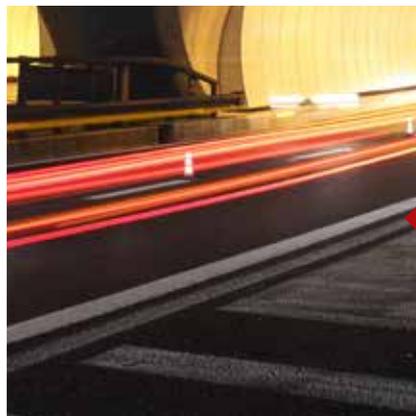
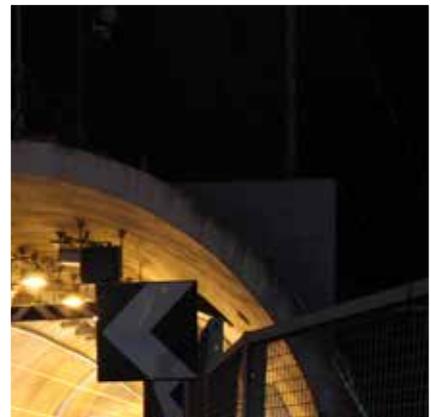




INSTITUTE FOR APPLIED FIRE SAFETY RESEARCH

■ TUNNEL & METRO



ASKING.
ANALYSING.
ANSWERING.

TUNNEL & METRO

IFAB tunnel and metro services cover both rail and road tunnels. IFAB specialises in particular in complete metro systems, including all elements - tunnels, stations and trains. Road, rail, metro - each has its own specific requirements that must be taken into account during the fire safety design phase. Road tunnels typically have very high design fires, rail tunnels have more complex ventilation designs, and metro systems have to deal with the evacuation of high numbers of passengers.

IFAB's consultants are highly experienced with real underground fires. IFAB's team has carried out over 200 full scale tunnel fire tests with very severe fire loads and scenarios. Many of the tests have been part of large European research programmes such as UPTUN and SOLIT. Knowledge based on real experience is the asset that sets IFAB apart from other typical fire consultants. It ensures that the service provided is efficient and cost effective, especially for tunnel and metro applications that often include a variety of hazards and are not well covered by fire standards.



Fire safety concept for Metro Budapest

IFAB – OUR SERVICES

IFAB provides services ranging from fire risk analyses and feasibility studies to the commissioning of different fire protection systems and solutions in tunnel and metro applications.

» FIRE RISK ANALYSIS

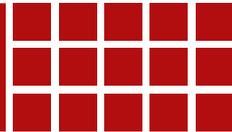
Fire risk comprises the probability of fire and its expected damage to life, business or property. Fire risk analysis is the starting point for effective fire safety designs and it can include different methods such as semi-quantitative index methods, quantitative event tree analysis, and quantitative system reliability analysis. The risks and especially the different levels of consequence are defined in close co-operation with the client.

» FIRE SAFETY CONCEPTS AND FEASIBILITY ANALYSIS

Fire safety concepts are implemented to mitigate and reduce fire risks and their consequences as identified in the fire risk analysis. IFAB has specific experimental knowledge gained from fire tests, resulting in a fuller understanding of the performance of different fire fighting and mitigation methods. This makes the services provided more realistic and effective than those based solely on a theoretical approach.

» FIXED FIRE FIGHTING SYSTEMS

Fixed Fire fighting Systems (FFFS) involve different technologies and design objectives depending on the tunnel being equipped. IFAB is the test and research institute with the most experience in FFFS, which gives a solid experimental basis for designing or evaluating these systems. IFAB personnel have been involved in the installation of FFFS in five countries.



» FIRE INVESTIGATIONS

IFAB's engineers are qualified to conduct fire investigations. In addition, IFAB can model fire and its dynamics using CFD or even with laboratory scale fire tests as part of investigations.

» FIRE AND SMOKE TESTS

Fire and smoke tests forms one of the key areas for IFAB. IFAB's experienced team has already carried out more than 200 full scale fire tests in test tunnels. These cover various scenarios with flammable liquids or demanding solid fires. The fire tests have been part of international research projects such as SOLIT and UPTUN or related to private operators like Eurotunnel or Tunnel Mont Blanc. IFAB's mobile tunnel testing measurement system is the largest in the world, and makes fire tests possible in various locations as needed. IFAB also possesses specialised equipment for carrying out smoke tests with either hot or cold smoke, giving experimental evidence on the performance of smoke management systems.

» COMPUTATIONAL FLUID DYNAMICS (CFD)

Computational Fluid Dynamics (CFD) has developed during the last decade and has become a standard tool in fire safety engineering. IFAB also provides various services that utilise CFD. IFAB has a massive fire test database available from full scale tests, so it can in most cases verify CFD models against experimental data. This sets IFAB apart from organisations that use CFD without validation. CFD services cover ventilation, evacuation, FFFS, temperature and heat transfer modelling.

» VENTILATION SYSTEMS

Fire incidents and air quality management during normal operation set the basic requirements for ventilation systems in tunnel and metro applications. IFAB offers design services for ventilation systems. The tools used are computational fluid dynamics (CFD) and experimental tests. IFAB also designs ventilation systems in combination with fixed fire fighting systems.

» TRAINING SESSIONS AND SEMINARS

IFAB organises training sessions and seminars on tunnel and metro fire safety. Some training sessions are designed for the wider public, others are tailored to customer needs. Training sessions can be held at IFAB's or the customer's premises. The experts conducting the training are either IFAB personnel or from a pool of IFAB network contacts.

REFERENCES AND MORE INFORMATION

See the most up-to-date reference lists and other information at

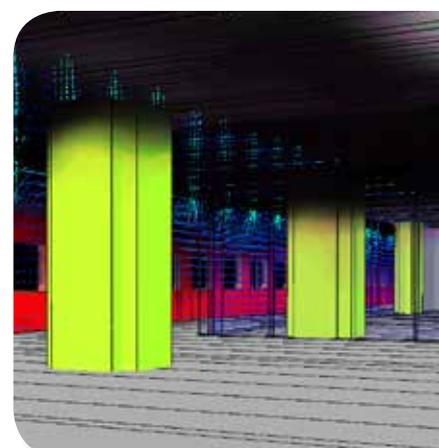
www.ifab-fire.com



Fire safety concept and tests for Eurotunnel



Tunnel Mont Blanc fire tests with different fixed fire fighting systems



Fire and smoke simulations for German Metro & Railway stations according to EBA

■ FIRE SAFETY SERVICES

CONSULTING

CONCEPTS

FEASIBILITY STUDIES

RISK ANALYSIS

CFD (FIRE, SMOKE, EVACUATION, VENTILATION, SUPPRESSION)

PERFORMANCE BASED DESIGNS (FIXED FIRE FIGHTING SYSTEMS)

TENDER PREPARATION AND EVALUATION

FIRE TESTING (LABORATORY OR FULL SCALE)

SMOKE TESTING

APPROVAL SERVICES

FIRE INVESTIGATIONS

SEMINARS, TRAINING

RELIABILITY ENGINEERING

■ FOR

TUNNELS & METRO

RAIL

BUILDINGS & INDUSTRY

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