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Date 20.12.2024
Our ref. FO001_01/nph

Løgmansskrivstovan
The Prime Minister´s Office
Tinganes
FO-100 Tórshavn / Faroe Islands

Att. Dan M. Knudsen

Dear Sir

As kindly requested by The Prime Minister's Office (Løgmansskrivstovan) we hereby send the response to the consultation response (høringssvar), which have been received by The Prime Minister's Office from Landsverk (Landsingeniøren), in connection with Suðuroyartunnilin.

The consultation response (translated into English):

> *"The tunnel developper has had the consulting firm HOJ Consulting from Switzerland review their safety report, but Landsverk must point out that there are also shortcomings in their safety assessments, and that the safety issue in the tunnel is therefore still not sufficiently clarified. Landsverk also points out that there is limited information available about the company HOJ Consulting. There are doubts about the company's experience in preparing or reviewing safety and risk assessments for projects as large as the Suðuroyar Tunnel."*

Comments from HOJ Consulting (Niels Peter Høj):

1) To the first sentence "*…there are also shortcomings in their safety assessments...":* We would of course be willing to discuss any comments to our contribution, but it should be noted, that (according to the scope agreed with P/F Suðuroyartunnilin) our report "*Peer Review and Second Opinion of Risk Analyses for Suðuroyartunnilin, H-FO-001 of 11.10.2024*" does not include any safety assessment. It is purely a peer review of the risk assessments done by SINTEF, Norconsult and Sweco. Hence, it is unclear what is meant by this remark.

2) To the second and third sentences *"...there is limited information..."* and "*There are doubts about the company's experience in preparing or reviewing safety and risk assessments...":* We are pleased to inform more about the company. For further details, also a CV of the author, Niels Peter Høj, can be provided.

   HOJ Consulting has extensive experiences and is highly specialised in the field of risk analyses and risk assessments of large infrastructure projects, in particular road tunnels.

   HOJ Consulting was founded by Niels Peter Høj in 2003 based on his 20 years of experience from consulting companies and higher education institutes. In the following, some few keywords about the experience of Niels Peter Høj and the company is summarised:

- HOJ Consulting has since 2003 carried out risk analyses and risk assessments for 117 tunnels in all regions of Norway. These tunnels are from few hundred meters long up to the 26 km long Rogfast Tunnel and the 14 km + 4 km + 6 km long Ryfast tunnel complex. Some projects have been carried out as subconsultant to other consultants (like Rogfast), whereas most risk assessments (incl. Ryfast) have been done directly for NPRA (Norwegian Public Roads Administration).
- HOJ Consulting has carried out risk assessments of 7 tunnels in Iceland up to 13 km long and 18 tunnels in Finland, which constitute more than half the tunnels existing in these countries.
- In Sweden, HOJ Consulting has provided expertise concerning risk assessment for the 20 km long Bypass Stockholm and has been in the review committee for the safety analyses of the Norra Länken project.
- In Denmark, HOJ Consulting has been involved in the 20 km long Fehmarn link, the 20 km Østlig Ringvej, etc. For these projects HOJ Consulting has mostly collaborated with COWI and has been involved as risk assessment expert.
- Outside the Nordic countries, HOJ Consulting has carried out 92 risk assessments of road tunnels. Not least in Switzerland, where it has been taken part in 53 road tunnel projects. Among these is the 17 km Gotthard Road Tunnel, including the tunnel presently in operation and the new tunnel tube under construction.
- For various international projects, HOJ Consulting has been subconsultant to other consulting companies, like COWI and HBI, providing expertise on risk assessment. These projects count among others: Busan - Geoje Fixed Link in South Korea, Sharq Crossing in Qatar and Lower Thames Crossing in the UK.
- HOJ Consulting and Niels Peter Høj have been involved in national and international research projects related to tunnel safety. For example, the European projects: FIT (Fire In Tunnels), DARTS (Durable And Reliable Tunnel Structures), UPTUN (Upgrading methods for fire safety in existing TUNnels), the Norwegian “Moderne vegtunneler” and a Swiss-Norwegian project for establishing the best practice for risk assessment of Road Tunnels.
- 20 years ago, Niels Peter Høj, together with other leading international experts, founded the organisation ITA-COSUF (Committee of Safety of Underground Facilities) and has participated as member of steering board and other positions. In various international organisations, he also contributes to activities related to tunnel safety and fire.
- HOJ Consulting has, together with its collaborating partner Matrisk, developed a quantified risk analysis- and risk evaluation-methodology for road tunnel, which has been applied for projects in Switzerland, Norway and Iceland.

I hope the above information have been helpful to highlight the vast among of expertise that HOJ Consulting has in the field of risk assessment for infrastructure projects, especially for road tunnels.

If you have further questions, you are most welcome to contact me again.

Yours sincerely



Niels Peter Høj

Curriculum Vitae

Niels Peter Høj



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Specialisation
Safety design, risk analysis, risk management, RAMS and decision support. Risk analyses of tunnels, railways, roads and bridges
Design of tunnels, structural behaviour during fire, structural reliability, structural engineering

Nationality: Danish
Birth: 1959
Civil Status: Married
Children: Two

Education
Master's degree (M.Sc.) in Structural Engineering from the Institute of Structural Engineering at Aalborg University, Denmark. Thesis: "Estimation of Failure Probability for Frame Structures", 1983

Awards and Prizes
Recipient of the 1999 annual IABSE Prize given in recognition of an outstanding contribution in the field of structural engineering. Niels Peter Høj was awarded the prize in recognition of his "outstanding efforts with introduction and application of modern probabilistic ways of thinking in professional practical engineering activities, in particular related to methods for risk analysis, structural reliability and decision making"

Key Qualifications
Mr. N. P. Høj is an expert in risk management with broad experience and special knowledge of design for safety, RAMS, risk analysis, management, system engineering, and decision support.

The special expertise on safety and risk analyses has been applied in practice to support decision within design and operation of major infrastructure projects and as part of feasibility studies. He has conducted RAMS and risk analyses for numerous civil engineering projects including 150 road tunnels, rail and metro tunnels and other underground facilities. Furthermore, risk analyses have also been carried out for some of the world's most important bridge projects.

Mr. Høj has contributed with his experiences and developed new methods for safety design through his participation in several research projects. Further, he is a sought-after lecturer in various congress and educational courses relating to risk-based safety management.

Analysis of concrete structures, and particularly fire in tunnels, is part of Mr N. P. Høj's expertise. Furthermore, he has a broad experience in design of tunnels, bridges and other structures, as well as structural analysis in general.

Language

	Speaking	Reading	Writing
Danish	Excellent	Excellent	Excellent
Norwegian	Excellent	Excellent	Excellent
Swedish	Fair	Excellent	Good
English	Excellent	Excellent	Excellent
German	Excellent	Excellent	Excellent
French	-	Good	Good

Memberships

JCSS Joint Committee of Structural Safety (2001 – present). Board member, Liaison IABSE. (2017-2022) Reporter WP2 Risk Analysis.

International Tunnelling Association (ITA), member WG6, WG21 Committee on Operational Safety of Underground Facilities (COSUF), Founding member. Member AG1. 2004-2012: Steering Board.

