www.traffgo-ht.com

PedEd AENEASed
PedGo AENEASsim
PedView AENEASview

User Manual

Version 2.6.1

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PedGo and AENEAS

PedGo and AENEAS are software packages developed by TraffGo HT GmbH for evacuation analyses. Both are based on the same model but differin details of functionality. PedGo is the basic version for everything and was developed for evacuation analyses on land. AENEAS offers extra functions for maritime applications. It is distributed in cooperation with Germanischer Lloyd AG and offers a ship motion module.

As both programs are quite similar, this manual covers the functionalities of PedGo as well as of AENEAS. Terms like e.g. “editor” or “simulation” refer to the following groups of programs:

Name	**PedGo**	**AENEAS**
Editor	PedEd	AENEASed
Simulation	PedGo	AENEASsim
Viewer	PedView	AENEASview

Content

1 Introduction

Thank your for choosing PedGo or AENEAS! Our software constitutes the current state of research and is based upon up to date findings of science. Due to the consistent use of discrete algorithms PedGo/AENEAS is one of the fastest simulation programs available. This in combination with the intuitively usable interface allows for a fast and efficient analysis and a quick comparison of different evacuation concepts.

We are working on providing you a robust, fast and reliable software and to support you in using it. Due to persistent development and the implementation of scientific findings you can be assured that our software represents an up to date state.

The following manual illustrates how the floor plan is modelled, simulations are conducted and results are evaluated. The design of the bodywork enables you to learn about the Simulation and the Editor by working through it just like a textbook. Even though the software is based on a sophisticated model you will soon find out, that even good and efficient models can be understood and used easily. All the software enclosed underlies a persistent development. Thus, slight differences between your software version and the content presented are possible. In case of significant alterations you will receive supplementary or renewed chapters.

Especially with software like an evacuation simulation, it is important to comprehend how the model works in order to interpret the outcomes correctly. As many information as the simulation provides, it cannot be disregarded that it only reflects an idealized case and thus reality never can be reproduced with all its contingencies. A simulation is just as good as its assumptions!

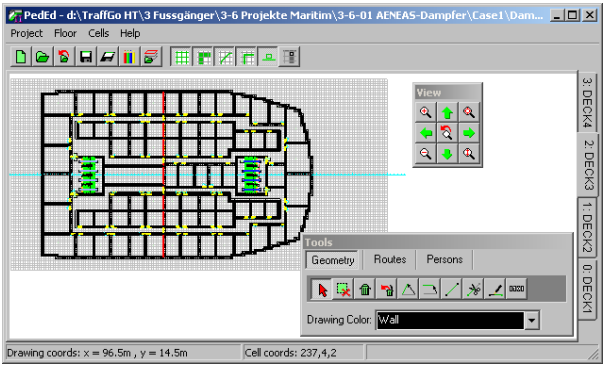
Information about new releases, fixed bugs and new functions can be found on our homepage at http://www.traffgo-ht.com.

2 Software Overview

The software package consists of several applications, which will help you step by step through the evacuation analysis.

2.1 Editor

You will use the editor for the first steps. After the import of CAD drawings you can use it to rework the geometries. The editor also serves to define routes, which the agents will follow and you will “populate” the floor plan by indicating which amount of agents will be distributed where.



The editor is used to:

- import of CAD drawings,
- prepare the geometry,
- define exits and routes
- define blocked rooms (by hazards), and
- to distribute agents.

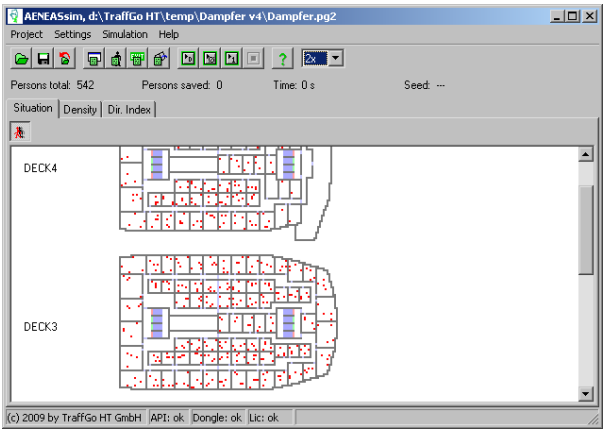
It saves the project file with the file-extension *pg2*.

