

Channel Tunnel Fire, UK/France

- *The Arup View*

Introduction

A fire occurred in the Channel Tunnel on Thursday 11 September 2008.

The tunnel provides both passenger and freight services between the UK and France.

This is the third major fire incident in the world's longest undersea tunnel since its opening in May 1994. The first was in November 1996 involving a freight train, which resulted in the tunnel being closed for six months for refurbishment. The second fire occurred in August 2006, when a fire broke out on a lorry on a freight train about 12km from Folkestone.

Both incidents involved freight trains and in both passengers and train crew were evacuated.

The following information provides background information on the design of the tunnel as well as initial and as yet unconfirmed reports of the latest incident. All information for this report has come from publicly available sources, and any definitive facts and conclusions concerning the incident or conclusions to be drawn will have to await any future government or other inquiry.

Tunnel Design

The tunnel between the UK and France is 50km long whereby 38km are located up to 40m below the seabed.

The tunnel is designed to provide two running tunnels each with an internal diameter of 7.6m, with a service tunnel (internal diameter of 4.8m) situated between them. The main parts of the tunnels are constructed using precast segmental reinforced concrete lining rings. The service tunnel is connected to both of the running tunnels by regular cross-passages spaced 375m apart.

Evacuation walkways are provided in each of the running tunnels providing access via the cross-passages to the service tunnel.

The walkways are designed to contain trains within the tunnel gauge, should they become derailed. The two running tunnels are fitted with a smoke ventilation system that is designed to control and purge the smoke. The fans are located at either end of the tunnel providing longitudinal airflows around any stationary trains.

Fire brigade attendance is via the service tunnel. It is equipped with water mains and hydrant connections in each of the cross-passages. Additional fire extinguishers and foam creating devices are also provided.

Train Services

There are three different services provided between the UK and France; Eurostar passenger trains, Eurotunnel's road vehicle shuttle and freight shuttle.

The passenger trains, operated by Eurostar, provide a direct link between London and Paris and other destinations in Europe.

The Eutotunnel shuttle services for the road vehicles and the freight services are shuttled between Folkestone, UK and Calais, France. The road vehicle shuttle service carries road vehicles, their drivers and passengers. During the journey the vehicle occupants remain with their vehicle. The freight shuttle service uses specially designed rail carriages. During the journey through the tunnel, lorry drivers are separated from their lorries, and are accommodated within a separate sealed passenger compartment at the front of the train.

History of Fire Scenarios

In November 1996, the tunnel was severely damaged by a fire on a freight train. The fire burned for about seven hours. The concrete lining of the tunnel was severely damaged, requiring extensive refurbishment which took approximately six months and cost about £200m.

In August 2006, fire broke out on a lorry on a freight train about 12km from Folkestone, UK. The tunnel was closed for several hours.

Fire Scenario

The following provides further information regarding the recent scenario, which has been pieced together from the information that has been reported in the news. These are unofficial timings and would have to be confirmed by the official inquiry.

On Thursday 11 September 2008, at about 14:55 UK time a fire incident within the running tunnel from the UK to France was reported.

The train was about 38km from the UK side and 12km from the French side, when the incident happened. Normal practice would be to try and drive the train out of the tunnel before evacuation, but on this occasion the train was stopped. The reasons for this are at this stage unknown.

Initial reports mention that a truck's braking system overheated which spread to a tyre. From there the fire spread to the driver's cab and then to two other trucks. It is believed that overall the fire involved 6 carriages and a locomotive.

One of the 30 trucks on the shuttle was allegedly carrying about 100kg of phenol, also known as carbolic acid. This lorry was not directly involved in the fire.

Current information indicates that the fire was an accident and was not started deliberately.

A total of 32 passengers and train crew were evacuated, mostly lorry drivers.

Eyewitness statements include:

'We heard two loud bangs, like explosions, and suddenly thick smoke swept through the carriage. The train came to a grinding halt, we were all thrown forwards, the lights went out, and there was total mayhem - people just started to panic. We didn't know what had happened.'

"A truck was on fire and there was a series of explosions. There were about 20. Everything was exploding around us -- tires, fuel tanks and then there was this smoke which stopped us seeing and breathing properly,"

"The door of our coach was locked and impossible to open. We saved ourselves by breaking a window with a hammer. We left the train through this window. It's really at that moment that we panicked the most. We felt we were really stuck. We were incredibly lucky."

