

## Light Rail Vehicle (LRV) Pantograph Failure

### The incident

On 27 May 2021, an LRV travelling from Town Hall to Central in the Sydney CBD had the pantograph on the trailing vehicle entangle with the overhead wire suspension cables. This caused a power trip with pieces of the pantograph falling to the ground. There were no injuries as a result of the incident, but it caused significant damage to the pantograph and held up rail traffic from Circular Quay to Moore Park for around five hours until repairs could be completed.

A CCTV footage review showed the pantograph on LRV 45 was damaged and displaced at least 25 minutes before the entanglement with the overhead wire.

### Operator follow up

Immediately following the incident the operator commenced an investigation to determine the contributing factors to the pantograph failure.

OTSI's Chief Investigator requested a copy of the operator's investigation report under Section 45 of the *Passenger Transport Act 1990*. The report was provided on 26 June 2021.

The operator identified several contributing factors to the incident. It found that the pantograph heads detached from the rocker box units causing the pantograph upper frame to eventually become entangled in the overhead wire. Increased electrical resistance through the rocker box connections caused metal deterioration and eventual component failure. The design of the rocker box connection to the head units created multiple weak points, increasing potential for failure from mechanical stress and increased electrical resistance in the traction power path.

The operator began implementing actions to prevent recurrence of the event including, installing electrical shunt cables to the rocker box unit to assist in reducing electrical load through the spacer block and mounting bracket components; designing a new rocker box assembly to improve mechanical strength and reduce the electrical resistance; carrying out ongoing daily pantograph inspections using a thermal camera to monitor heat abnormalities on metal components; and fixing an accelerometer to an LRV to monitor overhead wire forces on the pantograph.

### Key points for operators

The operator's response to determine the contributing factors to the pantograph failure included an event timeline review, Failure Mode Effects and Criticality Analysis and review of the pantograph and overhead design, which was completed in a timely manner.

The actions to minimise the opportunity for recurrence included a short/medium-term fix and a longer-term solution developed from the root cause analysis and ensured the risk of thermal heat from high electrical resistance could be engineered out.

### Safety message

Operators' post-incident approach should identify contributing factors using an appropriate root cause analysis method and specific actions that address those contributing factors with controls that preferentially eliminate, substitute or engineer out the risk.