ILC

Risk Management

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Risk Management

Content

- Definition
- ITA (=International Tunnelling Association)
- ILC-Project

Risk Management

Risk management is the systematic process of identifying, analyzing and responding to project risks.

Risk management is

- **not only a single event**
- **a continuous process during the entire project.**

Therefore the risk control is part of the project life cycle from project initiation to project completion.

Risk Management, Threats and Opportunities

Risk management covers the handling of

- project threats and

- project opportunities.

Project threats are risks which can have a negative impact on a project.

Project opportunities are risks which have a positive impact on a project.

Risk Management, Steps

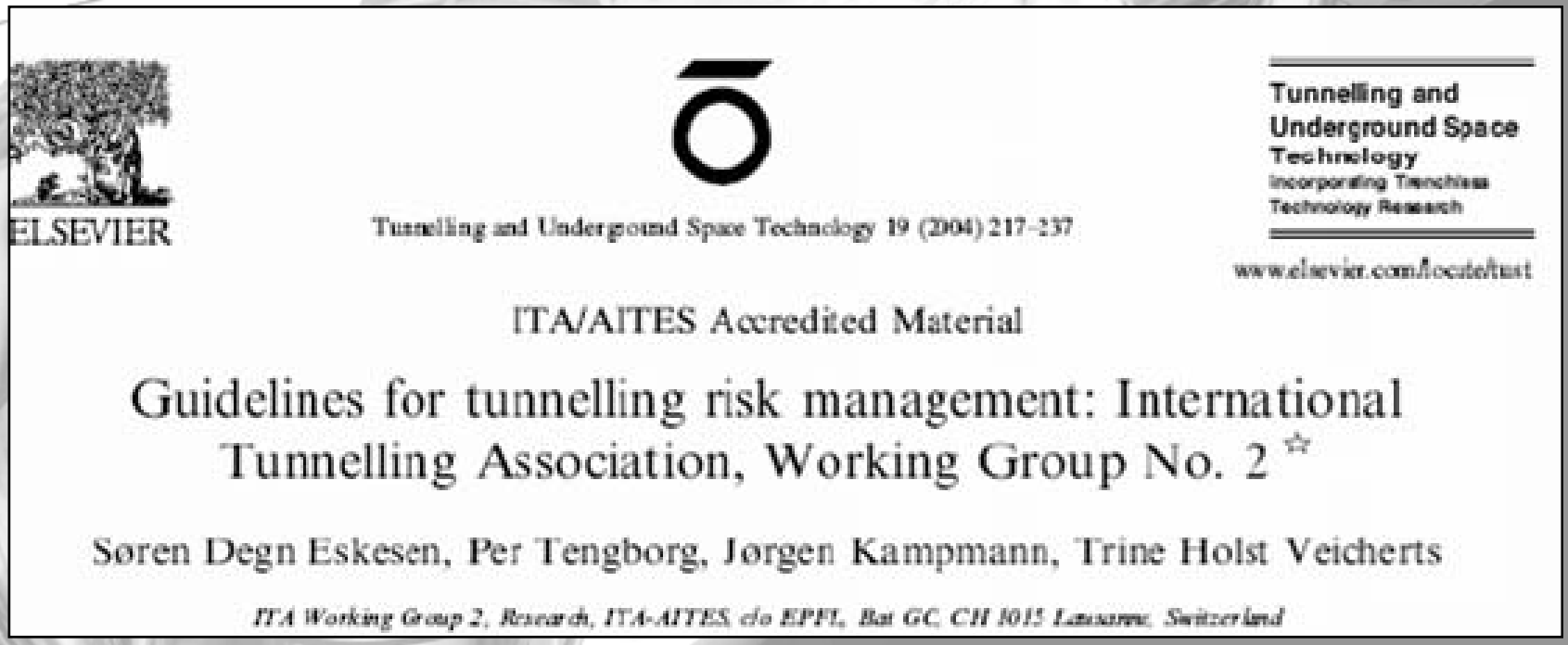
Risk management consists of:

- **Risk Management Planning**
- **Risk Identification**
- **Risk Analysis**
- **Risk Responding**
- **Risk Control**

Risk Management, Flowchart

Risk Management Guidelines

ITA Risk Management Guidelines prepared by Working Group 2 „Research“, published 2004



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ITA/AITES Accredited Material

Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2 ☆

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Risk Identification According to ITA Guidelines

The ITA Guidelines distinguish in general and specific hazards

General Hazards (considered for each contract)

- **Contractual disputes**
- **Insolvency and institutional problems**
- **Authorities interference**
- **Third party interference**
- **Labour disputes**

Specific Hazards (considered for each part of the project)

- **Accidental occurrences (earthquakes, flooding, sabotage etc.)**
- **Unforeseen adverse conditions (geotechnical, geological risks)**
- **Inadequate designs, specifications and programs**
- **Failure of major equipment**
- **Slow or out-of-tolerance works**

(Source: Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2, Eskesen, S.D., Tengborg, P. et al, Tunnelling and Underground Space Technology 19 (2004)

