

THEORETICAL-PRACTICAL COURSE ON INTERVENTION IN TUNNEL FIRES

San Pedro de Anes (Asturias)



General Information

Tunnel Safety Testing S.A.
www.tunneltest.com

CENTRO EXPERIMENTAL SAN PEDRO DE ANES

1 INTRODUCTION.

The aim of this documentation is to describe and evaluate a practical-theoretical course on fires and ventilations in tunnels for fire-fighters. The course will be held at TST facilities in San Pedro de Anes (Asturias).

The characteristics of TST facilities allow for real scale tests of emergency situations in tunnels, and more specifically, real scale fire tests simulating all types of ventilation systems used in these kind of facilities and with a large availability of powers and settings.



2 COURSE CONTENTS.

GENERAL OBJECTIVE:

Interventions in fires in long tunnels have their own characteristics, in some cases similar to more common interventions such as fires in cellars or long galleries, but with certain singularities that require specific handling, mainly due to very large approach distances and smoke penetration.

The increasing number of these kind of structures in urban and interurban areas, as well as the serious accidents that have occurred in Europe in recent years, have raised awareness among authorities and emergency service officials. This fact has resulted in

the need to train officials responsible for the operations and for the extinguishing and emergency services.

There is a lot of technical data, as well as many case studies and practical trials in this regard, but emergency services are lacking in real experiences as interventions in these environments are very scarce. The potentially high risk resulting from a fire in these kind of facilities and the huge difficulties emergency services may face, as well as the fact that international terrorist groups have targeted them, make it necessary to handle the matter thoroughly.

These courses provide enough theoretical knowledge to address the problem with guarantees. Practical training is provided in real-like conditions in facilities, which are the only ones of their kind.

SPECIFIC OBJECTIVES:

To reach the objective previously set, the agenda proposed is flexible and adaptable to students' and the target service characteristics, making headway in the following areas:

Problem analysis: this involves the description of the environment where we will be operating and the potential circumstances we may encounter. The fire behaviour and evolution will have to be analysed in detail in order to be addressed. We must also be aware of the different options provided by protection designs and facilities in these environments.

Addressing the intervention: once the problem has been identified, different intervention possibilities will be identified: from the basic viewpoint of the first person to intervene and from the tactical and strategic viewpoint linked to the incident control and management. An advanced course is offered targeting qualified staff such as professional fire-fighters and intervention teams, as well as organisation officials and commanding officers.

Implementation: gradually, the skills and competences acquired will be put into practice, depending on the level of the students and the contracted course, in the form of case study, practical examples, emergency drills and operations.

STUDENTS:

Given the size of the facilities and in order to take greater advantage of the courses, the ideal number of students is 18. If this number is surpassed the course quality will suffer. Likewise, a course with fewer than 10 students would lead to an excessive reduction of the objectives of the practical training and emergency drills.

Nevertheless, the course approach will vary depending on the students' profile, and obviously the technical content will be higher in the case of higher positions and the practical content will be greater in the levels of more experienced students.

METHODOLOGY:

The teaching methodology is based on delivering theoretical knowledge, as well as practical exercises and emergency drills with increasing difficulty, encouraging students' participation.

Theoretical contents target the resolution of practical cases that the operational staff may encounter. During the practical exercises and emergency drills, the learning methodology is based on the detailed final analysis of what students have done, promoting their active participation. For the theoretical part of the course, Power Point presentations will be used, with many graphics, films and photographs to facilitate understanding in the different subjects. During the classes, written documentation including all the contents of the course will be handed over to the students.

In the case of commanding officers and officials, table exercises can be done in the form of practical cases, case analysis and different studies.

CONTENTS:

Here follows a list of the different theoretical and practical contents a typical course may include:

Theoretical contents:

- Intervention scope and potential problems

Analysis of the intervention difficulties and characteristics of the facilities.

- Fire evolution

Description of the fire behaviour, temperatures and smoke inside a tunnel.

