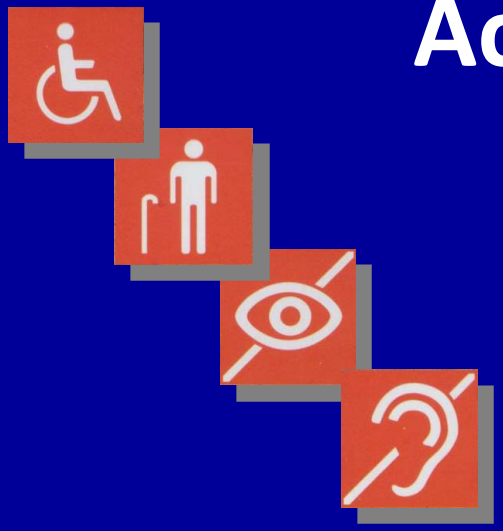


Accessibility and Evacuation Planning

Similarities and Differences

Hubert Klüpfel

The Goal:
Evacuation Planning for All

Facts in Numbers

People with special access needs:
20-24% of the world population

Meaning:

- 45 million Americans
- 42 million in the European Community
- 4 Million Australians

An additional 10% are elderly (The number of people with disabilities increases with age).

Who are people with special access needs?

Wheelchair users

Limited mobility

Visually impaired

Hearing impaired

Cognitively disabled

Mental disorders

Visibility of disability

Disability	Visible	Invisible
Mobility Impaired	Wheelchair, Crutches, Walker, Deformation	Heart condition, equilibrium
Sensory Impairment	Guide dog, Cane, Telescopic glasses, Hearing aid	No external aids
Intellectual impairment	Facial looks, Expression	No external indication
Learning disabilities	Prominent behavior	No external indication
Mental disorder	Appearance, Expression	No external indication

The Law for Equal Rights

Stands for:

"elimination of discrimination against individuals with disabilities in all aspects of life"

Mandatory:

- physical, sensory & psycho-social accessibility to all public institutions – new and old. (including public transportation, public space - streets, shopping, recreation, nature sites, historic sites etc.)

- accessible services (including technology base aids and devices)

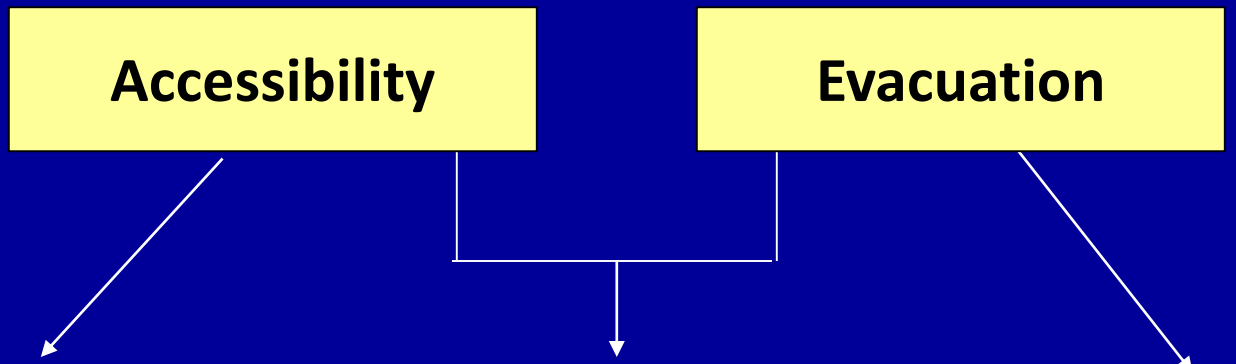
Therefore:

- **Accessibility** of a facility must be an integral aspect of the design
- The **evacuation** concept for a building must take into account aspects specific to people with disabilities

Accessibility and Evacuation Correspond to and complement each other

- **“Accessibility”:** related to universal design – involves "direct access." Making the environment accessible to all people (whether they have a disability or not).
- **“Emergency evacuation”** is the immediate and rapid movement of people away from the threat or a hazard.

Similarities and Differences



Utilization

Ingress

Slow Egress

Population

Occupancy

Spatial Configuration

Route Marking

Hazard

Fast Egress

The “Time” Factor

- Accessibility: time plays no decisive role
  → ASAT = ∞
- Evacuation: Criterion ASET > RSET has to be met for safe evacuation
  → ASET = (e.g.) 15 min.

