FIRE ALARM RECOGNITION AND EXIT CHOICE IN UNDERGROUND STATIONS

BUROHAPPOLD ENGINEERING

Safety Design in Buildings

Jeddah Conference

Crowne Plaza Jeddah, Wednesday, October 21, 2015

21st October 2015

COURSE DESCRIPTION

Researchers have been collecting building evacuation data, especially pre-movement time, for various occupancies for the purpose of egress analysis studies. However, little effort has been exhorted in determining the effectiveness of the various types of fire alarms available in the market, especially with the increased use of open architecture assembly spaces. This study presentation focuses on occupants' ability to recognize various alarm signals, most suitable alarm signal for underground stations, and how to increase occupant awareness of emergency exits

PRESENTER

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Senior Fire Engineer

Majed is a Ph.D. Candidate at WPI's Department of Fire Protection Engineering. He is one of a handful of researchers examining the effects of cultural differences on occupant movement and behavior during emergency evacuation. He has published numerous papers on the subject in various conferences and scientific journals. He also has a Bachelor and Master degrees in fire protection engineering.

In addition, Majed also worked at Saudi ARAMCO as a fire protection engineer and has recently joined Buro Happold.

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LEARNING OBJECTIVES

1. Introduce fire alarm and its importance
2. Identify challenges associated with fire alarm recognition
3. Challenges associated with underground stations
4. Highlighting areas of advancements and future research

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OVERVIEW

- What is a fire alarm?
- Why is it important?
- Do you know how it sounds?
- Fire alarm studies
- Underground stations
- Challenges
- Studies
- Where to go from here?

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WHAT IS A FIRE ALARM

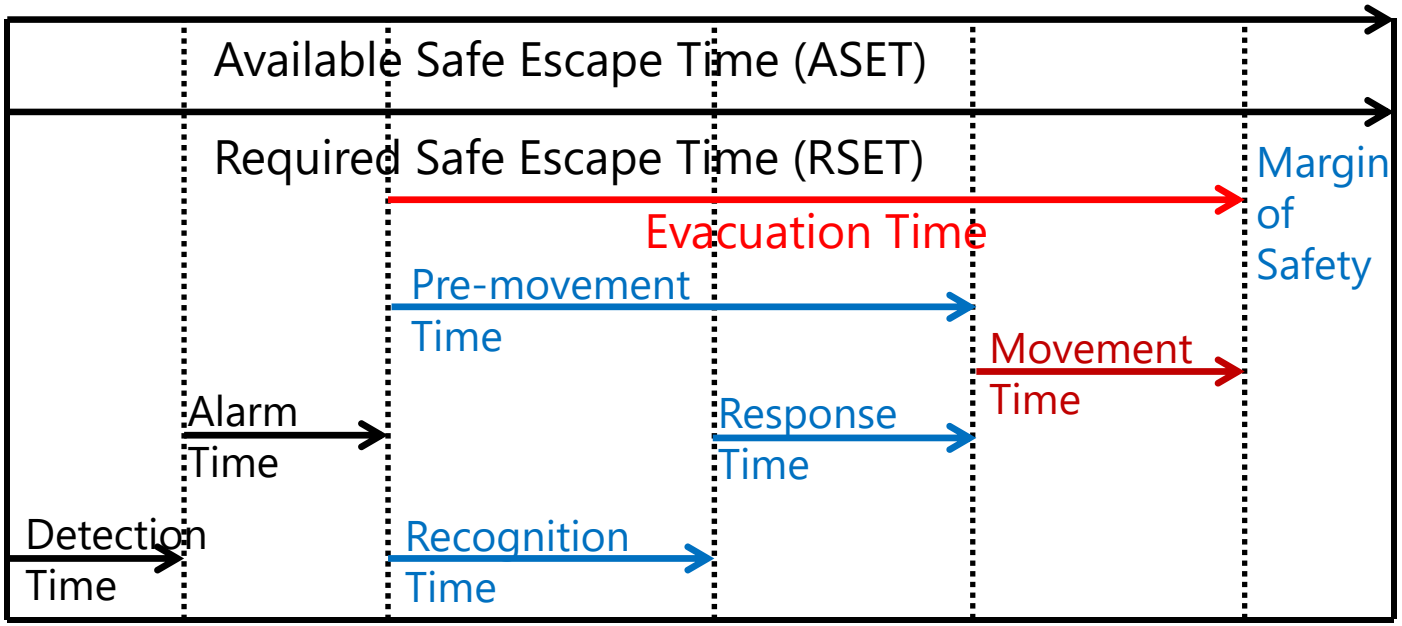
- System used to notify occupants (automatically/manually) of any incident in the premise through audio/visual devices
  - horns
  - Strobes
  - Screens
  - Speakers

