

and particularly when leaves are present on the rails, or any substance such as oil, tar or bitumen, etc.

55. COUNTERACTION OF BAD RAIL CONDITIONS.

This is accomplished by the more gradual application of the brakes and the application of sand to the rails.

56. SANDING APPARATUS.

Sand is applied to the rail by depressing the sand valve foot punch. It is forced from the sand container by compressed air. It is the responsibility of motormen to see that the sand hoppers have plenty of sand, and that the apparatus is in good working order. Under conditions that render slippery rails likely, the inspection should be frequent.

57. TO PREVENT OR STOP WHEELS SKIDDING.

When slippery rails are known to exist, a light application of sand should be made before making the brake application. Should the wheels skid, the brake must be released for a moment to permit the wheels to turn, and with sand application, re-applied gradually to bring the tram to a stop. A greater distance must always be allowed in which to stop a tram when adverse rail conditions exist, because the brakes must be applied more gradually.

58. GREATEST DISTANCE REQUIRED TO STOP A TRAM.

The distance becomes greater when the following conditions are met, and correspondingly greater when they occur

61. simultaneously :- ON APPLYING REVERSE POWER.

- (a) When tram is heavily loaded.
- (b) When the tram is travelling at faster speeds.
- (c) When the tram is on a down grade.
- (d) When the tram rails are slippery.
- (e) When using the hand brake.

62. Also, a greater distance must always be allowed for when approaching any obstruction.

(D) FAILURE OF THE MECHANICAL BRAKES:

59. POSSIBLE CAUSES OF BRAKE FAILURE.

Air brake - Since the air brake is dependent upon the supply of compressed air, and requires a minimum of 50 lbs. pressure for adequate braking, failure of the air supply due to electrical fault or break of a pipe line would put the air brakes out of action.

63. The same mechanical levers and bars used for both the air brake and the hand brake, and it therefore follows that the breakage or jamming of a lever or bar would render both the air brake and the hand brake in-operative.

60. TO STOP A TRAM IF BRAKES SHOULD FAIL.

65. This would be effected (in the case of the tram travelling forward) by applying one or two notches of series power to reverse the motors. This would be done by pulling the controller reverse lever back, and sand should be applied to the rails at the same time.

controlled only by the current self-generated. Therefore the motion would consist of a series of movements and retardations, since the stopping or nearly stopping of the tram also stops the self-generation of electrical energy by the tram motors.

66. DIFFERENCES IN THE TWO MEANS OF ELECTRICALLY STOPPING A TRAM.

In the first case, in paragraph 60, the placing of the controller key into reverse position, and cutting on the controller handle to the first or perhaps second series power notch, is in effect putting the motors into reverse. This requires that power is obtained from the trolley wire and that the circuit breaker is closed. Should the circuit breaker open, or the pole be off the overhead wire, this means of stopping the tram is removed.

In the second case, in paragraph 62, the placing of the controller key into the reverse position, and moving the controller handle to the full parallel position, with the circuit breaker open or the pole off the wire, is effective because the retarding current is developed by the tram motors themselves. The current, of course, is only developed whilst the wheels are turning, and are thus driving the motors. The amount of current produced is greater or lesser according to the speed of the tram. The essential to produce this braking effect is - (1) The controller key must be in reverse direction to the motion of the tram, and (2) the handle must be in full parallel position. The retarding effect is produced by the current generated in one motor tending to reverse the other motor. This method is the

sequel to reverse with power if the circuit breaker opens. It is, of course, ineffective if a motor is cut out in the controller.

(E) TRAMCAR EMERGENCY BRAKING (ACCIDENT PREVENTION):

67. MOST EFFECTIVE BRAKE.

The most effective and reliable brake is the air brake. It is instantly applied by the quick movement of the brake handle to the extreme right position for full emergency application.

68. USE OF FULL EMERGENCY AIR BRAKE APPLICATION.

This should only be used when the rail surface is in good condition. The extent of brake application must always be in consideration of such conditions. Harsh braking on slippery rails will inevitably result in the tram wheels skidding and consequent increase in the distance taken to stop the tram.

69. EMERGENCY BRAKING AND USE OF SAND.

Sand should be used on all occasions when the emergency brake is being applied to prevent an accident.

70. EMERGENCY BRAKING ON SLIPPERY RAILS.

The first action taken should be the application of sand to the rails, and the brake valve handle moved to the service application position and held there. In this manner the sand ensures improved grip of the wheels on the

74. rails, and the gradual application of the brake will tend to reduce the risk of skidding. The brake valve handle in the service application position provides for gradual building up of the brake pressure to the maximum obtained in the emergency position.

