



**Water Mist Fire Protection for
Underground Mass Transport
Facilities**

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FOGTEC Fire Protection

Development of Urban Mass Transport



- Due to the growth of mega cities, public transport has become to a challenge
- Underground rapid transit systems are built or refurbished in cities and metropolitan areas to transport large numbers of people quickly for short distances at high frequency
- The capacity of these public transport systems is constantly increasing
- Without these underground mass transport systems metropolitan areas would collapse due to the ever growing traffic density

Fire Risks in Mass Transport Facilities



- The excessive fire loads by metro vehicles, electric equipment and goods people carry into underground stations in combination with the high air flow along platforms constitute a serious fire risk
- Fires in underground mass transport facilities are caused by equipment failure or vandalism, respectively arson
- In case of fires, it is a challenge to safely evacuate these areas due to the massive heat development and the rapid smoke spread as well as human behaviour in congested areas
- The intervention of fire services is often delayed due to long access distances

Fire Protection for Mass Transport Facilities

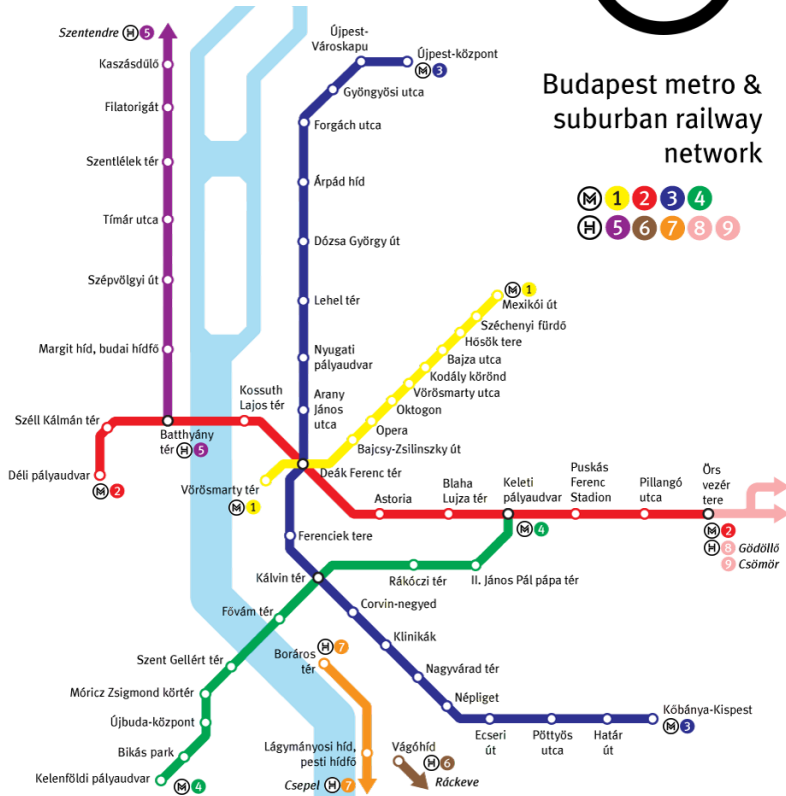


- A holistic approach to fire protection in underground mass transport facilities is key to mitigate risks and safely operate these systems
- Water mist technology offers high cooling ability and partly reduces smoke, thus creates tenable conditions for evacuation and access to fire services
- Damages to equipment and to the infrastructure are reduced, limiting down-times and increasing the availability of the underground facility
- Water mist technology allows for more flexibility in the architectural design of the station and can more easily be retrofitted to existing metro stations due to the small water amounts required, thus smaller equipment dimensions

Budapest Metro Line Network



Budapest metro & suburban railway network



- Budapest is today operating 4 metro lines with around 40 km of underground transport network and 52 metro stations
- The M1 metro line was opened in 1896 and belongs to the oldest metro lines in the world. In those days the line transported 250.000 passengers per day
- Metro line M1 was refurbished in the 1970es when also the metro lines M2 and M3 were opened
- In 2014 the new M4 metro line was opened
- Today around 1,3 Mio. passengers are frequenting the metro system every day

