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SOCIETY CONTACT INFORMATION

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EDITOR: Andrew Waugh, 28 Amelia St McKinnon, VIC, 3204
Phone (03) 9578 2867 (AH), (03) 9348 5724 (BH), email andrew.waugh@gmail.com
PRESIDENT: David Langley, P.O. Box 8, Avenel, VIC, 3664, Phone (03) 5796 2337
SECRETARY and MEMBERSHIP OFFICER: Glenn Cumming,
Unit 1/4-6 Keogh St, Burwood, VIC 3125. Phone (03) 9808 0649 (AH)
NSW CONTACT: Bob Taaffe, Unit137, 319 Macquarie St South Hobart 7004, Phone: (03) 6223 1626
QUEENSLAND CONTACT: Phil Barker
PO Box 326, Samford, QLD, 4520, Phone: 0400 334403, email: signal01@bigpond.net.au

MINUTES OF MEETING HELD FRIDAY 18 MARCH 2022, AT THE SURREY HILLS NEIGHBOURHOOD CENTRE, 1 BEDFORD AVENUE, SURREY HILLS, VICTORIA.

The SRSV meeting scheduled for Friday 18 March 2022 was held on site at Surrey Hills and was broadcast as an online meeting on the internet using the 'ZOOM' application.

Present: – (On site). Glenn Cumming, Graeme Dunn, Michael Foley, Chris Gordon, Judy Gordon, Andrew Gostling, Bill Johnston, Keith Lambert, David Langley, Andrew McLean, Laurie Savage, Rod Smith, Andrew Waugh and Rob Weiss. (14)

(Online). Ken Ashman, Noel Bamford, Phil Barker, Robert Bremner, Brett Cleak, Michael Formaini, Graeme Henderson, David Langberg, Eddie Oliver, Andrew Pardy, Peter Silva, James Sinclair, David Stosser, Bob Taaffe, and Andrew Wheatland. (16)

Apologies: – Michael Menzies, Colin Rutledge and Stuart Turnbull.

The President, Mr. David Langley, took the chair and opened the meeting at 21:30 hours following the 2021 Annual General Meeting.

Minutes of the February 2022 Meeting: – Accepted as published. Laurie Savage / Graeme Dunn. Carried.

Business Arising: – Nil.

Correspondence: – The invoice for the issues of "Signalling Record" for 2021 was received from the SRSUK and payment was sent. Rod Smith / Keith Lambert. Carried.

Reports: – Nil.

General Business: –

David Langley reported on the recent commissioning of new crossovers and signals near Longwood and Violet Town on the North east Line. David displayed some recent images of the new crossovers and signals at Longwood.

Graeme Henderson provided an extensive report on the recent flooding in New South Wales including details of the damage to the railway network and repairs. The report was accompanied by a number of images of the flooding.

Keith Lambert reported that a ten (10) day occupation in late April and early May 2022 is planned to remove the level crossing at Glenroy Road, Glenroy.

Keith Lambert noted that the occupation for the removal of the level crossing at Hallam Road, Hallam finishes this coming Monday. The railway station will reopen for passenger traffic on Monday 2 May 2022.

Andrew Waugh reported on progress with preliminary works for the removal of the level crossing at Glenhuntly Road, Glenhuntly.

(Front cover) Most Victorian Railways signals looked much the same, but others… Post 7 at Glenrowan was a bracket post with the Home on the right hand doll provided with a co-acting arm. The upper co-acting arm, unusually, is mounted on a separate straight mast located precisely behind the doll. The lop bracket post, without the co-acting arm, was provided in June 1961 when the yard was reconstructed for the new standard gauge line. Post 7 applied to Down movements from the platform loop (left) and the through line (right). The reconstruction also involved replacing the level crossing at the Up end of the yard with an overbridge. Clearly, when combined with the rising grade approaching the station, the overbridge blocked the view of the right hand Home signal and the co-acting arm was provided in November 1961 in this unconventional manner. Photo: Andrew Waugh

David Langley described a proposal for the removal of the Surf Coast Highway level crossing between Marshall and Waurn Ponds.

Andrew Waugh advised that the ATSB had released the report into the derailment in November 2018 of a runaway train on the BHP Iron Ore rail network in Western Australia's Pilbara region. Andrew provided a summary from the report of what happened in this incident.

Laurie Savage asked if a single line power signalling system will be provided between Waurn Ponds – Warrnambool? Answer – Yes.

Ken Ashman described recent developments in his part of New Zealand:

- A new freight terminal is being developed at Ruakara.
- Planning for the introduction of a new interlocking system known as "HIMA".
- A new connection is to be provided from the main line into the yard at Te Rapa.

David Stosser asked when the connection to the Don River Railway in Tasmania was removed. The answer provided was approximately ten (10) years ago.

Phil Barker reported on the recent landslide at Ipswich in Queensland caused by the heavy rainfalls. Queensland Rail have constructed a deviation with overhead wiring around the landslide to ensure access to the stabling sidings at Wulkuraka.

Phil Barker described a proposal for duplication between Caboolture – Gympie North which will avoid the need for the installation of ETCS on the single line.

Phil Barker noted that the installation of ETCS Level 2 (no lineside signals) may be delayed. The third-party freight train operators have claimed that they cannot afford to install the new equipment on their locomotives.

Glenn Cumming noted a recent report about ARTC carrying out re-signalling works at Brooklyn and asked what actual work was done?

Glenn Cumming also noted a suggestion that the signalling works for the triangle at Ararat are planned for completion in August 2022.

Laurie Savage asked Ken Ashman about concrete sleeper sizes in New Zealand. Ken Ashman advised that only one size concrete sleeper is used that allows for 22 tonne axle loads.

Rob Weiss asked if anybody knew of any information about the history of clocks used in Victorian signals boxes.

David Stosser asked if the cane hoops or staff carriers were used with miniature electric staffs or large electric staffs or train staffs. The answer given was that the cane hoops or staff carriers were intended for use with miniature electric staffs and were never used with large electric staffs. In recent decades train staffs were carried in cane hoops or staff carriers for use on electric trains.

David Stosser asked what safeworking system was used on the single lines of the VR tram system. Andrew Waugh answered that Train Staff and Ticket was the system used and noted that the Victorian Railways issued a rule book for electric street railways.

Ken Ashman displayed a V/Line Signal Assistant badge and asked what was a Signal Assistant. The explanation given was that a Signal Assistant was a Station Assistant with safeworking qualifications.

Graeme Henderson displayed some images of a derailment of a train that occurred at Casino NSW in the past 24 hours.

Meeting closed at 22:35 hours.

The next meeting will be on Friday 20 May, 2022 at the Surrey Hills Neighbourhood Centre, Bedford Avenue, Surrey Hills, Victoria, commencing at 20:00 hours (8.00pm).

SIGNALLING ALTERATIONS

The following alterations were published in WN 5/22 to WN 14/22, 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.

08.02.2022 **Raywood** **(SW 21/22, WN 5)**

Construction of a 180 metre platform has commenced between 193.794 km and 193.974 km (approximately 45 metres on the Down side of Inglewood Rd).

Amend Diagram 46/17 (Eaglehawk – Raywood).

