

## **English Channel Tunnel**

### **November 18, 1996**

*NFPA's Chief Fire Investigator, Ed Comeau, traveled to the United Kingdom to investigate the fire which occurred in the English Channel Tunnel.*

The fire occurred on a 29-car shuttle traveling from France to the United Kingdom on Monday, November 18, 1996 at 8:45 p.m., UK time. (NOTE: There is a 1-hour time difference between Folkestone, UK and Coquelles, France. For consistency, all times quoted will be UK time.) The shuttle that was involved was a Heavy Goods Vehicle shuttle, or an HGV, which transports lorries (cargo trucks). The carrier wagons on which these lorries are conveyed are covered with a solid roof, and the sides are open lattice.

The tunnel is 50.45 kilometers long (31.35 miles), and runs from Folkestone in the United Kingdom, to Coquelles, France and is operated by a private corporation, Eurotunnel. It is configured with two running tunnels, which run in parallel (each tunnel is referred to as the north running tunnel and the south running tunnel) and measure 7.6 meters (25 feet) in diameter each. A service tunnel runs between the two running tunnels. It is connected to the running tunnels by 270 cross passages located every 375 meters (1,230 feet). The service tunnel measures 4.8 meters (16 feet) in diameter. The depth of the tunnel beneath the seabed varies from 45 meters to 75 meters (150 feet to 250 feet).

The fire was reported to have occurred in a carrier wagon at the rear of the train. According to personnel from the French Fire Brigade, the fire was observed as the train was entering the tunnel. This report was relayed to the Railway Control Center (RCC), and the decision was made to have the train continue towards the UK where the fire would be extinguished when it emerged, per pre-existing standard operating procedures. This information was relayed to the driver of the train.

There are emergency response teams stationed at each end of the tunnel that are referred to as the First Line of Response, or FLOR. The FLOR from the French side began responding immediately through the service tunnel. The United Kingdom team was notified initially, but a response was not requested. However, the UK FLOR elected to begin responding towards the midpoint of the tunnel via the service tunnel in the event that they were needed.

During the passage through the tunnel, the driver of the train received a warning light on his control panel that indicated that there was an abnormality in the train that may cause a derailment. Standard operating procedures require that the train be stopped until such a condition can be verified, and he was able to bring the front of the train to a controlled stop at marker 4131, approximately 19 kilometers (12 miles) into the tunnel from the terminal at Coquelles.

The Chef de Train (CdT), who is in overall charge of the train, then opened an exterior door on the club car to determine what was wrong, and smoke immediately entered the club car, which was occupied by 33 people. He then closed the door, but it was reported that the smoke was so heavy that people were required to lie on the floor in order to breathe.

According to UK fire officials, the CdT then proceeded to evacuate the passengers and crew from the club car and into the cross passage.

The French FLOR arrived on the scene and assumed command. A passenger train traveling in the opposite tunnel was stopped and the uninjured passengers were placed on it.

The UK FLOR arrived on the scene while the French FLOR was treating the injured victims. After a brief consultation between the officers of the French and UK FLORs, it was decided that the French would continue to treat the victims while the UK personnel sent a crew into the tunnel to evaluate the fire.

The door at the cross passage at marker 4131 was used to gain access to the tunnel. By this time the Supplementary Ventilation System (SVS), which can control the direction and volume of the airflow within the tunnel, had been activated and air was being directed from the front of the train towards the rear (UK

side towards the French side). Personnel from the UK FLOR entered the running tunnel and verified that the club car and locomotive did not contain any additional trapped victims. They then proceeded towards the rear of the train to evaluate the conditions.

Meanwhile, the victims who were being treated in the service tunnel were transported by ambulance vehicles through the service tunnel to the French terminal.

Additional fire-fighting resources from the French side arrived, and a French command officer assumed command of the incident and declared it a bi-national emergency. (Per the pre-established bi-national plans for the Tunnel, any incident which occurred within a country's territory would be commanded by that country's personnel. This incident was well within the French boundary.)

