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SIGNALLING RECORD SOCIETY (VICTORIA)

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Deadline for July 1990 issue is 10 June 1990.
NEXT MEETING: Friday, 18 May 1990.
VENUE: Uniting Church Hall, Hotham Street, Mont Albert, commencing at 20.00 hours.

MINUTES OF MARCH 1990 MEETING.

HELD AT: Uniting Church Hall, Hotham Street, Mont Albert.

HELD ON: Friday, 16 March 1990.

MEETING COMMENCED: after the conclusion of the Annual General Meeting.

PRESENT: Jack McLean, Wilfrid Brook, Jon Churchward, Glen Cumming, Alan Jungwirth, David Langley, Andrew McLean, Colin Rutledge and Rod Smith.

APOLOGIES: Peter Brook, Jim Brough, Graeme Inglis, Roger Jeffries, Greg O'Flynn, Andrew Waugh and Rob Weiss.

MINUTES OF PREVIOUS MEETING: adopted as read out. (Cumming/Rutledge)

BUSINESS ARISING:

1. Glen Cumming has arranged a suburban signal box tour for Saturday, 21 April 1990, from Royal Park to Upfield.
2. The Department of Labour and Industry inspected the lop brackets at Rockbank and Melton and were not impressed - reason unknown.
3. The up automatic signal at Melton shows green over red even when the up departure signal is at stop and some discussion followed.
4. The question was asked as to the reason for installing light signals at Melton and Rockbank. It was suggested that if the semaphores had been retained then motors would have had to be fitted.

GENERAL BUSINESS:

1. The Eastmalvern collision in 1951 was between the 1737 down empty cars and the 1755 up Glen Waverley.
2. The Spencer St. South End signal box has been fully decommissioned, and on Tuesday 13 March was being used as a shunters cabin.
3. The question was raised as to how we should reproduce *The Signalling Record* (UK SRS) as at present production is inferior in quality to the UK produced magazine. It was suggested that a number of copies be sent in bulk for local distribution. Negotiations to take place with SRSUK. (A.McLean/Smith).
   Further discussions followed on how to reproduce the magazine in the event of being unable to obtain original copies.
4. The statement was made that there is one staff and ticket section left on V/Line, but ths was disputed. Finally, the following staff and ticket sections were listed:-
   Mildura-Yelta, Springhurst-Rutherglen, Bendigo-North Bendigo Junction, Castlemaine-Maryborough-Ararat, Ouyen-Cowangie-Pinnaroo, North Geelong C Box-Warrenheip (Sundays only and no tickets), Long Island Junction-Long Island and West Tower-Webb Dock.

The meeting then adjourned at 2200 hours to the garage at 60 Kenmare Street, Box Hill North, where supper was served and further slides of trains and signals in Victoria and South Australia from David Langley's collection were shown.

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SIGNALLING ALTERATIONS

22.1.1990 UNDERGROUND LOOPS. Speed boards were provided in the underground loops as under:-

	BURNLEY LOOP		
Spencer Street-Flagstaff	3.260km-3.700km	40km/h	
	CAULFIELD LOOP		
Spencer Street-Flagstaff	3.250km-3.700km	55km/h	
	CLIFTON HILL/CITY CIRCLE LOOP		
Spencer Street-Flagstaff	3.270km-3.760km	55km/h	
Museum-Parliament	5.200km-5.700km	55km/h	
Parliment-Jolimont	6.340km-6.700km	55km/h	
	NORTHERN LOOP		
North Melbourne-Flagstaff (West Lead)	2.890km-3.050km	55km/h	
North Melbourne-Flagstaff	3.390km-3.640km	55km/h	
Museum-Parliament	5.250km-5.720km	55km/h	
Parliment-Flinders Street	6.220km-6.700km	50km/h	(O 2019/90)

26.1.1990 RINGWOOD. Up signal L828 was converted to a home signal and renumbered 828. Amend diagram No 53'86. (O 2026/90)

1.2.1990 DIGGERS REST-SUNBURY. Flashing lights were brought into service at Watsons Road level crossing at 34.098km. Healthy state lights were provided. (O 32/90)

1.2.1990 SYDENHAM-DIGGERS REST. Flashing lights were brought into service at Calder Park Drive level crossing at 25.777km. Healthy state lights were provided. (O 33/90)

4.2.1990 TOTTENHAM YARD. The second siding in the repair sidings was shortened about 40m and baulked. A connection was made from the thrid repair siding to No 7 road East Yard. No 8 road was shortened by about 40m and connected with No 7 road about 15m on the upside of the new connection to the repair sidings. A notice board lettered " TRAINS MUST NOT PASS THIS POINT UNTIL INSTRUCTED BY YARD STAFF" has been erected at the fouling point of No 8 road. (O 76/90)

5.2.1990 FLINDERS STREET. No 10 road was booked out of service until further notice. A baulk was placed across No 10 road opposite signal 948. Signal 943 and 948 are unable to signal moves towards No 10 road. (O 2044/90)

WN6/1990 MURRAWA. The down end points have been spiked out of service until further notice. (O 44/90)

WN6/1990 SHUNTING OPERATIONS. Commencing forthwith shunting staff must not ride foul but must ride on the end steps of wagons or walk on the ground. Locomotives must not exceed a speed of 15km/h during shunting operations. (O 39/90, O 41/90)

13.2.1990 GHERINGHAP. The up distant post 7 on the Maroona line was converted to a home signal and the existing up home signal post 6 abolished. Lever 3 was abolished. A location board was provided 1000 metres in the rear of post 7. Amend diagram No 28'88. (O 47/90)

WN7/1990 ARARAT. Signalling diagram No 6'90 became effective aand diagram No 10'85 was cancelled. The diagram shows the "As in service" situation. (O 51/90)

14.2.1990 WOODEND. The following alterations were carried out:-

1. Signal posts 3, 3B, 3C, 4, 4B, 5, 5B, 7, 7B, 11 and 11B were abolished.
2. Points 10, 26, 27, 28 and 29, catch points 12, 13 and 31 were abolished.
3. Sidings A, B and C, and Nos 1, 2 and 3 roads were abolished.
4. The main line crossovers and the connection to the loco yard (formerly points 9, 20 and 30 respectively) were converted to hand operation via WSa levers and secured by hand locking bars and padlocks. A Hayes derail was provided in the lead from the loco yard. The keys to the padlocks are kept in the SM's office.
5. Levers 3 and 40 became pilot levers.
6. Levers 4, 5, 6, 7, 9, 10, 11, 12, 13, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32 and 33 were sleeved normal.

Amend diagram No 16/40. (O 45/90)

17.2.1990 FLINDERS STREET. Posts 329 and 339 were relocated to ground masts.

18.2.1990 FLINDERS STREET. Posts 145 and 153 were relocated to ground masts. The co-acting signals for these signals were abolished. Post 311 was converted to a short ground mast. Amend diagram No 21'89.(O 2060/90)

WN 8/1990 REGULATION 271A. Instructions issued on 25.2.1990 regarding the new regulation 271A concerning Infrastructure Maintanence operations in the "Clearly Defined Suburban Area".