12.02.2022 **Ballarat East** **(SW 22/22, WN 5)**

On Saturday, 12.2., a 40 km/h RFR speed sign was provided at the Up end of the former Ballarat East platform (113.109 km) showing the speed limit of 40 km/h between Humffray St (113.109 km) and Macarthur St (119.867 km).

Amend Diagram 116/19 (Warrenheip – Ballarat East).

14.02.2022 Melbourne Yard (SW 23/22 & 24/22, WN 6)

On Monday, 14.2., the West Gate Tunnel Project installed baulks on Tracks 1A, 2A, 3A, 4A, and 5A in the Melbourne Operations Terminal, and on the ARTC dual gauge Canal Lead on the Up side of signal APD26. The broad gauge, standard gauge, and dual gauge tracks on the Up side of the baulks, over F Gate Access Road to the former Canal Yard bridge, will be removed.

Stop Boards A, B, & 7 were abolished.

Amend Diagram 70/20 (Moonee Ponds Creek).

Operating Procedure 132 (Melbourne Yard) was reissued. SW 1/20 was cancelled.

18.02.2022 Hoppers Crossing (SW 55/22, WN 6)

Between Friday, 18.2., and Thursday, 24.2., the level crossing and pedestrian crossing protection was decommissioned and removed. The stopping/express functions for Automatics G957 & GG957 were removed.

The display for the Werribee signal box ULP was updated to reflect the abolition of the level crossing.

Provision of road/rail access pad HCG1 has been deferred.

21.02.2022 Lake Boga (SW 29/22, WN 7)

On Monday, 21.2., the Down end points were abolished. The Master Key lock, small point lever, and rodded connections were abolished. The key switch at the Down end points for manual operation of Station Street was taken out of service and will be removed. The noticeboard for Down shunting movements was abolished.

The siding remains in use as a maintenance siding accessible from the Up end but was reduced in length to 100 metres and baulks were provided.

Amend Diagram 8/21 (Lake Boga).

21.02.2022 Albury (SN 345/22, WN 6)

On Monday, 21.2., the signalling associated with the extended dead end siding at the south end of the Back Platform Road was provided:

- Southbound Home AY50 will display Clear Medium Speed, Medium Speed Warning, Low Speed Caution, and Stop.
- The northbound Shunt Limit sign on Home AY50 (Back Platform Road) was removed. When shunting from the dead end towards the Back Platform or Engine Road, crews are to observe the indications on Home AY71. Points 27 will remain locked during this movement.
- A buffer stop light (white over red) was provided on top of the insulated friction buffer stop at the end of the newly extended dead end at the south end at 646.740 km
- TPWS dead end equipment was provided in the south end dead end at 646.701 km set for 15 km/h.
- Track circuit 27AT was replaced by a new track circuit with the same identifier.

TPWS is provided at Homes AY15 (304.223 km/647.045 km), AY71 (304.710 km/646.544 km), and for the buffer stops at the north end of the Back Platform Road (which is stated to be at 305.082km/646.701km). Note that it appears the notice has confused the two dead end TPWS installations – one at the south end approaching the new buffer stops, and one at the north end in the Back Platform Rd.

ARTC Drivers Diagram DD088 was issued.

27.02.2022 North Geelong C (SW 36/22, WN 8)

On Sunday, 27.2., the interlocking data will be updated to correct problems at Separation Street.

28.02.2022 Franklin Street (SW 207/22, WN 7)

On Monday, 28.2., the point machine on Points 449U will be replaced by an 84M Mk3 point machine.

28.02.2022 Pyramid (SW 20/22 & 32/22, WN 5 & 7)

Between Tuesday, 8.2., and Monday 28.2., the following alterations took place:

- The existing Nos 2 & 3 Roads were abolished, including the hand operated Derails at the Up and Down ends of Nos 2 & 3 Roads and the WSa levers/hand locking bars on the points leading to No 3 Road at each end.
- The Up end main line points were abolished, including the Master Key lock and WSa point lever.
- The push buttons at the Up end points for manual control of the flashing lights at Victoria St were taken out of service and will be removed.
- A new No 2 Road (250 metres in clear) was constructed with access only from the existing Down points. A set of Catch points was provided at the Down end of the new road.
- The Master Key lock and WSa point lever was removed from the Down end main line points.

- The Down end main line points and the Catch points were equipped with dual control point machines and were numbered Points 27D and Catch 27U. These points machines are only available for hand operation.
- An E pattern Annett lock was fitted to the selector lever of the point machine on Catch 27U to secure the catch normal.
- An F pattern Annett lock was fitted to the selector lever of the point machine on Points 27U to secure the points normal.
- No 2 Road will not be available for use. Points 27D and Catch 27U will be secured normal.
- The operation of Victoria St will not be altered as part these works.

Diagram 4/22 (Pyramid – Kerang) replaced 14/21.

TON 51/08 was cancelled.

(01.03.2022) Brooklyn (TON 53/22, WN 8)

The Train Operating Data for the Newport to Sunshine line has been updated to note that the Brooklyn – Newport line between Brooklyn Post 9 and Newport Post NPT709 (i.e. West Line) is not available for traffic.

The details of the level crossing on the Brooklyn Quarry Siding over Somerville Road has been updated. The crossing is at 16.076 km (via Newport), is equipped with flashing lights, and has a location number of MW0160.

(01.03.2022) Geelong (SW 34/22, WN 8)

Operating Procedure 61 (Geelong) was reissued to correct SW 186/21. SW 186/21 was cancelled.

(01.03.2022) Macedon (SW 38/22, WN 8)

'Station ahead' signs have been installed 3000 metres from the station platforms in each direction on both lines (66.700 km and 72.860 km). The advisory signs have a white background and are lettered 'Macedon/3000 m/High Wheel Slip Area'.

03.03.2022 Lalbert (TON 86/22, WN 9)

On Thursday, 3.3., the siding (368.580 km to 369.425 km) was booked back into service. The siding continues to be only available for track machines.

07.03.2022 Franklin Street (SW 208/22, WN 7)

On Monday, 7.3., the point machines on Points 449D, 606U, 606D, 611U, 611D, and 618U will be replaced by 84M Mk3 point machines.

(08.03.2022) Footscray (SW 235/22, WN 9)

The crossover between the Up & Down Newport lines on the Down side of Footscray has been returned to service.

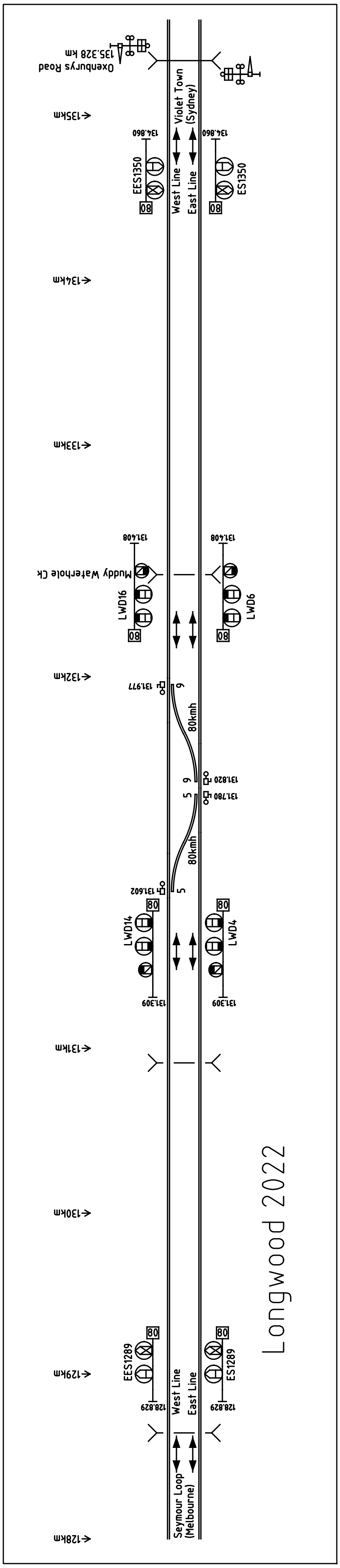
14.03.2022 Longwood – Violet Town (SN 471/22, SN 472/22)

Between Saturday, 12.3., and Monday, 14.3., crossovers will be commissioned at Longwood and Violet Town. The existing section Seymour Loop – Benalla on the East and West lines will be split into three: Seymour Loop – Longwood – Violet Town – Benalla.

