Managing Technical Risks
Matrisk

List of projects

December 2009

Matrisk

Civil Engineering Projects

Traffic risk analysis – Tromsø

Analysis of Traffic risks in a tunnel system in Norway by using Bayesian Probabilistic Networks (BPN).

Client: Statens vegvesen Region nord, Norway, 2009.

Traffic risk analysis - Ev016 Flenjatunnelen

Analysis of Traffic risks in a tunnel system in Norway by using Bayesian Probabilistic Networks (BPN).

Client: Statens vegvesen Region vest, Norway, 2008.

Risk Management and Decision Support for the Andermatt Tourist Resort (ATR)

Development of a general risk based strategy for the planning and construction of the ATR; feasibility for the utilization of deep geothermal energy resources for the ATR; development of a holistic safety concept for the implementation of the planned ATR into the cantonal land use planning requirements. **Client:** Andermatt Alpine Destination Company AG, Switzerland, 2007 – 2008.

Traffic risk analysis - E39 Gartnerløkka – Hannevikdalen

Analysis of Traffic risks in a large tunnel system in Norway by using Bayesian Probabilistic Networks (BPN).

Client: Statens vegvesen Region Sør, Norway, 2007.

Computational Framework for the Asset Integrity Management of Large Deteriorating Concrete Structures.

Development and implementation of a strategy for the risk based asset integrity management of concrete surfaces subject to corrosion of the reinforcement, including the development of a specialised software tool.

Client: COWI AS, Lyngby, Denmark, 2004-2005.

Third Abu Dhabi Island Bridge Crossing. Check of the design basis for the third bridge crossing for Abu Dhabi Island . Position: Expert consultant to the client in collaboration with COWI. **Client**: Consultant to COWI AS on project for the Works Department, Emirate of Abu Dhabi, 2002.

MMS - Management Maintenance Systems. Responsible for establishing basis, risk based models and software systems for quantifying the relation between the operation and use of the rail system and need for maintenance and reinvestments. The project utilizes principles of the economical decision theory and RCM methods. Position: Project manager for advanced risk assessments. **Client**: Employed by COWI working for the Danish Railways, Denmark , 1996-1998.

Safeguarding and Rehabilitation of the Zarate Brazo Largo Bridges Cable Stayed Bridges. Assessment of cable deterioration, reliability evaluation of strength and fatigue life of damaged stays (parallel wire bundles), planning and evaluation of laboratory tests on stay wires, reliability based evaluation of safety format and design basis for emergency and rehabilitation phases, using statistical models for traffic and train loads. *Position*: Lead safety and reliability engineer. **Client**: Employed by COWI working for Direction National de Vialidad , Argentina 1996-1998.

Øresund High Bridge . Probabilistic fracture mechanics and crack growth analysis for verification of safety for welded connections in the main girder. *Position*: Lead engineer. **Client**: Employed by COWI working for Skanska, Sweden , 1997.

Storebælt East Bridge . Fracture mechanic and crack growth analysis for verification of safety for cast hanger clamps with defects. *Position*: Lead engineer. **Client**: Employed by COWI working for Storebælt, Denmark , 1997.

DuraCrete Project BE 95-1347. Durability based design of concrete structures. Formulation of the basis for a design code for concrete structures taking basis in durability aspects and service life costs. The design basis is formulated using state of art models for deterioration and strength of concrete structures. The calibration of the design basis is performed using statistical methods and modern reliability analysis. *Position*: Responsible for reliability analysis and probabilistic modeling. ***Client***: Employed by COWI working for the European Community, Brussels , 1995-1998.

Guideline for Reliability Based Assessment of Existing Highway Bridges. Two phase project performed in collaboration with Prof. O. Ditlevsen, DTU (phase I) and the Danish Road Directorate (phase II). During the project a guideline for reliability bases assessment of existing bridges is formulated. Phase I (completed) comprises a thorough description of probabilistic framework, modelling of loads and structural capacity. Phase II adapts the special conditions valid for the bridges of the Danish road directorate to the general models identified under phase II. Position: Initiator and project leader (COWI). **Client**: Phase I: The Danish National Science Foundation (STVF), Phase II: Employed by COWI working for the Danish Road Directorate , Denmark .

