# SOMERSAULT

SEPTEMBER 2013
Vol 36, No 5

## SIGNALLING RECORD SOCIETY OF VICTORIA INC

*One of the surprise losses this year was South Kensington signal box which was unceremoniously demolished on the weekend of 20/21 July, apparently because it was foul of the new RRL lines. This box was brought into use on 21 October 1928 in connection with the provision of the goods lines to West Footscray. It contained a 68 lever McKenzie and Holland Style A power frame. On 18 December 1960 a control panel was provided opposite the frame to control the points and signals in the South Dynon area in connection with the provision of the new standard gauge lines. The power frame was replaced by a control panel on 13 July 1992 which worked the same layout. At the time it was reported that there was some urgency about the replacement due to the deteriorated condition of the insulation of the wires in the relay room. In late June 1992 control of the Dynon/South Dynon area was transferred to a new panel in West Tower. Like Franklin St and North Melbourne, South Kensington simply faded away. At some date control of the points and signals was transferred to Metrol, however the panel apparently remained available for use in an emergency.*

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Published by the Signalling Record Society Victoria Inc (A0024029F)

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## Minutes of Meeting held Friday 19 July, 2013, at the Surrey Hills Neighbourhood Centre, 1 Bedford Avenue, Surrey Hills

Present: – Brett Cleak, Graeme Cleak, Glenn Cumming, Mike Drew, Graeme Dunn, Steven Dunne, Michael Formaini, Ray Gomerski, Chris Gordon, Bill Johnston, David Jones, Keith Lambert, David Langley, Andrew McLean, Alex Ratcliffe, Colin Rutledge, Laurie Savage, Brian Sherry, Rod Smith, Andrew Waugh, Andrew Wheatland and Ray Williams.

Apologies: – Jim Black, Wilfrid Brook, Brian Coleman, Judy Gordon, Chris King, Steve Malpass, Bruce McCurry, Tom Murray, Greg O'Flynn, Peter Silva, David Stosser, Stuart Turnbull and Bob Whitehead.

The President, Mr. David Langley, took the chair & opened the meeting at 20:03 hours, following completion of the Annual General Meeting.

Minutes of the May 2013 Meeting: – Accepted as published. Michael Formaini / Ray Williams. Carried.

Business Arising: – Wilfrid Brook was a late arrival, not an apology.

Correspondence: – The Annual Return was sent to Consumer Affairs Victoria.

The invoice for the public liability insurance was received and payment has been sent.

The invoice for the "Signalling Record" for 2012 was received from the SRSUK and payment was sent.

Membership pack sent to Sean Kelly of Mount Dandenong.

The invoice for the rent of the rooms in Seymour for 2013 – 2014 was received from Victrack and payment was sent. Alex Ratcliffe / Graeme Dunn. Carried.

Reports: – Glenn Cumming advised that the tour is being organised for Saturday 14 September 2013. Locations to be visited will be Kensington, Showgrounds, Flemington Race Course and Essendon. Final details to be advised when known.

General Business: – Alex Ratcliffe asked about the status of the Archives Room at Seymour. David Langley responded. In short, we need more people to get involved in this activity.

Alex Ratcliffe asked about plans to digitise the SRSV collection of paper. David Langley responded that there were no plans at present. Colin Rutledge suggested that the SRSV could lease a plan scanner. This would require labour to do the scanning.

Alex Ratcliffe asked about the diagram of Spencer Street suburban platforms in the latest issue of "Somersault". Platform number 13 is shown as bi-directional. Is this correct? This detail will be checked.

Laurie Savage advised that work has commenced on the provision of boom barriers at New Street level crossing in Brighton to replace the hand gates.

Rod Smith noted that the final section of CTC between Gheringhap – Maroona and ATC between North Ballarat – Maryborough had been commissioned.

Brett Cleak noted that the demise of Electric Staff and Section Authority Working had seen the removal of two (2) safeworking systems in one year.

Alex Ratcliffe asked about level crossings being installed with axle counters instead of track circuits. Is this the policy across the state? No. Each site has factors that need to be considered e.g. rail wheel interface.

Brett Cleak advised that in South Australia, CTC is now in use between Coonamia – Stirling North. Construction of CTC with axle counters between Spencer Junction – Tarcoola is now underway.

Chris Gordon described the imminent slew of the Werribee Lines between Maribyrnong River Junction – Footscray.

Chris Gordon advised that the Solid State Interlocking at South Kensington will be replaced in three weeks. The Signal Box will be abolished and demolished.

The Signal Box at West Footscray will be demolished in October 2013.

Colin Rutledge advised that commissioning of the new crossing loop at Warncoort is scheduled for late September 2013.

Chris Gordon noted a funding announcement for the remote control of the junction at Dunolly.

David Langley reported that re-sleepering works are now underway between Toolamba – Echuca.

Andrew Wheatland advised that the interlocking frame from Greensborough is now in storage at Puffing Billy.

Andrew Wheatland reported that three (3) sets of boom barriers had been commissioned at Puffing Billy in the past two months.

Keith Lambert reported that the new Traffic Control System to replace the existing system at Metrol would be trialled this weekend.

Rod Smith advised that re-signalling of the Flemington Racecourse Line had been deferred until 2014.

Rod Smith noted that the signalling headways for Regional Rail Link had been designed for 2.5 minutes.

Alex Ratcliffe asked about a disaster recovery centre for Metrol. A backup centre for Metrol is believed to have been in use for three years.

Syllabus Item: - The President introduced Member Mike Drew to present the Syllabus Item.

Mike presented a selection of approximately digital images from a recent visit to the United Kingdom.

The images viewed concentrated on the Great Central Railway between Loughborough Central and Leicester North.

Special attention was given to the signalling facilities on the GCR. Views were seen inside and out of the various Signal Boxes and a variety of trackside signalling equipment.

The presentation was thoroughly enjoyed by those present.

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

Meeting closed at 22:40 hours.

The next meeting will be on Friday 20 September, 2013 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 26/13 to WN 32/13 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 alteration.*

27.12.2012 **McIntyre Loop** (TN 33/13)

From Thursday, 27.12., the Up end of No 3 Track was taken out of service. Dwarf MCT/V4 was removed. No 3 Track was baulked near the former site of MCT/V4.

31.01.2012 **Melbourne Yard** (TN 208/13)

From Friday, 31.1., Points 205D leading to the Creek Sidings have been clipped.

04.02.2012 **Melbourne Yard** (TN 208/13)

Commencing Monday, 4.2., ownership of the Creek Sidings was transferred from VicTrack to the RRL Project for construction work.

(08.02.2013) **Newport** (TN 258/13)

The point machine on Points 601 has been changed to an M23A dual control point machine.

(14.01.2013) **Emerald Tourist Railway** (A 1/13)

A number of Station Masters have been trained in Level 1 Safeworking. This means that they can send and receive ACRE messages. Instruction 3 of the Supplementary Instructions is modified to permit a person qualified in Level 1 Safeworking to transmit an ACRE message by the most suitable means available. When a person qualified in Level 1 Safeworking sends an ACRE message, they must cancel the Staff Ticket by writing 'ACRE', 'Cancelled', and the time the ACRE message was sent, across the face of the Ticket. The 'ACRE sent or received form' must be filled out and handed to the Signalman so that the TRB can be filled out.

08.03.2013 **Vite Vite Loop** (TN 436/13 & 439/13)

On Friday, 8.3., DICE and TAILS equipment was decommissioned and all DICE signage was removed. Homes VVE61 and VVE63 were removed. Homes VVE/6 and VVE/26 were commissioned but fixed at stop. Vite Vite will only be available for crosses when attended (generally 0700 to 1700 hours daily).

11.03.2013 **Berrybank Loop - Vite Vite Loop** (TN 438/13 & 439/13)

On Monday, 11.3., Centralised Traffic Control replaced Section Authority Working on the sections Berrybank Loop - Tooli Loop - Vite Vite Loop. Tooli Block Point was abolished, and Tooli Loop was commissioned.

At Berrybank Loop the 'Commence' and 'End' Section Authority Territory Boards and location boards will be abolished. Up Repeating GV1552 was converted to an Automatic.

Tooli Loop was established at 172.073 km. New signals GV1683, TOZ/6, TOZ/10, TOZ/12, TOZ/26, TOZ/30, TOZ/32, and GV1760 were provided. The speed limit for departing trains from No 2 Track is 60 km/h.

Tooli Loop is equipped with Emergency Automatic Mode operation.

Tooli Block Point was abolished and all signage was removed.

At Vite Vite Loop, new signals GV1843, VVE/6, VVE/10, VVE/12, VVE/26, VVE/30, VVE/32, and GV1920 were provided. 'End CTC - Start Section Authority' boards were erected adjacent to VVE/30 and VVE/32. A 'End Section Authority - Start CTC' board was provided at VVE/26. The speed limit for departing trains from No 2 Track is 60 km/h. Vite Vite Loop is equipped with Emergency Automatic Mode operation.