23.2.1990 COBURG. A lever lock was provided on lever 2 and will prevent lever 2 from being placed fully normal until the signal is proved normal. (O 2089/90)

WN 9/1990 MACLEOD. Indication lights were provided on the control panel to indicate the position of the Car Siding security gates. A red indication is displayed when the road access gate is closed to road traffic but no indication when it is open. A yellow indication is shown when the rail access gate is open to rail traffic and a red indication when it is closed. (O 2090/90)

25.2.1990 SPENCER STREET No 1 and SOUTH END SIGNAL BOXES. The points and signals in the west yard worked from South End box were connected to a control panel in No 1 signal box. The alterations were:-

1. Points 45 and 50 became 255 and 257.
2. Plunger 46 and lockbar 51 were abolished.
3. Dwarf signals 49 and 52 became dwarf light signals 262 and 254.
4. Home signals 56 and 59 on No 4 road became No 260 and 256.
5. Two new three position home signals were provided in No 5 road. Post 252 will apply from No 5 South towards No 5 or No 4A road.
6. Levers Nos 45, 46, 49, 50, 51, 52, 53, 54, 56, 57, 58 and 59 were sleeved normal.

The above alterations will be shown on diagram No 4'90 which will be issued shortly. (O 55/90)

27.2.1990 COLAC. Post 1 was renewed insitu. The new post is 1.7m higher than the former mast. (O 91/90)

3.3.1990 MURTOA-HOPETOUN LINE. The points at both ends of COROMBY, NULLAN, BATCHIA, LAH, GALAQUIL, BEULAH SUB TERMINAL, ROSEBERY and GOYURA will be converted from small points lever operation to WSa levers. The points will continue to be secured by Master Key locks. In addition the rodded catch points at LAH and GOYURA will be replaced by hinged derails. (O 81/90)

5.3.1990 SPENCER STREET PASSENGER YARD. Signalling diagram No 4'90 (Flinders Street to North Melbourne) became effective and diagram No 12'84 was cancelled. The alterations were as follows:-

1. South End signalbox was abolished and the points and signals in the Centre Yard are now worked from the relay control panel in No 1 signal box.
2. All points and catch points were converted to power operation and renumbered as follows:-
   a) points 20, 23, 24 and 33 became 245, 241, 231 and 233 respectively.
   b) catch points 19 and 22 became 247 and 243 respectively.
3. All signals were renumbered as follows:-

Old No	New No	Old No	New No	Old No	New No	Old No	New No
2	236	10	240	27	230	31	232
5	242	U14	250	28	246	36	244
9	248	U15	238	30	234		

(O 74/90)

6.3.1990 BALLARAT C BOX. The points leading to the Works Depot Siding were spiked normal. Lever A was sleeved normal. Amend diagram No 22'82. (O 83/90)

7.3.1990 TALLYGAROOPNA. Flashing lights were provided at Victoria Road level crossing at 198.767km at the up end of the station. Healthy state lights are provided and the necessary notice boards associated with Level Crossing Predictors were also erected. (O 100/90)

WN 12/1990 SULKY LOOP-TALBOT. Signalling diagram No xx'90 became effective and diagram No xx'xx was cancelled. (O xxx/90)

WN 12/1990 CHROME LOOP-PORTLAND. Signalling diagram No xx'90 became effective and diagram No xx'xx was cancelled. (O xxx/90)

WN 12/1990 LANGI LOGAN-JACKSONS LOOP. Signalling diagram No xx'90 became effective and diagram No xx'xx was cancelled. (O xxx/90)

6.3.1990 MEATIAN. The down end rodded catch point was replaced by a hinged derail whilst the up end safety point is now secured by a hand locking bar pin and padlock. (O xxx/90)

x.x.1990 MOONEE PONDS. Pedestrian boom barriers were provided on the upside of the level crossing and the down side boom barrier mast was moved 3m in the down direction due to road works. (O xxxx/90)

8.3.1990 SHEPPARTON. A closing lever, lever B, was added to the interlocking frame. A 5P key switch ws provided at the down end of the platform so that signal No 10 can be cleared when the interlocking is switched out. Amend diagram 6'88. (O 102/90)

12.3.1990 RINGWOOD. Signlling diagram No 1'90 (Blackburn-Ringwood) became effective and diagram No 53'86 is cancelled. The diagram is issued for the conversion of L828 to a non-lever controlled home signal No 828. (O 2135/90)

15.3.1990 MORDIALLOC. Dwarf signal post MOR715 (from the Track Machinery siding) was relocated 12 metres in the up direction. Amend diagram No 63'87. (O 2174/90)

22.3.1990 BIRCHIP. Signal posts 1 and 5 were abolished. The miniature annett locks on the up and down end main line trailable points were removed. The E and F type locks on the siding points were replaced by ST21 type locks. The 5P key switches for posts 2 and 3 were relocated to the up end fouling point of Birchip Loop. (O 131/90)

23.3.1990 ARNOLD, BOORT and CHARLTON. Bi-directional end of train detection was brought into service. Locos and trains must be provided with a modified end of train marker. (O 120/90)

26.3.1990 LALOR-EPPING. 50 km/h speed boards were provided at 21.830km and 21.930km between Lalor and Epping. (O 2193/90)

26.3.1990 FLINDERS STREET. A Guards indicator for signal 583 (west end of No 6 road) was provided on the indicator cabin of plat 6 & 7. (O 2225/90)

28.3.1990 LYNDHURST. Healthy state lights were provided at Lyndhurst Road level crossing. (O 143/90)

28.3.1990 LYNDHURST. Flashing lights were brought into use at Abbotts Road

WN 13/1990 RULES AND REGULATIONS. Existing clause (a) of Rule 21, p489 is deleted and replaced by the following. 21(a) At any station where vehicles are to be detached, the second person or shunter must, whenever practicable, before detaching the vehicle(s) concerned,, ensure that the air brake is fully released on the portion to be detached and then apply sufficient handbrakes to secure that portion.
In all cases, after the handbrakes are applied and before disconnecting the locomotive, the second person or shunter must request the driver to make a service brake application and then open the brake pipe cock on the leading vehicle of those to be detached to allow all the brake pipe air to escape. (O 147/90)

3.4.1990 QUAMBATOOK. The up and down home signals and plunger locking was removed and the main line points fitted with master key locks. Hinged derails were provided in No 2 road. (O 127/90)

3.4.1990 WARRNAMBOOL. The crossover from No 2 road to shed siding was abolished. The diamond in No 1 road was replaced by a turnout leading to shed siding. A small point lever was provided rodded to derail in siding and secured with a B pattern annett lock.(O 169/90)

6.4.1990 GEELONG-SOUTH GEELONG. The following alterations were carried out:-
1. The fixed signals on posts 7 and 8 at South Geelong will display the proceed indication after control lever No 132 at Geelong A signal box has been reversed.
2. Control lever No 132 at Geelong A signal box must be reversed after up home signal lever No 130 has been reversed.
3. For up movements to Nos 2 or 3 roads at Geelong, the medium speed aspect will be displayed on the up home signal at Geelong (Post 130) after a train or light locomotive passes the up home signal (Post No 8) at South Geelong.
4. For moves to the car sidings, a running low speed will be displayed provided there is no obstruction between post 130 and derail 127. Should there be an obstruction then the low speed signal will be time delayed for 50 seconds after the move has been brought to a stand at post 130.

