



Rail Accident Investigation Branch

Fire on board a freight shuttle in the Channel Tunnel - web site update and supplementary information

- 1 The RAIB has been working with the Bureau d'Enquêtes sur les Accidents de Transport Terrestre (BEA-TT), the body responsible for the investigation of railway accidents in France, to jointly investigate a fire on board a train in the Channel Tunnel. Since the train stopped in the French section of the tunnel, the investigation is being led by BEA-TT. The RAIB's scope was primarily to determine the cause of the fire.
- 2 The fire completely consumed two lorries that were being conveyed on the shuttle, and caused damage to rolling stock, railway infrastructure and the tunnel lining. It also severely disrupted services through the Channel Tunnel for several days.

The incident

- 3 At 12:00 hrs (CET) on Saturday 17 January 2015, Eurotunnel freight shuttle 7340, travelling from Folkestone to Coquelles (France), was entering the UK portal of the Channel Tunnel, when an electrical arc occurred between the overhead power line and the train. The arc occurred above a lorry carried on the 15th (out of 32) carrier wagons (each carrier wagon is designed to carry one lorry or a number of smaller commercial vehicles), and was almost certainly due to an over-height radio aerial attached to the back of the lorry's cab.
- 4 The fault operated electrical protection devices which automatically tripped the power supply to the overhead line, and shuttle 7340 came to a stand inside the tunnel. The control centre staff were unaware of the reasons for the power trip and, in accordance with Eurotunnel's procedures, re-instated power. They then gave the driver of shuttle 7340 permission to restart its journey, but at a reduced speed of 100 km/h (instead of the normal speed of 140 km/h).
- 5 About 23 minutes later, at 12:23 hrs, the control centre received a fire alarm from a detector located within the tunnel approximately 29 km from the UK portal (21 km from the French portal). At the same time, a fire alarm system on the train detected a fire, which the driver reported to the control centre. Shortly afterwards, the power supply to the overhead line tripped for a second time.
- 6 At that moment, the shuttle had already entered the last SAFE station in the Running Tunnel North. SAFE stations are areas of the running tunnels fitted with a water mist system that is designed to control a fire on a stationary train. There are two in each running tunnel, each approximately 870 metres long.

- 7 Without electrical power, the driver of shuttle 7340 had to bring the train to a controlled stop in the tunnel. At 12:26 hrs, the driver stopped the train positioned such that the amenity coach, which is located immediately behind the leading locomotive, was adjacent to cross-passage 4418, approximately 16 km from the French portal. Cross-passages, which are located at frequent intervals throughout the system, connect the two running tunnels with the adjacent service tunnel, which provides a safe haven in case of fire. In this position, the rear of the train had passed the end of the last SAFE station by approximately 750 metres, and so the water mist system was not activated.
- 8 All 38 passengers and 3 members of staff were travelling in the amenity coach. Once the door of cross-passage 4418 had been opened by the control centre, evacuation into the service tunnel commenced at 12:30 hrs. This was reported to be complete by 12:37 hrs.
- 9 By 13:35 hrs, all other trains had left the tunnels and firefighting operations were commencing. The passengers and crew of shuttle 7340 departed from cross passage 4418 at 14:03 hrs and were taken by service vehicles to the French terminal of the Channel Tunnel system. Two lorries on the shuttle were confirmed to be on fire by the firefighting services. The fire was brought under control at 16:40 hrs but it still required several hours of dousing to cool the shuttle afterwards.



Figure 1: Images of the damage to the two lorries (both still located on the carrier wagons)

The investigation

- 10 The CCTV footage of the lorry loaded on the 15th carrier wagon captured during the loading operations on the Folkestone terminal shows a whip aerial standing higher than the leading edge of the trailer. With the assistance of the lorry and trailer manufacturers, the RAIB established that this aerial was standing higher than Eurotunnel's height limit of 4,200 mm above road level and as a result came close to the overhead power line at the UK portal (a location where the height of the overhead power line reduces). The proximity of the whip aerial to the overhead power line almost certainly caused the electrical arc at the UK portal which initiated the fire.

