shows how much clerical work was involved.

Starter's duties (PM shift):

- ***4:20 pm*** *- Sign On*
- *Confer with Depot Master, Depot Foreman & Relieving Officer*
- *Check Matters for Attention*
- *Check shed & cars still to Run Out*
- *Prepare PM Run In & write onto Run In Board*
- *Update Mileage Book, Traffic Adjustments & Lost Mileage*
- *Prepare late Run Out*
- ***8:30–9:30 pm*** *- Meal*
- *Prepare Brake Adjustment Report for leading hand*
- ***10:30 pm*** *- Check shed*
- *Prepare late PM Run In & write onto Run In Board*
- *Prepare next day's AM Run Out*
- *Note Defective Cars signed off*
- *Last Cars In – padlock Locked Cars*
- *Ensure all platform staff have left & lock up*
- *Update Mileage Book & other paperwork*
- *Ring Carlton Control to cut off power*
- ***1:20 am*** *- Lock Starter's Office & Sign Off*

Run Out Boards

Once the starter knew which trams were available for the next shift, he prepared the Run Out Board, as illustrated on the next page. This too was a board with a clear perspex cover and a page inserted under the perspex.

RIGHT: Part of a Weekday Run Out Board showing first cars out between 5 am and 5.17 am (c1977).
Illustration: Kevin Stanes

WEEKDAY RUN OUT

TABLE	TIME OUT	RUN NO	DESTINATION	TRAM NO	ROAD	TIME IN
3	5:00	87	Toorak – City	888	LC	8:51
7	5:01	2	Depot – Kew	1020	LC	5:45
23	5:03	8	Depot – St Kilda	900	7	9:05
67	5:07	35	W'tree Rd – Malvern	275	13	6:43
145	5:08	65	MTH - City	990	8	5:55
109	5:10	67	MTH – Glen Iris	919	8	12:03
99	5:12	85	Toorak - City	897	7	8:45
189	5:13	33	W'tree Rd - City	624	14	6:12
57	5:15	27	Bala Jnc – E Malv	608	15	5:46
45	5:15	3	Depot - Kew	292	2	7:11
45	5:16	23	Bala Junc - City	1012	9	8:46
113	5:17	69	MTH – Glen Iris	898	8	11:43

Most of the details were already on the page and the starter only needed to fill in the Tram No and Road columns with a stablo pencil as shown in the above example. Red ink indicated that the starter should allocate trams required for servicing after the morning peak; green indicated that 'big cars' should be allocated as they would be in use until late at night.

This board was then hung on the wall near the depot entrance so drivers could see which trams they were to run out. There were a variety of Run Out Boards to cover AM and PM weekdays, Saturdays, Sundays and public holidays.

The 'LC' written at the top of the Road column referred to Locked Cars. These were usually the last two cars run in the night before and berthed at the front of the depot blocking all the roads. The leading handbrakes were wound on and padlocked by the PM Shift Starter. The driver's handles were then locked in the Starter's Office.

Run In Boards

There was also a Master Run In Board covered with perspex to assist the starter to allocate the roads for drivers to berth trams. During the morning or afternoon peak, the starter copied the tram numbers from this board to the larger Run In Board at the front of the depot. This was a large blackboard with columns numbered 1 to 15, representing each road.

RIGHT: Malvern Depot as seen from Glenferrie Rd prior to the entrance track changes in 1969.
Photo: Ron Scholten collection

RIGHT: W2 class 497 decorated by Erica McGilchrist on Swanston St (1979).

Photo: David Featherstone

Art trams

The State Government financed several prominent artists to paint a number of the W2s in a theme suitable to Melbourne's artistic culture. The details can be read in Russell Jones's article, *Transporting Art*, on the museum website.

ABOVE: Melbourne's first Art tram, W2 class 243 decorated by Mirka Mora, running out of Malvern Depot (1980).

