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# Report by the Health and Safety Executive's Railway Inspectorate into the train accident at Winsford South Junction on 23 June 1999

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## Executive Summary

Shortly before 9 o'clock on Wednesday, 23 June 1999, at Winsford in Cheshire, the 0630hrs Virgin Trains Euston to Glasgow express collided with the rear end of the 0844hrs First North Western Crewe to Manchester empty coaching stock train at around 50 mph. The collision caused injury to 27 people, 4 of whom sustained major injuries.

The collision took place near to a track junction which has existed in its present form since around 1973. No previous accidents have occurred at the junction in its current layout.

The Euston-Glasgow train was a traditional express made up of an electric locomotive and modern passenger coaches. The empty coaching stock train was made up of two 142 diesel multiple units, known as "Pacers". The "Pacer" train suffered severe damage, and it was fortunate there were no passengers on board.

HSE investigations have concluded that the cause of the collision was the result of the driver of the empty coaching stock passing a signal at danger, and this was most likely the result of driver human error. No evidence of signalling or braking malfunction has been found.

HSE's investigation has found no corporate level breach of health and safety legislation and HSE considers there is insufficient evidence for any prosecution under the Health and Safety at Work etc. Act.

HSE has considered the lessons which can be drawn from this accident with a view to reducing the likelihood of similar events on the network, resulting in injury :-

- Firstly, since the incident HMRI has made public the results of a year long audit into the way the railway industry manages the risks of signals being passed at danger. As a result of discussions with the industry, Railtrack and all train operating companies, including First North Western, have been asked to produce action plans by 1 October to implement the 22 specific actions identified by the audit. Railtrack, in collaboration with all train operating companies, have also been

requested to submit quarterly progress reports to HSE to demonstrate that any actions which are identified are being fully implemented.

- Secondly, Parliament has recently introduced the Railway Safety Regulations 1999, which will require the fitment of automatic train protection systems to protect certain types of junctions by 1 January 2004 to reduce the chances of signals being passed at danger leading to train collisions. The junction at Winsford is of the type which is covered by these new legislative requirements, and will therefore need to have such a protection system fitted by that date.
- Thirdly, as a result of the severe damage sustained by the Class 142 Pacer vehicles, HSE is concerned to ensure that appropriate risk reduction measures are identified and considered. As part of this work, HMRI requested the Health and Safety Laboratory (HSL), in collaboration with the consultants W S Atkins and Halcrow Transmark, to examine as a matter of urgent priority the Class 142 Pacer vehicles involved in the incident, assess their likely crashworthiness when impacting other rail vehicle types and advise on possible ways of improving their safety. HMRI is in discussion with industry, particularly both Rolling Stock Leasing Companies who own Class 141-144 vehicles, to consider the outcome of this research. HSE intends to publish the results of the research shortly.

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## The incident

1. At approximately 08.45 on 23 June 1999, the 06.30 Virgin Trains Euston to Glasgow express (train identifier 1S47) collided with the rear end of the 08.44 First North Western empty coaching stock from Crewe - Manchester (train identifier 5H80). 27 people were injured ( 24 passengers and 3 railway-related employees), four of whom sustained major injuries. The collision took place on Railtrack owned infrastructure at Winsford South Junction just south of Winsford station in Cheshire.

## The Infrastructure

2. Winsford South Junction is where the West Coast Main Line (WCML) changes from a double line to the north (up and down lines) into a quadruple line from the south. The four track section lines south of the junction are referred to as Down slow, Down fast, Up fast, and Up slow. The convergence of Down slow and Down fast is protected by two 4 aspect colour light signals WD12 (Down slow) and WD13 (Down fast) which are controlled from Winsford signalbox approximately 2.8 kilometres (1  $\frac{3}{4}$  miles) to the north. The junction is not visible from the signal box. Line speeds are 176kph (110 mph) for the fast line and 80 kph (50 mph) through the junctions from and to the slow lines. Prior to the junction, line speed on the Down slow is 120kph (75 mph). The signals in rear of WD12 and 13 are a series of four aspect automatic signals from Crewe Coal Yard, and appear on the Winsford box diagram. In the Up direction south of the junction the signals are parented on Crewe Coal Yard Signal box. All lines are equipped with Automatic Warning System (AWS).

