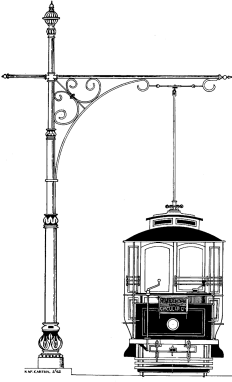


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LEVEL CROSSING OPERATION MANUAL

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1.0	31/10/2006	Initial issue
2.0	03/02/2008	Rewrite of the manual
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2.2	05/03/2009	Add comments about more than 2 trams using the crossing at the same time.
2.3	23/10/2009	Changed of STM6033 to Occurrence form.
2.4	25/05/2010	Amended procedure with regard to manual operation.
2.5	15/11/2011	Minor changes to the operation including the horn.
2.6	16/11/2012	Amend the checking of the RNP crossing lights
2.7	20/07/2014	Amended to change RTA to RMS
2.8	12/02/2015	Amended to new controller logic Document structure revised

Approved by Signature & Date

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Level Crossing Operation Manual

1. Purpose

To explain the operation of the level crossing at the Princes Highway.

2. Scope

This manual applies only to the Princes Highway level crossing where the Royal National Park line crosses the highway.

3. Responsibilities

STM personnel are responsible for understanding the operation and reporting any faults on the Occurrence Report Form ([STM6033](#)) as soon as they are noticed.

4. References

Occurrence Report Form ([STM6033](#))

Princes Highway Level Crossing Inspection Report ([STM6194](#))

5. Definitions

OIC – Officer in Charge– the person appointed on a day-to-day basis to supervise all operations and work parties for the Society.

PLC - Programmable Logic Controller

STM - Sydney Tramway Museum, a trading name of South Pacific Electric Railway Co-Operative Society Limited.

**WARNING: DO NOT PARK A TRAM OVER
INDUCTIVE LOOPS IN AUTOMATIC MODE**

**IF, FOR ANY REASON, A TRAM MUST PARK OVER THE
LOOPS, SET THE SYSTEM TO MANUAL OR TURN IT OFF.**

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6. Description

6.1 General

At the location of the crossing, the Princess Highway two lanes wide in each direction with a median dividing barrier. The road speed limit is 80km/h.

The height of the trolley contact wire is 5.9m above the roadway.

6.2 Warning Equipment

The road traffic is controlled by standard railway level crossing "F-type" flashing light warning signals with electric warning bells. The Roads and Maritime Services provide active advance warning with flashing lights.

6.3 Control System

The control equipment is housed in a secure hut on the north-western side of the crossing. A master switch is provided in a locked box on the wall of the substation on the south-western side of the crossing to enable the system to be switched on and off as required in normal operations.

On each approach to the roadway, detectors located between the rails sense the presence of large metal objects. A Programmable Logic Controller (PLC) monitors the detectors and controls the warning equipment.

In automatic operation, the PLC registers the direction of travel when an approaching tram passes over the first detector. As the tram is detected by the second detector, the PLC initiates the warning sequence.

As the warning sequence starts, a control signal switches on the RMS active advance warning yellow flashing lights, to warn motorists that the crossing will soon be operating. Simultaneously, flashing yellow lights beside the tramway confirm that the warning sequence has started.

After 10 seconds, the red lights at the crossing will begin flash and the warning bell will begin to sound.

After a further 10 seconds the white "bar" light will go out and two white "T" signals will come on and the horn will sound for approximately 3 seconds. When the tram driver has determined that it is safe to proceed, i.e. traffic has stopped / is stopping or no traffic is closely approaching, they may operate the tram across the road.

When a tram proceeds onto the road, a timer is started. In convoy operation, the timer is reset as each tram enters the road. The timer works in two stages, 15 seconds and a further 4 seconds (total 19 seconds).

The warning terminates as follows:

- a. If a tram is detected at the exit side of the crossing after the 15 seconds, the warning will cease at the end of the 4 seconds.
- b. If a tram is detected at the exit side of the crossing after the full 19 seconds, the warning will cease immediately.

If the warning does not cease automatically, manual Stop push-buttons are located in locked boxes below the flashing yellow lights each side of the Highway.

A push-button located in a locked box on pole 102 (eastern side of Highway) will manually initiate the warning operation to return trams from the National Park if the automatic operation does not work.

Manual controls are provided in the crossing equipment hut for special working or for working under certain failure conditions.

In all cases, if the crossing has been operating for 2 minutes, the warning will cease immediately.

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In automatic mode, a timer prevents the warning being activated within 5 minutes, to allow the Highway traffic to clear. For emergencies or where an operator can determine that traffic has cleared, the manual controls are not restricted by this timer.