Photo: State Library Victoria

Malvern Depot had eight of its fleet painted as Art trams, and the directive from Head Office was that they were to be spread around all routes operated by the depot, not confined to just one. However, from time to time starters tried to roster the Art trams on the same route. Toorak, Glen Iris and Malvern were ideal as only five to seven trams were needed to run the off-peak services. But it was often difficult to book enough of these trams out on the same route due to Foreman's requirements.

One afternoon after signing on, I noticed that there were no Art trams required for servicing the next day. I prepared the Run In so that all these cars would run into 14 and 15 Roads. By grouping them together, placing them on suitable Runs for the next day was pretty easy. As I prepared the Run Out for the next morning's peak, I made sure I booked all the Art trams onto the Toorak route, with the remaining three being booked out on the Malvern–Burke Road route.

The next afternoon when I reported for duty, the Relief Inspector told me I had to see the Depot Master, my boss. "Stanes, what do you think you're doing? You put all those Art trams out on Toorak, didn't you?"

"Well, I did the Run Out, but I didn't realise all the trams I booked onto Toorak were the coloured ones!"

"That's a load of rubbish, Stanes", he said. "The phone rang hot this morning with shopkeepers wanting to know what all these pretty trams were doing along Toorak Rd. Now don't pull that stunt again, and wipe that smirk of you face!"

I walked out of the office and down to see the Foreman who also knew what I had done. "Gee, Kev, you starters can't have much to do at night if all you do is play around with trams." I made no comment and walked back to the office feeling very pleased with myself that my efforts had not gone unnoticed.

Kevin Stanes

ABOVE: W2 class 439 decorated by Stewart Merritt on Colblo Rd, Malvern Depot (1984).

Photo: John Wayman

Brunswick West Substation: Tramway Heritage

RIGHT: Z3 class 166 passing the decommissioned Brunswick West Substation at Melville Rd and Dawson St corner (October 2020).
Photo: Mal Rowe

Across Melbourne's extensive tram network are 60 electrical substations supplying power to trams. Some of these date from the earliest years of our electric trams.

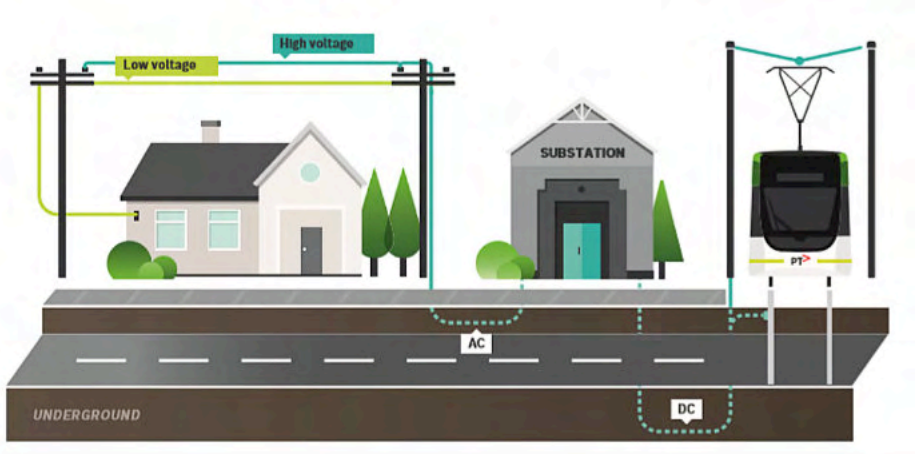
In February this year, the Brunswick West Substation on the West Coburg tram line was added to the Heritage Victoria Register (VHR H2397). Among its original plant and equipment are four visually striking mercury-arc rectifiers. *See photograph on page 20.*

To understand the significance of the Brunswick West Substation, an overview of the history of tramway substations will provide some context.