WHY IS IT IMPORTANT

- Life safety
  - Ideally, Early notification = short evacuation time
- Property protection
  - Early detection/notification = less property damage

WHY IS IT IMPORTANT

- Evacuation Analysis



HAVE YOU EVER HEARD A FIRE ALARM?

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DO YOU KNOW HOW IT SOUNDS

- Can you distinguish a fire alarm from other types of alarm?
  - Alarm 1 
  - Alarm 2 
  - Alarm 3 
  - Alarm 4 
  - Alarm 5 

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DO YOU KNOW HOW IT SOUNDS

- Do you what the alarm means?
  - Alarm 4
  - Alarm 6
- Which one conveys the intended message?

FIRE ALARM STUDIES

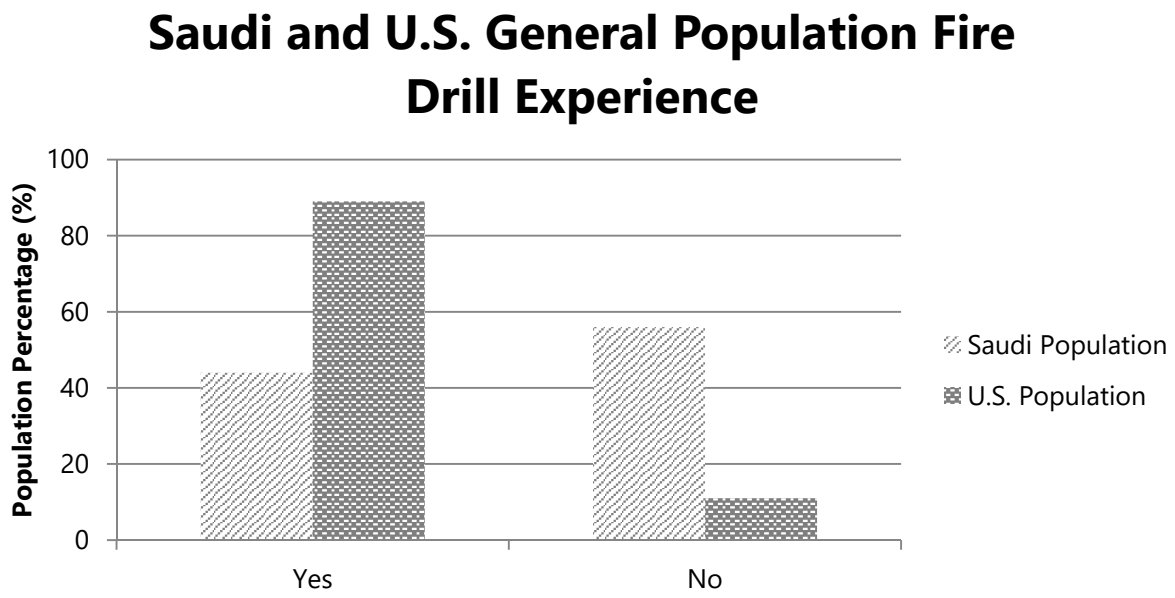
- 2001 study conducted in Canada
  - 307 participants
  - 6% correctly identified T-3 signal
  - T-3 Required in Canada since 1997
- No other fire alarm familiarity study conducted since then
- Lack of recent data
  - Difficulty in assessing effectiveness of T-3 & other signals
  - Impact of signals cross culturally