Risk Identification: Geotechnical Risks

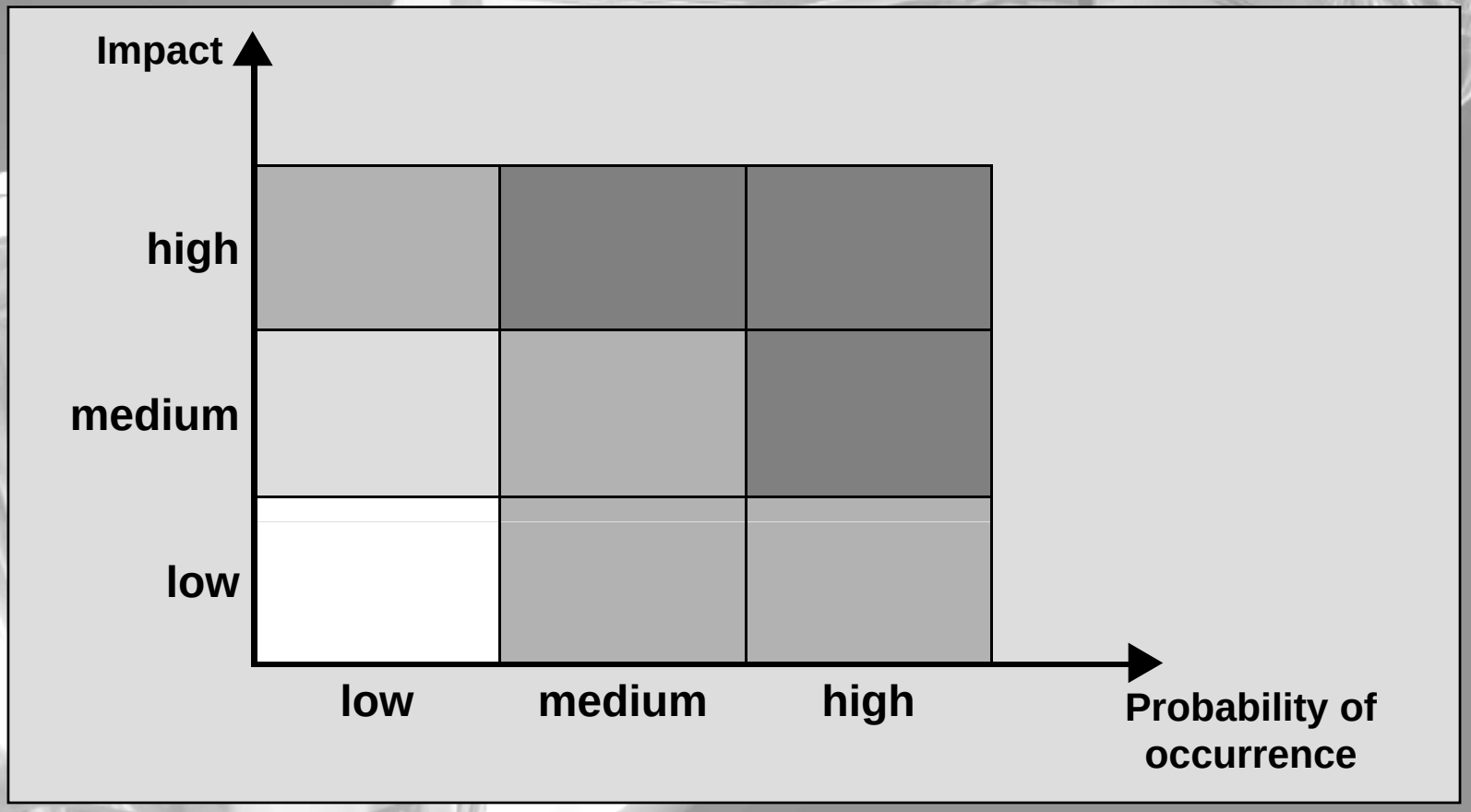
Geotechnical risks on the surface	Geotechnical risks underground
• Settlements of buildings and existing infrastructures > cracks, inclination, damage • Settlements of service utilities (electricity, gas, water etc.) > cracks, damage • Vibrations > cracks	• Deformations • Instability of crown and / or face • Cave-in • Rock fall / wedges

Procedure of Risk Analysis

Risk Score = Probability P x Risk Impact RI

Probability P			
	1	2	3
Likelihood	Low	Medium	High
Risk Impact RI (examples)			
	1	2	3
Costs	<10 MEUR	10-100 MEUR	>100 MEUR
Schedule	< 2 months	2-12 months	>12 months

Risk Analysis Matrix



Classifications According to ITA Guidelines

Probability of Occurrence (Frequency)

- Very unlikely
- Unlikely
- Occasional
- Likely
- Very likely

Impact (Consequence)

- Insignificant
- Considerable
- Serious
- Severe
- Disastrous

The classifications can be defined according to the specific project.