Budapest Metro Fire Protection



- Traffic discontinuance due to a fire would lead to severe infrastructural and economic problems for the city of Budapest
- In the new millennium the operator of the Budapest metro network (BKV) decided to start a refurbishment program for the metro lines built in the 1970es operating old Soviet vehicles
- A risk assessment was carried out to develop a holistic fire protection concept including evacuation, fire detection, fire fighting, smoke extraction and last not least overall cost evaluation including life cycle costs (LCC)

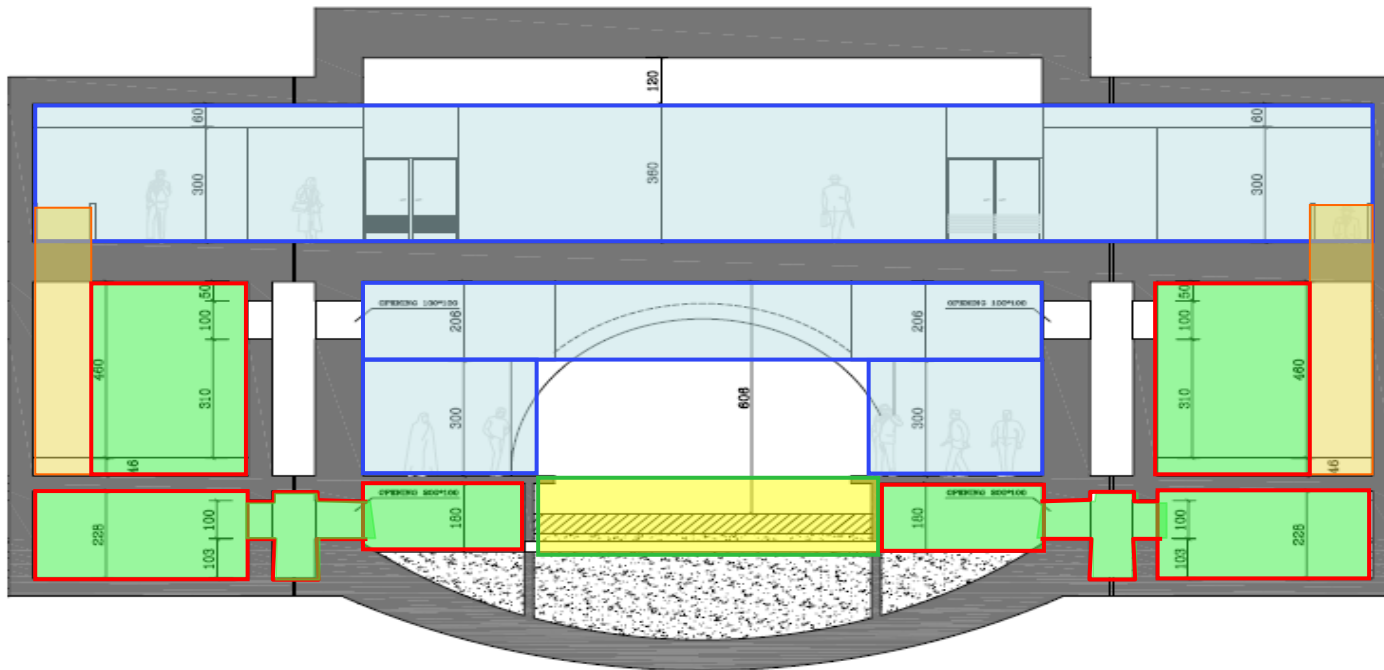
Budapest Metro Fire Protection

High pressure water mist technology was selected to be most favourable due to



- Fire test proof of fire fighting effect
- Best cooling abilities with smallest water amounts (lowest damage potential)
- Smoke reduction
- Lowest impact on electric equipment
- One fire fighting technology for all risk areas
- Easiest retrofit to existing metro stations
- Positive LCC balance

