

TU/e Fellow - Fire Safety Engineering

Department Built Environment – Unit Building Physics and Services

Concerns: Re-appointment of the Fellow Fire Safety Engineering TU/e, ir. R.A.P. van Herpen FIFireE

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1. Introduction and goals

The chairman of NL-Ingenieurs, drs. E.T.H.M. Nijpels, expressed in a letter at the Board of Directors on September 14th 2010 his concerns about the lack of a chair at the Dutch universities in the field of fire safety.

The TU/e responded by appointing a Fellow Fire Safety Engineering (FSE) at the unit Building Physics and Services (BPS) of the Department Built Environment. That does not mean that the fellowship FSE only is involved in fire safety related to building physics and services. Other expertise in the Department Built Environment are important too in fire safety, like façades, building constructions, construction materials and simulation techniques.

Therefore the following goals are formulated for the fellow FSE:

- Providing a mastercourse FSE, guest lectures in other courses, supporting bachelor- and masterprojects of students, promotional activities to expose FSE at the TU/e.
- Coordination with different areas of expertise within the Department of the Built Environment and setting up a committee of interested parties (companies, knowledge institutes and government).
- Formulating a socially relevant research track within the domain of FSE.

The research track at the TU/e is distinctive in comparison with existing master tracks in FSE (Ghent - B, Edinburgh - UK, Lund - S) by the following implementation:

- Performance-based projectspecific approach for tailormade fire safety (comprehensive package of measures for building components, building services and internal organisation), to anticipate on changing boundary conditions due to ageing building population and energy transition in the built environment.
- Quantification of public objectives in acceptable failure risks.
- Formulation and quantification of private objectives like fire resilience, sustainability/durability, protection of property, process and environment.
- Use of preventive 'Lines of Defence' for suppression by the fire service, to connect the links 'prevention' and 'suppression' in the fire safety chain (cooperation of TU/e with the Dutch Fire Service Academy).



Prevention and suppression: important links in the fire safety chain



Fellowspeech March 2013

2. Evaluation: period until 2020

2.1. Goals

- Research:
 - Socially relevant fire safety research that fits in the research track: *Objective based projectspecific fire safety – goals and acceptable failure risks*
- Education (courses):
 - Providing a mastercourse Fire Safety Engineering
 - Providing guest lectures in in bachelor and master courses about fire engineering, both inside and outside the TU/e
- Masterprojects and graduation projects:
 - Mentoring students in their research and supervising them on their (graduation) theses in the field of fire safety
 - Initiating student research topics within the mentioned research track
- Publications:
 - Publications in scientific journals, professional magazines, engineering journals.
 - Conference contributions (presentations, lectures, workshops, posters and papers)
- Profiling and connection with the market:
 - Committee of stakeholders (industry, government and knowledge institutes)
 - Vision on current themes in fire safety through articles, interviews, webinars, etc.

2.2. Results

- Research (see Annex A):
 - Two completed and two ongoing studies, with a limited role for the Fellow FSE. One research proposal has not yet been approved.
 - Review of some research proposals for VLAIO (Flanders, Belgium), see Annex D
- Education (see Annex B):
 - FSE mastercourse and contributions in various other master courses
 - Supervision of project groups in 7YY00 (MIO)
 - Guest lectures outside TU / e (TU Delft master course Fire Engineering, various universities of applied sciences in the Netherlands, Thomas More International Days in Flanders)
- Education, external:
 - Post Bachelor course Fire Safety Engineering & Management (IFV/Dutch Fire Service Academy in cooperation with NVBV-Kennisoverdracht Bouwfysica): Course coordinator en professor of the course. The course is CPION accredited and is taught at the Dutch Fire Service Academy.
 - Bachelor module Specialist Fire Prevention (IFV/Dutch Fire Service Academy): teacher and examiner for the Fire Safety Engineering module, part of the fire service officers education at the Fire Service Academy.
- Master and graduation projects (see Annex C):
 - A total of 29 completed and current projects, of which 15 TU/e graduation projects and 1 TU Delft graduation project
 - Number of students: 27, of which 1 from TU Delft
 - 6 theses were nominated for the annual IFV-VVBA thesis contest (they belong that year to the best three graduation projects of a bachelor's or master's program in the Netherlands and Belgium), 3 of which have won the thesis prize
- Publications (see Annex D):
 - 3 articles published in international scientific journals (Fire & Materials and Fire Safety Journal)
 - 1 article submitted for placement in an international scientific journal (Journal of Building Performance Simulation)
 - 2 articles reviewed for Journal of Building Performance Simulation
 - 17 contributions to international conferences (abstracts, presentations and/or papers)
 - 18 articles in national professional magazines
- Profiling and connection with the market (see, amongst others, Annex E):
 - Establishment of the FSE-wo2 foundation as official supporter from the market for the FSE fellowship at TU/e. Participants in the foundation are trade associations, research institutions, IFV/Dutch Fire Service Academy and companies from the building industry (see www.fellowfse.nl)