(Source: Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2, Eskesen, S.D., Tengborg, P. et al, Tunnelling and Underground Space Technology 19 (2004)

Examples of Impact Scale According to ITA Guidelines

	disastrous	severe	serious	considerable	insignificant
Economic loss to owner [Mill. Euro]	> 30	3 - 30	0.3 - 3	0.03 – 0.3	< 0.03
Delay [months]	> 10	1 - 10	0.1 - 1	0.01 - 0.1	< 0.01
Harm to environment	permanent severe damage	permanent minor damage	long-term effects	temporary severe damage	temporary minor damage

(Source: Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2, Eskesen, S.D., Tengborg, P. et al, Tunnelling and Underground Space Technology 19 (2004)

Risk Analysis Matrix According to ITA Guidelines

Conse-quency / Fre-quency	insignificant	considerably	serious	severe	disastrous
very likely	unwanted	unwanted	unacceptable	unacceptable	unacceptable
likely	acceptable	unwanted	unwanted	unacceptable	unacceptable
occasional	acceptable	acceptable	unwanted	unwanted	unacceptable
unlikely	negligible	acceptable	acceptable	unwanted	unwanted
very unlikely	negligible	negligible	acceptable	acceptable	unwanted

(Source: Guidelines for tunnelling risk management: International Tunnelling Association, Working Group No. 2, Eskesen, S.D., Tengborg, P. et al, Tunnelling and Underground Space Technology 19 (2004)

Risk Responding: Possible Strategies

Avoid:

eliminate the uncertainty or execute the project in a different way

Transfer:

transfer the risk to another party which is then responsible to handle the impact

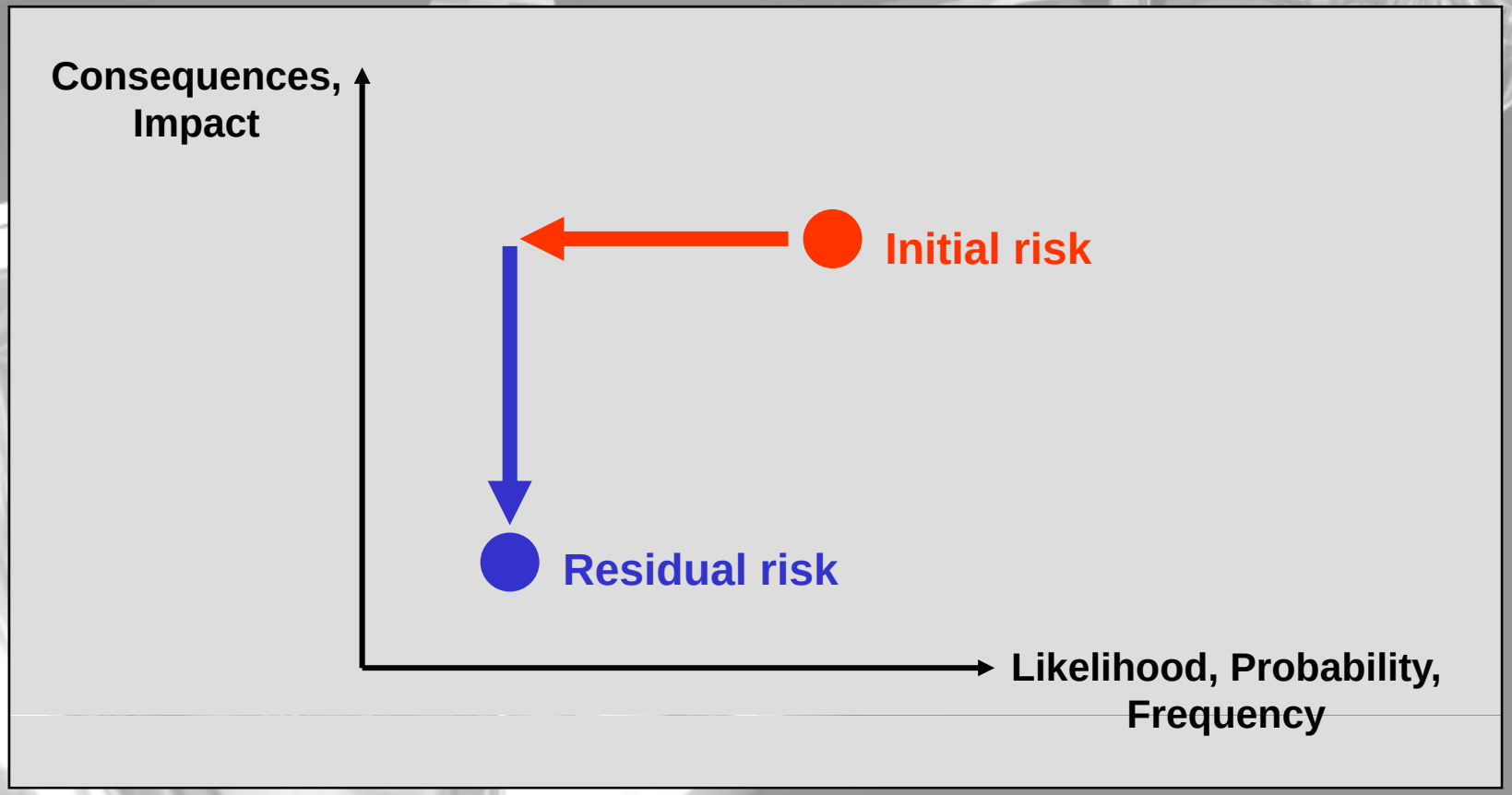
Mitigate:

reduce the risk to make it more acceptable to the project by reducing the probability and/or the impact

Accept:

