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Working Group 1

Improve tunnel operation and maintenance

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Contents

Introduction

1. *Report* 'Recommendations for strategic road tunnel safety management'
2. *Report* 'Good Practice for road tunnel emergency exercises'
3. *Report* 'Recommendations on management of maintenance and technical inspections of road tunnels'
4. *Report* 'Life cycle aspects of road tunnel equipment'



Introduction

Constitution of Working group 1

Leader : Jean-Claude MARTIN

Secretary : Les FIELDING

Working group 1 members	Total	European countries	Non european countries	Developping transition countries
C4 members	19	15	4	0
Corresponding members	5	1	4	0
Associate members	14	11	3	0
TOTAL representing	38 from 19 countries	27	11 from 6 countries	0



Introduction

- **Working method :**
 - One task group for each task



Introduction

	<i>Outputs</i>
<i>Task 1</i>	Recommendations on organisation and procedures for tunnel safety management, including role and skills of players
<i>Task 2</i>	Guidelines on tunnel staff and emergency teams training, exercises and feedback from operation and incidents.
<i>Task 3</i>	Recommendations on management of maintenance and safety inspections, as well as operational aspects to be considered during the design and installation of technical systems.
<i>Task 4</i>	Recommendations to take in account life cycle costs of equipments in the infrastructure design and maintenance
<i>Task 5</i>	Participation to the building of the compendium Topics in concern with operation and maintenance



Done by Task Group 1
(Leader : Peter Hedley)



Done by Task Group 2
(Leader : Les Fielding)



Done by Task Group 3
(Leader : Jean-Claude Martin)



Done by Task Group 4
(Leader : Urs Welte)



Done by Task Group 5
(Leader : Pierre Schmitz)



Introduction

- **Working method :**
 - One task group for each task
 - Individual written contribution during WG1 meetings
 - Written contribution between meetings
 - Discussion during WG1 meetings
 - Comments from peer reviewers
 - Approval by the C4 Committee



Contents

Introduction

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2. *Report* 'Good Practice for road tunnel emergency exercises'
3. *Report* 'Recommendations on management of maintenance and technical inspections of road tunnels'
4. *Report* 'Life cycle aspects of road tunnel equipment'



1 – Recommendations for strategic road tunnel safety management

- **Goals :**
 - To collate experiences around the world
 - To establish good practice
 - To promote this good practice
- **Groups targets :**
 - States
 - Administrative authorities
 - Tunnel owners
 - Operators ...



1 – Recommendations for strategic road tunnel safety management

Contents of the report

Summary

Introduction

1. Existing guidance
2. Tunnel safety management strategy
3. Procedures
4. Strategic organisation
5. Conclusions and recommendations

Bibliography

Glossary

Appendices : current international experience



1 – Recommendations for strategic road tunnel safety management

- **The report shows that it is good practice to have :**
 - A body responsible for the tunnel, including the responsibility for (establishing accepted safety levels), ensuring and confirming safety
 - A nominated entity who manages the tunnel
 - Measures to audit the safety of the tunnel and advise on systems, equipment and procedures
 - Measures in place for independent inspections.

The purpose of the report is for the safety of all tunnel users, and not to promote the actions of European Union or any specific member state, however this does not preclude citing good practice from EU directives or member state law.



