

RAILWAY SAFETY REGULATIONS 1999 – Train protection systems and Mark I rolling stock

Background to the Regulations

Old trains did not meet modern standards of safety and construction

1. Many of the Mark I vehicles¹ on Britain's railway network were over 30 years old, dating from between 1951 and 1974 (with a life expectancy of 30-40 years). They consisted of a rigid underframe and a much less rigid body. There was no protection against vehicles over-riding one another, with the result that in the event of a crash the underframe of one carriage would slice into the passenger survival space of another.
2. Mark I rolling stock did not meet modern standards of railway vehicle safety and construction. Although fit for purpose when designed, in many respects Mark I trains did not meet the needs or expectations of today's travelling public.
3. The majority of Mark I vehicles also had hinged (slam) doors not under central control and which could be opened by passengers while the train was in motion, compromising safety of both the passengers on the trains and those waiting to board at stations.
4. Three Train Operating Companies (TOCs), Connex South East, Connex South Central and South West Trains (later South East Trains, Southern and South West Trains) operated the majority of the Mark I vehicles which remained in use after privatisation in 1994. Like all passenger vehicles on the mainline network, they were leased from all three rolling stock leasing companies (ROSCOs).

High profile incidents highlighted the need to replace old trains

5. Several accidents on the railways, including that at Clapham Junction, emphasised the need for improved passenger safety. The historical record suggested that in the past thirty years there had been about 150 deaths which might have been prevented if the rolling stock involved had been given a level of protection equivalent to that provided by the post Mark I designs.
6. Almost half (19 out of 39) of the incidents involving Mark I stock had resulted in more than three deaths, including totals of 35 and 49 at Clapham and Hither Green respectively.
7. The Hidden inquiry into the 1988 Clapham Junction incident concluded that there was a need to minimise the risk of deaths and injuries in railway incidents by improving trains' crashworthiness in the event of a collision.

¹ A vehicle is a car or carriage

8. It also recommended the introduction of Automatic Train protection (ATP)² across the network. But British Railways Board (BRB) and Railtrack concluded that the costs would be disproportionate to the benefits. The Health and Safety Commission (HSC) accepted that the network-wide fitment of BR ATP was not reasonably practicable on the basis that the money could be better spent on other safety measures, and that a Train Protection and Warning System (TPWS) would be fitted at selected locations as part of Railtrack's Train Protection strategy.

9. BRB concluded that it would be excessively costly to upgrade vehicles with a limited residual life expectancy. HSE accepted the finding in the expectation that Mark I stock would be phased out by 1999. But it then became clear a substantial number of Mark I vehicles would continue in service for much longer into the next decade.

10. Since the Clapham Junction incident, there were more collisions with fatalities involving Mark I stock. The Cannon Street buffer stop collision in 1991 also involved Mark I stock and resulted in two fatalities and nearly 550 injured. The investigation report stated that the design of the rolling stock increased both the severity and number of injuries involved.

In response, the government introduced statutory requirements to modify and replace the oldest slam-door trains

11. By 1995/96 the perceived lack of progress with withdrawal of Mark I rolling stock was examined by the Parliamentary Transport Select Committee. The Committee sought HSE's and Office of Passenger Rail Franchising's (OPRAF)³ (the then franchising regulator) agreement to a strategy for the stock to be phased out by 2003.

12. The HSC/HSE response in February 1997 indicated that work was in hand to review the available options for achieving modification or withdrawal of Mark I stock to a clearly stated timetable. Discussions with OPRAF indicated that it was thought that the stock would be completely replaced through the operation of the franchising process by 2006/7.

13. The Chairman of HSC wrote to the Secretary of State (SoS) for Transport on 10 March 1997 with proposals to discuss with the industry possible options, including Regulations prohibiting unmodified Mark I stock after a specified date. The SoS's reply endorsed the HSC's general approach.

² Automatic Train Protection intervenes automatically to slow an over-speeding train from going through a signal at red. It involves the installation of computerised equipment in both the train and at key points along the track.

³ When the railways were privatised in 1996, OPRAF was the principal supervisory body for rail passenger services

HSC consultation on the proposed Regulations

14. HSC held a public consultation in May 1998 on proposal to modify and subsequently remove from the network all Mark I trains. HSC's consultation document outlined the case for detailed, prescriptive Regulations.

15. HSC recommended the beginning of 2007 as the Mark I 'sunset' date, submitting Regulations to DfT Ministers in December 1998. The regulatory proposals were for Mark I stock to be prohibited by the beginning of 2003 and gave the industry option of retaining the stock if it was rebodied or modified (eg. by fitting the override devices such as 'cup and cone') by 1 January 2007.

16. The rebodding/modifying option was to allow the industry flexibility to run the rolling stock longer but it became clear that the preferred option for most of the industry was to introduce new rolling stock. After research HSE had accepted that the possible cup and cone modification to improve crashworthiness had proved impractical to implement. The Regulations effectively gave the railway industry the option of investing in the old rolling stock to make it safer or removing it from the network.

17. In July 1999, OPRAF and the Shadow Strategic Rail Authority advised the Secretary of State that removal by 31 December 2004 would be achievable if replacement stock for all remaining Mark I vehicles was ordered before the end of 2001. In view of this advice, HSC agreed to the Secretary of State's request that the statutory deadline for the removal of all Mark I stock be brought forward to 31 December 2004.

18. The decision to bring forward the date for removal of all Mark I rolling stock to the end of 2004 also had the effect of making the modification option economically less attractive and it became clear that the industry preferred to pursue a programme of replacement.