2.2 Simulation

The project file, generated by the Editor is loaded into the simulation which performs a sochastic analysis. This means that e.g. 500

evacuation runs are simulated for each project. The results are then evaluated statistically.

Each single run can be repeated in order to obtain detailed information.



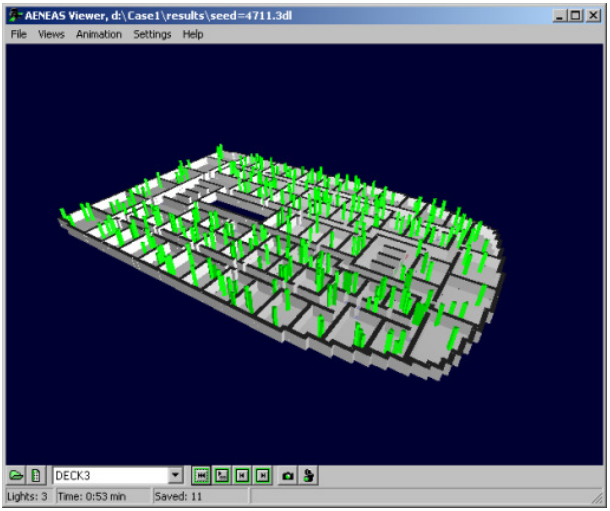
The simulation loads the project file (file extension pg2) and is used:

- for stochastic analyses of the evacuation (500 runs), and
- for the repetition of individual runs for detailed data.

The results are saved in tables, diagrams and a log-file with the file extension *3dl*.

2.3 Viewer

The tables and diagrams help to analyse and interpret the results. The log-file (file extension *3dl*) can be read by the viewer, which visualizes the evacuation process in a three dimensional environment. The viewer is free of charge, thus it can be copied and passed on your clients to enable them to look at the results themselves.



The viewer loads the log-file (file-extension *3dl*) and:

- visualizes the process three dimensionally, and
- creates screenshots.

It can be copied and distributed free of charge.

2.4 Linking PedGo to the Start Menu

Our software programs are compiled as so-called stand-alone versions. This means, that all libraries are compiled into the execution files, so they can be run without any installation. In order to use PedGo within your Windows[1] environment, it is helpful to link the exe files to your start menu.

2.4.1 Windows XP

By following the following steps, you can create a link in your start menu:

1. Right-click on the Windows Start button.
2. Choose *Open All Users* (Fig. 1).

[1] Windows is a registered trade mark of the Microsoft Corp.

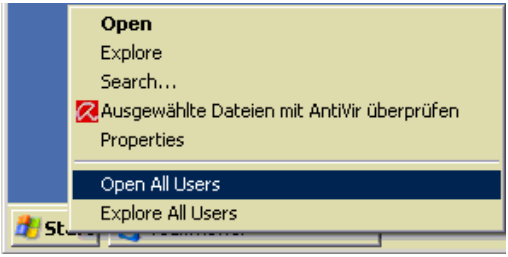


Fig. 1: Right-click on Start.

3. The opening Explorer window shows you the structure of the start menu. You can create directories and links, which will then appear in the start menu. Right-click in the wished area and choose *New→Shortcut* ().

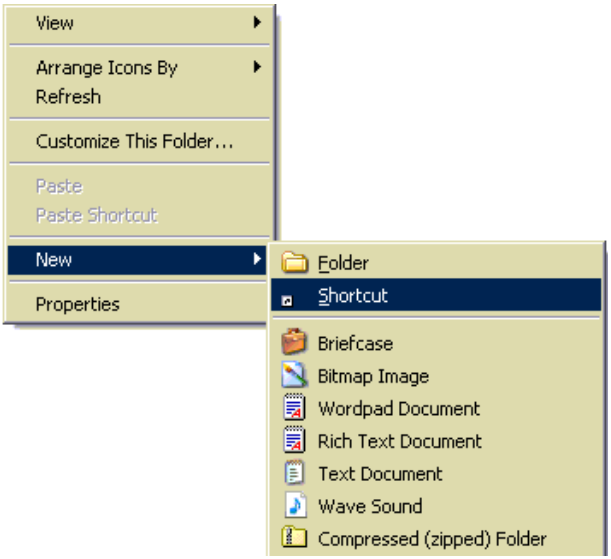


Fig. 2: Generating a short cut.