1 – Recommendations for strategic road tunnel safety management

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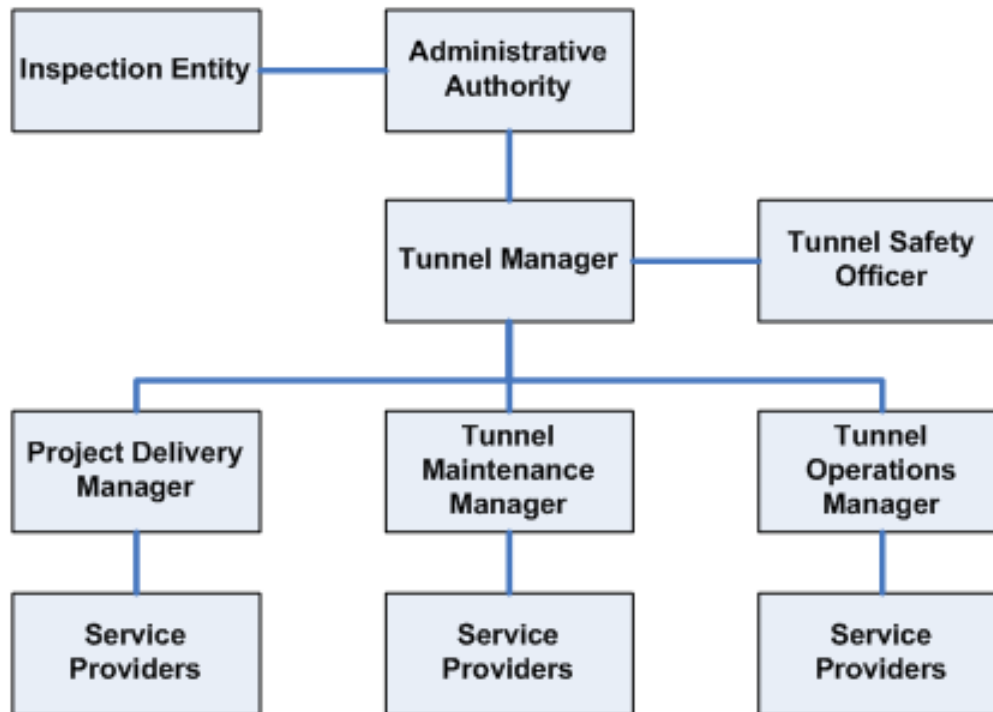
Glossary

Appendices : current international experience



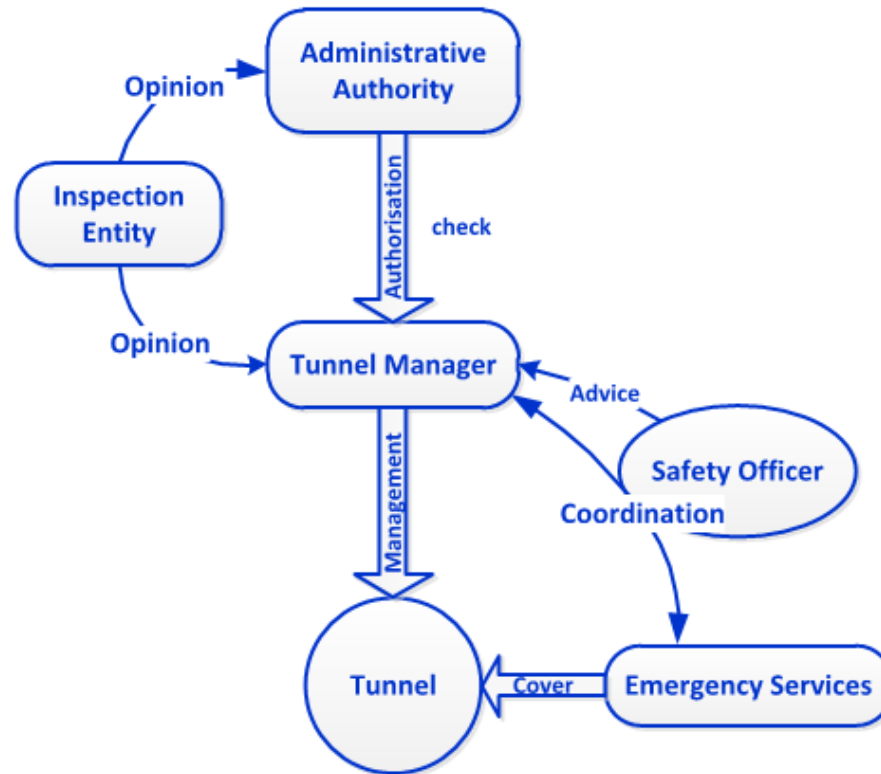
1 – Recommendations for strategic road tunnel safety management

As an example of good practice the diagram below illustrates the principal functional roles and reporting for management of road tunnels (consistent with EU directive)



1 – Recommendations for strategic road tunnel safety management

As example of good practice the diagram below illustrates a tunnel management communication structure (consistent with EU directive)



1 – Recommendations for strategic road tunnel safety management

Contents of the report

Summary

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Bibliography

Glossary

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1 – Recommendations for strategic road tunnel safety management

- An important conclusion is that it's necessary to have :
 - Safety documentation
 - A technical reference and a risk analysis method
 - Procedures to ensure safety at design and commissioning stage
 - Procedures to ensure that safety is maintained during operation



Contents

Introduction

1. *Report 'Recommendations for strategic road tunnel safety management'*
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3. *Report 'Recommendations on management of maintenance and technical inspections of road tunnels'*
4. *Report 'Life cycle aspects of road tunnel equipment'*



2 – Good practice for road tunnel emergency exercises

- **Goals :**

- To make a survey of current international experiences
- To establish good practice in term of :
 - objectives,
 - preparation,
 - carrying out,
 - evaluation.



