



CURRICULUM VITALE

Date:

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Name	:	Eivind Grøv
Work title 1 st position:	:	Chief Scientist
2 nd position	:	Adj. Professor Norwegian University of Science and Technology
Special appointment	:	Past Vice President International Tunnelling Association (ITA) Past President of the Norwegian Tunnelling Society (NFF) President Norwegian Tunnelling Network (NTN)
Born year	:	26.05.1958
Country	:	NORWAY
Language	:	English
International experience:	:	Saudi Arabia, China, Iceland, Korea, Faro Isl., Shetland Isl., Russia, India, Singapore, Hong Kong, Sweden, Finland, Switzerland, Czech Republic, Vietnam, Canada, Chile, Ecuador, Scotland. South Africa, Malta, Indonesia, Turkey, Peru
Memberships	:	Norwegian Academy of Technological Sciences - NTVA

Summary:

Geotechnical engineering and rock mechanics design of; underground tunnels and caverns with respect to geometry (cavern height/width), alignment, localisation; preparation of rock mass grouting schemes, rock support design and hydrogeological models; preparation of cost estimates, time scheduling and risk analysis; design of geotechnical investigation schedules. *Preparation of;* tender documents according to FIDIC and Norwegian Standards for tunnelling and underground works, contract strategies & forms, Technical Specifications, Work Descriptions and Bill of Quantities for hydropower projects, road tunnel projects (also sub-sea tunnels), underground storage facilities and TBM tunnelling. *Resident Engineer and site supervision on;* geotechnical investigations, rock mass grouting and rock support determination for hydropower projects, incl. unlined pressure shafts and air surge chambers, underground oil and gas storage, road and pipeline tunnels (also sub-sea); site supervision of TBM tunnels in hard rock. *Familiar with and experienced in;* the Q-system for quantitative rock mass classification, numerical analysis (UDEEC, Phase²) for design verification and documentation of geometrical layout and permanent rock support; observational method for field determination of rock support and stabilisation; GIN-principle for rock mass grouting; risk analysis; and Steen-Lichtenbergs method for cost estimates; FIDIC and other contract types.

Some major assignments; unlined LPG storage facilities (Norway 96-98); technical advisor for Owner of Hvalfjörður sub-sea road tunnel (Iceland 94-98); advisor first time water filling hydropower project (Tian Huang Ping 97, 99); feasibility study underground railroad cargo-terminal (Norway 97); preparing environmental documents for refined petroleum storage facility (Saudi-Arabia 95-96/00-02); technical advisor for Owner of sub-sea road tunnel projects in the Faroe Is. design and construction phases (Vágatunnilin 98-03, Nordoyatunnilin 02-05); feasibility studies for several hydropower projects (Norway 96-99); detailed feasibility study for crude oil storage India (99/00); numerical modelling of underground mines at Drag, Akselberg and Tverrfjellet (01); design review of sub-sea road tunnels in the Shetlands (Shetland Is./UK 02); pre-feasibility study for sub-sea tunnel Anadyr (Russia 02), alternative design acc. to NMT Gochang tunnel (Korea 02), review of leakage in unlined gas storage (Sweden 03-04), planning of underwater piercing at Aukra at 82m water depth (04), advisor on Scandinavian tunnelling aspects for HATS 2A (Hong Kong 05-), planning of pre-investigations for 2 sub-sea tunnels (Faroe Isl. 06), PM & design review/approval unlined hydrocarbon caverns Jurong Island (Singapore 06-11), technical auditor of internal gas pressure increase UGS Haje (Czech Rep. 07); feasibility study TBM-tunnelling to Norwegian oil fields (08-10); PM research project on Cutter development (11-15); member expert groups in Iceland, South Africa, Chile; PM – TIGHT research project on rock mass grouting (14-17.)

HIGHER EDUCATION:

Master of Science, Geotechnical Engineering and Applied Geophysics, University of Science and Technology, Trondheim, 1983. Academic thesis on: "Electrical resistance as a parameter to locate and describe weakness zones in hard rock".

ADDITIONAL TRAINING:

Post Graduate Courses, University of Science and Technology, Trondheim 1984.
Bachelor Degree in Economics, 1989.

PROFESSIONAL EXPERIENCE (Some selected assignments):**2010- SINTEF Building and Infrastructure****Chief Scientist Dept. of Rock Engineering**

Responsible for scientific & technological development. Review and conducting QA on all documents, reports, technical offers being produced within the Department, preparing research applications.

Shatin Waste Water Treatment Plant (Hong Kong)

Underground expert in design team for the planning of the relocation project of Shatin Waste Water project, sub-consultant to the main designer AECOM for DSD in Hong Kong.

TIGHT – True Improvement in Grouting High pressure Technology (Norway)

Project manager for TIGHT which is competence building project with the Norwegian Research Council aimed at developing new competence for the Norwegian tunnelling industry that can trigger innovative solutions amongst the participants

Statkraft – Internal Audit on Geological risks in hydroelectric power development

Assigned as an external expert by Statkraft to assist in an internal audit on how Statkraft as an owner of hydroelectric power plants deals with geological risks in their projects, both during design as well as for the construction phase, auditing projects in Turkey, Peru & Norway.

Alto Meipo HEP project (Chile)

Member of an Expert Panel which has been established to follow the design and construction of the hydropower project until its completion. Review and scrutiny of documents as well as participating in preparation of documents as per projects request.

Lefdal Mine Datacenter (Norway)

Advisor to the developer, a private entrepreneur who is developing an existing nepheline mine to become a modern data center located underground in abandoned mine caverns.

Member of expert panel (Iceland)

Member of 3-men group who are taking the task of constituting a Dispute Resolution Committee, or actually an expert panel for two road tunnels being built at the same time in Iceland, Vadalheiði and Nordfjordur tunnels.

Expert competence to Reinertsen Engineering (Norway)

Providing Reinertsen Engineering with expert competence for two tunnelling projects, one project is the Onshore pipeline - Fjord crossing tunnel for Johan Sverdrup oil field development, and the other is the design of new tunnels for the existing E6 north of Trondheim and rehabilitation of existing tunnels.

Norwegian contractor NCC

Providing expert competence to NCC in discussions with the owner of a road tunnel where the portal collapsed during construction. Preparing documents for the District Court.

ESPEJO DE TARAPACÁ Pumped HPP (Chile)

Reviewing and scrutinizing design documents for the Owner to secure a sound and robust design of the project, based on Norwegian tunnel philosophy.

Expert witness to Norwegian contractor Mesta

Giving witness statement in both District Court and High Court for Mesta in the case versus the company Hæhre (another contractor) on the possibility of economic disloyalty

The Norwegian Foreign Affairs Department, Norwegian Embassy in Jakarta (Indonesia)

Preparing a report for the FAD on the possibility and need of developing a close cooperation between NTNU and Indonesian universities to build up competence within the fields of Underground Technology and Clean Energy (Hydroelectric power)

FAST-Tunn (Feature Advanced Steel Technology for Tunnelling)

Project manager for a 4 year research project on development of cutter steel for hard rock TBM's focusing on steel quality and cutter geometry. FAST-Tunn is funded by the Norwegian Research Council in cooperation with private and public partners.

Relocation of Shatin waste water plant to underground facility (Hong Kong)

Together with AECOM preparing a pre-feasibility study for the Shatin WWT plant being converted from a surface installation to an underground facility with a capacity of 800000 pe.

Bergen Bybane (Norge)

Advisor to Mott MacDonald on the detail design of tunnels for the light rail project in Bergen on engineering geology

Malta crossing Gozo-Malta (Malta)

Advisor to the Government of Malta on the development of a future sub sea tunnel crossing between the two islands of Gozo and Malta.

Energy Norway (Norway)

Prepared a report for Energy Norway being a state -of-the-art report on of the tunnel system and associated technologies for conventional high head Hydro Electric Power concepts

Gautrain (South Africa)

Assigned as international grouting expert in dispute between the owner and the concessionaire on the water control and grouting works being employed for sections of the tunnels. Following a DRB-conclusion assisting the concessionaire with the preparation of the mitigation works.

Expert witness for Hydro - Hydroelectric Power at Suldal and Holsbru (Norway)

Being assigned as expert witness in two cases, where 1) a steel lining in a 350m static pressure shaft buckled at Suldal HEP (arbitration) and District Court, and 2) conflict with the contractor on geological conditions, tunnelling progress for the Holsbru HEP (District Court).