- Active protection systems

Listing and describing the different elements found in the tunnels aiming at reducing damage due to fire.

- Special equipment

Description of the special equipment designed to be used in case of a fire in a tunnel.

- Long-lasting and durable equipment

Among the special equipment, attention is paid to long-lasting and durable respiratory protective equipment.

- Ventilation systems

These may be included in the protection system section, but they deserve special and more detailed attention given their great importance in case of fire.

- Case study

There are some catastrophic incidents in tunnels that are well documented and therefore can be analysed.

- Practical events

Several developing accidents similar to real ones are analysed. Students will have graphic documentation, pictures, etc, to make responsible decisions.

- Risks during intervention

A review of risk situations, especially in terms of fires in tunnels related to excess temperatures.

- Operational procedures

Intervention methodologies, procedures and systems are suggested; basically, a strategic and tactical view of a general tunnel intervention.

- Staff control

Within the procedures, control formulae are established for the teams entering the tunnel.

- Management and control

A review of the guidelines on management and control of incidents, but focusing on fires in tunnels.

- Legal framework

To a greater or a lesser extent, description of the legislation framework and existing regulation on tunnels in Europe and Spain.



Practical content:

Many different practical sessions can be carried out in these facilities, depending on the fire loads, on the students' skills and equipment, the ventilation handling and the number of objectives set out. Examples of the different possibilities are briefly described below. These can also be combined together.

- Smoke evolution:

This is a very interesting basic practical session so that students can observe how smoke evolves in a "real tunnel". The instructor will describe, on site, the smoke conditions and how this evolves in agreement with what has been seen in the theory sessions.

- Cold practical sessions:

Appropriate for students having their first contact with long-lasting and durable equipment or who have had little contact. They are also used as an adaptation process for the following drills. They are carried out with cold smoke, using the main tunnel and galleries.

- Orientation and search:

Long distance exercise to practice the basic guidelines related to advancing, tracking, orientation and search for victims. Basic movements with twin-bottles and coordination of large team.

- Penetration with long lays and tracking sectorisation.

Penetration of teams downstream from fire, from entrance with long lay and penetration from side access with entry into gallery and lay from heavy-duty urban pump. Tracking, rescues and extinguishing are the objectives of both.

- Penetration with heavy-duty urban pump:



If the customer is able to do so, adapting a heavy-duty urban pump with a heat chamber, smoke plug penetration can be carried out, verifying the possibilities of this action and experiencing the feelings.

- Penetration through entrances:

Foot teams, with and without lay, carry out penetrations of around 400m on foot, carrying out tracking, rescues and extinguishing single or multiple sources.

- Simultaneous penetration:

An attack is carried out on an incident via an entrance and side accesses, galleries or upper access, all at the same time. The objective established will be more or

less complicated depending on the type of students and the characteristics of the available respiratory apparatus. These will include rescues, self-rescues, tracking, extinguishing, and the demand on the management and control of the teams will be very great.

- Multiple penetration:

As in the previous case, but approaching at least three accesses at the same time; this is an offensive attack carried out en masse to rescue victims and control the fire.

DURATION:

To take advantage of the facilities, it is not recommended to offer courses that last less than three days, and in the case of advanced courses no less than 4 days.

For non professional first intervention teams, courses should last two to three days, depending on previous knowledge, especially in terms of handling respiratory protective apparatus.

In the case of professional fire-fighters, commanding officers and heads of Fire Extinguishing and Rescue Services, courses should last four days with annual three-day refresher courses. They can be adapted to the customer's needs following an analysis of the tunnel or tunnels they service.

TIMETABLE:

This can be adapted to the customer's needs. Typically, lessons start at 9:00 am. Each theoretical lesson lasts 45 minutes, which is considered the optimal length of time not to saturate the student. There is a 5-minute break between lessons.

In the morning, there is a 30-minute break with catering. Then lessons go on till lunch time. Lunch lasts an hour and a half.

In the afternoon, there are two more 45-minute lessons. Each day lasts eight hours. Six hours are devoted to specific teaching and training.

