

# RAIB Bulletin 08/2009

## Collision between a moving tram and stationary tram

### Description of the accident and findings of the RAIB

1. On 24 June 2009, a single car tram was approaching another tram that was stationary at a tram stop at the southern extremity of the route. When the driver applied the service brake, no braking resulted and by the time he applied the emergency brake, it was too late to prevent a collision occurring with the stationary tram. The collision occurred at an estimated 8–10 mph (13-16 km/h) and the moving tram pushed the stationary tram forward 0.42 metres. Although in passenger service, there were no passengers aboard either tram and no injuries to the crews. Minor damage to both trams resulted from the collision.
2. The moving tram (Figure 1) was one of a fleet of eight trams constructed between 1984 and 1987. Two other trams of a different fleet type have the same braking system. Three braking systems are fitted:
  - A service brake operated through a combined power/brake controller which pneumatically applies brake blocks to each of the eight wheels by means of brake cylinders.
  - A parking brake operated by a handle which applies brake blocks to the four outer wheels. The brake is applied by spring pressure and released by pneumatic pressure.
  - An emergency brake operated by depressing a plunger which pneumatically applies the brake blocks to each of the eight wheels. The spring applied parking brake is also applied to the four outer wheels.



Figure 1: tram involved in the collision at Starr Gate

3. The service brake when operated admits air pressure to a relay valve on each bogie (Figure 2). These operate to allow air pressure from each of two air reservoirs to the eight brake actuators. The pressure admitted to the actuators is in proportion to the movement of the service brake handle.

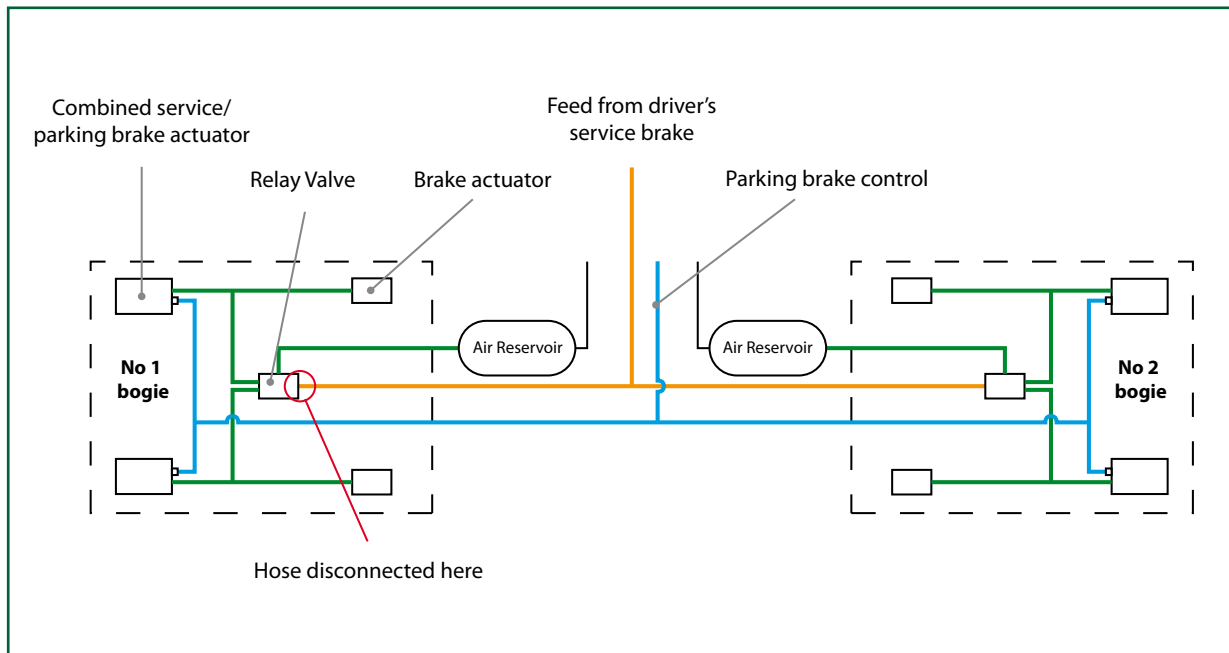


Figure 2: diagram of air system



Figure 3: disconnected hose

4. In order to accommodate the rotation of each bogie, the brake system pipework between the underframe and each bogie consists of flexible hoses secured in position by jubilee clips. One of these clips broke and the corresponding flexible hose came apart from its connection to one of the relay valves. The broken clip was found still in situ on the end of the hose. It is likely that the hose became disconnected from its fitting (Figure 3) in the period between the driver's last use of the service brake when it operated normally and his use of it when he attempted to stop just before the collision.
5. Depot tests indicated that with the hose to one of the relay valves disconnected, the service brake was completely ineffective, including to the bogie whose relay valve connections were intact, because there was insufficient air pressure left to operate it. Operation of an emergency brake plunger did provide sufficient air pressure to operate the relay valve whose connections were still intact to apply the brakes on that bogie. The parking brakes on both bogies also applied when an emergency brake plunger was operated.
6. Jubilee clips once fitted were not subject to any maintenance requirement or any consideration as to their serviceable life. The subsequent accumulation of dirt and detritus would also have hidden any failure of a clip which may otherwise have been noticed as part of a general inspection of the tram underframe.
7. The duty holder had not identified that the failure of a single clip could result in the complete failure of service braking. There was no evidence that any hazard analysis was carried out when the tram was built and there is no explicit requirement under the duty holder's safety management system for subsequent design changes to be subject to hazard analysis.
8. The existence of possible single point failures that could result in unsafe conditions had not been identified. The identification of such failures could have provided the opportunity to implement measures to prevent unsafe conditions occurring.

#### Actions taken by the duty holder following the accident

9. The duty holder replaced every jubilee clip on all 11 tram cars with the same sort of braking system fitted to the tram involved in the accident. Efforts were also being made to obtain a better quality fastening.

#### Conclusion

10. The RAIB has decided not to conduct a full investigation as it does not believe that it would lead to the identification of any significant lessons that would improve the safety of the railways or tramways, or prevent further accidents or incidents.

#### Learning points

11. Duty holders' safety management systems should include a requirement to carry out hazard analysis on the designs of new or altered rolling stock. The aim of this is to identify single point failures which could potentially lead to unsafe situations and to implement control measures commensurate with the severity of the risk.
12. The process in paragraph 11 should be applied retrospectively to older rolling stock that has not previously been the subject of hazard analysis.

13. Duty holders should consider the serviceable life of components in their maintenance plans so that they are renewed before they fail.

**The event took place at Blackpool Starr Gate on 24 June 2009**

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