3. The convergence of the Down lines occurs at points No. 24. The junction type is a typical "trailing point" installation. The distance between signal WD12 and the junction is 265 metres (294 yards), which is in accordance with current signalling principles. All signals and points on the WCML through Winsford are operated electrically from Winsford Signal Box, and the present junction layout has existed since circa 1973. Since that time, there is no recorded history of incidents at this junction. Although there have been 2 previous major incidents at or close to Winsford this century, in 1948 and 1962, neither of these are considered relevant given the nature of these incidents and the changes that have been made to the infrastructure since then.

## The Trains

4. Train 1S47 was operated by Virgin Trains and comprised Class 87 locomotive 87027 and a rake of eight Mk III coaches and a driving van trailer. In addition to passengers there was a train crew which included a driver and guard.

5. Train 5H80 was operated by First North Western (FNW), and was an empty coaching stock move from Crewe to Manchester, following routine tyre turning of the wheels. It comprised two Class 142 diesel multiple units (DMUs), 142003 leading (comprising cars 55594 and 55544) and unit 142008 in rear (comprising cars 55549 and 55599). The train crew consisted of the driver only.

### *Investigation*

6. Inspectors from HSE's Railway Inspectorate (HMRI) attended the scene of the incident the morning of the incident. The subsequent HMRI investigation was carried out in conjunction with, and with the full co-operation of, representatives from Railtrack, British Transport Police, First North Western and some of Railtrack's contractors, all of whom were conducting investigations for their own purposes.

7. Evidence from the scene of the incident suggested a significant impact speed, indicated by:-

- a) the extent of damage to the class 87 locomotive
- b) the destruction of the rear cab and part of the passenger space (approximately one window bay) of car 55549.
- c) the displacement of both bodies from their under frames on unit 142008, by approximately 2 metres
- d) fracture of the DMU inter-unit couplers

Subsequent simple mathematical modeling of the incident supported this conclusion and suggests an impact speed of around 80 kph (50 mph.)

8. Points 24 were damaged, with a burr on the "six foot" side point blade, the cess-side point blade standing off from the cess stock rail, and several components of the linkage and stretcher bars distorted. This damage is consistent with a points "run-through" from the slow line, i.e. a train has traversed the points with the point blades not set for that movement. Damage was also evident in the form of a break in the Down main running rail, at about the mid-point of the Virgin train. There was no evidence of battering - suggesting that the rail fracture occurred at the time of the collision.

9. There was nothing unusual or unexpected found in the driving cabs of either trains. In both cases the AWS equipment switches were in the "ON" position, with the seal for this equipment intact. AWS "sunflower" status in the driving cabs was as follows:

Virgin Train Class 87 (train 1S47) - "All black". This means that the status of the last AWS sub-system passed by this train had either been "clear" (signal at green with no need for driver acknowledgment) OR "warning" (for example if signal at caution or red) which had not been acknowledged by the driver.

First North Western DMU set (train 5H80) - "Yellow/black". This means that the status of the last AWS sub-system passed by this train had been "warning" and the train driver had acknowledged the audible alert that would have sounded in the cab. By acknowledging the alert, within a brief time window, automatic brake application is prevented.

10. During the initial investigation, Railtrack zonal control advised HSE inspectors that they had received a NRN radio message from the FNW train driver shortly before the collision, advising he had passed a red signal and

was blocking the main line, and asking that a message be broadcast to stop all trains in the Winsford area. This was immediately done, but by this stage the Virgin train was already approaching Winsford with the driver applying the emergency brake having seen signal WD13 suddenly change to display a red stop aspect. The train describer display at Winsford signal box was subsequently examined, and it showed the Virgin and First North Western trains as held at signals WD12 and 13 respectively, suggesting both trains must have passed a signal at red immediately prior to the collision.

## HSE's Preliminary Conclusions and Further Investigations

11. All the initial evidence supported a conclusion that the primary cause of the collision was the passing of signal WD12 whilst at red (danger) by FNW train 5H80, and this is consistent with the AWS "sunflower" status in the driving cabs of the respective trains and the train describer display in Winsford Signal Box. A consequence of passing WD12 at red, and its overlap, would be to suddenly change signal WD13 from green to red out of normal sequence (see paragraph 10 above). HSE's further investigations therefore focused on possible reasons for passing WD12 at danger, specifically DMU braking equipment malfunction and human error.

