

The Special Design for Firefighting in Tunnels

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Abstract:

This paper points to firefighting in long tunnels. Normally firefighting is designed to maintain the structures. Through this research, a special design is suggested in addition to present protecting instruments for fire extinguishing.

Key words:

sluice gates, tunnel, firefighting, impulse fire extinguishing system

Introduction:

The fire in tunnel is more dangerous and destroyer than other normal fires. Lack of natural air movement and repletion of hot air in tunnel, will increase the temperature of tunnel to 1000°C which in the case of , fuel existence in tunnel it will reach to 1350°C.

In this condition, not any direct fire extinguishing is possible since none of equipments can work in this temperature. Also, this high temperature causes heat stress in tunnel structure and it may result in its destroying.

So, there is a need for a new fast way to fire extinguishing in tunnel.

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1. Normal fire extinguishing installation:

These installations are present in these to below groups:

- a) The fire extinguishing system: sprinkler, hose pipe,...
- b) The smoke control system: injection of fresh air to tunnel by means of fan which results in smoke movement.

In special condition, these installations are equipped with alarm systems and detection systems.

2. Firefighting in this design

2-1-The divide of space and the installations of sluice gates

Long tunnels are divided into some spaces and each zone is separated from other zones with sluice gates. These sluice gates are installed in every 300-500m.

At first, this design was introduced in 1980. But it couldn't get support from firefighting departments, Because of the possibility of people surrounded by fire, while the gates are closed.

This design will be practicable and safe because all of the protecting affairs are observed.

Each zone will be blocked with two sluice gates by division of tunnel.

G.L.TAN [2002] suggested usages of robber gates instead of steal gates. Steal gates are heavy and their installation will be difficult. While inflatable robber gates have suitable sealing and their installation is easy.

For fire protection, complete sprinkler system is considered in these gates which will prevent their burning by water scattering.

The resist doors are considered near the sluice gates for release of surrounded people. Then, they are directed to safe place by service tunnel which is designed between two main tunnels.

2-2-fire extinguishing in danger zone

2-2-1-lack of oxygen

The fire will be extinguish in isolated zone because the lack of oxygen. Although the sluice gates don't prevent completely the oxygen arrival, it will gradually decrease the amount of oxygen which results in fire extinguishing.

2-2-2-impulse fire extinguishing system

At first, the technology of these kinds of fire extinguishing was presented in 1980.

This kind of fire extinguishing called IFEX (impulse fire extinguishing system) is available in different models.

Rail IFEX is specified for usage in tunnels. This system is installed on rails on ceiling. They are movable and rotate and can cover whole space.

IFEX systems spray the water and volley to center of fire and extinguishing fire quickly.

Water particles make the wide surface of heat transfer with throwing them out to the center of fire, it makes the water evaporate very quickly and it be cooled .This system is suitable because it can be controlled easy from control room and doesn't need any fireman. Rail IFEX has high efficiency and low water demand.

3-2-smoke control

The studies and experiments have presented that longitudinal air condition is better than other distributions.

Also, discharging from ceiling operate better than others.

Therefore, injection air and air condition is longitudinal in this design with consider to air flow, isolated zone is pressurized better and prevent smoke leakage to the surround zones.

With installation the vents in ceiling, hot smokes rises up and discharge by vent quickly. Vent can be equipped with vertical ducts to conduct the smoke to out or connected to main duct and discharge the smoke by fans at the beginning and the ending of the tunnel.

3. General schematic of danger zone

It has been shown in figure (1).the important cases in this design are the best usage of available facilities and installations.

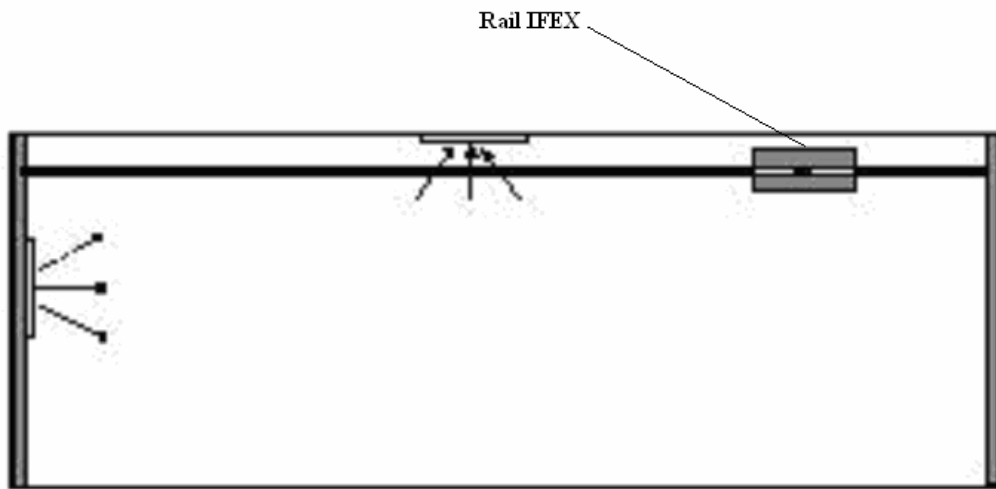
Conclusion:

- 1-The application of sluice gates and their protection in tunnels was studied.
- 2-Rail IFEX was introduced as fire extinguishing in tunnels.
- 3- A suitable procedure for smoke controlling in tunnels was presented.
- 4- A general schematic of fire extinguishing was suggested for tunnel.

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Appendix A:
Schematic figure of special design



Figure(1): The general schematic of special design