Evacuation Strategy Planning – Special Requirements For Hospital Departments

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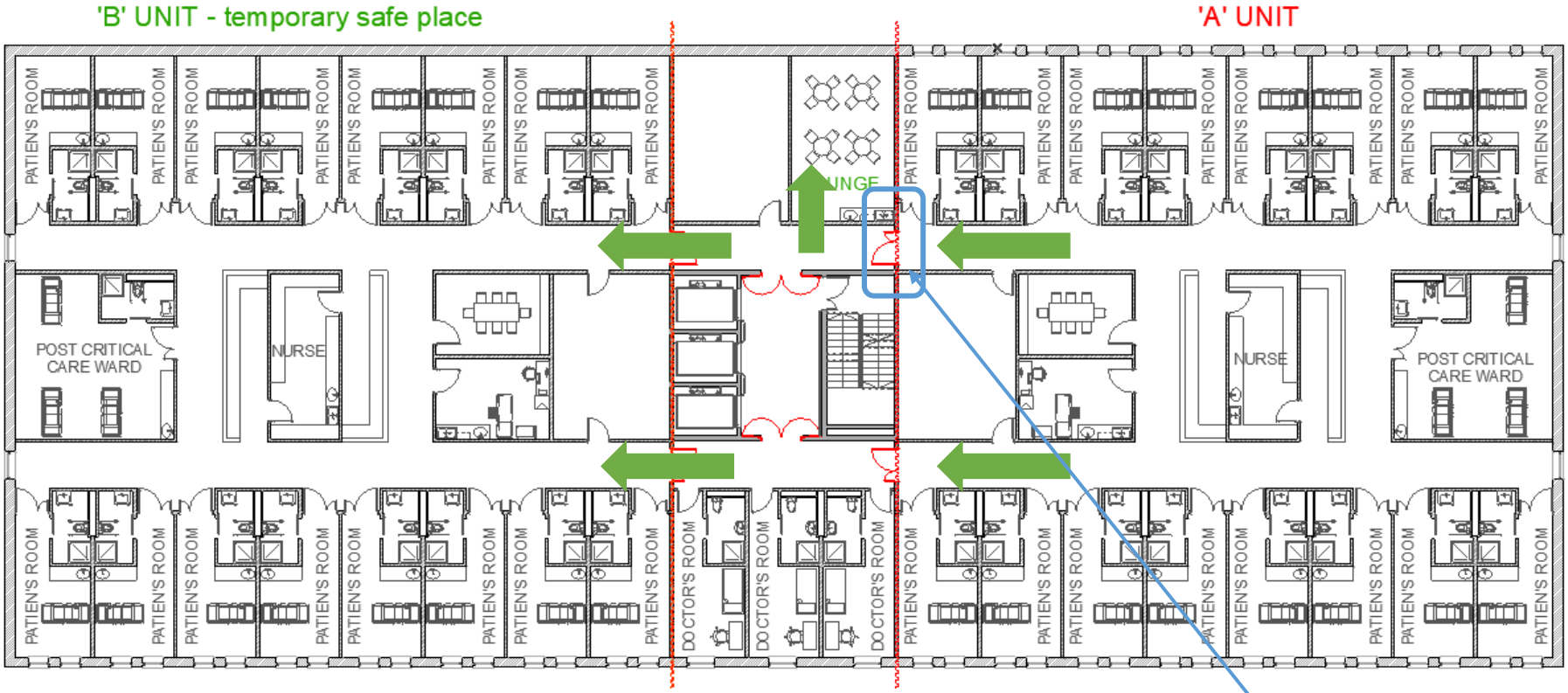
introduction

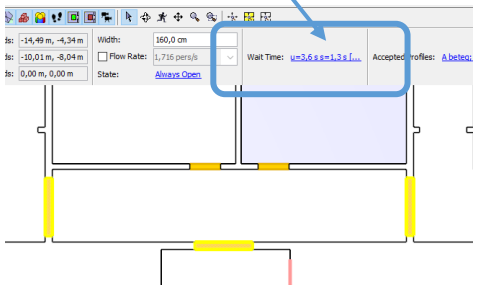
- in hospitals the evacuation process may be very complicated, patients typically need help for escaping
- the evacuation process must be planned carefully: both during construction planning and during operation of hospital
- in Hungary there is no calculation method for hospital evacuation, there is no guide for developing a strategy
- although evacuation drills should be repeated annualy, this is not typically in hospitals
- in the event of an emergency, the success of the rescue depends on the personnel