### DMU Braking equipment malfunction.

12. A number of tests and examinations of the brakes of the FNW train were carried out and witnessed by HSE inspectors and industry experts:-

- a) Static operational brake tests on unit 142003 were carried out in accordance with prescribed procedures, and no defects were found.
- b) Visual examination of the damaged unit 142008 suggested that all brakes were hard on at the time of the collision. It was not possible to carry out an operational test, given the extent of accident damage.
- c) The agreed conclusion of the examination of all 32 brake blocks, the full complement from both DMUs, was that their last application was "significant"
- d) The electrical control aspect of the DMU braking system was examined with a view to identifying possible fault scenarios, that could lead to a braking malfunction which the driver could have been unaware of. No plausible scenarios were found.

### Human Error

13. Both train drivers have co-operated fully with HSE's and the industry's inquiries. The FNW driver's recollection of events is not entirely clear, but he can recall passing WD12 at danger, and that prior to that he had passed a

single yellow signal and a warning for the 50mph speed restriction. He recalls he acknowledged the AWS audible alerts prior to the red signal. The driver also recalls making the NRN radio message having slipped past the red signal onto the main line.

14. There are no irregularities in the driver's (documentary) competence to be in charge of the train . The following items in particular have been examined and found satisfactory:

- Route knowledge (qualification to be driving the route)
- Assessment of competence to be a driver
- Traction knowledge (qualification to drive this class of unit)
- Working hours prior to the incident
- Drugs and alcohol tests immediately after the incident.

The driver is not on FNW's "at risk" register, i.e. he does not have a record of passing signals at danger.

## Conclusion

15. Based on the evidence collected, it is HMRI's opinion that the cause of this collision was First North Western train 5H80 passing signal WD12 whilst at danger. With no evidence of mechanical or electrical failings within either train or infrastructure, the conclusion is drawn that the underlying cause was human driver error.

## Legal requirements

16. The legislation applicable that is enforced by HSE is:

- a) General - The Health and Safety at Work etc. Act 1974 (HSW Act)
- b) Railway specific :
  - Railway Safety Case Regulations 1994
  - Railway Safety Critical Work Regulations 1994

There are no indicators of corporate shortcomings in the above legislation, with respect to the railway companies involved.

17. With respect to individuals, Section 7 HSW Act places a duty on every employee at work "to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work". Whilst there is one indicator to suggest a breach of Section 7 by the FNW driver, acknowledgement of AWS warnings without appropriate braking response, in the opinion of HSE it is insufficient on its own to pursue a breach of Section 7 in the courts. This appears to have been a genuine human error by a driver with long experience and a previously unblemished record.

Immediately after realising his mistake, he followed all the correct procedures to minimise the consequences of his erroneous actions.

## Wider Observations and future actions

18. Signals passed at danger. This incident at Winsford was not unique, as last year there were 643 incidents of trains passing signals at red (often referred to as SPADs - Signals Passed At Danger). HMRI has just made public the results of a year long audit into the way the railway industry manages the risks of SPADs, and as a result of discussions with the industry, Railtrack and all train operating companies, including FNW, have been asked to produce action plans by 1 October to implement the 22 specific actions identified by the audit. HMRI have also requested Railtrack, in collaboration with all TOCs, to submit quarterly progress reports to HSE to demonstrate that any actions identified are being fully implemented.

19. Automatic train protection systems. The recently introduced Railway Safety Regulations 1999 will require the fitment of automatic train protection systems to protect certain types of junctions by 1 January 2004 to reduce the chances of signals being passed at danger leading to train collisions. The junction at Winsford is of the type which is covered by these new legislative requirements, and will therefore need to have such a protection system fitted by that date. While these measures will not prevent every accident, it will provide a high level of protection against accidents of this type caused by driver error.

20. Crashworthiness of "Pacer" trains. These trains were developed to provide a lower cost alternative to the traditional design of railway train. The design was based on a bus type body of construction which is carried on a 4-wheel underframe. The body is secured to the underframe by "wire straps". In the Winsford collision the end of the body was severely damaged by the heavy Virgin locomotive before the securing straps parted and the "body" was then propelled forward along the underframe. Although the interior fittings of the body broke loose, the forward parts of the body shell were relatively undamaged.

21. Immediately after the Winsford crash HMRI requested the Health and Safety Laboratory (HSL), in collaboration with the consultants W S Atkins and Halcrow Transmark, as a matter of urgent priority to examine the Class 142 pacer vehicles involved in the incident, assess their likely crashworthiness when impacting other rail vehicle types and advise on possible ways of improving their safety. HMRI is already in discussions with the two Rail Stock Leasing Companies who own Class 141-144 vehicles (which include Pacers) to consider the outcome of this research. The results of the HSL work will be published shortly.