4. Choose the exe file (e.g. PedGo.exe) in the following window (Fig. 3).

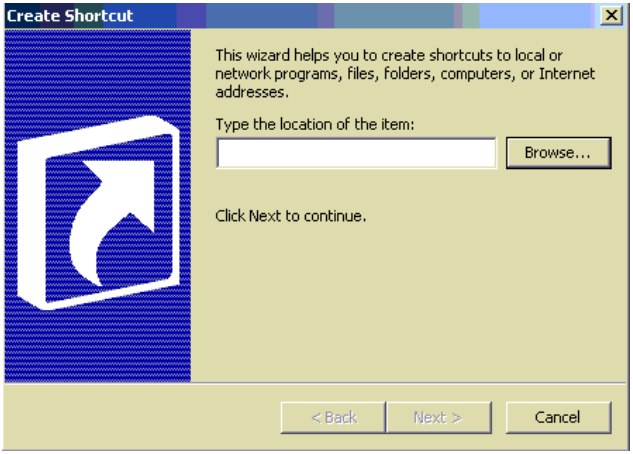


Fig. 3: Choose an exe file.

The new link can now be found in the start menu. You can also move, copy and rename it by right clicking on it.

2.4.2 Windows 7

Under Windows 7 right-click on the exe file in the file explorer and choose “attach to start menu”. The icon will now appear in your start menu.

3 Model

The basis of the simulation model is a so called multi-agent-model, which is based on a cellular automaton ([1], [2], [3], [4]). Thus agents are represented as individuals (=agents) with independent attitudes, abilities and goals in a discrete space and discrete time.

3.1 Discretising

The floor plan that is to be analyzed is fragmented into a grid of quadratic cells (Fig. 4). The length of the cell edges is 0.4 meters, thus the total cell area is 0.16 m². The agents occupy one cell and when they move, they jump from cell to cell, just like the figures of a chess game.

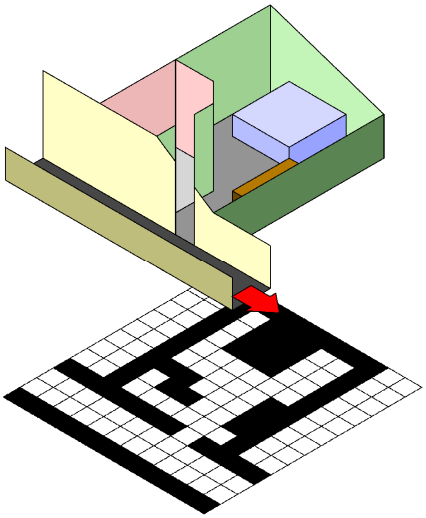


Fig. 4: Example for discretising the floor plan.

The cell area represents the area an agent uses within a congestion. It is based on scientific observations [5]. Hence the maximal density of agents in this model accounts for 6,25 P/m².

The functional relation between the flow of agents (agents per meter width and seconds) in dependence of the density (agents per square meter) was derived from empirical research [6]. The fundamental diagram shows, that the flow decreases, after a maximum flow is reached and the density is further increased (Fig. 5).

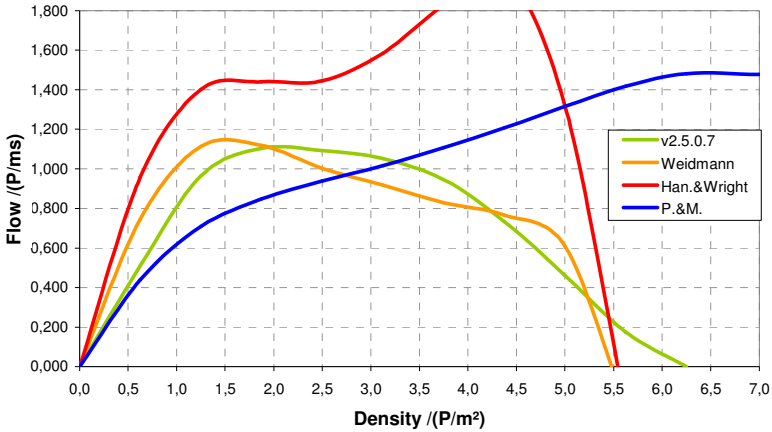


Fig. 5: Fundamental diagrams of the simulation model (v2.5.0.7) and empirical data (Weidmann, Hankin & Wright, Predtechenskii & Milinskii).