Longwood

The crossovers at Longwood are situated on the Up side of the site of Longwood station, about half way between the former sites of Locksley and Longwood.

Crossovers 5 & 7 were provided. Automatics EES1129, ES1289, ES1350, & EES1350 and Homes LWD4, LWD6, LWD14, & LWD16 were provided.



Home SEY132 at Seymour Loop will clear for Down movements on the West line when the preceding train has cleared the normal speed overlap of Automatic EES1253 (ES12530T) at 125.627 km. Automatic EES1253 will clear when the preceding train has cleared the normal speed overlap of Home LWD14 and is occupying or clear of A5T (Points 5) at 131.612 km.

Homes SEY112 or SEY132 at Seymour Loop will clear for Down movements on the East line when the preceding train has cleared the normal speed overlap of Home LWD4 and is occupying or clear of 5T (Points 5) at 131.612 km.

Homes LWD4 or LWD14 will clear for Down movements on the West line when the preceding train has cleared the normal speed overlap of Automatic EES1501 (ES15010T) at 151.130 km. Automatic EES1501 will clear when the preceding train has cleared the normal speed overlap of Home VTN14 and is occupying or clear of A5T (Points 5) at 163.512 km.

Homes LWD4 or LWD14 will clear for Down movements on the East line when the preceding train has cleared the normal speed overlap of Home VTN4 and is occupying or clear of 5T (Points 5) at 163.502 km.

Homes LWD6 or LWD16 will clear for Up movements on the West line when the preceding train has cleared the normal speed overlap of Home SEY134 (136T) at 103.163 km.

Homes LWD6 or LWD16 will clear for Up movements on the East line when the preceding train has cleared the normal speed overlap of Automatic EES1222 at 121.817 km. Automatic EES1222 will clear when the preceding train has cleared the normal speed overlap of Home SEY114 at 103.163 km.

Violent Town

The crossovers at Violet Town are situated on the Up side of Violet Town station, about halfway between the site of Balmattum and Violet Town.

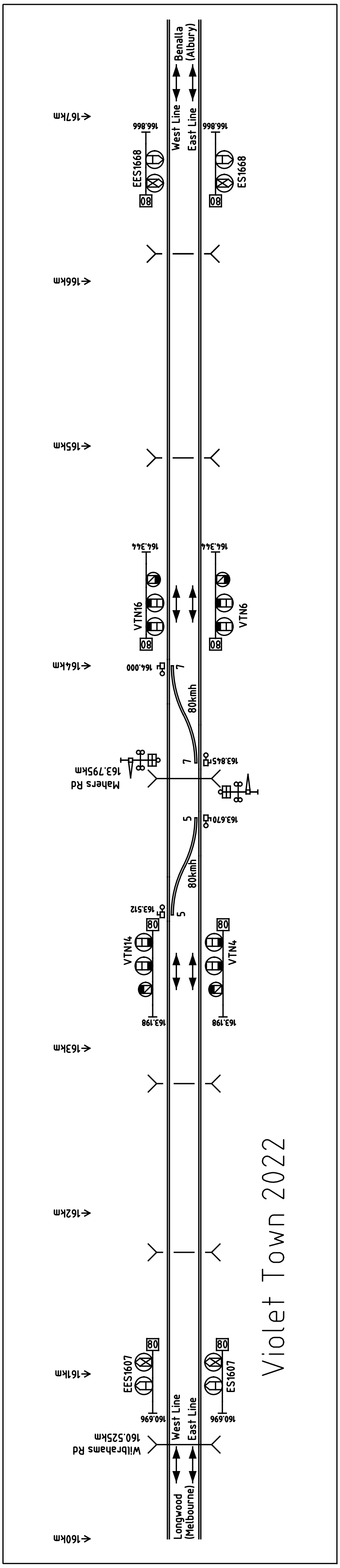
Crossovers 5 & 9 were provided. Automatics EES1607, ES11607, ES1668, & EES1668 and Homes VTN4, VTN6, VTN14, & VTM16 were provided.

Homes VTN4 or VTN14 will clear for Down following movements on the West line when the preceding train has cleared the normal speed overlap of Automatic EES1745 (ES17450T) at 174.897 km. Automatic EES1745 will clear when the preceding train has cleared the normal speed overlap of Home BNL24 at 194.233 km.

Homes VTN4 or VTN14 will clear for Down following movements on the East line when the preceding train has cleared the normal speed overlap of Home BNL4 at 194.233 km.

Homes BNL26 or BNL46 at Benalla will clear for Up following movements on the West line when the preceding train has cleared the normal speed overlap of Home VTN16 and is occupying or cleared Crossover 7 (A7T) at 164.042 km (sic – this is likely to be clear of the normal speed overlap of Automatic EES1668 and is occupying or cleared Crossover 7 (A7T)).

Homes BNL26 or BNL46 at Benalla will clear for Up following movements on the East line when the preceding train has cleared the normal speed overlap of Automatic EES1716 at 171.406 km and is clear of 9T at Violet Town Sidings. Automatic EES1716 will clear when the preceding train has cleared the normal speed overlap of Home VTN6 and is occupying or clear of 7T at 164.042 km.



Homes VTN6 or VTN16 will clear for Up following movements on the West line when the preceding train has cleared the normal speed overlap of Home LWD16 and is occupying or clear of Points 7 at 131.977 km.

Homes VTN6 or VTN16 will clear for Up following movements on the East line when the preceding train has cleared the normal speed overlap of Automatic EES1464 (ES14640T) at 146.070 km. Automatic EES1464 will clear when the preceding train has cleared the normal speed overlap of Home LWD6 and is occupying or clear of 9T at 131.987 km.

All signals are LED, and will display an '80' indication for medium speed moves with a clear aspect displayed on the Home Departure Signal. All points are equipped with Siemens M23a MKII dual control point machines.

18.03.2022 Inglewood (SW 49/22, WN 10)

On Friday, 18.3., the junction points were abolished (the points had been booked out in TON 145/13). Removal of the points will allow the lifting of the temporary speed restriction on the Dunolly – Korong Vale line.

The HLM, switch lock, track circuit releasing tracks, and V5PSW key switches were abolished. Repeating Signals ING1 and ING2 were abolished. The Location Boards were abolished. The Up noticeboard at the Up end of the platform was abolished. The 500m notice board, 'Stop' noticeboard and 'Start Release Circuit' notice board for Down trains on the Eaglehawk line were abolished.