Lillebæltsbroen of 1935, Large Riveted Steel Bridge . Reliability based reassessment of characteristic train loads for ultimate limit state (ULS) and fatigue limit state (FLS) verification of superstructure using non-stationary FEM evaluations for the assessment of bridge dynamics. *Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Railways, Denmark , 1996.

Design Basis for Cable Stayed Bridge Using Carbon Fibre Based Stays and Reinforcement. Calibration of partial safety factors for the design of a cable stayed bridge using carbon fibre material for the stays as well as the reinforcement of the girder. The partial safety factors are calibrated according to specific safety requirements using structural reliability analysis. *Position*: Responsible for structural reliability assessments and methodical developments. **Client**: Employed by COWI working for The Danish Road Directorate, Denmark, 1996.

Ørestad, Mini Metro. Design Basis for Civil Works in connection with the design of the Mini Metro Structures, Copenhagen , Denmark . The Euro Codes were used as basis for the Design Basis. *Position*: Project manager and lead engineer. **Client**: Employed by COWI working for Ørestadsselskabet, Denmark , 1995.

Dronninggårdvej Bridge , Railway Bridge . Reliability analysis with respect to fatigue life and evaluation of inspection methods. *Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Railways, Denmark , 1994.

Lillebæltsbroen of 1935, Large Riveted Steel Bridge . Strength and fatigue life re-assessment. The work included a detailed assessment of the fatigue characteristics for riveted structures including FEM analysis of stress concentration factors. Reliability analyses were performed to assess the residual fatigue life and the effect of inspections.*Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Railways, Denmark , 1994.

Gudenåbroen, Pile Foundation, Concrete Bridge . Strength and durability reassessment in connection with an up-classification of the bridge. The work included a re-evaluation of the concrete strength and a comprehensive probabilistic model of the pile foundation strength updated by pile strength experiments. *Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Road Directorate, Denmark, 1994.

Eurocodes, Consequence Analysis. An evaluation of the ENV 1 Part 3 (traffic loads) with respect to an assessment of the differences in reliability as compared to the existing specifications for traffic loading. *Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Road Directorate, Denmark, 1994.

Chloride Penetration Model. Corrosion Initiation Life. Formulation of statistical methods for the assessment of the corrosion initiation life for reinforced concrete structures. The basis of the models consists of observed chloride concentration profiles and the diffusion theory. *Position*: Lead engineer. **Client**: Employed by COWI working for The Danish Road Directorate, Denmark, 1994.

Parallel Wire Cable Reliability. Statistical Analysis of Fatigue Life Experimental Data of Steel Wires for the construction of the Storebælt suspension bridge. *Position*: Assistant to Prof. Dr. Ing. habil. Rudiger Rackwitz. *Client*: Employed by COWI working for Storebæltforbindelsen, Denmark , 1989

General statistical analysis, decision modeling & software development projects

RBI Software for Offshore Process Systems. Development and implementation of the iPlan software for the risk-based inspection planning for process systems offshore. Client: COMIMSA, Saltillo, Mexico, 2005-2006

RBI Software for Offshore Steel Structures. Development of the tailor-made iPlan software for the planning of in-service inspections of offshore steel structures. Client: Maersk Oil & Gas, Denmark, 2002-2004

Danish Standard. Statistical analyses of load bearing capacity of masonry. *Position*: Expert consultant. **Client**: Danish Standard, 2003.

Code Reliability Quantification Study. Quantitative assessment of the reliability and safety of structures designed according to the proposed partial safety factors and load combination factors of the Swisscodes. *Position*: Expert consultant to the client. **Client**: Swisscodes Project, Switzerland , 2002.

Danish Standard. Reliability based calibration of partial safety for the Danish National Annex to Eurocodes. *Position*: Expert consultant. Client: Danish Standard, 2002.