SIA (Swiss Society of Engineers and Architects), Norm Commission SIA 262 Concrete Structures, Activity group Fire

International Federation for Structural Concrete (fib)
2000 – present: fib Comm. 2, Modelling of Structural Behaviour
2000-2019: Convener (chair) of Task Group 2.3, Fire Design of Concrete Structures,

International Association for Bridge and Structural Engineering (IABSE)
Member of Technical Committee
Chair of Commission 1: Performance & Requirements 2017-2025
Editor: Publications Editorial Board of IABSE
2005-2013 Editor of Structural Engineering International

PIARC (World Road Association) Technical Committee 4.4 Road Tunnels Operations WG2 Road tunnels, Safety and resilience

Employment record

Period	Employer	Position
2003-	HOJ Consulting GmbH	Director, chief consultant
2019-2024	Sporveien, Oslo Norway	Seconded expert
2016-2018	Bane NOR, Oslo Norway	Seconded expert
2001-2003	COWI A/S, (Paris, France)	Senior Engineer, Special Services Department
1999-2001	OECD, Paris, France	Consultant for OECD
1999-2000	Chair of Safety Technology, PST, ETH, Swiss Institute of Technology Zürich, Switzerland	Deputy Head of Chair
1995 - 2001	COWI A/S, (Switzerland)	Senior Engineer, Special Services Department
1989 - 2003	COWI A/S, Copenhagen, Denmark	Senior Engineer, Tunnel Department, Head of Group, Special Services Department
1983 - 1989	B. Højlund Rasmussen Consult. Engineers, Aarhus, Denmark	Engineer, Structural Design Department

Selected Assignments
Suðuroy Tunnel (22 km long subsea tunnel in the Faroe Islands under planning). Peer review of risk analysis reports and second opinion concerning risk analyses. P/F Suðuroyartunnilin, 2024.

Risk analysis for Gåseheller Tunnel (an extension of the existing 1.3 km tunnel to be in total 2.6 km). AE, Tavler, for Agder Fylkeskomme, 2024

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Nordhavnstunnel, Copenhagen. Evaluation of fire design and fire tests. BESIXMTH JV, COWI, Denmark, 2024

Østlig Ringvej (Eastern Ring Road), Copenhagen, 10 km immersed tunnel. Detailed risk analyses and multi criteria, life-time decision criteria for evaluation of tunnel cross section with or without emergency lane. Sund&Bælt, COWI-Arup, Denmark 2023-2024

Responsible for RAMS analyses for extension- and upgrade projects, including risk analyses of signalling and civil engineering, documents for internal project control as well as reporting and applications to Norwegian Railway Authority. The activities include among others the following:

- New Østensjø Metro-line: Etterstad-Hellerud incl. new section partly in a new tunnel,
- Overall Risk analyses for CBTC Communication Based Train Control
- Upgrade of Operational Control Centre and establishment of a back-up centre
- New Metro station Brynseng
- Measures for extending lifetime of the metro line, various sections. RAMS studies.
- Upgrade of level crossings and barriers for Oslo Metro Holmenkollen line,
- Renewal of point machines for Oslo Metro,
- Noise protection screens for Kolsås Metro-line,
- Adaptation of tram stops to new tram type SL18,
- QRA risk analyses of the risk reducing effect of signals at the platform outside a tunnel.
- Projects for Oslo Metro Grenbaner lines, Grorud line, Stortinget – Blindern, etc.
- QRA Risk evaluations of measures against flank collisions. Modifications to signalling system, crossovers, points and point machines at the Metro-line by Ullevål – Blindern
- New Metro station at Majorstuen: upgrade of the station to four tracks, realignment of all lines in one of Norway's most busy stations.
- Risk evaluation of blasting near the Metro-line.
- Development of new and improved procedures for RAMS in Sporveien's regulatory framework

2019-2024. Client: Sporveien, Oslo, Norway.

Gotthard Road Tunnel. Total Tunnel System (GTG) new and existing tube. Evaluations of the location of the emergency lane based on quantitative risk analyses according to ASTRA 19004, ASTRA, Canton TI Switzerland, 2023.

Risk analysis of Tunnel Vue-des-Alpes and Mont Sagne according to ASTRA 19004/89005. AE, Canton Neuchatel, Switzerland, 2023-2024.

Risk Acceptance Criteria for Tunnels. Review and Expert Recommendation for Finnish Transport and Communications Agency, Traficon, 2023.

West Harbour Tunnel, Helsinki. Detailed risk analyses and expert judgements. Traficon, Helsinki Harbour, Finland 2021- 2023

Study of fire and explosion risk and design loads for the 1 km long new Sotra suspension bridge. Statens vegvesen, Norway 2020-2023.

Risk analysis of Sæbraut tunnel in Reykjavik, Evaluation of fire design (1 km with AADT= 50000 veh/d, in design). Vegagerðin, Iceland 2021-2023.

Study of safety of motorcycles on national roads in Norway. Review for the Norwegian Road Supervisory Authority (Vegtilsynet), which shall monitor and inspect whether safety measures can be taken in the road infrastructure to reduce the risk. Vegtilsynet, Norway 2021 – 2022.

Rødsliane Road tunnel, Rv13. 2.8 km long tunnel in an area exposed to rock fall. Detailed risk analysis and comparison of effect of gradients. Statens vegvesen, 2022.

Gotthard Tunnel, first and second tube, 16.9 km in operation/in design, one and two tubes / two-way and one-way traffic. Risk analyses according to ASTRA 19004/89005. Canton UR / TI (FEDRO Bellinzona Branch), 2022. Update 2023.

Spange St. Gallen. Risk analyses of a complex tunnel system in the city of St. Gall. Risk analysis according to ASTRA 19004/89005. Canton SG (FEDRO Branch Winterthur, AE), 2016-2017, 2019, 2023.

Study of intentional unwanted events for the E39 ferry-free project. As part of the framework contract, the security issues of large cable-stayed and suspension bridges as well as deep rock tunnels were studied, incl. identification, assessment and evaluation of risk reducing measures. Statens vegvesen, Norway 2021.

Risk analysis of Tunnel Städterwald according to ASTRA 19004/89005. AE, Canton Zug, Switzerland, 2021.

Risk analysis of Tunnel Schönbühl according to ASTRA 19004/89005. AE, Canton Bern, Switzerland, 2021.

Industriestrassetunnel. Rorschach, 0.3 km in design. Risk analysis according to ASTRA 19004/89005. Canton SG (TBA St Gallen, Amberg Engineering) 2020-2021.

Study of the effect of new energy carriers (NEC) on safety, design, operation, and preparedness in road tunnel. Statens vegvesen, Norway 2020.

Lower Thames Crossing, London. Review of the safety documentation, safety concept and risk analyses. Expert input to safety design of the tunnel. Review of the quantitative risk analysis. LTC is a major project in London for the third Thames crossing. COWI, LTC, 2017 – 2020.

Tunnel Girsberg. QRA Phase 1 according to ASTRA 19004/89005. gr+lo, Canton TG, FEDRO Branch Winterthur, Switzerland, 2020.

A53 Gaster. Risk analysis of Tunnel Gubel according to ASTRA 19004/89005. AE, TBA Canton St. Gall, Switzerland, 2020.

New Hvalfjörður Tunnel. Risk analyses for decision support of various extension alternatives: Parallel tunnel tubes, supplementing tunnel with new

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alignment. Tunnels with one-way and two-way traffic. Client Vegagerðin, Iceland 2019-2020.

Establishment of a QRA (quantitative risk analysis) model for evaluation of minimum safety distance and train operation, incl. GEBR (guaranteed emergency brake rate), in relation to capacity and safety. The special task is part of the CBTC (communications-based train control) project for Sporveien (Oslo Metro). 2019. Client: Sporveien, Oslo, Norway.

Riedberg tunnel (in construction), QRA according to ASTRA 19004/89005 supporting decision on design changes. Canton VS, FEDRO 2019.

Julierpass road. Risk Analyses of the tunnel Sils. Risk analysis according to ASTRA 19004/89005. Canton UR, FEDRO Branch Bellinzona, AE), 2019.

Motorway N2 upgrade. Risk Analyses of the tunnel Schweizerhalle, with a very high traffic exposure: up to 150000 veh/day. Risk analysis according to ASTRA 19004/89005. Canton BL, FEDRO Branch Zofingen, AE), 2018, 2020.

Safety Dossier for Section BE04 Swiss national road N16: Risk analyses of 10 tunnels: Pierre Pertuis, an approximately 2.1 km long tunnel in operation, two tubes one-way traffic. Gradients up to 4.6 % and La Rochette, Côte de Chaux, Sous le Mont, Métairie de Nidau, La Heutte, Taubenloch T01+T02, Taubenloch T04, Tabenloch T06 og Taubenloch T08. Risk analysis according to ASTRA 19004/89005. Canton BE (FEDRO Filial 1 Estavayer-le-Lac, Egis), 2018-2022.