Diagram 82/21 (Llanelly – Kurting) replaced 28/21.

Operating Procedure 34-90 (Inglewood) was withdrawn.

19.03.2022 Warragul (SW 47/22, WN 10)

On Saturday, 19.3., the Up end single blade catch point from No 3 Road, Catch AD, was replaced by a new double blade catch point at 99.505km. The rodded connection from Points A was removed and the catch is worked from a dual control point machine worked in hand mode.

The HLM Mk 1 switch lock, U5A detector, and National Trackwork point lever on Points AU (99.450 km) was replaced by a dual control point machine worked in hand mode.

A Crosslock was provided at Points AU to release an F pattern Annett key. The F pattern Annett key unlocks the selector lever on Catch AD. When reversed, this releases an E pattern Annett key from a ground mounted Annett lock which can be used to unlock the selector lever on Points AD.

Diagram 48/21 (Warragul – Yarragon) replaced 128/14.

(22.03.2022) Blackburn – Ringwood (SW 271/22, WN 11)

Diagram 11/22 (Blackburn – Ringwood) replaced 7/21. The new diagram shows the road/rail access pad at 23.571 km between Mitcham and Heatherdale.

(22.03.2022) Heathmont - Belgrave (SW 271/22, WN 11)

Diagram 9/22 (Heathmont - Belgrave) replaced 3/20. The new diagram shows the road/rail access pad at 29.863 km between Heathmont and Bayswater.

22.03.2022 Meredith (SW 52/22, WN 11)

Between Tuesday, 22.3., and Friday, 25.3., the Up and Down end main line points were removed.

Amend Diagram 4/99 (Bannockburn – Lal Lal).

22.03.2022 Hallam (SW 273/22, WN 11)

On Tuesday, 22.3., the level crossing at Hallam Road was replaced by a rail over viaduct. The viaduct is 394 metres long and extends from 37.333 km to 37.604 km. The existing station was replaced by a new station located on the viaduct. The new station is not yet open for passenger traffic.

Down Automatic D1133 and Up Automatic D1152 were converted to uncontrolled Home Signals and retained the same identifiers. A low speed signal head was installed on each post, but will not be commissioned.

Automatics D1176, D1181, and D1216, were abolished.

Homes HLM793, HLM794, and HLM795 were provided. Each signal displays normal speed aspects and Low Speed Caution.

Down Automatic D1223 was renumbered HLM694

A road/rail access pad named 'HLM01' was provided at 38.311 km on the Down side of Hallam.

Diagrams 13/22 (Dandenong – Hallam) and 15/22 (Narre Warren – Cardinia Road) replaced 77/21 and 1/22 respectively.

(29.03.2022) Hand points booked out of use (SW 56/22, WN 12)

When hand points are booked out of use for maintenance or safeworking purposes, the point lever must either be removed or an orange bollard placed over the lever and secured with a cable tie. This is in addition to securing the point blades by a lockable point clip or spiking the points.

Operating Procedure 135, Clause 22 (Booking out of Track) will be updated.

David Langley has sent in some pictures of the new signals at the newly commissioned Longwood crossovers on the North Eastern line. Both photos are taken looking in the Down direction; the upper photo past Homes LWD4 and LWD14, and the lower past Automatics EES1289 and ES1289. In each case the left track is the West Line (former broad gauge) and the right track the East Line.

(29.03.2022) Pakenham – Bunyip – Warragul (SW 54/22, WN 12)

Operating Procedure 126 (Pakenham – Bunyip – Warragul) was reissued to reflect the upgrade of Points A at Warragul (SW 47/22). SW 74/20 is cancelled.

29.03.2022 Victoria Park (SW 282/22, WN 12)

On Tuesday, 29.3., track machines will depart from the Maintenance Siding at Victoria Park for the absolute occupation between Clifton Hill and Mernda.

29.03.2022 Caulfield – Westall (SW 285/22, WN 12)

Between Tuesday, 29.3., and Thursday, 31.3., the Rail Network Alliance undertook Stage 01E System Acceptance Testing (Campaign 1) on the CBTC equipment installed between Carnegie and Clayton between passage of the last train each day (around 2120 hours) until 0400 the next day.

29.03.2022 Warragul (TON 135/22 & 136/22, WN 14)

On Tuesday, 29.3., Nos 3 Road (99.700 km to 100.090 km) and 4 Road (99.600 km to 100.050 km) were booked out of service due to track condition.

Both roads are available for stabling track machines. No 3 Road is also available for overflow train stabling if required and if authorised by the Eastern V/Line T&C Supervisor.

SW 1/06 & TON 167/13 are cancelled.

30.03.2022 St Arnaud (SW 57/22, WN 12)

On Wednesday, 30.3., the aerial pole line that carried the circuits to operate the level crossings at Howitt St (298.949 km), Millett St (299.420 km), Wimmera Hwy (299.656 km) and Alma St (300.023 km) was replaced by trenched cables.

The speed limit for trains passing through St Arnaud between the Wimmera Hwy and the Sunraysia Hwy will remain at 40 km/h. Notice Boards were provided for Down trains at 298.558 km (Up side of Sunraysia Hwy) and Up trains at 299.656 km (Down side of Wimmera Hwy) advising of this speed limit.

Diagram 20/22 (Bealiba – St Arnaud) replaced 12/18.

(05.04.2022) Ararat (SW 59/22, WN 13)

A locked box is provided in the Safeworking Room at Ararat for securing the Wendouree – Ararat Train Staff.

07.04.2022 Borung (TON 152/22, WN 14)

On Thursday, 7.4., the siding was booked into use for the stabling of track machines. TON 32/21 is cancelled.

11.04.2022 Melbourne Yard (SW 295/22, WN 13)

On Monday, 11.4., the Westgate tunnel project will temporarily reduce the length of the following sidings at Melbourne Yard Stabling Siding: No 2 (now 163 metres); No 6 (181 metres); No 7 (163 metres); and No 8 (158 metres). Buffer stops were provided in each affected road.

Dwarf MYD144 (No 8 Track) was raised to 1.5 metres.

Diagram 51/21 (Melbourne Yard) replaced 83/20.

06.04.2022 Seymour (SW 66/22, WN 14)

Between Wednesday, 6.4., and Thursday, 14.4., the broad gauge crossover from the Fuel Point Siding was abolished. This crossover was already out of service, and has been abolished in conjunction with track renewal in the locomotive depot. Amend Diagram 20/19 (Seymour).

(12.04.2022) Book of Rules, Section 36 (RFR) (SW 67/22, WN 14)

Section 36, Rule 6, Clause M (Signal Maintenance Technician Testing Axle Counters) was amended.

An SMT may reset axle counter track sections while an Absolute Occupation is in force. The specific resets to be performed are to be jointly agreed by the SMT, the Track Force Protection Co-ordinator, and the Train Controller. As the resets are for testing purposes, the exchange of the 'Axle Counter Section Reset' form is not required.

14.04.2022 Bendigo (SW 69/22, WN 14)

On Wednesday, 13.4., Stop Board 6 was relocated 100 metres in the Up direction. There is standing room of 60 metres between the baulks and Stop Board 6.

