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SOCIETY CONTACT INFORMATION

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MINUTES OF MEETING HELD FRIDAY 21 NOVEMBER, 2014, SURREY HILLS NEIGHBOURHOOD CENTRE, 1 BEDFORD AVENUE, SURREY HILLS

Present: – Wilfrid Brook, Glenn Cumming, Graeme Cleak, John Dennis, Graeme Dunn, Michael Formaini, Ray Gomerski, Chris Gordon, Judy Gordon, David Jones, Chris King, Keith Lambert, David Langley, Andrew McLean, Michael Menzies, Alex Ratcliffe, Laurie Savage, Brian Sherry, Rod Smith, Andrew Waugh and Andrew Wheatland.

Apologies: – Brett Cleak, Steven Dunne, Bill Johnston, Steve Malpass, Tom Murray, Greg O'Flynn and Peter Silva.

Visitors: – Jim Gordon.

The President, Mr. David Langley, took the chair & opened the meeting at 20:06 hours.

Minutes of the September 2014 Meeting: – Accepted as read. Laurie Savage / Michael Menzies. Carried.

Business Arising: – Chris King was also an apology for the September 2014 meeting.

The Ringwood Signal Box building and lever frame are to be relocated to the front of the station this weekend.

Correspondence: – Letters to David Ward and Trevor Wyatt at Metro Trains Melbourne thanking them for granting permission for the signal box tour.

Letter to Keith Lambert thanking him for his assistance with the suburban signal box tour.

The annual return for 2013 was sent to Consumer Affairs Victoria.

Letter to Surrey Hills Neighbourhood Centre with dates for meetings in 2015.

Alex Ratcliffe / Andrew McLean. Carried.

Reports: – A report on the signal box tour in September 2014 was provided.

General Business: – Keith Lambert provided details about various works in the Metropolitan District. A summary of the discussion follows: –

- The new connections between the Broadmeadows Lines and the RRL Lines at Spion Kop will be commissioned next week. These connections will be worked from Kensington.
- The connections to the new stabling sidings at Calder Park will be commissioned in a fortnight's time.
- One Xtrapolis set has been modified to allow operations on the Frankston Line.
- The commissioning of the grade separation work at North Road, Ormond, is planned for a five week occupation in January 2017.

The State Election campaign was discussed. Rail projects that had been promised included a new crossing

(Front cover) Z1 92 waits at the tram boom barrier in Burke Road, Gardiner, in December 2014 while a train slowly passes through the level crossing. The flat tram/train crossing currently has a 15 km/h speed restriction for trains which is exacerbated by the width of the crossing. This results in increased transit times on the Glen Waverley line as well as lengthy delays to road and tram traffic. Work has started on the replacement of this level crossing by lowering the rail line into a cutting. This will mean the end of the adjacent Gardiner signal box, and also these unique tramway boom barriers that have been knocked up from pedestrian barriers. The new Labour government has promised to eliminate 50 level crossings in Melbourne over eight years, but implementation of their election promise will not see the end of tramway crossings in Melbourne as the list does not include either Glenhuntly Rd Glenhuntly, or Riversdale Rd Riversdale. Photo Andrew Waugh

loop at Rowsley on the Ballarat Line and duplication of the line between Bunyip – Longwarry.

Proposals for high capacity signalling for the Sandringham and Dandenong Lines were discussed.

Alex Ratcliffe noted a recent Weekly Notice entry describing the removal of signals at Kerang which was then cancelled in a subsequent issue.

Chris Gordon provided details about the preliminary report into the recent collision at Galvin.

Laurie Savage noted that the signal control panel at Essendon was still in place.

Chris King described the "M", "T" and "E" boards provided over the lines between Spencer Street and Franklin Street.

Brian Sherry discussed progress with the RRL Lines between Deer Park Junction – Manor Junction. The infrastructure has been commissioned and Driver training is in progress. Timetable alterations are planned for April 2015 for the commencement of operations.

David Langley advised that the XPT has recommenced running into Spencer Street Railway Station.

Alex Ratcliffe asked what disaster recovery procedures were in place for a major disruption to Craigieburn or Epping Signal Boxes. Nothing was known.

It was reported that an emergency control panel has been provided at Newmarket in the event of a failure at Kensington.

Rod Smith discussed electrical shielding at Newport.

Syllabus Item: - The President introduced member Roderick B. Smith to present the Syllabus Item.

Rod presented the 25th annual screening of slides from the collection of the late Stephen McLean.

This year's presentation featured Stephen's trip to India with Michael Davies in January 1981. Various scenes of India and its railways including the Darjeeling Railway were viewed. The final scenes were in Calcutta and then the arrival at Rangoon Airport.

The presentation was thoroughly enjoyed by those present.

At the completion of the Syllabus Item, The President thanked Rod for the entertainment & this was followed by acclamation from those present.

Meeting closed at 22:10 hours.

The next meeting will be on Friday 20 February, 2015 at the Surrey Hills Neighbourhood Centre, Bedford Avenue, Surrey Hill, commencing at 20:00 hours (8.00pm).

SIGNALLING ALTERATIONS

The following alterations were published in WN 41/14 to WN 48/14 and ETRB A circulars. The alterations have been edited to conserve space. Dates in parenthesis are the dates of publication, which may not be the date of the alterations.

10.10.2014 Waurn Ponds (SW 185/14, WN 41)

On Friday, 11.10., Down Home WPD14 was interlocked with the boom barriers at Ghazeepore Rd. The boom barriers at Ghazeepore Rd will not operate on the approach of a Down train if WPD14 is at stop. WPD14 can be cleared when the train has been proved at stop in the platform, but the departing train must observe the 50 km/h speed restriction for stopping trains to the level crossing. The Waurn Ponds workstation displays indications for operation of the boom barriers at Ghazeepore Rd.

11.10.2014 Control – Bendigo Line Workstation (SW 187/14, WN 41)

On Saturday, 12.10., the Bendigo line workstation was upgraded to display the controls for Epsom. Local operation of the signalling at Epsom will continue and SW186/14 will not come into effect.

12.10.2014 Spencer Street (SW 319/14, WN 40)

On Sunday, 12.10., the following alterations were made to Homes 520, 529 and 536.

The train stop at Up Home 520 (Up East Suburban Line) will now be lowered for movements towards Nos 8 & 8A Tracks (wired), but will remain up for movements towards No 7 Track (unwired). The theatre route on Home 520 had been previously altered (SW 307/14) to display '7' for movements towards No 7 Track, '8' for movements towards Nos 8 or 8A Tracks, or 'M' for moves along the East Suburban Line.

Down Home 529 (No 8 Track) will only be interlocked with a route beyond Home 509 when Points 418 are reversed. Home 529 will not clear until Down Home 509 is clear.

The theatre route indicator on Up Home 536 (No 8 Track) was removed. A low speed indication will be displayed for movements along No 8 Track to the dead end if the track is clear and the approaching train has passed Homes 508 or 518 (track circuit 422T occupied). SW 14/05 is cancelled.

13.10.2014 Deer Park Junction (TON 258/14, WN 42)

On Monday, 13.10., Boral Resources Siding (Points 9) was booked back into service.

(14.10.2014) Deer Park Junction – Manor Junction (SW 188/14, TON 254/14, WN 41)

Commencing forthwith only non-revenue trains may operate on this line, and only one train is to be between Deer Park Junction and Manor Junction at one time.

Passenger trains hauled by A, B, GM, N, S, or X classes are permitted 115 km/h between Deer Park Junction (19.350 km) and Manor Junction (47.432 km); H, P, or T classes 100 km/h; and G, XR or BL 90 km/h. Sprinters and Vlocity DMUs are permitted 130 km/h. Freight trains are not permitted. All trains must be equipped with TPWS.

15.10.2014 Richmond (SW 321/14, WN 41)

On Wednesday, 15.10., Up Automatic 679 (Up Caulfield Through line) was provided with a U-style co-acting signal located on the right hand side of the line and numbered 679P.

16.10.2014 Richmond (SW 322/14, WN 41)

On Thursday, 16.10, Down Automatic F71 (Down Caulfield Through line) was provided with a U-style co-acting signal located on the right hand side of the line and numbered F71P.

18.10.2014 Trawalla (SW 189/13, WN 41)

On Saturday, 18.10., the level crossing at Ercildoune Rd (153.411 km) was abolished. The boom barriers were abolished and road barriers were provided on each side of the crossing. Amend Diagram 76/11 (Wendouree – Beaufort).