Amend diagrams Nos 46'89 Geelong and 38'89 South Geelong. (O 187/90)

10.4.1990 BROADMEADOWS. The home signal on post 19 was converted to a light signal. Amend diagram No 3'89. (O 195/90)

WN 15/1990 RULES FOR TRAIN ORDER WORKING - Clarification of Rule 22.
The rule states:- "Where a train with more than one locomotive (or two or more light locomotives) are required to run to an intermediate siding and return, the numbers of the leading and trailing locomotives must be shown on the Train Order. In this case only one train order is required. Should it be necessary for a train to run to an Intermediate Siding and return, and the train describer number of such train alters according to direction, both train describers much be shown on the Train Order."
The above clearly implies that a Train Order may be issued for a train to proceed from a crossing station to an intermediate siding and return to that crossing station, and is the only ocasion that a return train order is to be authorised.
The above does not permit a train proceeding to the intermediate siding and locking away for another train to pass.
This is only permitted at Hamilton, Stratford Junction and Glenburnie.

WN 15/1990 RULES FOR TRAIN ORDER WORKING - BIRCHIP LOOP. Except as shown hereunder whenever it is necessary for a train to foul the running line outside the facing points at Birchip Loop, the driver must be in possession of a train order for the section in advance.
Exceptions. The above will not apply when:-
1. when the driver is in possession of a through train order.
2. when in accordance with Rule 23 a train order to shunt to the Location Board is issued by the train controller.
Insert as new instruction page 41. (O 199/90)

11.4.1990 FRANKSTON. The disc on post 7 was repositioned to improve signal sighting. (O 197/90)

WN 15/1990 RULES FOR TRAIN ORDER WORKING - Stabling or otherwise of On Track Maintenance Machines at specially locked sidings.
When it is necessary for On-Track Maintenance Machines that are working in a section under their own protection to enter onto or stable clear of the running line and such machines exit from or stable in an intermediate specially locked siding, the following instructions will apply:-
(a) (i) the Road Foreman in Charge of the Machines must obtain possession of a master key from the nearest signalman.
(ii) the signalman must enter in the Train Register Book across the figure columns the number of the master key in possession of the Road Foreman. Both the Road Foreman and the signalman must sign the entry in the Train Register Book.
(iii) it must be distinctly understood by all concerned that the Road Foreman will be personally responsible for the safe custody of the master key and for the security of the main line points after every move into or out of the specially locked siding by the track machines.
(iv) when the work has been completed for that section and the On-Track Maintenance Machines move to another area, the Road Foreman must return the Master Key to the signal box from which it was received whereupon the signalman will make a notation in the Train Register Book that the Master Key has been returned. Both the signalman and the Road Foreman must sign the entry.
NOTE:- During the time that the machines are occupying the siding, the train controller must, if practicable, advise the drivers of all trains passing or to work at the siding that the machines are in the siding.
(b) On-Track Maintenance Machines departing the Specially Locked Siding.
Prior to the machines entering the main line from the siding the Road Foreman must confer with the Train Controller, obtain the latest train running information and receive the Train Controllers permission to enter upon the running line.
Before the machines enter the running line they must be protected in accordance with Regulation 271.
After the machines have entered the running line, the points must be restored to normal and locked. The Road Foreman must then withdraw the Master Key and test the points, and then must inform the Train Controller that the points are secured and tested for the running line, and that he is in possession of the master key No .... The Train Controller must endorse this information on the Train Control Graph.
(c) On-Track Maintenance Machines stabling at Specially Locked Sidings.

When the machines are to stable in clear of the running line at a specially locked siding, the Road Foreman must, after the machines are clear of the running line, restore the points to normal withdraw the master key and test the points.
When the points have been tested, the Road Foreman must inform the Train Controller that the machines are clear of the main line, that the points have been tested, and that the master key No .... is in his possession. The Train Controller must endorse this information on the Train Control Graph.
Insert the above on page 30, Book of Train Order Working Rules. The above is effective forthwith. (D 152/90)

WN 15/1990 GENERAL APPENDIX - Geelong Yard Working. Delete existing instructions under above heading page 248 (right hand column), page 249 (left hand coumn) and insert the following:-

Geelong - South Geelong

1. (a) The signalman at Geelong A box controls the section of line between Geelong and South Geelong.
   (b) When a Down train or locomotive departs towards South Geelong, no other train or locomotive is to be allowed to foul the track from which the movement was made, nor must the points at the down end of Geelong yard be altered until the departing train or locomotive has arrived at South Geelong.
   (c) Should a train be stopped in the tunnel owing to the train stalling the following instructions must be observed by the Locomotive Crew:-
      (i) Immediately the train comes to a stand the Driver must secure the locomotive and observe the air pressure and air flow gauges. If the gauges indicate that the train is complete, the Driver must at once inform the signalman at Geelong A box by means of the end to end radio, and commence to set the train back.
      (ii) The signalman, on being informed by the Driver that the train is setting back, must at once place the up home signal No 130 to the proceed position to permit the train to set back into the road from which the train departed.
   (d) The signalman at Geelong A box must not allow any up train to depart from South Geeong unless the line is clear to the up home signals - posts 16, 17 and 19 - nor then until the points have been set for the clear road and the up home signal No 130 has been placed to proceed.
   (e) After the up train has departed South Geelong, no obstruction of the line must be permitted at Geelong until the train has arrived complete into the road for which it has been signalled.

2. Down Freight Trains.
Except where instructions are issued to the contrary, all Down Freight trains must be routed via the patform tracks.

3. Failure of Signals.
(a) A signalmans caution order form 2377 is to be used in all cases of signal failures between Geelong and South Geelong.
(b) If either the home signal No 8 or dwarf signal No 7 at South Geelong fail, the signalman at Geeong A box must, after assuring himself that the section is clear and that No 132 control ever is in the reverse position and that signals Nos 122, 124, 126 and 128 are in the normal position, dictate a caution order to the signalman at South Geelong.

(continued on page 58.)