- Annual expert classes at the TU/e “FSE - Next Generation” with nominations for the IFV-VVBA thesis contest.
- Participation in the advisory committee of the Social Cost-Benefit Analysis of fire safety in residential buildings (Ministry of Security and Justice, SEO report 2014-16, March 2014).
- Participation in the Tunnel Safety Knowledge Platform (KPT), research platform, for risk-oriented fire safety of concrete road tunnels, ongoing since 2018.
- Participation in the IFV research into internal smoke propagation in buildings, an experimental research in a senior residents complex in Oudewater (June 2019).
- Member conference committee (2014 to 2021) for the International Fire Safety & Science Congress of the IFV.
- 2 Webinars (Brandveilig.com and Eisma Media)
- Various interviews for TV, Radio and Press
- Guest editor Stedebouw | Architecture, theme fire safety, July 2014, with a focus on FSE student research at TU/e.
- Expert in the hearing at the Parliament on fire-unsafe facades.
- Expert at the Dutch Safety Board for the New Years fires in Scheveningen.
- Expert/teacher at the CPD (Continuous Professional Development) seminars in London, Glasgow and Birmingham on facade fire safety (invited by Rockpanel).



Small fire experiment in an airtight room

Expertclass 'FSE – Next Generation' 2018



Webinar Fire safe façades

2.3. Conclusion

It can be concluded that many objectives have already been achieved since the FSE fellowship was established. The FSE fellowship is also expressly brought to the attention of market parties, research institutions and educational institutions, such as NVBV-SKB (PHBO courses), IFV/Dutch Fire Service Academy, Delft University of Technology, University of Ghent and the bachelor courses of Saxion (Enschede), Avans ('s-Hertogenbosch and Tilburg), Windesheim (Zwolle and Almere), Hogeschool Utrecht, Haagsche Hogeschool and Thomas More (Flanders).

The student research conducted under supervision of the fellowship fits into the research track and thus applies to specific components within that research track. The resulting FSE vision and the related education and research is distinctive from the existing FSE masters in neighbouring countries. This gives an FSE outflow profile in the unit BPS right to exist.

For the next term of the fellowship, it is desirable to shape the research track into a research proposal regarding objective based fire safety (see Chapter 3). This is an extremely topical theme, the importance of which is only increasing due to the energy transition of buildings and the aging building population. The necessity of an objective based approach, making acceptable failure risks or failure probabilities more explicit, is therefore greater than ever.

Once an objective based approach of fire safety is established, it is also possible to formulate private fire safety objectives in addition to public fire safety objectives. Private fire safety objectives could be related to sustainability/durability, building resilience, business continuity, property protection and environmental protection.

3. Outlook: period after 2020

3.1. Mission and vision

The FSE fellowship has been established to anchor fire safety in the academic building & architecture education and to link it to engineering practice.

The vision with which this mission is fulfilled in the fellowship will be no different for the coming years than in previous years. The implementation of the research track in four specific topics, as mentioned at the end of Chapter 1, is consistent and more relevant than ever. Fire risks are shifting due to the energy transition and the ageing building population. The probability of fire will increase and the fire scenarios are clearly different from the traditional scenarios. Due to the aging building population, building users need more time to bring themselves to safety. Fire becomes more hazardous, since both probability and consequences will increase. Regulation-based fire safety cannot anticipate on these changing boundary conditions. Objective based fire safety, in which project-specific characteristics can be valued and changing boundary conditions can be taken into account is the answer.

Objective based fire safety also enables safety-concepts other than those assumed in the regulations. A stay-in-place concept instead of an evacuation concept in case of fire in a building is an example of a different concept that doesn't fit in the building code, although it can provide in a safe solution. By categorizing public objectives into derived sub-objectives (risk subsystems) that are mutually consistent, an integral fire safety concept in which both prevention and suppression are considered is possible. If necessary, also any private objectives can be taken into account.

This vision is distinctive for the TU/e and therefore gives a master's specialization in FSE in the unit BPS right to exist.

The FSE fellow, Ruud van Herpen, gives a clear shape to this vision. The vision can therefore be found in the teaching and learning material and in the student research projects. To continue this, Ruud van Herpen would also like to be available as a fellow for the next four years.

3.2. Strategy

There are currently active studies at TU/e in which FSE plays an important role (under the responsibility of Prof. Dr. Ir. J. Brouwers and Dr. Ir. H. Hofmeyer). This also includes the commitment of the Fellow FSE.

In addition, a new stakeholder has explicitly come into the picture in recent years, namely IFV/Dutch Fire Service Academy. The Dutch Fire Service Academy has its own research agenda, it also conducts experimental research, but is not experienced in defining research goals, boundary conditions and simulations. That is why the Dutch Fire Service Academy needs and wants to continue the

cooperation with the TU/e. This also makes it possible to properly implement the connection between suppression and prevention, two important links in the security chain..



