

Norwegian Tunnelling Technology and Practice Workshop Singapore February 09

”Norwegian Contract System and Risk Sharing”



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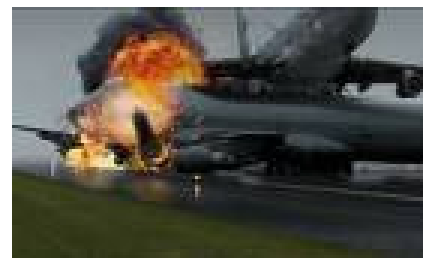
Norwegian Contract System and Risk Sharing

**Contract management or
risk management?**

**Risk management by
contract arrangement?**

**Management of risk by
adequate contract and
management?**

**Could the contract be a tool
for proper risk
management?**



Norwegian Contract System and Risk Sharing

**A CODE OF PRACTICE FOR
RISK MANAGEMENT OF
TUNNEL WORKS**

**In 2006 ITIG (Intl
Tunnel Insurance
Group) with the
endorsement of ITA
issued a code of
practice for risk
management of tunnel
works**

**This is a good initiative, but it won't work without
a tool like a proper contract**

Norwegian Contract System and Risk Sharing

What is traditional Norwegian contract practice?

- Remeasurement, all expected items are *quantified*, *detailed described* and *priced*, contractor *reimbursed* acc. to his tendered unit rates, that stay valid during the contract
- 2 contract standards, well known to contractors
- Employer responsible for the preparation of all design
- Risk sharing principle
- Standard capacities on items that may limit advance rate
- Normally 100% variation in quantities applies without adjustment of unit rate

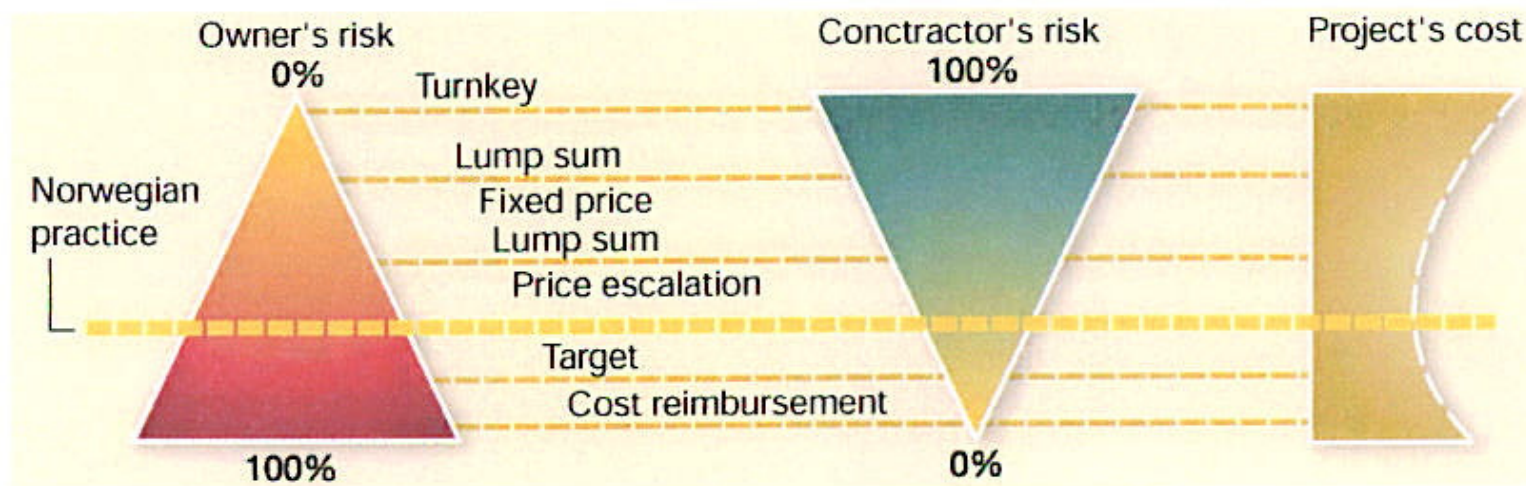
Norwegian Contract System and Risk Sharing

What is traditional Norwegian contract practice?

- Owner controlled contracts, owner directs and pays
- Geological report follow tender/contract documents
- Decision taking at tunnel face, qualified follow-up
- Active design in support determination, drained tunnel concept
- Contract has tools to deal with water inflow/handling

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Contractual risk sharing principles



Norwegian practice is in this context equivalent to Unit Rate contracts, or Remeasurement applied in:

* 4000km of hydropower tunnels *appr. 1500km road & railroad tunnels + + +

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Risk sharing in Norwegian tunnel contracts

- The Owner carries the risk for the rock mass conditions
- The Contractor carries the risk for the appropriate and efficient handling of the works focusing to improve technical and organisational performance.
- The Owner is responsible for the collection of information on ground conditions. All information is disclosed to the tendering contractors for their own interpretation.
- The Owner presents their estimate on quantities on rock support, rock mass grouting etc. all expected measures are quantified in the tenders/contracts.
- The contracts include regulations for extension of construction time based on actually performed quantities.

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Risk aspects in tunnelling



General risk elements:

Type of project

Type of Owner

Type of project organisation

Type of financing etc.