A computer-based evacuation model allows the analysis of different scenarios. It looks like to be an easier, faster solution of decision-making progresses thus does not cause practical and ethical issues ...
But how to use it?

floor plan



single bed rooms, with 1,30 m wide doors
2,00 m wide corridor, with 1,80 m wide doors



persons in the modell

11 occ. staff
4 occ. type A
5-5 occ. type B, C, D

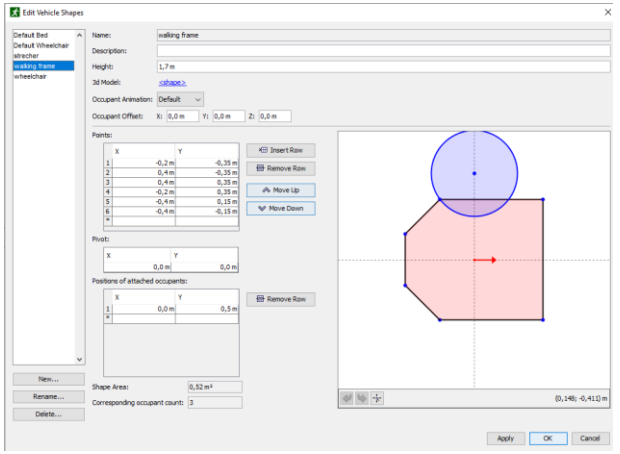
<u>healthcare personnel - staff</u>

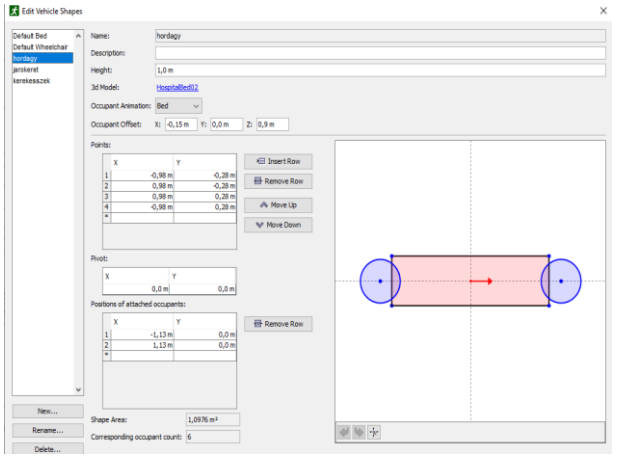
- nurses and doctors

<u>patients</u>

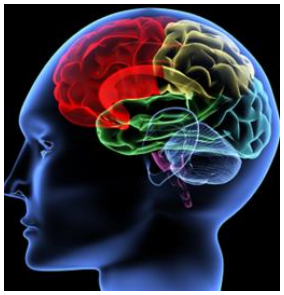
- 4 types of patients

persons		staff	patient type A	patient type B	patient type C	patient type D
shape		roll	roll	cuboid	cuboid	cuboid
		-	cane	walking frame	wheel-chair	delivery bed
dim (m)	average	46,5	66	70/80	110/70	176/56
speed (m/s)	min	0,65	0,15	0,11	0,84	-
	average	1,35	0,56	0,34	1,30	1,04
	max	2,05	1,18	1,04	1,98	-
	SD	0,25	0,22	0,20	0,34	-





pre-evacuation time



‚normal' –
- recognize and understand the fire alarm
- interrupt the activity
- prepare for evacuation

special for hospitals –
- MSTR triage-type system
- staffs arrive
- medical prepare
- relocation into the evacuation equipment
- returning times