LEVEL CROSSING PROTECTION

7.5 TRACK AND SIGNAL CONTROLS (THIRD PHASE)

The first boom barriers listed for 1971 in Table 7.3 (Page 11, Jan 90) are those at Keon Park, still then spelt as one word. A fragment of the layout is shown in Figure 7.10 so that the problem with a double-to-single line junction can be discussed. Home signal 18 when at Stop necessarily cuts out the effect of the Down approach and outer approach tracks, so that the booms cannot be held down automatically for a Down train while an Up goes through; the booms will rise as soon as the latter clears the crossing. At Keon Park the problem was overcome by providing an electrical switch for holding down the booms, to be operated manually by the signalman.

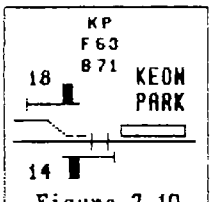

Figure 7.10

The problem had arisen at Prospect Hill Road, Riversdale, in the mid-1960s when Down Alamein trains were first scheduled to run via the two-way Up line from Camberwell. Passengers waiting in an Up train (and this happened often enough) had to wait further after the Down arrived until the booms had gone up, stayed up for 25 saconds, and come down again. Probably no provision was made to hold the booms down because when they were provided in 1959 at the same time as the flyover it was expected that the former single line would be used in the Down direction only by Goods trains shunting at Camberwell. However no provision had been made 20 years later, and as far as is known none still has.

The position arose also at Westgarth when the booms were provided and the box abolished in favour of a Control Panel at Clifton Hill B (1968). However it is understood that the former LL & TC Control lever was replaced on the new Panel, and that when operated suitably this holds down the booms for an Up train. For Fern Tree Gully, where similar circumstances arose later (1977), a three-position "Traffic Direction Lever" No 2 was provided on the Panel at Upper FTG. This was moved to the Left to set the points and signal (2L) for an Up train, and to the Right for a Down (2R). If moved from L to R while an Up was passing over the points the booms could be held down for the Down.

Although not so obvious, the same problem apparently occurred at Cheltenham where a Down terminating train which was delayed while an Up went through had to wait still further for the booms at Park Road to go up and come down again before it could run through the facing crossover. A push button to hold down the booms was eventually provided in 1988 (10 Aug).

Reverting to 1971 projects, the existing booms crossing at Elgar Road was grade-separated (15 Aug) and major alterations made to the controls at Union Road, Surrey Hills, and Mont Albert Road, in conjunction with provision of a third track between East Camberwell and Box Hill (19 Dec). The new controls were quite complex and admittedly not fully understood by the writer, but no paper on Boom Barriers would be complete without some description of them. The three tracks were arranged Down, Centre (two-way), and Up, but to avoid undue clutter in Figure 7.11 only the Down and Centre lines are included, and only the Down direction signals are shown; other changes have been made to the general style of diagrams in Part 7 to assist readability.

The Down line is equipped with 4-aspect Light signals displaying the sequence G/R-Y/G-R/Y-R/R arranged to give a headway of 2 minutes for stopping trains; maximum speed is 65 km/h. The Centre line has 3-aspect Light signals spaced to give a headway of 2 minutes for express trains at a maximum speed of 80 km/h, or of 3 minutes for stoppers. The normal use of the Centre line was for Up expresses in the morning peak, Down trains in the off-peak, and Down expresses in the evening peak. A stopper or an express might however run on any track, and both crossings have selective speed control on all tracks; signals protecting the crossings therefore normally show Stop. The Centre line is worked under the Lever Locking and Track Control system (a technical description of this particular application is given in

SOMERSAULT vol 5 no 4, July 1982) but the intermediate Automatics, although normally at Stop, are shown in Figure 7.11 displaying the aspects which apply after a Down train has left Camberwell and is ready to pass signal H367 on the extreme left.

Down trains are timed through Canterbury to set the controls for Union Road (UR) for an express or a stopper. In Figure 7.11, an express on the Down line on passing point A causes signal L397 to clear to G/R, and L393 and L389 follow suit. The booms at UR start when the express passes C. A stopper causes L397 to clear when it passes B, and the booms start when it passes D. On the faster Centre line an express causes H393 to clear when it passes J, and the booms at UR start when it passes L. A stopper causes H393 to clear when it passes K, and the booms start when it passes M. There are no insulated joints at this point which is determined by timing; it occurs about 10 to 12 seconds after a suburban electric passes L.

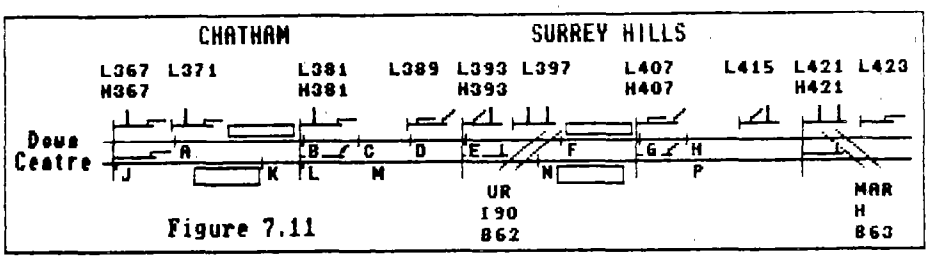

Figure 7.11

Considering now the booms at Mont Albert Road (MAR), an express on the Down line causes L421 to clear when it passes E, and the booms start when it passes G. A stopper causes the signal to clear 40 seconds after it passes F, and the booms start when it passes H. On the Centre line an express causes H421 to clear when it passes M and the booms start when it passes N or a few seconds later. A stopper causes the signal to clear 40 seconds after it passes N, and the signal clears when it passes P; this also is without insulated joints.

The stopping approach tracks on both lines for both crossings (starting from D, H, M, and P) seem to be made as short as safely practicable. The 40 seconds delay at Surrey Hills might be imposed for two reasons, to ensure that the train really was a stopper - if it beat the timing then L421 would remain at Stop until the train had passed H and the booms had come down - and as a method of shortening the stopping outer approach track. Section FH would be much longer than 35 seconds having in mind the station stop, and GH would be too short; the delay enabled the starting point to be effectively between F and G.

The booms at Royal Park (1971) were one of the few sets at stations not equipped with speed control, but signal C226 near the box was controlled by a miniature lever in the office to hold trains if required during special traffic. At about this time externally-mounted 5P key switches were introduced generally as a means of controlling booms through the protecting signal.

The crossings listed at Clayton (1971) and Hughesdale (1972) were equipped with co-ordinated Traffic Lights. As with those at Blackburn the T/L controls were closely integrated with the train movements, and at these three places the Railways maintained the whole installation. Provision of the booms at Hughesdale led to control of signals D441 and D474 by adjacent boxes.

The booms at Charman Road, Cheltenham (1972), were installed in conjunction with three-position signalling from Highett suitable for a maximum speed of 96 km/h, and enabled the mechanical lever frame to be replaced by a Control Panel in the station office. New Up Home signal No 12 which protected points and the existing booms at Park Road, now converted from manual to automatic control, cleared when the boom arms began to drop. Down trains could now arrive in the Up platform, requiring the unusual provision of a three-position Home signal, No 14, fixed at Stop to protect the booms at Charman Road and the Up line towards Mentone. The interlocked gates and signal box at Highett were unexpectedly retained although there were now Automatic signals on both sides.