71. FAILURE OF AIR BRAKE IN EMERGENCY.

75. In the event of the failure of the air brake and there being insufficient time to stop the tram with the hand brake, it is possible to stop the tram by electric means. These are -

- (1) Reverse power to the motors, as explained in para. 60.
- (2) If the circuit breaker opens when reverse power is applied, self-generated reverse power should be applied, as explained in para. 62.

(F) AUTOMATIC BRAKING (DEAD MAN CONTROL):

72. PURPOSE OF THIS EQUIPMENT.

This equipment is installed for the purpose of automatically stopping the tram in the event of illness, etc., of the motorman. It must not be used for service stop purposes.

73. CONTROLLER VALVE.

This is operated by the depressing of the controller handle. The handle must be kept depressed whilst driving the tram, to prevent the automatic brake application.

74. FOOT VALVE.

This is a valve which holds the air pressure obtained from the controller valve. Its purpose is to permit motorman to remove his hand from the controller if he desires to do so for any reason, but the foot valve will not hold the air pressure indefinitely.

75. CIRCUIT BREAKER CYLINDERS.

The pistons of the circuit breaker cylinders are connected into the automatic brake application circuit, so that when the brakes are automatically applied, the circuit breakers on the tram are also thrown open. This ensures that any power being applied by the controller is automatically cut off.

76. SERVICE OPERATION.

Press down controller handle, release air brake, and cut on power as usual. Keep controller handle depressed when making a service stop until full service brake pressure is applied.

77. TO RE-START TRAM AFTER AUTOMATIC BRAKE IS APPLIED.

- (1) Depress the controller handle to discharge the automatic brake line and permit the circuit breaker to be closed.
- (2) If tram is on a steep grade, it will be necessary to apply the service air brake to hold the tram when the automatic brake is released, to prevent the tram from rolling backwards whilst the

81. DESCRIPTION OF THE CIRCUIT BREAKER
 circuit breaker is being closed.
 (3) See that the controller is off before re-closing the circuit breaker.

78. LEAVING TRAM UNATTENDED WITH AUTOMATIC BRAKING.

Release the service air brake and permit automatic brake to operate and hold the tram. Remove the controller handle and reverse key, also brake valve handle. To lock on the automatic brake should the air supply fail, apply the hand brake. (On single track trams this must only be done at No. 2 end, which is marked "brake operating end").

79. TAKING UP TRAM AT THE DEPOT.

If the pole is off the wire, it is likely that the air pressure gauges will be at zero. Replace the pole and see that the compressor starts up. The controller handle should not be depressed until the air pressure is more than 40 lbs. If an air escape is observed which is preventing the build-up of the air pressure, see that the brake valve handle is in the "off" position.

(G) AUTOMATIC ELECTRIC SIGNALS:

80. PURPOSE OF THE SIGNALS.

To facilitate the movement of trams over single track sections, usually between loops.

81. DESCRIPTION OF OPERATION.

The signals are operated by the trolley wheels of the trams in conjunction with insulated fittings called contactors. The fittings used for trams about to leave loops are setting contactors, and those used by trams arriving at loops are restoring contactors. It is necessary that the trolley wheel remain in contact with the trolley wire when passing under the contactor, and the speed of the tram must not exceed 6 miles per hour at these points, to ensure operation. The lamps in one signal box are wired in series with the lamps in the next connecting box. This ensures that the lamp in one box will not operate unless the connected lamp in the other box is also in action. The Green Light, therefore, in one box is connected with the Red Light in the box at the next control point. Green Light is "Proceed", and Red Light indicates "Danger and Stop". The signals are interlocked so that a Green Light cannot be obtained if the Red Light is showing.

82. REGULATIONS AS TO OBSERVANCE OF SIGNALS.

In their normal operating condition, a motorman arriving at a loop can define as follows :-

- (1) No light in signal - Single track section ahead empty.
- (2) Green light showing - There is a tram ahead in the section.
- (3) Red light showing - There is a tram approaching in the section.

Unless running as otherwise provided in these instructions, motorman must not enter a section unless they have made the

loop he is approaching, and he must exercise extreme caution near any blind spots, by vigilance, reduced speed, and use of foot gong. There must be no attempt at this time to make up any loss of time.

Motormen approaching a signal section similarly must not enter the section until they have referred to the schedule in operation and the points at which trams are normally met. They also must approach all blind areas very cautiously, and be prepared to stop at short notice. The use of a motorist who may be passing to act as pilot and warn any tram he meets is a valuable safeguard, but must not be relied upon in manner of driving the tram in blind areas.

