

# *International Tunnelling Association (ITA) and Risk*

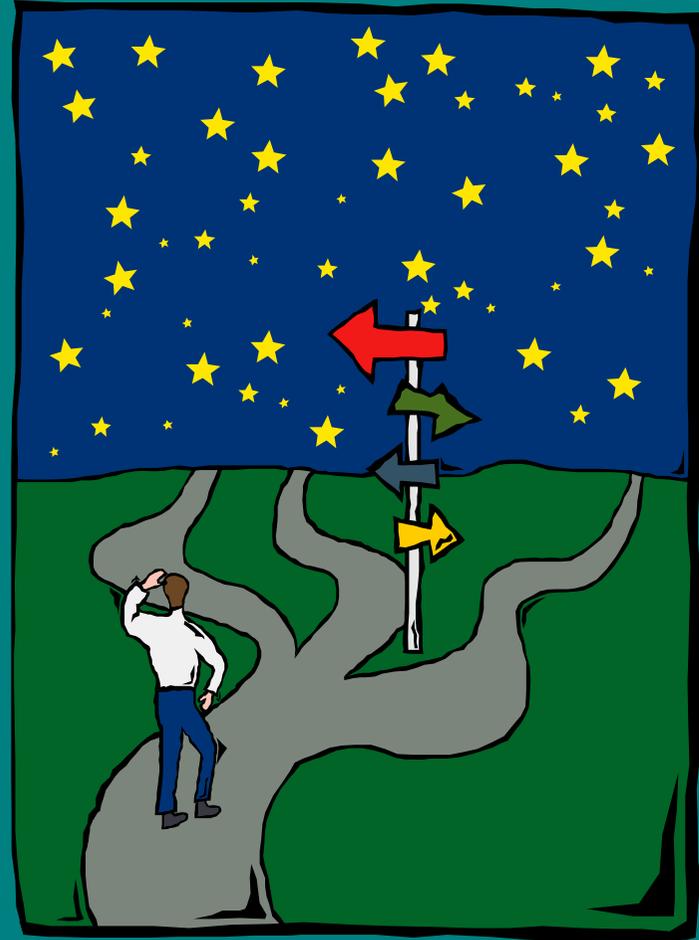
## George Fox Seminar

Harvey W Parker

President, International Tunnelling Association (ITA)

January 25, 2005

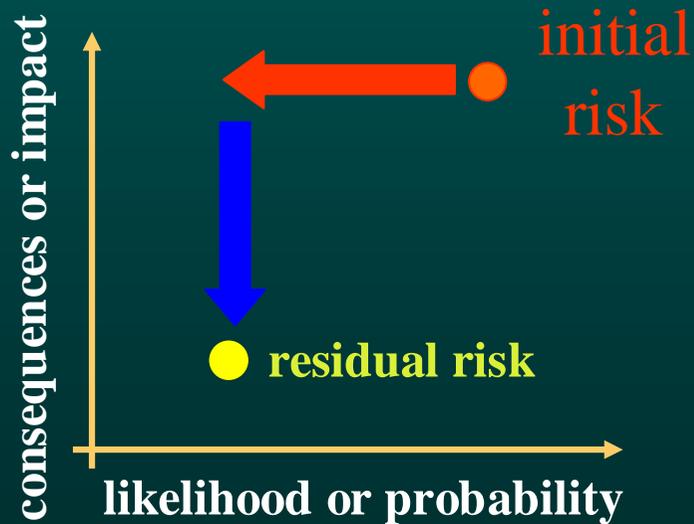
# RISK & CHOICES ARE PLENTIFUL



Harvey W. Parker March, 2004

# NEED FOR RISK MANAGEMENT

Realistically, not all risks associated with complex construction projects can be entirely avoided or mitigated.



# Risk Management for Tunnels

- Now Routine for Major Projects Worldwide
- ITA Guidelines
  - Published last year (2004)
- British Code of Practice
  - Published and in Effect
  - Attempts to Require it Internationally
- International Code of Practice
  - To be published

# International Tunnelling Association

- ITA Founded in 1974
- Organization of Member Nations
  - NGO of the United Nations
- Member Nations = 53      ~20,000 People
- Annual Congress & General Assembly
  - Istanbul in May, 2005
  - Working Groups/Committees
- Communications
  - Website: [www.ita-aites.org](http://www.ita-aites.org)
  - ITA @News
  - Scientific Journal: TUST