Metro Station Protection Concept



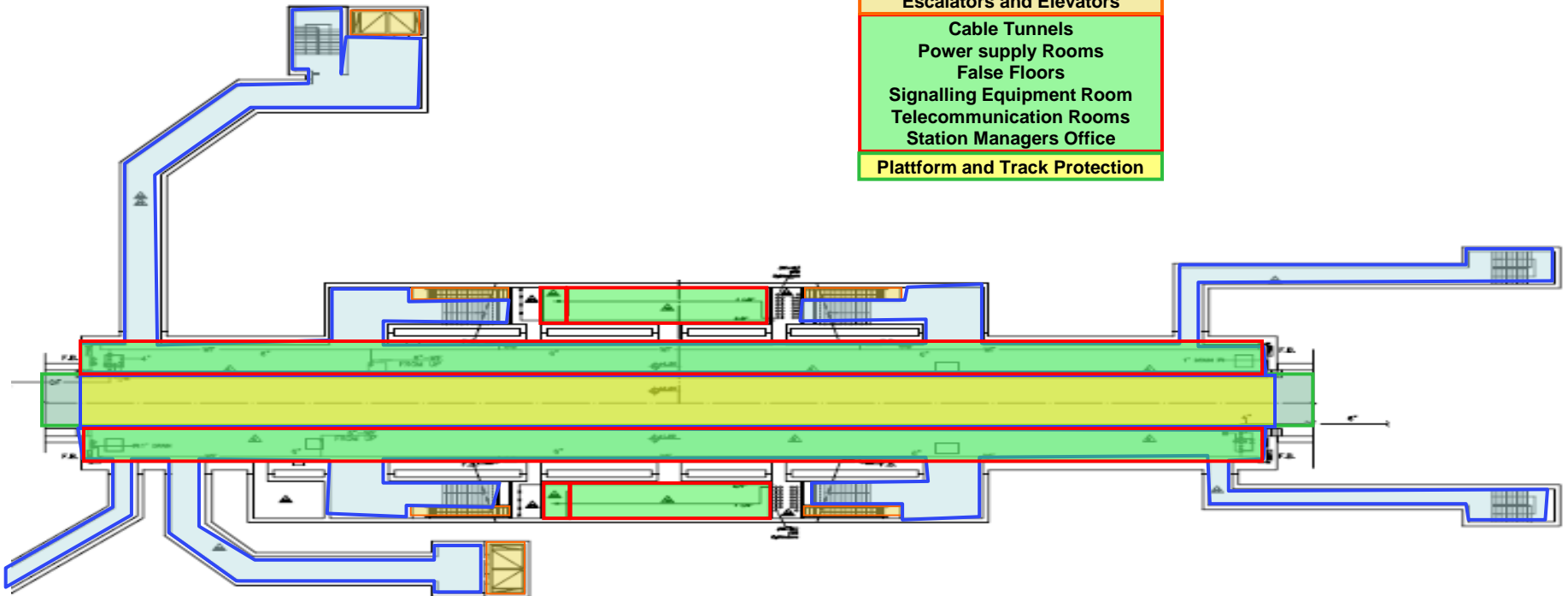
Fire risk areas

- Public Areas / Structure Cooling
- Escalators and Elevators
- Cable Tunnels
- Power supply Rooms
- False Floors
- Signalling Equipment Room
- Telecommunication Rooms
- Station Managers Office
- Platform and Track Protection

Metro Station Protection Concept

Fire risk areas

Public Areas / Structure Cooling
Escalators and Elevators
Cable Tunnels Power supply Rooms False Floors Signalling Equipment Room Telecommunication Rooms Station Managers Office
Platform and Track Protection



Fire Tests and System Acceptance Process

TECHNICAL SPECIFICATION	CENTS 14972
SPECIFICATION TECHNIQUE	
TECHNISCHE SPEZIFIKATION	May 2008

ICS 19.220.20

English Version

Fixed firefighting systems - Watermist systems - Design and installation

Installations fixes de lutte contre l'incendie - Systèmes à brouillard d'eau - Conception et installation