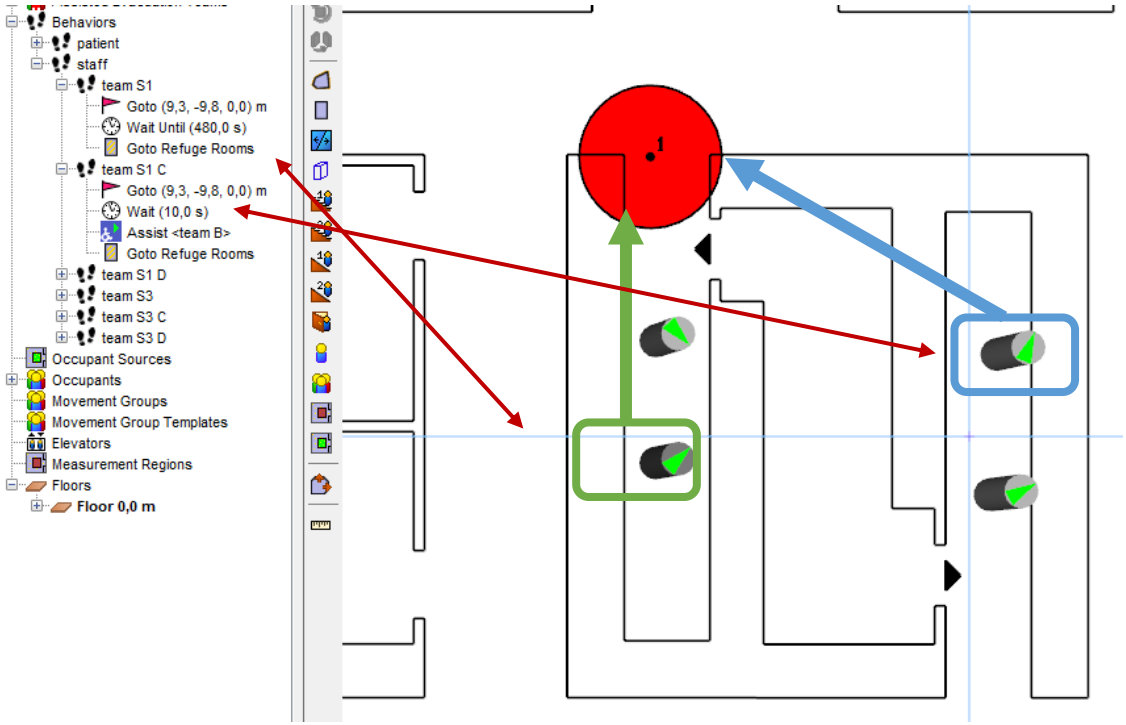
much more time!!!

pre-evacuation time

MSTR triage-type system

1. exposed to direct danger
2. unaided or with assistance
3. unaided with transportation equipment
4. with assistance and with evacuation equipment
5. medical preparation

to save the largest number of patients



pre-evacuation time

medical prepare

- may be nessesary
- difficult to estimate
- doctors or medical technologist?