Preliminary risk analysis of transport of dangerous goods through the tunnel system below Tromsø Norway. (Breivik/Sentrumstangenten and Langnestunnelen) as well as expert review of risk of transport of dangerous goods on open roads in Tromsø. (with RED Consulting). Statens Vegvesen, Norway, 2018 – 2019.

Comprehensive risk management and risk assessment activities (operational risk of railways). Establishment of basis. Specification and preparation of methodology and tools for risk analyses of railways in Norway. Evaluation of preparedness. Fire design specifications. Evaluation of malicious damage. Application for the railways near Oslo and throughout Norway. Centerpoint, Bane NOR (Norwegian national railway infrastructure company), 2016-2018.

Framework contract for risk analyses of road tunnels in Norway, Region North. HOJ consulting in association with RED is one of three consortia to hold this contract. Statens Vegvesen, Norway, 2017 – 2020.

Three framework contract for the major Norwegian infrastructure project “Coastal Highway Route E39”.
- Risk Analyses (HOJ, RED, AE)
- Fire / CFD analyses (Hoj, RED, AE.)
- Security studies (HOJ, RED)

Statens Vegvesen, Norway, 2017 – 2021.

Risk Analyses of the tunnels Vue des Alpes and Mont Sagne. Risk analysis according to ASTRA 19004/89005. Canton NE, FEDRO, BG, AE), 2019.

Risk Analyses of the tunnel Pomy. Risk analysis according to ASTRA 19004/89005. Canton VD, FEDRO, BG, AE), 2019.

Amsteg – Göschenen: Risk Analyses of the tunnels Langlaui and Naxberg. Risk analysis according to ASTRA 19004/89005. Canton UR, FEDRO Branch Zofingen, AE), 2018.

Sha Tin Sewage Treatment Works. Review of Fire Safety Design Using Risk Based Verification Approach Establishment of risk evaluation criteria. With AE and Emprodes for Drainage Services Department, Hong Kong, China, 2018

Amsteg – Göschenen: Risk Analyses of the tunnels Teiftal and Platti. Risk analysis according to ASTRA 19004/89005. Canton UR, FEDRO Branch Zofingen, AE), 2017-2018.

Course on Risk and Asset Management in Buildings and Infrastructures. Seven modules on introduction to risk Analyses in practice and application for bridges, tunnels, railways. With Univ. of Minho for Infraestruturas Portugal. Three courses in Lisbon (March 2017, Nov. 2017, Nov. 2018) one course in Porto (March 2018).

Cholfirst Tunnel, and Fäsenstaub Tunnel 1.3 + 1.5 km in operation, two tubes one-way traffic. Underground exits. Gradients up to 4.8 %. Risk analysis according to ASTRA 19004/89005. Canton ZH + SH (FEDRO Filial Winterthur, AE), 2017, 2019.

General risk analysis of the Tampere Rantavälän Tunnel, Finland. Discussion of tunnel equipment and speed limit. Expert statements concerning fixed fire fighting systems in the tunnel. Tiehallinto (Finnish Road Administration), Traficon Oy, Finland 2008 – 2014, 2019.

Risk analysis Fannefjord Tunnel an existing 2.7 km long subsea tunnel – special studies of risk of fire in heavy vehicles. (with HR Prosjekt) Statens Vegvesen Norway 2017.

Lecture at Tonji Unversity, Shanghai, China: “Risk Informed Decision Making”. JCSS and International Joint Research Center for Engineering Reliability & Stochastic Mechanics (CERSM), 2017

Arisdorf Tunnel, 1.4 km in operation, two tubes, one-way traffic. Risk analysis according to ASTRA 19004/89005. Canton BL (FEDRO Branch Zofingen, AE), 2016-2017.

Courses for FEDRO Swiss Federal Roads Administration concerning risk management and risk analyses of road tunnels. Introduction in the guidelines ASTRA 19004 /ASTRA 89005, FEDRO, Bern and Branches, 2016.

Risk analysis and risk evaluation of planning projects for the Håfjelltunnel with adjacent infrastructure – in particular crossings and roundabouts just outside the tunnel and near the

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Fyksesund Bridge. Specific risk-based proposals for project adjustments. Kvam herad Norway, 2016.

Risk analyses of concepts for new tunnels for Strynefjellveien (rv 15) and fv 63 in Norway. The concepts include very long tunnels underground intersections and steep gradients. The analyses support the further planning in the KVU (Concept evaluation). Statens vegvesen region vest, Multiconsult, 2016.

Gotthard Tunnel, 16.9 km in operation/in design, one and two tubes / two-way and one-way traffic. Risk analysis of the existing tunnel as well as the extended project with a new tube. Analysis according to ASTRA 19004/89005. Canton UR / TI (FEDRO Bellinzona Branch, IG Gottardo Due) 2015.

COST Action TU1406 Quality specifications for roadway bridges, standardization at a European level (BridgeSpec), Participant and Swiss representative. Lecturer at training course. SER State Secretariat for Education and Research Berne, Switzerland, COST (European Cooperation in the Field of Scientific and Technical Research) EU 2015 – 2019

City Tunnel, Umfahrung Biel Westast, 0.6 km in design, two tubes, ramps, one-way traffic.
Weidteile Tunnel Umfahrung Biel Westast, 1.4 km in design, two tubes, ramps, one-way traffic.
Port Tunnel Umfahrung Biel Westast, 1.7 km in design, one tube, two-way traffic.
Risk analysis according to ASTRA 19004/89005. Canton BE (TBA Kanton Bern, Amberg Engineering) 2015-2016

Hof Tunnel, 0.6 km in operation, two tubes, one-way traffic. Risk analysis according to ASTRA 19004/89005. Canton SG (FEDRO Branch Winterthur, AE), 2015.

Ebenrain Tunnel, 0.4 km in operation, two tubes, one-way traffic. Risk analysis according to ASTRA 19004/89005. Canton BL (FEDRO Branch Zofingen, AE), 2015

Gei-Brusei: Gei Tunnel, 0.5km in operation, one tube, two-way traffic. Brusei Tunnel group (Cozz, Brusei, Seda, Land, Cianca Presella) 2.2 km in operation one tube, galleries, two-way traffic. Risk analysis according to ASTRA 19004/89005. Canton GR (FEDRO, Bellinzona Branch, ASIT), 2015-2018.

Hohrain Tunnel Rorschach, 0.3 km in design, one tube, two-way traffic. Risk analysis according to ASTRA 19004/89005. Canton SG (TBA St Gallen, Amberg Engineering) 2015-2016, 2019.

Audit of the safety documentation and evaluation of the compliance with the regulation for Norra Länken, which is a complex tunnel infrastructure in Stockholm. The audit is carried out under the responsibility of Transportstyrelsen, who is the responsible authority for approval, Sweden 2014 - 2016.

Rosenberg Tunnel 1.6 km in operation/ in design, two tubes, one-way traffic, ramps. Risk analysis according to ASTRA 19004/89005. Canton SG (FEDRO Branch Winterthur, Amberg Eng.) 2015

Kaiserstuhl Tunnel 2.1 – 2.5 km in design, one tube two-way traffic, Risk analysis according to ASTRA 19004/89005. Canton OW (HTA Kanton Obwalden, Gruner AG, Amberg Engineering) 2015, 2021.

Hetlevik Tunnel Slettebrekka Askøy. Risk analyses (QRA) of a 0.6 km long tunnel. Statens vegvesen region vest, Multiconsult, 2015.

Bözberg Tunnel 3.7km in operation, Canton AG
Schweizerhalle Tunnel 0.9 km in operation, Cant. BL
Cholfirst Tunnel 1.3km, in operation, Canton ZH,
(Risk analysis according to ASTRA 19004/89005 (examples). FEDRO Dept. N, Matrisk) 2015.

Preparation of the guideline ASTRA 19004 for risk analyses for road tunnels in Switzerland. Specification of methodology and tools described in ASTRA 89005 and assistance with the approval and launching process of the methodology. First and second phase of the project for the development of a national guideline. In collaboration with HBI and Matrisk. Swiss Federal Roads Administration, FEDRO, 2011-2015.