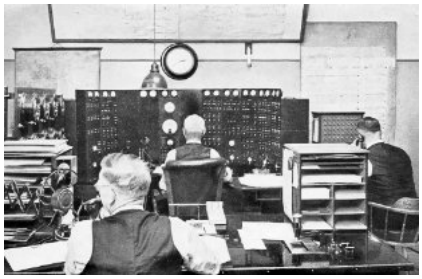
How tramway substations work

Substations do not generate their own power. Rather, they convert the alternating current (AC) public electricity supply into direct current (DC) at the voltage required to power trams.

Substation equipment receives supply at either 6.6 kV, 11 kV or 22 kV alternating current (AC) and transforms it to 470 volt AC. Rectifiers then convert this to 600 volts direct current (DC) which is fed to the overhead wires above the tracks. To complete the electrical circuit, the tracks are connected to the substation by return cables.



RIGHT: Tramway substations receive high voltage AC current to convert to low voltage DC current for the tramway overhead.
Image: Public Transport Victoria



ABOVE: Central control room at the Queensberry St, Carlton Substation. Photo: M&MTB 1941 Annual Report

Substation development

From the 1890s, both AC and DC electrical networks were developed in Victoria for commercial and domestic use. From 1901 the Melbourne CBD had a low voltage DC electricity supply network.

In 1932 the Melbourne City Council decided to phase out its DC system in favour of AC. This was because low voltage transmission lost a lot of power over substantive distances or required uneconomically large cables to reduce resistance losses. If a high DC transmission voltage was used, it could not be readily reduced, or stepped-down, to the lower voltages needed for commercial and domestic use as can AC by the use of transformers.

However, until recent decades the characteristics of DC motors were well suited to trams and trains. So the Melbourne and Metropolitan Tramways Board (M&MTB) and the Victorian Railways (VR) needed to convert, or rectify, the mains AC power to DC. Substations were constructed to hold the rectifier plant. Because DC voltage drops quickly with distance and tram performance therefore suffers, substations had to be constructed approximately every four kilometres along a tram route.

In order to reduce labour costs, the M&MTB constructed remote supervisory equipment of its own design for its substations. In 1933, fifteen of its 19 substations were fully automatic and unattended stations. The main central control room was in Queensberry Street, Carlton. In recent years the main control room has been relocated to Bourke St, Melbourne.

Improved equipment

Rotary converters were installed in substations constructed before 1930. The substations were specifically designed to house this large heavy equipment. *See photographs on page 21.*

Mercury-arc rectifiers were introduced by M&MTB from 1930. The equipment was smaller and offered higher conversion efficiency than the rotary converter plant of similar capacity. Mercury-arc technology wasn't so well suited to locations with high power demands, such as the Malvern Tram Depot, but was adequate and cheaper to run for locations towards the outer ends of a line, like Brunswick West. *See photographs on page 20.*

Solid state silicon diode rectifiers were slowly adopted from the 1960s, with only two of 26 substations using silicon rectifiers by 1975.

Since the 1960s, new equipment has been installed in many long standing substations, with superseded equipment usually removed and scrapped as part of the decommissioning process. In addition, new substations have been constructed behind some earlier substations or on entirely new sites.

Further information on many of Melbourne's tramway substations can be found in Russell Jones's article, *From Rotary Converters to Solid State*, on the museum website.