Einzelne Brandbekämpfungssysteme - Feuersprüh-Löschanlagen - Planung und Einbau

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MŰSZAKI IGASZGATÓSÁG
MEGFELELŐSÉGERTÉKELŐ KÖZPONT

TELJESÍTMÉNY ÁLLANDÓSÁGI TANÚSÍTVÁNY
20-CPR-229-(C-9/2017)

A 275/2013. (VII.16.) Kormány Rendelet alapján és a tanúsítvány rögzített típusú készülékek

FOGTEC magas nyomású vízköddel oltó rendszer

építési termékre vonatkozó, amelyek a tanúsítvány 2/3 és 3/3 oldalai melléklete szerinti teljesítménnyel és az azáltal felhatalmazással szereltelt rendszernek

Nagy nyomású viadékos típusú építelek és légi létesítmények védelméhez és letart.

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üzemében gyártott.

Ez a tanúsítvány igazolja, hogy az A-14/2017 számú, 2017.07.05. dátumú Nemzeti Műszaki Értékelés szerint meghatározott teljesítmények és a teljesítmény állandóság értékelésére és ellenőrzésére vonatkozó követelmények tekintetében a vonatkozó (E) rendszer szerinti

a termék teljesíti a fent meghatározott összes követelményt.

Ez a tanúsítvány, amely először 2017.08.25.-én került kiadásra – a vonatkozó nemzeti műszaki értékelésben meghatározott – a termék teljesítményének az értékeléshez alkalmazott vizsgálati módszerek és/vagy a gyártásellenőrzésre vonatkozó követelmények, illetve a termék és annak gyártási körülményeinek változatossága esetén – visszavonásig érvényes.

Szentendre, 2017.08.25.





Molnár Ágnes
tanácsadási igazgató
Tanácsadási iroda
EMI Nonprofit Kft.

1/3

Bemutató számú: NKA/19-2-20170002_TAT

- System acceptance process based on full scale fire test results according to fire test scenarios specified in Annex A respectively developed following Annex B of CEN TS 14972 standard
- Validation of fire test results by 3rd party fire consultant respectively by the Hungarian system approval institute EMI based on international system certification
- Challenge for platform protection with metro vehicle fire as fire risk scenario

Fire Test Scenarios for Metro Stations

Public spaces



Machinery spaces



Storage areas



Cable tunnels



Transformers



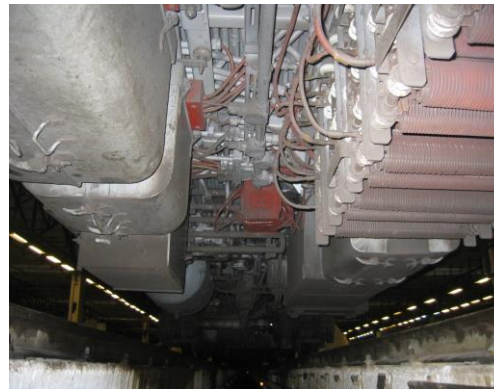
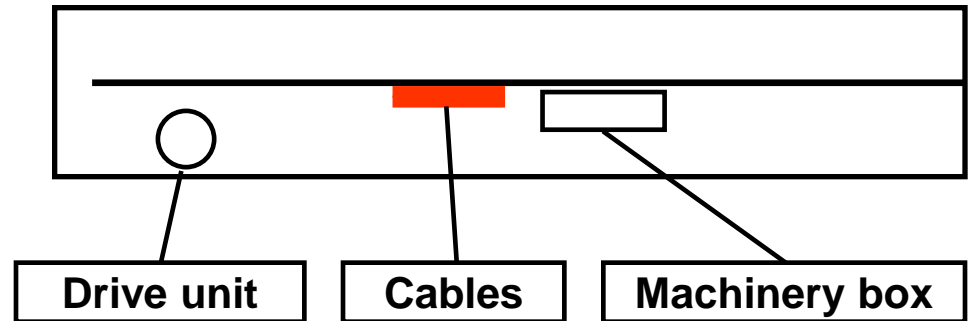
Escalators