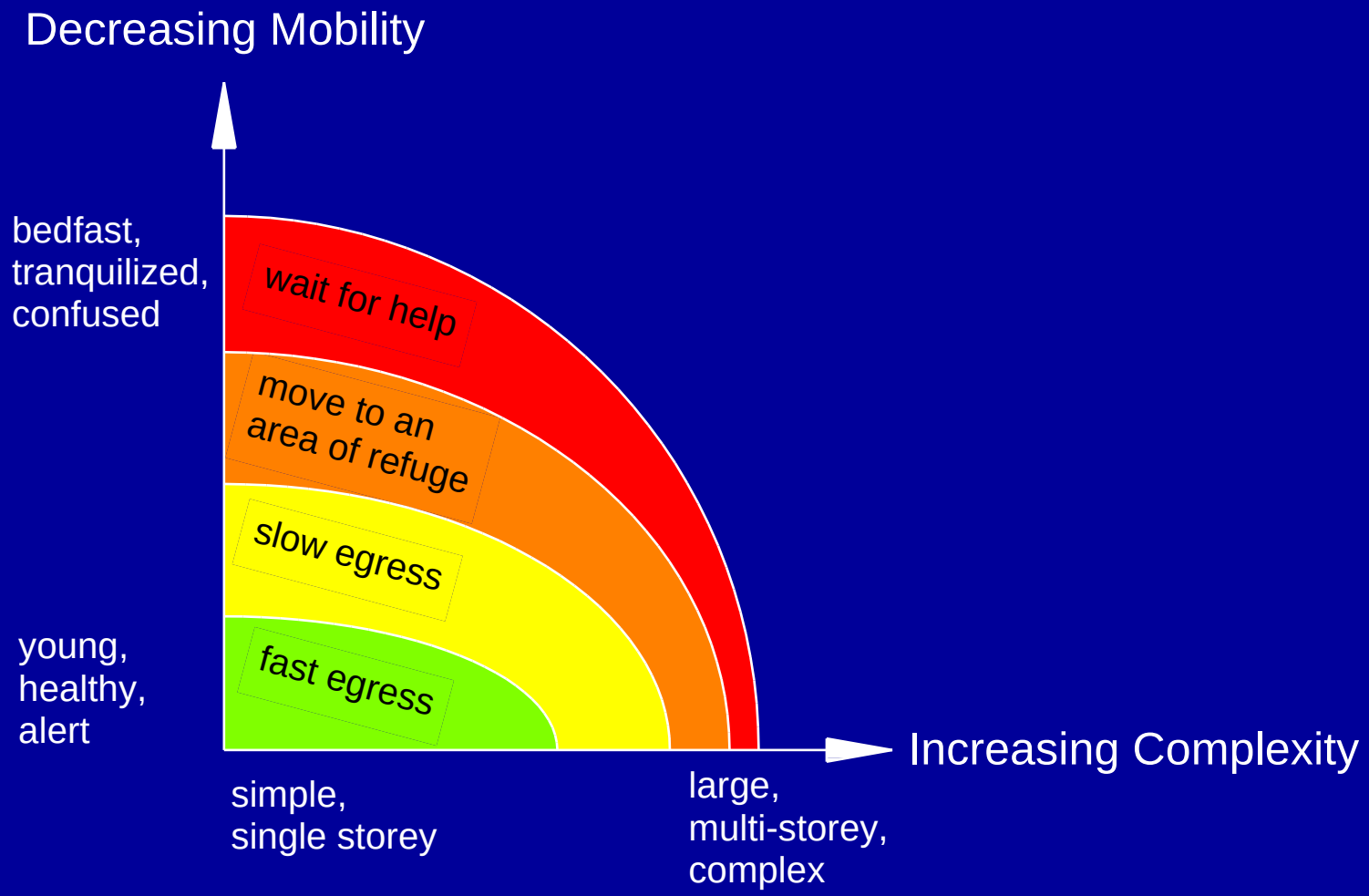
ASAT > ASET

Imbalance: Use of Elevators

Ingress ⟷ Egress

Figure taken from www.mysafetysign.com

Mobility, Complexity, and Strategy



Accessibility elements which have an impact on evacuation:

Egress routes (do not include stairs, steps, or escalators)