The Wayside Monitoring Facility was brought into service. It will operate automatically when a vehicle passes the sensor located 13 metres on both sides of the facility. Pulsed visible and infrared lasers are used to measure and record the wheels and brakes of V/Locity Units, and digital cameras to record images of the sides and roof for damage or missing components (such as body equipment skirts). No-one is to walk through the facility; if it is necessary to exit a train in the facility the Driver must walk through the train and exit the train outside.

Diagram 34/22 (Bendigo) replaced 79/21.

End£

LATTICE MAST POSTS

To my mind, there is nothing that quite epitomises Victorian Railways signalling as a lattice post, with a somersault arm, and Stevens finial. For something that is so ubiquitous and typical of the Victorian Railways it is surprising how many questions there are about these masts.

It is a curious feature of straight lattice masts that the first known constructional drawings were produced as late as 1941 – over thirty years after the masts were introduced. It is not clear how earlier masts differed from these 1941 drawings. An examination has been made of a small number of surviving masts which suggests that older lattice masts were similar, but not completely identical to the plans produced in 1941.

Further, only general information was included on the 1941 drawings about the location on the masts of standard components such as arms, ladders, lever plates, etc. This allowed a significant variation in detail placement.

Originally I had in mind to prepare some drawings of lattice masts, but it rapidly became clear that a lot more information would have to be found to make firm conclusions about lattice mast design over time. Instead, I have pulled together some photographs of the details of masts to illustrate some of the design features and vaiations. Hopefully, this will shake out more information.

Before starting it is well to mention that on lattice masts the height of a post was measured from the top of the foundation to the rivets of the first ‘zig’ of the lattice at the top of the mast – nominally this was the centre line of the topmost arm or centre of the topmost disc. We will come back to this point.

The top of the mast

Figure 1, top right, illustrates the ‘standard’ application of a somersault arm to a lattice post. (Note that this post has had its normal spectacle and lamp replaced by a blinder and reflective targets.)

The post has lost its finial, but this allows us to see the cast iron distance piece at the top of the mast. This was rivetted inside the four angles The finial slips over the top of the mast, covering the distance piece, and the holes in each face of the distance piece allow the finial to be secured.

On masts under 25′ tall, the four corner angles are 1½″x1½″x$\frac{5}{16}$″ and are positioned with the corner of the angle outwards. British practice with lattice posts was to

Figure 1. Detail of the front of the top of the Up Home from the Deniliquin line at Barnes.

Figure 2. Detail of the distance piece and top of mast, Healesville.

have the corner of the angle towards the centre of the post. A very small number of Victorian lattice posts were constructed with the angle inside, and these were probably sourced from McKenzie & Holland.

The arrangement of the top of the mast can be seen in greater detail in Figure 2, showing how the distance piece neatly sits inside the corner angles. The back of the flush rivets securing the distance piece to the angles can be seen at the top left and bottom left corners. The paint line shows that the finial, when in place, entirely covers the distance piece.

The distance piece fixes the size of the top of all masts at 6″ square (6′ 0⅛″ on masts 25′ and over due to the slightly thicker angles). Masts are slightly tapered. According to the 1941 drawing, masts under 25′ tapered approximately ¼″ per foot, and masts 25′ and over had a slightly smaller taper of 3⁄16″ per foot. The smaller taper for taller masts is probably to reduce the width of the mast at the foundation to a reasonable figure. A comparison with size of the foundation shows that the quoted taper on the drawing is for both sides of the mast; the taper on each side is half that.

The cast iron semaphore bracket is secured to the mast by four hook bolts. The standard semaphore bracket used at the top of a mast was a Type A (1B615), as seen here, however examples have been seen that use a Type C (3B615). This will be discussed later. The Type A casting had lugs at all four corners to allow it to be mounted on a 6″ wide mast. To ensure that the semaphore bracket did not slip down the mast, a 1¼″x5⁄16″ strap was rivetted to the front of the mast. The lip of the arm bracket casting rested on this strap. This strap can be seen on the right of Figure 2.

Figure 3 shows more details about the lattice work and the mounting of the semaphore arm.

The lattice work starts just below the distance piece; the topmost rivet was 4″ below the very top of the mast. The

Figure 3. Detail of the rear of the top of the Up Home from the Deniliquin line at Barnes.

lattice work always started from the left hand angle as you face a side. In 1941 the length of a lattice bay was 24″ for masts under 25′ tall, and for taller masts started at 25½″ and "gradually increased" down the mast. In practice, most of the masts I have examined, tall and short, had a bay length of 24″. This may reflect a design change at some time, or it may reflect the small number of masts examined. A bay length of 24″, incidentally, provides an easy method for calculating the height of a mast and the location of the fittings – simply count the zigs in the lattice work.

The spindle of the upper arm was normally located at the end of the first half bay of the lattice work (i.e. 16″ below the very top of the mast for masts with a 24″ bay length). The spindle was also roughly the centre line of the arm. As already mentioned, the height of a lattice post was measured from the top of the foundation to the rivets at the first half bay below the top of the mast – that is, to the position of the topmost arm spindle.

The back bearing for the arm spindle was also clamped to the angles using hook bolts. Four different varieties of back bearings were provided with different widths depending on the width of the mast where the arm was mounted:

- Back bearing 6B616 was for an arm mounted at the standard position at the top of a mast and up to 3′0″ lower.
- 7B616 was for arms 5′0″ below to 8′0″ below the top arm.
- 8B161 was for 9′0″ to 12′0″ below the top arm.
- 9B616 was for arms 13′0″ to 16′0″ below the top arm.

In all cases the 11⁄16″ mounting holes were drilled as required for the specific location; they could be varied up to ¾″ in position. The minimum distance apart was 7″ centre to centre; again nicely matching up with a 6″ width of mast. The furthest the mounting holes could be apart was 11″, which would suit a location where the mast was 10″ wide.

Interestingly, I have found no information as to which specific hook bolts were used for securing the arm to the mast. Drawing H292 showed 10 varieties of standard hook bolts.

Taller masts were manufactured with slightly heavier material. Three designs of masts were provided for in 1941; masts between 15′ and 24′ (1B934), masts between 25′ and 29′ (2B934), and masts over 29′ (3B934). Masts between 25′ and 29′ had angles that were 2″x2″x⅜″ and the bracing was rivetted to the angles with ⅜″ rivets. Masts over 29′ show the greatest evidence of change over time. In 1941, masts of this height were made of two different size angle. Approximately the lowest 18′ of the height was of 2½″x2½″x⅜″ angles and the remainder was 2″x2″x⅜″ angle. The two portions were butt welded together. Butt welding