Vol. 19, No. 3, May 2004

ISSN 0886-7798

Original research, innovations and case studies in the development of tunnelling, trenchless technology and underground space

# Tunnelling and Underground Space Technology

incorporating **Trenchless Technology Research**

Editors: Einar Broch (Norway); Chris Rogers (UK); Raymond Sterling (USA); Jian Zhao (Singapore)



- geo-investigation
- underground mapping
- planning
- regulation
- design
- construction
- operation
- maintenance

[www.elsevier.com](http://www.elsevier.com)

Also available on  
SCIENCE @ DIRECT®  
[www.sciencedirect.com](http://www.sciencedirect.com)



Tunnelling and Underground Space Technology 19 (2004) 217–237

---

Tunnelling and  
Underground Space  
Technology  
Incorporating Trenchless  
Technology Research

---

[www.elsevier.com/locate/tust](http://www.elsevier.com/locate/tust)

ITA/AITES Accredited Material

## Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2 <sup>☆</sup>

Søren Degn Eskesen, Per Tengborg, Jørgen Kampmann, Trine Holst Veicherts

*ITA Working Group 2, Research, ITA-AITES, c/o EPFL, Bat GC, CH 1015 Lausanne, Switzerland*

# Tunnel Construction Risk

- Construction Imposes Risk on:
  - All Parties involved
  - Those not directly involved
- “Traditionally, risks have been managed indirectly through the engineering decisions taken during the project development.”
- ITA Guidelines recommend Systematic Risk Management Techniques instead

# Systematic Risk Management Techniques

- The practice of performing risk management requires much experience, practical and theoretical knowledge.
- Can not cover every aspect therefore Guidelines are given by ITA to suggest Best Practice

# Risk Management is Formula For:

- Minimizing Cost to Owner
- Maximizing Profit for Contractor
- Achieved by Joint
  - Planning and Problem Solving
  - Scheduling and Mitigation of Delays
  - Partnering

# Risk Management

- Risk Identification
- Risk Assessment
- Risk Analysis
- Risk Elimination
- Risk Mitigation

# Risk Objectives & Strategy

- Identify Hazards
- Identify Mitigation Measures
- Implement Measures to:
  - Eliminate Risk
  - Mitigate Risk to ALARP
- Conduct Risk Assessment at Each Stage of Design and Construction