17.03.2013 **Clematis** (A 13/13)

On Monday, 17.6., boom barriers were provided at the existing flashing lights at Belgrave - Gembrook Rd, Clematis. The arrangement of the boom barriers is conventional, however, two bells are provided, one of which is silenced when the booms are horizontal.

The controlling circuitry is provided with a timer that will restore the crossing protection signals to stop after 5 minutes of continuous operation, and raise the boom barriers after a further 30 seconds and cancel the flashing lights and bells. The approach track circuits will subsequently be inoperative until the fault is cleared, however the level crossing equipment can be operated by the test switch, or by occupying the island track circuit (which extends 25 feet on each side of the crossing). Train crews must consequently be observent when approaching a boom barrier crossing. If the crossing protection signals are at Stop, the train is to draw forward onto the island track circuit. If the level crossing equipment does not start, the test switch is to be operated. If the level crossing equipment still does not start, GI 7.7.2 must be followed.

17.03.2013 **Selby** (A 13/13)

On Tuesday, 18.6., boom barriers were provided at the existing flashing lights at Long Pocket Ln, Selby. The arrangements are the same as that provided at the Belgrave - Gembrook Rd Clematis.

24.03.2013 **ARTC RAS Manual** (TN 605/13)

The ARTC Route Access Standard (RAS) Manual became effective in Victoria from 24 March 2013. Ultimately, the RAS Manual will replace the existing TA02 Network Interface Co-ordination Plan (outside NSW) and the Train Operating Conditions (TOC) Manual (for NSW).

07.04.2013 **Section Authority System - End of Daylight Savings** (TN 683/13)

On Sunday, 7.4., at 0800 hours the Section Authority Workstation will be shut down to update the clock back to Eastern Standard Time. Prior to shutting the system down, the Train Controller is to confirm that no authorities have been issued for trains, hi-rail, or track work have been issued. After rebooting the system, the Train Controller is to confirm that the time has been changed, endorse the paper train graph, and confirm that all other downloaded trips are recorded as per RAMS download. Normal working may then be resumed.

01.05.2013 **Appleton Dock Sidings** (TN 881/13)

On Wednesday, 1.5., derailers and ramp blocks were installed at the Up and Down ends of Common User Roads Nos 4 & 5 to allow these roads to be used for making up and breaking down of trains. After installation, the derailers were secured off the rails.

09.06.2013 **Tatyoon Loop - Maroona** (TN 1202/13, 1204/13)

On Sunday, 9.6., DICE and TAILS equipment at Tatyoon Loop were decommissioned and all signage removed. Homes TYP71 & TYP73 were removed, and new Arrival Homes TYP/6 and TYP/26 (fixed at stop) were provided. Tatyoon will only be available for crosses when attended (generally 0700 to 1700 hours daily).

On Sunday, 9.6., Maroona Loop was booked out of service. Signals VD2401, 244/10, and 244/12 were taken out of use.

10.06.2013 **Vite Vite Loop - Maroona** (TN 1204/13, 1210/13)

At 1500 hours on Monday, 10.6., CTC was brought into use on the sections Vite Vite Loop - Westmere Loop - Tatyoon Loop - Maroona. The Section Authority System Vite Vite Loop - Fiery Creek BP - Tatyoon Loop - Maroona was abolished.

These are the last remaining sections worked by the Section Authority System. Once the Network Controller is satisfied that the CTC system is operational, they are to check that there are no locomotives or track machines logged on to the Section Authority workstation. Once this has been confirmed, the Network Controller can log off from the workstation and shut it down.

At Vite Vite Loop the 'Commence' and 'End' Section Authority Territy Boards and location boards were abolished. Up Repeating GV1920 was converted to an Automatic.

Westmere Loop was established at 212.258 km. New signals GV2085, WSM/6, WSM/10, WSM/12, WSM/26, WSM/30, WSM/32, and GV2186 were provided. The speed limit for departing trains from No 2 Road is 40 km/h. Westmere Loop is equipped with Emergency Automatic Mode operation.

Fiery Creek Block Point was abolished and all signage was removed.

At Tatyoon Loop, new signals GV2277, TYP/6, TYP/10, TYP/12, TYP/26, TYP/30, TYP/32, and GV2362 were provided. The speed limit for departing trains at the Up end is 40 km/h and at the Down end 65 km/h. Tatyoon Loop is equipped with Emergency Automatic Mode operation.

Maroona. Repearting Signal VD2401 was redressed as an Automatic and will only display R/R, Y/R, & G/R (the 'b' arm will be fixed). Home 244/10 was converted to LED and will now display Clear Normal Speed for moves towards Melbourne (instead of Normal Speed Warning). Home 244/12 was converted to LED and will now display Clear Medium Speed for moves towards Melbourne (instead of Medium Speed

Warning). The Start CTC/End Section Authority Boards were removed from Home 244/6. The 'Start Section Authority (Melbourne Line)' boards were removed from Homes 244/10 and 244/12

23.06.2013 **ARTC Addendum to the Code of Practice for the Defined Interstate Network** (TN 1132/13)

On Sunday, 23.6., Addendum Issue 4 became effective.

23.06.2013 **Tottenham - McIntyre Loop** (TN 1316/13)

On Sunday, 23.6., the standard gauge line was slewed to the Up side of the existing line between 12.733 km and 13.347 km (over the future Anderson St bridge). Banner Indicator MGS122 was provided at 12.550 km.

17.03.2013 **Emerald** (A 13/13)

On Monday, 24.6., boom barriers were provided at the existing flashing lights at Belgrave - Gembrook Rd, Emerald. The arrangement of the boom barriers is conventional, however, two bells are provided, one of which is silenced when the booms are horizontal.

The controlling circuitry is provided with a timer that will restore the crossing protection signals to stop after 5 minutes of continuous operation, and raise the boom barriers after a further 30 seconds and cancel the flashing lights and bells. The approach track circuits will subsequently be inoperative until the fault is cleared, however the level crossing equipment can be operated by the test switch. If the signals protecting the level crossing are at Stop when they should be at proceed, the driver is to operate the test switch to trigger the level crossing protection equipment. The test switch must then be restored. When the booms are horizontal, the signals will clear according to their normal controls. If the level crossing equipment still does not start, GI 7.7.2 must be followed.

26.06.2013 **Epsom** (SW 146/13, 153/13, WN 26)

On Wednesday, 26.6., the existing flashing light signals at Golf Course Rd (168.905 km) were altered to be operated by axle counters. Healthy state indicators, yellow whistle boards, and remote monitoring were brought into use. Amend Diagram 32/12 (Goornong - Elmore).

26.06.2013 **Epsom** (SW 145/13, 153/13, WN 26)

On Wednesday, 26.6., boom barriers were provided at the existing flashing light signals at Howard St (169.811 km). Automatic pedestrian gates were provided on the Up side of Howard St. Operation will be by axle counters. Healthy state indicators, yellow whistle boards, and remote monitoring were brought into use. Amend Diagram 32/12 (Goornong - Elmore).

28.06.2013 **Epping** (SW 172/13, SWP 12/13, WN 28)

On Friday, 28.6., train stabling gates 719 were commissioned at the Down end of Epping Yard.

Clifton Hill Group Operating Procedure 1 (Epping - Failure of Signals) was amended by the addition of clause (n) dealing with the failure of Gates 719.

30.06.2013 **Burnley** (SW 191/13, WN 26)

On Sunday, 30.6., Automatic BLY379 was converted to a UGL tri-colour LED signal.

01.07.2013 **ARTC - Radio Network** (TN 1517/13)

The NTCS transition is scheduled to be completed by 30.6.13. After this date, all locomotives operating on the ARTC controlled lines in Victoria, South Australia, and Western Australia must have a functioning ICE unit installed. This replaces the NUTR radio in Victoria.

01.07.2013 **Southern Cross - West Tower - South Kensington** (SW 154/13, WN 26)

At 2300 hours on Sunday, 1.7., the signalling on the Up and Down RRL lines between Southern Cross and South Kensington, together with the Melbourne Yard Arrival Roads, will be commissioned for driver training.

Homes SSS728 & SSS738 were commissioned but fixed at Stop.

Homes SSS908, SSS909, SSS910, MYD731, MYD951, & MYD958, Automatics MW019, MW024, & SKN695, and Dwarfs MYD712, MYD714, MYD716, MYD718, MYD733, MYD735, MYD737, MYD739, MYD741, MYD762, & MYD952 were commissioned.

