

METRO

A research project about fires and explosions
in metro systems (underground)

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METRO - A joint Safety in Infrastructure Project

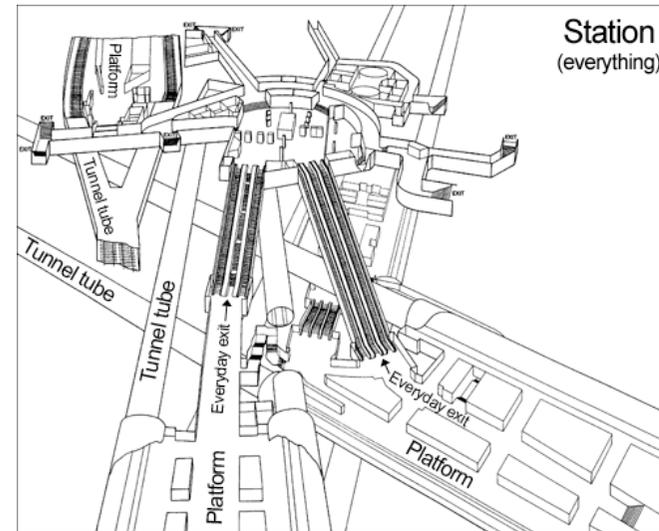
Outline

- Background
- Introduction
- WPs
- Participants
- Funding bodies
- Time plan
- More information



Background

- Critical infrastructure protection
 - Metro systems (underground)
 - Fires and explosions - devastating consequences
 - King's Cross fire
 - Baku fire
 - London bombings
 - and more...



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Introduction

- Swedish research project about fires and explosions in metro systems (underground)
- Multidisciplinary - Social science to Engineering
- Total budget: **€ 1.5 mil.**
- Three years: **Dec 2009 - Dec 2012**



Introduction

- Overall aim of the project
 - Safer metro systems in the future
 - Develop design recommendations
 - Fire safety design, Explosion protection, Evacuation, Rescue operations, etc
- Relevance - accident investigation
 - New data and knowledge - fire damage, human behaviour, etc



WPs

- Work Packages (WPs)

- WP1 - Design fires

- WP2 - Evacuation

- WP3 - Integrated fire control

- WP4 - Smoke control

- WP5 - Extraordinary strain

- WP6 - Rescue operations

- WP7 - Project management



WPs

- WP1 - Design fires
 - Develop design fires
 - Mathematical models
 - Measure temperature, species, etc
(relevant for accident investigation)

- Relevance - accident investigation
 - Fire development
 - Fire damage



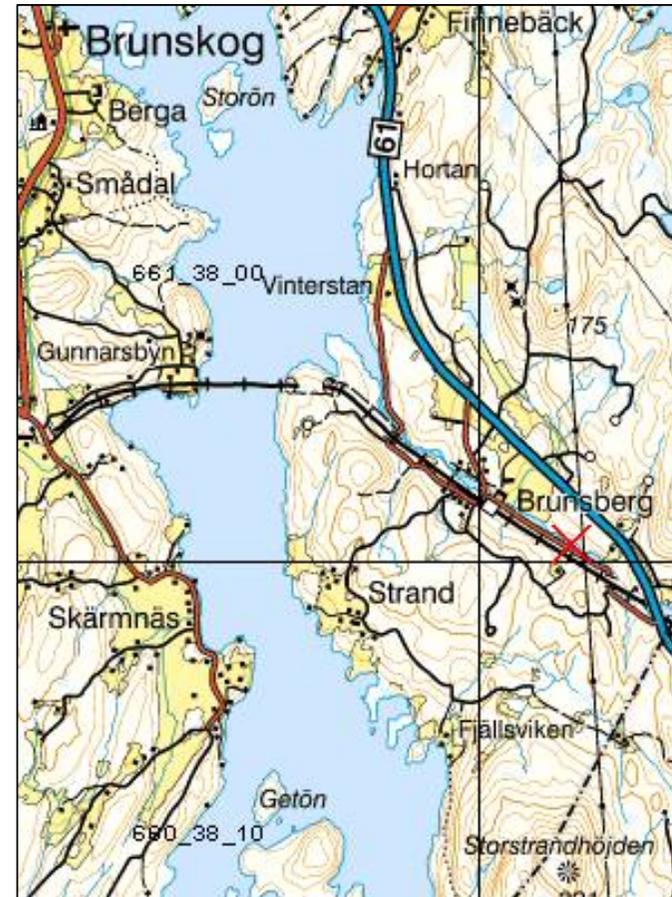
WPs

- WP1 - Design fires
 1. Single burning item (bags, strollers, etc)
 2. Model-scale tests
 3. Full-scale tests
 4. Correlation models



