Risk Management of Tunnelling Projects

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IRM Construction SIG

UK Risk Engineering
Risk Management of Tunnelling Projects

- The problem with Tunnels...
- Effects of tunnelling losses on the Construction Insurance Market
- Development of the Joint Code of Practice for Risk Management of Tunnel Works
- Implementation of the Joint Code – How it is being used
- Effectiveness and Influence of the Joint Code
- Future development of the Code of Practice
About me…

Ade Adeyemo
Risk Engineer, Zurich Insurance

Chartered Civil Engineer

Previous Employers:
~ Wimpey Engineering & Construction
~ Tarmac Civil Engineering
~ Carillion Civil Engineering
~ HDI-Gerling Insurance

Member of British Tunnelling Society

Chairman of the Construction Insurance Risk Engineers Group (CIREG)
The Problem with Tunnels…
Insurance Market Concerns

- Frequency and size of insurance claims
- Major losses occurring both in UK & Overseas
- Tunnelling Sector had become unprofitable for Insurers:
  ~ Engineering/Construction  > 110% Loss Ratio
  ~ Tunnelling > 500% Loss Ratio
- Insurers withdrawing from tunnelling insurance
- WTC led Insurers’ to re-evaluate profitable and non-profitable books of business
Examples of Major Claims…
1994: Munich Metro Project, Germany
Examples of Major Claims…
1994: Heathrow Express Tunnel, London
Examples of Major Claims...
2000: Taegu Metro Project, South Korea
Examples of Major Claims…
2002: SOCATOP A86 Tunnel, France
Examples of Major Claims…
2003: Shanghai Metro, P.R. China
Examples of Major Claims…
March 2004: Singapore MRT Project
Examples of Major Claims…
April 30th 2004: Singapore MRT Project
Hull Wastewater Tunnel
Example of a Typical Tunnelling Claim

Original Contract Value: £60M
Length of Tunnel: 10km
Therefore, cost per metre: £6,000 per metre

Length of damaged section in tunnel collapse = 150m
Therefore, approximate construction cost for this length
= 150m x £5,000 = £900,000

However, the insurance claim for reinstatement was
IN EXCESS OF £42,000,000

i.e. reinstatement cost was **4,667%** of the original Contract Value!
Examples of Major Claims…
2005: Pinheiros Station, Sao Paulo, Brazil
Examples of Major Claims…

2005: Pinheiros Station, Sao Paulo, Brazil
## Tunnel Losses (1994 - 2005)

<table>
<thead>
<tr>
<th>Year</th>
<th>Project</th>
<th>Cause</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Great Belt Link, Denmark</td>
<td>Fire</td>
<td>US$33M</td>
</tr>
<tr>
<td>1994</td>
<td>Munich Metro, Germany</td>
<td>Collapse</td>
<td>US$4M</td>
</tr>
<tr>
<td>1994</td>
<td>Heathrow Express Link, UK</td>
<td>Collapse</td>
<td>US$141M</td>
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<tr>
<td>1994</td>
<td>Taipei Metro, Taiwan</td>
<td>Collapse</td>
<td>US$12M</td>
</tr>
<tr>
<td>1995</td>
<td>Los Angeles Metro, USA</td>
<td>Collapse</td>
<td>US$9M</td>
</tr>
<tr>
<td>1995</td>
<td>Taipei Metro, Taiwan</td>
<td>Collapse</td>
<td>US$29M</td>
</tr>
<tr>
<td>1999</td>
<td>Hull Tunnel, E. Yorkshire, UK</td>
<td>Collapse</td>
<td>US$55M</td>
</tr>
<tr>
<td>1999</td>
<td>TAV Bologna - Florence, Italy</td>
<td>Collapse</td>
<td>US$9m</td>
</tr>
<tr>
<td>1999</td>
<td>Anatolia Motorway, Turkey</td>
<td>Earthquake</td>
<td>US$115m</td>
</tr>
<tr>
<td>2000</td>
<td>Taegu Metro, South Korea</td>
<td>Collapse</td>
<td>US$24m</td>
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<tr>
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<td>TAV Milan-Bologna, Florence, Italy</td>
<td>Collapse</td>
<td>US$12M</td>
</tr>
<tr>
<td>2002</td>
<td>Taiwan High Speed Railway</td>
<td>Collapse</td>
<td>US$30M</td>
</tr>
<tr>
<td>2002</td>
<td>SOCATOP Paris, France</td>
<td>Fire</td>
<td>US$8M</td>
</tr>
<tr>
<td>2003</td>
<td>Shanghai Metro, PRC</td>
<td>Collapse</td>
<td>US$80M</td>
</tr>
<tr>
<td>2004</td>
<td>Singapore Metro, Singapore</td>
<td>Collapse</td>
<td>US$100M</td>
</tr>
<tr>
<td>2005</td>
<td>Barcelona Metro, Spain</td>
<td>Collapse</td>
<td>US$ ???</td>
</tr>
<tr>
<td>2005</td>
<td>Lausanne Metro, Switzerland</td>
<td>Collapse</td>
<td>US$ ???</td>
</tr>
<tr>
<td>2005</td>
<td>Lane Cove Tunnel, Sydney, Australia</td>
<td>Collapse</td>
<td>US$ ???</td>
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<td>2005</td>
<td>Kaohsiung Metro, Taiwan</td>
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**20 Major Losses (17 costs) – Approximate Total Losses:** US$600m
Results of Insurers’ Claims Analysis