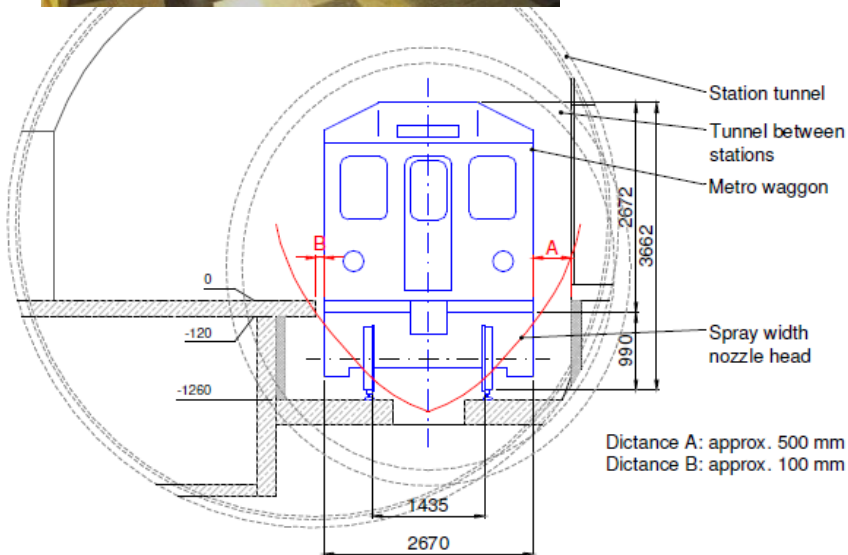
Fire Risk Assessment for the Platform and Metro Vehicle



Definition of a fire test mock-up with original rail track and train dimensions (20 m mock-up length)



Platform and Metro Vehicle Fire Tests



- Definition of three different fire scenarios with longitudinal ventilation conditions to account for the smoke extraction system
- Water mist nozzle positioned between the rails spraying upwards
- System acceptance criteria (VdS 2728)
 - Limitation of temperatures at the platform below 65°C
 - Control of fire spread to vehicle interior and to platform area
 - Keeping smoke gas concentrations at survivable level
 - Increasing visibility to allow self-rescuing and easier access for fire brigades

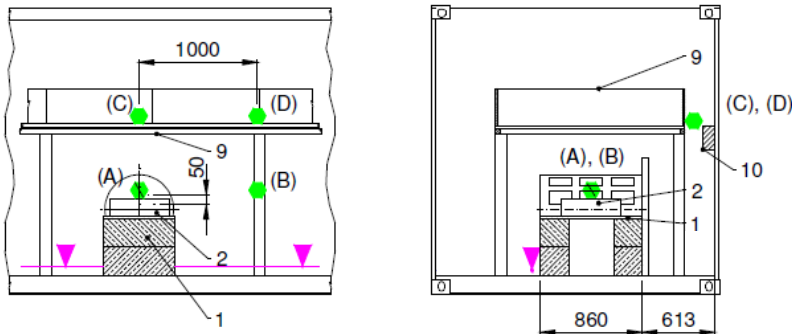
Fire Tests for the Drive Unit



- Partly covered diesel pool fire to simulate a ruptured hydraulic or lubrication pipe
- Plywood at the platform and as floor plate of the metro vehicle as target
- Longitudinal ventilation of 1,5 m/s along the platform
- No direct impact of water mist on the fire
- 1 minute pre-burn time