Centre for Masonry Structures, Denmark . Statistical basis for testing and quality control of clay masonry units. *Position*: Expert consultant. **Client**: Centre for Masonry Structures, 2002.

Danish Hydraulic Institute. Statistical basis for extreme short- and long-tern design waves. *Position*: Expert consultant. **Client**: Danish Hydraulic Institute working for Mærsk Oil and Gas, 2000.

Danish Standard. Reliability-based calibration of partial safety for the Danish Structural codes. *Position*: Expert consultant. **Client**: Danish Standard, 1996-1998.

Decision Making for Requalification of Structures. BRITE EURAM project 5935. Development of a common decision basis for the requalification of bridge structures, offshore structures and power plant installations. Multi criteria decision making. Bayesian uncertainty modelling. Fuzzy uncertainty modelling. Case studies. *Position*: Responsible for reliability analysis and probabilistic modelling. **Client**: Employed by COWI working for the European Community, Brussels, 1993-1996.

The Finite Element Program NASCOM. Further developments of the commercial Finite Element computer code for linear elastic analysis, including temperature gradient loading and Eigen-frequency analysis. *Position*: Team member. **Client**: Internal development as partner of RCP-ApS , Denmark , 1993.

IMREL. Development of a Software Module (IMREL) for the Inspection and Maintenance Planning for Fixed Offshore Structures subject to fatigue. Position: Project manager and lead engineer. Client: As partner of RCP-ApS working for ELF-Production, ELF Aquitaine, France , 1992.

RISC Project. Implementation of Reliability Software in the RISC Project (University College London) which is an integration of expert systems with inspection and maintenance planning software using advanced models for the fatigue crack growth. *Position*: Responsible for reliability analysis and probabilistic modelling. **Client**: As partner of RCP-ApS working for the European Commission, Brussels , 1992.

Fatigue Experiment Planning. Statistical Considerations of Lifetime Predictions. Developments of models for the crack initiation lifetime of metals subject to low and high cycle fatigue loading. *Position*: Lead engineer. **Client**: As partner of RCP-ApS working for MAN-Technologie GmbH, Munich , Germany , 1992.

ARIANE 5 Front Skirt Structure. Statistical analysis of experimental data on the strength and stiffness. Reliability analysis and estimation of the systems reliability of the ARIANE 5 front shirt structure. *Position*: Responsible for reliability analysis. **Client**: As partner of RCP-ApS working for MAN-Technologie GmbH, Munich, Germany, 1990-1992.

Traffic Modelling for Storebælt. Statistical Analysis and Collection of Data on Congested Traffic (Storebælt-Eastern Bridge). Collection of data on queue length and queue duration from the German highways. *Position*: Assistant to Prof. Dr. Ing. habil. Rudiger Rackwitz. **Client**: Storebæltforbindelsen , Denmark , 1989.

Offshore & Marine Engineering Projects

Inspection Planning Philosophy. Development of a general inspection planning procedure for fixed offshore steel structures, by joint consideration of all relevant types of hazards and deterioration modes. Consultancy in the implementation of the approach using Bayesian nets. *Position*: Responsible for overall methodology and philosophy and for the development of RBI plans. **Client**: Instituto Mexicano de Petroleo, Ciudad de Mexico, 2004-2005.

Bay of Campeche Jacket Structures. Service life assessment and extension study using risk based approaches for the fixed steel jacket structures in the Bay of Campeche, Mexico. **Position**: Responsible for overall methodology and philosophy and for the development of RBI plans. **Client**: Pemex, Ciudad del Carmen, Mexico, 2002-2004.

Decommissioning Risk Assessment. Technical risk assessment for the" refloat" and "in-situ" decommissioning options for the concrete structures MCP01 on the Frigg field including - structural reliability analysis - degradation assessment and modelling for the concrete structures - assessment of residual capacity of the concrete structures - operational risk analysis - cost benefit analysis using Bayesian networks. *Position*: Expert consultant to COWI. **Client**: Consultant to COWI working for Totalfinaelf, Stavanger , Norway , 2003.