In brief

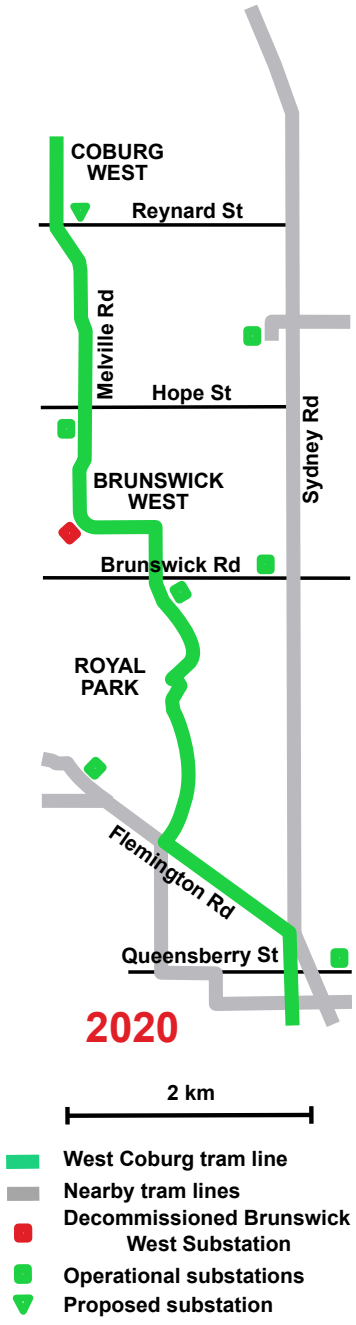
- *Melbourne's W, Z, A and B class trams constructed prior to 2000 use DC motors.*
- *Modern C, D and E class trams constructed after 2000 use AC motors and on-board electronics to invert the DC power to AC.*
- *Melbourne's modern E class trams can draw up to 1,500 amps, whereas W class trams required up to 500 amps to operate.*
- *There are currently 60 substations on the tram network, with another 30 planned.*

RIGHT: Front wall of the Brunswick West Substation showing central gate, behind which is located the air-cooled transformer (2020).

Photo: Mal Rowe

FAR RIGHT: An inside view of the transformer (2019).

Photo: Miles Pierce



ABOVE: Location of substations near the West Coburg tramline (2020).

Construction of Brunswick West Substation

When the West Coburg tram line commenced operations between 1925 and 1927, DC power appears to have been provided by the rotary converter plant accommodated at the rear of the Brunswick Rd cable tram engine house, as noted on page 21.

In 1935 the Brunswick West Substation was constructed on a triangular block of land at the corner of Melville Rd and Dawson St. It was commissioned in 1936 to takeover powering the West Coburg line. The origins of this tram line can be found in the article, *The Tram through the Park*, on the museum website.

Russell Jones describes the architecture of Brunswick West as follows.

> Attractively built in red brick with a flat roof, exemplifying the early Moderne symmetrical design as applied to a small industrial building. The dominating feature is a central gated opening displaying the high voltage transformer – a perfect expression of the spirit of new technology inherent in Futurism. Attractive use is also made of decorative brick streamlining in classic Moderne horizontal and vertical elements, while sparing use is made of decorative bosses in cream brick.

The prominent location of the large, air-cooled transformer also served a practical function. It needed to be exposed to the exterior air. Transformers in other substations were sometimes located outside or on breezeways for the same reason.

Brunswick West remained in service until early 2019 when its function was taken over by modern solid-state rectifier substations at other locations on the tram route – one south of Grantham St between Brunswick Rd and Park St and one on Melville Rd between Hope St and Whitby St.

A third substation has been proposed at 320 Reynard St, 50 metres from the line. The use of modern trams including the planned introduction of E class trams to this route is the reason for the power upgrade.

ABOVE: Bank of four cabinets inside the Brunswick West Substation that each contain a mercury-arc rectifier. RIGHT: An activated mercury-arc rectifier inside one of the cabinets (2019).

Photos: Miles Pierce

Adding Brunswick West Substation to the register

Miles Pierce, the engineer who prepared the application for inclusion of the Brunswick West Substation on the Victorian Heritage Register (VHR), provides the following details.

> The application for its inclusion in the register was submitted by Engineering Heritage Victoria, a special interest group within Engineers Australia, and included both the building and its extant plant and equipment.
>
> The plant and equipment includes incoming 6.6 kV, 3-phase AC switchgear housed in purpose-built brick cells, the rectifier transformer and a bank of 4 x 150 kW Hewittic glass bulb mercury-arc rectifiers. Also included are an open panel type 600 V DC switchboard plus other related and ancillary equipment.
>
> The Brunswick West tramway substation has also been accorded formal recognition under the Engineering Heritage Australia heritage recognition program.