- **Groups targets :**

- Tunnel managers
- Safety officers
- Emergency planning personnel ...



2 – Good practice for road tunnel emergency exercises

Contents of the report

Summary

Introduction

1. Information gathering and questionnaires
2. Previous PIARC guidance
3. General consideration for emergency exercise planning
4. Exercise design and preparation
5. Pre-exercise, final arrangements and realisation
6. Debriefing / Post exercise/ Incident analyse/ Feedback
7. Exercise reporting
8. Conclusions

Bibliography

Glossary

Appendices : Guidelines for debriefing and national guidelines

2 – Good practice for road tunnel emergency exercises

The report identifies four types of exercises :

- Seminar – also known as workshops or discussion based exercises,
- Table top – also known as floor plan exercises,
- Control center post – also known as training on simulator,
- Live exercises.



2 – Good practice for road tunnel emergency exercises

Contents of the report

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8. Conclusions

Bibliography

Glossary

Appendices : Guidelines for debriefing and national guidelines

2 – Good practice for road tunnel emergency exercises

As a step by step guide the report defines :

- Who has to be in the planning group,
- The detailed objectives,
- The timing of the exercise,
- The exercise location,
- The temporary traffic management,
- The safety measures,
- The exercise staff and observers,
- The needed communications,
- Public information and media participation.



2 – Good practice for road tunnel emergency exercises

As conclusion, this report is also usefull as a checklist for exercise planners to :

- Establish exercise objectives,
- Choose the most appropriate exercise to meet those objectives,
- Establish the human and technical ressources needed,
- How to control an exercise,
- Conduct a post exercise analysis,
- Evaluate the result of the exercise.



Contents

Introduction

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2. *Report* 'Good Practice for road tunnel emergency exercises'
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4. *Report* 'Life cycle aspects of road tunnel equipment'



3 – Recommendations on management of maintenance and technical inspection road tunnels

- **Goals :**
 - To collate experiences around the world
 - To provide recommendations for road tunnels maintenance
 - To give information about technical inspections
- **Groups targets :**
 - Tunnel owners
 - Operators
 - Maintenance managers ...



3 – Recommendations on management of maintenance and technical inspection road tunnels

Contents of the report

Summary

Introduction

1. General principles

2. Maintenance

3. Technical inspections

4. Conclusions

Bibliography

Glossary

Appendices



3 – Recommendations on management of maintenance and technical inspection road tunnels

The report gives information about several aspects of maintenance like :

- Level of maintenance,
- Maintenance strategy (preventive/corrective/subcontractors,...)
- Defintion of tasks,
- Maintenance staff,
- Maintenance management system.



3 – Recommendations on management of maintenance and technical inspection road tunnels

Contents of the report

Summary

Introduction

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Bibliography

Glossary

Appendices



3 – Recommendations on management of maintenance and technical inspection road tunnels

Regarding technical inspections the report defines :

- The definition of tasks,
- The required resources and inspectors qualifications
- The rating system (for evaluation of results),
- The framework of inspection report,
- Actions to be taken after an inspection.



3 – Recommendations on management of maintenance and technical inspection road tunnels

As conclusion this report is about good practice in the field of maintenance.

It is also regarding the controls that have to be implemented for verifying that maintenance achieves defined objectives at economical costs.

These controls are defined in the form of technical inspections.



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4 – Life cycle aspects of road tunnel equipment

- **Goals :**
 - To describe how life cycle cost (LCC) supports the design of equipment
 - To give some theoretical background on the LCC aspects
 - To show influence of special factors on life expectancies
- **Groups targets :**
 - Tunnel owners
 - Tunnel managers
 - Operators ...