- **Length** of route (Travel distance**)**
- **width**
- **Passing Space**
- **Head Room**
- **Surface Textures** (such as carpet, slippery surface, uneven surface etc)
- **Slopes**
- **Doors**

Continue:

- **treatment of elevation changes**: a curb ramp, ramp, elevator, or platform lift
- Evacuation elevators
- Signage
- Alarms
- Stairways

Example: Signage

Location, letter size and shape

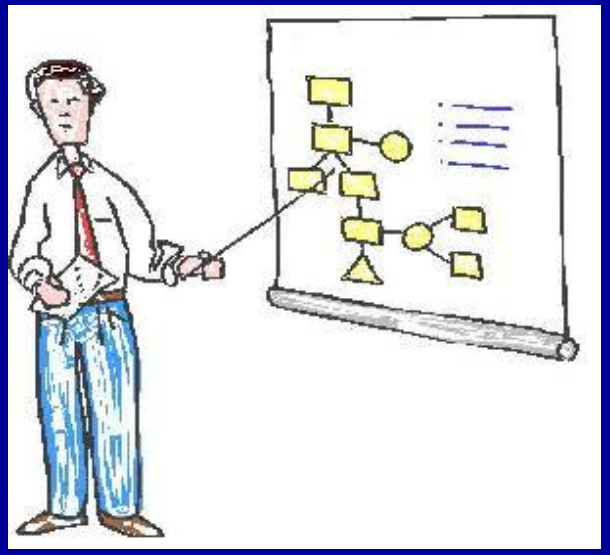
Symbols, text, location

clarity

Evaluating Accessibility Model

Objectives:

- To **analyze** access information in a systematic way for wide range of people with disabilities



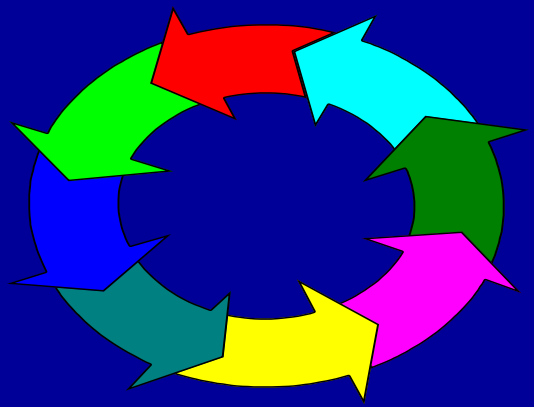
- To present **processed** access information in useful and a clear way across counties.

Challenges

- Accessibility is a result of the combination of many details.

  Each detail does not stand alone.

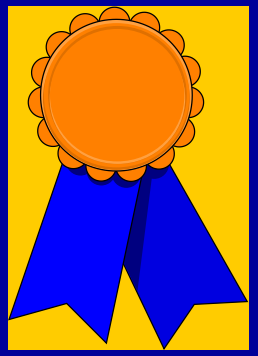
  There are many possible interactions



- Unique design of sites/ buildings have to be considered

- There are guidelines but no official audit tools to assess accessibility
- Various types of disabilities have different access needs

The decision support and scoring system model



- The system focuses on the interaction between
  the individual and the environment
- The system is a computerized audit tool which is grading the findings.
- Our scoring system operates on 2 sets of mathematical equations for each type of disability. generating bias free scores to define accessibility:

1. For each element and facility separately
2. For the site as a whole

Site Grades

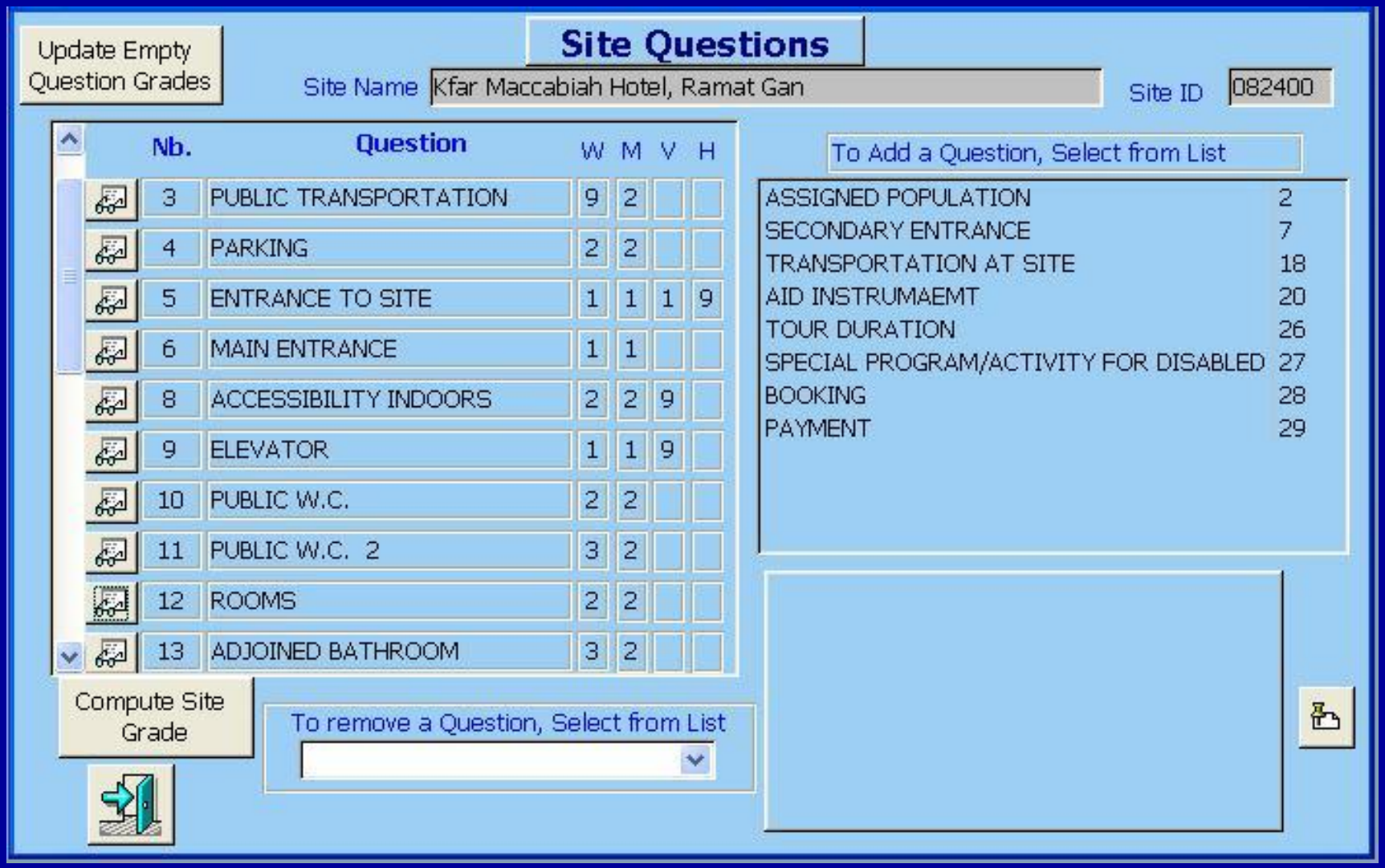
1 Inaccessible

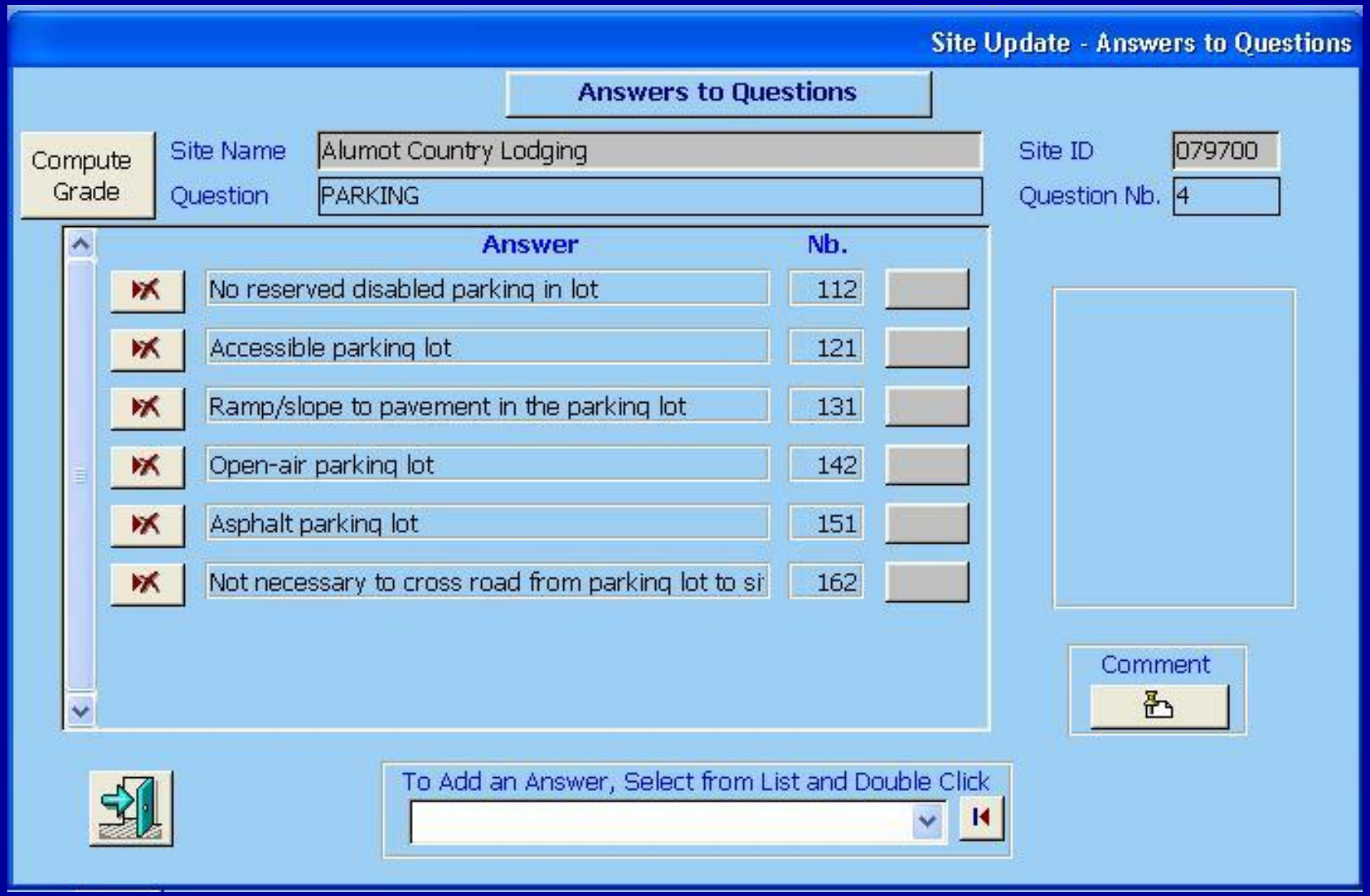
2 Partially accessible or requires assistance

3 Accessible but does not meet the standards

4 Accessible according to standards

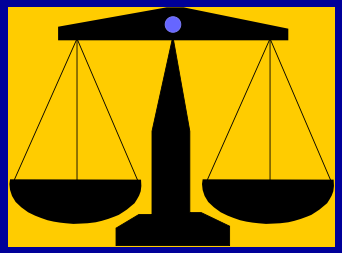
Data input


Update Empty Question Grades
Site Questions
Site Name
Kfar Maccabiah Hotel, Ramat Gan
Site ID
082400
Nb.
Question
W M V H
3 PUBLIC TRANSPORTATION 9 2
4 PARKING 2 2
5 ENTRANCE TO SITE 1 1 1 9
6 MAIN ENTRANCE 1 1
8 ACCESSIBILITY INDOORS 2 2 9
9 ELEVATOR 1 1 9
10 PUBLIC W.C. 2 2
11 PUBLIC W.C. 2 3 2
12 ROOMS 2 2
13 ADJOINED BATHROOM 3 2
To Add a Question, Select from List
ASSIGNED POPULATION 2
SECONDARY ENTRANCE 7
TRANSPORTATION AT SITE 18
AID INSTRUMAEMT 20
TOUR DURATION 26
SPECIAL PROGRAM/ACTIVITY FOR DISABLED 27
BOOKING 28
PAYMENT 29
Compute Site Grade
To remove a Question, Select from List