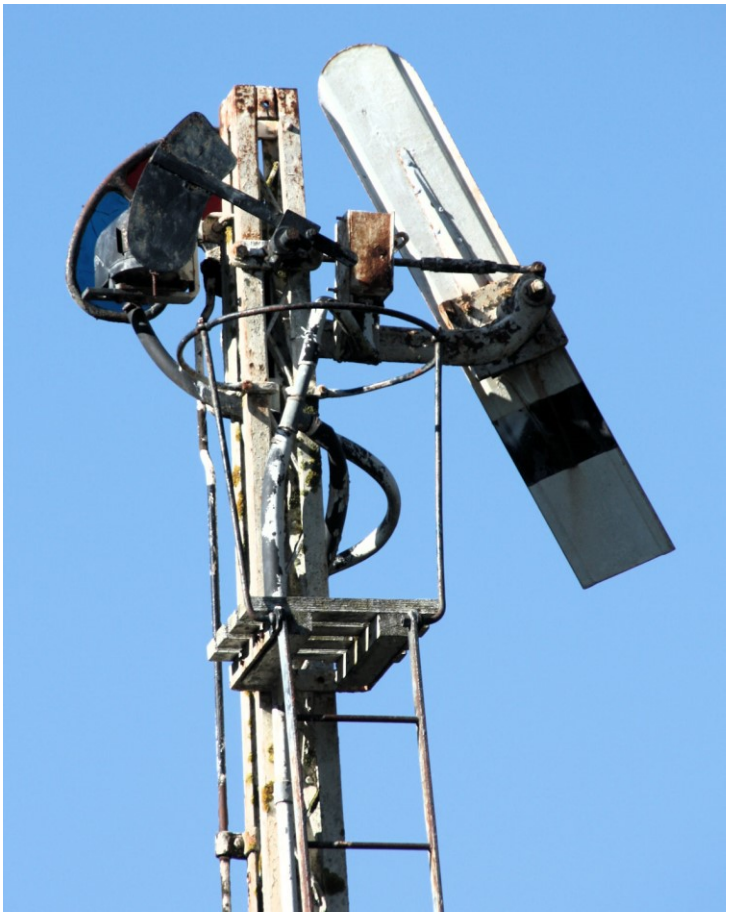


Figure 4 (above). Detail of the rear of the top of the Down Home at St Arnaud

Figure 5 (below). Detail of the foundation the Up Home from the Deniliquin line at Barnes.

would not, of course, have been used in 1910, and a 1912 calculation book shows that the 30′ and 35′ masts were originally entirely constructed of angles of 2″x2″x⅜″.

Figure 4 (top of previous page) shows the top of a 35′ mast at St Arnaud and shows the 2″ wide angles. Notice how the width of the angles are visually much wider when compared with the shorter masts, taking up two thirds of the width of the mast at the top.

Most masts were short enough to be manufactured from one length of angle. Two lengths could be fished together to make the taller masts (see Figure 9), but later masts might have had lengths of angle butt welded together. The bracing, also, was normally in one length, but multiple lengths could be joined together using a simple overlap join with two rivets.

Figure 6 (left). The bottom of a lattice mast foundation showing the lightening hollow. Notice the rough 'as cast' finish of the foundation. Healesville.

Figure 7. The Up Home signal at St Arnaud had a hollow foundation. Note the sharply defined bevel and the flat top of the foundation outside the line of the angles.

Foundations

Turning now to the base of the mast, the angles and lattice work continued below ground level. A concrete foundation was cast around the lower end of each mast (Figure 5, previous page). The 1941 drawing shows that masts below 25′ had a foundation that was 15″ square and 6 feet deep. For masts between 25′ and 29′ the foundation was 18″ square, but still 6′ deep, and for mast over this height, the foundation remained 18″ square, but the depth was increased to 6′6″. Given that this width would have had to well cover the lattice mast itself, it suggests that the maximum mast height was around 50 feet.

It is possibly that earlier masts had shorter foundations; one measured example was only 5′6″ deep.

The top edges and the vertical sides of the foundation had a roughly 1½″ bevel at about a 45 degree angle to prevent spalling of the concrete during transportation. It seems to be common to take the top edge of the horizontal bevel back to the line of the angles, but in larger bases there can be a flat space outside the line of the angles. All surfaces would have had a slight taper to allow the cast foundation to be easily drawn from the mould. The concrete top of the foundation was brought to a peak in the centre of the mast to shed water.

With a lattice bay length of 24″, and the apparent desire for mast heights in even feet, this meant that the lowest visible lattice rivet should be about the top of the foundation. This appears to be usually the case – sometimes above the level of the concrete and sometimes below.

To reduce the weight of the foundation, the 1941 drawing shows a tapered hollow, 9″ square (at the bottom) and 4′6″ deep cast into the centre of the bottom of the foundation (Figure 6, top). However, in a significant number of masts this hollow was extended the entire depth of the mast. (Figure 7, above). It is assumed that this is an older design, but confirmation is lacking.

Diagonal bracing

In addition to the vertical cross bracing, there was also diagonal bracing fitted across the mast to ensure that it remained square.

The diagonal bracing was again 1¼″x⁵⁄₁₆″ flats secured to the angles using the same rivets as the vertical bracing. In most cases, it ran from the back of one of the front angles diagonally across the mast to the back of the diagonally opposite angle (Figure 8). This method of application was probably adopted to ease manufacture. Sometimes, however, the diagonal brace was secured to the front of the front angle (see Figure 9).

According to Drawing B938, one of these diagonal braces was fitted "approximately every 5 feet" (that is, every 2½ bays of vertical bracing). However, examination of actual masts suggests that the cross bracing was applied much less frequently and not at consistent locations. Many more masts would have to be examined to determine if there was any rhyme or reason as to their application.

Sheeting

One of the criticisms of lattice masts in the UK was that the open latticework was much less conspicuous than a solid wooden post. Several means were adopted or suggested in the UK to resolve this problem – such as expensive double latticework, and even turning the post so that the corners faced the oncoming trains.

The Victorian Railways adopted a far simpler solution to this problem. Sections of 18 SWG galvanised iron sheeting were cut to the shape of the front of the mast and simply wedged between the angles and the bracing. Painted white, this was cheap and effective.

The sheeting did not cover the entire height of the mast. The exact amount to be covered was note specified on any drawing.

(To be continued)

Figure 8 (above). A diagonal brace. Echuca Wharf. The front of the post is to the left. Figure 9 (below). The galvanised iron sheeting on the Up Home from the Tocumwal line at Strathmerton. Note the diagonal brace secured to the front of the angle just above the fishplate on the left angle.

The Development of the US Train Order System

Many years ago, Jack McLean penned a lengthy and interesting article[1] in his inimitable style for Somersault on the operation of trains in North America under the Timetable and Train Order system. While an excellent introduction to the peculiarities of the TT&TO system, it did raise the question as to how it was developed and standardised over the vast North American railway system. This question has been answered by a recent academic book by Benjamin Sidney Michael Schwantes[2] on the relationship between the railroad and telegraph industries in the US. The following has been based on the arguments in that book, but considerably augmented.

The development of the TT&TO system started in the earliest days of American railroads and evolved intertwined with the railroads. Consequently, the TT&TO system exploited features of US railroad operations, and, conversely, US railroad operations were shaped by the limitations and strengths of the TT&TO system.

Operation by timetable and rulebook

Shaw[3] notes that the very first railways had a unique operating problem: they were the fastest land communication method available. Once a train left its starting point it was entirely beyond any supervision of a central authority. Further, in the US where the railroads were almost all single track, "the basic characteristic of railroading would bring trains into violent collision in the absence of any system of control"[4] Other countries started with double track lines where the hazard of head on collisions was almost eliminated. The solution in the US, as Schwantes notes, was to put in place a system of rules that controlled how trains operated.