FIRE ALARM STUDIES

- 2015 study comparing Saudi and U.S general
  - 500 U.S. participants (229 males, 271 females) and 154 Saudi Participants (87 males, 67 males)
  - Asked about previous fire drill experience
  - Asked to rate 5 audio clips on likelihood of being fire alarm
  - 57.2% of Saudi population never experienced fire drill (10.5% U.S.)

FIRE ALARM STUDIES

- 2015 study comparing Saudi and U.S general



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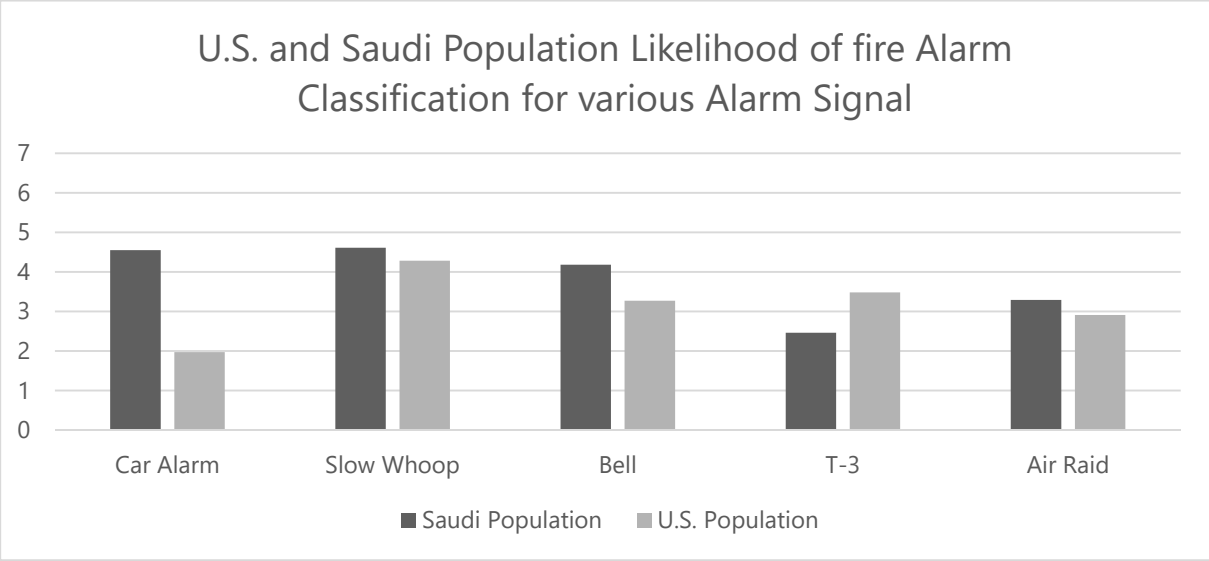
FIRE ALARM STUDIES

- 2015 study comparing Saudi and U.S general
  - Saudi population were less familiar with T-3 signal
  - Saudi population more likely to consider bell signal as a fire alarm
  - Saudi population more likely to identify car alarm as a fire alarm
  - Saudi population considered T-3 least urgent
  - U.S. population considered alarm bell least urgent