20.10.2014 Moorabbin – Frankston (SW 328/14, WN 41)

Between Saturday, 18.10., and Monday, 20.10., the following signals were altered as part of the Bayside Rail Improvement Project:

- Converted to LED: Cheltenham: Down Home 6, Up Home 12, & Down Automatic F687; Parkdale: Automatics F785 & F803; Mordialloc: Down Co-acting Home MOR712P & Up Home MOR709; Aspendale: Automatics F942 & F947; and Edithvale: F966, F967, F986, F991, & F1004.
- Moorabbin: MRN709P was relocated 400mm in the Up direction.
- Highett: Automatic F609 had the signal heads altered to a reverse stagger.
- Chelsea: Automatic F1044 was provided with a co-acting signal mounted on the right hand side of the signal mast and numbered F1044P.
- Bonbeach: Automatic F1087 had the signal heads altered to a reverse stagger and the lights upgraded to LED.
- Carrum: Controlled Automatic F1130 (6) had the signal heads altered to a reverse stagger.
- Frankston: Buffer light provided at the end of Platform No 1.

Amend Diagrams 65/12 (Glenhuntly – Highett), 25/11 (Cheltenham – Chelsea), and 41/12 (Bonbeach – Frankston).

(21.10.2014) Deer Park Junction – Manor Junction (SW 193/14, WN 42)

Commencing forthwith the restriction that only one train can be between Deer Park Junction and Manor Junction is withdrawn. SW188/14 is cancelled.

22.10.2014 Laverton (SW 340/14, WN 43)

On Wednesday, 22.10., Points 639 were booked back into service.

23.10.2014 Epsom (SW 196/14, 197/14, 198/14, WN 42 & 43)

On Thursday, 23.10., remote control of the signalling at Epsom was provided. The Bendigo Corridor VDU was altered by the provision of:

- Control and indications for Home EPM30.
- Indications for the Howard St crossing
- Track occupancy indications between North Bendigo Junction and Epsom. The track between BDG36 and Epsom platform is indicated as one combined block track section, with a second block track section in Epsom platform. Track vehicle blocks can be applied to these track block section for the protection of road/rail vehicles. Axle counter resets are not be provided for these track circuits.
- The 5P keyswitch at Epsom for control of EPM30 will remain for local control when required.

Operating Procedure 108 (Epsom) was reissued to reflect these changes and SW 176/14 was cancelled.

After commissioning, control of Home EPM30 from the Bendigo Corridor VDU was inhibited and local control will continue to be used.

26.10.2014 Southern Cross (SW 195/14, WN 42)

On Sunday, 26.10., the following signalling alterations took place.

- An additional two Up Homes, SST986 & SST996, were provided leading from the Flyover. Home SST984 can now display Clear Normal Speed. An additional Down Home SST989 was provided on the Down Dual Gauge Line leading to the flyover. The original Down Home SST989 was renumbered SST991 and can no longer display a Medium Speed aspect. All three Homes are fitted with TPWS.

- An additional TPWS(OSS) was provided at MYD987
- The East Country Line became available for bi-directional shunting movements. Down Dwarfs SST543 & SST545 were provided on the East Country Line. Dwarf SST543 is fixed at Stop.
- An additional track circuit (SST547T) was provided and track circuits 888T, 989T, & 891T were renumbered 986T, 991T, & 992T respectively.

Amend diagrams 74/14 (Southern Cross to North Melbourne Passenger Lines) and 70/14 (Southern Cross V/Line Passenger Lines).

(04.11.2014) Oakvale (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, rodded connections, derails, and Intermediate Siding Board have been abolished. Amend Diagram 142/11 (Boort – Oakvale).

(04.11.2014) Cannie (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, derail blocks, and Intermediate Siding Board have been abolished. Amend Diagram 144/11 (Quambatook – Meatian).

(04.11.2014) Meatian (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, derail blocks, and Intermediate Siding Board have been abolished. SW 1099/03 is cancelled. Amend Diagram 144/11 (Quambatook – Meatian).

(04.11.2014) Chillingollah (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, rodded connections, derail blocks, and Intermediate Siding Board have been abolished. TON 197/12 is cancelled. Amend Diagram 146/11 (Ultima - Chillingollah).

(04.11.2014) Chinkapook (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, derail blocks, and Intermediate Siding Board have been abolished. Amend Diagram 148/11 (Chinkapook - Annuello).

(04.11.2014) Cocamba (SW 202/14, WN 44)

The siding has been abolished. The Up and Down main line points, point levers, Master key locks, rodded connections, derail blocks, and Intermediate Siding Board have been abolished. Amend Diagram 148/11 (Chinkapook - Annuello).

(04.11.2014) Kilmore East (SW 201/14, WN 44)

Commencing forthwith the Down Refuge has been restored to use for infrastructure activity use only. Points 12 leading to the Down Refuge have been relocated 97 metres in the Up direction. The points and rodded derail/wheel crowder remain worked from a small point lever and secured by an Annett lock. Crossover 16 has been restored to use. Amend Diagram 66/13 (Heathcote Junction – Kilmore East). SW 63/14 is cancelled.

09.11.2014 Charlton (TON 284/14, WN 45)

As of Sunday, 9.11., the Charlton Mill siding points (317.680 km) were booked back into service and the siding is available for track machines only. TON 319/08 is cancelled.

10.11.2014 Southern Cross (TON 285/14, WN 45)

As of Monday, 10.11., the XPT is permitted to operate on the North Melbourne Flyover to No 1 Platform. It is not permitted to operate to No 2 Platform.

(11.11.2014) Southern Cross – North Melbourne & Melbourne Yard (SW 206/14, WN 45)

Diagrams 116/14 (Southern Cross, V/Line Passenger Lines), 41/14 (Southern Cross – North Melbourne Passenger Lines) & 124/14 (Moonee Ponds Creek) replaced Diagrams 70/14, 33/14, & 78/14 respectively as in service.

Amend the notice board at MYD987 on Diagram 72/14 (West Tower – Melbourne Yard) to reflect a diverge speed of 15 km/h.

(11.11.2014) Warncoort Loop (SW 205/14, WN 45)

Commencing forthwith Operating Procedure 56 (Warncoort Loop) was reissued and SW 75/14 was cancelled. The alterations concern the commissioning of Waurn Ponds, and the results of a post commissioning review.

14.11.2014 Deniliquin (TON 292/14, WN 46)

On Friday, 14.11., No 3 Road (305.845 km – 306.100 km) was booked out of use.

14.11.2014 Wallan (TON 293/14, WN 46)

On Friday, 14.11., the crossover (48.017 km – 48.076 km) was booked out of use.

15.11.2014 **Metrol** **(SW 349/14, WN 45)**

Between 0200 hours Saturday, 15.11., and 0300 hours Monday, 17.11., the signalling and train control functions at Metrol were operated from the Disaster Recovery Site.

18.11.2014 **Charlton** **(TON 305/14, WN 47)**

On Tuesday, 18.11., the Charlton Mill siding points were booked out of use.

20.11.2014 **Sunshine** **(SW 211/14, WN 46)**

On Thursday, 20.11., Down Home SUN945 and Up Home SUN946 were replaced by new LED masts.

23.11.2014 **Craigieburn** **(SW 356/14, WN 46)**

On Sunday, 23.11., the following alterations took place in connection with the provision of the underfloor wheel lathe in Siding 7.

Dwarf CGB752 and Derail/crowder 449D were relocated 63 metres in the Up direction. Track circuits 572T & 492T were relocated to suit the new position of Dwarf CGB752. Track circuits 573T and 493T were abolished. A key switch release was provided between the signaller and the lathe operator.

Sidings 7 & 8 remain booked out of service (vide SW 141/14).

23.11.2014 **Dandenong** **(SW 355/14, WN 46)**

On Sunday, 23.11., the TPWS(TSS) at Home DNG704 was modified and returned to service. The UPS and remote monitoring was removed. TPWS(TSS) was provided at Home DNG724.

(25.11.2014) **Disarrangement of level crossing and pedestrian crossing protection** **(SW 366/14, WN 47)**

MTM practice "Level & Pedestrian Crossing Equipment Disarrangement Notice" (L2-SIG-PRO013) has replaced SW 153/11 "Disabled Level Crossing and Pedestrian Crossing Equipment during an Absolute Occupation". SW 153/11 is cancelled.

23.11.2014 **Upfield** **(SW 359/14, WN 47)**

On Sunday, 23.11., the blocking jack facility for the single line section Gowrie – Upfield was removed from the SSI. The relevant panel indications and controls were removed.

01.12.2014 **North Melbourne** **(SW 371/14, 217/14, SWP 012, WN 47)**

On Monday, 1.12., the connections between the RRL lines and the Broadmeadows Suburban lines at Spion Kop junction were commissioned.