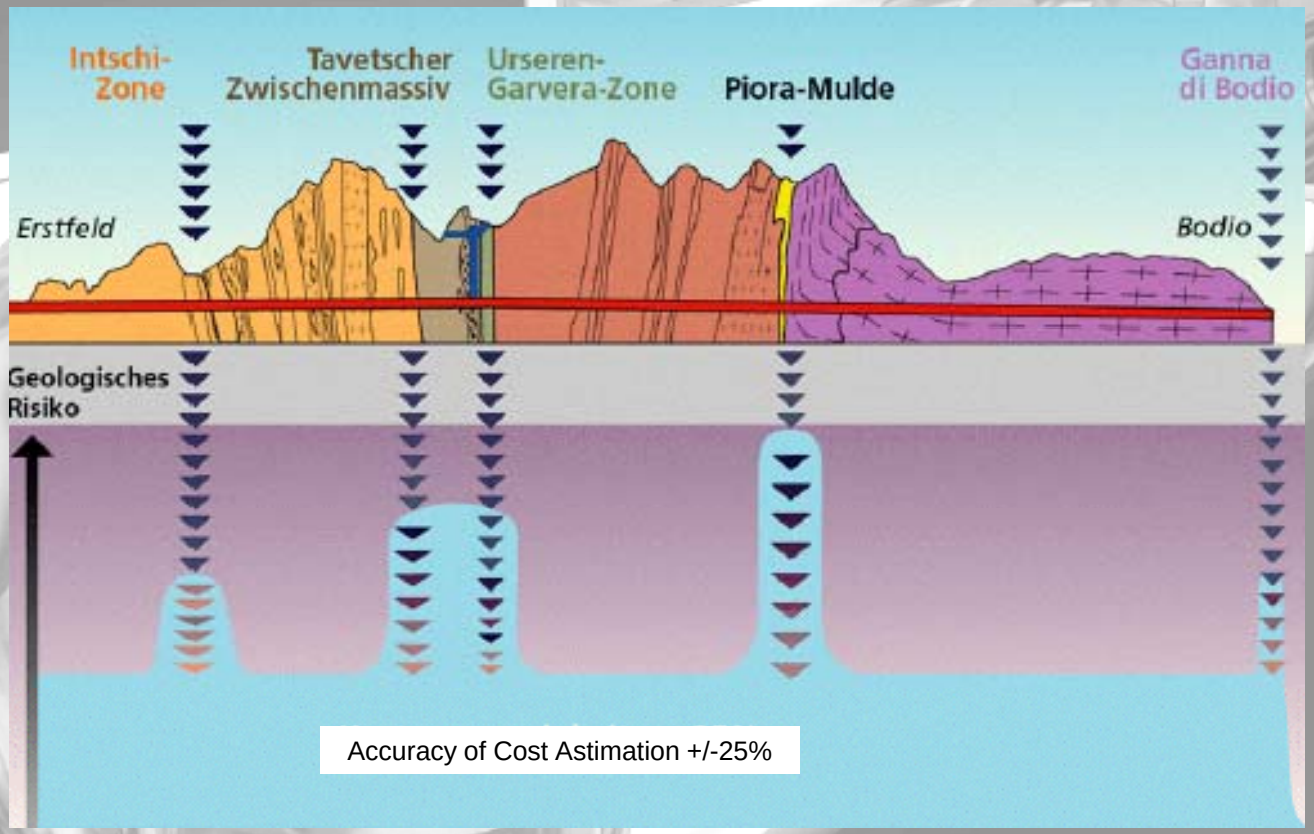
accept the risk (normally done for project risk which have a low priority or a low impact)

Risk Analysis Matrix



(Source: Int. Tunnelling Association (ITA) and Risk; Parker, H.W.; George Fox Seminar; New York, 2005

Example for Risk Responding: Range of Geological Risks 2005 and Accuracy of Cost Estimation +/- 25%



(Source: Baumgärtner, Büchler, Systematik der Kostenrisiken am Beispiel Gotthard Basistunnel, Kasseler Projekt-management Symposium 2005)