no time period in this case study

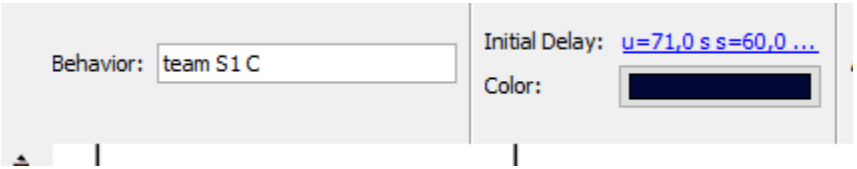
staff movement time

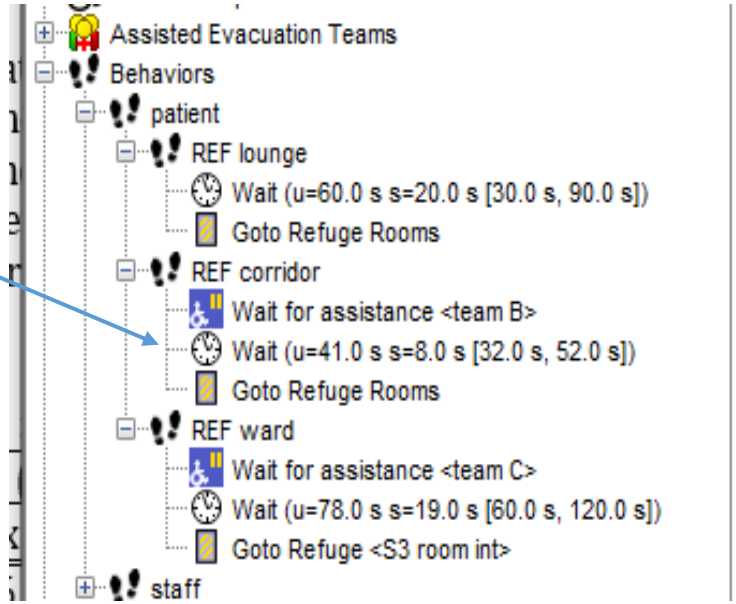
- staff arrives
- returning time

depends on: input data or result

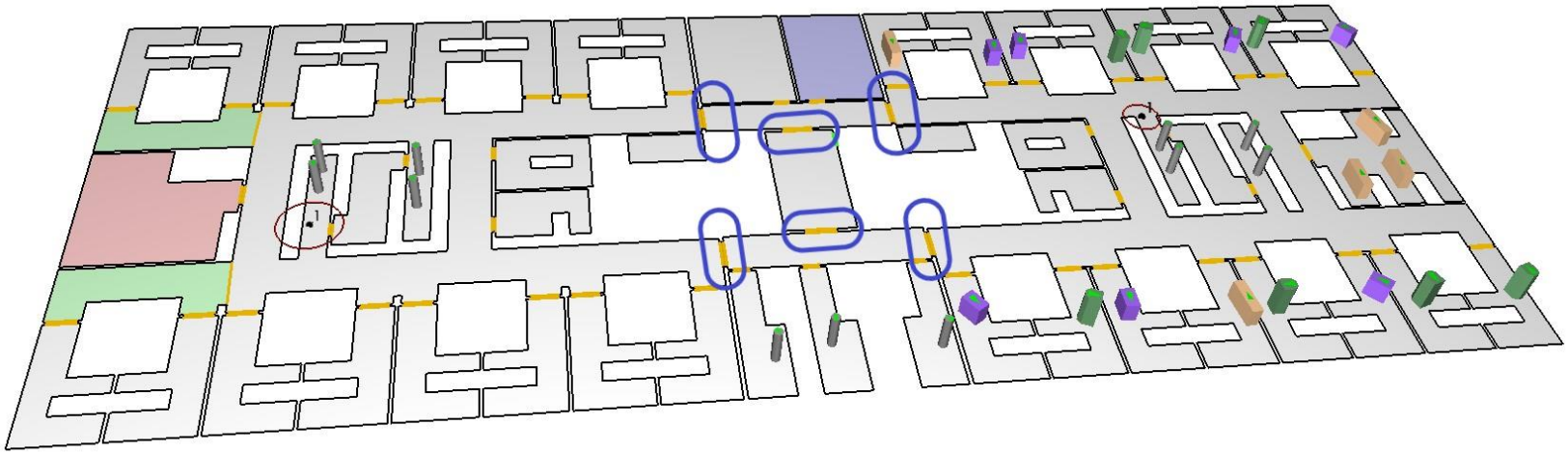
help into the evacuation equipment

applied delay (s)	staff	patient type A	patient type B	patient type C	patient type D
min	30	30	30	32	60
average	71	60	60	41	78
max	246	90	90	52	120
SD	60	20	20	8	19





