Fire safety in metro trains, tunnels and stations – Evacuation

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Outline

- Background
- WP2 - Objectives
- WP2 - Steps
  - Literature review
  - Questionnaire
  - Laboratory experiment - train to track
  - Laboratory experiment - tunnel
  - Evacuation - Stockholm METRO
  - Egress model
Previous fires in tunnels
- Kings cross, 1987 - 31 fatalities
- Baku Metro
- Kaprun
- etc
Background

- Previous fires in tunnels
  - Long pre-movement times
  - Difficulties moving through smoke
  - Complex environment

- Needs
  - Effective notification systems
  - Way-finding systems
  - More information about walking speed, flow rates, behaviour, etc
Background

- The METRO/KESØ project
  - WP2 - Evacuation
WP2 – Evacuation

Objectives

- investigate how train passengers can be safely evacuated in case of an emergency
- study initial behaviour
- examine way-finding behaviour
- examine walking speeds
- test different way-finding systems
- include many populations
Steps

1. Literature review – accidents

Example:

King’s cross fire
- fire in escalator
- 31 fatalities

Conclusions
- roles important
- inaction initially
- police/fire service
WP2 – Evacuation

■ Steps

1. Literature review – accidents
2. Questionnaire survey – operators

Example topics:
- installations
- training
- organizational
- suggested research
Steps

• 1. Literature review – accidents
• 2. Questionnaire survey – operators
• 3. Laboratory experiment - train to track
WP2 – Evacuation
WP2 – Evacuation

- **Experiment 1**
  - Relative study with students
    - Flow rate = f(height, floor material, lighting conditions, handles, ladder)

- **Experiment 2**
  - Interview study with senior citizens and people with disabilities
    - Acceptable height
    - Exit strategies
    - Handles, etc
WP2 – Evacuation

Steps

• 1. Literature review – accidents
• 2. Questionnaire survey – operators
• 3. Laboratory experiment – train to track
• 4. **Laboratory experiment – tunnel**
WP2 – Evacuation

- Studied aspects
  - walking speed
  - behaviour
  - way-finding
  - systems

- Participants
  - 100
  - all ages
WP2 – Evacuation

- Installations
  - wall signs (always)
  - std design
  - green flashing lights
  - illuminated exit + strong lights
  - sound (siren + voice message)
WP2 – Evacuation

Procedure

• arrive
• safety instructions
• video of train trip
• enter the tunnel
• walk in the tunnel
• led out by fire fighter
• questionnaire
• interview
WP2 – Evacuation
WP2 – Evacuation

- **Procedure**
  - arrive
  - safety instructions
  - video of train trip
  - enter the tunnel
  - walk in the tunnel
  - led out by fire fighter
  - questionnaire
  - interview
WP2 – Evacuation

Results

- Wall sings very important
- Exit design
  - Std design - sometimes worked
  - Flashing lights - good
  - Illuminated + strong lights - misinterpretations
  - Sound - excellent
- Data on walking speeds and movement patterns
WP2 – Evacuation
WP2 – Evacuation

Results

• Wall sings very important
• Exit design
  – Std design - sometimes worked
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WP2 – Evacuation

Steps

- 1. Literature review – accidents
- 2. Questionnaire survey – operators
- 3. Laboratory experiment – train to track
- 4. Laboratory experiment – tunnel
- 5. Evacuation - Stockholm METRO
WP2 – Evacuation

- Postponed – fall 2013 (?)
WP2 – Evacuation

Steps

- 1. Literature review – accidents
- 2. Questionnaire survey – operators
- 3. Laboratory experiment – train to track
- 4. Laboratory experiment – tunnel
- 5. Evacuation - Stockholm METRO
- 6. Egress model
Summary

- Background
- WP2 - Objectives
- WP2 - Steps
  - Literature review
  - Questionnaire
  - Laboratory experiment - train to track
  - Laboratory experiment - tunnel
  - Evacuation - Stockholm METRO
  - Egress model
Contributors

- People involved in WP2
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  - Sam Grindrod, Edinburgh University