Through an oversight, the UK second line of response (SLOR) was not notified of the fire until 10:02 p.m. At approximately 10:19 p.m., the UK SLOR was responding via the service tunnel. The SLOR for both countries is comprised of fire fighting resources that respond from stations located outside of the respective terminals. The command officer who served as the UK liaison with the French incident commander responded as part of the SLOR.

A consultation was held between the French and United Kingdom command officers, and it was decided that the French would attack the fire from cross passage 4163 and that the UK FLOR would attack the fire from cross passage 4201. This strategy would allow the French FLOR to attack the fire from "upstream" and the UK FLOR to attack the fire from the middle. It was felt that if the fire was attacked from only upstream, they would not be able to gain effective fire control within an acceptable period of time. This was based on the fact that few crews could actually be placed within the tunnel because of space limitations.

UK personnel were positioned at the cross passage door at 4201, which was then manually opened. The air pressure in the service tunnel was being maintained at a higher level than the air pressure in the running tunnel, which resulted in a very high airflow through the open cross passage door into the running tunnel. This airflow was so strong that it was necessary for personnel to brace themselves as the door was opened and to ensure that they did not have any loose equipment, which would have been blown into the tunnel as the door was opened.

In addition to the airflow in the service tunnel, the ventilation system in the running tunnel had been increased and was blowing from the UK side to towards the French side (west to east). The airflow in the running tunnel, coupled with the airflow coming out of the cross passage, created a "bubble" that measured approximately 1 meter (3.2 feet) out of the cross passage into the running tunnel. Within this bubble it was possible to stand in relative comfort and safety. However, once personnel passed beyond this boundary, there was intense heat and smoke which required that all personnel wear full protective equipment. Hose lines were connected into the service tunnel's wall hydrant and advanced into the running tunnel. Initial fire-fighting efforts focused on extinguishing the fire directly in front of this cross passage door. Once this was achieved, personnel then turned to the east and began advancing hoselines towards the rear of the train. Attempts were made to advance lines down the walkway on the north side of the train, through the train itself, and on a smaller maintenance walkway on the south side of the train. Due to the extreme heat, crews were able to work for only about 8 minutes before having to retreat and be replaced by fresh crews.

It was extremely difficult to advance the lines. Large amounts of concrete were spalling off explosively from the tunnel lining due to its exposure to the fire. This resulted in very fine concrete rubble collecting on the access walkway, which had the consistency of large grains of sand and made the footing very difficult. In addition, this concrete rubble was hot, and a number of fire fighters reported that the soles of their feet were becoming hot while standing on this rubble. Furthermore, the fire fighters were being regularly bombarded on their helmets by the debris as it fell off of the tunnel lining.

The debris was also collecting on the roof of the HGV transporters, which ultimately collapsed in a "V" shape due to the weight of the material.

Two lines were being advanced from the UK position, while five or six lines were being advanced from the French position. It was reported that there was insufficient water pressure and volume to maintain an aggressive attack until Eurotunnel engineers reconfigured the water supply approximately 6 hours into the incident.

Fire control was reported at 5:00 a.m. on the following day, and the fire was reported to have been extinguished at 11:15 a.m.

A total of eight HGV transporters and their contents were completely destroyed, as well as a loader and the rear locomotive. Significant damage occurred to the tunnel lining for approximately 200 meters (656 feet), with serious damage to an additional 200 meters (656 feet).

According to reports from the Kent Fire Brigade, approximately 406 millimeters (16 inches) of concrete was destroyed in some areas, leaving only 51 millimeters (2 inches) of concrete remaining.

No injuries to fire fighters from either country were reported.

The fire resulted in passenger service interruption for 15 days. Freight trains started running through the undamaged tunnel again on November 21, 1996. Eurostar (passenger trains that operated between London and Paris) service was allowed to resume on December 4, 1996. Tourist shuttles (cars only) between Folkestone and Coquelles were allowed to begin service on a limited basis on December 10, 1996. Tourist shuttles carrying coaches started running again on January 6, 1997.