"Fire risk assessment" of an airport terminal – “Connector building” Brussels International Airport

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Abstract – This article makes a fire risk assessment of a new airport terminal.

The purpose is to find the influence of the active, and the passive fire protection systems and the organization of the fire protection on the fire risks.

Keywords – Fire risk assessment, airport terminal, fire protection systems, organization

Introduction

The ‘Connector’ is a new airport terminal that will be build on the airport of Brussels International. Due to its architectural design the building wasn’t in compliancy with the existing ‘Fire Safety Regulation’ [1], therefore a deviation was asked.

To achieve an equal safety level they used the principles of Fire Safety Engineering and introduced sprinklers and smoke management in their design.

The scoop of this article is to make a Fire Risk Assessment using the ISO/TS 16732-1 [2] and ISO/TS 16733: 2006 [3] and to estimate the consequences of a failure of the fire protection installations or of the fire management.

ISO/TS 16732 ‘Fire Safety Engineering – Guidance on fire risk assessment’

In the ISO/TS 16732 Fire Risk Assessment (FRA) is described as a well defined procedure to quantify and to interpret the fire-related risk of an object in function of objectives as they could be:

- safety of life,
- conservation of property,
- continuity of business and safety operations,
- protection of the environment,
- preservation of heritage.

This part of the standard is designed as a guide that provide formal procedures for the implementation of the risk assessment principles for specific applications.

Risk assessment is a part of the overall risk management (see figure 1), that also includes risk treatment, risk acceptance and risk communication. They form the risk “ATAC”.

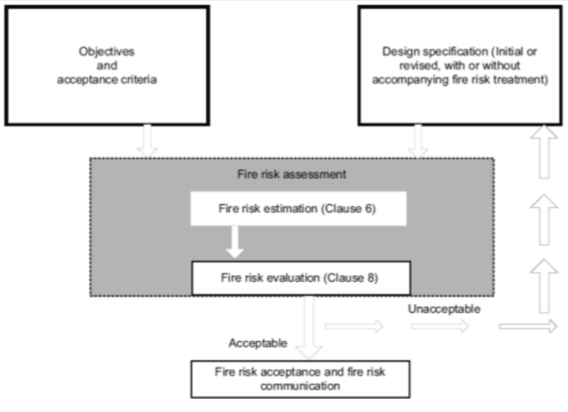

Figure 1 — Fire risk management flow chart

The steps involving the risk estimation are illustrated in figure 2 and begins with the establishment of a context, providing a number of quantitative assumptions, required to perform the estimation.

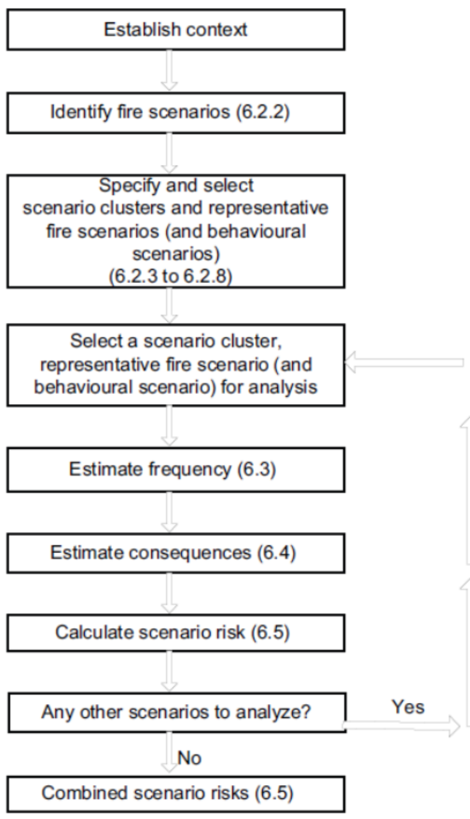

Figure 2 — Fire risk estimation flow chart

The next step is identifying the hazards used as basis for the specification and selection of the scenario clusters and the associated representative fire scenarios. Those will then be analyzed to estimate the frequency and the consequences. The combined fire risk for the design can then be calculated.

An abbreviated fire risk calculation can be used to select a small number of scenarios for a deterministic evaluation – see ISO/TS 17633: 2006.