Validation of multizone models for internal smoke propagation (TU/e) by experiments (IFV/Dutch Fire Service Academy)

In addition to prescriptive regulations, it is desirable to develop a document in which the public (derived) objectives of fire safety are explicitly stated and their acceptable failure risks or failure probabilities are defined. Acceptable failure risks or failure probabilities are not explicitly defined in the current prescriptive regulations. In fact, the current prescriptive regulations for each building function and building type lead to a wide range of failure risks. Safeguarding public (derived) objectives is therefore not possible with prescriptive regulations. It is precisely the safeguarding of public objectives that is important with changing boundary conditions, such as an aging population and (nearly) zero energy buildings. Anticipating changing boundary conditions is only possible in an objective based approach. Anticipating changing boundary conditions is not possible in a rule based approach, the victim risk will increase while the regulations remain the same.

Making the acceptable failure risks explicit requires a lot of research, in particular simulation research with sensitivity analyses of the relevant stochastic boundary conditions for both the source (fire) and the response (behavior of structures, installations and people). Such a comprehensive study would fit perfectly into the next four years of the FSE fellowship, which fulfills an important long-term objective: stimulating research within the domain of FSE at TU / e.

There is a great social need for such research, not only from a public point of view but also from private objectives with regard to sustainability, durability, business continuity and damage control. This research requires knowledge of statistics and probabilistics. Knowledge that is often not sufficiently available among master students. External funding in order to deploy the right capacity in this research is therefore necessary. The first months of the coming period can be used to prepare a research proposal. External funding can then be raised on the basis of that proposal.

3.3. Research proposal

Below is a brief summary of the content of the research into objective based fire safety. With an objective based approach it is possible to define an unambiguous fire safety level for buildings, based on a natural fire concept, taking into account project-specific characteristics.

- Subject:
Objective based fire safety

- Focus:
Public and private objectives for fire safety (sustainability, durability, building resilience, damage control, business continuity, etc.)

- Market:
 - Government: ministries of BZK, V&J, EZ
 - Construction and installation sector (partly represented in the Fellow FSE foundation)
 - Engineering branch: NLingenieurs, VVBA (partly represented in the Fellow FSE foundation)
 - Knowledge institutes: IFV, TNO Fire Safety, Efectis, Peutz (partly represented in the Fellow FSE foundation)
 - Fire Service: IFV, BrandweerNL

- Content:
Formulating the public and private objectives for fire safety and determining acceptable failure risks. Project-specific characteristics (with regard to fire and fuel, building, building users and assistance) are valued in an objective based approach. Simulations based on a natural fire concept are necessary to calculate the response and failure probability of load bearing construction elements, separation constructions, escape routes, attack routes and the human behaviour of building users and emergency services. The uncertainties in boundary conditions determine which margins lead to a sufficiently low failure risk. This acceptable failure risk determines the level of fire safety.

For this research it is necessary to work out a large number of cases. This requires a lot of capacity for both simulating and collecting and analyzing statistical and probabilistic data. Extra support for the Fellow FSE and master students might be desirable.

The research will be especially relevant for external parties if it is linked to the energy transition in buildings. This also provides insight into the specific fire risks related to energy transition.

- Knowledge partners:
IFV/Dutch Fire Service Academy and TNO Fire Safety are knowledge partners who can participate in this research. Both institutions are attempting to achieve objective based fire safety. In case of IFV/Dutch Fire Service Academy this is related to fire suppression and in case of TNO Fire Safety to fire prevention. TNO Fire Safety is currently developing a 'building model' for fire safety, an automatic code checking tool, focused on Building Code regulations. It may also be possible to make this 'building model' objective based.
- Financing:
The various market parties, the Dutch Fire Service (BrandweerNL) and the Ministries of BZK, V&J and EZ will be approached for financing. It will also be investigated whether funds can be raised for this research via calls.

Annex A: Research projects (TU/e)

- Polypyrrol – adding smart functions to biobased facades (RAAK-mkb, Saxion: prof. Mieke Oostra)
Status: completed, 2018
Part fire safety/fire engineering: 20 k€
- Fire safety of geopolymer-based building materials (STW, TU/e: prof. Jos Brouwers, Qingliang Yu)
Status: ongoing
Total proposal fire safety: 1.148 k€
- Fire safe buildings with thin-walled steel and insulation systems (China Scholarship Council, TU/e: Herm Hofmeyer, Johan Maljaars, Ruud van Herpen, Aiden Xu)
Status: ongoing
Total proposal structural fire engineering: 70 k€
- Environmentally safe and friendly intumescent coatings (NWO-TTW proposal, Herm Hofmeyer)
Status: proposal
Part fire safety/fire engineering: 230 k€
- Benefits of sprinkler protection for personal safety (European Fire Sprinkler Network, in cooperation with Nieman Consultants, Ruud van Herpen, Claudia Rojas)
Status: completed, 2018
Total proposal fire safety: 20 k€

Annex B: Education (TU/e)

- Mastercourse 7Y320 (FSE), period 2012-2015: 7x2 hours of lectures with accompanying course material, exercises and exam cases.
- Bachelorcourse 7S4X0 (Building Physics), period 2015-now: 1x2 hours of lecture en 1x2 hours seminar with accompanying course material, exercises and exam cases.
- Bachelorcourse 7S8X0 (Building Services), period 2015-2017: 1x2 hours of lectures with accompanying course material, exercises and exam cases.
- Mastercourse 7LY4M0 (Building Services and FSE), period 2015-now: 7x2 uur hours of lectures and 7x2 hours seminar with accompanying course material, exercises and individual final assignment.
- Guest lecture fire safety in the bachelorcourse 'Gevels en Daken' and the mastercourse 'Highrise Building', period 2013-2015: 2x2 hours of lectures, including examination questions.
- Support fire safety in project education 7YY00, period 2014-now: MIO-project, supervision of project groups during 4 months.
- Post graduate course 'Fire safety engineering and management', period 2012-now: 1 year course at post bachelor level with 25 lecture days (SKB, IFV/Dutch Fire Service Academy).