Points 612, 614, 616, 618, 620, 633, 635, 637, 653, & 811U, 854, 855, & 858, Crossovers 851, 852, & 853, and Derail/Crowder 620, 628, 631, 633, 635, 637, & 662 were commissioned. Points 620, 633, 635, & 637 and Derail 620, 628, 631, 633, 635, 637, & 662 are auto-normalising. Points 858 & Crossover 852 were secured normal. Points 620, 854 & 855 were secured reverse.

Gates 603 were not commissioned, and were secured reverse (open for trains).

Note: Home MYD731, Dwarf MYD760, Crossovers 851 & 853, Points 620 & 653, and Derails/Crowders 620 & 631 were previously commissioned - see SW 130/13.

SW 63/13 is cancelled.

01.07.2013 **Franklin St** (SW 196/13, WN 26)

On Monday, 1.7., Automatic 482 and Home 556 were converted to LED heads. The illuminated letter 'A' on Home 556 was removed, and the arrow type route indicator was replaced by a theatre type. This will show 'M' for routes towards the Up East Suburban and Up Main Suburban lines, and 'R' for routes towards the Through Country and Main Country lines.

(02.07.2013) **Ballarat** (SW 149/13, WN 26)

Operating Procedure 69 (Ballarat - Train Order Status) was reissued. SW 128/13 is cancelled.

A new section was added dealing with the movement of Master Keys between Ballarat and Maryborough.

When a Down train between Batesford and Ballarat East is carrying a Master Key, the Key can be carried through to Maryborough. When arriving at Ballarat East, the Driver is to confirm with the Train Controller whether the Key is to be carried forward to Maryborough, and the Train Controller is to endorse the Train Graph accordingly. Upon arrival at Maryborough the Key can be secured in the Master Key Securing Box, or retained on the locomotive for use in the Train Order territory beyond Maryborough. Similarly, a Master Key for use between Ballarat East and Batesford can be carried from Maryborough. If the train originates on the Down side of Maryborough, and carries a Master Key, it may be retained for use between Ballarat East and Batesford.

(02.07.2013) **Kerang** (SW 147/13, WN 26)

Boom barriers have been provided at the passive crossing at Mitchell St (287.831 km). Operation will be by level crossing predictor. Trains travelling at more than 50 km/h at the predictor boards may accelerate before the level crossing. RFR indicator boards and remote monitoring was provided. Amend Diagram 30/13 (Pyramid - Kerang).

03.07.2013 **Warncoort Loop** (SW 150/13, WN 26)

Between Tuesday, 2.7., and Wednesday, 3.7., signal bridges will be provided at 137.530 km and 138.180 km for the future Warncoort Loop. Amend Diagram 136/12 (Birregurra - Colac).

03.07.2013 **Caulfield** (SW 199/13, WN 27)

Commencing Wednesday, 3.7., EMUs must not be routed into the Through Siding from the Down end.

(09.07.2013) **Southern Cross - West Tower - South Kensington** (SW 152/13, 155/13, 156/13, 158/13, 190/13, 193/13, WN 26 & 27)

Rail Safety Accreditation has been completed for the RRL Lines between Southern Cross and South Kensington, and these lines are now available for use. Driver training will be conducted on the RRL Lines between Southern Cross and South Kensington. N class locomotives will be used for the training at a maximum speed of 40 km/h.

A temporary headshunt has been provided at South Kensington to connect the Up and Down RRL lines. The points at the end of the double line are fitted with a CCW lever weighted to lie for the Up line. A handsignaller will be provided at Home SKN793 to control movements into the headshunt. The handsignaller will issue Caution Orders to pass SKN793 without reference to the Signaller Western Panel, Metrol, but must not allow an engine to pass Home SKN793 if the headshunt is occupied. The handsignaller must record train movements in a Train Register Book.

Driver training will be conducted under absolute block conditions. The handsignaller at Home SKN793 must inform the signaller Metrol when a train has passed the signal and is proceeding towards the headshunt. At Southern Cross, the Drivers must inform the RRL Train Controller when the locomotive has arrived in clear in Platforms 15 or 16. The Drivers must also inform the Train Controller when the locomotive is in clear in the Arrival Sidings. The RRL Train Controller must not signal a second train until they have been informed of the clearance of the previous train.

Prior to signalling an engine over any self normalising points in the reverse position, the Signaller must apply a point block. This must be maintained until it has been confirmed that the locomotive has arrived in clear.

14.07.2013 **Southern Cross - South Kensington** (SW 159/13, WN 28)

From 1600 hours, Sunday, 14.7., the signalling on the Up and Down RRL lines between Southern Cross and South Kensington was taken out use. Absolute Occupation of Platforms 15 & 16, the Up and Down RRL lines, and the Arrival Sidings was instituted. The signalling for the Through Siding (as shown in SW 130/13) will remain in service to permit train movements between the Bypass Tracks and North Dynon Yard. SW 152/13, SW 154/13, SW 155/13, & SW 158/13 were cancelled.

14.07.2013 **South Kensington** (SW 208/13, WN 27)

On Sunday, 14.7., the following alterations took place:

* The illuminated letter 'A' on Home NME572 was removed.
* Home SKN755 was replaced by a new tilting mast with LED heads.
* Posts NME572, SKN658, SKN755P, SKN756, SKN757, & SKN759 were provided with LED heads. The ladders and landings of Posts SKN755P and SKN756 were replaced.

Amend Diagrams 100/12 (North Melbourne & Macaulay) and 53/13 (South Kensington).

14.07.2013 **Sunshine** (SW 207/13, WN 27)

On Sunday, 14.7., Points 435 and 454 were provided in the Up and Down lines at the Up end of Sunshine. These will form part of a double crossover to the RRL lines. Diagram 63/13 (Sushine) replaced 61/13.

20.07.2013 **North Melbourne** (SW 223/13, WN 30)

On Saturday, 20.7., the signal units on Home 551 were lowered 600mm due to construction of the walkway on the flyover.

21.07.2013 **Metrol** (SW 215/13, WN 28)

Between 0300 hours Sunday, 21.7., and 0300 hours, Monday, 22.7., the signalling and train control at Metrol will be operated from the new TCMS facility.

21.07.2013 **Highett** (SW 217/13, WN 30)

On Sunday, 21.7., circuit alterations were carried out to improve co-ordination with the traffic lights and to remove redundant circuitry associated with Automatic F609. SW 162/13 is cancelled.

# One Sunday Morning - A Wrong-side Signalling Failure

By Phillip Barker

**Introduction**

A number of years ago, I undertook an investigation of an incident during what should have been a routine signalling commissioning. These are my recollections of events.

The incident was notable as it involved a wrong-side signal failure brought about as a result of a project not going to plan, poor understanding of responsibilities between the parties involved, fatigue and the pressures under which staff were placed in an effort to keep trains running.

The nature of the commissioning meant that no data recorders were available to provide a record of train movements and signal indications. With a greater reliance on the recollections of those involved and the time consuming piecing together of their actions, the investigation was more challenging than it could have been.

The location is not relevant other than it was a suburban station with a mix of express and stopping passenger services and few freight trains.

**Signalling Commissioning**

The work involved the addition of new points and associated signalling to an existing double line station. The infrastructure was three-aspect route-signalling with bi-directional running through the platforms and remotely controlled from a central control centre. The interlocking was a Vital Processor Interlocking (VPI) and was to receive data updates for the new signalling configuration.

In the lead up to the commissioning, all new wiring was tested and made ready with temporary modifications carried out on some existing signals to facilitate the operation of trains during the changeover. Signalling work was scheduled to be done between the last train Saturday night and 15:30 Sunday afternoon, although trains would start running again early Sunday morning. Once the interlocking was taken out of use, any control over signalling or indications from track and points would not be available at the control centre.

Due to the nature of the location and the safeworking methodologies in place at that time, a number of restrictions were considered. The principal constraint was a practical limit to the number of controlled signals at stop where trains would be authorised to pass. This meant that two controlled signals were required to work automatically throughout the commissioning and it was one of these signals that were to figure in the wrong-side incident later that morning.

Two level crossings with automatic half boom protection also existed in the area and without an operating VPI, each required manual operation by a Protection Officer.

**Description of Events Leading to Signal Failure**

The last train for the night had passed and by 01:30 on the Sunday morning the clipping of points and temporary signalling arrangements were complete before work started on VPI alterations. Although no further trains were scheduled, an engineering possession was taken out for the location until the first train Sunday morning.

The VPI was powered back up at approximately 03:00, however, it failed to reboot as expected. Testing staff then started checking cables and connections and other possible causes of the failure until around 04:30. Although the commissioning was to last until 15:30 that day, there was an expectation that the VPI would be operating and that track indications would be available at the control centre for the first train.