My thanks to Miles Pierce for his assistance. *Geoff Brown*

References:

Brunswick West Mercury-Arc Tramway Substation Nomination, Engineers Australia (2019)

From Rotary Converters to Solid State: Tramway Substation Architecture in Melbourne, Melbourne Tram Museum (2014)

Introduction to Tram Substations, Public Transport Victoria website (2020)

Recommendation of the Executive Director and assessment of cultural heritage significance under Part 3, Division 3 of the Heritage Act 2017, Heritage Victoria (2020)

Substation to Substation: Melbourne's tram power infrastructure, Yarra Trams website (2013)

Wongm's Railgallery, Marcus Wong website (2020)

ABOVE: Open panel switchboard inside Brunswick West (2019).

Photo: Miles Pierce

Malvern Depot and Brunswick Road Substations

ABOVE: Two rotary converters and the open panel switchboard inside the decommissioned Malvern Tram Depot Substation (2019)

Photo: Miles Pierce

In August 2020 the Victorian Heritage Council accepted recommendations regarding two further tramway substations. This has meant that the remaining retired electrical plant and equipment have been added to the existing Victorian Heritage Register (VHR) listings for the Malvern Tram Depot and the Brunswick Rd former cable tram engine house and (later) tram substation.

Malvern Tram Depot Substation (VHR H0910)

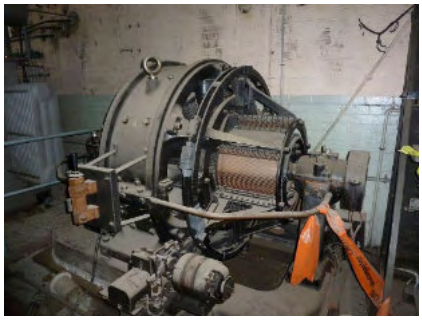
In 1929 the M&MTB built a substation at the rear of the Malvern Tram Depot. It was retired in the mid 1990s but remains essentially as it was at that time. When built it contained two 1000 kW English Electric Company rotary converter machines that converted the 3-phase AC mains electricity supply to 600 V DC for supply to the tramway overhead. It also included 6.6 kV AC switchgear cells, stepdown transformers, and a large 600 V DC open panel switchboard.

It is the only intact remaining substation from the rotary converter era in Victoria and, it is believed, nationally. An application was lodged by Engineering Heritage Victoria in 2014 to have the plant and equipment added to the VHR in its own right. When the new Victorian Heritage Act came into force in 2017, the application was changed to nominate that the substation plant and equipment be added to the existing registration for the Malvern Tram Depot.

Brunswick Road Substation (VHR H2332).

In 1925 the M&MTB made the rear part of the former Brunswick Rd cable tram engine house behind the Sarah Sands Hotel into a tramway substation. It contained two 500 kW rotary converter machines with associated incoming 6.6 kV AC switchgear cells, stepdown transformers and an open panel 600 V DC switchboard.

It is likely that this substation originally provided DC power to the West Coburg line from its inception in 1925-27 until the former Brunswick cable tram line along Sydney Road was rebuilt as an electric tram route in 1936. The electrical plant at Brunswick Rd was then used to power the Sydney Rd line.



BELOW: Decommissioned rotary converter inside the Brunswick Rd Substation (2019).

Photo: Miles Pierce

The substation remains in service but the rotary converters and the 600 V DC open panel DC switchboard have been replaced by silicon rectifier equipment and modern fully enclosed switchgear. Fortunately, some of the original AC switchgear, one of the rotary converter machines, its associated stepdown transformer and two panels of the original 600 V DC switchboard were retained and have been added to the VHR listing. Apart from the 6.6 kV AC switchgear cells, the old equipment is no longer in service and, except for the DC switchboard panels, not in its original location.

Miles Pierce