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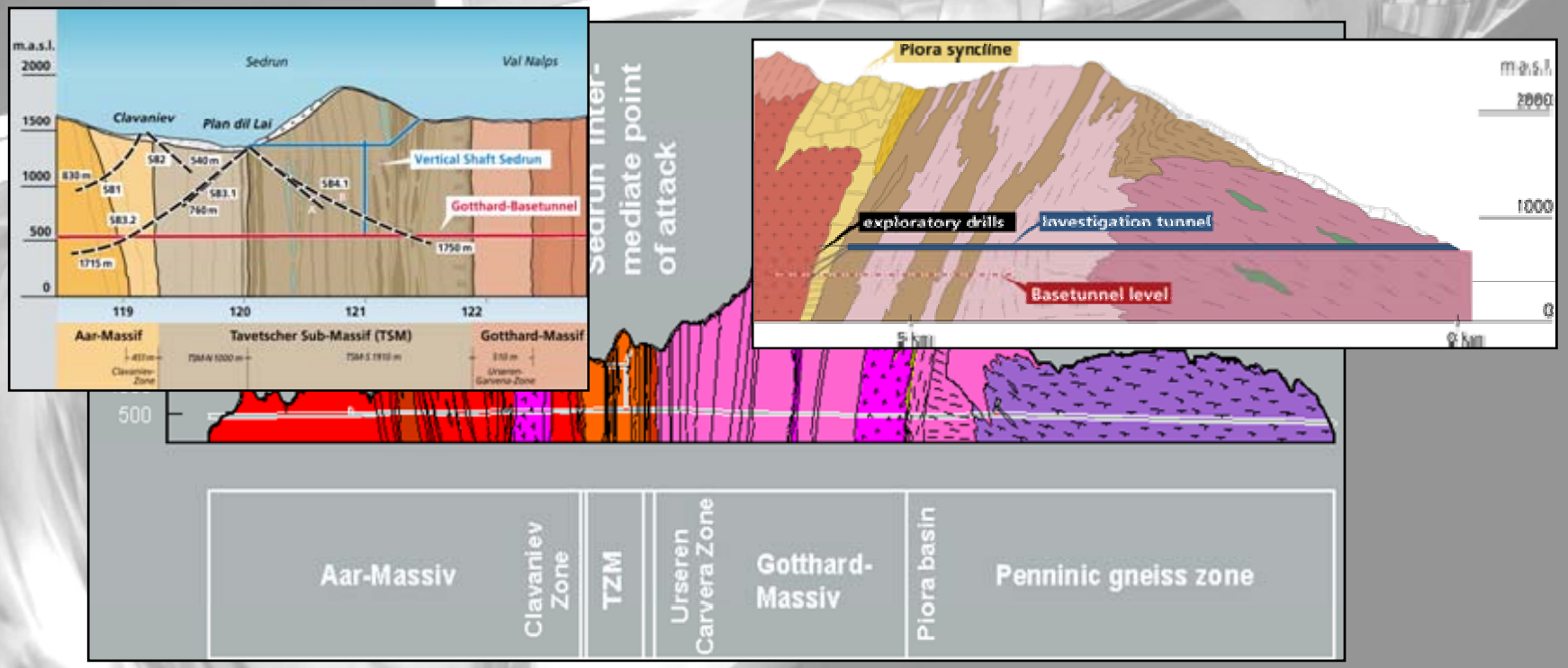