*Diagram 1. (Opposite) Simplified track and signalling diagram of the location. Automatic signals A1, A2, A3, A4 and A5 were to work normally although A2 and A4 would display red and yellow aspects only on account of the home signals in advance being held at red. Protection Officers were placed at each level crossing to manually operate the equipment on the approach of trains and Safeworking Officers were located at home signals 1 and 2. The Safeworking Officers facilitated the provision to train drivers of written authorisation to pass controlled signals at stop - 1, 3 and 5, and 2, 4 and 6 respectively and to provide "train arrived" at the exit of the location on the opposite line. Controlled signal 7 was configured to work automatically displaying only red and yellow aspects, while controlled signal 8 was required to work automatically and be able to display red, yellow, and green aspects (Diagram by author).*

By around 04:30 Operations and Safeworking Officers were arriving on site in preparation for the running of trains through the location under the planned temporary arrangements. One Officer noticed on his way to work that signal A2, which should have been displaying a yellow aspect, was displaying a red. Some concern was soon expressed that the temporary signalling arrangements may not be correct, and with the pending arrival of the first train, levels of anxiety were rising.

Signal electricians were then sent to check on the aspects of all signals and to ensure that things were as planned. This exercise confirmed that signal A2 was still at red when it should have been displaying yellow and had apparently found that other signals were without any temporary measures being in place.

It was becoming evident that temporary signalling arrangements had not been considered or carried out on the Up line in preparation for rail traffic. For example, signal A1 had a replacement control fed from the interlocking and was therefore showing a red aspect. Signal 8 had not been configured to work automatically and was also sitting at red. With signal A2 still at red, this meant that the six consecutive Up signals would require special authorisation to pass for each train.

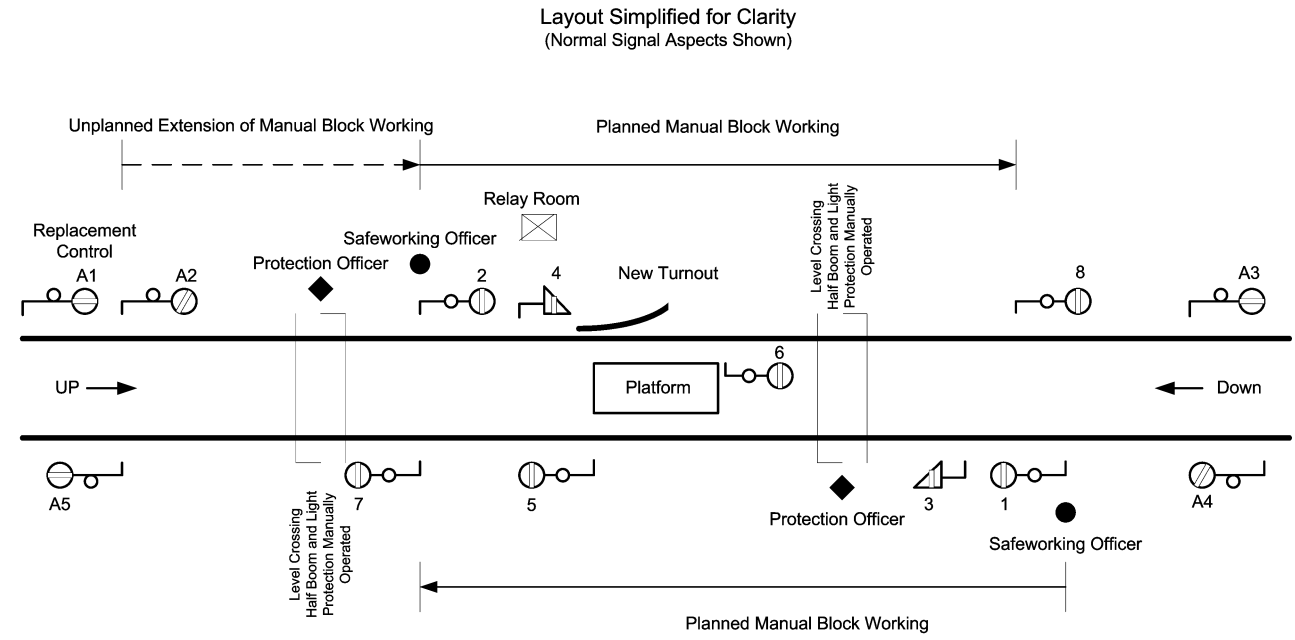
Things weren't coming together as much as most would have expected and there was a perception that trains could be delayed. This prompted some to consider that further contingencies where required, however, this was the start of some well meaning but misplaced ideas exposing the commissioning to further risks.

By this time, the pressure of the situation and in all probability fatigue appeared to be having an affect on decisions made by operations and engineering staff. A number of fixes were conceived for signals A1, A2 and 8 but without the fullness of planning that would be warranted in these situations. Poor communications between the engineering and operations sections also led to some misunderstanding of requirements.

Between 05:30 and 05:50, signal A1 received a false feed to pick up a control relay remedying the effect of the replacement control and allowing normal automatic operation. This signal was of no further consideration in the incident.

As the first train would also require signal A2, an im-

## Location Track and Signalling Diagram




Planned Arrangements for Manual Block Working
1. Signals 1, 2, 3, 4, 5 & 6 to be Fixed at Stop
2. Signals 7 & 8 to be Converted to Automatic Operation (Signal 7 to Display Red & Yellow Only)

Unplanned Arrangements
1. Signal A1 False Fed to Overcome Replacement Control Function
2. Signal A2 Maintained at Stop (On Account of Level Crossing Controls)
3. Signal 8 Alterations Attempted to Entice Automatic Operation

mediate consideration was to make it operational. The commissioning plan called for this signal to operate (displaying red and yellow aspects only); however, the effects of the disconnected level crossing controls and the loss of the VPI were not considered, resulting in this signal failing to clear. While the engineering sections proposed solutions to overcome the problem, the Operations Officer surprisingly called for it to remain at red to augment the protection of the level crossing. This of course meant that a separate written authority would need to be issued to train drivers at A2 and then another as originally planned at signal 2. It is not known what was considered at that time to ensure signal A2 was held at stop as it was later found to be free to clear should conditions become favourable.

The fixes considered for signal 8 were neither straight forward or appropriate.

A temporary power feed from the relay room was arranged, also between 05:30 and 05:50, to pick up the relay controlling the yellow aspect (HR) in signal 8. It is not known if any aspect checking or testing was carried out or that the track sections were clear of obstruction before inducing this false clear indication in the signal. This measure remained in place until 09:25.

The first train, an Up empty passenger, arrived late at 06:02 and successfully passed through the location on written authority for signals A2, 2, 4, and 6. Signal 8 was showing a proceed aspect at this time.

The next Up passenger train at 06:44 also passed signals A2, 2, 4, and 6 on written authority, however, signal 8 was now showing a red aspect as the previous train had restored it. After some safeworking formalities, this train was then provided with an authority to pass signal 8 at stop. The next two Up trains at 06:59 and 07:22 were similarly issued with written authority to pass A2, 2, 4, 6 and including 8.

At this stage of events, five consecutive signals were being passed on written authorities and so between 07:22 and 07:43, it appears that a further modification was made to signal 8 at its location case where temporary connections were applied bridging out contacts on the track stick relay for the signal replacement track circuit (immediately in advance of signal 8). It is not known who authorised this modification although a rudimentary test was carried out on the modification by removing and replacing the replacement track circuit fuse and observing that signal 8 restored to red and cleared once again. This modification also remained in place until 09:25.

Signal 8 then displayed a proceed aspect for the next two Up trains at 07:43 and 07:52 respectively. Although everyone was under the impression that the problems with signal 8 were now resolved, the modifications had dire safety implications.

While this work was going on in the field, engineers were still working on the VPI. A signal design specialist was able to be contacted at 04:50 to provide assistance with the burning of a new set of EPROMS for the VPI, although, by 07:30 further assistance had been sought from the contractor and alternative cards were obtained for the VPI.

### The Wrong-side Failure of Signal 8

At 08:24, the Safeworking Officer stationed at signal 1 noticed that signal 8 on the opposite line was displaying a green aspect after an Up passenger train had passed it. This was soon confirmed by the Operations Officer who observed the signal displaying a yellow aspect.

Arrangements were made by the Operations Officer for trains to revert once again to written authorities to pass signal 8 - regardless of the indication it may be displaying. It was further required that trains were clear of signal A3 before signal 6 was passed. The Operations Officer then directed signal electricians to attend to the anomaly in signal

8.

Following the report of the wrong-side failure, a Signal Engineering Officer went to the location case and found that signal 8 was being replaced (to stop) by the first track circuit (8AT) and would re clear once the train had vacated this track circuit. This meant that subsequent track circuits (8BT and 8CT) to signal A3 and the overlap beyond it had not been considered in earlier ad-hoc modifications. A train was therefore not protected by signal 8 except when occupying the 430 metre long 8AT section. The usual aspect sequencing was functioning and when a train passed signal A3, signal 8 would revert to a yellow aspect and then to green when A3 displayed a yellow aspect.