FIRE ALARM STUDIES

- 2015 study comparing Saudi and U.S general
  - Fire alarm Classification



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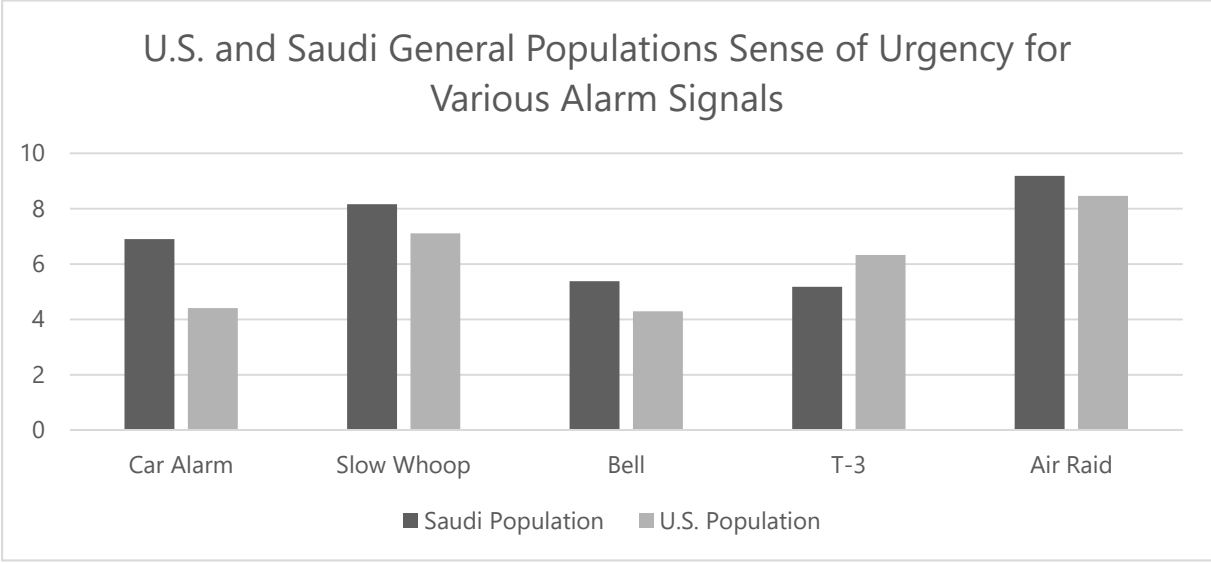
FIRE ALARM STUDIES

- 2015 study comparing Saudi and U.S general
  - Alarm Urgency



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FIRE ALARM STUDIES

- Can we use recognition / pre-movement time data cross culturally?
- Should we use the same alarm signals globally?
- Is the T-3 signal the solution?
- How are fire drills conducted and are they effective?

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UNDERGROUND STATIONS

- Popular use in-city train systems
- Saves space / real estate
- Increase use in the Middle East
  - Dubai Metro
  - Riyadh Metro