The early development of these rules is traced by Schwantes. It seems to have commenced on the Boston & Providence Railroad where a set of 14 operational rules were written in the mid 1830s, probably by William Gibbs McNeill. These were replaced in 1839 by a rulebook written by George Whistler with 45 rules. The 1839 rules required Conductors to protect trains by flagging if they were delayed in a single line section. If an opposing train failed to appear for a meet, the conductor would hold the train for 30 minutes and could then proceed slowly into the section provided the train was protected in advance by flagmen. In 1841 Whistler, by then Chief Engineer of the Western Railroad of Massachusetts, issued a new set of rules after a major collision on the road. In these rules, the road was divided sections governed by Superintendents who had the sole responsibility to adjust the day to day running of trains within the framework of a timetable issued by the Chief Engineer. The characteristics of practices developed in this period were based on "a hierarchical, rule based management model that ensured safe and efficient train movements by placing operational authority in the hands of senior managers and by severely proscribing the ability of lower-level employees to make critical decisions or alter established protocols"[5].

To give some idea of the timetable approach adopted by the middle 1840s, here are the rules in force on the Washington 'branch' of the Baltimore & Ohio Railroad in 1845[6] relating to train movements:

> First. – No train will leave a station, under any circumstances, before the time specified in the time-table has fully expired.
>
> Second. – In cases of detention to either of the trains, the one arriving *in time* at the appointed place of meeting, will wait half an hour beyond the time fixed by the time-table for its departure, and then proceed at the established speed, taking care to keep half an hour behind, or later than the time fixed for its arrival at the several stations, until the train *out of time* is met or heard from.
>
> Third. – The Conductor of the train *out of time*, will, if his detention has been Temporary, and his Engine not disabled, proceed at the established speed until he reaches a station within no less than one hour's run of the approaching train and there lay off for its arrival (or in other words he must attain the station one hour before the time fixed by the time-table for the arrival of the approaching train at that point), and immediately dispatch a messenger to give notice of his position to the approaching Conductor. In cases where his engine, or the cars of his train, are so badly disabled as to render it impossible to proceed without aid, he will immediately send notice to the Conductor of the approaching train, and also dispatch a messenger to the nearest point from which the necessary assistance may be obtained to enable him to proceed.
>
> Fourth. – In the event of both the trains being delayed, messengers will be immediately dispatched from each, and will proceed until they meet; and after having determined on the point at which the train shall pass, which it will be their duty to do, they will return to their respective Conductors and give notice of the arrangement.
>
> Fifth. – Conductors of tonnage trains[7] must in all cases keep out of the way of passenger trains. Nor must they leave a station where a passenger train is due without first having received positive information of its position, and then only in cases

[1] Running trains by Time Table and Train Orders, Canada 1944, Jack McLean, Somersault Vol 9 No 4, p59-72, & Vol 9 No 5, p80-90

[2] "The train and the telegraph, a revisionist history", Benjamin Sidney Michael Schwantes, John Hopkins Press, 2019. This book covers the relationship between railroad and telegraph technologies in 19th century America. A significant aspect of this history is the use of the telegraph for traffic operations.

[3] "A history of railroad accidents, safety precautions, and operating practices", Robert B. Shaw, self published, 1978, p22

[4] Shaw, op cit, p22

[5] Schwantes, op cit, p12

[6] Reprinted in the Railroad Gazette, 12 March 1886 p177

[7] Probably freight trains.

> where the assistance of their Engine is wanted to enable the passenger train to proceed. Furthermore, it is particularly enjoined upon the Conductors of tonnage trains, that in cases of inability to reach the designated points of meeting, as shown by the time-table, they will lay off at some sideling at least one hour's run from the supposed position of the approaching train or trains, assuming them to be in time; and if from any cause a tonnage train is compelled to come to a halt, or moves at an unusually slow rate, and it is known to the Conductor than an Engine is approaching on the same track, he will send a messenger some distance in the rear or advance, as the case may be, to give notice of his position.

These rules give lie to the common thought that, pre train-orders, a delayed or cancelled train locked up the railroad. Trains would continue to run, albeit extensively delayed. Some of these rules can be traced forward in the TT&TO system over 100 years; the first rule, for example, that trains were prohibited from leaving a time-table point before the given time.

Another approach was contained in the rules for the Tallahassee Railroad and the Pensacola & Georgia Railroad, issued 3 April 1858.[8] The relevant rules for avoiding collisions were simple:

> Should any two trains, approaching each other, become irregular, great caution is necessary in proceeding. Run slowly and keep a signal man far enough ahead to stop safely in case of meeting. Signal man must precede the train 300 yards. As a general rule, when trains meet between stations the train nearest the turnout will run back. Any dispute as to which train shall retire is to be determined at once by the conductors, without any interference on the part of the enginemen.
>
> Trains running in the same direction and near each other, will always observe a distance of one mile.

The introduction of the telegraph and train orders

Although the telegraph became established in the US in the 1840s, it was not used operationally by the railroad to control trains until the early 1850s. Schwantes suggests this was because the telegraph network, although often built along railroad lines, was operated by independent telegraph companies, and the operators were the telegraph companies' employees. Although the railroads typically had the right to send free telegraphs, in practice this right was restricted by the priority the telegraph companies placed on their commercial traffic.

It is well known that the first Superintendent to despatch trains by telegraph was Charles Minot on the Eire Railroad in 1851, however what Schwantes makes clear is that this was no accident or improvisation. Minot had previously been a Superintendent of the Boston & Maine Railroad and, unusually, had taught himself telegraphy while on that railroad. On the Eire, Minot convinced the board of the Eire of the need to have its own telegraph line under its control and this was completed in early 1851. Schwantes notes that by late 1850 "Minot's statements indicate that he was aware of the potential value of the telegraph as a tool for monitoring railroad operations in real time. More importantly, the Eire's telegraph line provided him with an opportunity to impose direct managerial control over the actions of train crews and station agents across the entire Eire route."[9] Minot got to trial the telegraph in the Fall of 1851 while on a west bound express that had been delayed at Turners, NY., where it was scheduled to pass the eastbound express which was late. The Eire's rules specified that under these circumstances, the train was required to wait one hour and then proceed cautiously. Minot telegraphed to the next passing location, Goshen, to see if the eastbound express had passed. Learning that it had not, he instructed the agent at Goshen to hold the eastbound express there. The engineer of the westbound express refused to proceed against the rules and, the story goes, Minot took the controls himself. The experiment was repeated at Goshen and further up the line until the westbound express finally passed the delayed eastbound train.

While this event is taken to herald the commencement of Train Order operations, it was not Train Order operations as would later appear. Schwantes notes that train crews strongly objected to the new approach, but Minot calmed them by issuing written orders that "only senior managers had authority to issue train orders that ran contrary to the Erie's timetable or operating rules" and Schwantes also notes that the 1853 New York & Erie annual report stated that the "telegraph saw service primarily when excess seasonal traffic caused delays and backups on the rail line," and "the telegraph is only permitted to be used for [train dispatching], when the trains have become deranged, and then only by one person, on each division, specially authorized to perform this duty"[10]

In 1854 Minot had been replaced as General Superintendent by Daniel C. McCallum. In that year, McCallum systemized Minot's train orders, issuing a rule book to the telegraphers that laid out clear procedures for their duties. This included procedures for issuing train orders from the Divisional Superintendent to train crews. Standard messages were identified by code numbers and preprinted forms were provided to telegraph operators labelled with the codes they were used for. The rules included procedures for issuing these train orders, including the signing of some types of train order by the conductor and engineer of the train at the station they received it. The telegraph operator had to repeat the train order back to the Superintendent to check for errors. The order was not valid until all affected train crews had acknowledged their receipt. Operators were required to telegraph hourly reports on the location of trains to the Superintendent. The train locations were marked up on a tabular form as they were received, giving a convenient overview of the traffic on the division. McCallum,

[8] Portions of these rules were reprinted in The Railroad Gazette, 1901 p572

[9] Schwantes, op cit, p37

[10] Schwantes, op cit, p38 & 9

however, resigned in 1857 and the rulebook issued in that year does not show any of this sophisticated approach. Telegraphic despatching was consigned to the section of the rules "Movement of trains by special orders".