Rogfast Sub sea road tunnel (Norway)

Preparing report on the evaluation of the use of TBM as an excavation method for the construction of two parallel tube, each 26km long to a depth of 390m below sea level and in difficult and adverse ground conditions.

Fjordane district court (Norway)

Member of the judge in legal proceedings between a Norwegian contractor and the public roads administration.

Codelco (Chile)

Arranging courses for employees of Codelco in tunnelling and underground works, a joint effort between SKAVA and Codelco in Chile and SINTEF/NTNU.

Alto Meipo Hydro Electric Power Project (Chile)

Performed a Due Diligence study for the tunnelling and underground works for the above project on the behalf of the company Quiñenco SA in Chile as client.

CEDREN (Norway)

Conducted a report for the research project CEDREN to investigate the resources needed to develop 20.000MW from pumped water storage during a period of 15 years identifying the constrains and possibilities.

Expert witness Glendoe HPP (Scotland)

Assigned by the owner to undertake and perform an expert witness on the possible cause of the collapse in the head race tunnel during the first year of operation mode of the project. Participated in the International Resolution Dispute Board.

Mineral Tunnel Andina Mine (Chile)

Conducted a second opinion on the design, cost estimates and time scheduling for various alterantive solutions for a tunnel dedicated for mineral transport from the mine to processing plant. The tunnel will have a length of appr. 25km with high overburden.

Tamakoshi HPP (Nepal)

Undertaken a design review of hydro power cavern design for the owner SNPower. Includes numerical modelling of the cavern and adjacent underground structures

Expert witness Mika (Norway)

Assigned by the Norwegian contractor Mika to be an expert witness for the District Court and High Court between Mika and the Norwegian Public Roads Adm. for the Vinterbru – Vassum road tunnel project.

Shetland Island Council (UK)

Advisor to the SIC in the preparation for vitalising the possibility of planning and constructing sub sea road tunnels in the Shetlands.

The San Francisco HPP (Ecuador)

Being appointed by the contractor Odebrecht to participate in the planning and inspection of the head race tunnel of San Francisco HPP following the second dewatering of the tunnel system for mitigation works within the contractors guarantee periode.

2009- Appointed Professor at the University of Technology in Trondheim (NTNU)

20% position, lecturing courses in Engineering Geology and Rock Mechanics, basic and advanced level, Supervising students for MSc- thesis and projects in their 5th and last year.

Contact person, lecturing and responsible for NTNU contribution to 'Tunnelskolen' arranged by the Norwegian Public Road Administration and the Norwegian Railway Authorities
Lecturing at various post-graduate courses, Supervising and co-supervising PhD-students, being opponent and administrator for public defence of PhD's

2007-10 SINTEF Building and Infrastructure

Research Manager Dept. of Rock and Soil Mechanics

Responsible for the administration and managing two disciplines including personnel and scientific development

Acona/North Energy (Norway)

Performed a pre-feasibility study for a concept of utilising three parallel sub-sea tunnel tubes leading to a cavern in located in the oil field off shore. From the cavern oil production is planned to be performed.

Statpipe tunnels (Statoil)

For the approach from the North Sea and to the refinery the Statpipe tunnels have been constructed to host gas pipes. These are 3 sub sea tunnels and were built in the early 80'ies and are now due to rehabilitation and overhauling to secure a prolonged operational period. Specialist advice to Statoil for the work to rehabilitate the tunnels.

Expert witness Mesta (Norway)

Assigned by the Norwegian contractor Mesta to be an expert witness in District Court and High Court versus the Norwegian Public Roads Adm. for the Frodeåsen road tunnel project.

B'ryoung sub sea tunnel Korea

Review of all design for a sub sea road tunnel in rock. The design has been made by local Korean companies and a careful and thorough review has been executed to secure that the design is in compliance with the experience from such tunnels in other countries.

The Norwegian Railroad Authority

Established a full scale testing facility in laboratory for testing of various concepts for water and frost protection in infrastructure tunnels. The facility is the only one of such type world wide.

Gjevingåsen railway tunnel

Acting as technical advisor to the owner during the construction of the 4km tunnel.

Crossing of the Strait of Bell Isles (New Foundland)

Technical advisor to the National Electric Power Agency of New Foundland and Labrador on the possible crossing of the Strait of Bell Isles utilising the techniques and technologies of sub sea tunnelling in hard rock.

Qing Dao sub sea road tunnel (China)

The project consists of 3 parallel tubes, with length each almost 7,5km. Technical assistance to the Owner of the Qing Dao sub sea road tunnel looking at possible solutions to replace cast-in-place concrete lining with "Single shell shotcrete lining" and thus follow the Norwegian sub sea tunnel concept.

Underground gas storage Haje, Czech Republic

Technical auditor of the pressure increase for the underground pressurised gas storage in unlined rock caverns. The owner Transgas Net increased the internal gas pressure to 12MPa and a risk analysis was undertaken to document the feasibility of the project. SINTEF/NTNU made a technical audit of the project.

Strategic Storage of Crude Oil, India

International specialist for the Back-up consultant performing the Basic Engineering Design and Tender documents for the underground storage project for crude oil in unlined caverns. The Back-up consultant assists EIL, Engineering India Ltd in the execution of the project.

Sub sea road tunnel in Åland

Technical advisor to the local government in Åland in the preparation of the first ever built sub sea road tunnel in islands. Preparing cost estimates, time schedules, investigation schemes, feasibility study etc. Holding meetings with various ministers in Åland to describe and present the sub sea tunnel concept and doing confidence building in the concept.

2005-06 SINTEF Rock- and Soil mechanics

Research Manager Underground Technology

Responsible for the administration and managing the rock engineering discipline including personnel and scientific development

Gemini Centre on Underground Technology

Managing a Gemini Centre on Underground Technology. The centre is a formalised co-operation between the University in Trondheim and SINTEF rock and soil mechanics to develop Underground Technology and to initiate common research projects.

Rongni Hydroelectric power scheme, India

Due diligence report of the project, a hydroelectric power scheme in Sikkim in the Himalayas, including construction feasibility, cost and time scheduling, technical solutions etc. for a Norwegian investor in the energy sector.

Prefeasibility study for bored tunnels to off-shore oilfields in the North Sea (Norway)

Together with a Norwegian company specialising in risk analysis undertaken a pre-feasibility study for a concept including sub sea rock tunnels to connect the off-shore oil fields with the main land with boring (TBM's) of 50-60km long tunnels.

Jurong Rock Caverns (Singapore)

SINTEF in cooperation with Multiconsult and Tritech are doing Project Management and Review & Approval of design and construction associated with Phase 1 of the hydrocarbon storage at Jurong Islands, appr. 1,5m³ rock storage. The project involves storage in unlined rock caverns of various hydrocarbon products in sedimentary rocks as sandstone and deep below the water table.

Harbour Area Treatment Scheme HATS 2A (Hong Kong)

Special advisor to consultant, Consulting group of Maunsell and Metcalf & Eddy ltd on implementing Scandinavian tunnelling methods for the entire tunnelling scheme in HATS 2A, including pre-investigation methods, contract philosophy, tunnel excavation methods, rock mass grouting etc. Prepared report on the Contract and Tender Strategy. HATS 2A includes >20km of deep tunnels (depth ~150m) in highly urbanised areas along the Waterfront on Hong Kong Island and also one sub sea crossing of Victoria Harbour to Stonecutter Island.

Hvalfjordur sub sea tunnel (Iceland)

The existing sub sea tunnel (open for traffic in '98) has experienced a tremendous traffic growth and the Owner, Spölur hf, explores the possibility to extend the capacity of the tunnel. Preparing a feasibility report on capacity improvement by various methods: adding a parallel, new tunnel, enlarging the existing whilst the current tunnel maintains its operation undisturbed.

Chai Li Kok Drainage scheme (Hong Kong)

Advisor to consultant Maunsell on design of drainage tunnels. Choice of tunnelling methods, rock support and measures to maintain the ground water level. Contract strategy.

Sandø-Streymøy and Skalafjord sub sea road tunnels (Faroe Islands)

Being a specialist advisor to the project owners in the early stage of developing the projects for the designing and planning the pre-investigations, and feasibility studies. The Sandø-Streymøy crossing with a length of 12km would be the longest sub sea road tunnel in the world open for public traffic. Particular focus to be considered on safety issues. The public road authorities is the Owner. The Skalafjord tunnel is 7,5km before branching off through a sub sea Y-junction to two 2,5km long tunnels. The project is operated by a private enterprise.