Fig. 5 clearly shows, that large differences exist between the empirical data sets. Therefore, the fundamental diagram of PedGo is orientated along the diagram of Weidmann.

3.2 Cell Types

In order to represent the floor plan in a realistic manner, several cell types are used. Most of them are generally influencing the walking speed of agents passing over them.

3.2.1 Free Cells

The simplest types are free cells. They can be entered by an agent without influencing the agents movement. In the following illustrations they are represented by white cells.

3.2.2 Wall Cells

To consider walls, furniture or other objects influencing the movement of agents physically, wall cells are introduced. These are cells which are blocked, thus they cannot be entered by agents. In the following illustrations they are represented by black cells.

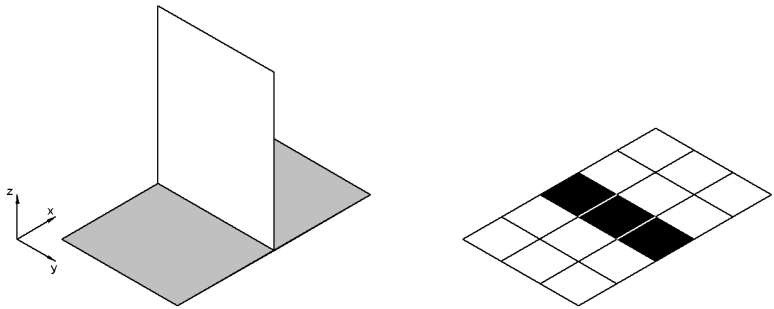


Fig. 6: Cell type „Wall“. On the left in continuous space on the right its equivalent in the simulation-Model (black cells)

3.2.3 Goal Cells

Each agent entering a goal cell of the route it follows is either marked as saved and removed or lead on to another route (depending on the route type). In the following illustrations the goal cells are labelled *G* (=Goal).

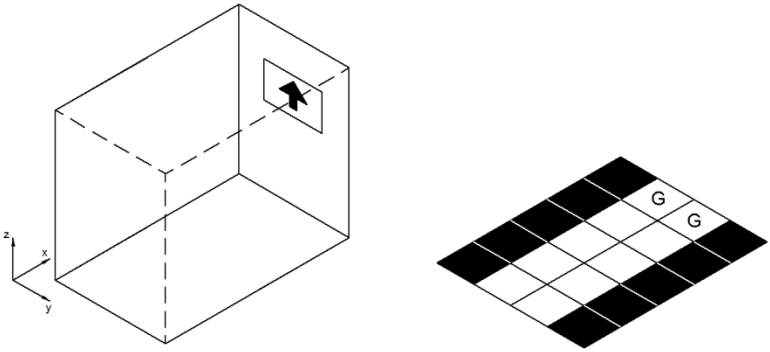


Fig. 7: Cell type „exit“. On the left in continuous space on the right the equivalent of the simulation-model (G = Goal).

3.2.4 Door Cells

Doors decrease the flow of agents by reducing the agents walking speed to ¼ of its maximum walking speed, when it passes. In the following illustrations, door cells are labelled *D* (=Door).