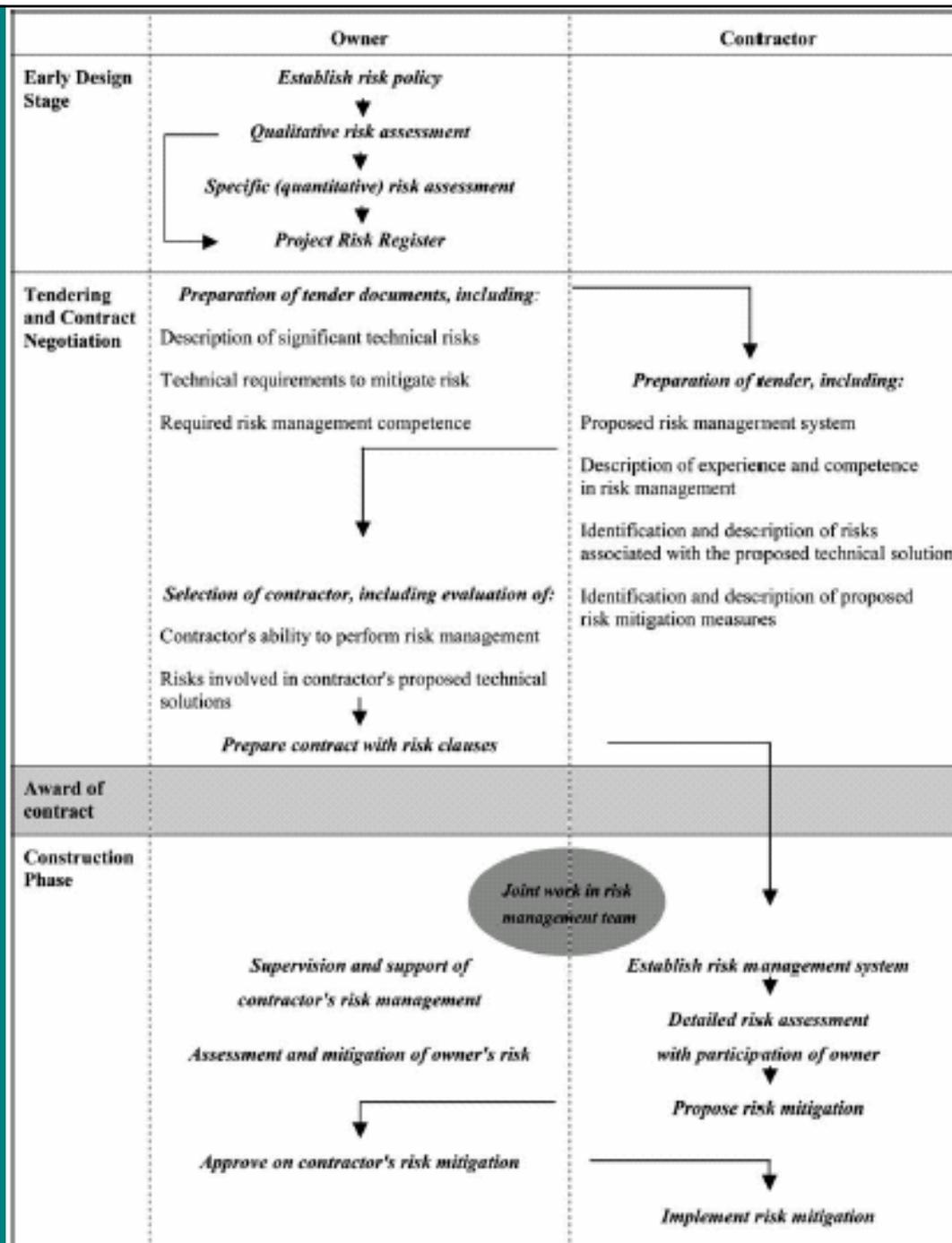
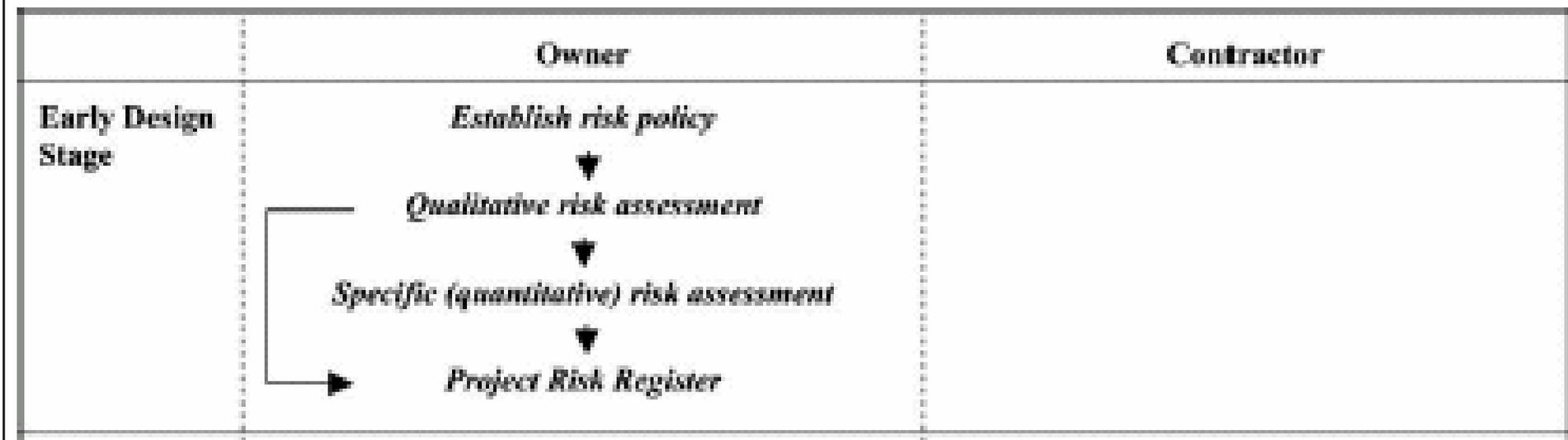


Fig. 1. Risk management activity flow for owner and contractor.