Lysaker – Sandvika railway tunnel (Norway)

Third party review. The Norwegian Railway authority is planning a new tunnel in the close proximity of the city of Oslo. The tunnel will pass a heavily populated, urbanised area with great focus on ground control and water ingress. The third party review was undertaken to evaluate the various types of potential successful construction, incl. TBM and drill & blast focusing cost and time estimations.

Zhenzhou road tunnel (China)

Design of rock caverns for safety purpose in a 18km long dual tube road tunnel. The caverns are 25m wide and 200m long, with a rock pillar between neighbouring caverns of 8m width. The rock cover is at the most 1450m, producing an vertical stress component of almost 45MPa. The tunnel is the longest road tunnel in China and the longest dual lane road tunnel worldwide.

Sub sea tunnel to Vestmannaeyar (Iceland)

Special advisor to the Icelandic Public Roads Administration to evaluate the feasibility of a 20km long sub sea tunnel connecting mainland of Iceland to the island of Vestmannayar. The tunnel alignment is located in young volcanic rocks, so-called Moberg-formation.

Expert advisor on tunnelling and grouting (Norway)

Expert advisor for the contractor, Mesta AS, on the Tønsberg-project on rock mass grouting and rock tunnelling in difficult ground. Preparation of a technical report reviewing the planned procedures and recommendation of alternative solutions.

Expert witness in court (Norway)

Expert witness for the contractor in lawsuit between contractor Veidekke and owner of the T-Baneringen in Oslo on the responsibility and claim following the collapse in the new tunnel causing severe delays of the project and traffic obstructions in existing, neighbouring tunnel.

E6-Øst Trondheim, Public Roads Administration (Norway)

Third party review body for the Owner, the Public Roads Administration, in planning, design and construction phases. Two parallel tubes to be excavated in highly urban area with low rock cover and difficult ground conditions calling for strict groundwater control and vibration blasting control.

Sub-sea tunnelling projects in the Fare Islands, Greenland, Åland, Scotland & Orkneys

Supervising and assisting entrepreneurs and innovators in various projects at an early stage. Assistance mainly based on the implementation of regulations and standards as presented in the Handbook 021 on Road Tunnels issued by the Norwegian Public Road Administration.

2003-05 SWECO Grøner AS, Branch Office Trondheim

Senior Advisor/Geotechnical Engineering & Rock Mechanics

Ormen Lange Aukra shore approach (Norway)

Design, planning and preparation of tunnelling and excavation procedures for two landfall tunnels including blasting of underwater piercing at water depths of 40 and 82m to the North Sea. The piercing was planned and conducted as an open blasting at atmospheric pressure and without water filling of the tunnels (dry tunnels).

Yurong Island Oil and Gas Storage (Singapore)

Appointed member of expert advisory group for the pre-investigations for underground oil storage in unlined rock caverns. A JV of Tritech (Singapore) and SINTEF (Norway) was contracted to conduct the pre-investigations for the underground storage facility. The advisory expert group consisted also of Prof. E. Broch, Prof. A. Myrvang.

Tunnel drainage and water handling (Korea)

Preparing a state-of-the-art report on tunnel drainage and water handling systems comparing various European guidelines and other codes/standards. Evaluating the various regulations in use in these countries. Client; ESCO Eng. & Consultants Company Ltd. of Korea.

Nordøya sub sea road tunnel (Faro Islands)

Technical advisor for the Owner, a private enterprise named Nordoyatunnilin pf, during both the planning and design phase and throughout the construction phase of the project. Advisor in negotiating the contract docs based on adjustable fixed price. The tunnel is a 6,2km excavated in basaltic rock. The tunnel is the 2nd tunnel of its kind in the islands.

Oslofjord sub-sea road tunnel (Norway)

Expert witness in the arbitration between the contractor and the Norwegian Public Roads administration on the tunnelling works.

Tinganes, Torshavn (Faro Islands)

Feasibility study for underwater blasting enabling an extension of the harbour in Torshavn. The close vicinity to the historical site, Tinganes calls for particular careful blasting. Recommendations on blasting method and pre-cautionary actions to prevent any damage to occur on the historical site of Tinganes.

Follafoss hydro electric power project (Norway)

Geotechnical, detail design of underground tunnels and caverns including design of unlined headrace tunnel and pressure shaft. Preparation of tender documents. Geotechnical follow-up during construction on behalf of the Owner, Nord-Trøndelag Electric Power Company. Water head appr. 200 m.

Dasan Engineering Co. Ltd (Korea)

Preparation of a feasibility study for two parallel, inclined 100 m long shafts with cross-section 20x20 m. Evaluation of various tunnelling and excavation methods and rock support, and also optimised shaft inclination.

Scanraff LPG-storage (Sweden)

Third party review and evaluation of possible causes for a reduced storage volume in a fully refrigerated underground storage of LPG. The storage is based on unlined rock cavern using water curtain and frozen zone for hydrodynamic and permeability control respectively. Appointed by the loss adjusters; Crawford & Comp. Ltd.

Hov-Øravig road tunnel (Faro Islands)

Pre-feasibility study and detailed design for a 3 km long road tunnel in basaltic rock type. Design of pre-investigations, cost analysis, alignment evaluation, geotechnical engineering and rock tunnel design. The local geology includes thick layers of tuff, which need to be tunnelled with great caution to maintain appropriate stability.

1994-03 O. T. Blindheim AS, Trondheim

Senior Advisor/Lead Engineer in Geotechnical Engineering & Rock Mechanics

Karahnjukar hydro power project and Reyðarsfjörður road tunnel (Iceland)

Advisor to NCC, a major Scandinavian main contractor in the preparation of their construction tender for these two projects. Particularly in the assessment of water leakage and associated rock mass grouting, rock support and tunnel stability. Both tunnels are located in mixed face geological conditions in basalt. Karahnjukar was to be tendered by the use of TBM's.

Gochang road tunnel (South Korea)

Preparation of alternative design for the Gochang road tunnel project based on the utilisation of Norwegian Method of Tunnelling (NMT) with respect to rock excavation, rock support and rock mass grouting. Advising on the application of free standing (pre-cast concrete lining) inner lining for water and frost protection.

Sub-sea road tunnel in Åland, Ålands Lagting (Åland, Finland)

Presentation of the Norwegian sub-sea road tunnel concept for local politicians and public opinion. In Åland the need of establishing fixed link between the various islands has been realised and rock tunnels would be a possible option.

Anadyr sub-sea road tunnel (Siberia, Russia)

Preparation of a pre-feasibility study for a sub-sea road tunnel crossing the strait of Anadyr. The pre-feasibility study included tunnel alignment evaluation, design concept, cost estimate and a plan for pre-investigations. The tunnel will be located in permanent frost area and mainly in basaltic rock.

Shetland Islands Fixed Links Projects (Shetland Islands/UK)

Design review on the behalf of Shetland Islands Council for 2 sub-sea road tunnels, length 2,5 - 5 km crossing the Bluemull and Yell Sounds. The review included technical solutions, alignment evaluation, cost estimate, time scheduling and pre-investigation program. The design is based on the Norwegian sub-sea road tunnel experiences. Using Steen-Lichtenberg method for successive calculation for cost estimate.

Karahnjukar hydro power project (Iceland)

Conducting a second opinion for the owner, Landsvirkjun, the Icelandic state electrical power board, on the tunnelling works; technical and economical matters, as well as time-scheduling. The tunnelling includes 40 km of mixed face excavation in basalt, mainly by TBM, but also conventional drill & blast.

ESCO Engineers & Consultant Co., Ltd. (Korea)

Prepared a state-of-the-art report on the application of inner lining in Norwegian road tunnels. The report included the practical, technical, economical and constructional aspects for two inner lining systems developed in Norway. One consisting of pre-cast concrete segments, the other of segments in the walls, combined with PE-foam covered by sprayed concrete in the roof.

Norðoya Sub-sea Road Tunnel (Faeroe Islands)

For the public roads administration in the Faeroe Islands (Landsverk-frødingurin), preparation of pre-investigation program for a sub-sea road tunnel, length 6 km in basalt. Prepared contract documents for pre-investigations, report and follow-up of investigations. Evaluated alternative tunnel alignments.