- Tunnelling projects becoming uninsurable
- Size (cost) of Losses vs. Premium
- Reinstatement Cost vs. Original Construction Cost
- Size of Insured Claim vs. Insurer’s Possible Maximum Loss (PML)

Other findings arising from Insurers’ Claims Analysis:
- Quality Control Issues in tunnelling industry
- Inconsistent approach (of tunnelling industry) to Risk Management
- Insurance industry did not query any of above issues
- Extent of insurance cover provided
This was an unacceptable situation...

Something **had** to be done!
Insurers’ Options...

**Negative...**

- Stop offering Insurance for tunnelling projects – some insurers withdrew completely from tunnelling
- Increase Insurance Terms...
  - increase premiums
  - increase deductibles
  - restrict insurance cover
- Tunnelling projects potentially becoming price prohibitive and uninsurable

**Positive...**

- Try to tackle problem issues and negative perceptions with a Code of Practice for Tunnelling
- Encourage good Risk Management and ‘Best Practice’
- Work with UK Tunnelling Industry to develop a Tunnelling Code, which could then be ‘exported’ overseas
- Based on positive experience with the *Joint Code of Practice for Fire Prevention on Construction Sites*. 
Code of Practice Working Group

- Association of British Insurers (ABI)
  ~ Underwriters
  ~ Risk Engineers

- British Tunnelling Society (BTS) - Institution of Civil Engineers (ICE)
  ~ Tunnelling Contractors
  ~ Designers & Consultants
  ~ Health & Safety Executive (HSE)
Implementation of the Code of Practice for Tunnel Works

- Code of Practice for Tunnelling is now used worldwide
  ~ Original (UK) version – produced jointly by the BTS & ABI.
  ~ ‘International’ Version – produced by ITIG

- Translated into several languages, including:
  ~ French, German, Spanish, Chinese & Russian!

- Links to download ‘International’ versions of Tunnelling Code
  ~ IMIA web site at www.imia.com
  ~ CIREG web site at www.cireg.org
Effectiveness of the Code

- Tunnelling remains insurable!
- Lower frequency and severity (cost) of tunnelling claims
- Code of Practice for Tunnelling now accepted throughout UK and many parts of the world
- Compliance with Code is Condition of all UK policies for tunnelling and most major international tunnelling projects
- ITIG (international) version of the Code adopted by ITA and international Clients, e.g. MTA Singapore
Effectiveness of the Code…
Encouraging Best Practice in Tunnelling

- Risk Sharing
- Risk Retention
- Baseline Ground Conditions
- Risk Management Procedure
- Risk Registers
Future Development of the Code

- General updates to UK and International versions
  ~ resolve USA/North American issues?

- Involving Brokers in development of revised Codes
  ~ early involvement with Clients
  ~ early involvement with Designers & Consultants
  ~ ensuring wider acceptance in insurance market

- Development of UK & International Code of Practice for Construction
  ~ based on Code of Practice for Tunnelling
  ~ general risk management core
  ~ annexes/modules for specific operations…
  e.g. piling, earthworks, roads, rail, bridges, dams, etc.
Projects Insured using the New Code of Practice for Risk Management...
Acknowledgements

- **Dr. Terry W. Mellors**  
  Principal, Mellors & Associates  
  *Paper: Application of risk management in construction of underground urban transportation projects.*

- **Michael Spencer**  
  former Head of Construction, Zurich Insurance, Global Corporate Division  
  now Head of Underwriting, Royal & Sun Alliance Singapore

- **Construction Insurance Risk Engineers Group (CIREG)**  
  [www.cireg.org](http://www.cireg.org)

- **International Association of Engineering Insurers (IMIA)**  
  [www.imia.org](http://www.imia.org)

- **International Tunnelling Insurance Group (ITIG)**
Thank you

UK Risk Engineering
www.zurich.co.uk