

TRANSPORT FOR LONDON

SAFETY, HEALTH AND ENVIRONMENT ASSURANCE COMMITTEE

**SUBJECT: SIGNALS PASSED AT DANGER ON LONDON UNDERGROUND**

**DATE: 20 JULY 2010**

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**1 PURPOSE AND DECISION REQUIRED**

- 1.1 To assure the Safety Health and Environment Assurance Committee that the safety risks arising from Signals Passed at Danger (SPADs) on London Underground (LU) are being managed As Low As Reasonably Practicable (ALARP). The Committee is asked to note the paper.

**2 BACKGROUND**

- 2.1 Serious accidents on the mainline railway at Southall in 1997 and at Ladbroke Grove in 1999 were caused by high speed trains passing a signal at danger. Following these accidents, the mainline railway has mitigated the risks from SPADs to a significant extent. The Committee seeks assurance that LU has similarly mitigated the risks arising from SPADs and has done all that is reasonably practicable to do so.

**3 LU POSITION**

- 3.1 The equivalent 'wake-up call' call on LU resulted from three fatal SPAD related accidents in the 1970s and 1980s. The accidents were:
- (a) At Moorgate station in February 1975, a Northern line train overran at speed the red stop signal at the end of the platform, resulting in a heavy collision with the end wall of the tunnel. There were 43 fatalities.
  - (b) Near to Leyton station in August 1984, a train correctly applied the procedure for passing a red signal but did not maintain a low speed thereafter, resulting in a collision with the train in front and the death of the driver.
  - (c) At Kilburn station in December 1984, a train incorrectly passed a signal at danger in foggy weather. The driver reset the controls, moved forward, and was killed when the train collided with a stationary train in front.
- 3.2 These incidents led to the introduction of automatic controls, which in the event of a train passing a signal at danger would minimise the chances of a derailment or collision. As a result of the incident at Moorgate, the Trains Entering Terminal Stations (TETS) protection system was introduced at all

terminal locations across the London Underground network. The incidents at Leyton and Kilburn resulted in the implementation of 'Speed Control After Tripping' (SCAT) where a train can only proceed at slow speed for a defined period after tripping past a signal at danger.

- 3.3 In addition to the two controls described above, LU has also undertaken work, between 1995 and 2005 to bring signal overlaps up to modern standards, further considerably reducing the chance of a collision between trains. As a result of these interventions, there have been no fatal incidents and no reported injuries as a result of a derailment or collision of a passenger train following a SPAD.
- 3.4 Although signals passed at danger now represent a very low safety risk, they still result in disruption to the train service. On average, each SPAD results in a delay of eight and a half minutes. Given LU's service frequency of two minutes, this causes a considerable delay to LU's passengers. This in turn gives rise to other risks associated with holding trains in tunnels and causing congestion on stations. LU therefore continues to look for ways of further reducing the number of SPADs in a structured, programmed manner. This ensures safety and reliability risks remain ALARP.
- 3.5 LU's ongoing and extensive SPAD reduction programme includes the following measures which have contributed to LU's success in progressively reducing the number of SPADs:
- Implementing a revised SPAD investigation process to establish and address root causes and development of appropriate corrective action plans for train operators;
  - Reviewing and dispelling myths about SPADs and their causes;
  - Ensuring signal sighting reviews meet good practice standards;
  - Replacement of signal lamps with much brighter LED displays;
  - Identification of SPAD 'hotspots' and communication of these to train operators;
  - Improvements to the train operator recruitment and selection processes and overall competence management system;
  - Improvements to instructor operator selection, deployment, development and ongoing competence management;
  - Continuing to refresh drivers' awareness of the whole SPAD reduction programme so that the importance of avoiding SPADs is continually emphasised;

- Human factor studies that indicate that LU's SPAD performance is at least as good as can be expected, given the natural human error rates that can be expected for repetitive tasks; and
- A recent statistical study (on the Bakerloo Line) showing that, as far as can be estimated given the large number of variables involved, train operators react correctly to 99.95 per cent of red signals; further work is in progress on this, but it is thought that this represents a high human performance reliability rate.

3.6 LU has benchmarked its programme and SPAD performance against comparable railways to ensure we are replicating good practice. The only directly comparable railway is the New York Subway. This does not have either TETS or SCAT protection systems and yet its SPAD performance is approximately 40 per cent worse than LU's. The Committee suggested that the SPAD performance of Chiltern Railways and the Metropolitan Line be compared where they run over the same tracks. Unfortunately, no meaningful comparison is possible. This is because Chiltern Trains receive 'route preference' over Metropolitan Line trains as dictated by the commercial agreement that governs operations over the joint route. This means that Metropolitan Line trains are held at red signals while the Chiltern Trains get green signals. As a consequence, Metropolitan Line trains face far greater numbers of red signals than Chiltern trains do. Due to the nature of the (old) signalling system, however, it is impossible to calculate what the difference in numbers of red signals is and it is thus impossible to calculate normalised SPAD rates.

3.7 All the above is complemented by LU's longer term programmes to implement Automatic Train Operation/Protection (ATO/P) on all lines, the timetable for which is as follows:

- Jubilee Line – 2010/11
- Victoria Line -2012 (new system replacing current ATO/P)
- SSR – In phases from March 2016 to March 2018, depending on the delivery strategy and signalling contract award which will not be finalised until later this year
- Piccadilly line – later in the next decade, depending on further developments regarding Tube Lines
- Bakerloo line – 2020.

ATO/P systems almost eliminate the very low residual risks arising from SPADs.

## **4 CONCLUSIONS**

- 4.1 On its lines with conventional signalling, LU has more extensive and effective, proven engineering controls protecting against SPAD related risks than any other comparable railway in the world.
- 4.2 LU introduced the first ATO/P railway in the world on the Victoria Line in the 1960s. It introduced an even higher safety integrity ATO/P system on the Central Line in the 1990s. There has never been a SPAD related accident on either of these lines in the time concerned. LU is progressively introducing even better such systems across the rest of the network now and over the next decade. This mirrors best practice on other much more modern 'metro' type railways across the world.
- 4.3 LU has an extensive and on-going SPAD reduction programme in place that is regularly refreshed and which introduces relevant good or best practice from elsewhere. This ensures that the competence of LU's train operators and the effectiveness of its SPAD related procedural controls are to ever higher standards. This programme is progressively reducing the number of SPADs, helping to improve service reliability and mitigate yet further the already very low residual safety risks arising from SPADs.
- 4.4 LU is not complacent about these or any other safety risks. As a result, LU reviews performance on this matter at least quarterly and questions whether there are further reasonably practicable measures available to improve performance yet further. Where there are, these are included in the programme and trialled for effectiveness. Those that are successful are developed and implemented.
- 4.5 LU also provides regular updates of progress against its improvement programme and copies of its safety performance reviews to the Office of Rail Regulation (ORR). The ORR has a similar view, that the residual risks from SPADs are very low.
- 4.6 Given the above, LU is confident that its approach is comprehensive and thorough and, as a result, that safety risks arising from SPADs are being managed ALARP and that they are significantly lower than similar risks on other comparable railways.

## **5 RECOMMENDATION**

- 5.1 The Committee is recommended to NOTE this paper.

## **6 CONTACT**

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