**Tendering  
and Contract  
Negotiation**

*Preparation of tender documents, including:*

Description of significant technical risks

Technical requirements to mitigate risk

Required risk management competence



*Selection of contractor, including evaluation of:*

Contractor's ability to perform risk management

Risks involved in contractor's proposed technical solutions



*Prepare contract with risk clauses*

*Preparation of tender, including:*

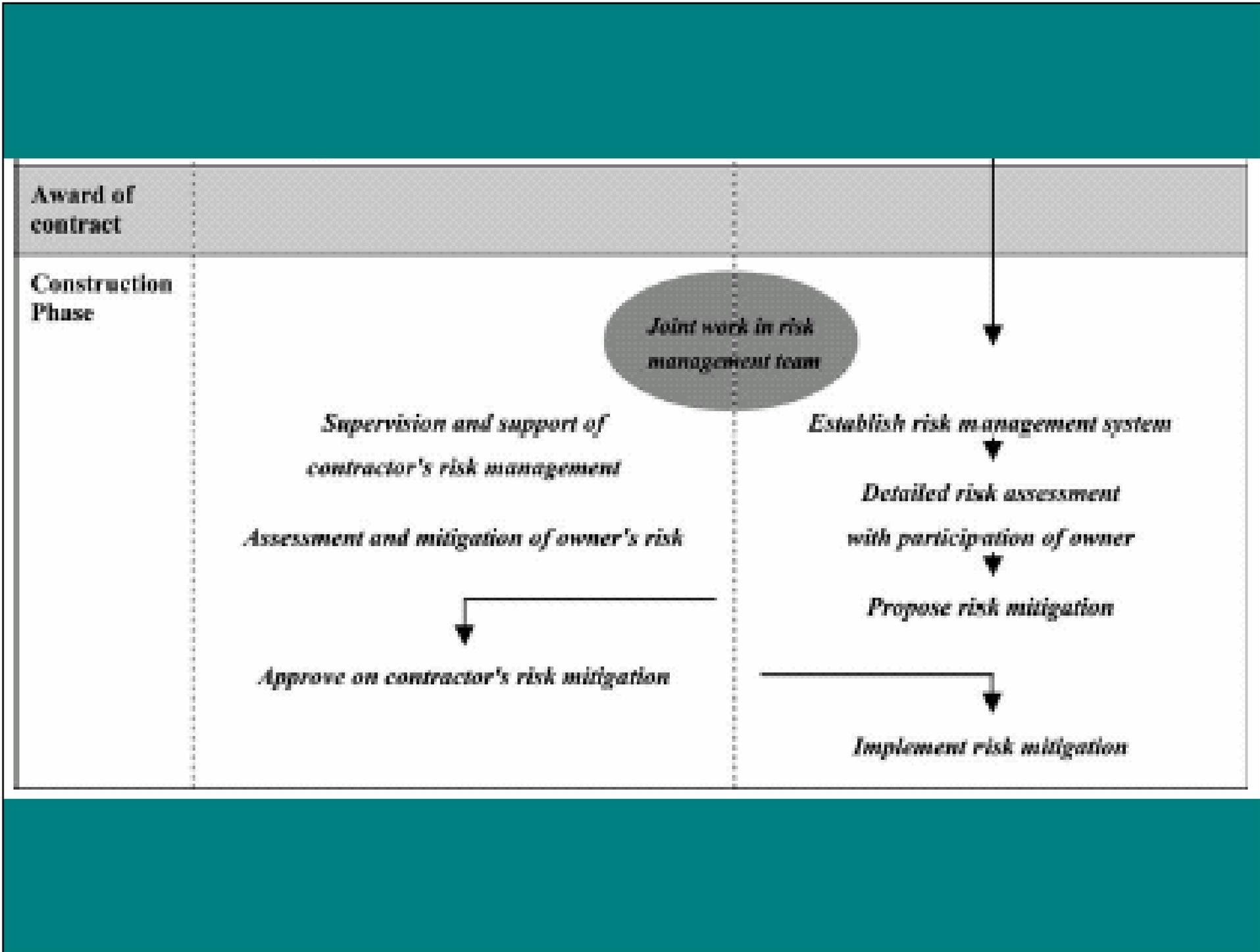
Proposed risk management system

Description of experience and competence in risk management

Identification and description of risks associated with the proposed technical solution

Identification and description of proposed risk mitigation measures





# Example Risk Matrix Classifications

- FREQUENCY

- Very Unlikely
- Unlikely
- Occasional
- Likely
- Very Likely

- CONSEQUENCE

- Insignificant
- Considerable
- Serious
- Severe
- Disastrous

# RISK = IMPACT x PROBABILITY

		PROBABILITY				
		Negligible	Unlikely	Likely	Probable	Very likely
IMPACT	Very high	5	10	15	20	25
	High	4	8	12	16	20
	Medium	3	6	9	12	15
	Low	2	4	6	8	10
	Very low	1	2	3	4	5