Site Update - Answers to Questions
Answers to Questions
Compute Grade
Site Name
Alumot Country Lodging
Site ID
079700
Question
PARKING
Question Nb.
4
Answer
Nb.
No reserved disabled parking in lot
112
Accessible parking lot
121
Ramp/slope to pavement in the parking lot
131
Open-air parking lot
142
Asphalt parking lot
151
Not necessary to cross road from parking lot to si
162
Comment
To Add an Answer, Select from List and Double Click

Grading system:

- Answers a wide range of access needs for each type of disability
- Weight accessibility based on the combination of building specific and disability specific criteria



- Equations are **built in** - thus enable instant data analysis while data input
- Does not require **personal judgement**
- **Personal impression** does not have an impact on grades

Evacuation Simulation

Relation Accessibility and Evacuation

- Generally: an accessible (barrier-free) building is required for evacuation
- an accessible building is not necessarily easy to evacuate
  → evaluation by e.g. simulation

Planning Guide

Emergency Evacuation Planning Guide For People with Disabilities

Building Evacuation System

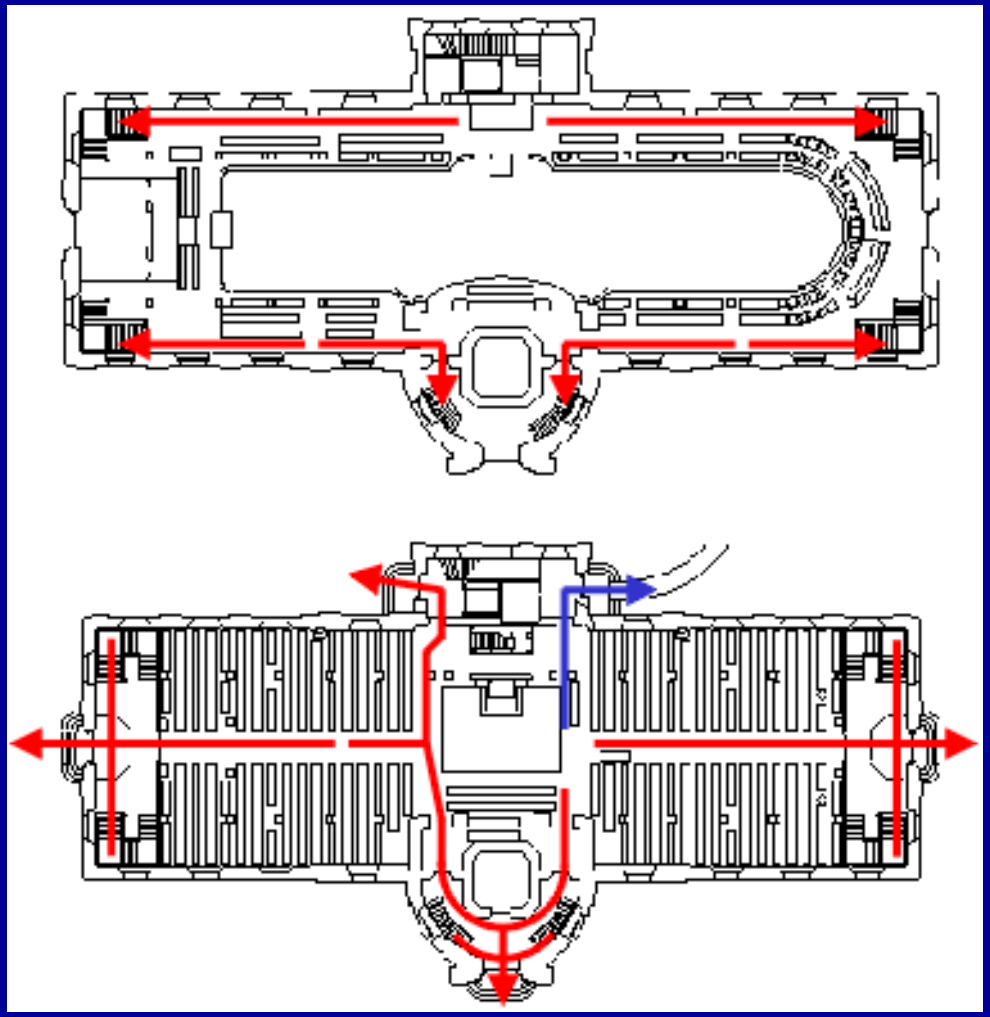
- Circulation Path (unobstructed way)
- Occupant Notification Systems
- Directions to and through circulation path

→ Usable Circulation Path: „A person with disabilities is able to travel unassisted through the path...“
(NFPA Evacuation Guide for People with Disabilities)

Elements of Evacuation Information

- Notification (correct response?)
- Way finding (which route?)
- Use of the way (self-rescue possible?)
- Assistence (which kind of assistence?)