Dwarf MYD741 was provided with a theatre type route indicator displaying 'W', 'D', 'G', 'R', & 'K'. Dwarf MYD731 was provided with a theatre type route indicator displaying 'D', 'G', 'R', & 'M'. Home MYD951 was provided with a theatre type route indicator displaying 'R' & 'M'. The routes indicated are: 'D' – towards Dynon; 'G' – towards the West Tower Line; 'K' – towards the Broadmeadows Suburban line (Kensington); 'R' – towards the RRL line; and 'W' – towards the Wash Road head shunt.

Points 499 & 858, and Crossover 498 were commissioned. Crossover 498 and Points 499 are worked from Kensington, and Points 858 by the RRL Signaller.

The Kensington SSI & Sigmap, and the Melbourne Yard SmartLock were updated.

Diagrams 39/14 (North Melbourne & Macaulay), 37/14 (South Kensington), & 122/14 (West Tower Melbourne Yard) replaced 21/14, 66/14, & 72/14 respectively.

The temporary circuit alterations at Kensington were removed and SW 336/14 is cancelled.

Northern Group Operating Procedure 15 (Kensington – Flemington Racecourse Line – Essendon Failure of Signals) was updated by the addition of clause J dealing with the failure of signals at the RRL/Kensington cross boundary interface.

01.12.2014 **Melbourne Yard** **(SW 218/14, WN 47)**

On Monday, 1.12., lockout zones were provided in the Arrival Yard, but not brought into service.

01.12.2014 **South Kensington** **(SW 218/14, SWP 013/14, WN 47)**

On Monday, 1.12., the signalling of the RRL lines on the Down side of SKN961 to Footscray, the West Tower Line, and the Up and Down Goods Lines towards North Dynon was transferred from the West Tower Signaller to the RRL Signaller.

The axle counter reset procedures on these lines were altered to make them consistent with those used on the RRL lines Footscray to Deer Park Junction.

The automatic operation of the Metro side of South Kensington during failure of the telemetry from Metrol was removed. Inner Group Operating Procedure 4 clause b (South Kensington) and c (South Kensington – Track block/point sleeve commands) were cancelled.

TPWS(OSS) was provided at Automatics MW017 & MW018, and Home MYD951. TPWS(TSS) was provided at Automatics MW019, MW027, MW040, MW050, & MF022, and Home MYD985.

All Automatic signals between Southern Cross and Sunshine have a manual replacement function that permit them to be held at stop.

01.12.2014 **Brooklyn** **(WN 48/14)**

On Monday, 1.12., a baulk was provided on the Tip Siding at the access gates on the southern side of Somerville Rd. Twenty eight days' notice must be given prior to any rail access being required.

01.12.2014 **Bacchus Marsh** **(WN 48/14)**

On Monday, 1.12., a baulk was provided on the Turntable Road on the Down side of the station access footpath. Twenty eight days' notice must be given prior to any rail access being required.

01.12.2014 **Somerton** **(WN 48/14)**

On Monday, 1.12., baulks were provided on the lines leading to Upfield. The baulks are located on the Up side of Dwarfs SOM10 and SOM543. Twenty eight days' notice must be given prior to any rail access being required.

01.12.2014 **Upfield** **(WN 48/14)**

On Monday, 1.12., a baulk was provided on the line leading to Somerton. The baulk is located at the Notice Board 543 metres on the Down side of the platform. Twenty eight days' notice must be given prior to any rail access being required.

01.12.2014 **Traralgon** **(WN 48/14)**

On Monday, 1.12., a baulk was provided on the Turntable Road clear of the fouling point. Twenty eight days' notice must be given prior to any rail access being required.

(02.12.2014) **Kerang** **(SW 225/14, WN 48)**

Commencing forthwith, Posts 3 & 5 (Dwarfs N & Q) have been secured at Stop. Movements past these signals must be authorised by the Signaller in accordance with Section 4, Book of Rules. The Signaller must operate the level crossing equipment at Wellington St using the test switch prior to authorising such movements.

08.12.2014 **Spencer St** **(SW 385/14, SWP 11/14, WN 48)**

From Monday, 8.12., the overhead wiring over Nos 8, 8A, and 8 South Tracks was restored to use. The overhead wiring over Crossover 014 has not been certified, and this Crossover is booked out of use and secured normal.

SW 198/04 and SW 16/05 were cancelled. Inner Group Operating Procedure 19 (Spencer St, Nos 8, 8A, & 8 South Tracks, Routing Restrictions Suburban Trains) was issued.

EMUs carrying passengers are permitted to be routed from Home 520 to No 8 Track via No 8 North or No 8A Tracks. This may only occur when advertised by a special circular and when Points 435 and 448 are secured normal by a point clip, and the special platform coping infill is in place. The Northern Group Signaller, Metrol, must record in the log book when these special protection devices are placed or removed, and they may only be placed or removed under cover of an absolute occupation.

EMUs (whether carrying passengers or not) are not permitted to be routed to No 8 South (from either direction), or into Nos 8 or 8A Tracks from the south (Homes 123, 303, or 567).

15.12.2014 **Calder Park Stabling Sidings** **(SW 384/14, SWP 015/14, WN 48)**

Between Friday, 12.12., and Monday, 15.12., the Calder Park Stabling Sidings were commissioned at 26.420 km. Three stabling sidings are provided and each holds two 6 car EMUs. The signalling are worked from Craigieburn signal box.

Automatic CPV717, Homes CPV702, CPV704, CPV715, CPV737, & CPV738, and Dwarfs CPV730, CPV732, & CPV734 were provided. Automatic CPV717 and Home CPV715 are provided with TPWS(OSS+TSS). Homes CPV702 & CPV704 are provided with TPWS(TSS). Home CPV738 is provided with a '65' indicator. All signals are LED.

Points 632 & 634, Crossovers 615 & 617, & Derail/crowder 630 were provided. All points and the derail are equipped with dual control point machines. Crossover 615 and Derail 630 auto normalise.

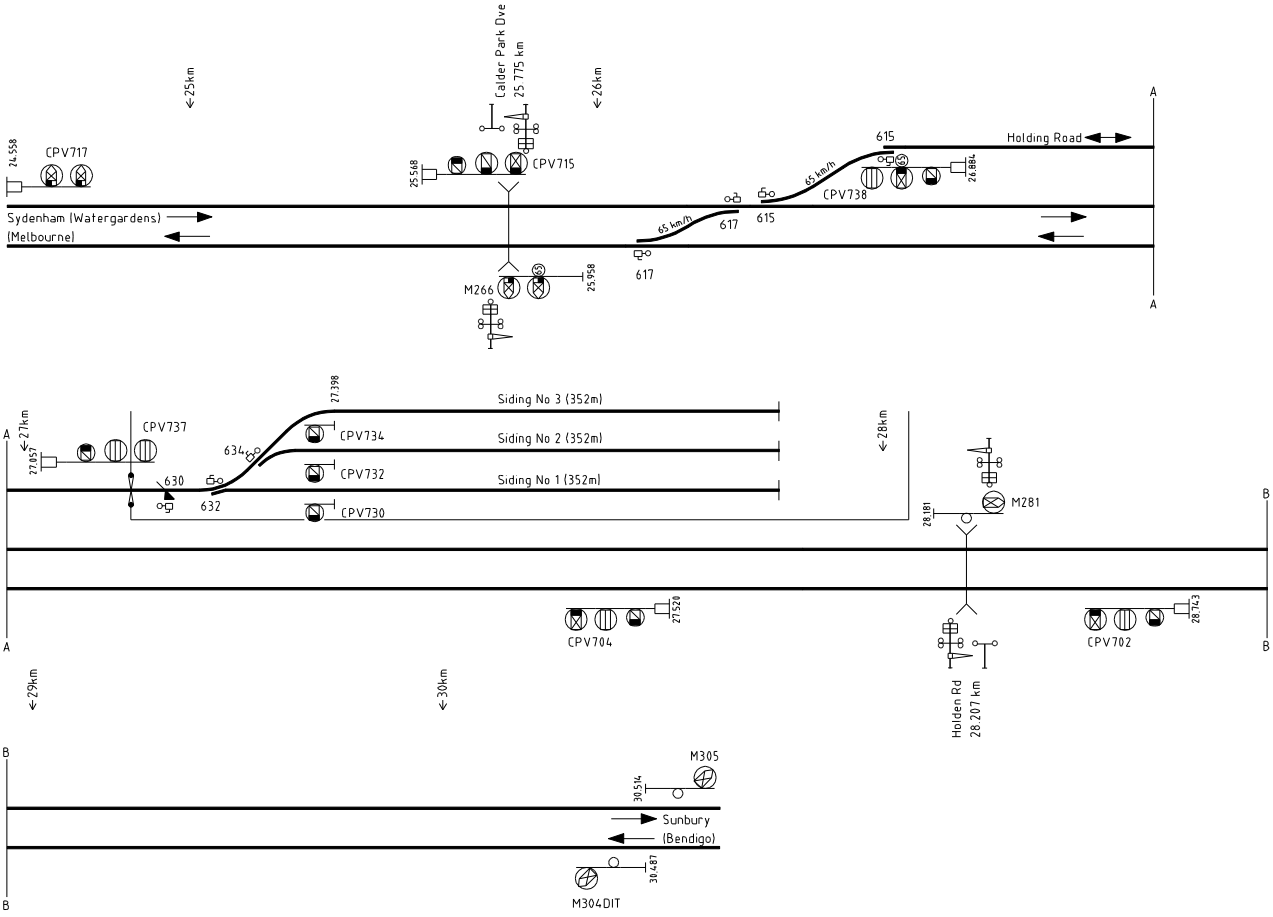
Security gates 628 were provided at 27.259 km on the Down side of Home CPV737.