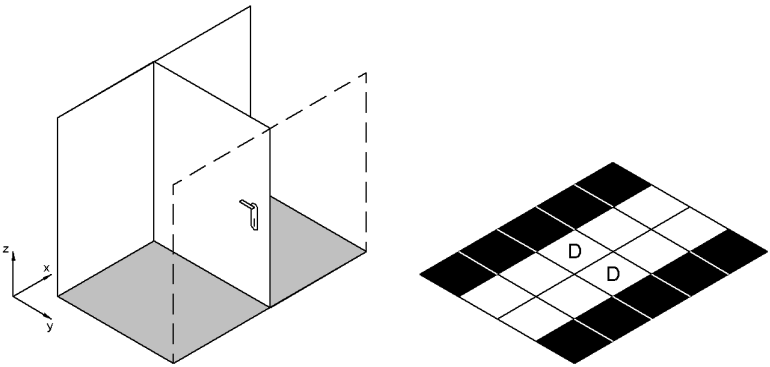


Fig. 8: Cell type „door“. On the left in the continuous space on the right its equivalent in the simulation-model (D = Door).

3.2.5 Virtual Doors

Virtual door cells have the same influence as normal door cells, without influencing the walking speeds of passing agents. They are

used to model virtual rooms for e.g. agent distributions or to influence the spread of the potential.

3.2.6 Stairs and Jump Points

To take stairways into account, step cells are introduced. They influence the flow by approximately halving the velocity of agents. If a stairway connects different floors, jump cells are introduced to make agents switch between levels. Stairs are always projected on the lower level of the two levels they connect, but agents can move in both directions when passing them.

In the following illustrations, the steps of a stair are labelled S (step) and cells, defining the direction are labelled *UP* and *DN (down)*. The sides of the steps have to be restricted by wall cells.

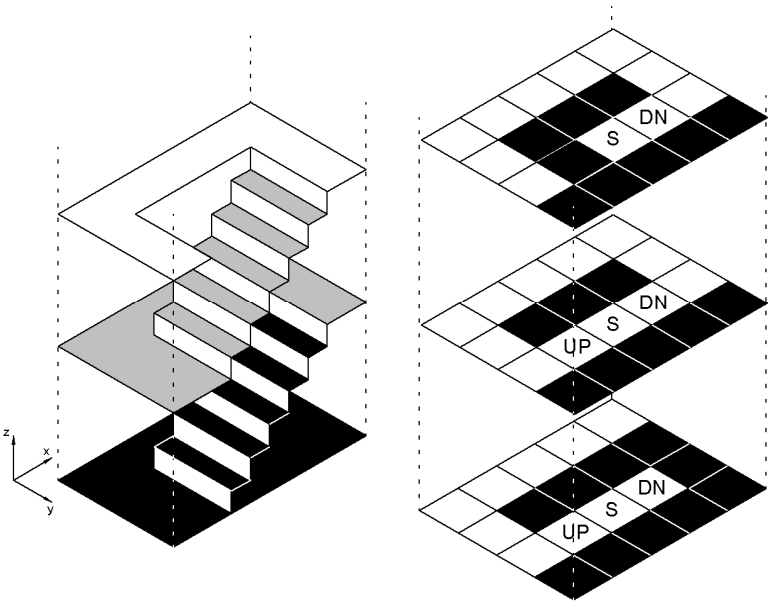


Fig. 9: Cell type „stair“ and information about the direction. On the left in continuous space on the right its equivalent in the simulation-model (S = step, UP, DN = down). The length of the stair depends on its projected length.

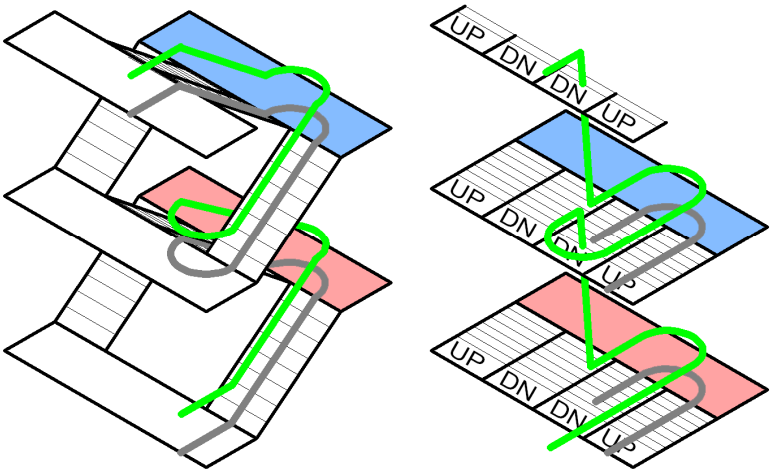


Fig. 10: The UP- und DN-Cells at the beginning of each stairway define the direction, resulting in the paths displayed.