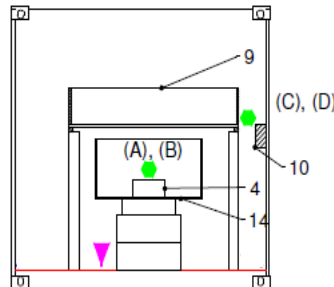
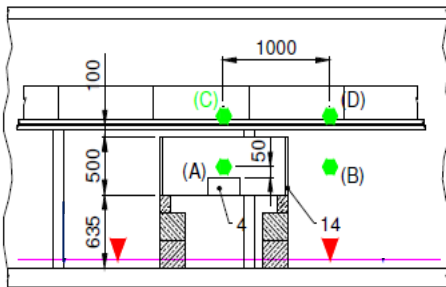
All acceptance criteria were successfully achieved
(Fires were extinguished in less than 180 seconds)



Fire Tests for the Machinery Box

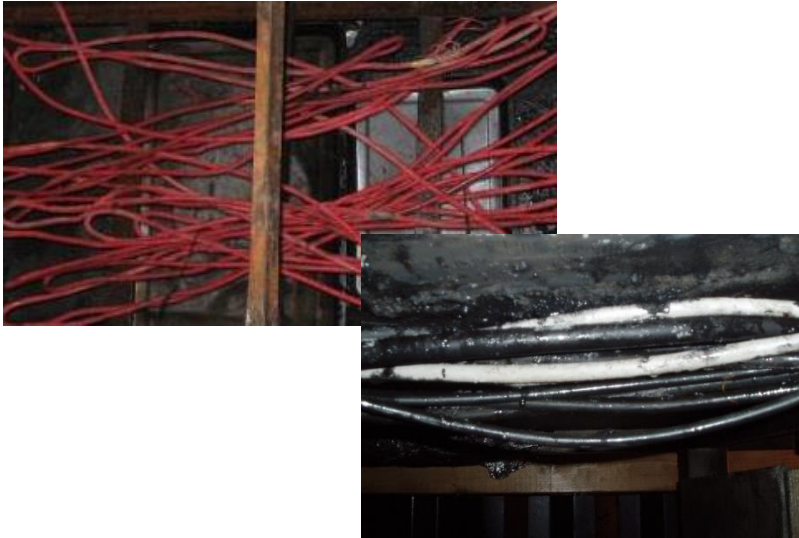


- Obstructed diesel pool fire to simulate a ruptured hydraulic or lubrication pipe
- Plywood at the platform and as floor plate of the metro vehicle as target
- Longitudinal ventilation of 1,5 m/s along the platform
- No direct impact of water mist on the fire (Second machinery box as spray obstruction)
- 1 minute pre-burn time



**All acceptance criteria were successfully achieved
(Fires were extinguished in less than 240 seconds)**

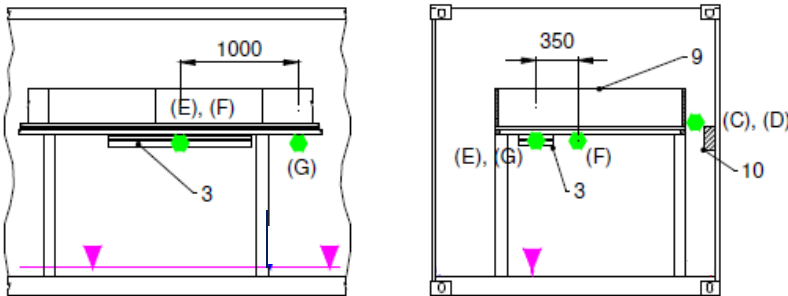
Fire Tests for the Cables



- PP, PE and PVC cable fire under the floor plate of the metro vehicle
- Plywood at the platform and as floor plate of the metro vehicle as target
- Longitudinal ventilation of 1,5 m/s along the platform
- 2 minutes pre-burn time with gas burner



All acceptance criteria were successfully achieved
(Fires were extinguished in less than 140 seconds)