In 1973 (28 Oct) the existing booms at Cherry Street (CS), Werribee (Figure 7.12), were converted from manual to automatic control in conjunction with completion of three-position signalling through the station; the two-way East and West lines on each side were already worked under the Automatic and Track Control system. The points were also now converted to power operation and the mechanical interlocking frame replaced by a Control Panel.

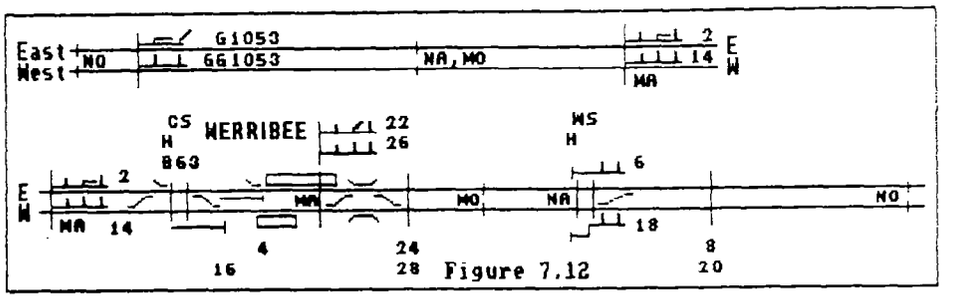

Figure 7.12

A new idea was adopted here for speed control of the booms approaches. Whether the train was to stop or not, if the signal protecting the booms showed a Normal Speed aspect then an approach calculated for 112 km/h applied, but if it showed Medium Speed then an approach for 40 km/h applied. The diagram is to be read from the top left, signals 2 and 14 being repeated on the bottom left. The beginnings of the Normal Speed and Medium Speed outers and approaches for both directions are marked on the diagram as NO, NA, MO and MA. Only the posts or bridges carrying the Up signals are shown, but the numbers are given along the bottom of the diagram. For movements through the high speed crossover at the Down end near the Werribee Street (WS) hand gates signals 26 and 18, or 8 and the preceding Auto G1178, showed an illuminated '40' with the Y/G and R/G or R/Y aspects; this meant that the crossover could be taken at 64 km/h (40 mph).

In Figure 7.12 it is assumed that levers 2, 22, and 6, which work signals on the East line, are operated but that the Gatekeeper's control at WS is applied to 6. A Down train thus passes signal G901 (off the diagram to the left) at G/R, and then as shown passes G1033 at Y/G, 2 at R/G, and 22 at R/Y unless by this time the gates have been opened and the control released. An explanation with comments follows on this unusual "aspect sequence" for a straight route G/R-Y/G-R/G-R/Y-R/R, but it is a diversion from the topic of Boom Barriers. The same sequence is thought to apply when Up signal 1/16 at Deer Park is at Stop.

The signal sections from Automatics G1033 and GG1033 at the top left in the Figure to Homes 2 and 14 are 3677 ft (1117 m) in length, near the minimum for 112 km/h running by locomotive-hauled trains. Homes 2 and 14 are repeated on the lower left and these are followed by two much shorter sections, to 22/26 and thence to 6/18. If signal 6 is at Stop then 22 cannot show better than Medium Speed Warning (R/Y), but the section from 2 is too short for 2 to show Reduce to Medium Speed (Y/G) for 112 km/h to 40 km/h, and so the best it can then show is Clear Medium Speed (R/G). Auto G1033 then shows Reduce to Medium Speed. Up signals display similar aspects - if 4 is at Stop, 24 shows R/Y and 8 shows R/G.

The distance from signal 2 to 22 is 2145 ft (647 m) and from 22 to 6 is 1921 ft (572 m), so that the total from 2 to 6 is greater than that from G1033 to 2. A deficiency with the existing system was that where a train needed two signal sections to stop, there was no way that it could pass the intermediate signal for a straight-ahead route at a speed greater than 40 km/h. Braking distance is proportional to the square of the speed V, and it is easy to prove that if the intermediate signal is at the half-way point then it would need to be passed at a speed v equal to $V/\sqrt{2}$ which approximates to 0.7V. Thus in the particular case of Werribee if a train passed 2 at 70 mph (112 km/h) then with uniform deceleration to stop at 6 it would pass 22 at around 50 mph (80 km/h).

Victoria had already modified the signalling system by allowing an illuminated '40' light to be displayed in association with Y/G and R/G or R/Y aspects for diverging movements through a high-speed crossover. This had been done at Altona Junction (1967), Newport South Junction (1968), Werribee (1970, as mentioned above), Box Hill (1971), Little River (1972), and Lara (1973-20 May). One of the signals equipped at Lara, No 2, applied for a straight route, the first example the writer knows about. A '40' light would not be suitable for 2 and 22 at Werribee because of the higher speed, but introduction of a '50' light might be considered a source of confusion and possible danger. The British system has an advantage here with its sequence Double Yellow - Single Yellow - Red, in that the speed at passing Single Yellow is not specified.

An unfortunate effect of the Werribee system, which was experienced more than once by the writer, was that a Down train had to slow at G1033, unreasonably early for passengers, but also too early for the hand gates to block the road. The position was relieved in 1976 (24 Oct) when the gates at Werribee Street were replaced by automatic booms, and signal 6 could be cleared well in advance.

The point is made above that in the Victorian system a signal showing R/Y with a '40' light for the straight road can be passed at a speed of up to 40 mph (65 km/h), but that there seems to be no method of authorising a higher speed. However good use was made of the '40' light in the three-position signalling installed in 1974 (10 Nov) between Glenhuntly and Bentleigh. The signal box at Ormond, which already had automatic booms, was abolished concurrently, and two weeks later the boxes at McKinnon and Bentleigh were also abolished when automatic booms were provided replacing interlocked booms or gates.

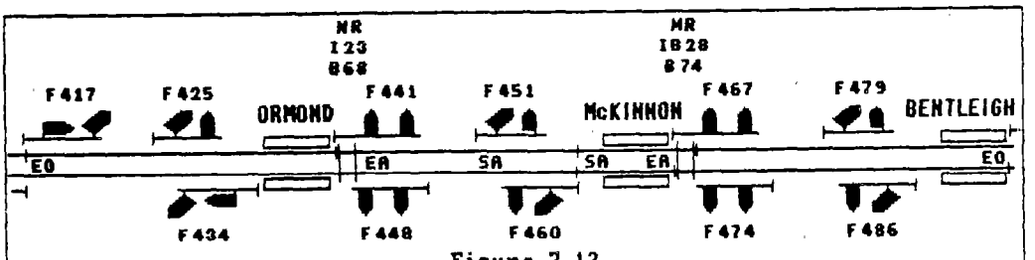

Figure 7.13

In Figure 7.13, North Road (NR), McKinnon Road (MR), and Centre Road (just outside to the right) were evidently surveyed to be at half-mile (800 m) intervals. With four three-aspect signals between Ormond and Bentleigh the spacing would be suitable for 50 mph (80 km/h) running (minimum required spacing about 1250 ft (380 m)). But the Railways did better than this and provided four-aspect signals at the same spacing showing the sequence G/R-Y/G'40'-R/Y'40'-R/R. It took a long time to realise that this signalling was suitable for 60 mph (96 km/h) running, the four aspects being necessitated by the closeness of the stations. Elsewhere on the Frankston line, three-aspect signalling can be used for 96 km/h because the minimum spacing of about 1800 ft (546 m) is achievable.