Risk analysis of Fjarðarheiði tunnel in Iceland: (13.5 km in design). Vegagerðin, Iceland 2015

Research project concerning “Evacuation in Tunnels”. The project includes evaluations related to tunnel expertise and Evaluation of human behaviour. The project is carried out for the NordFoU cooperation, which consist of all 5 Nordic public road administrations. Phases DP1 and DP2 deal with high traffic urban tunnels, whereas DP3 deals with tunnels with two-way traffic in rural areas. In collaboration with HBI, Traficon and TNO. Norway 2011 – 2015.

Risk analysis for the Flenja Tunnel in Norway (an existing 5 km long tunnel), which has been upgraded. Statens Vegvesen, Norway 2015.

Member of ISO TC98 SC2 WG1 Bases for design of structures, Reliability of structures, General principles (ISO 2394). Development of revision of standard. ISO (International Organization for Standardization). 2011 – 2015.

Fire Analyses and expert statements concerning fire behaviour of the railway tunnel TP10 Holbækmotor-vejen for the new railway Copenhagen – Ringsted, for EKJ, CGJensen / Banedanmark, 2014 – 2015.

Detailed risk analysis of the planned tunnels on Rv 94 around Hammerfest.(Salen Tunnel, Fuglenes Tunnel, an underground roundabout and an adjacent parking area) Statens vegvesen Reg. Nord Norway 2014-2015.

Fire analyses for 3rd Bosporus Bridge: a suspension bridge for railway and road with a span of 1408 m. Fire analyses of the steel superstructure: main cables, hanger, stiffening cables, girder as well as for the concrete pylons. For T-Engineering. Turkey, 2014.

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Risk management and -assessment for the Sharq Crossing in Doha Qatar. The crossing is in total about 10 km long and consists of 3 large bridge, a 5 km long immersed tunnel linked together in by artificial islands and a marine interchange, in addition approach tunnels and pedestrian bridges, marina and people mover. Risk assessment, hazid investigation, fire analyses and safety concept in the validation phase. With HBI, TEC and Calatrava, for Ashghal, Qatar, 2013 – 2014.

Ryfast: Ryfylke Tunnel, Eiganes Tunnel and Hundvåg Tunnel. 14.4 + 3.7 + 6 km long sub-sea tunnels with gradients up to 8%, as well as 3 sets of ramp tunnels and an underground interchange. Project in design (Ryfylke to be the longest road tunnel in Norway and worldwide upon opening). Comprehensive risk analysis and review of safety related activities. Fire design of exposed tunnel parts. Statens vegvesen Region Vest, 2013 – 2014.

Rogfast Tunnel. 25.5 km long sub-sea tunnel in design (to be the longest road tunnel in Norway and worldwide upon opening). Analysis of risks related to heavy goods traffic, particularly fire risk taking steep long gradient into account. Risk analyses of the entire project in connection with the regulation plan. Statens vegvesen Region Vest, 2012 – 2015.Update 2020.

Risk analysis of the Gudvanga road tunnel. (Second-longest tunnel in Norway: 11.5 km). Risk-based support to the decision of upgrade. Statens vegvesen Region Vest, Norway, 2012 – 2014.

Doha Metro. Fire calculations of concrete segments and specification of fire tests for Doha Metro. Follow up on the result after the tests. Red Line North Underground, Doha, Qatar. With COWI / CIO, 2013-2014.

Risk analysis for the Knappetunnel in Norway, which is a 6.5 km long twin tube tunnel, on the ring road around Bergen. Recommendation of improvements of the tunnel design and operation. Risk analyses of intersection (open road) between two tunnels. Statens Vegvesen Norway 2009- 2014.

RAMS analyses of access ways (underground funicular railway) and production areas for an alpine underground hydropower plant (Lindth Limmern). Support to the project management. Axpo, Switzerland, 2012-2014.

Editor of Structural Engineering International, journal of IABSE (International Association of Bridges and Structural Engineering). Editorial Board, IABSE, 2005 – 2013.

Risk analysis of the Bømlafjord road tunnel. (8 km, sub-sea tunnel with 9% gradients), Statens vegvesen Region Vest, Norway 2012- 2013.

Review of risk analyse and 3D CFD calculations of the ventilation for a short tunnel in Denmark. 0.32 km, Tunnel at Gødvad Bakke. Funder –Låsby Motorway. Vejdirektoratet, Denmark, 2013-2014.

Follo Railway Tunnel Oslo - Ski. Expert advice concerning the safety concepts for the 20 km railway tunnel in design. AE, B&H, Aa-J, 2013.

Risk analysis of five tunnels in Iceland: Hvalfjörður Tunnel (6 km in operation), Héðinsfjörður Tunnels (4 km + 7 km in operation), Nordfjörður Tunnel (8 km in design) and Vaðlaheiði Tunnel (7 km in design). Mannvit, Spölur and Vegagerðin, Iceland 2012 – 2013.

Risk analysis of the Bekkestu road tunnel in Oslo, Statens vegvesen Region Øst, 2012.

Participation in the review board for Explosion design for tunnels in the Netherlands, TNO and Dutch Traffic Ministry, RWS (Rijkswaterstaat), the Netherlands, 2012.

ITA (ITACET) training course “Safety Operation in Metro and Road Tunnels”. Four modules: 5.1: Results of recent R&D projects and topics for the future, 5.2: Integrated safety analysis for road tunnels, 5.3: Models for probabilistic risk analysis of road tunnels, 5.4: Safety measures for road tunnels. Tongji University, Shanghai, China, 2012.

Risk evaluation of congestion in tunnels. Research of literature, scenario analysis, establishing of exposure models and evaluation of risk and risk reducing measures. Application of the approach on the 6 km long Opera Tunnel in Oslo. Statens vegvesen Region Øst, Norway, 2012.

Preliminary hazard analysis and RAMS (reliability, availability, maintainability and safety) Analyses of the railway installations in the 15 km long Ceneri Basistunnel (Part of the AlpTransit Gotthard railway link). Marti Technik AG, Switzerland 2012.

Risk analyses of the four tunnels: Vesttunnel, Blåkolltunnel, Hagantunnel and Rællingtunnel in Bærum and Romerike, Statens vegvesen Region øst, 2012.

Risk analyses of the four tunnels: Follotunnel, Frogntunnel, Nordbytunnel and Smiehagentunnel in Follo and Akershus, Statens vegvesen, Region øst, 2012.

Contribution to the Task Force established by Swiss Federal Roads Administration, FEDRO after the severe accident (collision with wall in lay-by) in the Sierre Tunnel. Switzerland 2012.

Risk analyses and study of safety design and ventilation of an old railway tunnel converted into a road tunnel. Industrigatans Tunnel, Helsinki, Finland, 2012.

Risk analysis of Sörnäinen road tunnel. City of Helsinki 2012.

Risk analyses, study of structural behaviour and fire protection for the Smestad tunnel in Oslo. Study of consequences to the surrounding areas in cases of fire and due to deviated traffic. Statens vegvesen, Reg. Øst, 2012.

Risk analyses of the road link E39 Svegatjørn – Rådal. The link includes complex road alignment

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and long tunnels up to 10 km. Evaluation of technical equipment and design lay-out. Statens vegvesen Reg. Vest 2012, 2014.

Risk analyses of the Løvstakk tunnel in Bergen. Staten vegvesen Reg. Vest, 2012.

Risk analyses of eight alternative solutions incl. tunnels for fv. 17 og fv. 720 Kvarving-Sprova-Malm for development planning. Statens vegvesen, Region Midt, 2011- 2012.

Calculation of key risk figures for the Baneheia Tunnel, Kristiansand, Statens vegvesen Region sør, 2011.

Calculation of key risk figures for the Jondals Tunnel, Nordrepollen Tunnel and Torsnes Tunnel, Statens vegvesen Region vest, 2011.