Jeumont Schneider and CSEE track circuits were provide on the main line and the Holding Road. Axle counter track circuits were provided within the siding area on the Down side of Home CPV737.

Automatics M257 & M282 were abolished. Up Automatic M304 was renumbered M304DIT.

Diagram 49/14 (Watergardens – Clarkefield) replaced 59/12.

A new Northern Group Operating Procedure 12A (Calder Park Failure of Signals) was provided.



Calder Park Stabling Sidings (2014)

Based on WN 48/14 and Diagram 49/14

METROL

(Continued from Vol 37 No 6)

This second part of the history of Metrol will concentrate on the operators and the systems. Unfortunately, limitations of space will mean that the focus will be on the JZA715 train describer system and not on the ancillary systems at Metrol. The following description has been pieced together from published material and information obtained from the SRS visits to Metrol. It is not as complete as would be desired and may be incorrect in places. Sometimes the published material is contradictory or incomplete. In addition, Metrol and its systems have changed over time. I have tried to be consistent and use the past tense when describing an aspect of Metrol that has changed, and the present tense when the aspect has not changed.

Staffing

The operations staff at Metrol around the time the JZA715 was brought into operation consisted of:

- A Manager who was responsible for co-ordinating and implementing decisions for suburban train operation.
- A Chief Operations Controller who oversaw and supervised the control room operations.
- Two Operations Controllers who controlled the movement of trains in the inner area and supervised the Area Controllers.
- An Emergency Operations Controller who took control of special train operations and who handled train radio calls.
- Two Line Controllers who controlled the movement of trains in the outer area by communicating with stations and signal boxes. One Line Controller dealt with Eastern lines, the second with the Western lines.
- Five Area Controllers who controlled the signalling and setting of routes within the inner area. The five Area Controllers were the Sandringham, Caulfield, Burnley, Clifton Hill, and Northern Area Controllers.
- A PA Announcer who listened to train control communications and conveyed alterations to normal running to station staff and passengers.
- A PIDS Operator who monitored train running to ensure that the passenger information displays were correct.

It would be remiss not to mention the technicians that maintained the Metrol systems – certainly by the late '90s the only reason the systems continued to operate was their skill and expertise.

The staffing levels at Metrol were initially set based on guidelines on the use of screen based equipment – in the mid '80s these typically imposed a maximum time people could use this type of equipment. The result was that staff savings were not as high as originally anticipated. Before Metrol, the inner area required 54 signalmen and 6 block recorders (these totals probably reflected the staffing required by the relay panels, not the original mechanical and power signal boxes). In addition, there were 10 train controllers. In November 1986, the staffing level at Metrol was 38 Area Controllers, 17 Operations Controllers, 9 Line Controllers, and 4 Public Address Announcers. This represented a headcount reduction of 2, but many of the new positions were likely to be at a higher salary than that of the positions they replaced.

The plan of the operating room reproduced on the next page shows the layout of the operating floor around the time Metrol was brought fully into service.

The five Area Controllers were situated across the western end of the room (at the top of the plan). From left to right these were the Sandringham, Caulfield, Northern, Burnley, and Clifton Hill panels (note the plan refers to these positions as 'regulators'). Behind the Area Controllers were the three Operations Controllers, with the Emergency Operations Controller seated in the middle.

Behind and to the side of the Operations Controllers were the two Line Controllers, the Western Line Controller being on the southern side of the room (left) and the Eastern on the right. Note the dashed outline of the four future Area Controllers, two on each side of the room in front of the Line Controllers. These Area Controller positions were to work the outer areas when these were brought under the control of Metrol.

At the rear of the room, behind the Controllers, was a single desk that accommodated the PA Announcer and the PIDS operator.

An elevated glassed in office was situated at the rear of the control room. The forward desk in this office was occupied by the Chief Operations Controller. The desk behind him and to the left was for the Manager.

The JZA715 panels at Metrol

Metrol contains five Area Control interfaces (panels) to operate the signalling in the inner area. Each interface consists of a desk containing the controls and a set of colour monitors that displayed the status of the layout controlled by the panel. A variety of ancillary systems are also provided. Originally these were limited to a telephone concentrator and a black and white monitor to display the timetable. Over time additional systems were added, such as a terminal to control radio equipment and to display the docking sheet.

To the Area Controller, the JZA715 is an NX(pp) system. To set up a route from one signal to the next, the operator pushes a button at the start of the route (usually a signal), a second button at the exit of the route (again, usually a signal), and finally a third command button to initiate route setting. Other routine commands, such as manually setting points, setting up the train describer, and cancelling routes, can also be initiated using command buttons. Behind this physical interface, however, the JZA715 is actually driven by text commands which can be entered from a keyboard.

This overall view of the original Metrol operating floor on the occasion of the SRS visit on 19 September 1998 can be compare with a plan of the operating floor (below) dating from the mid '80s. Surprisingly little has changed. Immediately in the front centre of the photo is the desk for the Eastern Lines Controller. Above that, in the centre of the room, is the desk for the three Operations Controllers which is dominated by the bank of monitors. Against the far wall are the consoles for the Area Controllers. (All photos Andrew Waugh)

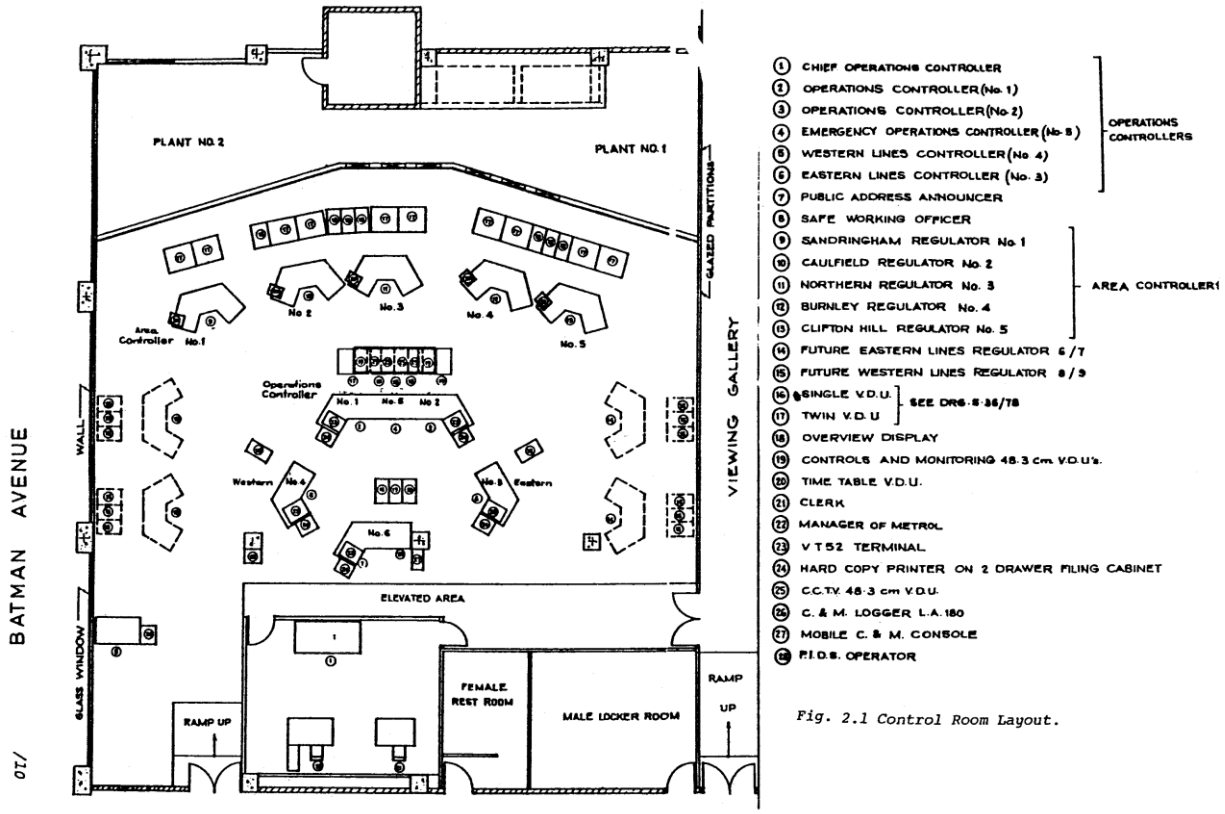


Fig. 2.1 Control Room Layout.