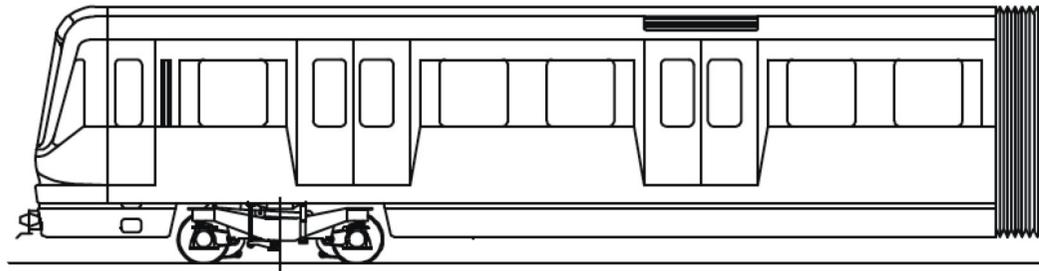
WPs

- WP1 - Design fires
 - Full-scale tests
 - Real tunnel
 - Brunsberg tunnel



WPs

- WP1 - Design fires
 - Full-scale tests
 - Real tunnel
 - Brunsberg tunnel
 - Real trains (3)
 - X1 furnished as C20



WPs

- WP2 - Evacuation
 - Develop design recommendations
 - More accurate computer modelling
 - Special focus on
 - Senior citizens
 - People with movement disabilities
- Relevance - accident investigation
 - Theoretical framework, walking speeds, input for egress models, etc



WPs

- WP2 - Evacuation

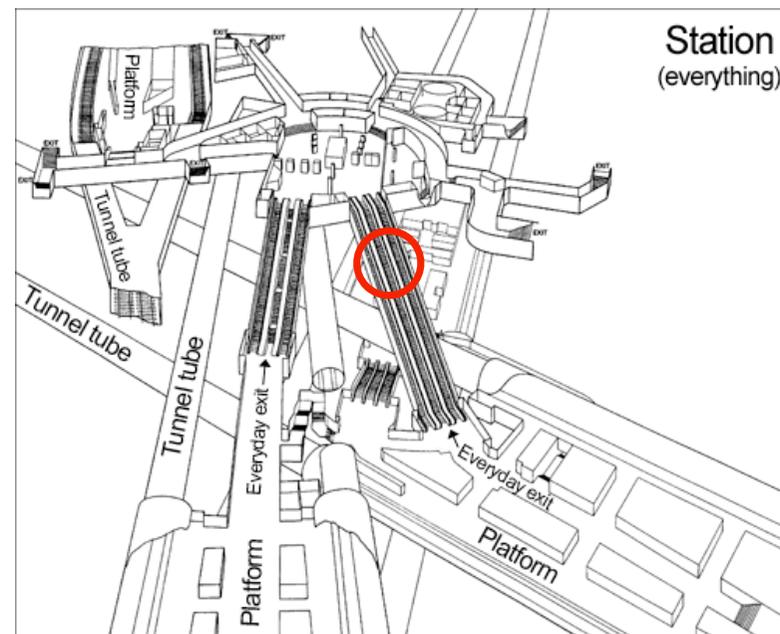
1. Literature review - accidents

Example:

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

Conclusions

- roles important
- inaction initially
- police/fire service



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WPs

- WP2 - Evacuation

1. Literature review - accidents

2. Questionnaire survey - METRO operators

Example topics

- installations
- training
- organisational
- suggested research



METRO Questionnaire

Stations, safety instructions and exercises
The following five questions relate to your stations, safety instructions and exercises. The purpose is to get a picture of your typical underground station. The purpose is also to gather information about tunnel occupants' evacuation possibilities. Please observe that we are only interested in information about your underground stations. If your subway includes stations above ground we therefore ask you to disregard these stations when answering the following questions.

How many stations have platforms with only one everyday exit?
E.g., 13 stations.