ITA (ITACET) training school “Safety Operation in Metro and Road Tunnels”. Six modules: 2.1: Integrated safety analyses for metro systems, 2.2: Models for probabilistic safety analyses for metros, 3.1: Integrated safety analyses for road tunnels, 3.2: Models for probabilistic safety analyses for road tunnels, 3.3: Technical measures for road tunnels, 3.4: Structure, management and operation of safety and emergency forces, contingency plans. Tongji University, Shanghai, China, 2011.

Risk analyses of new tunnels for E134 across Haukelifjell in Norway. Two of the new tunnels (New Haukeli and New Seljestad Tunnels) are very long (> 12 km). Furthermore two tunnels are studied: Haukeliseter and New Vågsli. The investigation is carried out to support the regulation plan process. Statens vegvesen Region vest, 2011-2012.

Risk analyses of five existing tunnels: Sløverfjord, Myrland, Raftsund, Ingelsfjord and Sørdals Tunnel on the Lofast link to Lofoten in Norway. The tunnels are investigated in order to discuss the safety standard and to support further measures. Statens vegvesen region nord, 2011- 2014.

Risk analysis of the Churchill Tunnel in the Netherlands. The tunnel has a complex lay-out with entrances and exits. TNO 2011.

Risk analyses for Keilaniemi and Hagalund Tunnels on the ring road of Helsinki. Risk analysis of complex tunnel lay-out. Study of risk in phased construction, Finnish Road Administration, Traficon Oy, Finland 2011 - 2014.

Risk analyses of seven existing tunnels on E134: Haukeli, Svandalsflona, Austmannali, Røldal, Seljestad, Rullestad and Åkrafjord Tunnel approaching and on the Haukelifjellveien in Norway. The tunnels are investigated with a detailed risk analysis to support possible upgrading. The existing safety standard is very low for some of the tunnels. Statens vegvesen region vest, 2011.

Risk analyses of 8 concepts for new tunnels for Strynefjellveien (rv 15) in Norway. In total 14 different tunnels were investigated in variations and combinations. The concepts include very long tunnels. The analyses support the further planning in the KVU (Concept evaluation). Statens vegvesen region vest, 2011.

Methodology for the risk analysis of tunnels on the national road net. Comparison of methodologies and tools of national and international risk analyses. First phase of the project for the development of a national guideline. Swiss Federal Roads Administration, FEDRO, 2011.

Expert advice concerning safety of the Jemulpo road tunnel, a 7.5 km long tunnel with intersections under the city of Seoul, Korea, with BnTTek for Daelim, 2011.

Risk analysis of deep tunnels on E39 between Skei and Ålesund in Norway. Different tunnel alternatives with lengths up to 35 km and with underground intersections. Maximum depth under sea level 650 m. Statens vegvesen Region Midt, 2011.

Risk analyses of three existing tunnels: Ospeli, Grasdal and Oppljos on the Strynefjellveien in Norway. The tunnels are investigated with a detailed risk analysis before and to support upgrading. The existing safety standard is very low. Statens vegvesen region vest, 2011.

Establishment of supplementing modules for risk analyses of road tunnels in Switzerland and Norway. Modules for risk of accidents with dangerous goods transports influence of drainage systems, ventilation and handling of complex tunnel systems. Statens vegvesen, Vegdirektoratet, Norway 2011.

Risk analysis for the existing Lyderhorn Tunnel in Norway, which is a 1.1 km long twin tube tunnel, near Bergen. Recommendation of improvements of the tunnel design and operation. Statens Vegvesen Norway 2011

Risk Analyses for the Fehmarn Belt Bridge. Comprehensive risk management and risk analysis activities (operational risk and construction risk) for the 20 km long combined road and rail fixed link across the Fehmarn Belt between Germany and Denmark. Femern Bælt AS, Denmark 2009-2011.

Preparation of safety concept for the Fehmarn fixed link, comprising: Safety requirements, escape- and access routes, power supply and lighting, ventilation and firefighting, drainage systems as well as SCADA system and control-, alarm-, communication- and monitoring systems. Presentation of the safety concept for the local authorities. Femern Bælt AS, Denmark 2010.

Risk analyses for the Messina Strait Bridge in Italy. The suspension bridge will with 3.3 km span hold the world record. Operational risk analyses for road and rail traffic are carried out for the Progetto Definitivo. In addition fire analyses of girder cables and pylon. Security investigations. COWI / ATI Impreglio / Stretto di Messina, 2010-2011.

Preparation of safety concept for the Messina bridge. Including description of aspects of hazards, prevention, detection, escape, mitigation, rescue and firefighting. COWI / ATI Impreglio / Stretto di Messina, 2010.

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Risk analysis of a new 3.5 km rail tunnel in Torino with underground stations. Estimation of risk of accidents and fires according to Italian regulation; and estimation evacuation from the tunnel. In corporation with HBI and Geodata, Italy, 2010 - 12.

Participation in the review board for new Dutch road tunnel safety regulations, Dutch Traffic Ministry, RWS (Rijkswaterstaat), the Netherlands, 2010.

Risk Analyses of the 1 km Vaajakoski Tunnel in central Finland. Finnish Road Administration, Traficon Oy, Finland 2010.

Risk Analyses of the 1 km Linnanrakentajantie Tunnel in Helsinki. Finnish Road Administration, Traficon Oy, Finland 2010.

Award of the tender design of the Fehmarn Belt Bridge between Germany and Denmark as part of COWI-Obermeyer JV, after the successful prequalification, Denmark 2009.

Independent review of safety and ventilation concept for the 20 km long tunnel complex Förbifart Stockholm (Bypass Stockholm). The main tunnel has 6 lanes, an expected traffic of 140000 vh/day and in total 45 km tunnel tube. In cooperation with HBI Haerter. Vägverket Sweden, 2009-2010.

Establishment of best practice for risk analyses of road tunnels for the road authorities in Switzerland and Norway. Study of models for representation of indicators, establishment of tools and reporting. In cooperation with Matrisk. ASTRA and Statens vegvesen, 2009-2011.

Development of the s/w-tool “TRANSIT” for risk assessment of road tunnels. HOJ-Matrisk, 2009-2011.

Risk analyses related to the bypass round around Larvik, Norway. Study of risk and options in relation to redirection of traffic in case of closure of the tunnel. Statens Vegvesen Norway 2010.

Risk analyses of the tunnel system Steinberg, Marienborgtunnelen and Skansetunnelen on the Western bypass around Trondheim in Norway. Three tunnels of 1500 m, 300 m and 200 m are connected with a roundabout. In addition a 500 m long tunnel was analysed. Evaluation and recommendation of action before inauguration of the tunnels. Statens Vegvesen Norway 2010

COST Action TU0904 Integrated Fire Engineering and Response, 2010-2014.

Risk analysis of the 1.25 km long Jokeri 2 Central Park Tunnel in Helsinki, a tunnel specifically intended for buses and trams. Evaluation of configuration options, City of Helsinki / Traficon, 2009.

Evaluation of European research projects concerning tunnel safety and recommendation to the Nordic countries. The evaluation comprised 9 project carried out 1996 – 2007. The project was carried out for the NordFoU cooperation, which consist of all 5 Nordic road administrations. HOJ was main technical contributor, in cooperation with Traficon, SP, F&SD, Petrell, Sweden 2009.

Establishement of risk acceptance criteria for third parties. Development project for Norwegian Directorate for Civil Protection and Emergency Planning (Direktoratet for samfunnssikkerhet og beredskap). In cooperation with Proactima, ETHZ, University of Stavanger and Norconsult, Norway, 2008-2009.

Risk analysis for the Flenja Tunnel in Norway, which is an existing 5 km long tunnel, which is about to be upgraded. Statens Vegvesen Norway 2009.

Risk analysis of the Langfjord Tunnel in Norway, which is a project for a 10 km long subsea tunnel with a 5 km long side branch up to 340 m under sea level. Statens Vegvesen, Norway 2009.

Framework contract for risk analyses of road tunnels in Norway. HOJ consulting in association with Matrisk is one of four consortia to hold this contract. Statens Vegvesen Norway 2008 – 2012.