The Caulfield panel was probably the most complex panel in Metrol in September 1998. The arrangement is typical with the controls spread out over two wings of the control desk. The monitor on the left hand wing of the control desk displays the timetable, and the controls in front of it are for the telephone concentrator. Out of view on the left is the terminal for the radio controls. Behind the desk are the monitors displaying the status of the controlled area. Originally, each panel had just four monitors. By 1998, some panels had gathered more! In this photo, the main monitors are the lower seven. The monitor on the extreme right displays Caulfield to Moorabbin, the second and third displays Richmond to Caulfield and Sandringham; the fourth Richmond Junction and the entrance to the Loop; the fifth Flinders St and Museum – Parliament; the sixth Spencer Street and the remainder of the Loop; and the seventh some of the lines approaching North Melbourne. The three upper monitors duplicate information shown to other Area Controllers. On this occasion, the rightmost (smaller) screen was showing the Burnley side of Richmond Junction, the middle screen the Parliament – Flinders St portion of the Northern Loop, and the rightmost a detailed view of the western end of Flinders St.

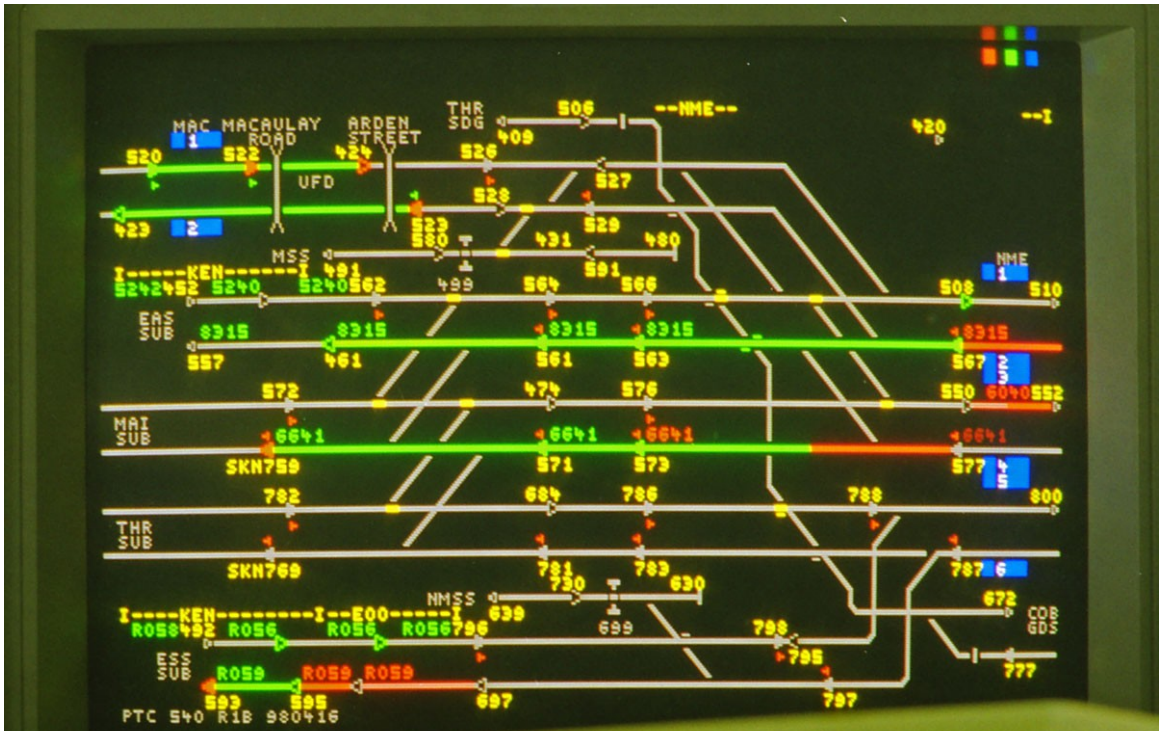
In a departure from traditional panel design, Ericsson took care to consider ergonomics when designing the control desks. The control desks consequently consist of three portions that wrap around the signaller to bring all the controls in easy reach of the seated signaller. The centre and right portions contain the facia of the NX panel itself. The left portion contains the telephone concentrator and timetable VDU.

Most of the control portion of the facia is occupied by a representation of the track controlled by that interface. A button is provided at each routing point (normally a signal) and at each set of points or crossover to address that function. Towards the bottom of each facia section a set of eleven command buttons are provided. These are used to perform routine control functions. Four buttons deal with setting and cancelling routes, three buttons with managing the operation of automatic route setting system, and four buttons with manually setting and locking points. Unfortunately, I do not know the functions of all the buttons, but those that are:

- R (SRO): Set Route
- A (ANL): ?
- L (SLS): ?
- C (CAN): Cancel Route
- T (STD): Set automatic routing mode for a signal
- F (SFO): Set signal to fleeting (simple automatic operation)
- M (SMO): Set signal to manual operation and prevent automatic routing or fleeting modes
- S (PTS): Lock points
- U (PTU): Unlock points
- N (PTN): Manually call points normal
- R (PTR): Manually call points reverse

A QWERTY keyboard is mounted in the centre portion of each Area Controller's panel with a single line display above it to show what has been typed. This keyboard is used to enter commands directly in the system (the three letter commands for the panel buttons, such as SRO, are given above). The keyboard has been modified by replacing the normal punctuation keys by keys lettered with specific commands (again, not all details are known):

- SRO: Set Route
- CAN: Cancel Route
- RQP: Request Picture
- RDN: ?
- TNE: Train Number Erase
- TNI: Train Number Insertion
- TNM: Train Number Move



A detail shot of the VDU for the North Melbourne Junction area showing some of the features of the Metrol displays. Train 8315 is currently standing in Platform 2 at North Melbourne and is routed to the East Suburban Lines towards Kensington. The green 'main route set' line is displayed all the way through the interlocking from Home 567 at North Melbourne to Automatic 461. The train number (8315) is displayed against each track section – notice how this extends to the automatically controlled section towards Kensington (to Automatic 557) even though the green route set is not displayed for automatically controlled track sections. Similarly, on the Up East Suburban trains 5240 and 5242 are approaching from Kensington. Signals are displayed as triangles in the track sections, with the point of the triangle pointing in the direction the signal applies and with a yellow number adjacent. Home signals are filled in triangles, and Dwarf or Automatic signals are open triangles/V shapes. Most of the Homes on this screen have a small red triangle adjacent to the main triangle. This shows that the signal is in automatic route setting mode. At the top left, however, Homes 520, 522 and 523 at Macaulay have small green triangles indicating that these are operating purely automatically. Note how the tracks in advance of these signals are displaying the green route set colour. At the bottom righthand corner, Home 777 on the Coburg Goods line has neither a red or green small triangle indicating that it is in manual mode.