Train orders become mainstream

Despite these experiments, almost all US railroads continued to use "strict time and rule based operating practices" for operations. The American Civil War was to change that. Schwantes details the use of the telegraph to manage traffic in the war zone; only those details relevant to the use Train Orders will be considered here.

Curiously, it was not the railways in and adjacent to the war zone itself that moved to a train order system. In the areas under Union control these railways were operated by the US Military Railroad (USMRR), a section of the army. The first head of the USMRR was Daniel McCallum who certainly wished to use his telegraph based systems of railway management. However, McCallum proved to be ineffective at directing operations in the field and Herman Haupt was appointed to direct field operations. Haupt refused to rely on telegraph lines for train operation. The telegraph lines in and around the war zone were under the control of the Military Telegraph Corps. Haupt took the view that the telegraph lines were subject to disruption at any time by enemy action, and when not disrupted would be fully occupied by military traffic. Instead Haupt preferred to rely on rules and written instructions, distributed by horse if necessary. Haupt was forced out of his role, due to politics, after a year, and McCallum once again became sole director of the USMRR. However, Haupt's methods remained in use, although it appears that some lines were operated under a train order system by the end of the war.

The train order system gained ground during the civil war on the railways that remained under private control. Many of these railways saw massive increases in traffic, either directly due to military movements to and from the war zone, or by the redirection of normal commercial traffic around the war zone[11]. Increasing traffic caused congestion – and accidents – and pressured managers to look for adopt better operations methods. Schwantes makes the point that many railroads were still reluctant to adopt train order working as this entailed appointing additional staff, in particular dispatchers and night operators. They also struggled with getting sufficient access to the commercial telegraph lines, and were often forced to negotiate with the telegraph companies to install private lines for the railway's use.

One particular company, the Chicago, Burlington & Quincy Railroad, was forced into adopting a train order system around the end of 1863. Frederick H. Tubbs, the CB&Q's Telegraph Superintendent, developed a telegraph order system in which "this mixture of older and newer practices later became known as the 'American system' of train dispatching. It called for a single dispatcher to monitor traffic on each division. When delays or increased traffic disrupted the daily timetable, the dispatcher issued new train movements orders to telegraph operators. Operators then passed these new orders to the train crews who were affected by the delays."[12] This 'American system' was the forerunner of the classic US TT&TO system.

Schwantes notes that the train order system introduced new risks into train operation, specifically the human chain of intermediaries through which the train orders necessarily passed. "Station agents and telegraph operators had little influence over train movements under the old managerial framework, but under the American system they could cause accidents by failing to properly communicate train orders to crews. Likewise, dispatchers could inadvertently send trains crashing into each other if they issued conflicting orders."[13] The higher risk of error by dispatchers was not caused by them being any less careful than the Superintendents who used to issue instructions. Rather, it was due to the far greater number of instructions being issued due to the greater flexibility of operations.

> Like the military lines, many civilian railroads in the North and Midwest were overwhelmed with freight and passenger traffic throughout the conflict. A few civilian officials, echoing Haupt, continued to depend on antebellum [pre civil war] time- and rule-based operating practices to keep traffic running. Others reluctantly expanded prewar, part-time telegraphic dispatching practices to accommodate round-the-clock service. The majority of officials hastily adopted telegraphic dispatching on their lines for the first time as wartime traffic exceeded the capacity of their networks.
>
> Few managers radically overhauled their operating practices when they adopted telegraphic dispatching during the war. Instead, most simply appended basic dispatching rules to their prewar employee rule books, thus creating what came to be known as the "American system" of train despatching. The new operating framework enabled managers to move trains more expeditiously, but it did not incorporate physical or organizational safeguards to prevent collisions. Instead, it placed operational safety in the hands of a cadre of overworked and underpaid train dispatchers and telegraph operators, critical intermediaries in the "dispatching chain." Despite the risks, the new management practices alleviated much of the wartime traffic congestion and cost far less than adding additional railroad tracks. It proved to be so successful that many officials continued to depend on it after the war." [14]

A major limitation in adopting a safer version of train despatching was the telegraph arrangements on most

[11] For example, in the grain producing states west of Chicago, much of the grain was normally shipped south via the Mississippi River to New Orleans. This route was cut due to the war and all grain had to be shipped east via the railroads.

[12] Schwantes, op cit, p77.

[13] Schwantes, op cit, p78

[14] Schwantes, op cit, p81.

railways. Before the civil war, access to a telegraph system was seen as a 'nice to have' rather than a necessity. Railways consequently signed agreements with telegraph companies where railways allowed the telegraph companies to use their right-of-way in return for free railway use. While in theory this should have supported the use of telegraph train orders, there were two problems. The first problem was that the telegraph companies[15] preferred to use the line capacity for their own commercial traffic, rather than to transmit the free railway telegrams. The consequent delay to the railway telegrams impeded the deployment of time critical and telegraph intensive safeworking systems. As an example of the tensions between the railroad and telegraph companies over the use of the telegraph wire, Schwantes notes an article in the 'Journal of the Telegraph', the biweekly Western Union company magazine, which stated that the problem was that the railways used the telegraph system inefficiently and highlighted the practice of repeating back train orders as a prime example. As we shall see in the third section of this chapter, repeating back train orders was an essential component of the safety of train order operation.

The second problem was that the telegraph companies naturally staffed their telegraph offices on the basis of commercial need. The telegraph service to wayside stations consequently shut down at night. The train service, however, was a twenty four hour operation. This meant that for a significant part of the day the ability to deliver train orders, and receive reports, was extremely limited.

Schwantes leaves these issues hanging, but it appears that the solution adopted was a separate railway wire, with the station agents, railroad employees, working as telegraph operators. Indeed, at smaller locations, the railroad agents replaced telegraph employees and handled the commercial traffic, for which the railroads received a benefit. This development meant that railroad agents at smaller locations had to be competent telegraphists, adding a significant skill requirement to the position. The problem of the mismatch between commercial hours and railroad hours was never fully solved. Railroads wished to minimise the number of operators, particularly night operators, to minimise costs. This meant that night operations often had lengthy gaps between staffed stations and placed a premium on railroad operating practices that allowed trains to meet and pass without ground staff.

(To be continued)

The late afternoon sun shines through the window of the signal bay at Avenel when the Society visited on the occasion of the 1989 Showday tour. This tour took in all the then remaining signal boxes between Wangaratta and Avenel. Photo Andrew Waugh

[15] By the late 1860s the telegraph industry had consolidated, and many railroads had contracts with one large telegraph company, Western Union. Only a few railroad companies had the financial, administrative, and legal presence to negotiate as equals with the Western Union.