Saudi Strategic Storage Program (Riyadh, Kingdom of Saudi Arabia)

Special assignment (1999-2000) for the contractor (ABV RG) to assist in the preparation of various documents for environmental and geo-technical issues. One particular task is related to the design of a water collection and handling system (incl. post-grouting if required) in a 13,5

km long pipeline tunnel, excavated by TBM technique. The assignment is based on periodically work in KSA with duration 4-6 weeks upon client's request.

Vestmannasund Sub-sea Road Tunnel (Faroe Islands)

Technical advisor for the Owner (a private enterprise) of the first sub sea road tunnel in the Faeroe Islands, in basaltic rock types, tunnel length 4,7 km. Review of geotechnical basis and tunnel alignment. Planning of supplementary investigations including core drilling and seismic survey. Contracting and follow-up of investigation program. Prediction of water ingress to the tunnel and planning of remedial measures such as rock mass grouting. Rock mass stability assessments. Assisting/participating in detail design and contract preparation for the tunnelling works. Follow-up of tunnelling works.

Akselberg, Drag and Tverrfjellet underground mines (Norway)

Numerical modelling using UDEC & Phase² and analytical calculations for stability analysis of large sub-surface caverns for 3 different mining projects. Recommendation on cavern size, underground geometry, pillar size, horizontal (crown and sill pillars) and vertical pillars. Preparation of excavation plans to maximise the output. Caverns located at shallow depth but with large in-situ stress components.

Norwegian Rail Road Authority, the Gevingåsen tunnel (Norway)

Cost estimate for 3 alternative solutions with the use of risk analysis and Steen-Lichtenbergs method for probabilistic calculations. Tunnel length 4.5 km in an area sensitive to ground water changes caused by tunnelling activities.

Strategic crude oil storage (India)

Detailed feasibility study for strategic oil storage in unlined rock caverns, the first storage facility of such kind in India. Clusters of caverns will be located in three geographically different locations and in different geological environment (basalt, gneiss). Sub-consultant for a major Scandinavian contractor, Skanska. Hard rock experience was provided for the design of all three sites, including localisation, pre-investigation programs, geometry of caverns and environmental assessments. Establishing geological and hydrogeological models based on pre-investigation results. Subconsultant for Engineering India Ltd.

Norwegian Research Foundation (Norway)

Technical secretary and responsible for the reporting of the program, for a group of tunnelling professionals with the scope to evaluate the pre-investigation methods and schemes currently in use for Norwegian underground projects. Identify the need of alternative methods and techniques and propose research projects based on this evaluation. This group was one out four different groups in a major project to evaluate the Norwegian tunnelling practice.

Follafoss Hydropower Scheme (Norway)

Feasibility study for a rehabilitation scheme of an existing hydro power plant in metamorphic rock mass. The scheme includes the design of underground power station, unlined pressurised head race tunnel and access /tail race tunnels. Water head appr. 200 m. The rehabilitation scheme is planned to be undertaken whilst full operation of existing power plant imposing strict requirements on plant layout, construction planning and blasting procedures.

Tian Huang Ping Pumped Storage Power Project (China)

Advisor, assigned by financing institution, the World Bank, on follow-up and site supervision of 1. water filling of two parallel, concrete lined, inclined shafts (fall '97 and winter '99). Water pressure head of 650 m. Independent observer, reporting filling progress and preparing suggestions on remedial actions; such as grouting (impermeabilisation) of areas with recorded excessive water leakage (concrete plugs and to the rock mass).

Master Builders Technologies (Hong Kong)

Preparation of a feasibility study for an alternative, water tight rock tunnelling method for high speed rail road systems (MTRC/KCRC Projects) in Hong Kong to replace cast-in place concrete lining. Applying Scandinavian tunnelling philosophy including probe-drilling ahead of face and pre-grouting (impermeabilisation) the rock mass to avoid lowering of ground water. Sprayed concrete and rock bolts to produce an unlined sub-surface structure. Reference to Scandinavian tunnelling projects.

Øksnelvan Hydropower Scheme (Norway)

Geotechnical design (feasibility study) for two alternative hydropower schemes including design of underground power stations, several pressurised, unlined head race tunnels, access

and tail race tunnels. The design included also evaluation of TBM tunnelling as an alternative excavation method, in sandstone originated from Devonian sedimentation. Water head up to 900 m.

Sture Oil Terminal and Herøya LPG-Storage (Norway)

Design and planning of geotechnical investigation program for extension of unlined, refrigerated LPG-storages in rock for 2 different projects, Sture and Herøya. Planning, contracting and follow-up of investigation program incl. core-drilling, stress measurements and permeability testing. Preparing geotechnical design basis, review of rock cavern design and localisation and geometry. Establishing hydrogeological model and rock mass grouting schedules as basis for water curtain design. Client; Skanska.

Hell-Hommelvik Rail Road Tunnel (Norway)

Geotechnical design of high speed rail road tunnel outside Trondheim for the main connection to Northern Norway. Design included evaluation of tunnel alignment, rock support measures and rock mass grouting, water collection systems and planning of investigations. Cost assessments for both single and double rack tunnels. Preparation of program to assess the risk of adverse impacts and evaluate necessary remedial actions due to ground water disturbances caused by tunnel excavation.

Kårstø Oil and Gas Storage (Norway)

Second opinion, verification of detail design and tender documents for unlined, underground caverns for storage of propane and condensate, chilled and liquefied (LPG). Review included rock caverns design and associated underground openings, support and exploratory drilling, ground water control by means of water curtains and rock mass grouting. Review of geotechnical investigation/geotechnical design basis.

Cargo Terminal Trondheim (Norway)

Preparation of feasibility study for an underground cargo terminal (shunting area) on rail road transport located in an urban area close to the city centre of Trondheim. Geotechnical engineering and design, including rock cavern layout, stability and water leakage. Cost estimation for a complete installation. Numerical modelling to document the design concept, geometry and layout of rock caverns including rock support design.

Hvalfjordur Sub-sea Road Tunnel (Iceland)

Technical advisor for the Owner, Spölnur hf. Tunnel length 5,7 km in young basaltic rock. Design co-ordinator with responsibility for all technical aspects. Geotechnical design incl. programmes for probing ahead-of-face and pregrouting. Preparation of technical specifications and contract documents for turn-key contract acc. to FIDIC. Evaluation and nomination of tenders, assisting during the contract negotiations. Preparation of seismic risk assessment. Follow-up of excavation activities, support, exploratory investigations ahead of face and pre-grouting during construction. Review and approval of the Contractors detail design documentation. Participating in construction advisory group during the execution of the works.

Numerical Modelling in Rock Engineering (Norway)

Heading research project in Norway on numerical modelling in rock engineering for verification of geometry and support. Specifically focusing input parameters to fit Scandinavian igneous rock mass. Project aims to prepare a handbook with practical guidelines for preparation and understanding of numerical models.

Saudi Strategic Storage Program (Saudi Arabia)

Special assignment (1995/1996) for Contractor (ABV Rock Group) of the SSSP-project working in the Kingdom of Saudi Arabia. Member of an expert panel for a comprehensive grouting scheme in a TBM-excavated tunnel with large water inflow. For 5 underground storage sites responsible for follow-up, co-ordination and technical review of sub-consultants, including external and internal assignments related to preparation of documents and design for environmental matters, Environmental Impact Assessments (EIA). Preparation of Environmental Monitoring and Protection Programs involving groundwater observation wells, hydrogeological models. Sedimentary rock types (limestone and sandstone) and also typical hard rock sites.

Underground Gas Storage (Norway, Sweden, Finland)

For a Scandinavian contractor, Midroc AB, preparation of technical state of the art report on gas storage (LPG and LNG) in unlined rock caverns. Evaluating present technology and

identifying/predicting future developments and improvements of chilled/pressurised concepts for underground gas storage. Special focus on igneous rock types and Scandinavian methodology including rock mass impermeabilisation by grouting and water leakage control. Hydrodynamic confinement using pressurised water infiltration. Preparing documentation of applied technology for world-wide references.

Naptha Jakry Hydro Power Scheme (India)

Preparation of feasibility study for the use of fibre reinforced sprayed concrete in drained concept replacing cast-in place concrete as permanent liner for large underground sedimentation caverns. Preparation of documentation of Norwegian reference projects with similar concepts.

The Oslofjord sub-sea Road Tunnel (Norway)

Preparation of geological report accompanying tender documents for a 7.5 km long, twin tube sub-sea road tunnel crossing the Oslofjord in granitic rock types. The report included geotechnical assessments for excavation works, rock support, exploratory drilling ahead of face and rock mass grouting.