Problems with meeting the statutory deadline of December 2004 to withdraw Mark I rolling stock

19. Under the leadership of the Strategic Rail Authority (SRA), a replacement programme, in partnership with TOCs and Network Rail – the Southern Region New Trains Programme (SRNTP) was established in 2002. The overall cost of SRNTP was estimated at over £3 billion and it included necessary very significant power supply upgrades of to handle the Mark I replacement stock. HSE monitored the delivery of this programme through cross industry summits and considerable progress was made. However, HSE had recognised that the timetable for delivery by the end of 2004 was becoming increasingly challenging.

20. During 2003, the National Audit Office (NAO) carried out a value for money study of the process of introducing new trains. The findings of the NAO, published in February 2004, highlighted a number of problems with the introduction of new trains and recorded that the deadline of 31 December 2004 was unlikely to be met without significant curtailment to London commuter services.

Exemption application by TOCs

21. The three TOCs (Southern, South Eastern Trains and South West Trains) and Network Rail applied to HSE for exemptions to operate Mark I rolling stock during 2005, past the deadline of 31 December 2004. HSE granted limited exemptions with conditions that allowed the TOCs to run Mark 1 rolling stock until the end of November 2005.

22. Under the stewardship of the SRA, the TOCs fully delivered their commitment to withdraw Mark I rolling stock by November 2005 and introduce the new trains. To date, the Regulations have successfully achieved what they were meant to as the Mark I issue is more or less closed out, but there is still a need to manage the existing and potential future exemptions given to Heritage and Charter operators to run Mark I.

Long-term exemptions

23. Long-term exemptions from Regulation 5 (1) of the Regulations have been granted to Heritage and Charter train companies and other operators to continue to run stock without central door locking. These exemptions expire on 31 March 2013.

24. HSE also granted exemption to South West Trains to continue, until 2013, operation of the two 3-car units formed of Mark I class 421 vehicles with the particular conditions that the train shall be operated (in passenger service) only on the Lymington Branch between Brockenhurst and Lymington.

25. Whilst any Mark I rolling stock continues to be used for special services on the mainline network some sort of regulatory approach is needed.

Position regarding TPWS

26. The end of 2003 saw the successful completion of the TPWS fitment programme across the network as required by the Regulations. HSE granted exemptions from these Regulations where the industry produced good evidence to show that the costs were high and safety benefits were low.

27. In 2003 HSE granted exemptions from fitting TPWS at certain categories of Permanent Speed Restrictions (PSRs) at diverging junctions and Temporary Speed Restrictions (TSRs). As a condition of the diverging junctions exemption, Network Rail prepared a programme of alternative, reasonably practicable fitments of greater safety benefit in the form of TPWS+; an enhancement developed since the Regulations were introduced. In granting these exemptions, HSE accepted that evidence suggests that TPWS is much less effective for mitigating overspeed risk than was anticipated when developing the Regulations. This was why the Regulations provided the regulator with wide-ranging exemptions powers.

28. In September 2005 Network Rail completed the programme of installation of TPWS+, an enhancement of TPWS that is effective at speeds up to 100 mph.

29. Other systems providing full Automatic Train Protection are installed on the fast lines of the Great Western Main Line (between London and Bristol), the Heathrow Express, the Chiltern Line (from Marylebone to Aynho Junction), and the Channel Tunnel Rail Link and on sections of the London Underground network.

HSE involvement in deciding the extent of TPWS fitment

30. Railtrack, which had developed and trialled TPWS, responded to HSE consultation on the Railway Safety Regulations accepting the broad thrust of the proposals. Railtrack endorsed the TPWS fitment to mitigate risk from SPADs and permanent speed restrictions. However it resisted fitment at other speed restrictions and at platform buffer stops. But HSE did not find its arguments sufficiently convincing and these locations remained within the Regulations and the regulatory impact assessment, but with a strengthened exemption facility. In late 1998, Railtrack indicated to the HSC that it was content with the draft Regulations.

TPWS costs

31. Railtrack provided HSE with the data, which underpinned HSE's cost benefit assessment in 1998, which estimated the total cost of TPWS fitment to be in the region of £ 99-102 million. The subsequent DfT Regulatory Impact Assessment in 1999 estimated the cost in the region of £ 80-105M. Railtrack original business case estimate for the programme of infrastructure fitment was £160m. Network Rail's final costs in 2003 were in excess of £580m.

Safety benefit of TPWS

32. The completion of TPWS fitments programme is a significant achievement for the industry and has already delivered real safety benefits. TPWS+ fitments are providing further safety enhancements. TPWS has reduced the risk from SPAD 90% since April 2001, which already beats the 80% improvement target set for 2009.

Exemptions have helped to reduce costs

33. One of the key changes HSE made to the draft Railway Safety Regulations as a result of consultation was to strengthen the exemption facility. This enabled HSE to consider 'all circumstances of the case' when applications were made, reflecting the unusually prescriptive and technical nature of the Regulations. This is because when they were drafted there were still uncertainties in developing possible Mark I modifications and using TPWS as an overspeed control mechanism.

During 2002/03, HSE granted a series of exemptions from the Regulations in response to evidence from Network Rail of the low safety benefit and disproportionate cost of fitting TPWS at certain types of speed restriction – around 2,000 locations. HSE and Network Rail worked together constructively on these exemption processes, and all work was completed by the end of December 2003. The two key exemptions resulted in savings of around £64 million.