The tunnel system below Tromsø Norway. Risk analysis of the tunnels Breivik/Sentrumstangenten and Langnestunnelen and the adjacent underground parking as well as expert review of risk analysis of the extension of the underground parking. Fire and ventilation analysis of the system. In cooperation with Matrisk and HBI Haerter. Norway 2008 – 2009.

E39 Risk analysis for the tunnel complex of E39 around Kristiansand: E39 Gartnerløkka – Hannevikdalen. Risk analyses using Bayesian Probabilistic Nets and preparation of generic tools for risk analyses. Ventilation study of the system. Statens vegvesen, Norge 2007 – 2008.

Risk analyses of the roads and tunnels of the Elefsina – Korinth – Patras – Pyrgos - Tsakona project, which is a 400 km long motorway Greece, Detailed analyses and review of safety concept of existing tunnels and road near Kakia Skala and on the Patras Bypass in total 9 tunnels. In addition detailed risk analysis and review of safety concept of 18 tunnels in the design phase. The studies include evaluation of transport of dangerous goods. JV Apion Kleos, Greece, 2007 – 2011.

Risk analysis of the 7 twin tunnels on the E65 central motorway in Greece. JV Central Greece Motorway, 2008 - 2011.

Risk analysis of the Pargas Nagu fixed link in Finland Tiehallinto (Finnish Road Administration), Traficon Oy, Finland 2008.

Risk analysis of the Husula and Kosila tunnels in Hamina, Finland Tiehallinto (Finnish Road Administration), Traficon Oy, Finland 2008.

Risk methodology basis for design and modelling of fires in a metro and local transport railways. Detailed studies of the physics of fires in a metro train including computational modelling. Guidance for risk approach and design of the tunnel structures. Participation in expert group. Stockholm Local transport, SL (BBK), Sweden 2007 – 2010

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Risk analysis of the extension of the harbour in Monaco. Exposure to accidental and natural hazards. In cooperation with COWI. Monaco, 2007.

Availability Risk Analysis for the Port of Miami Road Tunnel, Miami, Florida, USA. Risk analysis of tunnels as well as roads and technical equipment. Input for the tender documentation for a BOT project. In cooperation with COWI, FCC Concessions, Spain, 2006 – 2007.

Study the risk of excessive workload for the traffic management centre in Helsinki and Turku, Tiehallinto Finland 2007.

Study of the risk related to transport of dangerous goods through an immersed tunnel under River Shannon at Limerick, Republic of Ireland, 2007

Risk study for the 11 km Puente Nigale Link, including bridge, railway and road link, COWI Odebrecht, Venezuela 2007.

Lectures in postgraduate course "Risk and Safety". Application of risk analyses for structures and transport of dangerous goods on road and rail. ETHZ, 2000, 2007.

COST Action TU0610 Robustness of Structures, Participant and Swiss representative. SER State Secretariat for Education and Research Berne, Switzerland, COST (European Cooperation in the Field of Scientific and Technical Research) EU 2007 – 2011

Swiss national Research study: AGB1 “The traffic system road and its structures”, TP107 Risk and reliability of existing structures and TP110 risk related to construction work, TP105 Scenarios for development of hazards. Participation and development of risk approach and expert guidance. FEDRO, Switzerland 2006 – 2009

Risk analyses for 2 tunnels on the ring road of Helsinki. Evaluation of design concept in relation to operational risk and evaluation of relevant safety measures, Finland 2006 - 2009.

Fire impact and protection investigations for a tunnel in Oslo, Norwegian Public Road Administration, Region East, Norway 2006-2007

Fire studies of structures of the Multi-Functional Stations. Fire studies of secondary structures, joints and pipes. Alp Transit Gotthard, the 56 km long railway tunnel as part of NEAT (new Alpine crossings) Switzerland, 2006.

Safety concept studies for the Barcelona Metro line 9. Evaluation of evacuation concept and safety measures, Spain 2006.

Risk analyses for the 600 m Mestarin Tunnel on the ring road I of Helsinki. Evaluation of design concept in relation to operational risk and evaluation of relevant safety measures, Finland 2006

Risk analyses for 2 tunnels in the inner city of Helsinki. Evaluation of design concept in relation to operational risk and evaluation of relevant safety measures, Finland 2005 – 2006.

Risk analysis of the Nøstvedt tunnel on E6 South of Oslo. The analyses comprise benchmarking, qualitative evaluation of critical items, modelling of risk, quantitative risk analysis and evaluation of risk reducing measures. Norwegian Public Road Administration, Region East, Norway 2005 - 2006.

Fire Analysis of concrete structure. Performance-based design and robustness of structures. Investigations of the potential of performance based design for concrete structures. CEMBUREAU, Belgium 2005-2006.

Staff support and business development assistance for a Swiss Consulting Company. 2005- 2006.

Risk analyses for the 1.54 km Porvarinlahti Road tunnel for the Vuosaari Harbour project, Helsinki. Comprehensive risk analyses in accordance with EU tunnel safety directive and analysis of transport of dangerous goods. Vuosaari Harbour, Finland 2004-2005.

Contribution to the Finnish guideline for tunnel design and requirements for risk analysis, Finnish Road Administration, Finland 2004.

Risk analysis for the tunnels on Ring 3 Ulven-Sinsen (Løren Tunnel and Økern Tunnel) in Oslo. The analyses comprise benchmarking, qualitative evaluation of critical items, modelling of risk, quantitative risk analysis and evaluation of risk reducing measures. Furthermore the consequences of fires and explosions are investigated in detail and the interaction with the surrounding urban environment is studied. Norwegian Public Road Administration, Region East, Norway 2004 - 2010.

Risk analyses for an existing and a planned service tunnel connecting to parking areas and delivery access to shops and buildings under the city centre of Helsinki. Helsinki City Council, Finland 2004.

Risk analyses for the 3.4 km immersed road tunnel at the Busan - Geoje Fixed Link. Design assumptions, comprehensive risk analysis, study of fire risk and risk reducing measures, ALARP studies and safety review. GK Corporation, Daewoo Engineering and Construction, Korea, 2003 - 2004.

Busan - Geoje Fixed Link. Preparation of safety concept. Including description of aspects of hazards, prevention, detection, escape, mitigation, rescue and firefighting. GK Corporation, Daewoo Engineering and Construction, Korea, 2003 – 2004.

Expert consultancy concerning fire design and fire safety engineering including application of risk analyses of concrete structures. Application of semi-probabilistic approach and integrated safety analysis. CERIB, Centre d’Etudes et de Recherches de l’Industrie du Beton, France, 2003 - 2004.

Research project concerning upgrade of existing tunnels. Contribution to WP 2 planning of experimental works, review of deliveries in WP 3 human response and contribution to WP 4 critical components and WP 5 fire safety evaluation. Fire design aspects, explosion in tunnels, integrated risk analyses and safety measures. Co-editor of the

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delivery report of WP4. 5th framework EU research program: UPTUN, Upgrade of existing Tunnels, EU, 2003-2006.

Risk analysis for a 3 km tunnel on the E39 around Kristiansand. The analyses comprise safety review, benchmarking, qualitative evaluation of critical items, modelling of risk, quantitative risk analysis and evaluation of risk reducing measures. Statens Vegvesen Sør, 2003

Member of European Thematic Network on Fire in Tunnels EC Contract – N° G1RT-CT-2001-05017 (FIT). The network comprises 32 leading European tunnel safety experts within the area of fires in road, rail, and metro tunnels. Mr Høj hold the position as rapporteur of "General approach to tunnel fire safety" and "Compilation of guidelines for fire safe design", EU, 2001-2005.

Project coordination and research concerning decision support models, risk integration, fire risk and modelling for practical application. Design Optimisation for tunnels in various phases during the project lifecycle. Study of safety in tunnels and integration of risk analysis, environmental studies and durability models in design of tunnels. Modelling of design in the framework of decision-making. 5th framework EU research program: DARTS, Durable and Reliable Tunnel Structures, 2001-2004.