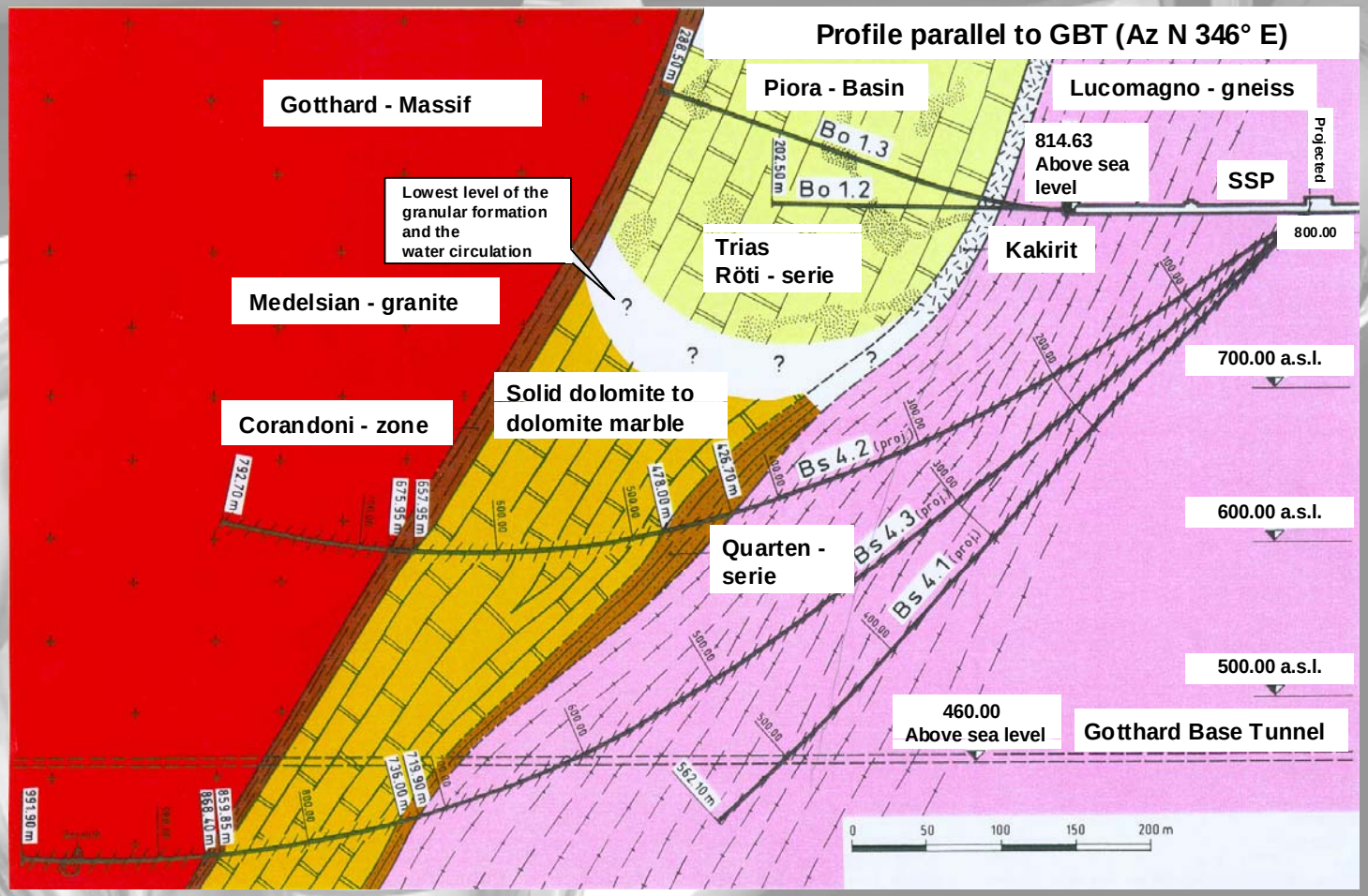
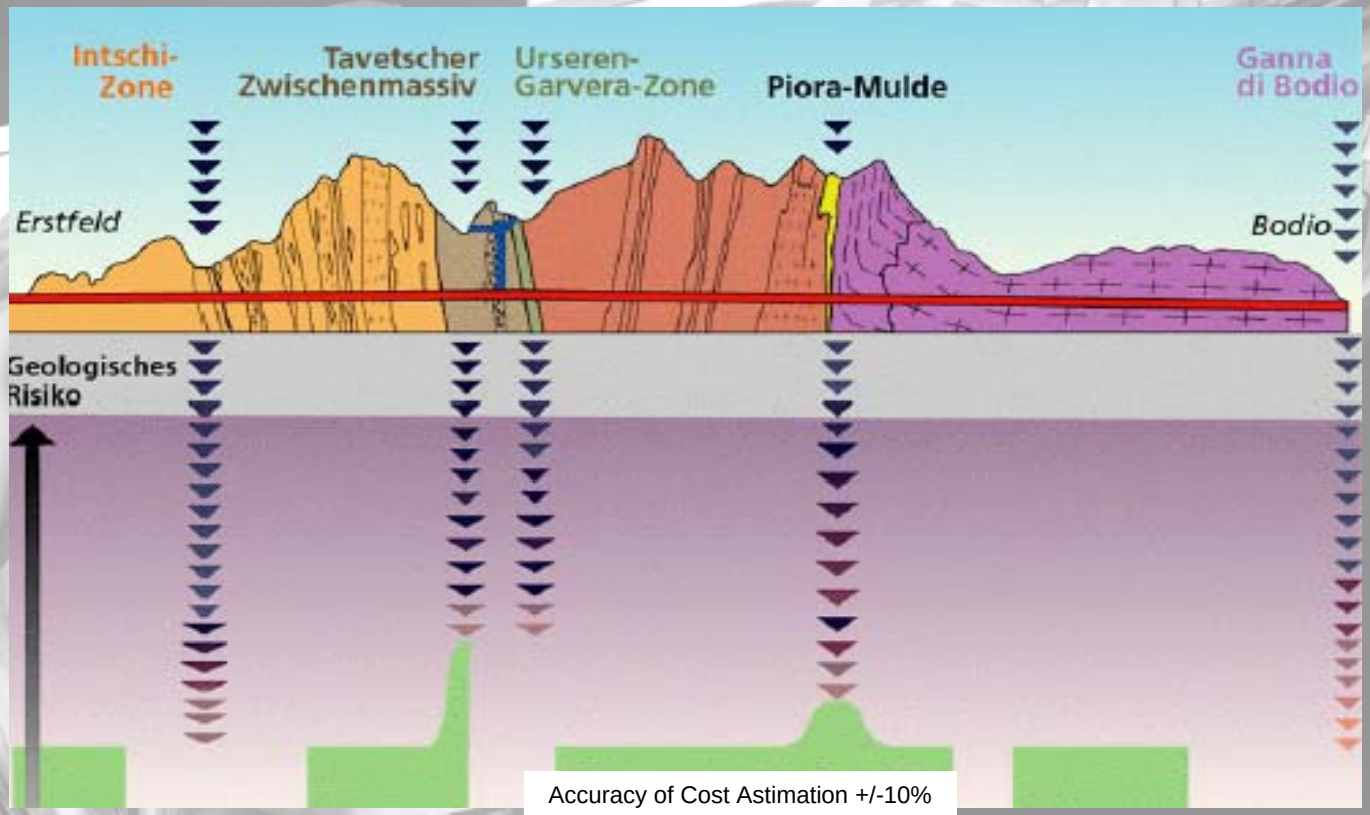
Investigations



