



## Safe refuge area-

design and communication  
based on user perspective

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## Design of safe refuge areas

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**BRANDSKYDDSLAGET**



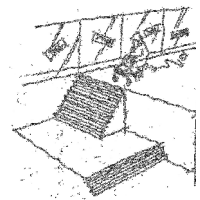
## Outline of seminar

- Background
- Interview study
- Questionnaire study
- VR study
- Results
- Conclusions
- Group assessments



## Background

- 6 % with mobility impairment
- Aging population & more active
- Accessibility in building
- Evacuation
  - Level differences
  - Vertical evacuation



## Background

### ■ Some statistics from Sweden

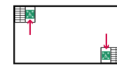
- 500 000 persons with movement disability and 80 000 of those use wheel chair
- 250 000 have low arm- and hand function
- 300 000 cannot turn page in a newspaper
- 5 % are older than 80 yr, 50 % of those born today will get 100 yr.
- Low orientation capability 5 %



## Basic principles for evacuation



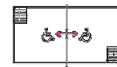
Direct to the outside



To a safe refuge area



Evacuation elevator



Separate fire compartments

Bild tagen från SBFs rekommendation Frångänglighet – Utrymning för personer med funktionsnedsättning



## Safe refuge area

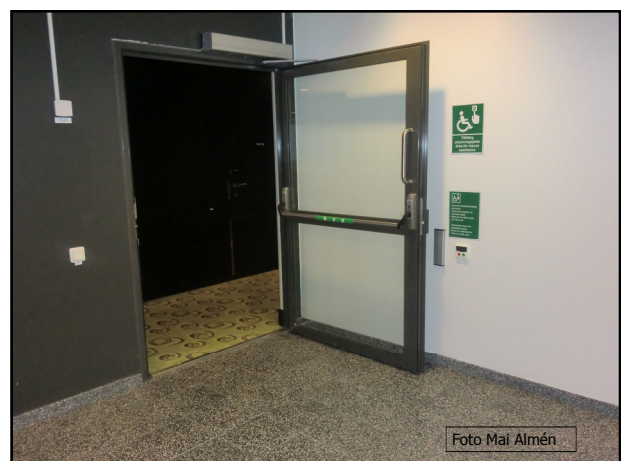
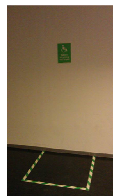
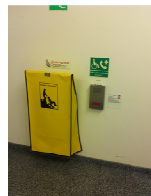


Foto Mai Almén

## Safe refuge area

### ■ Communication "2-way"



### ■ Other means for communication??



## Issues related to the design of a safe refuge area:

- New strategy for assisting the mobility impaired
- No common practice, different design
- Several unclear issues
  - organisational aspects?
  - rescue services involvement?
  - way guiding signs, information, communication?
  - other alternatives?
  - will it be used?



## Objectives for research project

- Explore what end users think about the evacuation strategy to use a safe refuge area, in case of emergency
- Collect information on how to design a safe refuge area to make the end users feel safe waiting for assistance
- Investigate what the accepted waiting time would be for the end users
- Collect thoughts and opinions from authorities and other stakeholders in the building planning process of how to design a safe refuge area



## Method

- Interview study
  - Authorities, fire consultants, fire brigade, accessibility consultants, 8 persons
- Questionnaire study
  - 71 end users with mobility impairment
- Virtual Reality study
  - 15 wheel chair users
  - 4 scenarios
  - communication aspects



## Interview study

- 8 participants: authorities, fire consultants, fire brigade, accessibility consultants
- The concept
- Design of the communication aspects
- Size of the SRA
- Wayguiding
- Location



## Interview study

- The concept of safe refuge area
    - Not well known in general
    - The fire brigade's knowledge is restricted to those working in the building planning phase and the knowledge is low among the firemen.
- "Organizationally we do not know that safe refuge areas exist, and we do not know in which buildings they might exist" (Fire rescue representative)*



## Interview study

- The concept of safe refuge area
  - Who is responsible of rescue assistance is not defined
  - It is hard to know that a building has a safe refuge area
  - It is not trustworthy solution and doubts that the areas actually would be used
  - Is there a need for standardisation?



## Interview study

- The concept of safe refuge area
  - There is a problem related to AV and Boverket having different requirements
  - Weak link between building regulations and rescue services intervention
  - How will the rescue services act when there is a SRA in the building. What if there is no fire alarm?



## Interview study

- Communication system at the safe refuge area
  - Feedback from fire brigade personnel and fire safety consultant regarding two-way communication

*"Do we know if two-way communication as a concept is working when using buttons? Will it contribute or is it just for show." (Fire safety consultant)*

*"If a signal light, connected to a safe refuge area, is lit on the fire alarm panel I guess it would not be given such a high priority." (Fire rescue representative)*



## Questionnaire study

- 71 end users with mobility impairment
  - "cannot walk in stairs at all" (N=42) or
  - "could walk in stairs if it was an emergency situation" (N=29)
  - active in the society



## Questionnaire study

- How I want to evacuate a building
  - On my own (17 answ)
  - With assistance of others (10 answ)
  - Elevator (7 answ)
  - Six other suggestions



## Questionnaire study

- Willingness to use a safe refuge area
  - About 60 % of the end users would use a safe refuge area
  - The end users who were not willing to use a safe refuge area said:

*"Would not dare to sit and just wait"*

*"It seems scary to sit and just wait for help. I would probably try to crawl down the stairs if it was possible"*



## Questionnaire study

- Feeling secure at the safety refuge area?
  - Be able to communicate with a person
  - Information that the location is safe



## Questionnaire study

- Willingness to use a safe refuge area
  - Factors that would cause most stress for those waiting for assistance at a safe refuge area

	No. of answ.	%
Factor causing stress		
Waiting time	2	3
Flames and smoke would get into the safe refuge area	28	40
Not be given any information	13	18
See other evacuees pass by them	5	7
Not know when assistance will come	18	25
Other	2	3

- About 80 % of the end users thought the safe refuge area would give them a greater feeling of safety visiting a public building



## Questionnaire study

- Waiting time
  - The end users are not willing to wait more than 10 minutes

Waiting time interval	No. of answer	%
1-5 minutes	32	45
6-10 minutes	18	25
11-15 minutes	6	8
more than 16 minutes	11	16
No answer	4	6



## Questionnaire study

- Communication system at the safe refuge area
  - How would the end users like to receive information?
    - A two-way voice communication system
    - A button and light signal communication system
    - A system using a text display to convey messages



## Questionnaire study

- Communication system at the safe refuge area
  - How would the end users like to receive information?