RISK	R=P x I	RESPONSE
Intolerable	17-25	Unacceptable
Significant	13-16	Unacceptable
Substantial	9-12	Early attention
Tolerable	5-8	Regular attention
Insignificant	1-4	Monitor

**Note:** The detailed process of risk identification is project-specific



In this case the high impact means the likelihood of the event must be considered with higher priority



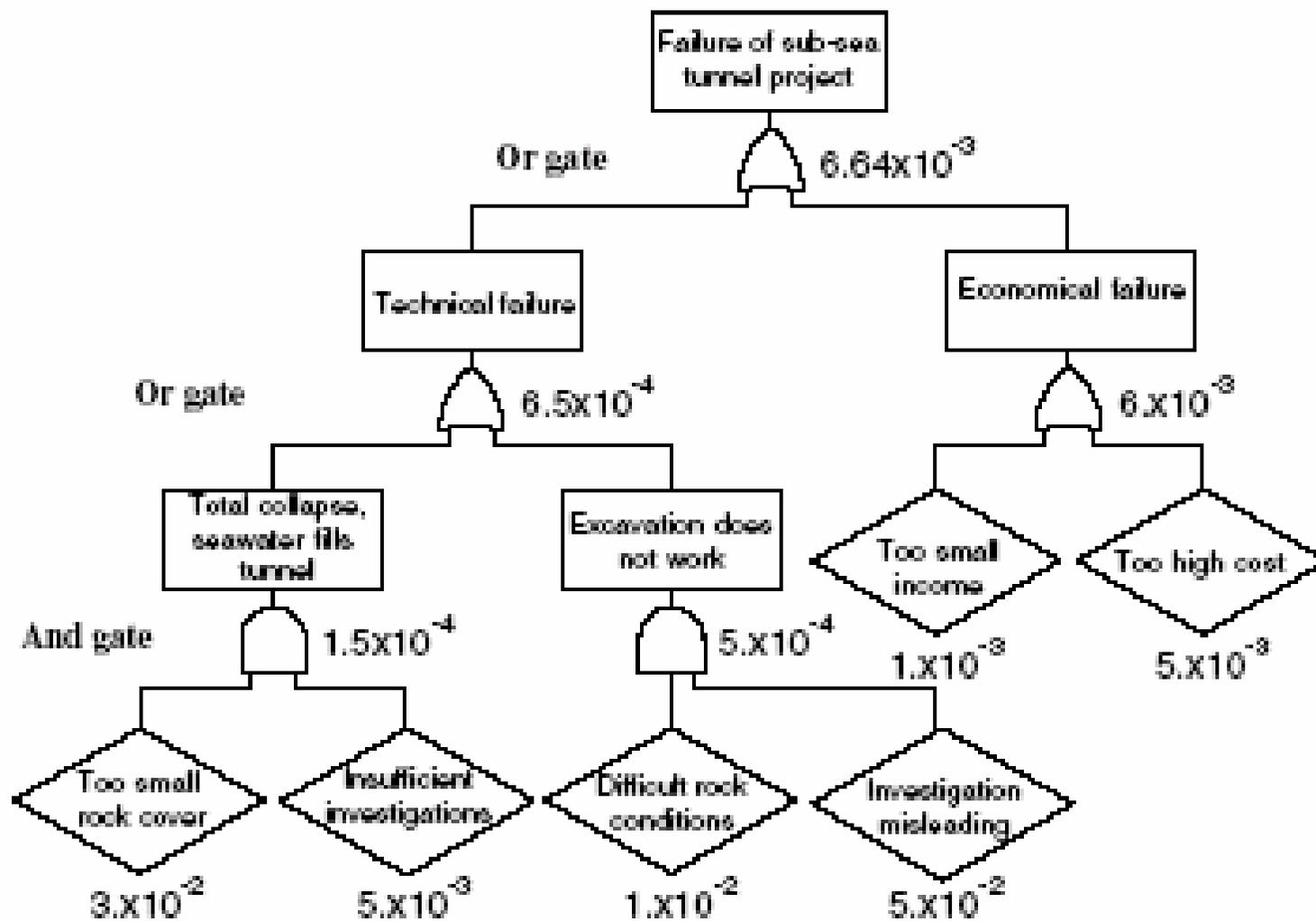
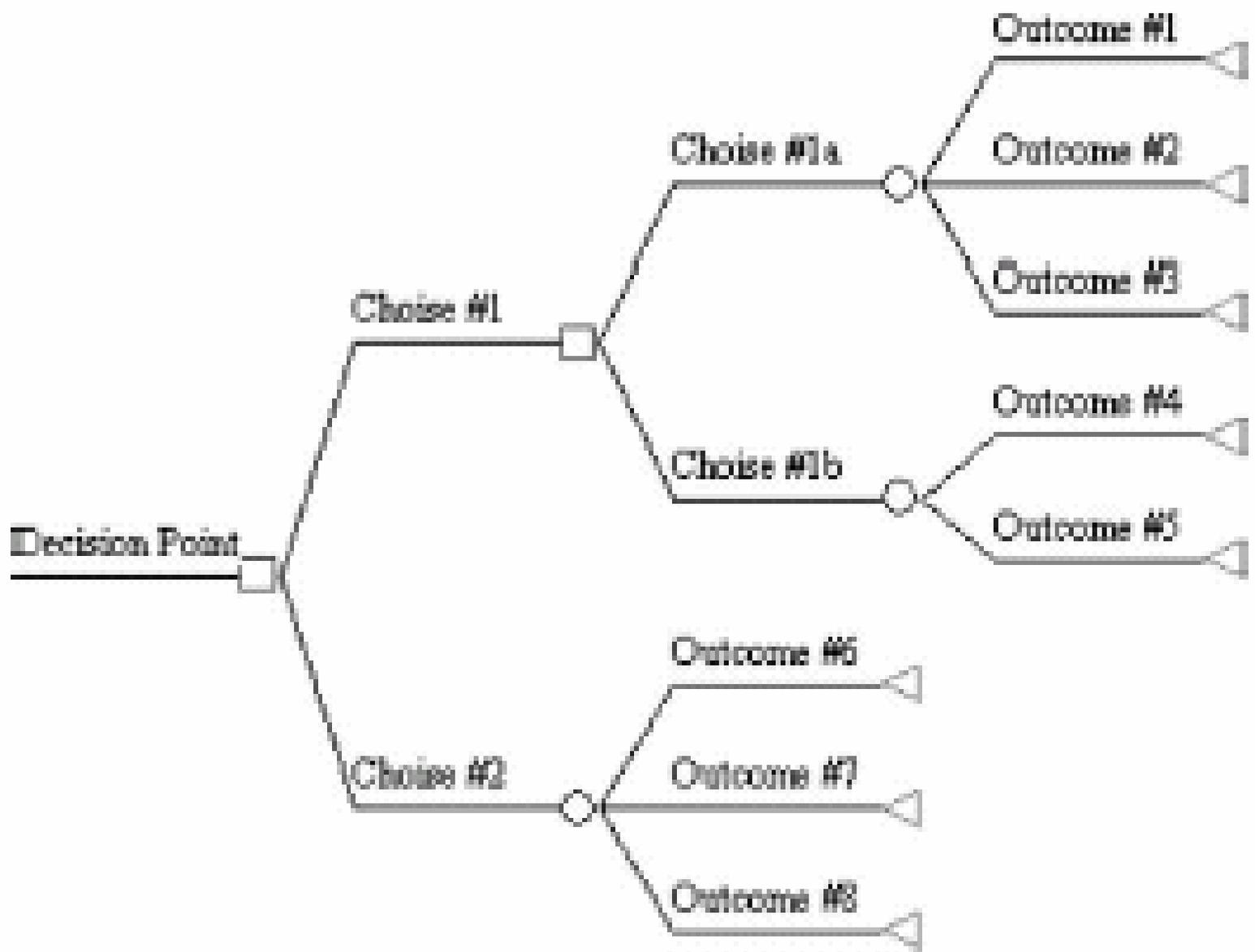


Fig. 2. Example of a fault tree with "and gates" and "or gates" and evaluated probabilities.