In order to make motormen aware of power failure, the supply will not be restored in less than $1\frac{1}{2}$ minutes during daylight hours.

85. FAULTS IN SIGNAL SYSTEM AND RESPONSIBILITIES OF MOTORMEN.

Faults may occur in the system, and all motormen must realise that the Green light does not mean "All Clear" without further responsibility to themselves. There is nothing to prevent a lamp from breaking down whilst the tram is in a section, and in that case the signals can be operated by a tram travelling in an opposite direction, the motorman of which is entirely unaware of the fault. Therefore, the signals do not remove any responsibility from any motorman as regards cautious and alert driving at reduced speed in all areas where forward visibility is restricted to short distances.

86. DIAGNOSIS OF FAULTS, AND ACTION TO BE TAKEN.

- (1) Signal box blank and Green light not obtained.

Trolley wheel did not operate contactor. Reverse tram and try again. If again no light is obtained, it would probably be due to a burnt out lamp.

- (2) Signal box blank and Green light operates and then goes off.

Fuse in signal box has been blown. In these cases word must be sent as soon as possible to the traffic office or depot, so that the fault can be remedied. If possible, get a motor car to act as pilot over the faulty section, but study first the running schedule and the points at which trams normally pass on same. Provided no Red light shows up, and no tram is to be anticipated in the section at the time, the motorman may proceed, but in the realisation that a tram in the opposite direction can obtain his normal signal and also enter the section concerned. Extreme caution must, therefore, be exercised.

- (3) If in passing a contactor a Red light appears, this is due to a tram in the opposite direction having entered the section first. It is not possible for a tram to make a Red light in a box instead of Green.

- (4) Tram arriving at box finds a Red light burning, and after waiting normal time for the section, no tram arrives to clear same -

This may be due to a previous tram in the opposite direction failing to clear the signal. Check running schedule and points of normal meeting for the service in operation. Give sufficient time for tram to run through the section. If no tram shows up, get a motorist to act as pilot, if possible, and proceed only with the utmost care.

87. REPORTING OF FAULTS IN SIGNALS.

All faults must be immediately reported to either the City Office or to the Depot Foreman, whichever is first reached. In addition, details must be given to the motormen of trams on the same route who may be passed, so that they are aware of same and can also advise the drivers of trams they meet.

88. SIGNAL SYSTEM LAYOUT DETAILS.

Signals are installed for the following single track sections :-

Gardens Route - Victoria Park loop and Carlton Street loop
 Carlton St. loop and Gardens South loop
 Gardens North loop and Tram Depot loop
 Tram Depot loop and Martin Avenue loop
 Martin Avenue loop & Macarthur St. loop
 Macarthur St. loop and Mill St. loop
 Mill St. loop and Sturt Street

Note: Trams from Depot via Drummond St. North commence signal operation at the Tram Depot loop. Trams from the Gardens via Drummond St. North restore the signal at the Depot entrance. Trams to the Gardens via Drummond St.

North clear the signal at the Depot Entrance, and then reset the light after passing the Depot points.

Eastern Routes - Grenville St. and Main Rd. Depot loop,
Grenville St. and King St. loop
(Victoria St. route)
Grenville St. and Grant St.
(Mount Pleasant route)

Note: On "Out" trips a selector switch on the pole at Grenville Street must be operated according to route required. Victoria St. trams - handle to the left. Mt. Pleasant trams - handle to the right. The Bridge Street section signal operates on both routes. On "In" trips the signals from outer loops are cleared at Main Street/Bridge Street junction after the tram has operated the Main Street/ Grenville Street signal box. The central of "off" position of the selector switch stops signal operation, and must be so placed for trams shunting only at Grenville Street.

Sebastopol Route - Sturt St. and Urquhart St. loop
Urquhart St. loop and Bell St. loop
Bell St. loop and Grey St. loop

Lydiard St. route -
Seymour St. loop and Gregory St. loop

Ripon St. Route - Macarthur St. to Martin Avenue loop.

89. TRAMS RUNNING TO THE DEPOT VIA DRUMMOND ST. NORTH.

If the tram sets the Green signal at the Depot loop, it must be restored to clear by leaving the pole on the south trolley wire to operate the contactor at the Depot points. If a Green light is already showing at the Tram Depot loop, it indicates that there is a tram already in the section on the way to the Gardens; therefore the pole must be moved to the Depot wire before reaching the contactor near the Depot entrance, to ensure that the other tram's signal is not interfered with.