How many stations have platforms with two everyday exits?
E.g., 13 stations.

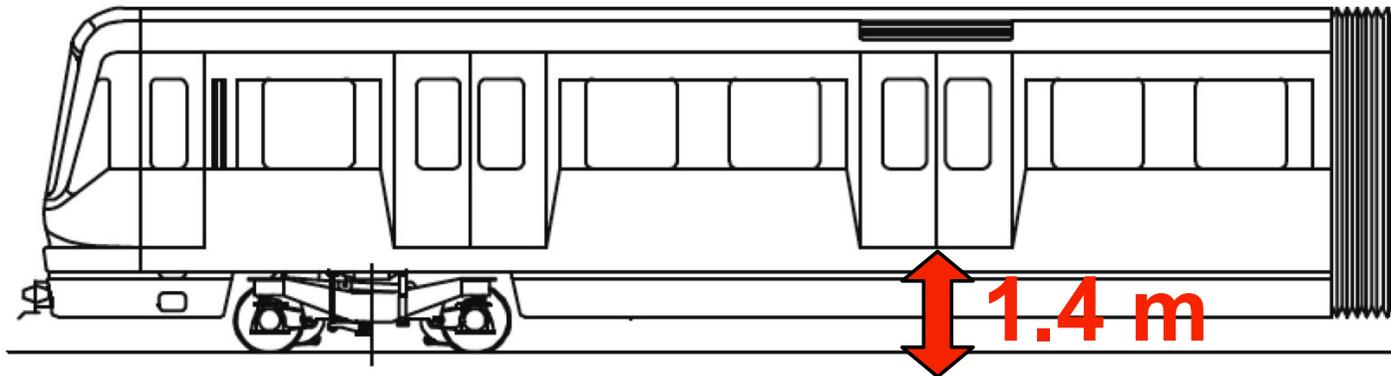
How many stations have platforms with three or more everyday exits?
E.g., 13 stations.

Are there instructions for passengers how to behave in fire emergencies, i.e., safety instructions?
You may choose more than one alternative. If safety instructions are provided elsewhere, please state so in the text box.

Yes, at stations
 Yes, at platforms
 Yes, on trains
 Yes, inside tunnel tubes
 No, there are no safety instructions
 Other:

WPs

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



WPs

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

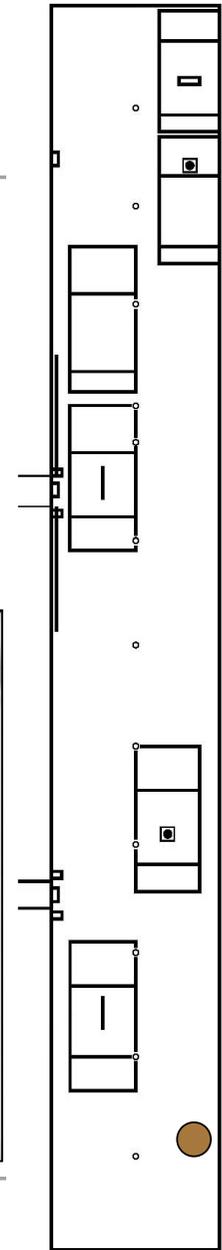


WPs

- WP2 - Evacuation
 - Similar to previous experiments (in a road tunnel)

Studied aspects

- walking speed
- behaviour
- way-finding
- installations



WPs

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



WPs

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



WPs

- WP2 - Evacuation
 1. Literature review - accidents
 2. Questionnaire survey - METRO operators
 3. Laboratory experiment - train to track
 4. Laboratory experiment - tunnel
 5. Evacuation - Stockholm METRO
 6. Develop egress model (computer)



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Participants

- Nine (9) organisations take part in METRO



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Funding bodies

- Five (5) organisations fund METRO
 - Brandforsk
 - Swedish Civil Contingencies Agency (MSB)
 - Stockholm METRO (SL)
 - Swedish Transport Administration
 - Swedish Fortifications Agency
- Total budget: **€ 1.5 mil.**



Time plan

- Start of project - **Dec 2009**
- Literature reviews - **Spring 2010**
- Evacuation experiment - **Fall 2010 - Spring 2012**
- Large-scale fire experiments - **Summer 2011**
- Seminar - **Dec 2012**
- Final report - **March 2013**



More information

- If you want more information about METRO:

www.metroproject.se

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