

Mitigation of Fire Hazard in Cable Tunnels

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Cable tunnels are mainly used for distribution of bulk power across large scale plants, substations and smart cities. Cables are routed through cable trays installed in tier formation on either side of the cable tunnels. Fire hazard is one of the major concerns in underground cable tunnels as it spreads rapidly causing accumulation of high temperature toxic smog. This makes the job of firefighting personnel extremely difficult to extinguish fire. Considering the large number of cables required for distribution of bulk power, fire in a cable tunnel results in disruption of power supply to a large area leading to huge loss in industrial production. It has been a challenging task to reduce fire hazards in cable tunnels to limit the extent of damage and its consequences.

It has been a long and proven practice to subdivide the considerable length of cable tunnels into compartments to prevent spread of fire and contain the fire in a compartment. Various statutory regulations and safety codes are available for design of cable tunnels at National and International level. However there are major challenges in the compartmental design of cable tunnels.

The following design considerations shall be taken into account while designing the fire partition system of an underground cable tunnel:

- i) Location of fire barrier shall comply with fire safety code of cable run inside tunnels
- ii) Each component of fire partition shall be 2 hours fire rated as per UL 1479 or in accordance with requirements of National/International standards.
- iii) Partition shall be mechanically rigid and durable
- iv) Materials will not deteriorate in presence of water in the tunnel
- v) Retrofitting of cables shall be possible with ease and with little rework without causing damage to existing structures
- vi) Other miscellaneous services such as lighting, fire detection system, sump pumps, drainage system etc inside the tunnel shall not be affected

A typical fire partition system divided into four (4) modules, namely A - fire door, B - masonry wall/ fire partition, C - fire partition shutter and D - fire stop barrier is shown in figure -1. All modules except brick walls are removable type, supported on slotted angles fixed at appropriate locations as depicted in figure – 2.

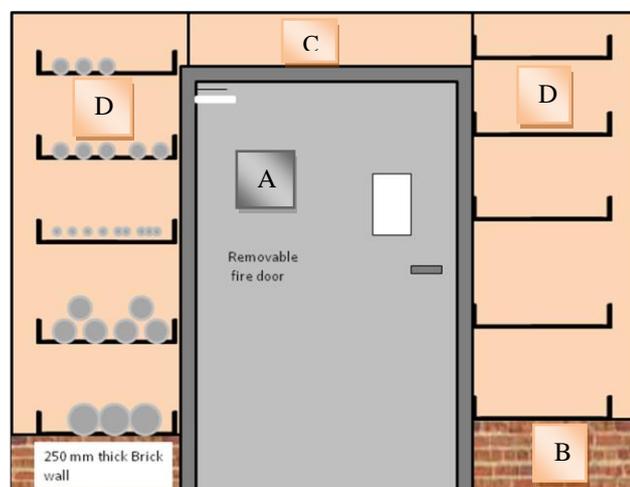


Fig 1 : Typical cable tunnel section

Fire stop barriers used shall be fabricated by bonding intumescent materials to a metal sheet. The fire stop sheet and partition shutter chosen shall be made of mineral slabs specifically designed to block flame and prevent the passage of toxic fume and smoke. Mineral slabs shall be of non-combustible material capable of withstanding temperature up to 750⁰ C. The compartmental design of cable tunnels shall duly take into consideration the tunnel ventilation system, lighting system, fire detection & alarm system, fire protection system, water drainage system and other utilities such as pipe lines routed in the cable tunnel.

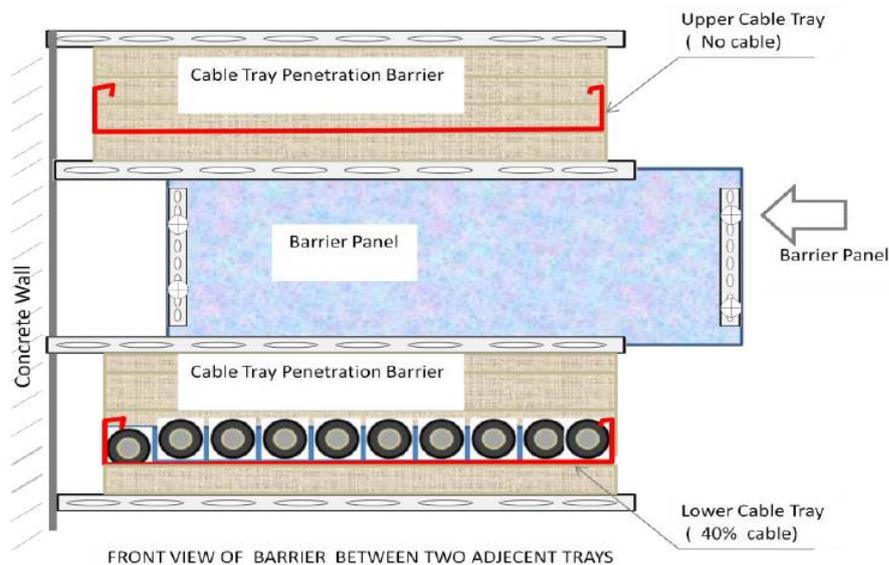


Fig 2 : Fire barrier arrangement in a typical cable tunnel

TCE have carried out design and engineering of a number of cable tunnels in various large industrial projects fully complying with fire and safety requirements of various local and international standards. TCE have evolved unique design practices for compartmental design of cable tunnel to mitigate the fire hazard substantially.