Floor Plan



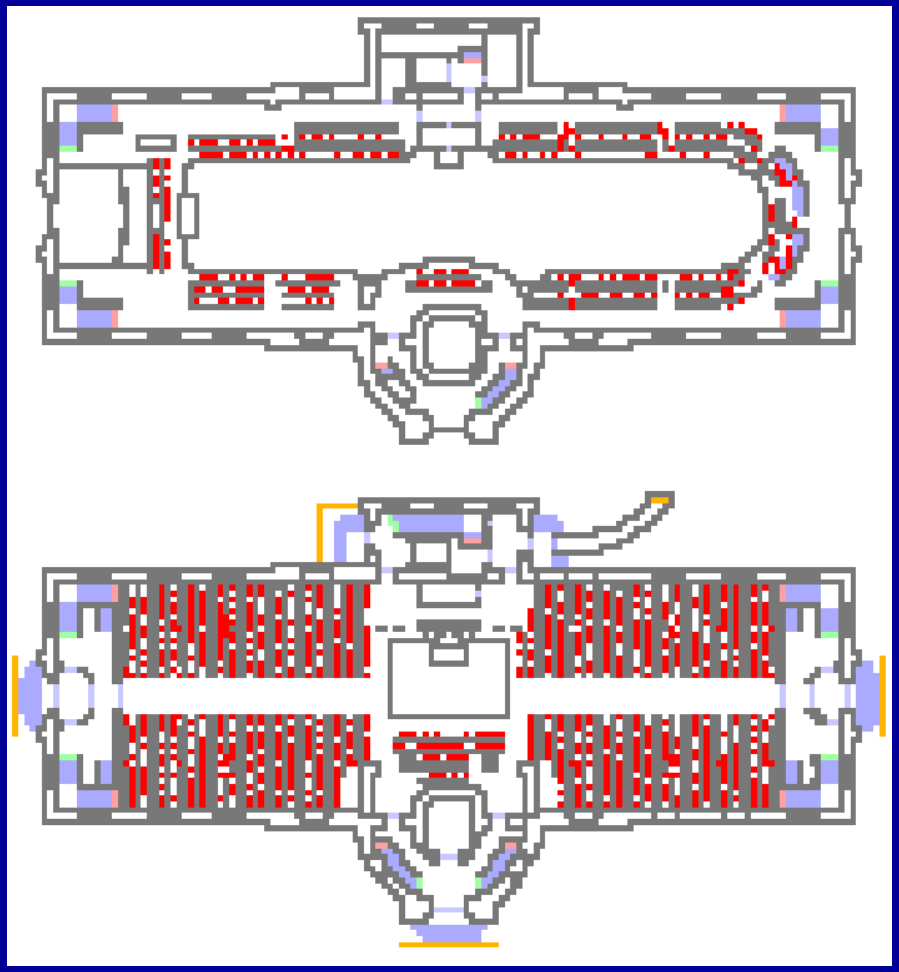
Gallery:

Seated:	202
Choir:	24

Ground Floor:

Seated:	788
Wheelchairs:	5

Model



Gallery

Ground Floor

Demographics

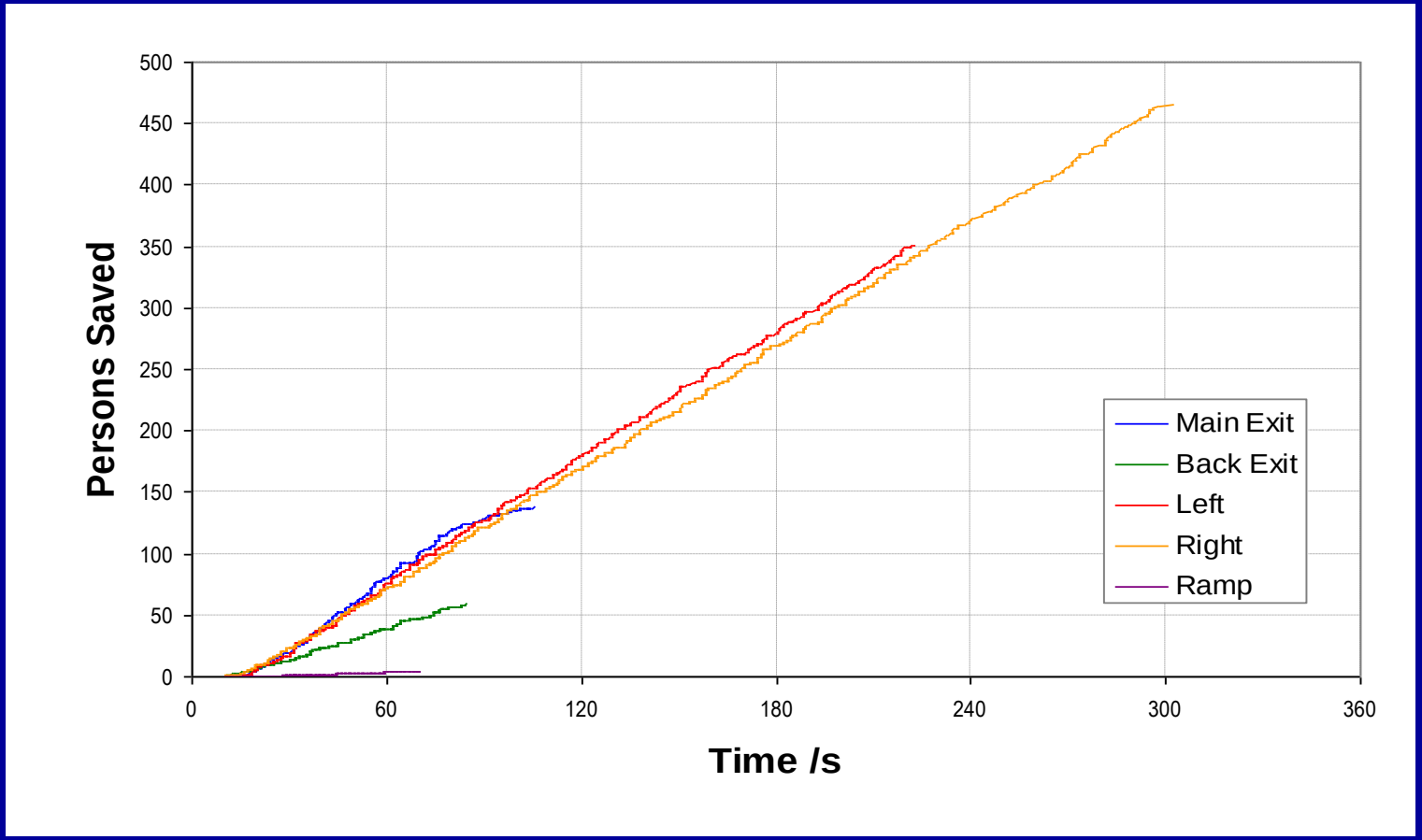
Standard Population

	Min	Max	Mean	Std.-Dev.	Unit
Velocity	0.8	2.0	1.2	1	m/s
Patience	5000	5000	-	-	s
Sway	1	5	3	2	
Reaction	0	60	30	300	s
Dawdle	0	30	15	5	%
Inertia	1	5	3	2	%

“Wheelchair Users”

	Min	Max	Mean	Std.-Dev.	Unit
Velocity	0.8	0.8	-	-	m/s
Sway	1	1	-	-	
Dawdle.	0	50	25	250	%

Results


Persons Saved
500
450
400
350
300
250
200
150
100
50
0
0
60
120
180
240
300
360
Time /s
Main Exit
Back Exit
Left
Right
Ramp

Summary

The main difference:

- The role of the time factor
- Simulation model is not based on the interaction and integration of the building elements

Conclusion:

- Accessibility is the requirement for evacuation
- Universal building designed by definition should provide for improved evacuation routes and procedures
- Additional evacuation planning for people with disabilities is necessary

Recommendations

- Awareness for design consequences
- Accessibility aspects should be combined while simulating the evacuation:
  - Information items should be added to the CAD plan
  - The accessibility grades (results of the accessibility analysis) should be incorporated in the simulation model
  - Accessible facilities should have an impact on parameters used in the PedGo evacuation simulation

Thank You

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