7. Actions

7.1 General

If an emergency vehicle approaches the level crossing (with lights flashing and siren going) after the crossing lights are activated, the tram **MUST** continue with the process and cross the Princes Highway once the signal has been given. The reason for this is that the process only takes a short time and allowing an emergency vehicle to continue whilst the crossing lights are flashing will also encourage to other vehicles to cross against the lights. **HOWEVER DO NOT CROSS IF THERE IS A POSSIBILITY OF A COLLISION WITH THE EMERGENCY VEHICLE.**

In convoy working, if the driver of a following tram has noticed the emergency vehicle waiting to cross, and can stop the tram before reaching the marked position of the detectors, stopping will allow the crossing warning to cease when the preceding tram clears the road. The tram will then have to wait 5 minutes for the road traffic clearance timer before attempting to use the crossing.

7.2 System On / Off

(A) Procedure to activate the National Park level crossing system.

1. Approach the level crossing from the depot and stop the tram near the National Park substation.
2. Open the green telephone box on the wall of the National Park substation and turn the switch inside to the "ON" position.
3. Check that the white horizontal "Bar" signal is illuminated on the other side of the highway.
4. Lock the green telephone box.

(B) Procedure to deactivate the National Park level crossing system.

1. Open the green telephone box on the wall of the National Park substation and turn the switch inside to the "OFF" position.
2. Check that the white horizontal "Bar" signal is extinguished on the other side of the highway.
3. Lock the green telephone box.

7.3 Automatic Operation

(A) Procedure to cross the National Park level crossing (Automatic Mode).

1. Approach the crossing and slow down to walking pace and, continue moving until adjacent to the "STOP" mark before of the crossing, stop at this mark and wait.

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NOTE: when leading a convoy, stop short of the marked detector positions and wait until all cars of the convoy are present before proceeding across the detectors to the “STOP” mark.

2. Check that the orange flashing light signal ahead of the tram is functioning; this indicates that the automatic system has started and the Roads and Maritime Authority highway Advanced Warning lights are operating.
3. Approximately ten seconds after crossing the automatic detection loops the highway level crossing lights will flash and the bells will ring.
4. Approximately ten seconds later the white horizontal “Bar” signal will be extinguished and the two white “T” signals will be illuminated and the horn will sound for approximately 5 seconds.
5. Once it is obvious that the highway traffic is stopped / stopping or no traffic is closely approaching, then proceed across the crossing. Trams should not be worked above “full series” speed.
6. In convoy working, drivers of following trams should endeavour to maintain between 3 and 5 seconds spacing between trams while traversing the Highway; closer spacing increases the risk of collision between trams, greater spacing increases the risk of motorists starting to drive while another tram is approaching.
7. In convoy working, drivers of following trams should check the two white “T” signals prior to crossing the roadway. If the two white “T” signals are not illuminated, the crossing is nearing the end of the warning sequence, and the driver should attempt to stop before the roadway. If however the ‘T’ signal illuminates again (may occur if there is a very large gap between trams), and road traffic is still stopped, the driver may proceed. If the tram does not proceed, the driver must set the tram back clear of the detectors, and wait 5 minutes before approaching again.
8. Crew of the last tram must observe the flashing orange light signal and ensure that it has been extinguished before the tram passes this signal.
9. If all the above has taken place then the system is functioning properly and the tram can continue on with the run.

(B) Procedure to follow in the event of failure of the automatic system.

1. If when the level crossing is approached in the manner as in (A) above but the white horizontal bar signal is not illuminated, check to see that the system has been activated as described in 7.2(A) above. If the system has been activated but is not working properly then try a second approach to the crossing, if this fails then **DO NOT ATTEMPT TO CROSS THE HIGHWAY**, return to the depot and advise the Officer in Charge and fill out an Occurrence Report Form ([STM6033](#)).
2. If when the level crossing is approached in the manner as in (A) above and the white horizontal bar signal is illuminated but the orange flashing light signal does not flash and after waiting approximately ten (10) seconds the highway flashing lights and bells have not started to operate, it may be that the crossing is still in the traffic clearance timeout. Set back clear of the detectors, wait 3 minutes, and approach the crossing again. If the crossing still does not operate, **DO NOT ATTEMPT TO CROSS THE HIGHWAY**. Return to the depot and advise the Officer in Charge and fill out an Occurrence Report Form ([STM6033](#)).