Annex C: Masterprojects

Support, supervision and assessment of individual masterprojects within the unit BPS in the field of fire safety or FSE:

- Eef Brouns (2013) – Investigation of suppression techniques in containerbuilding TRONED;
- Annelous Bossers, Thijs van Druenen (2014) – Zonemodels and natural ventilation through openings in separation walls;
- Marthe Doornbos (2015) – Fire safety in pavilion Summerlab: AST vs. RST;
- Dolf van Onna (2015) – Residential fire experiments in Zutphen: Modelling and validation in CFAST;
- Babette Mattheüs (2016) – Firesafe buildings without escaperoutes;
- Reem Shakerchi (2016) – Comparison of evacuation model FDS-Evac with ‘Rekenhulp Bouwbesluit 2012’ (building code assessment method);
- Nick Tenbült (2017) – Impact of the mechanical ventilation system on fire behavior in airtight dwellings;
- Erwin Slotboom (2017) – Efficiency of hot smoke layer cooling techniques: investigation of an experimental setup;
- Marjolein Benen, Lara Quaas (2018) – Reliability of fire compartmentation;
- Bram Dorsman (2019) – Probabilistic approach of ASET and RSET for bedridden building occupants;
- Jesse Hamers (2020) – Traveling fire concept in parking garages: consequences for the load bearing steel structure;
- Joost Dumas (ongoing) – Stay-in-place concept for a multi-storey multi-compartment building.

In the past 4 years, the following master graduation studies have been completed in the field of fire safety or fire engineering, supervised by the Fellow FSE:

- Ronald Huizinga (TU/e-BPS, 2012) – Influence of the performance of triple and double glazing on the fire development in a dwelling; *Nominated IFV-VVBA Thesis award 2013*
- Niels Starting (TU/e-BPS, 2012) – Evacuation of bedridden building occupants; *Nominated IFV-VVBA Thesis award 2013*
- Rob Kisjes (TU/e-BPS, 2014) – Brandveiligheid in hoogbouw: doelkwantificering op basis van Bouwbesluit 2012;
- Yan-Ying Wong (TUD-Civil Engineering, 2014) – Steel structures in an open carpark: the influence of trapped smoke on the fire resistance of steel beams;
- Luuk de Kluiver (TU/e-BPS, 2014) – Establishing flammability ranges of building insulation materials;
- Sander Giunta d’Albani (TU/e-BPS, 2014) – Fire behavior of sandwich panel core materials in the pre flashover phase; *Winner IFV-VVBA Thesis award 2015*

- Vincent van den Brink (TU/e-BPS, 2015) – Fire safety and suppression in modern residential buildings; *Nominated IFV-VVBA Thesis award 2015*
- Jelmer Feenstra (TU/e-SD, 2016) – Two-way coupling of CFD fire simulations and FE modelling on thin walled steel structures; *Winner IFV-VVBA Thesis award 2016*
- Babette Mattheus (TU/e-BPS, 2017) – Fire propagation in an open carpark;
- Reem Shakerchi (TU/e-BPS, 2017) – Numerical simulation of external flames in ventilation controlled post flashover fires;
- Nick Tenbült (TU/e-BPS, 2018) – Cooling of a hot smoke layer by a sprinkler spray; *Winner IFV-VVBA Thesis award 2018;*
- Jan de Boer (TU/e-SD, 2018) – Automated two-way coupled CFD fire and thermomechanical FE analysis of a self-supporting sandwich panel facadesystem;
- Lennart Gerritsen (TU/e-REMD, 2018) – Fire safety risk checker: risk factors for residential housing for elderly;
- Maarten Arntz (TU/e-SD, 2018) – The bearing capacity of an aluminium curtain wall, exposed to a standard fire;
- Mike van der Linden (TU/e-BPS, 2019) – Fire safety and the ageing population: a probabilistic link of preventive and repressive measures in residential buildings;
- Marc Scholman (TU/e-BPS, 2020) – Different concepts for personal safety in a multi-storey residential building, related to internal smoke propagation.