ISO/TS 16733:2006 'Fire Safety Engineering – Selection of design fire scenarios and design fires'

The ISO/TS 16733: 2006 describes a methodology for selecting design fire scenarios and design fires. The selection is tailored to the fire-safety design objectives, and accounts for the likelihood and consequences of potential scenarios.

This methodology for selecting design fire scenarios and design fires is summarized in the figure here below.

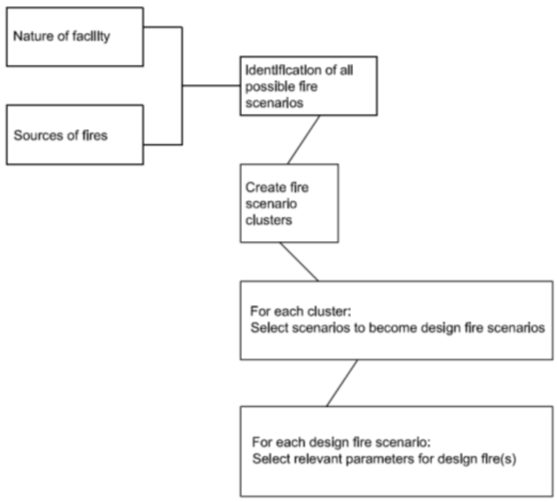

Figure 1 — Selection of design fire scenarios and design fires

The methodology uses a ten steps procedures being:

Step 1 – locate where the fire starts and give the specifications of this space.

Step 2 – what are the properties of the fire especially the intensity and the rate of growth of the fire.

Step 3 – identify the fire hazard associated with the design.

Step 4 – identify the fire-safety systems that have a impact on the course of the fire.

Step 5 – what actions can and will people take?

Step 6 – construct a event tree that represents alternative event sequences from fire ignition to outcome associated with the fire scenarios.

Step 7 – consider the probability of occurrence of each event.

Step 8 – consider the consequence of each scenario.

Step 9 – rank the scenarios in order of relative risk.

Step 10 – final selection and documentation.

'Fire risk assessment' of the 'Connector'

Here the Fire Risk Assessment is made using the mentioned methodology and the 10-step procedure.

The probabilities and consequences where made by engineering judgment following consultations of a workgroup.

The fire scenarios used for analyze where the same scenarios used in the deviation demand. For each scenario we used a day and night time situation this resulted in 7 fire scenarios and 804 possible scenarios which were described in 7 event trees made on Excel sheets.

The consequences were evaluated for the occupancy and for the building.

The risks were calculated and classified using the top ten risks per fire scenario.

We then calculated the percentage of failure of each fire-safety system based on the top ten risk scenarios. These were: 83,7 % for the sprinklers, 80,8 % for the smoke management system, 67,5 for the fire expanding outside the room of origin, 38 % for the Public Address system, 26,8 % for the automatic detection system and 18,3 % for noticing the operation centre.

The consequences from the scenarios were for more than 50 % of the top 10 risk scenarios categorized as serious to catastrophic for the building and its infrastructure and for more than 80 % categorized as negligible to average for the occupancy.

In the last part of this chapter comment is given on the here above result, per fire-safety system.

As conclusion for the fire risk assessment we can say that the fire-safety systems have a positive or negative influence on the fire risk depending on them operating well. But also that a good fire management indispensable is for upholding the required fire safety level.

Recommendations

In this last chapter some recommendations are made to uphold the required fire safety level, in particular how to organize the service and the control of the fire-safety systems and how to optimize the fire-safety management.

Also we highlighted the difficulties encountered when evacuating disabled people and the necessity of training and exercises for the personnel and the emergency services.

Conclusion

The Fire Risk Assessment of the ‘Connector’ proves that the fire-safety of the building is according with regulation, but in order to keep the same level of fire-safety a well thought out fire-safety management is indispensable.

To end I want to state that this assessment has strengthened my believe in the ‘Fire Safety Engineering’ approach of the fire-safety of buildings.

[1] Koninklijk besluit van 7 juli 1994 tot vaststelling van de basisnormen voor de preventie van brand en ontploffing waaraan de nieuwe gebouwen moeten voldoen, België.

[2] „ISO/TS 16732 -1 Fire safety engineering — Guidance on fire risk assessment,” nr. 1, p. 19, 15 Februari 2012.

[3] „ISO/TS 16733 Fire safety engineering — Selection of design fire scenarios and design fires,” vol. 2006, nr. 1, p. 37, 2006.