version 1 – daytime

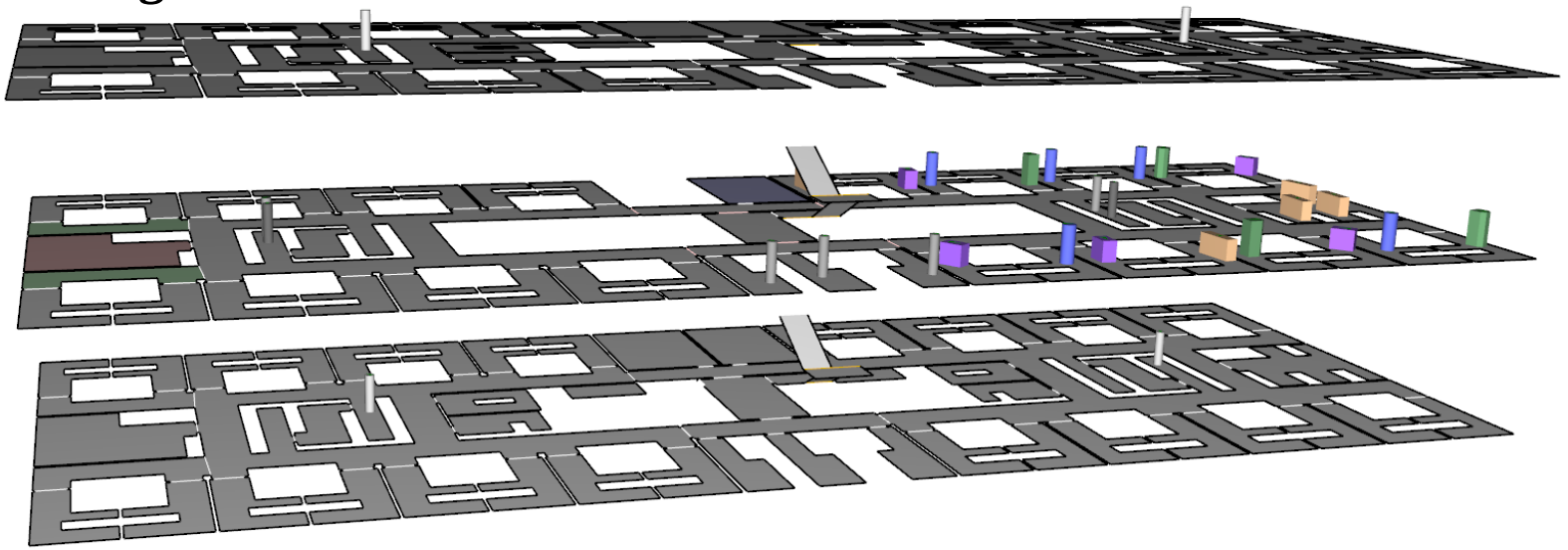


	(s)	first staff	last staff	first patient	patient to lounge	last patient	total time
simulation values	min	40	154	58	150	439	497
	average	70	191	78	232	487	533
	max	93	260	99	325	547	592
	SD	16	27	13	52	29	26
interval estimation	lower limit	62	179	72	209	474	521
	upper limit	76	203	83	255	499	544

Hungarian regulation is 420 s !!!

version 1 – daytime

version 2 – night shift



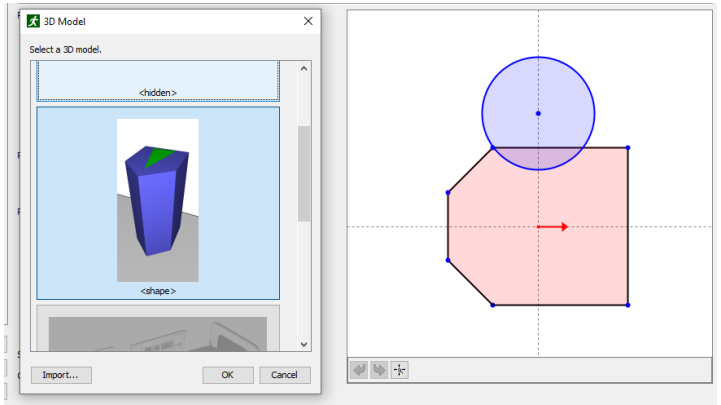
	(s)	first staff	last staff	first patient	patient to lounge	last patient	total time
simulation values	min	51	197	65	178	603	652
	average	79	227	83	255	667	710
	max	118	308	109	395	730	773
	SD	17	27	11	62	39	39
interval estimation	lower limit	72	216	78	228	650	693
	upper limit	87	239	88	282	684	727

+180 s more time in average

version 2 – night shift

How to improve my model method…

- use of further evacuation equipments – hospital moving bed, evacuation mattresses, rescue chairs, evacuation chairs, etc.
- several paitent distributions – depending on type of unit
- use of „change behavior” function - make better use of helpers in model space
- use of men or women helper – other abilities to carry
- modelling larger area
- use of direct sequence of patiens



How to develop the program…

- give a method for relocation time of patient in safe place
- more occupant’s 3D animation – sticks, cruthes, walking frame, stretchers, evacuation chair, transport chair, evacuation matrasse
- modified ‚monte carlo simulation’

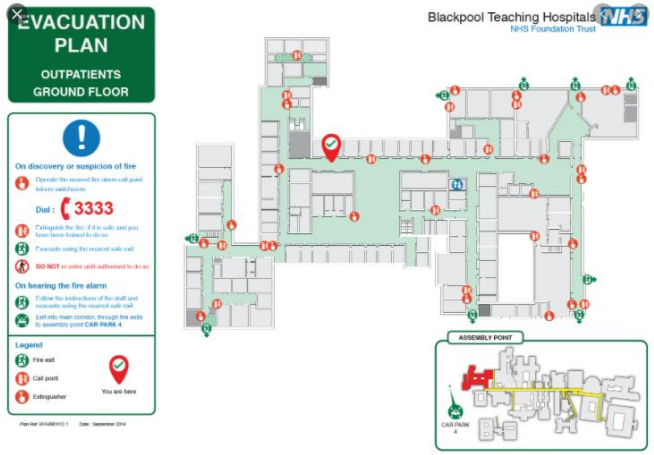
Where to use this method?

- examine of one or more parameter changing
- estimating the needed rescue personal
- examine of the exact equipment of given hospitals
- the result video can be used for fire safety training

in this case study the change of only 1 parameter causes 180 s changes in time

in real situation several parameters are constantly changing

more effective than only speak about + combined with VR can be a good future solution



Thank You for Your attention!

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