(H) GENERAL INSTRUCTIONS:

90. PRECAUTIONS BEFORE MOVING A TRAM IN THE DEPOT.

First ensure that no member of the depot staff is working either in or on or underneath the tram.

Second see that it can be stopped. Check air pressure gauge before cutting on power.

Third sound the foot gong as a general warning before moving the tram.

91. PREPARING TRAM FOR TRAFFIC.

Motormen must examine the tram allotted to them as follows :-
Test the lighting circuit and the sander apparatus, checking to see that the sand hoppers are filled. Check pressure gauge and see that the air reservoirs are fully charged. See that the tram has its point shifter bar, drawbar and angle iron. Motormen are held responsible for the tram equipment after they leave the Depot.

92. REPORTING TRAM DEFECTS.

Motormen are required to fill in a tramcar defect form intelligently and fully whenever a fault develops, and so facilitate the speedy tracing of the fault by the depot staff.

93. STOPPING PLACE.

The service stopping places for trams are marked in red paint on the tramways overhead poles. They have a white band at the top and bottom of the red section. These are the service stopping places for trams to be stopped either upon signal from the passengers to alight or as required for intending passengers to board the tram. Compulsory stops are marked with a white band in the centre of the red section on the poles, and all trams must be stopped at these locations.

94. PROCEDURE WHEN RUNNING TO THE DEPOT.

To avoid any confusion and consequent collision, the following rules will always be observed when trams en route to the depot approach the following locations simultaneously:

Trams via Drummond St. North will give precedence to trams via Ripon St. at the intersection of Macarthur St. and Wendouree Parade.

Trams via Sturt St. West will give precedence of entry to the Depot to trams via Ripon St. or Drummond St. North, when simultaneously approaching the tram Depot in the area between the Tram Sheds loop and Forest Street.

95. ENTRANCE DOORS (SINGLE TRUCK TRAMS). *See Tram Depot*

In the event of
Motormen are required to ensure that the front door is closed on the street side and opened on the safety zone side in the following areas :-

Sturt St. between Grenville St. and Pleasant Street.
Sturt St. between Pleasant St. and Hamilton Avenue.
Wendouree Parade throughout.

In these areas, which are declared safety zones, motor cars are not required to stop behind a stationary tram, and the motorman is, therefore, culpable in any accident to a person leaving on the wrong side of the tram through failure to close the entrance.

Entrance doors must on no account be changed by a motorman whilst he has the tram in motion.

96. ABSENCE OF RELIEF AT END OF SHIFT.

In the event of a relief not turning up to take over the tram at the appointed time, word should be sent to the Traffic Inspector on duty at the office, and the motorman or conductor is required to carry on until a relief can be obtained for him.

97. DERAILEMENTS.

All derailments must be reported to the Senior Traffic Inspector in writing. In the case of a serious derailment, the motorman concerned must telephone the

Traffic Office (Telephone 395) or the Tram Depot (Telephone 267) from the nearest phone. In the event of derailment on the open ballast track in Sebastopol, no attempt must be made to pull the derailed tram by means of another tram.

98. STANDING BY TRAMS.

When trams are detained for any reason, the motormen and conductors must stand by their trams and be ready to respond immediately to instructions of Inspectors.

99. SIGNALS BY FOOT GONG.

Signals by foot gong as between tram motormen are confined to a four-gong signal, which must be clearly and deliberately given. This signal is used to -

- (1) Stop the preceding tram.
- (2) Stop a tram at an intersection to facilitate transfer of passengers.

100. TRACK CLEANER TRAM.

As far as practicable, the cleaning of the tracks by the cleaner tram will be carried out in the early morning between 5.00 a.m. and 10.00 a.m. This must be noted by motormen, and the cleaner tram will operate the signals as required for its movements.

101. SECTION INSULATORS.

These are fittings on the trolley wire which subdivide the system into a number of separate circuits. It is necessary that controllers be moved to the "off" position whilst the trolley wheel runs under the insulator, in order to prevent an arc due to the break in current supply.

102. DE-WIREMENTS.

The motorman must report to the first Inspector met and/or the Overhead Foreman all instances of the trolley pole leaving the overhead wire.

103. CONDUCTORS.

Motormen shall not enter into conversation with their Conductors whilst tram is in motion, nor encourage the Conductor to post himself at the front end of the tram. When not engaged in collection of fares, the Conductor should be in the rear portion of the tram.

104. TROLLEY POLES.

Single Truck Trams: After dark, the pole must not be removed from the wire at a terminus until the passengers have left the tram.

Bogie Trams: After dark, the Conductor must not remove the pole from the wire at the rear end of the tram until the Motorman has first placed the pole at the forward end upon the wire.