Budapest Metro Fire Protection

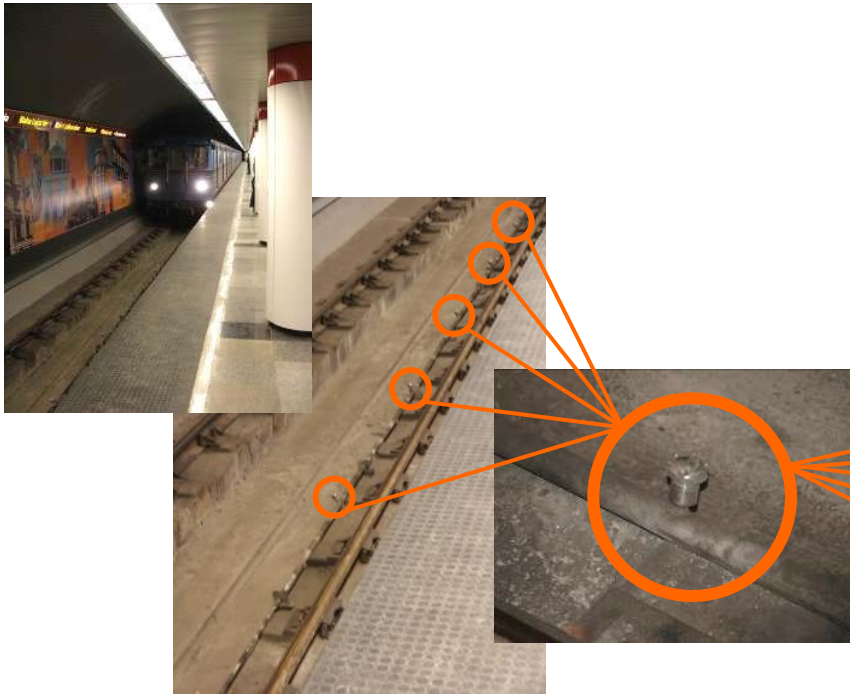


- **Water mist fire protection of 9 metro stations of metro line M2 from 2004 onwards based on the fire test results for platform protection and system certification for other fire risk areas**
- **Extension of the water mist fire protection to 10 metro stations of the new built metro line M4 from 2009 onwards. The protection also includes the control tower and the metro train depot and service area**
- **The first 6 metro stations of metro line M3 are currently being equipped with a water mist system**

Platform Fire Protection of Metro Budapest

- Water mist nozzles equipped with protective caps to account for the harsh environment
- Water mist guns for manual fire fighting at platforms

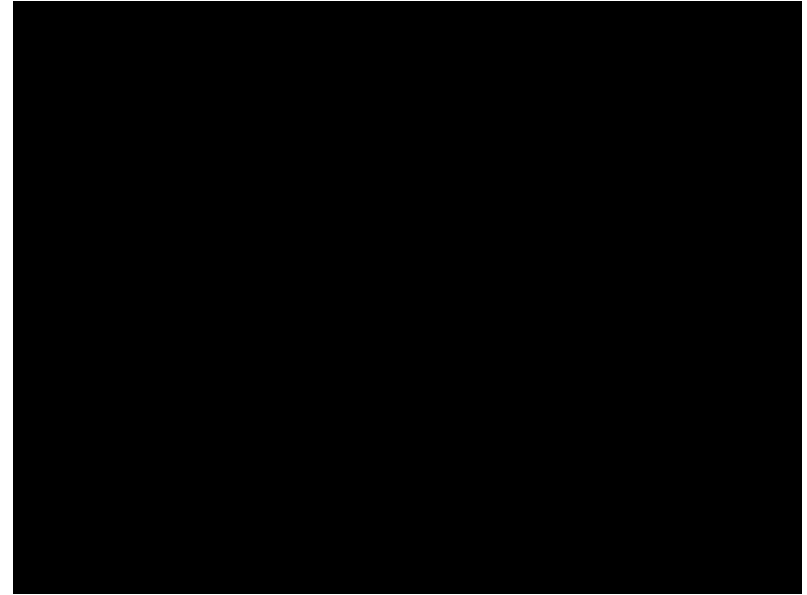
Retrofit to Metro Line M2 and M3



New built Metro Line M4



System Discharge at Platforms of Metro Budapest



- Discharge at a metro station along metro line M2
- No panic or disturbance of the traffic