The Operations Officer who was becoming uneasy with the situation went to the signal 8 location case and spoke with the Signal Engineering Officer. At 08:45, the Operations Officer then informed the control centre that signal 8 was now 'safe to use', although, it is not certain what modifications had occurred for this call to have been made as it wasn't until 09:25 that the problem was recorded as being rectified.

A further three Up passenger trains passed signal 8 at 08:46, 08:55 and 09:22 respectively and although it is unclear what modifications were attempted by the Signal Engineering Officer, it is likely that all track circuits up to signal A3 had been incorporated into the controls. Due to some difficulties, the A3 overlap track circuit was not included however. This omission meant that a yellow aspect was possible in signal 8 even though a vehicle could be standing immediately beyond signal A3.

**More Problems**

One further Up train passed signal 8 at 09:45 before the VPI recovered at 09:46. With the return of the interlocking, track indications for the location were restored in the control centre. This restoration of the VPI caused signal A2 to clear to a yellow aspect despite an earlier request to have it fixed at red. The situation wasn't apparent until 09:56 when the next Up train continued past signal A2 (at yellow) without having stopped to collect a written authority as expected. Arrangements where made by 10:05 to hold signal A2 at stop.

**Conclusion**

The investigation concluded that three trains passed signal 8 between 7:25 and 08:24 and continued without the full protection this signal would have offered. The minimum headway recorded between two trains was nine minutes.

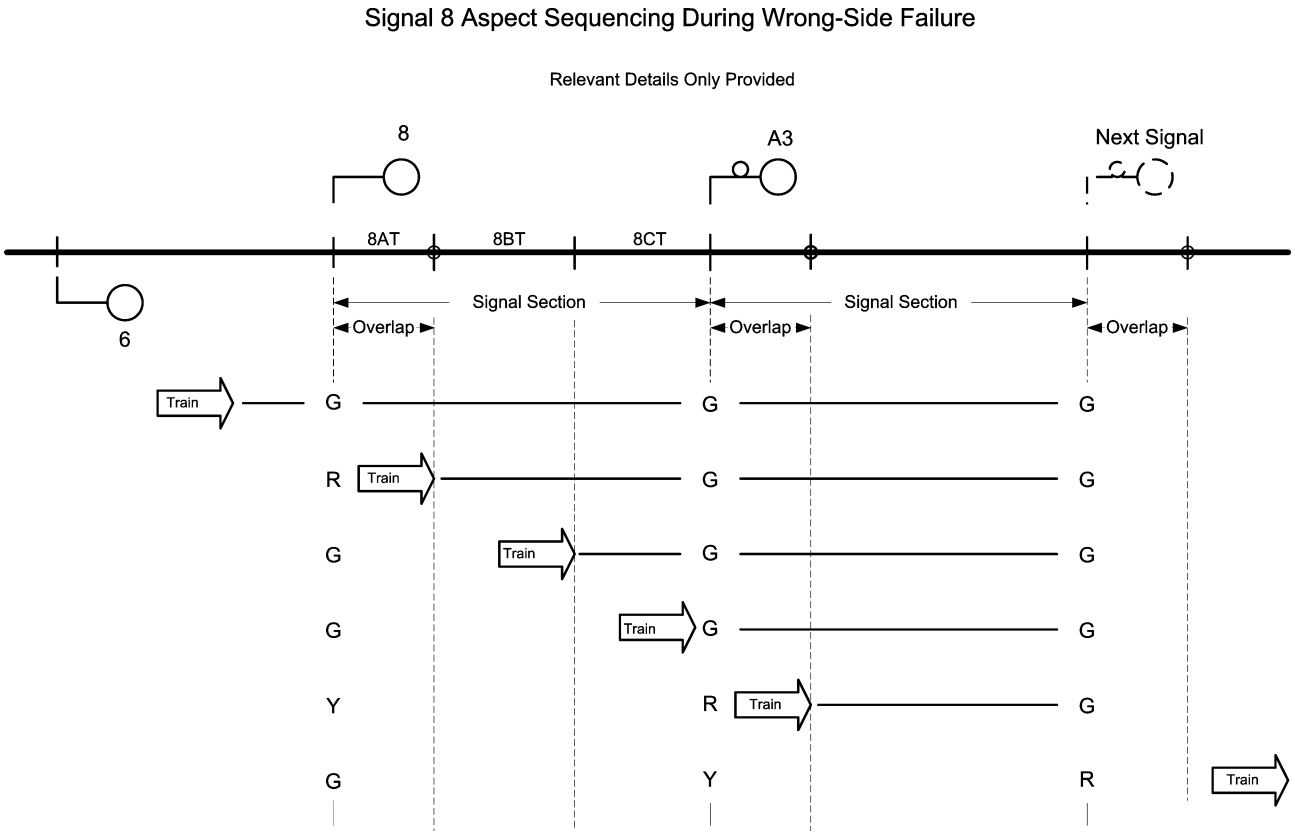
A number of issues leading to the wrong-side failure at signal 8 as well as other unwanted situations at other signals were identified.

There was less than adequate attention given, to the design and implementation of signalling modifications required when the interlocking was not available, and for the special safeworking arrangements implemented to move rail traffic through the location. This included poor contingency arrangements in the event that commissioning did not go to plan.

There was a mistaken belief amongst the signal engineering parties as to who was responsible for the various arrangements being put in place. It is known that the signalling modifications required for the special safeworking arrangements, with the exception of signal 7, were not carried out and remained so, despite these omissions being raised.

The attention of engineering staff was mainly towards returning the VPI to operation. This meant that the issues in the field were secondary and generally left to others to deal with; especially as it was considered that the safe op-

*Diagram 2. The operation of signal 8 is shown in each phase as a train progresses from the area of manual block operation and from signal 8. Signal 8 displayed a stop aspect only for the time a train occupied the 8AT overlap and otherwise aspect sequenced with signal A3 (Diagram by author).*



eration of trains was being covered by the Operations Officer.

There was also some misunderstanding between operations and signal engineering as to what was specifically required when contingencies where being devised. For example, the term, 'fix' was used by the Operations Officer to mean 'rectify' whereas, signal engineering staff considered this to refer to 'fixing at proceed'. This misunderstanding was apparent when signal 8 was first treated at 05:30 by directly feeding a relay to induce a proceed aspect. This action appeared to be justified as the signal was merely required to be cleared once for convenience, as the safe separation of trains was thought to be covered by the operational methodologies in place.

It was likely that signal engineering staff were displaying the effects of fatigue as some may well have been awake since Saturday. Moreover, critical decisions in regard to further contingencies were being made during the less desirable early hours of the morning.

The Operations Officer was becoming apprehensive about the operation of trains when much of the signalling temporary modifications were not in place. This anxiety is likely to have led to less than optimum decisions by operations and engineering staff when further contingencies were being considered. Train delays were contained to between 1 and 11 minutes.

Despite there being nothing innocent about the actions of those involved, thankfully a just culture attitude prevailed and lessons were learnt rather than lost through disciplinary action.

*(Right) The VPI that was being commissioned. Photo: Phillip Barker*

## Letters to the Editor

Brian Coleman is continuing his research into the history of the life and times of the Victorian Railway Block and Signal Inspectors and proposes to write a book on the history of this interesting position. Further information is required on the following people who were former Block and Signal Inspectors. Family and friends are urged to contact Brian at PO Box 2239, Melton South, 3338, or email brianblocko1@bigpond.com

The inspectors are (with the year of their birth in brackets):

Mark F. Baynes (1889)
Thomas F. Beary (1862)
Ernest C. Blazey (1864)
George Bowden (1849)
Alexander Burns (1864)
Thomas B. Cook (1860)
Thomas Edwards (1871)
John Evans (1866)
Edward M. Hoare (1869)
John Jackson (1849)
John Jordan (1885)
Hugh Lynch (1860)
Alexander Mathieson (1854)
John Z Mullins (1868)
Alfred W. Murfitt (1871)
Daniel McFarlane (1849)
John McGee (1848)
John T. Nolan (1869)
Cyril Owen (1903)
William Phelan (1863)
John Patrick (1861)
Charles Ralston (1860)
John Richmond (1849)
James Rudd (1837)
Lawrence L. Stevens (1866)
John A. Watkins (1886).

## Signalling Alterations

(Continued from page 81)

and replaced by a new tilt mast with a LED head. Home SKN668 was converted to an Automatic but retained its identifier.