Annex D: Publications

Scientific articles

Peer-reviewed:

Giunta d'Albani, A.W., Kluiver, L.L. de, Korte, A.C.J. de, Herpen, R.A.P. van, Weewer, R., Brouwers, H.J.H. (2017): *Mass loss and flammability of insulation materials used in sandwich panels during the pre-flashover phase of fire*; In: Fire and Materials 41, pg 779 - 796, Wiley and sons, UK

Feenstra, J.A., Hofmeyer, H., Herpen, R.A.P. van, Mahendran, M. (2018): *Automated two-way coupling of CFD fire simulations to thermomechanical FE analyses at the overall structural level*; In: Fire Safety Journal 96, pg 165 – 175, Elsevier, NL

Boer, J.G.G.M. de, Hofmeyer, H., Herpen, R.A.P. van, Maljaars, J. (2019): *Two-way coupled CFD fire and thermomechanical FE analyses of a self-supporting sandwich panel façade system*; In: Fire Safety Journal 105, pg 154 – 168, Elsevier, NL

Ready for peer-review:

Herpen, R.A.P. van, Garces, C. (2020): *Benefits of sprinkler protection for personal safety – a probabilistic approach in simulating the available safe egress time*; In: Journal of Building Performance Simulation, Taylor & Francis, UK (submitted)

Chapters

Scientific, peer-reviewed:

Den Boer, D., Burcksen, R., Hartgerink, R.J.M., Herpen, R.A.P. van, Janse, E., Kersten, B., Kobes, M., Oberije, N. (2013): *Brandveiligheid in de bouw – integrale brandveiligheid voor het realiseren van brandveiligheidsdoelen* (lesboek/coursebook). Saxion Hogeschool, Enschede

Herpen, R.A.P. van (2010): *Hoge gebouwen, hoge veiligheidsrisico's? Een integrale risicobeschouwing voor hoogbouw*. In: Korte, A. de (2010): Beveiliging Totaal 2011, Vakmedianet, Alphen aan den Rijn

Herpen, R.A.P. van (2015): *Hoe veilig is vluchtveilig? – Noodzakelijke marges als gevolg van onzekere randcondities*. In: Korte, A. de (2015): Beveiliging Totaal 2016, Vakmedianet, Alphen aan den Rijn

Application-oriented, not peer reviewed:

Herpen, R.A.P. van, Drost-Hofman, M.S. (2012): *Brandveiligheid van rieten gevels*. In: Kuindersma, P. (2012): Handboek gevels 2012, SDU, Den Haag

Reviews

Journal of building performance simulation: <https://www.tandfonline.com/toc/tbps20/current>
(2014): *Computational analysis of the performance of smoke exhaust systems in small vestibules of highrise buildings* (manuscript TBPS-2013-0156)

Journal of building performance simulation: <https://www.tandfonline.com/toc/tbps20/current>
(2018): *A novel approach of fire safety systems in highrise buildings and evacuation modelling on accidental fire occurrence* (manuscript TBPS-2017-0250)

Agentschap Innoveren en Ondernemen Vlaanderen VLAIO: www.vlaio.be (2017): *Onderzoek naar het veiligheidsniveau in gesprinklerde ondergrondse parkeergarages* (onderzoeksvoorstel FESG, onderzoek WTO / 170331)

Agentschap Innoveren en Ondernemen Vlaanderen VLAIO: www.vlaio.be (2020): *FIERCE: Fire Integrated Environment for risk comprehension and evaluation – tunnelsafety* (research proposal FESG and UGent, research HBC.2019.2839)

Conference contributions / Papers

(Papers can be found at www.fellowfse.nl)

Herpen, R.A.P. van, Quaas, L.C., Benen, M. (2021): *Reliability of fire compartmentation*. Fire & Materials 2021, San Francisco US (abstract submitted)

Herpen, R.A.P. van, Scholman, M. (2021): *Smoketightness of internal separation constructions*. Fire & Materials 2021, San Francisco US (abstract submitted)

Herpen, R.A.P. van, Scholman, M. (2021): *Smoketightness of internal separation constructions in a stay-in-place concept*. SFPE 21 Europe Congress, Berlin D (abstract submitted)

Herpen, R.A.P. van, Rojas Garces, C. (2021): *Improving evacuation safety in case of fire with automatic sprinklers*. SFPE 21 Europe Congress, Berlin D (abstract submitted)

Herpen, R.A.P. van, Hostikka, S. (2019): *Sprinkler protection and personal safety*. Fire Safety & Science International Congress, 2019, Anhem NL (workshop)

Herpen, R.A.P. van, Ebus, J. (2019): *Learning from fires using fire engineering for suppression*. Fire Safety & Science International Congress, 2019, Anhem NL (workshop)

Herpen, R.A.P. van, Rojas Garces, C. (2019): *Benefits of sprinkler protection for personal safety of building occupants*. SupFire 2019, Warsaw P (presentation and paper)

Herpen, R.A.P. van, Rojas Garces, C. (2019): *Benefits of sprinkler protection for personal safety of building occupants*. Fire Sprinkler International 2018, Stockholm S (presentation and poster)

Herpen, R.A.P. van, Witte, L. de (2019): *Interactieve FSE-casus voor persoonlijke veiligheid*. Nationaal Brandpreventie Congres 2019, Brandpreventie Academy, Echteld NL (workshop)

Herpen, R.A.P. van, Witte, L. de (2018): *Personal safety of less self-reliant building occupants*. Fire Safety & Science International Congress, 2017, Arnhem NL (workshop)