To avoid congestion in the Figure, the booms controls are shown in the Down direction only for McKinnon Road and in the Up direction only for North Road. A delay of 12 seconds occurred after a Down stopper passed SA before the booms started, and a similar delay applied at the other stations. Signal F474 changed to Y/G and F486 to G/R, about 30 seconds after an Up entered Bentleigh platform or about 10 seconds after it stopped; similar behaviour occurred at McKinnon. This would be for the same reason as the 40 second delay at Surrey Hills. The booms started about 15 seconds after the train passed F486 or F460. The SO would start when the signal changed. Class of train is selected by PB at at Glenhuntly (Down) or Cheltenham (Up), the latter using a progression system.

In 1976, speed control was provided at three existing crossings where booms were installed before 1960 and which therefore didn't have it initally, and at one crossing converted from manual control. The three were at Heatherdale, signal L747, express PB at Mitcham (25 Apr); Glenroy, signal E516, express PB at Broadmeadows (23 May); Laburnum, signal L528, further details unknown; and the other was at Darling, Up Home No 18, timing through East Malvern (26 Aug).

At Glenroy the booms started about 30 seconds after the train entered the platform such that nothing happened for about the first 10 seconds after it stopped. The signal, which was close to the crossing (as for 7 in Figure 7.2), cleared when the boom arms began to drop. But if a train identified as a stopper did not in fact stop, then the booms started when it passed the joints at the end of the platform, and the signal did not clear until the booms were fully down. This was seen one afternoon with the 153 h.p. DRC from Seymour; this was forced to stop for an instant before the signal cleared. At Laburnum L528 was at about the same distance ahead but the booms here started about when the train stopped, and the signal did not clear until they were fully down. North Port in the Up direction was similar (Home No 20 protecting the Ingles Street crossing).

At Darling three-position signalling was completed through the station and the existing booms were concurrently converted from manual to automatic control (26 Aug). The booms started about 5 seconds after the train stopped, and Up Home No 18, which protected a crossover between the platform and Moira Street, cleared when the boom arms began to drop.

The controls for the new booms at Centre Road beyond Clayton were somewhat similar to those for Mont Albert Road on the Centre line (Figure 7.11), with signals D607, D625, and D645, corresponding respectively to H393, H407, and H421 . Trains were timed through Huntingdale and D645 cleared when an express passed D607. For a stopper it cleared about 35 seconds after the platform was entered, i.e. about when the train was ready to depart.

As shown in Table 7.3, the year 1976 saw also the start of replacing interlocked gates at stations Aspendale to Seaford in conjunction with installation of three-position signalling, although the latter work was completed first. Flashing Lights at intermediate crossings beyond Carrum were also replaced with booms. The signalling was designed for 96 km/h running, and at Carrum and Seaford the arrangements on the Down line were similar to those at Chelsea shown in Figure 5.6 (except for the control by lever 20).

All stations, including Bonbeach, gained Control Panels, and when these where switched in, because of the wide spacing of the signals, the need to control certain of these because of shunting, and the use of approach-clearing, all Down signals from Aspendale to Carrum would be normally at Stop; it would also be difficult for a stopping train to receive an aspect better than Y/R. Express and stopping push buttons were provided at each box for both directions, with the circuits being connected through when a box switched out. The influence of co-ordination with road Traffic Lights was mentioned in the introduction to Table 7.3 on Page 11.

At Noble Park (1977-16 Oct) the controls at first provided for the booms not to start until a stopping train passed Auto D846; this signal had replaced in 1971 the Starting shown at the end of the platform in Figure 5.4. Shortly after installation a stopping train was timed at 23 seconds over this section, so that although satisfactory as a 20 second approach for F/Ls it was rather too short as a 25 second approach for Booms. The controls were soon altered (14 Nov) to allow the booms to start some seconds after the train stopped and the signal cleared at the same time, i.e. when the F/Ls started. The latter was a new idea, but was later observed at various crossings located about 550 to 1100 feet (167 to 333 metres) ahead of the station. This arrangement is suitable where the train would take at least 25 seconds to reach the crossing from the point where it started; this would be equivalent to about 17 seconds from the end of the platform.

In 1977 (22 Nov), the controls of the existing booms at Boronia, were co-ordinated with Traffic Lights. Two-position Light signal L1053, provided back in 1952 and shown in Figure 5.2, survived track duplication in 1957 (although moved sideways) and provision of booms in 1971 (which included a push button at Bayswater for identifying expresses); however with installation of three-position signalling in 1977 (24 Jul) L1053 was altered to show four NS aspects (G/R-Y/G-Y/R-R/R) because the next signal, L1097, normally showed R/Y. In accordance with a new practice the Traffic Lights controller here was mounted away from the Railways' apparatus and maintained by the Road Authority, but electrical co-ordination signals were exchanged over the connecting cable.

When a train enters the outer approach track a Call signal is sent to the TLC, and the Traffic Lights cycle round to the Railway phase. The Flashing Lights and booms then start when the train enters the approach track (If the T/Ls have not cycled correctly by the time the train enters the approach track then they are forced into showing Flashing Amber, the emergency indication). For a Down stopper however, where the approach track starts after a time delay while the train is stationary in the platform, the booms start 35 seconds after the outer approach is entered (about 10 seconds after the train stops) or when the T/Ls have cycled round if this occurs sooner. As at Glenroy and other places named the signal clears for a stopping train when the boom arms commence to drop. After a train clears the crossing and the booms have risen a Release signal is sent to the TLC and this then resumes its normal operation. Additional signals were installed Bayswater - Fern Tree Gully in 1983 (15 May) and L1053 at Boronia became an ordinary three-aspect signal.

The booms at Stawell (1978) were protected by mechanically-operated signals whose levers were fitted with electric locks. The lock was released by operation of a push button when the approach track was occupied. As at Toorak Road and Bridge Street, clearing of the signal at the crossing in some circumstances required operation also of the lever of the preceding signal. At Murrumbeena (1979) the booms controls were co-ordinated with those of road Traffic Lights; this may be the reason why signal D397 at Carnegie was, unusually, kept at Stop rather than D417 (former Home No 5) near the booms. Cool Store Road at Croydon was a new crossing which replaced the F/L crossing at Main Street closer to the station. The arrangements at the boom crossings between Keon Park and Lalor (1979/80) were substantially the same as in Figure 6.22, but TS580 cleared when the boom arms at HA began to drop. The new booms at Rooks Road led to signal L665 (seen in Figure 5.1) clearing while a Down train was standing in the platform at Nunawading, and L672 clearing while an Up was at Mitcham.

