



# **Safety challenges in train evacuation – How to keep passengers safe**

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**Lena Kecklund,**  
Ingrid Anderzén, Sara Petterson,  
Johan Häggström & Bo Wahlström  
MTO Psykologi & Brandskyddslaget,  
Stockholm, Sweden



# Purpose

To get a better understanding of evacuation situations

To identify areas for safety improvements

To identify and explore different types of evacuation situations

- System safety
- Human factors , M-T-O
- Get a better understanding of passenger behaviour

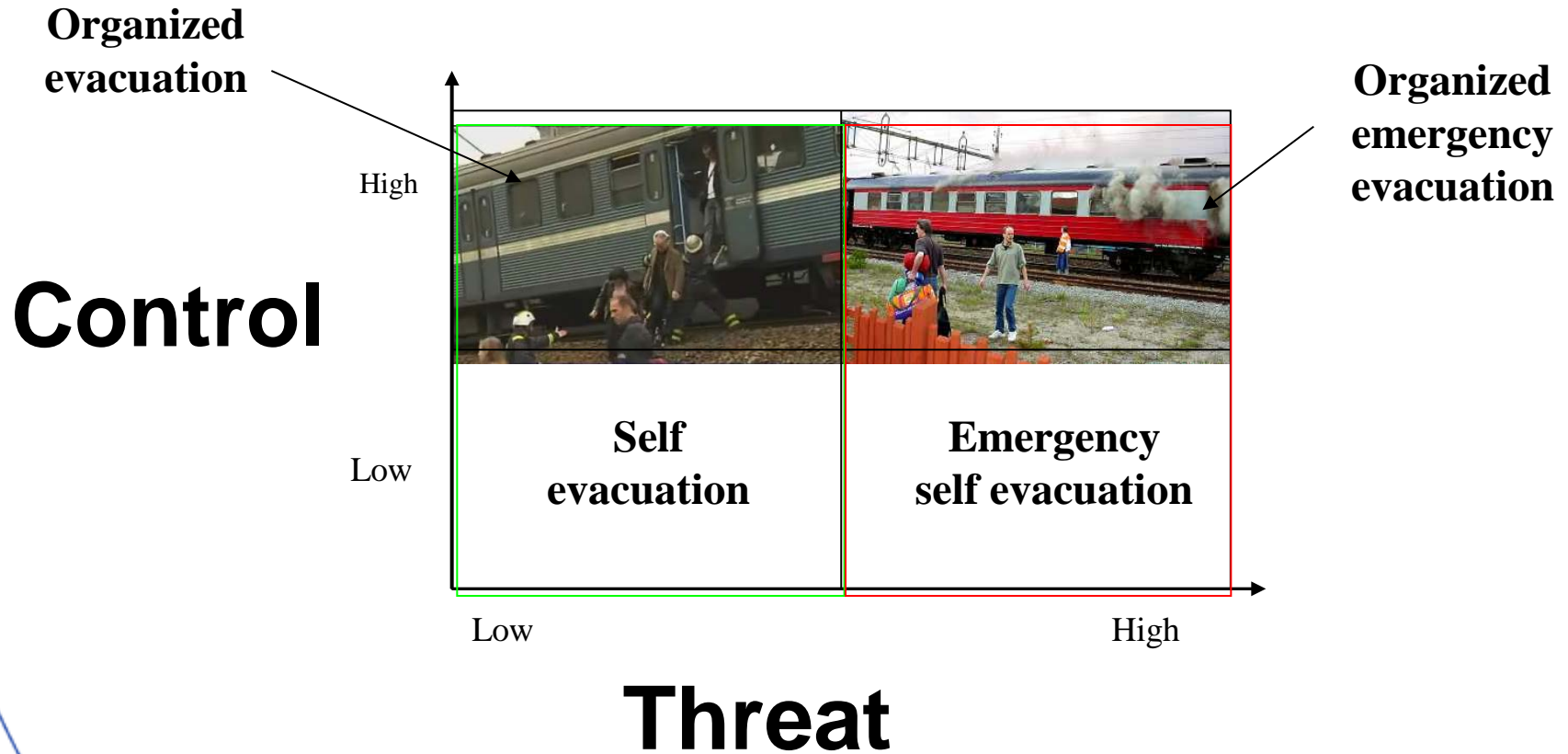


**Most of the evacuations occur in situations without any immediate danger - however there are still many difficulties for the passengers!**





# Different evacuation situations



# Definitions

- The train is standing on the track
  - The evacuation is outside the platform area
  - The passengers are moved outside the train
  - The environment outside the train and evacuations in tunnels is not included in the study
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- Train staff
  - Passengers

# Decision and decision-makers in evacuation

- **Different goals**
  - Driver
  - Dispatchers
- **When to evacuate?**
  - Wait on train
  - Evacuate to other train or buses
- **Who makes the decision to evacuate?**
- **When and for what reason?**
- **Available resources for carrying out the evacuation**

# Method

- Data from real evacuations
  - Low threat – higher control
  - Several TOCs
  
  - 113 evacuations
  - 160 train staff
  
  - 33 evacuations
  - 125 passengers



# WHY Evacuate?

- 38% vehicle problems
- 28 % the aerial line is broken
- 14% fire/smoke
- 8% stop in traffic, animal accident
- 11% others ( ex. somebody has used the emergency brake, trees fallen on track)

# Time spent waiting for evacuation

- The time from train stop to start of evacuation
  - From >10 minutes to four hours
  - In 57% of cases - more than 30 minutes
- Did the decision to evacuate change?
  - Yes, in 10% of the cases because the passengers started to self evacuate

# Time spent waiting for evacuation

Quote from train staff

*“Thank God it was 6 o’clock in the morning. If it would have been later in the day it would have been impossible to keep 200 passengers in the train the whole time.”*



## Time spent waiting for evacuation

*"It was extremely hot in our carriage since it was very crowded and people everywhere. The situation could have been improved if the firemen, as they passed through the carriage after we had waited for an hour, had broken a few windows. This would have given us fresh air. One and a half hours of waiting standing up in a tilting train is more than most people can handle. Fresh air would have made it easier"*



# Information from train staff to passengers

- Loudspeakers 66%
- Directly from train staff 25%
- No information 10%
  - Problems with loud speakers, language, insecurity and emotions (anger, worries), no information, unclear information, no staff available

**Passengers state the importance of information!**

# Areas for improvement

- Safety communication
- Reduction of time delay for the decision to evacuate
- Reduction of time delay for execution of decision to evacuate
- Training of train staff
- Procedures with decision criteria

# Conclusions

- Evacuation situations occur quite frequently
- New risks as time passes
  - Bad conditions for passengers on train
  - Self evacuation



# Conclusions

- What measures must be taken for risk management?
- Safety targets for risk management in evacuations
  - Define waiting times
  - Set time for when conditions become intolerable

# Thank you!

**Contact:**  
**Lena. kecklund@mtop.se**