Herpen, R.A.P. van (2018): *Fire safe facades*. Rockpanel CPD-seminars for architects and engineers, London, Glasgow and Birmingham, 2018, UK (presentation and workshop)

<https://www.youtube.com/watch?v=5z8lrhDiyL8>

Herpen, R.A.P. van (2018): *Fire protection of the Sea Lock Gates IJmuiden*. SFPE 18 Europe Congress, Rotterdam NL (presentation)

Herpen, R.A.P. van (2017): *A fire safe future? Influence of changing boundary conditions on the building envelope on the fire safety of buildings*. Fire Safety & Science International Congress, 2017, Arnhem NL (key-note presentation, paper in Dutch)

Strating, N., Zeiler, W., Herpen, R.A.P. van (2016): *Evacuation of bedridden occupants: experimental research outcomes*. Second International Fire Safety Symposium IFireSS 2017, Naples I (presentation and paper)

Huizinga, R.A., Zeiler, W., Herpen, R.A.P. van (2016): *The effects of triple glazing on nearly zero energy buildings on fire safety*. Second International Fire Safety Symposium IFireSS 2017, Naples I (presentation and paper)

Herpen, R.A.P. van (2016): *Prevention and suppression in large car parks, based on a travelling fire concept*. Fire Safety & Science International Congress, 2016, Arnhem NL (presentation)

Herpen, R.A.P. van (2015): *Prevention and suppression, dealing with uncertainties in a time dependent balance*. Fire Safety & Science International Congress, 2015, Arnhem NL (presentation, paper in Dutch)

Herpen, R.A.P. van (2014): *Doelgerichte vluchtveiligheid, Noodzakelijke marges als gevolg van onzekere randcondities*. Fire Safety & Science International Congress, 2014, Arnhem NL (presentation, paper in Dutch; whitepaper.brandveilig.com)

<https://www.brandveilig.com/nieuws/vluchtveiligheid-in-grote-compartmenten-48609>

Herpen, R.A.P. van (2013): *Fire Safety Consequences of passive houses*. Clima 2013, Prague CZ (paper)

Herpen, R.A.P. van (2012): *Tall buildings, safety by risk assessment*. SBR International Conference Highrise Buildings, 2012, Amsterdam NL (presentation)

Herpen, R.A.P. van, Huls, J.E., Lam, W.K., Zeeburg, A. van (2009): *Evacuation modeling: Comparison of (FDS+Evac) with Simulex*. First International Conference on evacuation modeling and management, 2009, Delft NL (presentation and paper)

Professional magazine articles

Scholman, M.C., Herpen, R.A.P. van (2020): *Persoonlijke veiligheid in wooncomplexen in relatie tot interne rookverspreiding*. In: Bouwfysica, 2020, nr. 2

Herpen, R.A.P. van (2019): *Nederlandse monumenten: weinig aandacht voor brandveiligheid*. In: Brandveilig.com, 2019, 17 april

(<https://www.brandveilig.com/nieuws/nederlandse-monumenten-weinig-aandacht-voor-brandveiligheid-60916>)

Herpen, R.A.P. van (2018): *Herbezinning brandveiligheid van hoge gebouwen*. In: Brandveilig.com, 2018, 28 februari

(<https://www.brandveilig.com/nieuws/herbezinning-brandveiligheid-hoge-gebouwen-53762>)

Shakerchi, R., Herpen, R.A.P. van, Naus, I.M.M.M.C (2017): *Numerieke simulatie van uitslaande vlammen bij ventilatiebeheerste branden*. In: Bouwfysica, 2018, nr. 1, pg. 23 – 27

Huijzer, J.C., Herpen, R.A.P. van (2016): *Rookoverlast vanuit grote brandcompartimenten*. In: Bouwkwiteit in de Praktijk, 2016, nr. 4, pag. 15 - 17

Herpen, R.A.P. van (2015): *Wat als niet voldaan kan worden aan het Bouwbesluit? – Doelgerichte brandveiligheid in bestaande gebouwen*. In: Beveiliging, 2015, oktober, pag. 44 – 46

Herpen, R.A.P. van (2015): *Handreiking brandveiligheid hoge gebouwen – Generieke voorschriften in een doelgerichte afweging*. In: Stedebouw & Architectuur, 2015, nr. 2, pag. 23 - 25

Herpen, R.A.P. van (2015): *Verpleegafdeling Amphia Ziekenhuis Breda – doelgerichte brandveiligheid*. In: Bouwfysica, 2015, nr. 1, pag. 20 - 23

Hagen, R.R., Hanssen, M., Herpen, R.A.P. van, Weewer, R. (2015): *Forumdiscussie brandveiligheid: roep om sprinklers en risicobenadering omgevingsgevaar*. In: Bouwkwiteit in de Praktijk, 2015, nr. 3, pag. 6 - 9

Strating, N., van Herpen, R.A.P., Zeiler, W. (2015): *Evacuatie van bedgebonden patiënten*. In: TVVL Magazine, 2015, nr. 2, pag. 46 - 48

