Occupational Health & Safety Risk Management in Tunnel Works

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ITA WG5 - Health & Safety in Works

Introduction

- Tunnelling is an environmentally friendly way of providing infrastructure
- Tunnelling presents a range of risks to be managed including health and safety risk
- With ever more challenging tunnels, better management of health and safety risk required
- Members of public at risk of being injured by tunnel collapse,

Introduction

- In shield tunnelling ground collapse affects the public not the workforce
- Health and safety risk should be considered at design stage
- Tunnels are valuable assets and may have to be recovered after a disaster e.g. a fire.

Responsibility for H&S risk management in tunnelling

- Within the European Community the Framework Directive has harmonised statutory requirements
- All construction including tunnelling is also subject to Temporary and Mobile Construction Sites Directive
  - TMCSD recognises respective roles of all parties to a construction project.

Techniques for risk management

- H&S risk management is no different to management of other risks
- Hazards should be identified
  - Guidance available
- Risks should be assessed
  - Sufficient data unlikely to be available for sophisticated numerical risk assessment techniques.

Role of parties to tunnel project

- All parties have a role to play
  - Client
  - Designers
  - Coordinator for H&S
  - Contractors
  - TBM Manufacturers
  - Workforce
  - Professional Organisations
  - Regulators and Standards makers
  - Insurers

Client

- Controls procurement of design and construction
- Finances project
- Should set overall strategy for health and safety for project

Designers

- Exert considerable influence over health and safety
- Determine tunnel diameter, alignment, shaft diameter and location
  - Working space must be adequate
  - Contaminated land should be avoided
  - Openings and changes in section should be designed to be done safely

Designers

- Should specify minimum standards for fire fighting requirements, atmospheric monitoring, communications, ventilation
- Early contractor involvement and/or partnering should be encouraged

Coordinator for H&S

- Requirement of EC directive
- Duties include
  - Ensuring a health and safety plan is produced
  - Ensuring a file of relevant health and safety information is produced at end of contract
  - Ensure general principles of prevention are implemented
  - Oversee cooperation between all parties

Contractors

- Contractors through their staff, have the greatest influence over health and safety risk management
- Should plan work, undertake risk assessment, then implement control measures
- Should train workforce

TBM Manufacturers

- TBMs have become much more sophisticated
- TBMs create a range of mechanical and electrical safety risks
- TBMs must comply with the EC Machinery Directive
- This is implemented through a range of harmonised (CEN) standards
- Manufacturers self-certify compliance

The Workforce

- Tunnelling has a hard living, macho culture
- This must be changed through training and education
- Worker consultation is important
- Trade Unions have an important role in health and safety risk management.

Professional organisations

- Provide guidance on good practice
- ITA is such an organisation
- Provide professional development opportunities
- Provide training and opportunities for sharing knowledge

Regulators & Standards makers

- Implementation of EC directives
- Regulation of work in compressed air
- CEN standards for tunnelling machinery safety – could become ISO standards
- British Standard 6164 – “Safety in tunnelling” – widely applicable in other countries also.

Insurers

- Insurers have become much more proactive following high profile collapses in recent years
- International Tunnel Insurance Group has produced a Code of Practice on ground risk management
- Some countries have social insurance system

Hazards of tunnelling

- Risks exacerbated by
  - Variability of ground
  - Confined space of the tunnel
  - Inadequate safety culture
  - Lack of commitment by industry
  - Industry is production oriented
  - Improvisation/problem solving is valued
  - Failure to learn from mistakes
  - Work in compressed air

Ground risk

- Collapse affects all parties
- High consequence/low frequency events such as collapse are rare
- Political consequences of collapse can be great
- Such events must be planned for

Managing ground risk

- Adequate site investigation
- Designers and contractors must liase
- Stability of primary lining is vital to all
- Correct sequence of excavation
- Contractor must adhere to specification and not sacrifice quality for productivity
- QA system is no substitute for engineering supervision

Risk to third parties

- Lack of data for research
- Risk appears to be increasing
- Collapses characterised by
  - Shield tunnels – some distance behind face
  - NATM tunnels – close to face
- Density and age of infrastructure being tunnelled under

Third party risk - mitigation

- Project management
- Organisational, procurement and contractual arrangements
- Engineering systems
- Health and safety systems
- Human factors
- The availability and use of “enforcement” action

Occupational health

- Health is poor relation to safety
- Health risk is two-fold
  - Fitness for work
  - Ill health caused by work
- “Healthy worker” effect – unrecorded cases of ill-health are common
- Need for general health care for peripatetic workforce

Welfare

- Important mitigating factor against ill health
- Respect for the workforce

Work in compressed air

- Makes consequences of many risks more serious
- Tunnelling industry lags behind diving in hyperbaric engineering practices

Education, training, competence

- Important factor in managing heath and safety risk
- Induction training essential
- Professional development should include health and safety issues
- Importance of worker competence and that of front-line supervisors

Concluding remarks

- Considerable progress has been made in managing health and safety risk in tunnelling and underground construction in recent times.
- All parties involved in tunnelling projects must work together to ensure this trend continues.
- We should all share knowledge, guidance and good practice in tunnelling through organisations such as ITA and gatherings such as the World Tunnel Congress

Thank you for your attention.