In 1980 (19 Oct) additional signals were provided from Box Hill and alterations made to the control of signals protecting existing booms at Laburnum and Blackburn. Signal L528, which was situated near Middleborough Road crossing, was replaced by two signals, L526 right at the crossing, and L532 at the end of Laburnum platform; the latter signal now normally showed Stop. The booms started, i.e. the F/Ls started, about 10 seconds after an Up train stopped, and L526 cleared at the same time, as at Noble Park. Down Departure Home 308 at Blackburn, which replaced the former 18 and was a similar distance back from the Blackburn Road crossing, about 167 metres, was altered to behave similarly.

For the booms at Bakers Road, the Down Starting at Batman was replaced by a Light signal; this clears while a train is standing in the platform. A two-position Up automatic Light signal which clears similarly was also provided between Merlynston and Shorts Road (SR in Figure 5.5), the next crossing beyond Bakers Road. But this signal isn't numbered C400 as notified in SOMERSAULT; the plate is hard to read, but the correct number should be about C452. Although the new booms at the Down end of Bayswater were about 190 metres from the platform, signal 306 did not clear until the boom arms began to drop, thus showing that some flexibility was possible in the design details.

7.6 TRACK AND SIGNAL CONTROLS (FOURTH PHASE)

For the first crossing listed for 1983 in Table 7.4 (Page 12, Jan 1990), Forrest Street at the Up end of Wendouree platforms, the outer approach and approach sections in both directions were based on a speed of 115 km/h. A new Down Starting Light signal for Ballarat C Box was provided at the crossing, and the existing non-Block Semaphores protecting the gates and White's siding were both abolished. The Up Starting for D Box (Linton Junction) was also replaced by a Light signal situated close to the crossing... Replacement of the interlocked gates at Munro Street meant that Coburg now had two levers for manual control of booms... Additional Automatic signals were provided on the G and GG lines on the platform sides in conjunction with installation of booms at Galvin and Hopper's Crossing.

At Windsor the booms were protected by existing Automatics B187 and B190, both being normally at Stop. B187 was single-armed Home signal 16 until the cross-over and sidings were abolished in 1979. The crossing is about 135 metres ahead of the Up platform, and so it came as no surprise to find that the booms start after a stopper has been stationary for a few seconds, and B190 clears when the boom arms began to fall. Auto B187 clears also (followed by B175) when a Down stopper has been stationary at Prahran for a few seconds, and the booms start when the train passes joints at the end of the platform. It is understood that there are no express approaches here, but if a Driver knows this he ought to be able to get through without being stopped by slowing down sufficiently early..

Lochiel Avenue was 348 metres from Edithvale, far enough for the booms not to have to start until a stopping train has passed signal F986 at the end of the platform; the calculated minimum distance for this, as explained later, is about 344 metres (1127 feet). The Up Starting for Fawkner (Figure 5.5) was replaced by a Light signal when booms were installed at Boundary Road, and control by the platform lever at Merlynston was abolished. The Home mounted above Fawkner's Down Distant was abolished at about the same time.

A number of crossings where booms were installed during 1984 and 1985 were the appropriate distance ahead of the station for the signal to clear at the same time the booms started, i.e. when the F/Ls started. The crossings were those at or near Ringwood East, Ginifer, Fawkner (U) (see Figure 5.5), Westall, and Seaholme (U).

In 1985 and 1986 the gates at the three remaining electric tramway crossings (Kooyong, Glenhuntly, Gardiner) were replaced by manually-controlled boom barriers. However, unlike the case at Riversdale, booms were provided only on the near side. Thus there appears to be no check on the signalman's vigilance to prove that a tram is clear of the crossing before a train can be signalled. Provision of booms at Neerim Road in June 1987, and opening soon afterwards of the third track between Caulfield and Moorabbin, meant that there were now five more boom crossings carrying three running lines.

The crossing at Macleod (1987) was far enough ahead of the station for the booms not to have to start until signal 111 at the Up end of the platform was passed.

7.7 TRACK AND SIGNAL CONTROLS (GENERAL)

In the foregoing survey it has been stated that, depending on the distance from the crossing, the signal clears (1) When the booms are fully down, or (2) When the boom arms begin to drop, or (3) When the booms start, i.e. when the F/Ls and bells start, or (4) A few seconds after the train stops, the booms not starting in this case until the signal is passed. An attempt is made in the paragraphs below to explain how the threshold distances could be arrived at.

In Figure 7.14, it is assumed that a train stops with the front at F 20 seconds after passing joints A at the entrance to the platform. It stands for 12 seconds and then re-starts from F, passing joints at B 8 seconds later. The crossing C is a variable distance ahead of B. A minimum of 25 seconds warning should be given at the crossing; the actual period should not be much greater.

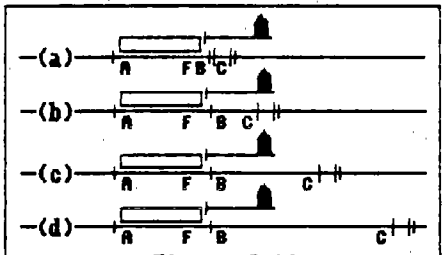

Figure 7.14

In (a) at most stations the booms start as a train passes A, and the signal clears when the booms are fully down which is at about the time that the train stops. However this gives a warning of 20+12+8=40 seconds before the train reaches the crossing. Although lengthy, this seems to be accepted, but at some places a time delay is introduced such that the booms do not start until up to 15 seconds after the train passes A, giving 40-15=25 seconds minimum warning.

In (b) C is at least 10 seconds ahead of B. Adding this to the above 40 seconds would give excessive warning, so the booms are now delayed to start about 25 seconds after the train passes A, which is 5 seconds after it stops; the signal clears as the boom arms begin to drop, i.e. about 7 seconds later. This allows 5+7=12 seconds for the station stop, and gives 7+8+10=25 seconds minimum warning. From the Calculation on Page 57 we see that the distance BC corresponding to a time of 10 seconds is 356-70=286 ft (88 m).

Examples of (b), with signal numbers in brackets, have been observed for stopping trains at Seaholme (WR579), Glenroy (E516)*, Regent (T394)*, Reservoir (T445), Thomastown (T576), Mont Albert (L428), Nunawading (L640), Croydon (H971), Bayswater (309, 306), Boronia (L1053)*, Darling (18), Cheltenham (12), Windsor (B190)*, and North Port (P95); (* signal near crossing C, not B).

In (c) C is at least 17 seconds ahead of B. The booms should now start about 12 seconds after the train stops, and the signal clear simultaneously. The station stop is thus allowed for and the minimum warning is 8+17=25 seconds. The distance BC corresponding to a time of 17 seconds is 687-70=617 ft (188 m).