Planning / update of the operational risk analysis for the railway link across the Great Belt, taking into account the first years of experience from the operation and the general development. Banestyrelsen and A/S Storebælt, 2003.

Specification and design basis for fire design and risk analyses for the immersed tunnel on the fixed link Busan - Geoje in Korea. Cooperation COWI and Daewoo Construction, 2003.

Application of QRA (quantitative risk analysis) and DSM (decision support model) for evaluation of traffic with dangerous goods in tunnels. Phase 1: general description, Phase 2: application. Finnish Road Administration, 2003.

Review and specification of fire analysis of the Dublin Port Tunnel. Bouygues Trav. Public, 2003.

Study of risk including preliminary analysis of risk of fire, safety measures and evacuation. Construction risk study. Support of decisions during the planning phase of an immersed tunnel under River Shannon at Limerick, Republic of Ireland, 2002.

Safety expert advice and preliminary risk estimation for road and tunnel projects in Norway. In cooperation with HjelnessCOWI, Oslo, 2001 - 2003.

Safety review of the equipment and design standard of Danish road tunnels, Road Directorate, 2001.

Responsible for quantified risk analyses (QRA) and decision support (DSM) for evaluation of transport of dangerous goods through the tunnels and river crossings in London. DETR and OECD, 2000.

Study of safety measures against fire risk, including planning of fire tests and documentation of the cost-benefit of tests. Pre-posterior experiment planning including a description of the physical models for degradation of tunnel structures during a fire. Malmö City Tunnel, MCT, 2000-2002.

Deputy Head of Chair and senior researcher at the Chair of Safety Technology, Swiss Institute of Technology (ETH) in Zurich. Lectures in "Risk and Safety" and "Risk Management". Research in topics related to risk of technical systems, transportation, tunnels and power production 1999 – 2000.

Safety expert responsible for review of the safety design and risk analyses for the Bjørvika tunnel project in Oslo, Norway. The methods of the analysis were evaluated and the safety options for the immersed tunnel were discussed. Statens vegvesen Oslo, Norway, 1999 - 2001.

Fehmarn Belt Fixed Link Feasibility Study. Responsible for safety and risk investigations, comparison of solution models and decision support, as well as for development of design basis, including accidental loads. Furthermore Mr Høj was involved as assistant to the project management. The study comprised evaluation of a large number of solution models for the 20km long coast-to-coast connection. Solutions for road and/or rail traffic are investigated: bored and immersed tunnels, suspension and cable stayed bridges. In joint venture with Lahmeyer International for Danish and German traffic ministries. 1996-1999.

Safety expert acting as personal consultant for OECD. Project initiated by OECD and PIARC concerning establishment and application of decision support for transport of dangerous goods. A decision model was established based on Bayesian theory respectively multi-criteria theory. The models supply support for decision on restrictions to the dangerous goods traffic based on risk analysis. The models are applied in practice for tunnel operators / authorities. 1999 - 2002.

Safety expert services concerning requirements for fire safety design and expert advice concerning design check as well as risk and safety of civil works and "Reliability, Availability, Maintainability and Safety" analyses for the Copenhagen Metro. Denmark 1996 - 1999.

Final update of Operational Risk Analysis for the railway link across the Great Belt, comprising the railway tunnel and the West bridge. Quantified risk analysis, risk management and communication. 1996-1998.

Member of specialist team evaluating the damages of the Channel Tunnel after the fire in November 1996, Mott MacDonald, UK, 1996.

Safety expert advice on fire design and fire risk on the Øresund Link: the Øresund Bridge (coast-to-coast link) and Kastrup Station (Øresund Landworks), 1996-1999.

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Responsible for establishing the update of the physical behaviour and risk of the Great Belt tunnel after the 1994-fire. Research in the topic of spalling and fire impact on concrete structures. Specification and detailed interpretation of full scale fire tests of concrete segments. Update of fire resistance of tunnel structure, 1994-1995.

Member of specialist team for the evaluation of the fire damage to one of the bores of the railway tunnel under the Great Belt after the fire in the Dania tunnel boring machine in June 1994. The evaluation comprised the immediate assessment of the damage, the investigation of the fire and the residual strength of the damaged tunnel. Furthermore, identification, planning and evaluation of safety of recovery and repair methods. Methodology and tools from structural reliability and risk analysis was applied, 1994.

Analysis of the risks during the construction period of the road and railway bridge across the Western Channel of the Great Belt. The analysis included a detailed study of the heavy lift vessel "Svanen" and the construction procedures. Denmark, 1992.

Project Manager for the EU-sponsored Research Study: "Decision Making for Requalification of Structures". In the project a common framework for systematic rational decisions related to requalification of structures was established. The decision basis included multi-criteria decision making, Bayesian uncertainty modelling and fuzzy uncertainty modelling. Leading partner for Bridge application. The project also includes off-shore-structures and power plants. Participation from 11 companies from 7 European countries. 1993-1996.

Head of design group, responsible for design of 1.4 km long cut & cover railway tunnel, under the runways of Copenhagen Airport, Denmark. Two phases prior to the tender design comprised design basis, conceptual design of concrete structures, evaluation of construction methods in the airport, security, safety and durability as well as special hydro-graphic conditions. 1991-92.

Tender Design of the pylons for the 1210 m span suspension bridge at Höga Kysten in Sweden, 1992.

Study of earthquake loads for the detailed design of the Great Belt East Bridge. Denmark, 1992.

Structural analyses, design and quality control for the detailed design of the 8 km bored railway tunnel across the Eastern Channel of the Great Belt. 1990 – 1993.

Fire and explosions: Analysis of risk and structural behaviour for the 8 km railway tunnel across the Eastern Channel of the Great Belt. 1990-1992.

Assigned to the Technical Services of the tunnel under the Great Belt. Design modifications to the tunnel structures, Denmark 1991.

Member of specialist team set up for design check of the tunnel structures of the tunnel under the Great Belt. Denmark 1989 -1991

Analysis of the properties of early age concrete and evaluation of the casting procedures for the 6 km combined road and railway bridge across the Western Channel of the Great Belt, 1990.

Construction cost estimates for 28 km bridge across the Strait of Gibraltar and establishment of procedure for cost estimates and updates, 1990.

Analysis of wind climate and wind loading incl. wind tunnel testing for the 6 km combined road and railway bridge across the Western Channel of the Great Belt, 1989-1990.

Structural analyses, CAD-integrated design, preparation of tender documents and general supervision of concrete bridges, for the motorway Horsens - Vejle, Denmark, 1984-89.

Research for the Danish Ministry of Energy for testing of the strength of district heating transmission pipes, 1987-88.

Analyses, rehabilitation design and general supervision for 50– 90-years old deteriorated railway steel bridges in Denmark, 1985.

Structural analyses, design, general supervision and preparation of design manual for district heating transmission pipes and associated structures for the Copenhagen Metropolitan area. Design and general supervision of two major pipeline- bridges over railway and roads, 1984-87.

Structural analyses, design, preparation of tender documents and general supervision of transmission pipes and underground structures for district heating in Århus and Fredericia, Denmark, 1983-85.