As mentioned, the passenger compartment is sealed and is located towards the front the train just behind the engine. If the train cannot continue out of the tunnel, and has to stop, the evacuation procedure is for the smoke ventilation system to be initiated prior to the opening of the compartment. This is to ensure that the smoke is ventilated away from the front of the train and the passenger compartment, and so push the smoke away from the evacuation route from the train to the nearest cross passage.

It was initially reported that the passengers found the door to the passenger carriage 'jammed'. Instead, an alternative route was created by the passengers, using the provided emergency hammers to break the windows. It was reported that the drivers felt trapped in the train, and smashed the windows as they did not hear or were not aware of the proper evacuation procedure.

Eurotunnel chairman Jacques Gounon said "It takes a few seconds. One can imagine that in the stress of the moment they took the red hammer to get out through the window. A few seconds later they would have got out more easily through the door. It doesn't matter, it worked."

The evacuation led them into the service tunnel. A train was sent via the non-incident tunnel from France, to pick everyone up from there.

A total of 14 people were taken to hospital; six with respiratory problems after inhaling fumes and eight who suffered cuts and bruises.

Reports on fire brigade attendance are conflicting at present mentioning that between 60 and 300 fire fighters were in attendance. This would have included both French and British fire fighters. As fire fighters would appear to have spent no more than 15 minutes at a time inside the incident tunnel, several teams would have been involved in their activities.

The main fire was put out at 7am UK time, 16 hours from ignition. Some minor fires were still attended to after 7am.

Business Continuity

As the tunnel provides a major connection between the UK and Europe, both passenger and freight services have been disrupted. Severe delays were reported on both sides of the link, with alternative routes by sea and air available as other options for cross-Channel travel.

The tunnel is divided into separate sections by crossovers, which allow trains to by-pass an incident. This was used following the first fire incident to allow services to be operating, whilst the damaged sections were repaired.

It is anticipated that inspections would now have to take place to not only assess the condition of the section involved in the fire, but also review the condition of the fire life safety systems, to assess if they are fully operational in the non-incident sections.

On Saturday 13 September Eurotunnel announced that freight shuttle services were resumed.

On Sunday 14 September Eurotunnel announced that all services were resumed but were very restricted as only the south non-incident tunnel is used.

At this point of time, it is not clear how long services will be disrupted or restricted.

Public Inquiry

A public inquiry into the incident was set up on Friday 12 September. Presumably, this inquiry will examine how and why the fire started, or why it was seemingly undetected at an early stage, as well as how the evacuation was managed and how the smoke control/ventilation system contributed or not to the evacuation and the injuries sustained. It will also presumably consider the response of the fire services to rescue and fire fighting, and provide recommendations for any improvements in design, operation or fire safety management.

Risk Management

Given the strategic importance of this link between the UK and France, and further connections to the wider Europe, this third major fire event raises very significant issues of risk management in terms of the implications of failure on freight and logistics, the tourist industry and other commercial/business operations. Of particular concern must be the impact of freight vehicle fires on passenger operations and the long term reputation of this service. It is understood that, at present, a restricted timetable has been introduced to the end of September and that longer journey times should be expected. Due to the refurbishment works particularly during the weekends, the general advice to passengers appears to be to not travel unless essential. This must have very significant implications for revenue into the future.

It would appear that, notwithstanding any public inquiry, the owners and operators of the Channel Tunnel should undertake a thorough review of the tunnels' design and construction, their fire protection, operational procedures and the mix of passenger and freight/vehicle trains using the tunnels from a risk management point of view. Some of the key questions that might be asked in such a review could include:

1. Is there a case for eliminating certain kinds of freight, and particular types of combustibles, on HGVs using the shuttle cars in the tunnels?
2. Can improved means of fire detection be achieved both before entry of trains into the tunnels and within the tunnels themselves?
3. Should the tunnel be fitted with a water based deluge system, water mist or foam/water extinguishing system to reduce the impact of any future fires on the tunnel linings and operational systems, and enable tunnel operations to be restored as quickly as possible, minimizing losses of revenue and reputation?
4. As an alternative, should shuttle cars carrying vehicles be equipped with high pressure, low volume and weight, water mist systems to control fires to specific rail cars and help maintain tenable conditions for evacuation?

The answers to these and other questions should be sought and form the basis for future operations of the Channel Tunnel if such incidents and their impact are to be minimized in the future.

Contact details

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References

The above note has been compiled using the reporting of the event in the following media:

BBC News | news.bbc.co.uk

Reuters | www.reuters.com

CNN | www.cnn.com

Guardian.co.uk | www.guardian.co.uk