Sture Crude Oil and Gas Storage and Terminal (Norway)

Resident engineer, integrated in Contractors (AF Spesialprosjekt AS) site organisation responsible for geological follow-up, mapping and rock mass classification, preparation of working procedures, determination of temporary and permanent rock support, quality control of rock support. Planning and site supervision of rock mass grouting schemes and water curtain system. Excavating oil storage caverns in igneous rock.

Gardermobanen High Speed Railroad Link (Norway)

Second opinion, evaluation and verification of turn key contract documents for high speed railroad tunnel in soil conditions, applying NATM or shield excavation. The first of its kind to be constructed in Norway. Evaluation of tenders/nomination of contractor.

CERN LEP - Tunnel (Switzerland)

Project-leader for joint venture; O. T. Blindheim AS, SINTEF Research Organisation and K. Garshol Geo-Service to prepare a preliminary design study for rock mass impermeabilisation by grouting in combination with drainage tunnels to reduce or eliminate risk of sudden ingress of sand and water in the Large Electron-Positron Collider (LEP-tunnel), the European Organisation for Nuclear Research. The group was one out of eight pre-qualified consultants. Site was in sedimentary rock types.

Norwegian Public Road and State Rail Road Authorities (Norway)

Several engagements in road and rail road tunnel projects involving; Geotechnical engineering, cost estimates, geological follow-up, quality control of excavation and support works, design of grouting schemes/determination of permanent rock support.

1990-94 Saudi Strategic Storage Program (Saudi Arabia)

Senior Rock Design Engineer.

Employed by the Contractor (ABV Rock Group on secondment contract with Berdal Strømme A/S) on turn key contract executing the SSSP-project in Saudi Arabia; underground storage facilities for refined petroleum products. Sites included both hard rock and sedimentary rock types. Responsibilities within:

Engineering geological mapping, planning of exploratory drilling and reporting for large underground caverns and tunnels, including also full-face bored (hard rock TBM) sections.

Preparing Conceptual Design documents for rock excavation and rock support including determination of locations and geometry of caverns and tunnels, rock support estimates, rock mass grouting efforts and rock drainage facilities. Alignment evaluation of two pipeline tunnels, each about 13,5 km long, including cost estimation, evaluation of geological and rock mechanics aspects and construction methods also TBM tunnelling, preliminary time scheduling.

Planning of mobilisation areas for TBM excavation and conventional drill and blast for these tunnels. Preparing technical specifications for tunnelling and underground works (rock excavation & rock support) according to the CSI format and Master Format. Preparing project procedures for determination and application of permanent rock support as well as for rock drainage measures. Preparing detailed design of underground rock caverns and permanent rock support and rock mechanics calculations, utilising the empirical Q-system and numerical rock mechanic analysis such as UDEC-calculations. Preparing tender documents for international tendering of tunnelling works (also TBM-tunnelling), Scope of Work, provisions, Bills of

Quantities, technical specifications and rules of measurements. **Review of bids. Preparing of monitoring and laboratory test programs for tunnels and caverns and *in-situ* stress measurements including evaluation and reporting of results. Preparing of environmental considerations and protective measures to hydrocarbon leakage to the ground. Follow-up of tunnelling works performed by internal construction units, supervision on construction methods, progress planning and technical solutions related to rock excavation and rock support. Preparing, follow-up and co-ordination of internal and external assignments related to engineering geological and rock mechanical matters also including technical review and quality control. Participating in technical meetings with the project's Client, being permanent member of the continuous geotechnical site supervision of rock excavation and rock support work.**

Reports, documents and meetings using the English language in accordance with the Webster Ninth Dictionary. Quality assurance according to ISO 9000/9001. Codes and Standards according to Americans such as ASTM. Rock mass classification according to the Norwegian Q-system. Technical Specifications according to the Manual of Practice developed by the Construction Specification institute (CSI). Rock mechanical calculations using the Universal Distinct Element Code (UDEC) by ITASCA.

1987-90 Berdal Strømme A/S, Sandvika, Norway.

Dokka Hydropower Scheme (150/44 MW, head 600 m)

Resident Engineering Geologist (2 yrs); responsible for Quality control of the contractors temporary rock support and determining, follow-up, site supervision and reporting permanent rock support. Follow-up of rock excavation and underground work. Site supervision and design of pre-grouting scheme for an air cushion surge chamber and water curtain with marginal rock cover. Follow-up and supervising grouting works for penstock and access gate plugs and several rock caverns. Quality control. Geological mapping. Vibration measurements, controlling blasting plans and construction inspections in relation to blasting. Planning and Site supervision of first time water filling, air-filling of air cushion surge chamber with reporting of its full development.

Averoy, Eiksund, Fimreite and Skatestraumen

Geotechnical engineering, alignment evaluations and cost estimates for sub-sea road tunnels. Planning, design and site supervision of seismic investigations.

Napetjern and Haukerei Hydro Power Schemes

Geological mapping for feasibility study. Geotechnical engineering & design of unlined pressure shaft and head-race tunnels. Rock support and cost estimates. Preparation of tender documents.

1984-87 Geco A/S (Geophysical Company of Norway A/S)

Geologist/Geophysics

Geophysical processing and interpretation of marine seismic data. Testing of new parameters and velocity functions to optimise the seismic data quality. Heading and supervision of a team consisting of 2-4 geologists and geophysicist. Presentation of achieved processing and interpretation results to Clients operating on the Norwegian part of the North Sea and the Barents Sea. Working language: English.

1984 Sør- Trøndelag Hydro Electric Power Company, Trondheim, Norway,

Orkla - Grana Hydro Power Scheme

Resident engineering geologist with responsibility of site supervision of TBM tunnels in hard rock, and geological mapping for permanent rock support.

OTHER APPOINTMENTS

Referee Computers & Geosciences (2014 -)

Member Scientific Committee Shotcrete For Underground Support XII in Singapore 2015

Member Scientific Committee World Tunnel Conference in Croatia 2015

Chairman editorial committee NFF-publication no. 23 on "Norwegian tunnelling" (2014).

Member Scientific Committee "14th World Conference of Associated research Centers for the Urban Underground Space, ACUUS 2014", Seoul, Korea 2014

Chairman Organising Committee exam related course in Norway on "Rock mass grouting"

Member Scientific Committee "Seventh International Symposium on Sprayed Concrete", Norway 2014

Member Scientific Committee World Tunnel Conference in Brasil 2014

Animateur ITA Working Group no. 12 on "Sprayed concrete application" (2013 -)
Member Programme Committee "Strait Crossings 2013". Bergen, Norway
President Norwegian Tunnelling Network (2013-)
Member Board of Directors Norwegian Tunnelling Network (2012-2013)
Member Board of Directors Giertsen Tunnel AS (2011 -)
Member editorial committee NFF-publication no. 22 "Rock mass grouting" (2012).
Manager Gemini Centre on Underground Technology, a formal cooperation between SINTEF Rock Engineering and relevant institutes at NTNU (University of Science and Technology in Trondheim)
Member Scientific Committee "13th World Conference of ACUUS 2012 Singapore", 2012
Member Scientific Committee "1st Virtual conference on Underground oil and gas storage in Iran", 2011
Member editorial committee for NFF-publication no. 20 "Norwegian Contract practice" (2011).
Member Board of Directors Dynamic Rock Support AS (2010 -)
Member Scientific Committee 1st International Symposium on Archimedes Bridge (2010), Qiandao Lake, China.
Member Scientific Committee for the World Tunnel Conference in Bangkok, Thailand 2013
Member Scientific Committee, International Journal on Mining and Environmental Issues, Iran (2009 -).
Member Scientific Committee for the World Tunnel Conference in Helsinki, Finland 2011
Member 7th Editorial Board of Journal of Modern Tunnelling Technology, China (2009-)
Member Scientific Committee, 6th International Symposium Sprayed Concrete in Tromsø, Norway 2011.
Member Academic Committee China's 4th International Symposium on Tunnelling, Shanghai 2009.
President Norwegian Tunnelling Society, NFF (2009 - 2011)
Elected Vice-President of ITA (2007-2010)
Member Executive Council of the International Tunnelling Association (ITA) (04-07)
Chairman Organising Committee "Strait Crossings 2009", Trondheim Norway, 2009.
Member Scientific Committee Urban Infrastructure of Urban Areas, Wroclaw Poland 2008.
Member Scientific Committee 5th International Symposium Sprayed Concrete, Lillehammer, Norway 2008
Vice-chairman Organising Committee International Symposium on Construction Technique of Subsea Tunnel, Xiamen China, November 2007.
Chairman Organisation Committee International Symposium "In-situ rock stress", Trondheim 2006
Member Board of directors Norwegian Tunnelling Society (NFF) affiliated with the International Tunnelling Association (AITES-ITA) (2003-2009).
President International Committee, Norwegian Tunnelling Society (NFF) (2003-2007)
Norwegian delegate to the General Assembly of the AITES-ITA (2000-2004).
Vice Animateur ITA Working Group no.20, International Tunnelling Association "Surface problems - Underground Solutions" (2002-04) and Working Group no.4 "Sub-Surface Planning" (2000-02).
Member editorial committee NFF-publication no. 15 "Sustainable underground concepts" (2005).
Chairman editorial committee NFF-publication no. 14 "Norwegian Tunnel Technology" (2004).
Chairman editorial committee for NFF-publication no. 12 "Water control in Norwegian tunnelling" (2002).
Supervisor, lecturer and senior in Geotechnical engineering and rock mechanics at the Norwegian University of Science and Technology in Trondheim (NTNU) (2000-2009).
Member and chairman Board of Directors O. T. Blindheim AS (1996-2001, 2002-2003).
Referee for Tunnelling and Underground Space Technology (TUST) (2001-).