Two particular risk aspects:

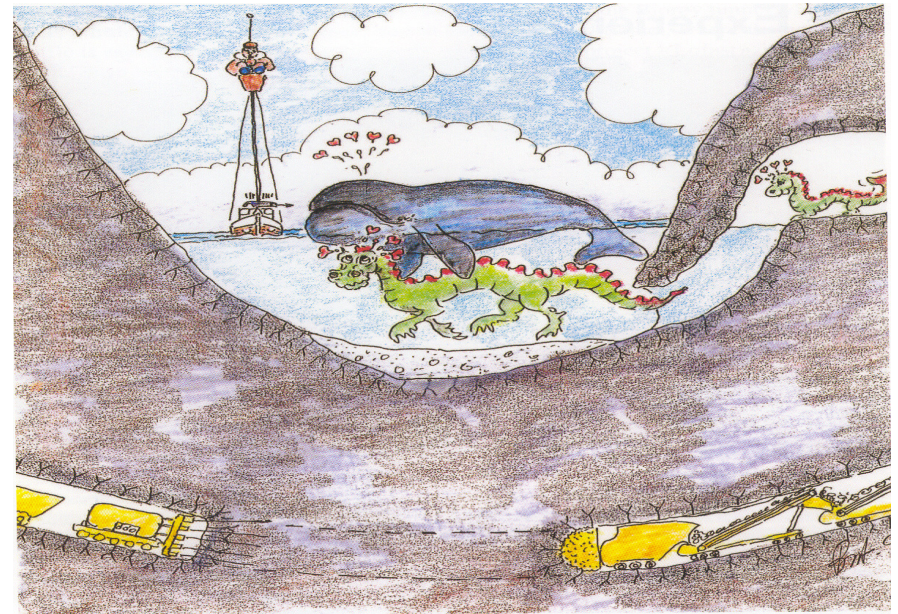
- Ground conditions
- Work performance

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Risks associated with Ground conditions

- Seismicity
- Waterinflow
- Rock support
- Rock mass grouting
- Abrasiveness

In Norwegian tunnelling, the Owner of the project holds the risk associated with ground conditions



Are there any surprises to be expected in connection with extensive use of subsea tunnels?

- He provides the ground and decides the project location
- He is responsible for the pre-investigations
- He takes the increased or reduced costs if changing ground conditions

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Risk associated with performance

- Quality of the works
- Time to conduct one unit in the bill of quantity
- Typically Contractors responsibility and risk
- Important measures for the Contractor are such as:
 - Contractors quality assurance plan
 - Well defined and developed working procedures
 - Trained and committed workers and supervisors
 - System analysis to identify and describe hazards, geological and organizational which could jeopardize construction



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”Standard capacities” or equivalent time principle

- Identify the best qualified estimate on rock support and grouting and advance delaying units
- Disclose these quantities in the BoQ
- Determine the construction time by using these quantities
- Avoid tactical quantities
- Use these to regulate bonus/penalty accordingly

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Some inevitable facts regarding risk

- We cannot investigate to such a level that all risk is ruled out
- We have to accept that some remaining risk exists
- We can reduce the risk to an acceptable level
- We aim at improving the predictability of risk aspects
- We aim at obtaining a fair and appropriate risk sharing between the Owner and the Contractor
- We realize that each project is unique and risk must be identified and managed in each particular case

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Aspects to be focused during construction

- High capacity equipment, multi-skilled workmen at the tunnelling face allowing high utilisation of the equipment.
- Adaptability to the actual ground conditions, careful following-up of the encountered rock mass by mapping and classification for a best fit the of rock support measures.
- Observation of the ground behaviour by visual surveying and physical measurements if required fulfilling the intentions of the Observational method.
- Installation of permanent rock support as close to the tunnel face as practically possible fulfilling the criteria for permanent support work.

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Co-operation at the tunnel site

- In a broad perspective there are probably more common interests at the construction site than interest of conflicts.
- Respect for the different roles and values as tunnelling is a complex process and various skills are needed at the construction site.
- Constructive co-operation between the representatives of the involved parties.
- Experienced professionals participating in the decision making.
- Solve conflicts at construction site by negotiation after the technical issues have been settled.



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Objectives of geological report in tender documents

- Convey information from the owner to the tenderers and the successful winner of the contract
- Enable the contractors to make up their own understanding of the geological model, and consequences
- Ensure predictability (increased?) is a key word that both Owners and contractors are seeking
- Disclose all geological/geotechnical data collected by the Owner
- ITA recommends full disclosure, separate factual data and interpretive data
- Unfortunately the trend in Norway is to minimize these reports

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Something to keep in mind!

- If truly unexpected or unforeseeable conditions occur, unit rate contracts may not provide a magical solution
- The success of contract will then depend on the ability and willingness of the parties to solve problems, technically and contractually
- Fixed price contracts may not provide a magical solution either, although being apparently predictable in price
- If unexpected, or unforeseeable conditions occur, the Owner may end up taking the risk and costs anyway
- The contractor must be able to price the risk!



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What is characterizing an adjustable fixed price contracts?

- Utilising both fixed price elements and remeasurable elements, support and grout are remeasured items, rest is fixed
- Can be DB as well as Engineers design
- Dedicating the risk to the most appropriate party
- Including incentives in the contract to focus tunnelling progress and advance of the tunnelling face
- Maintaining the use of "Standard capacities"
- Applying functional requirements on tunnelling elements

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Various types of incentives to encourage increased productivity and efficient but safe tunnelling

- Bonus for early completion
- Bonus for Health and Safety goals
- Sharing of savings with alternative solutions
- Bonus if less support and grout works have been applied
- Bonus for reduced water inleakage to the tunnel
- Regulations for changed ground conditions



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The ultimate manifestation of success and proper risk & contract management; cutting the ribbon at scheduled time and cost with quality as specified!

谢谢! - Tusen Takk