- TNR: ?
- TNX: Train Number Exchange

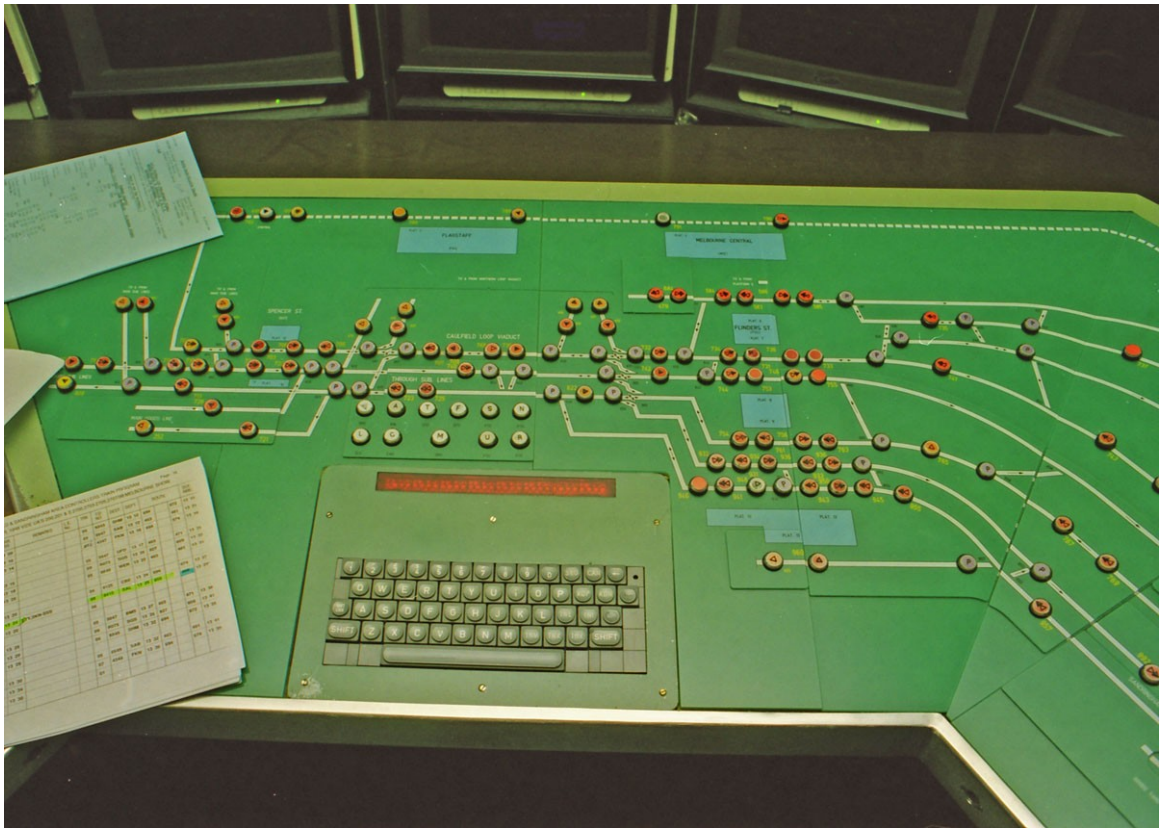
Located behind the control desk are the colour monitors that are used to display the status of the controlled area. The system is designed to show two types of views. The 'overview' mode the monitor only displays the tracks and train descriptions. In normal operation, however, the monitors display the 'Regulators' View' that show the status of signals, points, track circuits and trains. Commands can be used to add or delete information from these views (e.g. point and track circuit numbers).

Tracks are normally shown as grey lines; continuous lines at points showed the detected lay of the points. Where points are locked for flank protection or they are part of an overlap, a short yellow bar is shown in the grey track. Tracks change to yellow when the route is set, but the Home is not clear or when a low speed route is set, to green when a main route is set and the signal is clear, red when occupied by a train (or when the track is booked out of use), and magenta when a approach locking is timing out.

Signals are displayed as triangles set in the line of the track, with the point of the triangle pointing in the direction the signal applies. Home signals are shown as filled in triangles, Automatic signals as hollow triangles, and Dwarf signals as '>' symbols. The triangle is green when the route has been set, yellow when cleared for low speed, red when being held at red (e.g. blocked, or subject to automatic routing and not yet called), and magenta when the approach locking is timing out. Otherwise the signal triangles are grey. A small red triangle adjacent to the main signal symbol indicates that the signal is in automatic routing mode. A small green triangle shows that the signal is set to 'fleeting' (automatic) mode. Controlled signals have the signal number shown adjacent to the signal.

The train describer numbers are shown adjacent to track section. The number is, of course, shown adjacent to the section the train is actually located in (this number is in red, matching the track colour). In addition, the train description number is propagated forward adjacent to each section that has been set for the train (these numbers are in green, again matching the track section colour).

A small amount of ancillary information is shown on the display. This includes platforms (in blue with white



A close up of half of the Caulfield panel control desk. This portion shows Flinders Street (Platforms 6 to 13), the viaducts, Spencer Street Platforms 12 – 14 (right), and Parliament and Museum stations (at the top). The red buttons in the track lines represent points at which routes start or end. Normally these are associated with signals, but these are also provided at the boundary to adjacent control areas (e.g. on the lines leading to the Northern Loop at Flinders Street and Spencer St). The grey buttons in the track are used to address points or crossovers to provide manual control. At the bottom of the panel is the keyboard used to enter commands into the JZA715; the small strip at above the keyboard is the single line display that shows what is typed. Between the keyboard/display, and the first set of track lines are eleven isolated buttons arranged in two squares and an upside down triangle. These are the command buttons that execute commands selected by the point and route buttons in the track. The four buttons on the left set, cancel, and block routes, the three in the middle set the signal modes (manual, automatic, or route setting), and the four on the right set and block points.

platform numbers), three letter station identifiers, interlocking details, and the names of tracks.

In addition to the colour monitors, each Area Controller is also provided with black & white monitor that displays the timetable. This is not just a static display of the WTT, but shows how the trains are running as they pass reporting points, and any alterations that have been made to the timetable.

Metrol has five panels. Originally, these were not set up to control geographical areas, as the former signal boxes had been set up. Instead they controlled groups of lines through the Metrol area. The original panels were:

- Sandringham Panel. This controlled the Sandringham Lines, the connections to the Sandringham Sidings, the Goods Yard, and Jolimont Workshops, Tracks 10, 10E, 11 & 11E at Flinders St, and the start of the St Kilda and Port Melbourne lines. The panel also displayed the entire length of the Sandringham, St Kilda, and Port Melbourne lines.
- Caulfield Panel. This controlled the Caulfield Through and Local Lines from Richmond, the connections to the Caulfield and Oakleigh Sidings, Tracks 7, 8, 9, and 9E at Flinders St, the Caulfield Loop Viaduct and the Through Suburban Lines Viaduct, the junction to the Main Goods Lines at Spencer St, Tracks 12, 13, & 14 at Spencer St, the Through Suburban Lines to North Melbourne, and the Caulfield Loop. It also displayed the Caulfield Through and Local Lines as far as Caulfield.
- Burnley Panel. This controlled the Burnley Through and Local Lines from Richmond, the connections to the Camberwell and Burnley Sidings, Tracks 2, 3, & 4 at Flinders St, the Burnley Loop Viaduct, Track 10 at Spencer St, and the Burnley Loop. It also displayed the Burnley Through and Local Lines as far as Burnley.
- Northern Panel. This controlled the Main and East Suburban lines from North Melbourne, most of Franklin St Junction and the connections to Spencer St No 1 Box, the northern connections to Tracks 7, 8, 8A & 8B Spencer St as well as Tracks 10 & 11 at Spencer St, the Northern Loop Viaduct, Tracks 5, 5A, & 6 at Flinders St, and the Northern Loop.
- Clifton Hill Panel. This controlled the Clifton Hill line from Jolimont, the connections to the Collingwood Sidings, Tracks 1, 1A, 1E, 12 & 13 at Flinders St, the City Circle Viaduct, the connections to the Parcels

Docks, Track 9, and the southern connections to Tracks 8, 8A, & 8B at Spencer St, and the Clifton Hill Loop. It also displayed the Clifton Hill line as far as Clifton Hill.

The advantage of this arrangement was that one Area Controller was responsible for all the trains on each group of tracks, and interactions between the Controllers was only necessary when a train needed to move between groups. As a relatively large number of connections are available between groups, the conventional approach of releases between the panels was not provided. Instead 'phantom' signals are provided at the interface points. These signals do physically exist, but logically exist in the system. One Area Controller sets the route up to the phantom signal, and the other Area Controller sets the route from the phantom signal. When both routes are set the signal clears.

The panels were subsequently rearranged when North Melbourne Junction and South Kensington were brought into Metrol. The Sandringham panel was combined with the Caulfield panel, and the fifth panel was then used to control the new North Melbourne Junction/South Kensington area and is known as the 'Western' panel.

Automatic Routing

An important aspect of Metrol is the automatic routing of trains based on the train describer and time table. Ericsson and MetRail expected this to reduce the workload on the Area Controllers and, thus increase the number of trains each Area Controller could control. Automatic routing was one of the recommendations of the original Dell report, but it is unlikely that the program machines suggested by Dell could have coped with the relatively complex routings required in Melbourne. The computer system produced by Ericsson is much more powerful than the program machines.

Automatic routing starts with the preparation of a master traffic plan for that day. The traffic plan is prepared by a special program (TPGEN) that is run on a separate PDP 11. The Working Timetable for that day is entered (either manually or uploaded) into the program and then additional information is added. The result is essentially a list where each line represents a particular combination of a signal, a train, the route required, and the conditions that must be satisfied before the route will be set. It has already been noted that introduction of automatic route setting was delayed by several months while the necessary traffic plans were prepared – this hints at the time consuming nature of the process. Traffic plans are probably only prepared for the main timetables (weekdays, Saturdays, Sundays, and the special restricted service). Variations on these timetables would be dealt with by the Area Controllers manually setting routes.