Scientific Committees

- IABSE Symposium, “Bridging Advanced Technologies – Structural Innovation”, Copenhagen, Denmark 2026.
- IABSE Congress, “The Essence of Structural Engineering for Society”, Ghent, Belgium 2025.
- IABSE Congress, “Beyond Structural Engineering in a Changing World”, San Jose, Costa Rica 2024.
- IABMAS 2024, 12th International Conference on Bridge Maintenance, Safety and Management, Copenhagen 2024.
- IABSE Symposium, “on Construction’s Role for a World in Emergency”, Manchester 2024.
- JCSS/IABSE Workshop “Risk acceptance criteria, Principles and application in Civil Engineering Projects”, Trondheim Norway 2023.
- IABSE Congress “Bridges and Structures: Connection, Integration and Harmonisation” Nanjing, China, 2022.
- IABSE Congress “Structural Engineering for future Needs” Ghent, Belgium, 2021.
- IABSE Congress “Resilient Technologies for Sustainable Infrastructures” Christchurch, New Zealand 2021.
- IABSE Symposium “Risk Intelligence of Structures” Seoul,2020.
- IABSE Online Conference 2020.
- IABSE Congress “The Evolving Metropolis” New York, 2019.
- IABSE Symposium, “Towards a Resilient Built Environment” , Guimarães, Portugal, 2019
- RILEM spring convention and sustainable materials, systems and structures, 2019, Rovinj, Croatia,
- IABSE Symposium, “Engineering the Future”, Vancouver, 2017,
- IABSE/COST1402–1406 Workshop. Zagreb 2017

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- IABSE Symposium "Structural Engineering Providing Solutions to Global Challenges" Core Group and Scientific Committee Geneva 2015,
- fib Scientific committee Congress, "Improving performance of Concrete Structures", Mumbai 2014,
- fib Scientific committee Symposium "Engineering a concrete future: technology, modelling and construction" Tel Aviv 2013,
- Advisory committee: International Workshop on "Concrete Spalling due to Fire Exposure", Paris, 2013,
- IABSE Congress, "Innovative Infrastructures - Toward Human Urbanism". Seoul, 2012,
- ITA-COSUF Workshop, "Safety vs. Economics : Cost-efficiency of tunnel safety measures", Rome, 2012,
- ITA-COSUF Workshop, "Designing Underground Safety – How far to go?" Helsinki, 2011,
- ITA-COSUF Workshop "Risk Assessment – a state of the art approach to deal with Safety in Underground Facilities", Frankfurt, 2010,
- ITA-COSUF Workshop "Safety Challenges", Lyon, 2009,
- COSUF workshop on 'Safety and Security of Railway and Metro Tunnels" Graz 2008,
- fib Workshop "Fire design of concrete Structures, - From Materials. Modelling to Structural Performance", Coimbra, 2007,
- ITA-COSUF Workshop, "New aspects in Tunnel Safety', Prague 2007,
- Safe & Reliable Tunnels. 2nd Int. Symp. "Innovative European Achievements", Lausanne, 2006,
- fib Workshop "Fire design of concrete Structures, What now? What next?", Milan, 2004,
- Safe & Reliable Tunnels. 1st Int. Symp. "Innovative European Achievements", Prague 2004
- fib Workshop "Fire design of concrete Structures", Malta, 2001,
- IABSE Conference "Cable-stayed bridges: past, present and future", Malmö, 1999, tech. secr.
- IABSE Congress: "Structural Engineering in Consideration of Economy, Environment and Energy", Copenhagen 1996, tech. secr.

Selected publications and presentations

Høj, N. P., Kroon, I. B., Nielsen, J. S., & Schubert, M. (2024). System risk modelling and decision-making – Reflections and common pitfalls. Structural Safety. Advance online publication. https://doi.org/10.1016/j.strusafe.2024.102469

Risk-based evaluation of fire protection on cable-supported bridges, N.P. Høj, M. Bjelkerud, H. Matre. IABMAS 2024, 12th International Conference on Bridge Maintenance, Safety and Management, Copenhagen, 2024.

"Introduction to Acceptance Criteria", and "FN-criterion Lines", JCSS/IABSE Workshop on risk acceptance criteria in civil engineering decision making Trondheim 2023

Über Treppen ohne Geländer zum Safety-Engineering, J. Schneider, N. P. Høj, Bauingenieur TEC21, Espazium, 2023.

Performance Indicators for assessing RAMS SHEEP performance, N. P. Høj, I. Stipanovic Oslakovic, G. Klanker, IABSE Symposium, Vancouver, Canada Sept. 2017.

Multi-objective bridge performance goals, I. Stipanovic Oslakovic, N. P. Høj, G. Klanker, The Fifth International Symposium on Life - Cycle Civil Engineering, IALCCE2016, Delft NL, Oct. 2016.

On the Aerodynamic Characteristics of Partly Open Galleries in Case of Fire. Stammwitz T*, Rigert S, Hoj N. P., Bettelini M. 8th International Conference "Tunnel Safety and Ventilation. Graz Austria, April 2016."

Risk Analyses of Tunnels Using the Swiss Guideline and Methodology for Risk Assessment and Risk Evaluation. Niels Peter Høj **, Samuel Rigert *, and Marco Bettelini. 8th International Conference "Tunnel Safety and Ventilation. Graz Austria, April 2016."

Swiss guideline and methodology for risk analysis of road tunnels, Rune Brandt, Matthias Schubert, Niels Peter Høj, Bernard Gogniat & Christian Gammeter. The 7th International Symposium on Tunnel Safety and Security, Montreal, Canada, March, 2016.

Generic Quantification of Consequences of Road-Tunnel Fires, R. Brandt, N. Riklin, V. Butty, S. Frey, M. Schubert, N. P. Høj, C. Gammeter and B. Gogniat, 16th International Symposium on Aerodynamics, Ventilation and Fire in Tunnels Seattle, USA; 15 – 17th September 2015.

Acceptable risk levels during refurbishment work Høj, N. P. & M. Schubert, HOJ Consulting. ITA COSUF Workshop: Aging Tunnels – Safety in operation and during refurbishment, Dubrovnik, 26 May 2015

RAMS Analyses of Complex Technical Systems in Underground Facilities, Høj, N. P. & M. Schubert, HOJ Consulting. ITA COSUF Workshop: Complex Underground Multipurpose Facilities: Safety Challenges and Solutions, Geneva, 4 June 2013

The fib Model Code for Concrete Structures 2010, fib Lausanne, 2013, ISBN 978-3-433-030601-5. SAG 5, Chapter 7.5.1 Fire Design (N. P. Høj).

Complex urban underground road structures - Case studies, Høj, N.P., Amberg, F. 13th World Conference of ACUUS Singapore, Nov 2012.

Utvikling av risikoanalysmodell TRANSIT for Vegtunneler, Statens vegvesens rapporter Nr. 156. Høj, N.P., Schubert, M. et al, Vegdirektoratet (NPRA), August 2012.

On risk analysis using Bayesian networks on road tunnels, Brandt, R., Høj, N.P., Schubert, M., Tunnel Safety & Security, 5th International Symposium, March 2012, New York, USA.

On Risk Analysis of Complex Road-Tunnel Systems, Brandt, R., Høj, N.P., Schubert, M., 6th International Conference Tunnel Safety and Ventilation, Graz, Austria, April 2012

Schubert, M, N.P. Høj, A. Ragnøy, H. Buvik: Risk Assessment in Roadway Tunnels using Bayesian Nets, Transport Research Arena 2012, Athens, Greece April 2012.

fib Bulletin 66. Model Code 2010 - Final draft, Volume 2. Model Code (370 pages, ISBN 978-2-88394-106-9, (Contribution Høj, N.P.: Sec. 7.5.1 Fire design.) March 2012.

Development of a best practice methodology for risk assessment in road tunnels. Utvikling av beste praksis metode for risk modeling for vegtunneler. Matrisk GmbH and HOJ Consulting GmbH. Research project ASTRA 2009/001 at request of Federal Road Office (FEDRO) and Norwegian Public Roads Administration (NPRA), Nov. 2011.

Niels Peter Høj & Inger B. Kroon (COWI): Risk Analysis for Large Infrastructure projects. IFED (International Forum for Engineering Decision- making), Stoos, Switzerland, December 2010.

Niels Peter Høj & Ben van den Horn (Arcadis), Comparison of Risk Analysis Programmes for Road Tunnels. ITA COSUF Workshop, Frankfurt, June 2010

Niels Peter Høj: Challenges in Risk-Based Design of Road Tunnels ITA COSUF: Internal Workshop on Safety Challenges, Lyon, Nov. 2009.

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Proceedings of the International Workshop: Fire design of Concrete Structures, - from materials properties to structural performance, University of Coimbra, Portugal, Edited by J. P. C. Rodrigues, G. A. Khoury and N. P. Høj, May 2008, ISBN 978-972-96524-2-4.

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