Mastercourse 7LY4M0
2020 / 2021

Part: Fire Safety Engineering (FSE)

COURSE INFORMATION FSE

Code	**7LY4M0**	
Lecturer FSE	Ir. Ruud van Herpen FIFireE.	
Coursename	*Nederlands*: **Gebouwinstallaties en brandveiligheid**	*English*: **Building services and fire safety**
Main teacher	Prof. ir. Wim Zeiler	

Essential information

Goals, in operational terms
a) How to realize fire safe buildings, based on public goals and objectives: - Preventing/Limiting casualties from building fires; - Preventing/Limiting damage to adjacent properties; b) Using active installations for control of fire and smoke; c) In a consistent fire safety concept, that is sufficient robust for a sustainable and resilient building. The robustness of the safety concept can be quantified by a sensitivity analysis.

Summary

In the lectures we focus on natural fires, instead of standard fires according to the standard fire curve. Natural fires depends on fuel characteristics and building characteristics. This means that natural fires are project-specific, the basis for fire safety engineering.

Natural fires produce a different thermal load than standard fires. With a natural fire it is possible to calculate the thermal load and response of building elements, heat detectors, sprinkler heads, etc. Also the optical density of the smoke, caused by a natural fire is important. The optical density of the smoke decreases the visibility for the building occupants. Smoke detectors are often used to alarm building occupants in case of a decreasing visibilty in escape routes.

With thermal or optical detection it is possible to activate both active fire control systems (e.g. sprinker) and active smoke control systems (e.g. overpressure systems or smoke outlet systems). The influence of active fire and smoke control systems can be taken into account in the natural fire concept. In many cases this results in a decreasing thermal load and an increasing available evacuation time.

Safety of the building occupants by evacuation in acceptable conditions inside the building is the main objective in fire safety engineering. However, sustainable buildings need to be fire resilient. In that case the safety of other risk subsystems is important too: the reliability in case of fire of building structure and fire resistant separation constructions. With a high reliability a fire resilient building is possible. In a fire resilient building evacuation of building occupants is not always necessary, a stay-in-place concept for building occupants might be a safer option.

Simulation results, based on the natural fire concept, depend on boundary conditions. Since most boundary conditions are stochastic, a sensitivity analysis is needed to determine the reliability or robustness of the safety concept. With zone modelling a sensitivity analysis is possible.

Topics and schedule

Week	Lectures FSE	Date	Topics
1	Lecture 1	April, 21	Introduction Fire Safety Engineering; Building, Fuel and Building-user; Personal fire safety **Exercise:** Safety of bedridden building occupants
2	Lecture 2 and guestlecture	April, 28	Natural fires Stoichiometric and non-stoichiometric combustion **Guestlecture:** Natural fires; thermal load on loadbearing construction elements (Geert Ravenshorst – TU Delft C.E.)
3	Lecture 3 and exercise	May, 12	**Exercise (part of assignment):** Natural fires: Building & Fuel characteristics **Guestlecture:** Fire Service Science (Ricardo Weewer – IFV / Fire Service Academy)
4	Lecture 4 and guestlecture	May, 19	Safe evacuation: ASET / RSET, probabilistic approach **Guestlecture:** ASET / RSET for evacuation and for stay-in-place (Lieuwe de Witte – IFV / Fire Service Academy)
5	Lecture 5 and exercise	May, 26	**Exercise (part of assignment):** AST / RST, probabilistic approach for compartmentation **Guestlecture:** Large compartments, risk analysis cf. cascade model (Peter van de Leur – DGMR)
6	Lecture 6 and guestlecture	June, 2	Automatic fire control (sprinkler) Automatic smoke control (SHEV) **Guestlecture:** Project examples (Bram Kersten – LBP|Sight)
7	FSS Conference 2021	June, 9	Fire Safety & Science Conference 2021 **Free admission for TUE sudents**
8	Lecture 7 and question hour	June 16	**Guestlecture:** Façade as risk factor in fire spread: The Grenfell fire (Rudolf van Mierlo – DGMR) Question hour

Assignment

The assignment concerns a large fire compartment with different levels of fire protection:

- Passive fire and smoke control only by buffering in the compartment volume
- Active fire control (sprinkler)
- Active smoke control (smoke and heat extraction ventilation)

The assignment has to be finished in a small report, containing a comparison of the different levels of fire protection installations for the subsystems:

- Safe compartmentation (building resilience)
- Safe escape routes (safety of building occupants)
- Safe attack routes (safety of fire service and assistance)

Literature

Recommended literature:

- R.R. Hagen, L. Witloks (modification R.A.P. van Herpen) – *The basis for fire safety (part A)* – 2014, IFV Arnhem Netherlands (available in pdf)

- M. Kealy et al. – *Cibse Guide E – Fire safety engineering* - 2003, CIBSE London UK (available in pdf)

- IFEG - International fire engineering guidelines - 2005, ICC, USA. (available in pdf)