SELECTED ORAL PRESENTATIONS (SOME WITH AND SOME WITHOUT PAPER)

Invited lecture for the Icelandic Tunnelling Society. "Modern rock mass grouting techniques"
Keynote Lecture Shotcrete For Underground Support XII in Singapore 2015
Keynote Lecture VietRock, Hanoi, 2015. "Understanding and utilizing in-situ rock stresses in design and building of underground caverns and tunnels"
ITA Training Course WTC Brasil 2014, "Unlined pressurized tunnels and shafts"
ITA Training Course Nepal 2013, 5 lectures on topics related to Hydroelectric power development
Keynote lecture Nordic Grouting Symposium Gothenburg, 2013; Rock mass grouting in Sweden and Norway - A matter of cultural differences or factual causes?
Keynote lecture John Tattersall Memorial Conference Hong Kong, 2013; Rock mass groutability.
Key note lecture ITA Training Course WTC Geneva 2013. "Rock mass grouting"

Invited lecture Brazilian Tunnelling Conference Sao Paulo 2012. "Underground storage with particular focus on hydrocarbon products".

Key-note lecture Brazilian Tunnelling Conference Sao Paulo 2012. "Pre-grouting"

Bilateral seminar Indonesia – Norway. 3 oral presentations on various aspects on tunneling; "Introduction to Norwegian Tunnelling", "Future application of underground", Risk sharing principles".

Keynote lecture Joint HKIE-HKIP Conference on Planning and Development of Underground Space "Underground Space Application – a Global Picture"

Invited lecture Joint HKIE-HKIP Conference on Planning and Development of Underground Space "General Review on Geotechnical Aspects of Cavern Engineering"

Invited lecture Tunnelling 20Twenty Hong Kong 2011 "Exploring the use of rock mass grouting".

Key note lecture 6th International conference on Sprayed Concrete, Tromsø 2011. "Sprayed Concrete as an Integrated Part of Norwegian Tunnelling"

Münsteraner Tunnelbau – Kolloqium, Germany 2011. "Active design in civil tunnelling with sprayed concrete as permanent lining"

Meeting with the Russian Ministry of Transport, Moscow 2011. "International experience in construction, operation and maintenance of transport tunnels in permafrost conditions"

Tunneldagene 2011 Lillehammer. "Tunnel Norge 2011 – Status og utfordringer"

Bilateral seminar Rio de Janeiro 2011. "Sub sea tunnels to offshore oil production caverns; An innovative approach to meet environmental constrains & breaking new ground for TBM-tunnelling"

Bilateral seminar Rio de Janeiro 2011. "Welcome and introduction to Norwegian tunnelling"

Invited lecturer Tunnelbyggardagarne Stockholm 2011. "Tunnelbygging og grunnvannskontroll"

Statens vegvesen Tunnelskole 2010. "Nisser og dverger bygger i berg", in Norwegian

Bilateral seminar on tunnelling in Bratislava 2010. "Introduction to Norwegian Tunnelling"

Keynote lecture Tunnel Design & Construction Europe. Zurich October 2010. "Tunnel grouting and ground water control"

Invited lecture British Tunnelling Society, London June 2010, "Sub sea tunnelling in Norway"

Invited lecture Croatian Chamber of Cuvil Engineers, Opatija June 2010, "Nordic inter islands tunnel connections"

Welcome speech at NFF-seminar on "TBM-tunnelling" in Bergen June 2010

Bilateral seminar Kuala Lumpur, 2010. "Risk sharing principles" and "Planning and site investigations"

Kursdagene 2010 Trondheim. "Norsk tunnelinjeksjon i Hong Kong" In Norwegian

Kursdagene 2010 Trondheim. "Velkomsttale" In Norwegian

Statens vegvesen Tunnelskole, 2009. "Norsk tunnelteknologi-Sett fra Norge" In Norwegian

Intl seminar, Helsinki 2009. "Presentation of ITA Acitivities"

Intl seminar Ljublana 2009. "Presentation of ITA Acitivities"

Strait Crossings Trondheim 2009. "Welcome speech"

Johannesburg 2009. "ITA Working group No.12 Sprayed concrete Use"

The Swedish Tunnelling Society 2009. "Presentation of ITA Acitivities"

Bilateral seminar in Singapore. 2008 "Risk sharing principles" and "Planning and site investigations"

Seminar i Krakow, Polen 2008. Key note. "Urban Infrastructure of Urban Areas"

Bilateralt seminar in New Delhi 2008, NFF & Boarder Roads Authorities India. "Contract management experience from Norway and abroad."

Training course ITA Agra 2008, "Rock mass grouting"

Tribute to the Danish Tunnelling Society 25 years anniversary 2008. "ITA and its activities"

Statens vegvesen Forskningskonferansen Tromsø 2007. "FoU Tunnel."

Statens vegvesen Forskningskonferansen Tromsø 2007. "Sårbarhet knyttet til manglende kompetanse."

Training course ITA Prague 2007, " Examples from hard rock tunnelling "

Statens vegvesen Idedag vann og frostsikring. 2007. "Rammer og regelverk. Er forutsetningene gode nok for utviklingsarbeide? Funksjonskrav til kledninger"

Fjellsprengningskonferansen 2006 og 2007. "NFF's kvarter"

Keynote lecture.Korean Tunneling Association annual meeting 2007

Workshop USTeC Seoul 2007. "The importance of in-situ rock stress in design and construction of sub-surface openings and a lot more!!"

Training course ITA Seoul 2006, "Large underground caverns"

Intl conference on in-situ rock stress. 2006. "Welcome speech"

PUBLICATIONS:

- Grøv, E. & Lu, M. (2015).** Understanding and utilizing in-situ rock stresses in design and building large rock caverns. VietRock 2015, arranged by ISRM Hanoi, Vietnam.
- Trinh, N. Q., Holmøy, K. H. & Grøv, E. (2015).** Rock engineering service for unlined hydropower tunnels in Vietnam. VietRock 2015, arranged by ISRM Hanoi, Vietnam.
- Grøv, E. (2014).** Sustainable urban development by use of underground space, examples from Norway. ACUUS 2014, Seoul, Korea 2014
- Macias, F.J., Jakobsen, P.D., Bruland, A., Seo, Y. & Grøv, E. (2014).** Rock Mass influence on Hard Rock TBM Performance Prediction. WTC Brasil 2014.
- Macias, F.J., Jakobsen, P.D., Bruland, A., Log, S. & Grøv, E. (2014).** The NTNU Prediction Model: A Tool for Planning, Risk Management and Claims in Hard Rock TBM Tunnelling. WTC Brasil 2014
- Grøv, E. (2014).** Sustainable urban development by use of underground space, examples from Norway. 14th World Conference of Associated research Centers for the Urban Underground Space, ACUUS 2014
- Grøv, E. (2014).** Introduction to Norwegian Tunneling. NFF Publication no. 23
- Grøv, E. (2014).** Norwegian contract practice, Suitable also for dealing with unexpected geological conditions. NFF Publication no. 23.
- Grøv, E., Funehag, J., Janzon, T. (2014).** Rock mass grouting in Sweden and Norway-A matter of cultural differences or factual causes? Geotechnical News, March edition
- Tadesse, D.B., Grøv, E.** Pressure design in unlined tunnels and shafts. WTC Brasil 2014
- Grøv, E. (2014).** FAST-Tunn, a research program to develop steel quality for hard rock TBM-cutters. WTC Brasil 2014
- Vassenden, S., Grøv, E. (2013).** Fast-tunn; et forskningsprosjekt for øket effektivitet på TBM-kuttere med 25%. Fjellsprengningsdagen.
- Grøv, E. (2013).** Understanding and utilizing in-situ rock stresses in design and building large rock caverns. Intl Symposium on Tunneling and Underground Space Construction for Sustainable development. Seoul, Korea 2013.
- Grøv, E., Funehag, J., Janzon, T. (2013).** Rock mass grouting in Sweden and Norway-A matter of cultural differences or factual causes? Nordic Grouting Symposium, Gothenburg, Sweden
- Grøv, E., Kane, A-P., Østhus, R., Jakobsen, P.D., Smading, S., (2013).** TBM Cutter Steel – a Challenge for Norwegian Steel Suppliers. Tunneling Journal June 2013
- Grøv, E., Nilsen, B., Bruland, A. (2013)** Sub-sea tunnels to oil field developments in northern Norway, TBM-tunnelling at 300m water depth in sedimentary rock. Strait Crossings 2013
- Grøv, E., Boye, C., Holmøy, K. H., (2013).** Tunneling Rogfast with TBM at 390 m below sea level. Strait Crossings 2013
- Likar, J., Grøv, E. (2013).** Underground citing of nuclear stations. World Tunnel Conference, Geneva.
- Grøv, E., Ravlo, A. (2013)** Arbeidsforhold. NFF Jubileumsbok.
- Trinh, N. Grøv, E. (2012).** Norwegian Hydropower Technology applied in Vietnam. NFF Publication no.21
- Grøv, E., Ravlo, A. (2013).** Bransjens betydning for samfunnet. NFF Jubileumsbok.
- Grøv, E. (2013).** En hyllest til den norske tunnelbyggemetoden. Byggeindustrien Jubileumsutgave 2013
- Grøv, E. (2012).** Norske grunnprinsipper må gjelde. Byggeindustrien nr. 17, 2012
- Grøv, E. (2012).** Vil ta tilbake hegemoniet. Geo nr. 7, 2012
- Grøv, E. (2012).** Støtter TBM-utspill. Byggeindustrien nr. 12, 2012.
- Grøv, E., Lu, M. (2012).** Understanding and utilizing in-situ rock stresses in design and building large rock caverns. ACUUS conference in Singapore.
- Woldmo, O., Grøv, E. (2012).** Planning for water inflow control in tunnels and caverns. ACUUS Conference in Singapore.
- Grøv, E. (2012).** Construction of long road tunnels in Norway, including the Lærdalstunnel. Conference on Long Tunnels. Piarç – Santiago de Chile.
- Grøv, E., Nilsen, B., Bruland, A. (2012).** TBM-Tunnelling at 300m water depth in sedimentary rocks. A concept for future offshore oil and gas field development. World Tunnel Conference Bangkok, Thailand.
- Grøv, E. (2012).** Støtter TBM-utspill. Byggeindustrien nr. 12 september 2012.
- Grøv, E., Jakobsen, P.D. (2012).** Extracting oil sand by conventional mining methods. World Tunnel Conference Bangkok, Thailand.
- Grøv, E., Woldmo, O. (2012).** Tight enough for its purpose by pre-excavation grouting. 3rd Brazilian Tunnelling Conference, Sao Paulo
- Grøv, E. (2012).** Underground storage with particular focus on hydrocarbon caverns. 3rd Brazilian Tunnelling Conference, Sao Paulo
- Grøv, E. (2012).** Contract philosophy in Norwegian tunnelling. NFF Publication no. 21
- Dahl, F., Jakobsen, P.D., Nilsen, B., Grøv, E. (2012).** Classifications of properties influencing the drillability of rocks, based on the NTNU/SINTEF test method. TUST Vol. 28. March 2012
- Grøv, E., Woldmo, O. (2012).** Modern pre.grouting technology in Norway. 5th Grouting conference USA.
- Grøv, E. (2012).** Håper på norske PhD-søkere. Byggeindustrien (In Norwegian)

- Grøv, E. (2012).** Skal bli verdensledende på TBM-teknologi. Anlegg og Transport. (In Norwegian)
- Grøv, E. mfl. (2012).** Ny tunnelstandard ett skritt tilbake. Teknisk ukeblad (In Norwegian)
- Grøv, E. (2011).** Vil gjøre TBM mer effektiv. Byggeindustrien nr. 16, 2011 (In Norw.)
- Grøv, E. (2011).** Frost amount; a relevant parameter for design of water and frost protection in Norway? Conclusions after a year of testing at SINTEF frost laboratory (In Norwegian). Fjellsprengningskonferansen 2011
- Grøv, E., Woldmo, O. (2011).** Modern grouting technology in Norway. Tunnelling20Twenty, Hong Kong
- Grøv, E., Ming, L. (2011).** Design & build large underground caverns. The importance of understanding and utilizing in-situ rock stresses. Joint HKIE-HKIP Conference on Planning and Development of Underground Space, Hong Kong.
- Nermoen, B., Grøv, Holter, K.G., Vassenden, S. (2011)** Permanent waterproof tunnel lining based on sprayed concrete and spray-applied double-bonded membrane; First norwegian experiences with testing under freezing conditions, design and construction. 6th Sprayed concrete conference Tromsø
- Grøv, E. (2011).** Brukes gale frostsikringskrav. Byggeindustrien sept. 2011
- Grøv, E. (2011).** Sprayed Concrete as an Integrated Part of Norwegian Tunnelling. 6th Sprayed concrete conference Tromsø
- Grøv, E., Kristiansen, J., Olsen, V. (2011).** Norwegian Drill&Blast Tunnelling. Tunnelling Journal July 2011
- Grøv, E. (2011).** "Active design in civil tunnelling with sprayed concrete as permanent lining" Münsteraner Tunnelbau – Kolloquium, Germany 2011. Also presented in TunnelBau August 2011
- Grøv, E. (2011).** Resultatet av ett års testing med Masterseal i Frostlaboratoriet. Bygg.no
- Grøv, E. (2011).** Fremtiden ligger i undergrunnen. Geo nr. 5 2011
- Nermoen, B., Rise, T., Grøv, E., Holter, K.G. (2010).** Gevingåsen jernbanetunnel. Utfordringer i kjent berg og bruk av sprøytbar membran som vannsikring. Fjellsprengningskonferansen 2010
- Vassenden, S., Grøv, E. (2010).** Frostlaboratoriet – testing av varme/kuldeutveksling mellom tunnel og omkringliggende bergmasse. Bergmekanikkdagen 2010.
- Grøv, E. (2010).** Ta vare på historien. Geo nr. 7 2010.
- Grøv, E. (2010).** Tunneler til oljefelter og anvendelse av TBM-teknologi. Geo nr. 6 2010
- Grøv, E. (2010).** Hva er det med de norske tunnelene? Fjellsprengningskonferansen 2010
- Grøv, E. (2010).** Bergspenningsmålinger og betydningen av bergspenninger for utforming og bygging av undergrunnsanlegg. Anvendt Bergmekanikk, NBG-kurs. In Norwegian
- Grøv, E., Woldmo, O. (2010).** Pregrouting – Prevention is better than cure. Tunnelling Journal Aug/Sept 2010
- Dahl, F. Bruland, A., Nilsen, B. Grøv, E. (2010).** Trademarking the NTNU/SINTEF drillability test indices. Tunnels & Tunnelling International July 2010.
- Grøv, E. (2009).** **Geotechnical investigations and geomechanics.** Workshop of "Underground Structures in Hot Climate Conditions". Riyadh, Saudi Arabia
- Grøv, E. (2009).** **The fundamentals of Tunnelling.** Workshop of "Underground Structures in Hot Climate Conditions". Riyadh, Saudi Arabia
- Grøv, E. (2009).** Conventional methods of Tunnelling. Workshop of "Underground Structures in Hot Climate Conditions". Riyadh, Saudi Arabia
- Tattersall, J. W., Grøv, E. (2009)** Rock Mass Groutability – Application of Norwegian Experience to Hong Kong. Hon Kong Tunnelling Conference 2009
- Grøv, E. (2009).** Sprayed concrete as permanent support for QingDao subsea tunnel in China. Key-note lecture. Intl Conference on Tunnelling, Shanghai, China 2009
- Grøv, E. (2009).** Nye underverker skapes i undergrunnen. Formannens innledningsforedrag Fjellsprengningskonferansen 2009.
- Grøv, E., Hansen, D.R., (2009).** 30m Rock Pillar to the Atlantic Ocean, Sub sea tunnelling in the Faroe Islands. 5th Symposium on Strait Crossings in Trondheim, Norway
- Grøv, E. (2009).** New challenges for the use of the underground. Publication no. 18 by the Norwegian Tunnelling Society.
- Grøv, E. (2009).** Sub sea tunnels in hard rock outside Norway. Publication no. 18 by the Norwegian Tunnelling Society
- Grøv, E., Nilsen, B. (2009).** Sub sea tunnel projects in hard rock environment in Scandinavia. Key-note lecture. International conference on Tunnelling, Beijing, China.
- Broch, E., Grøv, E. (2008).** Construction of long traffic tunnels in Norway. World Tunnel Conference in Agra, India. The same article was published in the magazine World Tunnelling in November 2008.
- Grøv, E. (2008).** Control of seepage in rock tunnels. Training course in conjunction with the WTC in Agra.
- Grøv, E. (2008).** Water control in Norwegian tunnelling. Invited lecture. 2nd Brazilian conference on tunnelling and underground structures. Sao Paulo, Brazil.
- Grøv, E., Shuming, Z., Lu, M. & Moe, H.L. (2008)** Sprayed concrete as permanent support for Qigdao sub sea tunnel in China. 5th symposium on sprayed concrete. Lillehammer, Norway
- Grøv, E. (2007).** Key note lecture. Sub sea tunnel projects in hard rock environment in Scandinavia. Conference on sub sea tunnelling Xiamen, China.