Early in the morning, the traffic plan for the coming day is loaded into the JZA715. The Area Controller then has a choice how routes are set up. Normally, trains are automatically routed according to the traffic plan. However, the Area Controller can take particular signals out of automatic routing without affecting other signals.

Automatic routing is a relatively static process. When a scheduled train is the next one to arrive at a signal and is within a specified distance of the signal (these details are obtained from the train describer), the system will check the conditions associated with the required route. The basic condition is that the route is to be set after particular time, but it is also possible to check other conditions, such that another train is at a particular location (this ensures the correct relative order of trains). If the conditions are met, the system then checks to see if the required route should be free. The JZA715 has a simplified model of the interlocking built into it, and so can perform this check without querying the underlying interlockings. If the route should be free, the system makes a series of calls on the interlockings to set up the route and clear the signal. It is possible to include alternative routes in the traffic plan to be checked if the primary route is not free. If no route can be set, the system will place the route in a queue and try it again after 30 seconds.

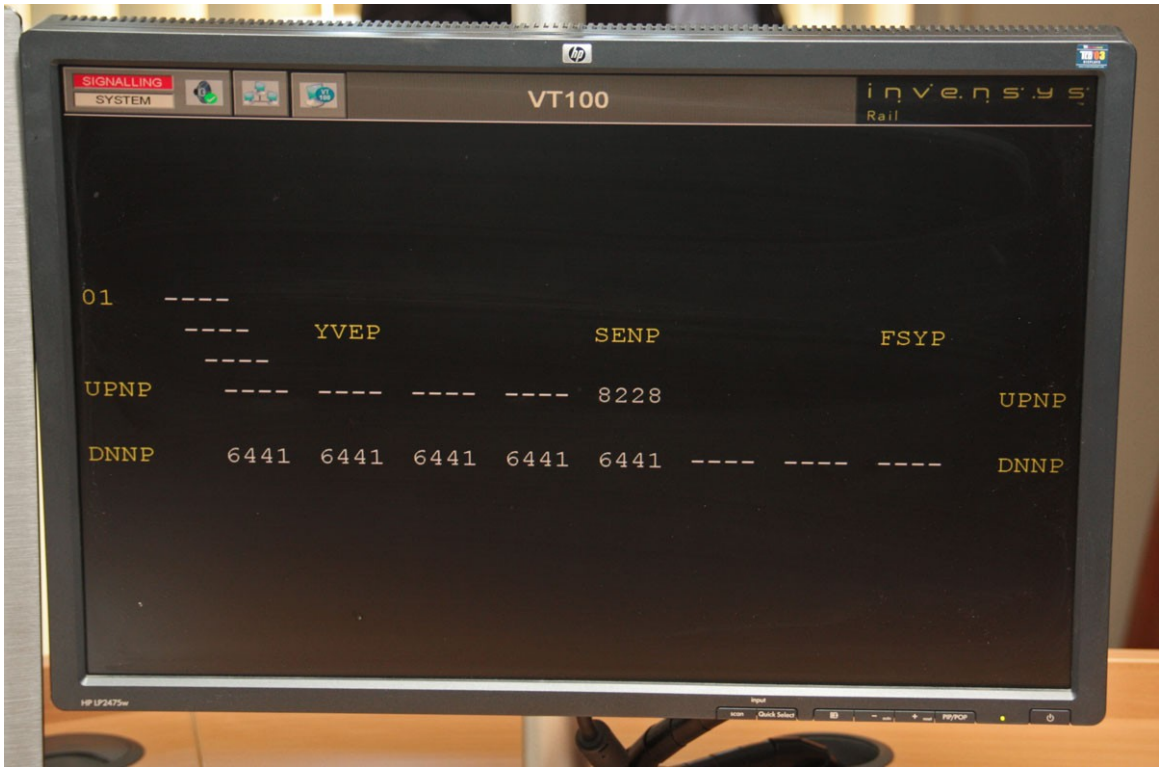
While the automatic routing was powerful for its time, it has a number of limitations. The first is that some moves, such as docks and shunts, are not included in the traffic plan and these routes have to be manually set by the Area Controllers. The second issue is that the condition evaluation is against static conditions in the traffic plan. If the service is substantially disrupted the conditions will not apply and trains will have to be manually routed. Essentially, the automatic routing gives the maximum support when the service is running perfectly, and far less support when the service is completely pear shaped. Modern automatic routing systems can make routing decisions based on minimising the total network delay to the conflicting trains. Finally, the growth in the number of trains has meant that the capacity of the system is being exceeded and automatically routing cannot be used for all trains.

Fringe boxes

Both manual and automatic routing depends on correct description of the trains. For trains entering the Metrol controlled area, the train descriptions are entered at the fringe boxes using computer terminals. These terminals are also used to display the identity of trains approaching the fringe box from the Metrol controlled area. Originally the fringe boxes were West Tower, No 1 Box, North Melbourne, Clifton Hill B, Burnley, and Caulfield. Fringe boxes changed over time as the controlled area was extended. With the inclusion of North Melbourne, South Kensington, and Clifton Hill within the controlled area, the fringe boxes were Newport, Sunshine, Kensington, West Tower, Franklin St, Spencer St No 1 Box, Upfield, Epping, Greensborough, Burnley, and Caulfield.

The interface to the JZA715 system at each fringe box is a standard 24 line by 80 column computer terminal[1]. The display is used to show a rough geographical layout

[1] Physical examples of these terminals are now exceedingly uncommon in the computer industry, but once were ubiquitous. The terminals used are the DEC VT100 or VT220. Modern signalling installations use software emulators of the VT100 instead of physical hardware as the JZA715 interface.



A modern version of the Metrol fringe box terminal. This is a monitor on the WestCAD system at Newport which is emulating a 22x80 VT100 terminal. This shows the Up (UPNP) and Down (DNNP) Newport lines between Yarraville (YVEP) and Footscray (FSYP) platforms. Each group of 4 dashes is a train describer berth. On the Down line, train 6441 (a Werribee EMU) is at Seddon and the train describer number has been propagated forward towards Newport. On the Up, train 8228 is also at Seddon and is just about to leave the portion of track indicated at Newport. The four 'steps' at the left hand end of the Up line are where the Newport signaller enters train descriptions at 'location 01'. Up to four trains can be queued at this point. When the train is detected as entering Yarraville platform, the first description is automatically stepped in the platform berth and then moved forward with the train.

showing the trains at various locations, and the keyboard is used to enter commands for the train describer.

The fringe signaller enters train numbers using commands similar to that used by the Area Controllers:

- FNI – Fringe Box Train Number Insert
- FNC – Fringe Box Train Number Cancel
- FNX – Fringe Box Train Number Exchange

The Signaller enters the train numbers into the approach berths – these do not represent actual track sections, but just the queue of trains approaching the signal box. While the train numbers are in this queue the Signaller can cancel them or alter the number. When an approaching train enters a particular track section, the first train in the approach berth queue is automatically stepped into a track circuit berth and the description is copied to Metrol. Once this happens, any changes to the train descriptions have to be performed by the Area Controller at Metrol (this ensures that the Area Controller is aware of any changes to trains that have been announced).

Overview sections

In addition to the actual lines controlled by Metrol, the VDUs also show the status of the lines approaching Metrol from the fringe signal boxes. In some cases, the approach sections actually extend beyond the fringe boxes.

The extent of the lines visible to Metrol gradually expanded as fringe boxes were closed, and signal boxes were concentrated. In 1999 the extent of the display was to Yarraville, West Footscray, Coburg, Bell, Heidelberg, Burnley (including the stabling sidings on the Glen Waverley line), Caulfield (on the Dandenong line), Moorabbin, and Sandringham. It is believed that the extent was subsequently extended as far as Sunshine, Upfield, Epping, and Greensborough.

Technical description of the JZA715

Ericsson considered the JZA715 to be one of the JZA700 family of remote control systems built around a common telemetry system. Specifically, the '715' indicated that the JZA715 was designed to use a keyboard for command input (1) and a mini-computer control centre driving a colour VDU display (5).

The JZA715 performs the following functions:

- Supervision and display of the status of field objects (i.e. points, signals, and track circuits). Upon full commissioning, the system controlled around 400 signals and 300 points.
- Control of individual field objects.
- Route setting logic, that is taking an entrance/exit command from the signaller and turning this into a sequence of calls on the individual field objects in the route.