Control Room Fire Protection of Metro Budapest

- Switch gear and control room protection in all metro stations
- In metro line M2 and M3 old Soviet equipment is still in use. Metro line M4 is equipped with the latest control technology

Retrofit to Metro Line M2 and M3



New built Metro Line M4



Cable Tunnel Fire Protection of Metro Budapest

- Protection of cable tunnels under the platforms in all metro lines
- Nozzles positioned to allow for future extensions of cables and cable trays along the cable tunnels

Retrofit to Metro Line M2 and M3



New built Metro Line M4



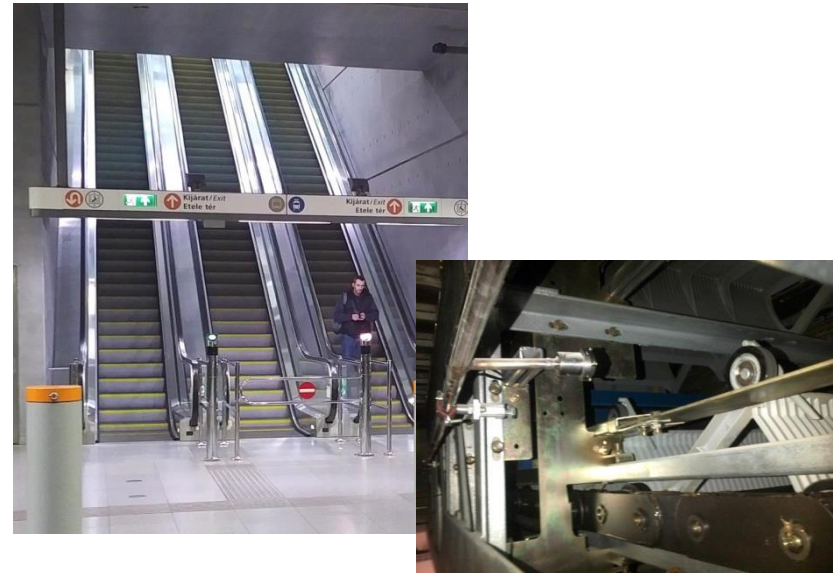
Escalator Fire Protection of Metro Budapest

- In metro line M2 and M3 old Soviet escalators are still in use. The escalator drives are considered as machinery spaces
- In metro line M4 modern enclosed escalators are protected

Retrofit to Metro Line M2 and M3



New built Metro Line M4



Water Mist System Equipment of Metro Budapest

- Section valves with pneumatic drives and compressor at the pump units
- High pressure pump units at each metro station with 4+1x120 l/min at 120 bar
- Water supply by the fresh water main via automatic reversible flow filter

Retrofit to Metro Line M2 and M3



New built Metro Line M4



Maintenance and Training at Metro Budapest



- Maintenance inspections in regular intervals and training of the operational personnel is of great importance to ensure safe operation of the system
- The operator (BKV) therefore has established a dedicated training area where their personnel is undergoing regular training sessions
- In this training area all specific water mist equipment can be operated and water mist can be discharged in the different risk areas as escalators, rail tracks etc.

Conclusion

- **Since two decades water mist technology is recognized as optimal fire fighting system for underground mass transport facilities**
 - **The small water amounts the systems use, ease the integration of the system to underground retrofit projects as well as to new built metro stations**
 - **Challenges in conjunction with metro station evacuation and smoke and heat extraction are effectively mitigated**
 - **Water mist can protect all different kinds of risks in underground stations, thus one technology covers the entire metro station**
 - **In case of fire, operational interruptions are reduced to a minimum resulting into a positive life cycle balance for water mist technology**
- ➔ Water mist is the most suited fire fighting technology for underground mass transport facilities**



Thank You for Your Attention

Ruediger Kopp

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