Examples of (c) for stopping trains have been observed at Seaholme (WR574), Ginifer (M578, not M568), Fawkner (Post 61), Croxton (T266, T271), Laburnum (L532), Blackburn (308), Ringwood East (H858), Westall (4), Noble Park (D846), and Highett (F600). The initial delay may be less than 12 seconds, e.g. on T271, but this could mean excessive delay at the crossing.

In (d) C is at least 25 seconds ahead of B. The booms now do not need to start until the train passes B; the signal however is still delayed to clear 5 seconds or more after the train stops, to ensure that it does stop. The distance BC corresponding to a time of 25 seconds is 1197-70=1127 ft (344 m). At this distance there could be two signals between the platform and the crossing.

Examples of (d) with one signal have been observed for stopping trains at Batman (Post 56), Macleod (111), Toorongo (DG248)*, Yarraman (D882)*, and Edithvale (F986), and with two signals at Northcote (T240), Thornbury (T305), Bell (107), Ruthven (T470), Nunawading (L665)*, Mitcham (L672)*, Kooyong (DG243)*, Carnegie (D397), Clayton (D645)*, Sandown Park (D793), Noble Park (D863), McKinnon (F448)*, Bentleigh (F474)*, Patterson (F498)*, Mentone (F769)*, Parkdale (F780)*, some others on the Frankston line, and Prahran (B187)*; (* signal near C).

In (b) or (c) the delay of 25 seconds or more which occurs after the train passes A before the booms start, counts as part of the outer approach section, as does the delay in (d) before the signal starts.

The Automatic signals at the departing ends of stations or station yards listed below were controlled by levers in the boxes shown, to prevent unnecessary operation or holding down of booms during shunting movements. This practice was unknown before the introduction of boom barriers. Some of the boxes no longer exist.

M475 (Sunshine), E296 (Essendon), E516 (Glenroy), S234, S273 (Fairfield), S280 (Alphington), L400, L421 (Surrey Hills), L460,L497 (Box Hill), L550 (Blackburn), L672 (Mitcham), L780 (Ringwood), DG248 (Tooronga), DG344 (Darling), D359 (Caulfield), D441 (Murrumbeena), D474 (Oakleigh), D714 (Springvale), F881 (Mordialloc), F987 (Aspendale), F1044, F1059, F1187 (Chelsea), F1130, F1157, (Carrum), F1238, F1257 (Seaford), F1368 (Frankston), B430 (Dendy Street), B458 (Brighton Beach), B558 (Sandringham), P100 (Graham).

CALCULATION

The displacement d after time t of a particle starting from rest and moving with uniform acceleration a is given by the text book formula $d=\frac{1}{2}at^2$.

The acceleration specified for a Hitachi silver train on straight level track with a full load is given in *Newsrail*, January 1973, as "1.5 m.p.h. per second (2.4 km.p.h./sec.) up to at least 20 m.p.h. (32.2 km.p.h.)"

Because the train starts from rest at F rather than B, in calculating the distances corresponding to particular times it is necessary in finding BC to calculate FC and then subtract FB.

Treating the formula as applicable to a train, and converting the accelerations to ft/sec^2 or m/s^2, the displacements for times t of 0, 8, 18, 25, and 33 seconds, are 0, 70, 356, 687, 1197 ft (0, 21, 109, 209, 365 m) respectively.

(End of Part 7)

(c) The signal man at South Geelong must write out a copy of the caution order as dictated by the signalman at Geelong A box and countersign it.

(d) Prior to delivering the caution order to the locomotive driver, the signalman at South Geelong must ensure that the points are set and secured in the required position.

NOTE: The down dwarf signal from the carriage sidings at Geelong and the up dwarf from Siding A at South Geelong are three position dwarf signals as described in Regulation 58. As these signals control the entrance into a single line section, they must be treated as home signals in the event of a failure and a signalmans caution order, suitably amended, must be issued to the driver.

4. Track Machines Trollies and Road/Rail Vehicles.

Before placing any track machines/vehices on the track in the Geelong-South Geelong single line section, the employee in charge must obtain the permission of the signalman at Geelong A Box. The signalman must immediately after granting permission, place to stop and sleeve the necessary fixed signals to protect the movement.

No 130 home signal is track operated by an approaching train except for movements towards No 1 road. The signalman must, in the case of machines/vehicles which do not operate the track circuits, inform the employee in charge when the machine/vehicle is to travel into any other than No 1 road that signal No 130 will not operate and grant him the necessary authority to pass it at stop.

5. Regulation 59 Clause E is modified.

When a medium speed aspect is displayed on home signals posts 122, 124 or 126 at Geelong, and a clear low speed aspect is displayed on dwarf signal No 128 at Geelong or dwarf signal No 7 at South Geelong, the speed restriction specified will only apply until the train has cleared the points protected by the signal.

The above is effective forthwith. (O 185/90)

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BOOK REVIEW

TRAIN CONTROL IN NEW ZEALAND
by J.A.Dangerfield. 32pp.
Published by The New Zealand Railway and
Locomotive Society (Inc). 1989.

This book is one of a series of books produced by the New Zealand Railway and Locomotive Society titled the New Zealand Railway History series.

The book sets out to describe Train Control as applied by the New Zealand Railways (NZR) and is devoted entirely to the subject of Train Control. This is the first book I have seen written solely on Train Control.

The book examines the origins of the Train Control system in New Zealand, which was introduced on 25 September 1922 to govern a short section of single line worked by automatic signalling. Following overseas tours to Canada, United States, England and Australia between 1921 and 1926 by officers of the NZR, an improved Train Control system was introduced in 1928. The improved system was based largely on the system in use on the South Australian Railways at that time.

Considerable work has been put into describing the role and operation of the Train Control system. Train Control graphs are explained as is the selector telephone system. The written description is assisted by the use of Train Control graphs and reproductions of railway forms and circulars.

A detailed Appendix lists all the Train Control offices in New Zeland, their reas of control and dates of operation. Unfortunately the effectiveness of the Appendix is restricted because of the lack of a suitable map. The book contains not one single map and for anyone not familiar with the geography of New Zealand and its railways, this is an annoying ommission.

Only the briefest mentions are made of safeworking systems, which is surprising considering the relationship between safeworking and Train Control. Very little is written about CTC, a system that is widespred in New Zeland. Even four photographs of CTC panels could not tempt the author to write more bout CTC. Strngely, these four photographs of the CTC panels are all dated in the 1960's. There are no photographs or text relating to the CTC installations of the 1980's.

The book is illustrated with thirteen photographs covering signals, trains, rail yards, signl boxes and Trin Control boards, with and without CTC panels.

Overall the book is well produced and is a pleasure to red, not withstanding the faults. Trin Control is a subject which can not be easily dealt with in 32 pages but the author has done n admirable job. Safeworking enthusiasts will enjoy this book. (Glenn Cumming)