The three Metrol systems in September 1998. The two original systems are on the left: System A is in the foreground with System B in the middle background. The new System C is on the right.

- "Through" routing logic – taking a long sequence of routes and calling the individual routes.
- Display and logging of alarms from field objects.
- Train describer functionality to display the position of trains on the tracks.
- Export of train location data to the passenger information system and train reporting system.
- Route storage which allowed the prestorage of route calls until they could be actioned.
- Automatic routing of trains depending on the time and the location of other trains.

The key feature of the JZA715 is that these functions are implemented by software running on general purpose computers. In the case of Metrol, the computer chosen was the PDP-11/70[2]. The PDP-11 series of computers were an extremely popular minicomputer of the time manufactured by the Digital Equipment Corporation (DEC) of the US. Minicomputers were smaller, less powerful, and much cheaper than the 'mainframe' computers used by large organisations such as banks. At Metrol each PDP computer was originally equipped with 512K of memory and ran the RXS11M plus real time operating system (i.e. an operating system designed to manage real time events). When the Metrol contract was originally signed in 1978 it was intended to use PDP-11/34s with a core (RAM) memory of 96K 16 bit words and 96 million words on RP04 and RK05 hard discs. The PDP-11/70s eventually installed were about three times more powerful than the PDP-11/34, which suggests that the performance necessary to operate the Metrol software was seriously underestimated initially. As will be described in the next part of the series, the PDP-11/70s were subsequently replaced by PDP-11/80s and then by Osprey PDP-11 emulators.

Although a PDP-11/70 had reasonable grunt for its time, it was not possible to operate the entire Metrol area from one computer. Instead, two Systems were provided. The Clifton Hill, Burnley, and Northern Area Controllers were connected to System A and the Caulfield and Sandringham area controllers were connected to System B. By 1999 a third System, System C, has been added. By this time functions had been distributed across the Systems to equalise the load. It is believed, however, that System C was primarily used to control Clifton Hill and the North Melbourne/South Kensington area. The systems operate independently with the sole interface between them involving the exchange of train describer numbers when trains crossed the boundary between the systems.

Each System initially consisted of two PDP computers, referred to as the 'left' and 'right' computer. At any instant, one PDP is the master and is actually controlling the signalling, and the other is a 'hot standby'. As a 'hot standby' the computer is operating and receiving all commands and field indications. If the operating computer fails the hot standby computer can immediately take over. Note that the these two computers did not check each other and the systems are not failsafe. This was not a risk as the vital interlocking was performed by relay interlockings. In 2006 a third, cold standby computer was

[2] It is a reflection on the development of computing power that a modern iPad has more computing power and far greater storage than the PDP-11/70 computers used initially at Metrol.

About half of System B in September 1998. The three rightmost vertical racks hold the 'right' computer (another three racks out of sight to the left hold the 'left' computer). The two leftmost racks contain the terminating units for the four telemetry lines driven by System B. The actual PDP-11/70 minicomputer is the bottom half of the second rack from the left. The PDP-11/70 front panel can be clearly seen with the toggle switches and lights that could be used to directly load/interrogate memory and register locations and step through programs. The two greyish boxes above the PDP-11/70, and above and to the right are hard disc drives – a removable platter for the drive can be seen at the top of the second rack. At the extreme right is a DECWriter dot matrix line printer which was, no doubt, used to record log information.

added to each System. A cold standby is normally switched off, and is switched on to replace the hot standby computer when it has become the operating computer.

Each PDP-11 computer in a JZA-715 System contains a number of Unibus cards that interface the computer with the field systems and the panel. In the original Metrol system these cards were:

- DR11-C Parallel Interface Controllers. These cards interface the PDP-11 with the telemetry to the remote field stations (interlockings) and the fringe signal boxes.
- DZ11 Serial Line Controllers. These cards provide the interface to the colour VDUs. Up to 48 VDUs could be controlled from each System. The outputs from these controllers passed through an arbitration system to ensure that only one side of a System was driving the VDUs at one time.
- KW11-W real time clock. This card provided an input to the arbitration system – probably a watchdog timer to allow detection of a failed half of a System.
- DR11-W CPU Link Interface Controller. This card provided a link between the two computers in the System. This appears to have been used to pass information from the Master computer to the Standby computer.

Each re-implementation of the hardware had to support the Unibus architecture as it was necessary to support these cards. A major change occurred in 2006 when the DZ11 serial line controllers were replaced by modern, non Unibus, equivalents. The modern hardware reduced the CPU processing needed to drive the VDUs and improved the performance of the system.

Software

The JZA715 software was designed in a modular fashion. At the highest level, it consists of a number of subsystems. The first four subsystems are common to all JZA715 systems:

- Operator Communication. This subsystem handles the communication with the operator (Area Controller), including handling commands from the keyboard and panel, and generating the images displayed on the VDUs.
- Process Analysis. This subsystem handles the signalling logic. This includes testing whether a requested route exists and can be set, storing routes that cannot be immediately set (e.g. due to conflicts), translating the route calls into individual calls on points, and translating the indications being received into data that other subsystems can use.
- Transmission. This subsystem handles the interface to the interlockings and fringe boxes. It consists of modules to control the telemetry units, and to convert

information between the JZA715 and the field units and vice versa.
- Recording. This subsystem handles the logging of events and the generation of reports.

The final three subsystems handle the 'secondary' functions. These are not included in every JZA715 system (depending on customer needs). They were included in the Metrol system:
- Train Describer. This subsystem handles the train description numbers. It consists of modules that manage the stepping of train descriptions from berth to berth, the querying of the position of trains, the automatic entry of train numbers, and the transfer of train numbers to other JZA715 systems.
- Automatic Routing. This subsystem handles the automatic routing of trains.
- Auxiliary Information. This subsystem records late trains for subsequent analysis.

The subsystems and their modules are connected by a software bus. When a module completes its work, it transmits the results on the software bus. This routes the information to other modules for further actions. This approach meant that it was very easy to integrate new modules into the system.

The JZA715 software is largely written in the computer language Pascal, with some sections written in PDP-11 assembler.

Like more recent train control systems, the JZA715 is data driven. The software is generic and was customised to a particular installation by configuration data. The key configuration data was a geographical model of the controlled layout. This was, in fact, built up in a similar fashion to a geographical relay interlocking. Standard components (main signals, points, track circuits, etc) are pre-defined in the system and instances of these components were defined in the data and linked together. A stand-alone generating program (GEN715) is used to generate this model.

Telemetry

Communication between the Metrol system and the field interlockings (and fringe signal boxes) is by a telemetry system. The original Systems A and B use the JZA700 (also known as the EBICOS 700) telemetry system. System C uses a mixture of JZA700 and the newer EBISAT 890 telemetry systems.

Each JZA715 System can drive four telemetry lines to the field (each line has two physical lines connected to it). Each telemetry line can address up to 127 field stations, and each field station has a capacity of a mixture of up to 384 inputs or outputs.

At the JZA715 each line is connected to a line unit which, in turn is connected to a parallel port on a DR11-C card on the Unibus. The transmission line takes the form of a loop which starts at the line unit and links each alternate field station and terminates at the same line unit. This loop allows communication to be maintained even if one link or node fails. No other redundancy is provided.

Transmission cycles to the field are around three seconds and each consists of three phases. In the first phase the JZA715 issues commands to the field stations. To reduce the bandwidth required, only the commands that have changed state are transmitted. In the second phase, the JZA715 receives indications from the field stations. Again, to reduce bandwidth, field stations with an unchanged status do not transmit anything. In the third cycle, one field station is requested to transmit all their indications whether or not they have changed.

Fringe boxes are also connected to Metrol using the same telemetry system. Each fringe box is a field station with a local microprocessor that drives the VT100 or VT220 terminal.

Other Metrol systems

Metrol contains a number of other systems, some of which were added after the initial commissioning. In 1998, these included:
- Overview Computer. This PDP-11/34 based computer took the VDU outputs of the JZA715 Systems and produced a composite overview of the controlled area to be displayed to the Operations Controllers.
- Train Reporting System. This dual PDP-11/70 system obtained information from the JZA715 systems and tracked the progress of trains in the Inner Area. Among other tasks, this system drove the timetable monitors, and the Passenger Information Displays on the station platforms.
- PICMAN. It is believed this controlled the train radio system.
- Docking Sheet. It is believed this application allowed co-ordination between Metrol and the various stabling sidings
- Simulation/Model Computer. This consisted of a pair of PDP 11/70 computers. One computer was set up as half of a JZA715 System, and the second simulated the field interlockings. These computers are used to test the alterations to the system and to train staff.
- Timetable Computer. This PDP-11/70 was used to develop the train plans used to control the automatic routing.