- Grøv, E. (2007).** Key note Lecture. Major principles of the Norwegian tunnelling philosophy. Annual meeting Korean Tunnelling Association. Seoul. Korea
- Grøv, E. (2007).** Geological requirements and challenges for underground hydrocarbon storage. NFF Publication no. 16 “Underground concepts for oil and gas industry”
- Grøv, E. (2007).** Examples from hard rock tunnelling. ITA Training Course in conjunction with the World Tunnel Conference 2007, Prague, the Check Republic.
- Lu, M., Dahle, H., Grøv, E., H. Y.Qiao, Q. L. Zhao & B. H. Wen (2006).** Design of rock caverns in high in-situ stress rock mass. ARMS-Singapore.
- Grøv, E. (2006).** Keynote Lecture. The importance of in-situ rock stress in design and construction of sub-surface opening. Intl symposium on utilisation of underground space in urban areas. Sharm Al Sheikh, Egypt.
- Grøv, E. (2006).** Experience with large rock caverns in Norway. ITA Training Course in conjunction with the World Tunnel Conference 2006, Seoul, Korea.
- Lu, M. & Grøv, E. (2006).** Norwegian experience on sub sea tunnels. Chinese Journal of Rock Mechanics and Engineering (in Chinese).
- Dahl, F., Grøv, E. & Brevik, T. (2006).** Development of a new direct method for estimating cutter life, based on Sievers J miniature drill test. Approved for publishing in TUST
- Grøv, E. & Broch, E. (2006)** Construction of long Norwegian tunnels. World Tunnel Conference 2006, Seoul, Korea.
- Grøv, E. & Hansen, D.R. (2005).** 30 m rock pillar to the Atlantic Ocean – Sub sea tunnelling in the Faro Island. To be printed in World Tunnelling.
- Grøv, E. (2005).** Storage of hydrocarbon products in unlined rock caverns. NFF Publication no. 15 “Sustainable underground concepts ”
- Grøv, E., Blindheim, O.T., Nilsen, B. (2005)** Norwegian sub sea tunnels. NFF Publication no. 15 “Sustainable underground concepts ”
- Grøv, E., Blindheim, O.T., Nilsen, B. (2005)** Nordic sub sea tunnels. Open Session ITA 2005 on Major Sub sea tunnelling projects
- Blindheim, O. T. & Grøv, E. (2003).** Contract suitability – unit or fixed price. Tunnels & Tunnelling International, December 2003.
- Blindheim, O. T., Broch, E. & Grøv, E. (2003).** Storage of gas in unlined rock caverns – Norwegian experiences over 25 years. ITA World Tunnel Congress, Singapore, 2004
- Blindheim, O.T. & Grøv, E., (2003).** Suitability of unit rate contracts for dealing with unexpected geological conditions. Conference on Underground Construction, London.
- Grøv, E. Blindheim, O. T. (2003).** Risk allocation in 'adjustable fixed price contracts'. Tunnels & Tunnelling International, June 2003.
- Rodrigues, C., Grøv, E., Prada, S. (2002).** Tunnelling in volcanic environment-experiences from some selected projects in Madeira Island, Iceland and Faeroe Island. Eurock 2002, Madeira Island, Portugal.
- Broch, E., Grøv, E., Davik, K. I. (2002).** Inner lining in Norwegian road tunnels. Tunnel and Underground Space technology (TUST) 2002.
- Blindheim, O. T., Grøv, E., Nilsen, B. (2002).** The effect of mixed face conditions on hard rock TBM performance. ITA World Tunnel Congress Sydney 2002.
- Grøv, E. (2002).** Water control in Norwegian tunnelling. World Tunnel Congress Sydney 2002.
- Grøv, E. (2001).** Introduction to water control in Norwegian Tunnelling. NFF publication no. 12 “Water control in Norwegian Tunnelling”.
- Steingrimsón, J.H., Grøv, E., Nilsen, B. (2002).** The significance of Mixed-face conditions for TBM performance. World Tunnelling (2002).
- Grøv, E., Reinert Hansen, D. (2001).** Vagatunnilin, the Faeroe Islands, 30 m rock cover to the Atlantic ocean. Strait Crossing, Bergen, Norway 2001.
- Grøv, E. (2001).** Shunting area in rock caverns, an environmental friendly solution. ITA World Tunnel Congress, Milan 2001.
- Grøv, E. (2001).** Active design in civil tunnelling with permanent sprayed concrete lining. International Conference on Engineering Developments in Shotcrete. Hobart, Tasmania.
- Grøv, E. (2000).** ”Norwegian” tunnels to Iceland and the Faeroe Islands. Byggeindustrien nr. 4, 2000 (In Norwegian).
- Grøv, E. (1999).** Tunnel know-how for export. GEO 12/99. (In Norwegian).
- Grøv, E., Haraldsson, H. (1999).** Hvalfjörður sub-sea tunnel Iceland. Pre-construction forecasts and construction experiences. Strait Crossing Oslo '99.
- Grøv, E. (1999).** Input formulation to numerical modelling in rock engineering. An attempt to prepare a streamlined procedure. ITA World Tunnelling Congress, Oslo, 1999.
- Grøv, E., Eriksson, S., Kröyer, J. and B. A. Hardarson (1998):** Crossing the North Atlantic. World Tunnelling, October 1998.
- Grøv, E., Hardarsson, B., Eriksson, S. and Kroyer, J. (1998).** The Hvalfjörður sub-sea road tunnel, Iceland. A hard rock concept in basaltic rock types. International conference of underground infrastructure, Stockholm, Sweden.

- Grøv, E. (1998):** Rock stresses and their influence on design of underground openings. Course on rock stresses, NTNU Trondheim Jan.'98. (In Norwegian).
- Grøv, E. (1997):** Hvalfjörður Sub-sea road tunnel, Iceland, a Norwegian tunnelling concept in volcanic rock types. Fjellsprenningskonferansen 1997. (In Norwegian).
- Rawlings, C.G., Simic, M., Grøv, E. (1997):** Tunnelling beneath Hvalfjörður, Iceland. Tunnelling '97, London, England.
- Aagaard, B., Grøv, E., Blindheim, O. T. (1997):** Sprayed concrete as rock support system for adverse rock mass conditions. International symposium on rock support, Lillehammer, Norway.
- Grøv, E., Blindheim, O. T. (1997):** Selecting properties of sprayed concrete for various rock mass application. International symposium on rock support, Lillehammer, Norway.
- Grøv, E. (1990):** Experiences from surge chamber Torpa. NIF-course on Grouting of tunnels, rock caverns and open pits. (In Norwegian).