Obviously, in the case of practical exercises and emergency drills, training time is lengthened. Breaks are eliminated although “dead” times are needed for transfers, preparation, etc. In the case of practical exercises, there is some time devoted to explaining the exercise, preparation, implementation, brainstorming and final analysis.

NUMBER OF STUDENTS:

As mentioned above, the optimal number of students is between 10 and 18. If there were more than 18, students would be divided into groups and more instructors would be needed for safety reasons.

In the case of theoretical lessons, more students may be admitted and also non operational staff who will act as observers during the practical exercises.

TEACHING STAFF:

All the teaching staff and collaborators are professionals with many years’ experience in real intervention procedures. The collaborators are members of the emergency staff with extensive hands-on experience and with expertise in practical situations and emergency drills.



The teaching staff is made up of active fire-fighting commanding officers, with at least 15 years' operational expertise and with training as fire-fighting instructors.

Finally, the main teaching staff in charge of monitoring the courses is especially skilled and qualified in this specific subject. They coordinate the course and prepare contents for the final product to offer greater guarantees and more practical interest for the participants.

3 SCOPE OF COURSE PRICES

Training courses are designed for a maximum of 18 fire-fighters and will last three or four days depending on the level chosen. The following concepts are included:

- Theoretical documentation
- Delivery of theoretical part by TST professional instructors.
- Design and monitoring of the practical exercises by two TST trainers.
- Three additional support instructors during practical sessions in the tunnel.¹
- Fuel to generate fires with different ratings, by means of a gasoil pool, burning vehicles or burning pallets.
- Fire preparation and design
- Ventilation, water and power in the tunnel for the drills.
- Hoses and foam compounds.
- Air bottle refuelling.
- Rental of facilities (tunnel, classroom, offices and changing rooms)
- Coffee break, catering and lunches.

Moreover, the following services can be added if required by customer:

- Rental of self-contained respiratory apparatus (single-bottle/twin-bottle), of the make MSA, including, back support, octopus type mask, automatic lung and bottles.
- Rental of self-contained respiratory apparatus in closed circuit.
- Specialist monitors for specific training in long-lasting and durable self-contained respiratory apparatus of the Mining Life-saving Brigade.

¹ The client may decide to eliminate this option and replace the TST support monitors with own *more experienced* personnel during the practical sessions, which would represent a saving in the final price; consult this possibility with TST.

- Transfers from hotel to facilities².
- Hotel for the stay whilst the course lasts in the Noreña or Gijón, in regime of choice.



If the customer wishes to include half-board accommodation in Noreña or Gijón, TST can include this aspect in the final course offer to prevent management problems, if necessary.

The apparel and IPE used during the practical sessions will be on account of the group of fire-fighters (protective clothing, helmet, gloves and boots).

TST has 24-hour surveillance service at its facilities to safeguard the equipment during the courses, so these may be kept there.

2.2. Programmes.

The programmes and practical exercises may be adapted to satisfy the customer's needs, should he be interested in including a specific activity. The customer can also

² The bus transfers to the centre or to the restaurant are not included. If required by the client TST can include the allocation of a bus during the days of the course.

design his own tailored programme and TST would offer and estimate in accordance to this programme.

4 ECONOMIC CONDITIONS

- Economic conditions will be reviewed and looked into depending on the characteristics of each station, given the fact that the customer and TST jointly design the course.



5 CONDITIONS TO IMPLEMENT PRACTICAL TRAINING

The client is responsible for appropriately selecting the staff that will attend the course, in agreement with their physical skills, initial training and experience. He will also be responsible for making sure that the IPE used during the practical sessions are appropriate and in proper conditions for use. In any case, the TST course monitors will have the authority to exclude from the practical sessions any person, who, during the course, they consider does not have the necessary preparation or experience for the level of difficulty of the practical training to be carried out.



TST
TUNNEL SAFETY TESTING S.A.

Fernando Garrido
Tunnel Safety Testing S.A.