Investigation Gallery, Piora Basin



Risk Responding: Range of Geological Risks 2005 and Accuracy of Cost Astimation +/- 10%



(Source: Baumgärtner, Büchler, Systematik der Kostenrisiken am Beispiel Gotthard Basistunnel, Kasseler Projektmanagement Symposium 2005)

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ILC Initial Risks: Examples

Risk factors during approval project
e.g. delay in permitting process, insufficient project management, objections raised by the public etc.

Risk factors during the tendering process
e.g. financial uncertainty, insufficient project basis information, engineering and tender document errors, insufficient quality of the bidding contractors etc.

Risk factors during project realization
e.g. unstable working face conditions, more numerous and longer fault zones than predicted, heavy water inflow, water pressure, project optimizations negatively influencing project requirements, inadequate contracts, insufficient control and monitoring of construction process, insufficient authority of site manager, insufficient preparation, lack of financial strength of the contractor, sabotage, environmental disasters etc.

Risk Analysis Matrix: Examples of ILC Risks

Consequence/ Impact	low	medium	high
high	• More numerous and longer fault zones than predicted • Insufficient preparation	• Strained situation of the job market in the building industry impairs the rekruitment of qualified personnel	• Lack of financial strength of the contractor
medium	• Insufficient project management • Sabotage	• Clogging /Blocking of cutter head, excavation chamber and conveyor system • Tunnel climate	• Deadline and cost pressure upon contractor • Delayed delivery of construction drawings
low	• False interpretation of geology • Insufficient, unsuitable advance investigation systems	• Delay in permitting process • Insufficient definition of interfaces	

Probability of occurrence

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Risk Responding: Example

Risk Factor: Tunnel Climate

The tunnel climate, apart from the construction work (exhaust gases), is affected by the influence of the rock (gas, radioactivity). Climate loading affects in particular the job safety (work conditions) and health of the underground workers.

Initial Risk Assessment:

Probability of Occurrence: medium / Impact: medium

Risk Reduction Measure:

Molasse can have gas deposits, ventilation must be designed accordingly, gas-sensors and measurement. Correct working temperature and vision shall be ensured.

Residual Risk:

Probability of Occurrence: small / Impact: medium

Risk Responding: Example

Risk Factor: Lack of the financial strength of the contractor:

Deficient financial stability of a JV (liquidity problems, financial stability, credit-worthiness) can lead to the loss and/or bankruptcy of a contractor and so disturb work continuity.

Initial Risk Assessment:

Probability of Occurrence: high / Impact: high

Risk Reduction Measure:

Only allow JV‘s with 3 - 4 equal partners. Intensive verification of financial stability of the individual JV partners.

Residual Risk:

Probability of Occurrence: medium / Impact: small

Risk Responding: Example

Risk Factor: Insufficient Preparation

Insufficient, unsatisfactory preparations can lead to inappropriate processes and / or unsuitable installations. Thus efficient and goal-oriented construction processes are obstructed.

Initial Risk Assessment:

Probability of Occurrence: low / Impact: high

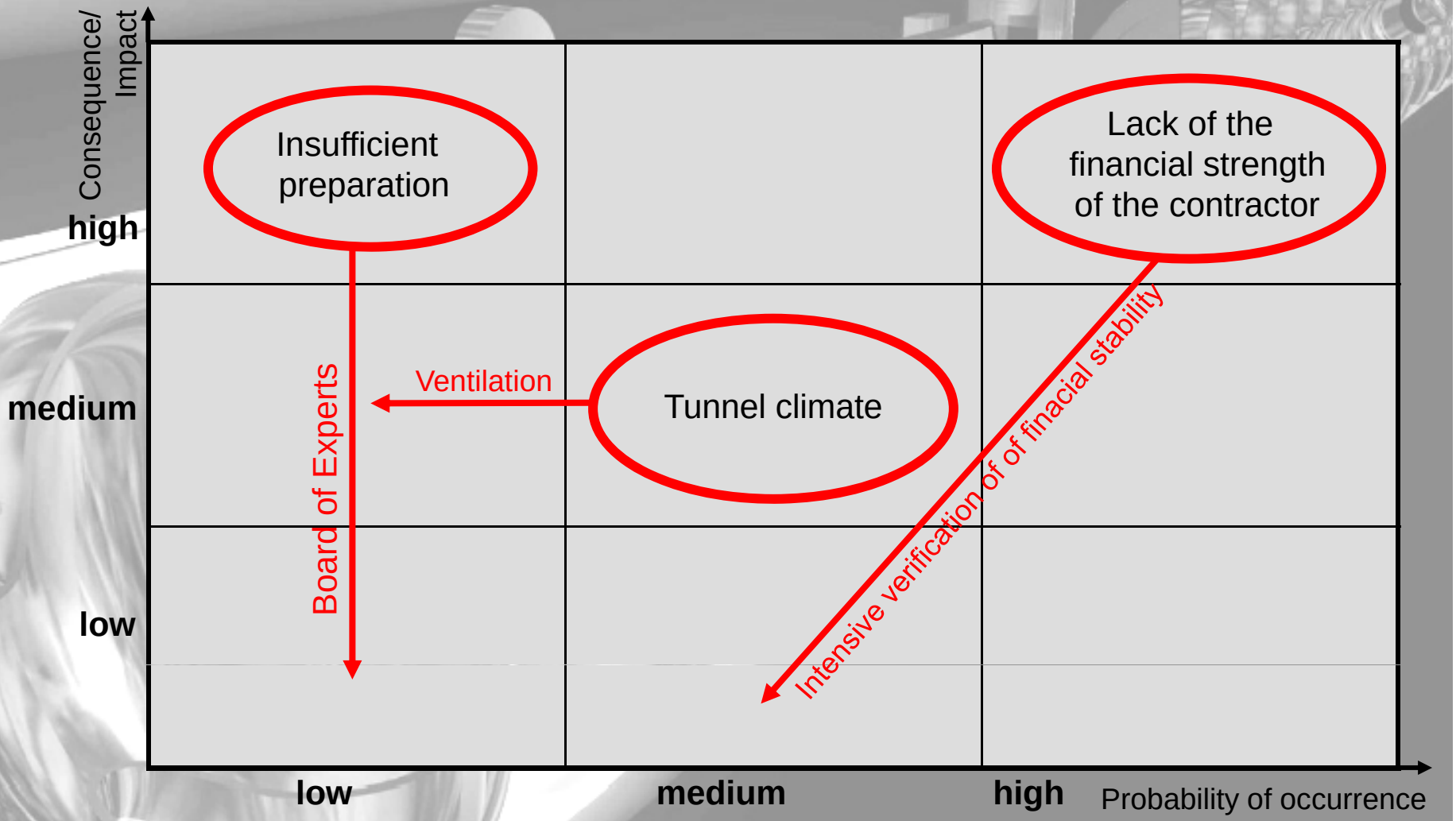
Risk Reduction Measure:

Set up of a „Board of Experts“ from construction-oriented specialists for the function of co-authoring

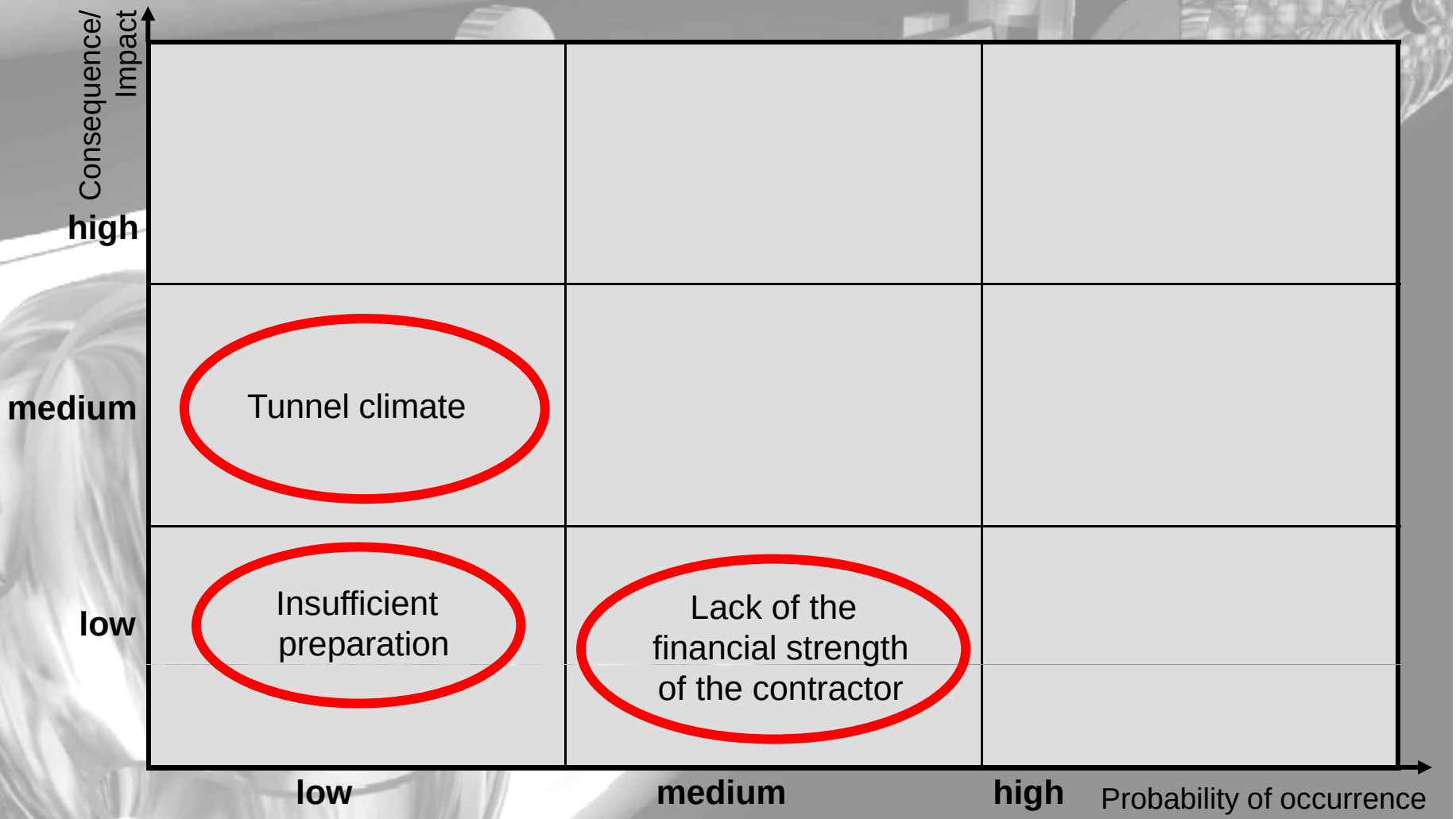
Residual Risk:

Probability of Occurrence: small / Impact: small

Initial Risks and Risk Responding, Examples



Residual Risks



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Thank you very much
for your attention