Herpen, R.A.P. van (2015): *Hoge gebouwen, hoge veiligheidsrisico's? – een integrale risicobeschouwing voor hoogbouw*. In: TVVL Magazine, 2015, nr. 2, pag. 36 - 41

Herpen, R.A.P. van, Witte, L. de (2014): *Brandveilige buffer – doelgerichte brandpreventie in bestaande bouw*. In: Brandveilig.com, 2014, nr. 6, pag. 12 - 14

Herpen, R.A.P. van (2014): *Duurzaamheid door doelgerichte brandveiligheid*. In: BREEAM NL Magazine, november 2014, pag. 62 - 63

Strating, N., Herpen, R.A.P. van (2014): *Redden met een stopwatch – evacuatie van bedgebonden patiënten*. In: Brandveilig.com, 2014, nr. 3, pag. 31 - 33

Herpen, R.A.P. van (2014): *Brandbeveiligingsconcepten voor parkeergarages*. In: Stedebouw & Architectuur, 2014, nr. 2, pag. 32 - 33

Herpen, R.A.P. van (2014): *Brandveiligheid natuurlijk geventileerde parkeergarages*. In: Bouwregels in de Praktijk, 2014, nr. 3, pag. 15 - 19

Herpen, R.A.P. van (2013): *Doelen en regelgeving voor brandveiligheid: consequenties voor een FSE benadering*. In: Bouwregels in de Praktijk, 2013, nr. 9, pag. 32 - 35

Huizinga, R.A., Herpen, R.A.P. van (2013): *Consequenties van de toepassing van dubbel en triple glas op het brandgedrag in een woning*. In: Bouwfysica, 2013, nr. 1, pag. 8 - 11

Annex E: Profiling

Webinars

Webinar 24 September 2019: *Voorkom een gevelbrand*; Eisma Bouwmedia
(<https://www.bouwwebinar.nl/webinar/voorkom-een-gevelbrand/>)

Webinar 6 June 2018: *Veilig vluchten en persoonlijke veiligheid*; Brandveilig.com
(<https://www.brandveilig.com/nieuws/kijk-het-webinar-over-veilig-vluchten-terug-54718>)

Expertclasses

Expertclasses 2019, 2018, 2017, 2016, 2015, 2014: *FSE – Next Generation*, incl. nominations for ‘Best Thesis Award FSE’ in cooperation with IFV and VVBA, TU Eindhoven NL

International Days Thomas More 2020, 2019: *A fire safe future? – Introducing FSE*. Thomas More University of applied sciences, Campus Geel B

Interviews

Onderzoeksraad voor de veiligheid (2019): *Vliegvuur op Scheveningen*, interview naar aanleiding van de vreugdevuren in de nieuwjaarsnacht 2019, Den Haag NL

Tweede Kamer der Staten-Generaal – Parliament, Standing committee of internal affairs (6 September 2018): *Hoorzitting brandveiligheid gevelplaten*, Den Haag NL

TV actualiteitenrubriek Zembla (23 May 2018): *Brandgevaar! Brandrisico nageïsoleerde gevels met kunststof isolatie in woongebouwen*, Interview NPO 2
(<https://www.bnnvara.nl/zembla/artikelen/brandgevaar>)

Meijer, G. (24 February 2018): *Brand in ecohuis: leerschool voor vuurbestrijders*, Interview in De Stentor

Radio actualiteitenprogramma 1-Vandaag (24 June 2017): *Brand in de Grenfell Tower in Londen – Kan dat ook in Nederland gebeuren?*, Interview NPO Radio 1
(<http://www.nporadio1.nl/radio-eenvandaag/onderwerpen/412751-in-het-nieuws-grote-brand-in-londen>)

Dujardin, A. (14 June 2017): *Hoe probeert Nederland een brand als ik Londen te voorkomen?*, Interview in Trouw

TV actualiteitenprogramma 1-Vandaag (21 December 2015): *Brandrisico van de Tesla Powerwall en Lithium-Ion accu's in het algemeen*, Interview NPO 1

(http://binnenland.eenvandaag.nl/tv-items/63993/zorgen_om_veiligheid_lithium_ion_batterijen)

Background document:

Herpen, R.A.P. van (2016): *Brandrisico van Lithium-Ion accu's*. TU Eindhoven NL

(www.fellowfse.nl)

Jongeleen, L. (2015): *Luchtdichtheid beïnvloedt ook de brandveiligheid*. Interview in Raam en Deur, 2015, nr. 1, pag. 22 - 23

Thoorn, A. van den (2014): *Omgaan met 'hoge' risico's*. Interview in Brandveilig.com, 2014, nr. 4, pag. 8 - 10

Herpen, R.A.P. van (2014): *Fire Safety Engineering aan de TU Eindhoven*. Interview in Stedebouw & Architectuur, 2014, nr. 4, pag. 44 - 45

Committees

SEO Begeleidingscommissie (2014): *Maatschappelijke kosten-batenanalyse brandveiligheid in woningen*, Amsterdam NL

(http://www.seo.nl/uploads/media/2014-16_MKBA_brandveiligheid_woningen.pdf)

KPT Begeleidingscommissie onderzoekstafel Kennis Platform Tunnelveiligheid (2018 – now): *Risk-based approach for thermal load and thermo-mechanical response of concrete tunnels*, Delft NL

(<https://www.kennisplatformtunnelveiligheid.nl/>)

IFV Congrescommissie (2013 – now): *Fire Safety and Science Congress* Arnhem NL

Standardization committee 351007 (2008 – now), Netherlands Normalization Institute NNI Delft NL:

3510070004 – *Fire Safety Engineering*

3510070014 – *Fire safety of large compartments* NEN 6079 c.a.