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3. If when the level crossing is approached in the manner as in (A) above and the white horizontal bar signal is illuminated and the orange flashing light signal is flashing but after waiting approximately twenty (20) seconds the two white "T" signals have not been illuminated, DO NOT ATTEMPT TO CROSS THE HIGHWAY. Deactivate the level crossing system as described in 7.2(B) above to prevent unnecessary disruption to road traffic, then return to the depot and advise the Officer in Charge and fill out an Occurrence Report Form ([STM6033](#)).
4. If all signals functioned correctly and the crossing was completed but the flashing orange light signal is still flashing as the tram (or final tram of a convoy) approaches it, the tram must be stopped and the driver must open the green telephone box mounted on the pole below the signal using a traffic key to open this box and press the red reset button and lock the box before proceeding with the run. After returning to the depot as usual, advise the Officer in Charge and fill out an Occurrence Report Form ([STM6033](#)).
5. If the crossing worked properly on the way to the Royal National Park but on the return journey the crossing will not activate, check that more than 5 minute has elapsed since the crossing stopped, and if so then the green telephone box on pole 102 should be opened and the green button pressed to activate the crossing.

7.4 Manual Operation

To operate the National Park level crossing in Manual Mode:

1. Open the door of the signal cabin and turn the Mode switch on the front panel of the box from "Auto" to "Manual".
2. When the tram is ready to proceed press the "Start" push-button momentarily. The relays inside the box will start the pulse, and the orange remote lights will start operating.
3. After the tram or trams have reached the other side of the highway press the "Stop" push-button momentarily. The relays will stop pulsing and the orange remote lights will stop operating.
4. When finished return the Mode switch from "Manual" to "Auto" and lock the door to the signal cabin.

7.5 Testing of Crossing Signals

The signals will require to be visually tested on the first Saturday each month. The workshop staff will perform this function.

The test will involve manually switching on the signalling system and observing that:

- The signal lamps facing the road traffic are working correctly;
- All other signal lamps are working correctly;
- The bells are heard to be ringing; and
- The horn working.

Once the inspection is completed, the system will be switched off.

When the inspection is completed, a *Princes Highway Level Crossing Inspection Report* ([STM6194](#)) must be updated and filed in the office.

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7.6 Emergency Operation

TRAM FAILURE ON CROSSING

The level crossing is reconstructed with a 1 in 30 (approximate) gradient along the centre line of the tramway. Therefore, in the event of an electrical failure to the tram, it is expected that it will be able to be coasted off the crossing under the terms of the coasting provisions of the Tramway Working Orders.

In the event of a mechanical failure, the crew must advise the Officer-in-charge immediately to call out the tramway breakdown crew and must advise the Sutherland Police to arrange emergency traffic control.

SIGNAL FAILURE

In the event that the driver of a Park-bound tram cannot arrange for the traffic signals to function properly, the trip will be terminated at the western side of the highway.

In the event that the signal failure takes place against a Sutherland-bound tram, the driver will call the OIC who in turn will call the Sutherland Police to stop the traffic to allow the stranded tram to cross. In any case of tram or signal failure, the tram service will be suspended forthwith and not resumed until the line has been cleared or the signals repaired. Other transport may have to be arranged as necessary for intending passengers who might be otherwise stranded between the Princes Highway level crossing and the Royal National Park terminus.

The signal failure must be reported on the Occurrence Report form ([STM6033](#)) as soon as possible.

6.5 7.7 Trouble Shooting

Signalling Will Not Actuate

Check that the R.T.A. switch on the right hand side of the hut is in automatic mode. The Programmable Controller will not start if this switch is in either “Manual” or “Off Mode”.

Check the “Manual/Automatic” switch on the Control Panel. All information from the inductive loop network is ignored if the switch is in “Manual”. ***The switch must be set to Automatic.***

Loop Detector Failure

In the case of a failure of the loop detector system one or more of the loops may signal to the controller that it has been activated even though nothing has passed over the loop/loops. This is a standard built-in safety feature.

If a failure does occur one of the following will happen:

SYSTEM STARTS WITHOUT BEING ACTIVATED

- Remedy:**
- Switch OFF at the Power-on Remote Switch or Emergency Off in the hut;
 - Switch to manual on the Control Panel;
 - Switch on power; and
 - Operate manually.

SIGNALLING WON'T START

- Remedy:**
- **Switch to manual operation. System Fails Power-Up.**

When the Power-on Remote-switch is turned ON, the white bar light between the “cross now” (T) lights should come on. If not the following may be the cause:

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- a) One of the globes in the facing signal may have failed. If so report the problem on the *Occurrence Report Form* ([STM6033](#)).
- b) Check the “Emergency OFF” button on the Control Panel. This button should be **OUT**. If it is not, a slight turn in the direction of the arrow on the button will unlock the switch.
- c) Power not turned ON. This switch is located under the cabinet at the right hand side.
- d) Mains power is OFF. Check to see if the circuit breaker in the distribution room is turned OFF. This is located in the opposite end of the signal hut.
- e) If all of the above fail, an internal fault may be the cause. Seek assistance from qualified personnel.

N.B. DO NOT PARK THE TRAM OVER THE LOOPS WHEN CHECKING THE ABOVE. RECTIFICATION OF FAULT WILL RESULT IN CROSSING BEING ACTIVATED IMMEDIATELY.