4 – Life cycle aspects of road tunnel equipment

Contents of the report

Summary

Introduction

1. Terminology

2. International requirements

3. Maintenance and life cycles

4. The international life cycle survey

5. Main factors influencing the aging process

6. Typical systems and their life cycles

7. Conclusions and recommendations

Abbreviations

Bibliography



4 – Life cycle aspects of road tunnel equipment

During 2008 an international survey was conducted within PIARC members to evaluate average lifetime of tunnel equipment :

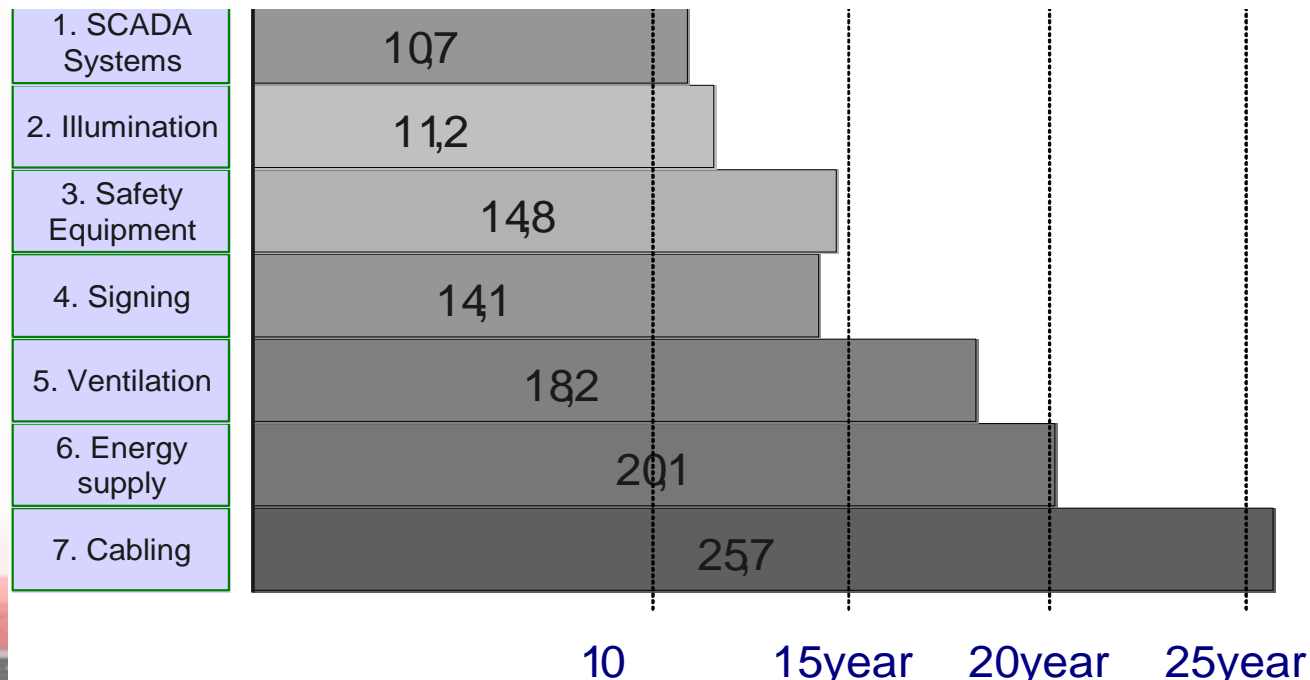
- 7 systems are involved : SCADA, Illumination, Ventilation, Signing, Safety equipment, Energy supply and Cabling
- Possible answers : 5, 10, 15, 20, 25, 30, 35.



4 – Life cycle aspects of road tunnel equipment

The typical life cycle of main tunnel equipment are shown below :

Average Lifetime of Tunnel Systems and Components



4 – Life cycle aspects of road tunnel equipment

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Summary

Introduction

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4 – Life cycle aspects of road tunnel equipment

The report defines the main factors influencing the aging process :

- The operating temperature,
 - The Arrhenius equation shows that a temperature increase of 10 degrees accelerates the aging process by a factor of 2 to 3
- The mechanical stress,
- The galvanic corrosion.



4 – Life cycle aspects of road tunnel equipment

As conclusion, the 2008 international life cycle survey showed that useful life of standard equipment varies between 10 and 25 years.

But some systems have life expectancy of 10 years and below, which makes it all more essential to consider the useful life periods.

The factors that exert a considerable influence on these systems need to be established, so that life cycles can be extended.



Conclusion

Three reports are currently been published in English and in French :

- Good practice for road tunnel emergency exercises
- Recommendations on management of maintenance and technical inspection of road tunnels
- Life cycle aspects of road tunnel equipment

This one will be published later :

- Recommendations for strategic road tunnel safety management



Thank you for your attention

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