The existing SSI and SIGMAP at South Kensington were replaced by a new SSI and protocol converter. The following route inhibitions will be retained: SKN753/SKN747 to SKN667 & SKN771; SKN767 to SKN771; SKN768 to SKN658; SKN771/SKN791 to DYN88; SKN772/SKN774/SKN776 to SKN658, SKN668, & MYD958; SKN793 to SKN667, SKN771, & SKN791; and SKN768 to MYD958 (212).

Diagrams 67/13 (South Kensington) and 69/13 (Footscray - Spotswood) replaced 65/13 and 49/13 (respectively). SW 175/13 is cancelled.

# Section Authority System

On 10 June 2013 the Section Authority working between Westmere and Maroona was abolished. This brought an end to this system of safeworking, and the following notes have been put together to document its short history.

**Development**

The Section Authority System was an example of an electronic token system. These systems are designed to replicate the functionality of traditional token systems (e.g. electric staff) without the physical presence of a token. Instead the token is an electronic message that it transmitted from a central workstation to the cab of a locomotive. Like a physical token, the message permits the driver to occupy the section. When the train clears the section the message is returned to the central workstation. Just like a traditional token instrument, the workstation will only issue one electronic token for a section at the one time. The electronic exchange of tokens avoids the key weaknesses of the physical token systems. They do not require staff on the ground at the crossing loops to operate the staff instruments, nor do they require the train to be stopped to exchange tokens.

The first example of electronic tokenless block was the British RETB (Radio Electronic Token Block). This was developed by British Railways R&D Division in the early '80s as a means of reducing the cost of operating remote lengthy single lines. The first trial installation was on the Dingwall to Kyle of Lockalsh line which was brought into trial use in September 1984 (in parallel with the existing token instruments). The token instruments were retired on 5 August 1984 (sic) when RETB took over complete operation. RETB was subsequently provided on a number of other lines in Scotland, the NE of England, and Wales. However, operational limitations in the initial installations of RETB meant that more equipment was provided in subsequent installations. This increased the cost to the point where further extension of RETB could not be justified.

The Priority Projects Division of the Public Transport Corporation created the Alternative Safeworking Project in the late 1980s to investigate, amongst other things, computer validated train order technology to reduce the operational costs associated with having locations attended essentially for safeworking purposes and to improve train running by eliminating the need for trains to stop at locations to exchange train staffs but not to cross or overtake other trains. RETB was considered, however, the cost of adapting this system to Victorian requirements was seen to be costly and time consuming compared to developing a 'bespoke system'. In 1986, the criteria of a successful solution were identified as:

* Unstaffed loops
* Trains could pass through loops without stopping (except where crosses were to be made)
* Minimisation of maintenance costs
* Effective safeworking
* No requirement to dedicate locomotives to a particular group of lines
* Cost effective
* Capable of replacing other safeworking systems (e.g. double line block)
* Provision of advice to the driver that the train is complete at loops

The options identified were:

* conventional CTC
* CTC using axle counters
* train order working using either verbal orders, printed orders, in cab displays, or wayside indications
* automatic train control

The prefered solution in August 1986 was for an electronic authority system. The train controller would issue authorities to trains through a central computer. The computer would ensure that two authorities could not be issued for the one section at the same time. Interestingly, at this time the authority to enter the section was intended to be by fixed signal (essentially a starting signal at each loop), with a possible later extension to an in-cab display. Trailable loops were to be provided with two end of train detectors for each direction of travel. One detector would detect the arrival of a train into the loop and this would release the single line section for an opposing move. The second detector would detect the departure of a train from a loop, and this would allow a following move from the previous loop. Two key differences with RETB were that trains would not be required to stop when receiving a new authority, and that the passage of the end of train past a point would be signalled to the driver. These differences were almost certainly due to the the Victorian system primarily being intended to control freight trains, while RETB was primarily used to control DMUs.

By November 1990 the proposed system had evolved to become the Alternative Safe Working System (ASW) and was described in a paper presented by Tom Deveney to the IRSE. The key difference to the system proposed in 1986 was that an in-cab display replaced the lineside signals in providing the authority to enter a section. A key feature of the in-cab display was that it could hold two authorities: a 'current authority' for the section currently being occupied by the train; 'next authority' for the section about to be entered by the train. The importance of this was that the 'next authority' could be obtained at any convenient time before the train entered the next section, and did away with the need for trains to stop to receive an authority.

The system introduced in 1992 as the 'Section Authority System' was a refined version of that described in the 1990 IRSE paper.

**Description of the system**

The key components of the Section Authority System was a central computer that managed the authorities, Locomotive Safeworking Display Units (LSDUs) fitted in each cab of each locomotive to display authorities, and a digital radio system to connect the computer and the LSDUs.

Basic operation of the system was straightforward. The train controller had a computer on which was displayed a representation of the conventional paper train graph. Trains were represented as paths on the graph, with section points as horizontal lines. To give a train authority to occupy a section, the train controller would use a mouse to click on a section of the train path. The computer would display a a filled in Section Authority for the train to occupy the selected section. After reviewing the Section Authority, the train controller would transmit it to the LSDU in the leading cab of the leading locomotive of the train. Each cab had permanently secured 'code plug' which was programmed with the locomotive id (class and number). The locomotive id and the train number was part of the security of the system. Plugging the 'code plug' into the LSDU allowed the LSDU to receive Section Authorities for that locomotive. The Section Authority would appear in the 'Next Authority' portion of the LSDU. The driver then checked the authority, and if correct, acknowledged it. Acknowledging the authority completed the transmission to the train and caused the flashing green path on the controllers workstation to change to a steady green line. When the train fulfilled its current

Section Authority, the driver returned it to the train controller's computer by pressing two buttons on the LSDU. The returned authority was displayed on the train controller's computer, who checked it, and, if correct, accepted it. Returning the current authority from an LSDU automatically steped the 'Next Authority' into the 'Current Authority' portion of the LSDU.

In addition to the basic 'Section Authority', there were four other types of authority defined in the system: 'Siding Authority', 'Shunt Authority', 'Mishap Train Authority' and an 'Intermediate Stand Authority'.

To protect track workers, a 'Section Authority' was directional - possession of a section authority to proceed from A to B did not authorise the train to set back in the section, or return to A. A 'Siding Authority', however, permitted a train to enter a section to proceed to an intermediate siding, shunt, and then return to the location from which the authority was issued. A Siding Authority could only be issued if the section was unoccupied. To facilitate shunting at stations, a 'Shunt Authority' permitted a train to enter a section for the purpose of shunting. The shunting train could not proceed past the location board (or distant or repeating signal). A Shunt Authority could be issued if the section was occupied by another train, provided the train was travelling away from the location at which shunting was taking place, and that train had passed the location board.

A 'Mishap Train Authority' was used to work relief trains to a disabled train or an obstruction. The driver of the disabled train would dictate a 'Driver's Relief Authority' to the Train Controller and arrange to protect the train. After receiving the Relief Authority, the Train Controller would establish the mishap in the computer and cancel the disabled trains' authority. When the relief train was ready to enter the section, the Train Controller would issue a 'Mishap Train Authority' to the relief locomotive to proceed to the location and return. When the relief train reached the disabled train, the driver of the relief train attach to the disabled train, cancel the Driver's Relief Authority, and clear the section. When the combined train cleared the section the Mishap Train Authority would be cancelled. Incidentally, a concious decision was taken not to have a procedure for dividing a stalled train. Due to the length of trains, and smaller train crews, it was considered to be faster to deal with a stalled train as a disabled train.

The final type of authority, an Intermediate Stand Authority, was used when it was necessary transfer a Section Authority from one LSDU to another in mid section. This might be necessary, for example, where the leading locomotive on a train was detached or detached mid section. It was used at Cope Cope, and was intended to be used at Kurting. Detailed rules for its use are not given in the rulebook, but it would appear that transmission of the Intermediate Stand Authority locked the section so that when the Section Authority was returned from the leading locomotive it could not be granted to another train. Intermediate Stand Authorities were removed from the system in January 1998.

There were three types of locations that terminated sections in the Section Authority System: attended crossing stations, unattended crossing locations, and block point locations.

An attended crossing station was one at which a signaller was in attendance to operate the fixed signals. At an attended crossing station, the single line sections started and terminated at the arrival home signals (or location boards if no home signals were provided). The area between the home signals was referred to station limits and train movements within the station limits were under control of the signaller. To avoid having to staff all attended crossing stations for all trains, some stations could be switched in/out and others could be opened/closed. Attended crossing stations that could switch in/out were those regularly required for crossing or follow-on purposes. Attended crossing stations that could open/close were those that were not ordinarily required for crossing or follow-on moves. Examples were Dunolly and Ouyen.

Unattended crossing locations were trailable loops. For following moves, the single line section ended at the fouling point at the far end of the loop (which was also the commencement of the following section). For opposing moves, the single line section ended at the fouling point at the near end of the loop. Consequently, an authority could be returned when the train was 'in clear' in the loop, but the system would not issue an authority for a following train until the first train had departed from the loop.