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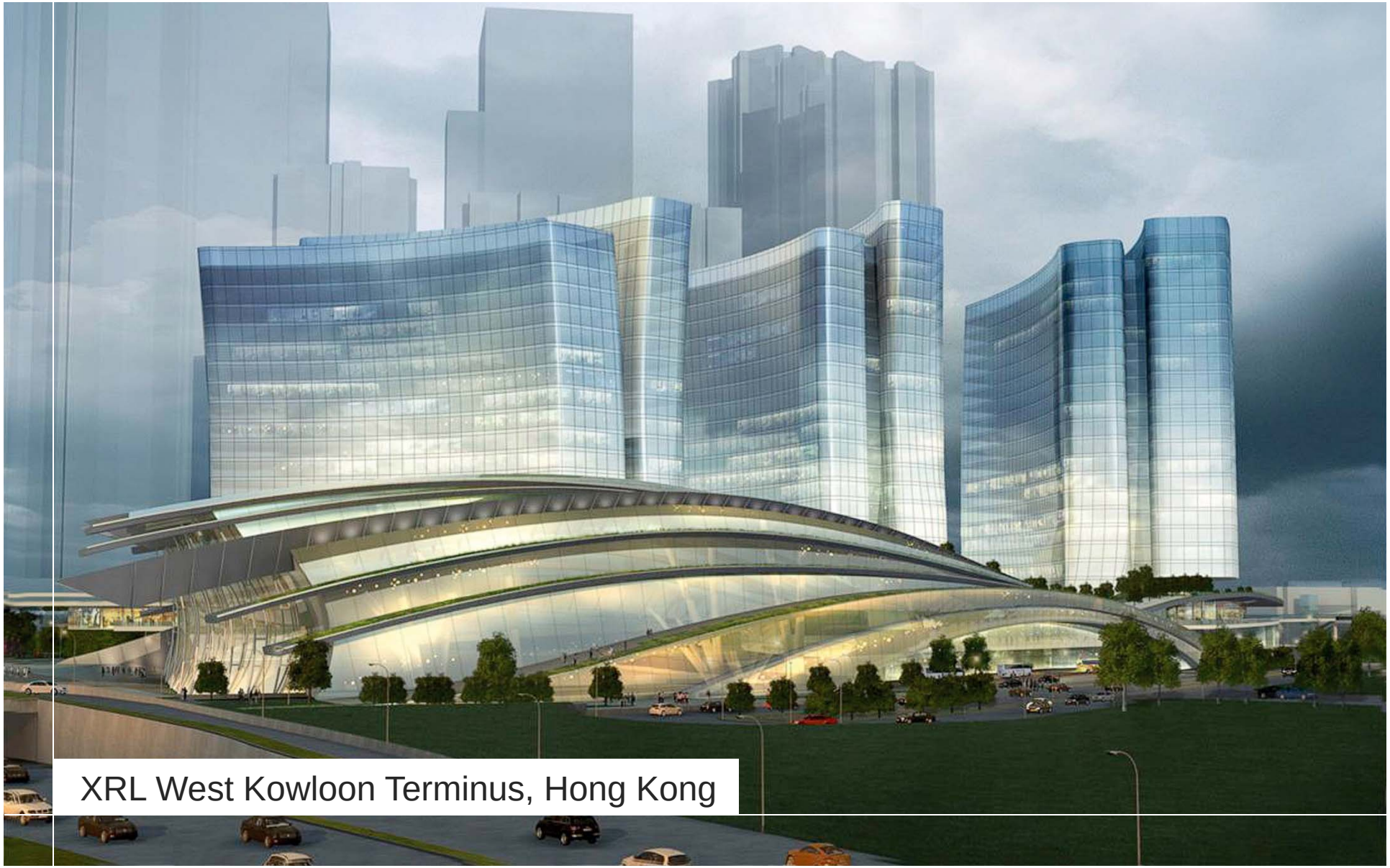
UNDERGROUND STATION CHALLENGES

- Open space
  - Smoke travel, fuel loads
- Location of exits
  - Use normal entrance or emergency exits?
- Transient population
- Notification
  - Type of fire alarm / what information to convey
  - Familiarity with Alarm
- Multiple occupancies (e.g. assembly, retail)



XRL West Kowloon Terminus, Hong Kong

Transbay Transit Center, San Francisco, CA, USA

Night view from high level

KAFD Metro Station, Riyadh, Saudi Arabia

Anaheim Regional Transportation Intermodal Center, Anaheim, CA, USA

UNDERGROUND STATION STUDIES

- What information to convey
  - Prompt evacuation when using
    - Alarm bell, staff members intervention and directive public announcement
    - Alarm bell with improved, live directive announcements
- Choosing an exit
  - Studies have shown that approx. 50% will evacuate via same route/ exit used to access the space
  - Familiarity with building increases probability of using emergency exit
  - Type of signage
    - Flashing lights increase likelihood of choosing emergency exit
  - Staff intervention

WHERE TO GO FROM HERE

- Need for additional data
  - Walking speeds
  - Cross-cultural studies
  - Exit signage
- This data can be used for
  - Evacuation modelling
  - Model validation
  - Egress analysis
  - Provide robust results
  - Decrease uncertainty with models / results
  - Propose code changes

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QUESTIONS?

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