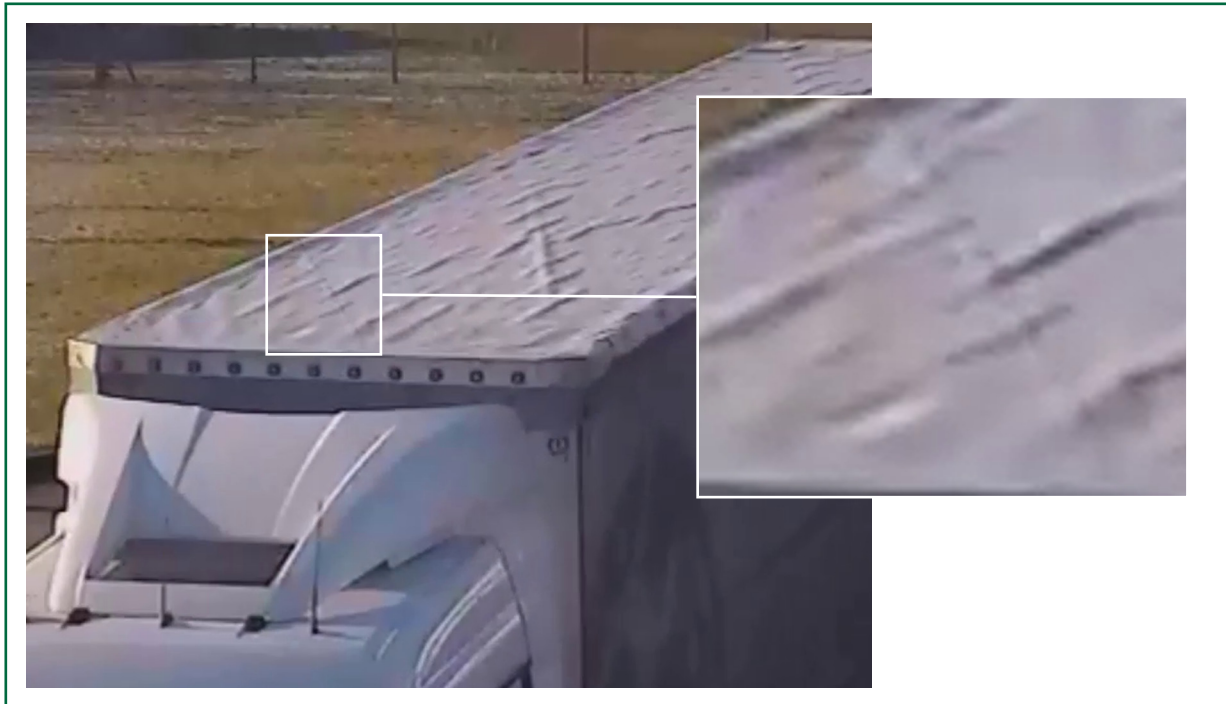


Figure 2: CCTV image of the incident lorry during the loading operations showing the whip aerial fitted to the back of the lorry's cab

- 11 The RAIB studied the equipment and processes that are in place on the Folkestone terminal aimed at detecting over-height, thin aerials (about 1 mm in diameter). It concluded that, in order to detect over-height aerials, Eurotunnel relied solely on the integrity of sensors located at the bottom of the loading ramps referred to as the aerial detection system. This system had been in place since operations began on Eurotunnel's infrastructure in 1994. On the basis of tests organised by Eurotunnel after the incident, and using the data provided by the manufacturer of the sensors, the RAIB concluded that the aerial detection system was not sensitive enough to reliably detect thin aerials at typical lorry speeds when they passed in front of the system. This is a probable explanation of why the system did not detect the over-height aerial.
- 12 One of the three loading agents in charge of observing the train on departure identified a metal aerial on the incident lorry which he perceived to be standing higher than normal. This loading agent was inexperienced and he was unsure whether this aerial was really over-height. He sought guidance from another member of staff who reminded him that the lorry would have already passed the aerial detection system and took no further action after this discussion. The RAIB reviewed the working instructions for these loading agents and witnessed the difficulties associated with identifying thin aerials on a departing train. The RAIB concluded that these loading agents cannot be expected to reliably detect thin aerials. Nevertheless, the RAIB observes that, in this instance, an opportunity to stop the departing shuttle was missed.

- 13 As the train came to a stand inside the tunnel following the initial power trip (12:00 hrs), smoke appeared to be developing inside the cab of the incident lorry (this can be observed from CCTV images taken from a camera located inside the tunnel). However, as there was no requirement for the train to be inspected, this early sign of a developing fire was not identified. It was 23 minutes later that the fire was detected. In the meantime, opportunities to stop the train within one of the two SAFE stations had been missed.



Figure 3: CCTV image of the incident lorry showing smoke inside the cab shortly after the power trip

- 14 The incident took place on a wagon without any roof structure to provide a physical separation between the overhead power line and the lorry. The wagons had originally been supplied with a roof which had subsequently been removed (in stages) because of concerns over its structural integrity. The RAIB investigated the robustness of the processes used by Eurotunnel to justify the removal of the roof. It concluded that the assessments of the safety risks prepared in support of the modifications did not lead to a review of the sensitivity and reliability of the aerial detection system, and relied on control measures which, while being positive steps towards the protection of assets and operations, did not address the additional risk to passengers and crew.
- 15 Eurotunnel has taken actions intended to reduce the probability of the recurrence of a similar incident.
- 16 The investigation into the cause of the fire is now complete. The investigation into Eurotunnel's response to the second power trip and the fire continues.
- 17 BEA-TT and RAIB will jointly publish the findings relating to both the cause of the fire and Eurotunnel's management of the incident, including any recommendations to improve safety, at the conclusion of the investigation. The report will be published in both French and English.