Generic Risk Based Inspection Planning – Field Implementation. Development and implementation of generic risk based fatigue crack growth inspection plans for all the Mærsk Olie og Gas fixed steel offshore platforms in the North-Sea. *Position*: Project manager and lead engineer. **Client**: Mærsk Olie og Gas, Esbjerg, Denmark, 2001-2003.

Bongkot Jacket Structures. Development of risk based inspection (RBI) plans for all fixed steel jacket structures of the Bongkot oil production field. *Position*: Expert consultant to Bureau Veritas, Paris , France . **Client**: Consultant to Bureau Veritas working for TotalFinaElf, Bangkok, Thailand, 2002-2003.

Chad FSO RBI. Development of risk based inspection plans for the floating production and off-loading unit Chad . The RBI includes detailed inspection planning in regard to fatigue crack growth as well as corrosion. *Position*: Expert consultant to Bureau Veritas, Paris , France . **Client**: Consultant to Bureau Veritas working for ExxonMobil, Surrey , UK., 2001-2002.

Decommissioning Risk Assessment. Technical risk assessment for the" refloat" and "in-situ" decommissioning options for the concrete structures TCP2, TP1 and CDP1 on the Frigg field (Lead Engineer) including - structural reliability analysis - degradation assessment and modelling for the concrete structures - assessment of residual capacity of the concrete structures - operational risk analysis - cost benefit analysis using Bayesian networks. *Position*: Project manager and lead engineer, 1999-2000. Expert consultant, 2000-2002. **Client**: Consultant to Bureau Veritas working for TotalFinaElf, Stavanger, Norway, 2000-2002.

Jotun & Balder Risk Based Inspection Planning. Risk based inspection planning for the offshore installations on the Jotun and Balder fields (Esso Norge) including – static process equipment – FPSO ship hull structures – jacket and topside structures – sub-sea satellites, flexible piping and risers. Project responsible for the RBI for the process equipment and development of probabilistic models for the degradation of flexible pipelines based on failure rate statistics. *Position*: Project lead engineer. **Client**: Employed by Det Norske Veritas working for Esso Norge, Stavanger, Norway, 1998-1999.

In-situ disposal of the Ekofisk Tank and Barrier structures. Responsible for the assessment of the future degradation and associated risks for the Ekofisk Barrier and Tank structures corresponding to different in-situ disposal and degradation mitigation options. Responsible for the development of economical risk models for the evaluation and comparison of the different disposal options. *Position*: Responsible for reliability and risk assessments. **Client**: Employed by Det Norske Veritas working for Phillips Petroleum, Stavanger, Norway, 1998-1999.

Probabilistic Framework for RBI. Responsible for the development of a consistent probabilistic framework for the DNV software ORBIT-Offshore for RBI for process systems. This includes the development of a Bayesian methodology for the utilisation of inspection results in the inspection planning. *Position*: Project manager. **Client**: Employed by Det Norske Veritas, Internal DNV development, Oslo, Norway, 1998-1999.

Inspection Philosophy Document, Formulation of inspection philosophy for the inspection planning for the South Arne offshore installation. *Position*: Lead engineer. **Client**: Employed by Det Norske Veritas working for Amarada Hess , Denmark , 1998.

Management of Marine Fouling. Assessment of removal and design marine fouling profiles for fixed steel offshore structures in the North-Sea. Mærsk Oil and Gas, 1995. *Position*: Project manager and lead engineer. **Client**: Employed by COWI working for Mærsk Olie og Gas, Esbjerg, Denmark, 1994-1995.

Nohoch-B Offshore Production Platform. Inspection and maintenance planning of fixed steel offshore structures, using IMREL software. Assisting NDE-Techology, University College London in using the IMREL software for reliability and life cycle costs based inspection planning of Pemex structures in the Gulf of Mexico. *Position*: Project lead engineer. **Client**: Consultant to Instituto Mexicano de Petroleo, IMP, Mexico City, Mexico, 1993-1995.