3510070021 – *Pressurization systems for personal safety* NPR 6095

Inaugural speech – TU/e fellowship

Herpen, R.A.P. van (20 March 2013): *Applying rules or engineering safety? – Brandveiligheid bij ombouw van bestaande gebouwen*. TU Eindhoven NL

(www.fellowfse.nl)

Annex F: Curriculum Vitae

“ Safety is just a phenomenon of prosperity: a high level of prosperity corresponds to a high safety standard “

Ruud van Herpen, Fellow Fire Safety Engineering TU/e

Updated: January 2020

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r.a.p.vanherpen@saxion.nl

Date of birth: 27 September 1962



Education

Delft University of Technology, Dept. Civil Engineering
Master degree in building physics (with honours)

1987

Master thesis:

*Indoor climate control in a closed micro ecosystem
of the zero-energy building ‘The Egg’ (CICAT)*

Fellow at the Institution of Fire Engineers IFE (FIFireE)

2011

Experience

Fellow Fire Safety Engineering
Eindhoven University of Technology TU/e
Dept. Built Environment; Unit Building Physics and Services

2013 – present

Professor fire safety of buildings
Saxion University of applied sciences, Enschede

2010 – present

Nieman Consultants & Engineers Utrecht / Zwolle
Technical director and senior fire engineer

2002 – present

Cauberg-Huygen Consultants Maastricht / Rotterdam / Zwolle
Senior consultant fire safety and building physics

1992 – 2002

Engineering projects

- Rockwool Roermond: Performance based fire safety concept for the Rockwool Plant (2020)
- Talis and WoonGenoot: Performance based fire safety framework for new and existing residential buildings (2019-2020)
- Shell Pernis and Arnhem: External safety in case of pool fires, CFD studies (2017-2019)
- Magna Plaza Amsterdam (shopping mall): Fire safety concept (2018-2019)
- Sea lock IJmuiden: Probabilistic fire safety concept (2017)
- Schiphol Amsterdam: Fire safety of P1 and P2 carparks; Performance based fire safety concepts for Schiphol RE Cargo buildings (2015-2020)
- Designer Outlet Centre Roermond (carpark): Performance based fire safety concept (2016)
- Radboud UMC Nijmegen (academic hospital): Performance based fire safety framework for existing and new buildings (2013)
- OLVG Amsterdam (hospital): Fire safety concept (2013-2020)
- Renovation of soccerstadiums AZ Alkmaar, FC Twente, Spakenburg and IJsselmeervogels: Egress safety, maximum occupation and structural safety (2007-2013)
- Metropool Hengelo (concert hall): fire safety concept (design and build team 2007-2008)
- Dutch Audiovisual Archives and museum NAA, Hilversum: fire safety concept (design team 2002)
- Souterrain underground light-rail, The Hague: fire safety concept (design and build team 2001)

Applied research

- Brandwijzer (www.dezorgbrandveilig.nl): a risk based tool for evacuating the potential threatened area in wards and hospitals, in cooperation with Crisislab and IFV fire service academy (2018)
- Research Ministry of housing (BZK): Fire safety of corridors (2018)
- Research Ministry of housing (BZK): Fire safety of staircases, directly connected to apartments at different levels (2015)
- Research NEN: Fire safety of large fire compartments (2011-2016)
- Research SBRCURnet: Directive fire safety of high-rise buildings (above 70 meters) (2009-2013)
- Research NEN: Boundary conditions in a natural fire concept for safety objectives according to the Dutch building code (NEN-EN 1991-1-2/NB) (2011-2014)
- Research NEN: Standardization of the Natural fire concept (NEN 6055) (2007-2011)

- Research NEN: A risk based approach for structural fire safety in high-rise buildings (above 70 meters) (2008)

Other activities

- Member of NL-engineers, NFPA, IBPSA (International Building Performance Simulation Association), VVBA (Association of fire safety consultants), IFE (Institution of Fire Engineers), SFPE (Society of Fire Protection Engineers) and VBE (Association of fire safety experts).
- Coordinator of the post-bachelor course (PHBO) Fire Safety Engineering & Management (SKB and IFV/Fire Service Academy)
- Member of the standardisation committee for the fire safety of buildings (NEN: NC351007)
- Author in the Work Group Fire Safety Engineering (NEN: WG3510070004) for natural fire concepts (standardisation committee)
- Author in the Work Group Fire Control (NEN: WG3510070013) for large fire-compartments (standardisation committee)