Block points were simple signs which allowed follow-on moves.

In the original design, there were two options for confirming that a train was complete at the end of a section. The first option was that a person could sight the end-of-train marker. This person could be either the signaller at an attended crossing station, or the driver of an opposing train at an unattended crossing loop. Alternatively, TAILS could be used to detect the passage of the rear of a train past a given point. This was achieved by magnetically detecting the passage of an End-of-Train marker and automatically radioing a short prerecorded message to the driver. At unattended crossing loops, four TAILS detectors were provided - one in each road at both fouling points. At block points, a single TAILS detector was provided at the block point itself. TAILS predated SAW, being first introduced in October 1988.

For the standardisation of the Western line, a third method of determining whether a train was complete was introduced. Known as ETAS (End of Train Air System), this used a special end-of-train marker that measured and broadcast the brake pipe pressure to the leading locomotive. The brake pipe pressure would fluctuate between two set values (the fluctuation consistency). If the measured presure was oscillating within the fluctuation consistency the current authority could be returned.(The crossing loops between Geelong and Maroona were fitted with annunciators that broadcast a short message when the track circuit over the loop points cleared, similar to a TAILS message, but this did not detect that train was actually complete.) By the mid '90s, TAILS was obsolete technology and the Digitair end of train technology was considered too expensive. During trialling, some problems were experienced with 'loss of signal' particularly in the Adelaide Hills and initially NRC were reluctant to use this equipment as they were trialling Digitair equipment.

ETAS gradually replaced TAILS as the standard mechanism for detecting that a train was complete in Section Authority Territory. TAILS was never installed on the Gheringhap - Maroona line and ETAS was used once the signallers were withdrawn from the crossing loops. By mid February 1997 the location boards between Geelong and Robinvale/Kulwin had been relocated to be 2000 metres out, and ETAS was permitted to be used if TAILS failed, or the train was only equipped for ETAS. By mid June 1999 TAILS had been decommissioned on the Maroona - Portland line and all trains were to be run using ETAS. It appears that TAILS remained in use on the Dunolly/Yelta line until after Section Authority Working had been withdrawn.

DICE (Driver Initiated Control Equipment) was an important adjunct to Section Authority Working and needs to be mentioned. DICE used the radio provided as part of Section Authority Working to allow the driver to remotely set

points and signals as the train approached locations. A code number was transmitted from the locomotive to call routes at a location. The first DICE installation was at Donald where it controlled the Down Home Post 2 when Donald was unattended. This was commissioned on 8 February 1996 (before Section Authority Working had reached Donald). DICE was also trialled at Maryborough. On the Gheringhap - Maroona line the crossing loops were all operated by DICE.

An LSDU was provided in each locomotive cab of fitted locomotives. In addition, portable LSDUs were provided for emergency use, or by engines not equipped with permanent LSDUs. By 1 October 1996, it was not permitted for locomotives on timetabled trains to use portable LSDUs. Portable LSDUs (TrackCom and Steam units) were provided for emergency working or exceptional circumstances as agreed by Superintendent Safeworking. In July 1998 the portable LSDUs were relocated and control of their use was exercised by the System Safety Department in Transport House. On 7 July 1998 the portable LSDU at Dimboola was relocated to Ouyen. On 10 July 1998 the portable LSDU at Geelong Operations was relocated to Ballarat Signalbox. At that time Portable LSDUs were located at Ballarat, Pyrenees Loop, Ouyen, and Level 3 Transport House. The portable LSDU was withdrawn from Pyrenees Loop when it was destaffed.

There was a stand alone training workstation located on Level 3, Transport House, in the System Safety Area. This workstation was used not only for training but for testing new versions of software and trialling the system on new territory.

**Initial trials**

When the IRSE presentation was presented, in November 1990, it was expected that Section Authority Working would be introduced on the North Geelong - Mildura corridor in November 1991, with the remaining corridors being converted over a subsequent 2 year period as locomotives were equipped. There appears to have been some thought given to trialling the system from 1 October 1992 between Dunolly and Robinvale/Kulwin, however SAW was never trialled on this section.

Section Authority Working trials commenced in early 1993 on the Mildura line. On 19 February 1993 a 48 hour trial of Section Authority Working on the Mildura line was completed. The DERM trip to Birchip for the centenary celebrations on 6/7 March 1993 used a portable LSDU throughout the trip, apparently with some complications.

This trial came to an abrupt end at 0200 hours on Tuesday 27 April 1993 when a serious safeworking irregularity occurred in the single line section between Emu Loop and Sutherland Loop. Two opposing trains came within 250 metres of colliding head on after a Train Controller error resulted in the trains being in the same single line section at the same time. The precursor to the near collision at Emu was the failure of the radio system. A train was shunting at Sutherland whilst another train had an authority to proceed from Emu to Sutherland. The train at Sutherland finished the shunt and requested a Section Authority from Train Control. The message was not very clear resulting in several attempts to clarify the communication. The Train Controller assumed that the down train had arrived at Sutherland and relinquished the Order but that the work station had not received it. At that time, there was a feature in the software that allowed a Train Controller to remove an authority from the workstation to balance the authorities. This the Train Controller did and issued an authority for the up train. It was the alertness of the crews and their ability to communicate on the end to end radio that prevented the collision. The then acting Superintendent Safeworking immediately suspended any further live trialling of the system and ordered the staff systems be resumed. The system remained in limbo for some 18 months until a fix acceptable to the Superintendent Safeworking was developed. This "fix" was the entering a four digit Superintendents Security Code for the failed section for which the authority return to the work station had failed. The Security Codes were held by the Superintendent Safeworking and a code was only released to the Train Controller after the Superintendent had ascertained the position of the train and any other Authorities outstanding, as well as the position of all trains on the corridor.

**Introduction and spread**

Section Authority Working testing recommenced on 29 December 1994 when it was introduced 'on trial' between North Geelong C and Warrenheip, replacing the electric staff system between those two locations. Gheringhap and Meredith became switch in/out locations and block points were provided at Lethbridge and Lal Lal (Lal Lal was closed as a crossing station). The Gheringhap - Maroona line was closed for gauge conversion two days later. The Maroona line was reopened on 23 May 1995 and standard gauge trains commenced operating under Section Authority Working on the dual gauge line between North Geelong C and Gheringhap. This meant that all standard gauge locos used on the line had to be equipped with LSDUs. NRC and AN locomotives had been worked to Melbourne via Broken Hill to be fitted with LSDU's whilst Melbourne – Adelaide was closed for conversion. The line between Gheringhap and Maroona was worked by Train Staff and Ticket at this stage.

The territory under trial was extended from Warrenheip through Ballarat to Maryborough on 21 May 1995 (the junction at Warrenheip had been abolished on 1 April 1994 when the double line between Ballarat East and Warrenheip had been converted to two single lines). The safeworking sections suspended were Train Staff & Ticket (Warrenheip Loop - Ballarat), and automatic Electric Staff (Ballarat - Sulky Loop - Tourello Loop - Talbot - Maryborough). On 4 June 1995 the Train Controller for North Geelong C to Warrenheip also took charge of the section Warrenheip - Maryborough.

A milestone was reached on 17 June 1995 when Section Authority Working was formally recognised as the safeworking system between North Geelong C and Maryborough.

Instructions were issued at the beginning of July 1996 for the operation of bank engines between Ballarat and Warrenheip Loop under Section Authority Working. The driver of the bank engine had to ensure that the driver of the leading locomotive had a Section Authority. When the train arrived at Warrenheip Loop and came to a stand, the driver of the bank engine had to advise the driver of the train that the train has arrived complete. The current Section Authority could then be relinquished, but the Train Controller was not to issue a Section Authority for the Warrenheip Loop - Lal Lal BP section until the bank engine had been issued with a Section Authority for the return to Ballarat and had departed Warrenheip Loop.

The second line to be changed to Section Authority Working was the Maroona - Portland line where it replaced Train Orders. Trial operation of SAW on this line commenced on 7 July 1995, and it was confirmed as the safeworking system on 23 August 1995. The sections were Maroona - Glen Thompson Loop - Grampians Loop - Chrome Loop - Heywood Loop - Portland. ETAS was introduced just prior to the introduction of Section Authority Working on the Portland line, probably for testing purposes.