**DRAFT**

**A Code of Practice for Risk  
Management of Tunnel Works**

Drafted by

**BTS in Association with Insurers**

# Background

- Insurance Industry
  - Big Insurance Losses
  - Insurers Lost 500%
    - Compared to 110% other construction
- Insurers Options:
  - Stop Insuring
  - Increase Premiums
  - Work with Tunnel Industry
- October 2001 ABI Approached BTS to Write a Joint Code of Practice

# International Code

- Being Prepared by British Tunnelling Society for:
  - ABI (Association of British Insurers)
  - Based on British Code Now in Effect
- International Version Still in Draft Form
- Likely to be completed soon
  - Would Affect USA

# Objectives of Code

- Promote And Secure Best Practice For Minimization And Management Of Risks
- Reduce Probability of a Loss Happening
- Reduce Size of Claim when Loss Occurs
- Give Insurers Better Understanding of Risk
- Enable Insurers to Enforce the Code
  - Reserve right to enter and inspect
  - Reserve right to cancel or suspend coverage

# International Code

- Projects of 1 Million Pounds (~\$2M)
  - Or otherwise risky projects
- Code Applies to:
  - Contractor's All Risks Insurance
  - Third Party Liability Insurance
- Intended to operate in parallel with existing codes
  - If local codes do not exist, use Internationally-Recognized such as British Standards

# Project Stage Basis

- Project Development Stage
- Construction Contract Procurement Stage
- Design Stages
- Construction Stage

# Risk Register

- Developed as Soon as Project Identified
- Working Document
  - Updated at Each Stage
  - “Cascading” of Risk Registers; Stage to Stage
- Included in Information Given to Tenderers
- Contractor required to submit own Risk Register
- Continual Update by Contractor during Construction

# Project Development Stage

- Client to assure sufficient time and budget to investigate and prepare designs
- Client to assure suitably qualified and experienced (hence competent) personnel
- Conduct Risk Assessment and Prepare Risk Register
  - Include effects on:
    - Third Parties
    - Environment
  - Risk Register Given to Contractor

# Construction Contract Procurement Stage

- Use FICIC, ICE, National, or Proven Form of Contract
- Clearly delineate how all parties comply with Code
  - Responsibility for meeting the cost of Insurer's Remedial Measures
- Include GBR in Contract Documents
  - Also Subcontract Documents
- Require tenderer to submit own Risk Register
- Must Pre-qualify Contractors

# Fundamental Design Objective

- Code intended to not be prescriptive in Design
- Requires a Robust Design
- Risk of Failure or damage to the tunnel works or to a third party from all reasonably foreseeable causes, and including health and safety considerations, is extremely remote during the construction and the design life of the tunnel works
- Consider high consequence/low frequency events that could affect Third Party

# Design Stage

- Assure transfer of information between successive designers
- Continued Risk Assessments and Risk Register updating
  - Constructability
  - GBR
  - Detail intermediate stages of construction
  - Sensitivity Studies
  - Third Parties
- Validate design by monitoring during construction

# Construction Stage

- Continue aggressive risk management and risk register updating
- Defines requirements for contractor's risk and management staff and training
- Requires Constructability Reviews Jointly with Designer
- Requires method statements that clearly and unequivocally detail the contractor's methods and resources
- Monitoring required

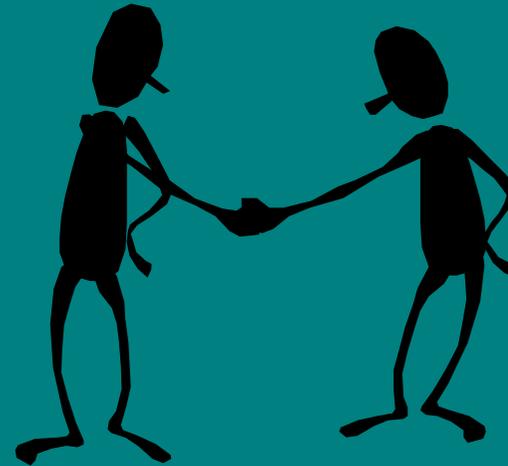
# Compliance

- Insurance contracts should include provisions enabling Insurers to enforce the requirements of the Code
- If necessary on pain of suspension or cancellation of the cover on what Insurers consider a breach of the Code
  - Can be reinstated if remedial measures taken

# Future

- BTS or Insurers expected to complete draft and send to ITA asking for approval
- ITA will evaluate Code in many ways and by several committees and international experts to make sure the Code is fair to all parties and will work within the legal system of our Member Nations
  - In advance of receipt to provide input before draft is complete
    - AUA has been asked to provide input in advance of receiving the final Code
- So far, ITA has not published a Standard or a Code
- However, Insurers still have the options to withhold coverage or significantly increase costs

# Challenge



Thank You