	Rank					
	1	2	3	4	5	Do not know
Two-way voice communication	0	1 (1)	14 (19)	21 (28)	29 (40)	2 (3)
Text display	20 (27)	16 (22)	18 (24)	7 (10)	1 (1)	5 (7)
Signal lamp	13 (18)	16 (22)	19 (26)	9 (12)	6 (8)	4 (6)



## Questionnaire study

- Communication system at the safe refuge area
  - End users describing what would be most important for them to feel safe while waiting at the safe refuge area:

*"Continuous contact with someone and that the rescue personnel knows where I am in the building. Information about when help will arrive."*

*"That someone knows that I am at the safe refuge area and to have contact with someone outside who can inform me about what is going on"*



## Questionnaire study

- Way guiding to the safe refuge area?
  - all the way to the outside by myself: 59%
  - to a safe refuge area: 6%
  - to a safe refuge area or I can go by myself to the outside: 35%



## Questionnaire study

- Willingness to use a safe refuge area
  - As a last question the end users were asked one more time about their willingness to use the area
  - About 50 % were positive



## Group assignment

- Is current recommendations for way guiding sufficient?
  - who is to follow the sign?
  - what shall be at the other end?
- How could recommendations be improved?

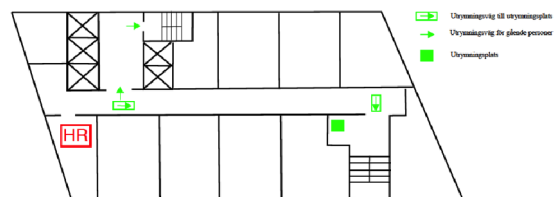


## Virtual reality experiments

Oculus rift



## Setup





## Setup



## Setup



## Virtual reality experiments

- 15 participants, all in wheel chairs
  - 4 could use stairs if necessary
- Four scenarios
  1. A button and light signal communication system
  2. A button and light signal communication system + window in door
  3. A system using a text display to convey messages
  4. A two-way voice communication system



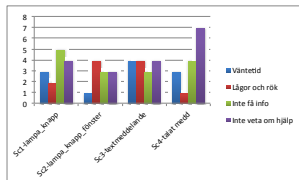
## Communication



+ scenario  
with a window  
in the door



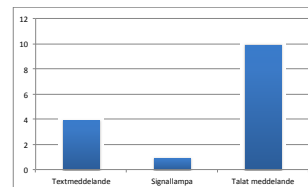
## Most worrying at SRA



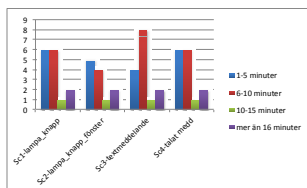
- want to leave the place
- helpless and dependent of others
- window was good
- feed-back having the voice communication



## Preferred communication system



## Waiting time and concluding remarks



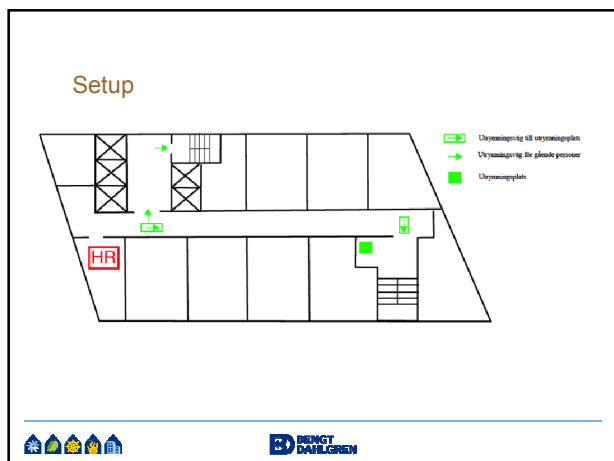
- Feel uncertain
- Helpless
- Better to have a SRA than not
- Provides a higher degree of security



## Group assignment

- Design and communication at the SRA
- You have a mobility impairment.
- Your name is Kim.
- Test terminates when you hear the word "STOP"





# Utrymningsplats

Plats för att avvakta vidare utrymning

- Blinkande sken, vänta på bekräftelse
- Fast sken, nödsignal uppfattad. Vänta på assistans

För nödsignal tryck minst 10 sekunder

## Group assignment

- Design and communication at the SRA
- Is it OK to wait at the SRA?
- Is there a need for anything?
- What would make you comfortable waiting at the SRA?



## Conclusions

- There is large uncertainty on how the SRA shall work together with the organisational fire safety
- Users are positive to SRA
- Approx 50 % are willing to use the SRA but all think it is better to have one
- Time to wait is far from what can be expected
- Information is important to users
- Most preferred is the 2-way voice communication



## Conclusions

- Interpretation of the "wheel chair sign"
- Alternative to a SRA?
- Who and how to assist the person at the SRA?
- Local rescue services uninformed
- Who will respond at the other end of the 2-way communication?



**Thank you!**