On 5 June 1996, Section Authority Working was introduced on the standard gauge line between Manor Loop and Maroona, replacing Train Staff and Ticket. The sections were Manor - Elders BP - North Geelong BP - Gheringhap - Hesse BP - Wingeel - Werneth BP - Berrybank - Tooli BP - Vite Vite - Fiery Ck BP - Tatyoon - Maroona. The 'interface' sections (Newport - Manor Loop and Maroona - Pyrenees Loop remained worked by Train Staff and Ticket). End of train detection was by ETAS, and TAILS was not installed. At this time DICE operation of the loops had not been commissioned, and signallers were initially retained at each crossing loop (they were withdrawn from 23 June 1996). DICE operation was commissioned at Gheringhap (both broad gauge and standard gauge loops) on 27 June 1996, however, the DICE operation was initiated by a local signaller by a portable LSDU. Interestingly, TAILS was provided at Gheringhap broad gauge loop from 8 July 1996 (matching the rest of the Ballarat line). Driver operated DICE was commissioned at Gheringhap on 4 November 1996 and the signaller was subsequently withdrawn. By 12 November 1996, broad gauge trains shunting at the Gypsum Siding at Gheringhap had to be in possession of a Section Authority or a Shunt Authority. Further, broad gauge trains shunting Elders Siding at North Geelong had to obtain an Electronic Manual Section Authority (as they had to cross the standard gauge and would probably not be fitted with an LSDU).

A further extension of the system occurred on 21 June 1997 when it replaced Train Staff & Ticket between Newport and Manor. The sections were Newport - Galvin BP - Manor. It appears that this extension required a new version of the SAW software, as Version 1C came into use concurrently with this extension. One change with this version was the addition of a 'Final Authority' message to allow drivers to determine that a returned authority had been received by the workstation.

The next extension was on the Yelta line beyond Maryborough. On 21 September 1997, Section Authority Working replaced Train Orders on the sections Maryborough - Dunolly - Emu - Sutherland - Donald. Dunolly was established as an open/close location. When attended, the authorities were issued to Dunolly and when unattended to Dunolly Loop. Dunolly had to be open for all movements to and from the secondary corridor (Inglewood), and for all standard gauge trains. On 12 October 1997 Section Authority Working was extended all the way to Yelta. The sections were Donald - Watchem - Birchip - Curyo BP - Woomelang - Gama BP - Speed - Ouyen - Hattah - Carwarp - Yatpool - Irymple - Mildura - Yelta. Irymple was a switch in/out location. Donald, Ouyen, and Hattah were open/close locations (Ouyen and Hattah were block points when closed, and Hattah was a Loop). Ballarat. Maryborough, and Mildura werre attended crossing stations. By 18 November 1997, instructions had been issued for shunting the sidings around Mildura. The Shell Oil Siding was worked by issueing a Shunt Authority in the Mildura - Yelta section. Merbein could be worked using a Siding Authority issued from either Mildura or Yelta. The Mildura Cement Siding was worked by a Shunt Authority in the Carwarp (or Irymple) - Mildura section. If Irymple was not switched in, it would be worked by a Siding Authority (the trains could also shunt the Mildura Cement Siding and Irymple Co-op Siding as well). On 28 June 1998 Irymple was closed as a switch in/out location.

The final extension of Section Authority Working took place on 28 June 1998 when it replaced Train Staff & Ticket on the section Maroona - Pyrenees Loop. Maroona became an Open/Close Junction station and had to be open for crossing trains, shunting trains, or trains to/from Portland line. Ararat was an intermediate siding with the main line points secured by Annett locks. Signalling at Ararat was by the signaller from Pyrenees Loop.

With this extension, Section Authority Working was at its greatest extent covering the Western line from Newport to Pyrenees Loop, the line from Gheringhap to Yelta, and the line from Maroona to Portland.

**Decline and abolition**

On 1 May 1999 ARTC took responsibility for the Section Authority Working between Newport and Pyrenees Loop. The ARTC Train Transit Manager now held the Superintendents Code for the system. Following privatisation of the Victorian Regional Network in May 1999, the one computer system was supporting both the ARTC operations Newport – Pyrenees Loop and the Freight Victoria Gheringhap – Yelta and Maroona - Portland lines. There had been some unresolved failures of the system and Freight Victoria's position was that Section Authority Working was not necessary to support train operations on the Mildura line. There was a further concern, that with a failure, ARTC could take action to rectify their fault which may or may not have an unintended consequence on the Freight Australia territory. The project team were unable to give sufficient assurances that this situation could be managed.

On 25 July 1999 Section Authority Working was eliminated from the Freight Australia system with both the Gheringhap - Yelta and Maroona - Portland lines being changed to the Train Order System. Maroona remained an open/close location, but was established as a block point when closed. Subsequently, ARTC made a number of software modifications to customise the system for their needs. The original changeover date had been intended to be 4 July, but driver training and notification to the Rail Safety Regulator delayed reintroduction of Train Orders.

ARTC had withdrawn the signaller from Pyrenees Loop on 26 May 1999, almost immediately after taking control of the line. The Annett key to secure the main line points at Ararat was then secured in a locked box near the points at Ararat. This led directly to a head-on collision at Ararat on 26 November 1999 when the points were reversed in front of an Up loaded grain train and it was diverted onto No 2 Road where it collided with a ballast train. The temporary solution, on 3 March 2001, was the provision of electric locking on the main line points with repeating signals. However, the long term solution was the provision of CTC on the Maroona - Pyrenees Loop section which was provided on 22 May 2002.

On 13 August 2002, North Geelong C became a switch in/out location in Elders BP - Gheringhap section. This meant that it was only necessary to staff North Geelong C for Grain Trains on the Grain Loop, and broad gauge trains in and out of North Geelong Yard.

At the Melbourne end of the Western line, CTC replaced Section Authority Working in early 2003. On 6 February 2003, CTC was provided on the Newport - Manor Loop section in conjunction with the provision of the new Laverton Loop. CTC was extended from Manor to Gheringhap on 13 April 2003. In preparation for this, the standard gauge loop at Gheringhap was converted on 3 April 2003 from DICE operation to remote control by the ARTC Train Controller.

This left only the Plains line between Gheringhap and Maroona worked by the Section Authority System. Surprisingly, the system was to last another decade. ARTC expected ATMS would displace Section Authority Working and were initially reluctant to install CTC. It was also possibly a reflection of the financial challenges facing ARTC with the gauge conversion of the north east. Conversion to CTC was as follows: Gheringhap to Wingeel Loop on 26 November

2012; Wingeel Loop to Berrybank Loop on 7 December 2012; Berrybank Loop to Vite Vite Loop on 11 March 2013; and Vite Vite Loop to Maroona on 10 June 2013. The last marked the end of Section Authority Working.

Curiously, in October 1998, VicTrack had assessed replacing Section Authority Working with CTC Newport – Pyrenees or at least Pyrenees – Maroona. However with the imminent hand over to ARTC (announced Nov 98) the proposal did not proceed beyond 'preliminary concept'

**Conclusion**

The demise of the Section Authority System was probably inevitable. Technically it was an innovative solution, retaining the features of the traditional token systems while allowing the withdrawal of signallers on the ground and non-stop passage of trains through crossing loops. However the reliability of the computer hardware, software and communications systems created concerns about its viability and safety. Possibly, with better support during the development of the software and a communications system that handled data transmission the story would be quite different.

Prior to privatisation, the ASW project team were assessing gradual expansion of the system over the regional network, initially to replace Train Order and Token Based safeworking systems. Feasibility assessments for the introduction of the system to replace Double Line Block and ultimately CTC were undertaken.

Post privatisation, Freight Victoria looked at a system of computer validated train orders, developed by Iowa Interstate Railroad Limited. The system, known in the United States as Track Warrant, would have been suitable for Victorian conditions. This was evaluated, but there was a reluctance to proceed with the project as it did not meet an acceptable cost/benefit requirement.


*The Down end of Tatyoon Loop on 2 April 2013 showing the DICE operated equipment. The loop points are fitted with a TD84M point machine equipped with a point indicator. Trains arriving into the Tatyoon are governed by the two position Up Arrival Homes TYP73 and TYPU73 - note the lights are properly staggered. An arriving train calls the route into Tatyoon using DICE. A 3000 metre track circuit is provided on the approach to the Home signals, and when the train is on the track circuit the driver can call the route. Two codes are used - one to call the route into No 1 Rd, and a second to call the route into No 2 Rd. (For some reason, when these photos were taken the code for entering the loop at the Down end had been disabled.) If the points are free and the selected road is unoccupied, the points at each end of the loop are called for the movement. When detected in the correct position the appropriate Home signal will clear and the train can arrive into Tatyoon. When the train has cleared the points, an arrival message will be broadcast over the radio. The instructions warned that this did not signify that the train was complete, and the drivers had to use ETAS to check that the train was complete. At the same time, the points will self normalise if they had been reversed for a move into the loop. No departure homes are provided (those that can be seen in the photo are for the impending provision of CTC and were not yet in service). Trains may depart if they are in possession of an authority for section - a reversion to a very old practice. The position of the points was indicated by the switch stand, and the route could be called, if necessary, using DICE. (Photo: Glenn Cumming)*