Due to the cells *UP* and *DN* an agent „knows“, whether it is moving up or down on the stairway and when to change the level. Mainly this is managed through the transition from a step cell (*S*) to the down (*DN*) cell as follows:

present cell	**following cell**	**→action**
S	*DN*	Move up one floor.
DN	*S*	Move down one floor.

3.2.7 Hazard

Rooms can be blocked at stochastically defined times in order to take e.g. smoke, fire or floodings into account. If alternative routes are defined (see Chpt. 3.3), agents choose an alternative route, when discovering cells of a blocked room. The information about the change of routes is then passed on to neighbouring agents.

If no alternative route is defined, agents will stick to their route but the duration spent in a blocked room is logged.

3.3 Routes and Orientation

On their way to the goal cells, the agents follow the routes, which are specified by the user. For orientation, agents make use of potentials. For each route, the cells have a value which is increasing proportional to the distance from the goal cells. The agent finds its way to the end of a route by comparing the potential value of the cell it is standing on with the value of the neighbouring cells.

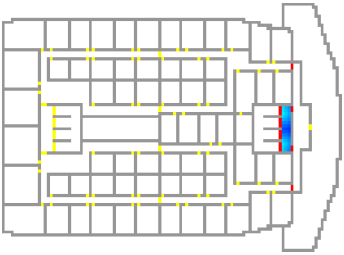
3.3.1 Route Definition and Potential Spread

In order to understand, how agents choose their way and in order to lead them as wished, it is very important to understand, how the potential is spread throughout the geometry, each time a project is loaded in the simulation.

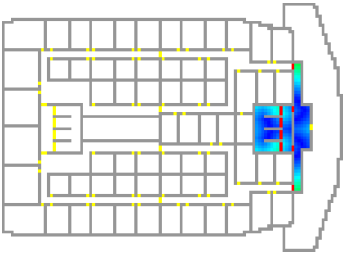
Starting at the user defined destination cells, the potential spreads out over the accessible cells (free, jump point, door and stair cells). Due to the users definition of the routes, the corresponding door and stair cells are marked and thus the spread of the potential can be controlled as follows:

1. From the goal cells, a potential value is assigned to all cells of the assigned room. Its boundaries are wall, door, virtual and jump cells. While the potential is spreading, all jump, door and virtual cells which are marked as routes are saved for the next step.
2. From the cells saved in step 1, which were marked as route cells, the potential spreads into the following rooms as in step 1. Once again, all the new cells which are marked as routes are saved.
3. Step 2 is repeated, until no more new route cells are found.
4. The potential is spread room wise via door-, virtual and jump cells, which were not marked as route cells, until all accessible cells are given a potential value.

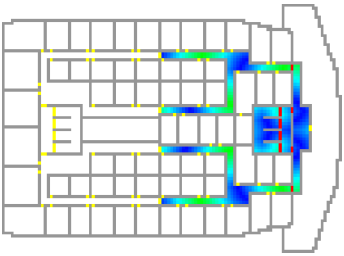
The impact of the definition of routes on the spread of the potential (blue and green cells) can be seen in the following example. Regular doors are marked yellow; the ones that mark the route are red.



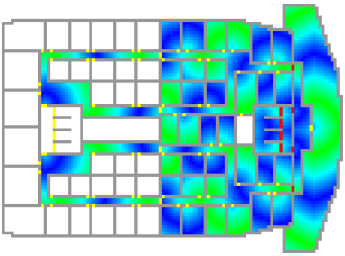
Step 1: The potential reaches the upper deck through the stairway.



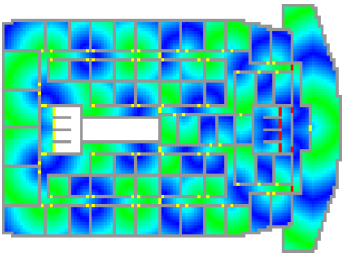
Step 2: The potential spreads along the marked doors and stairways.



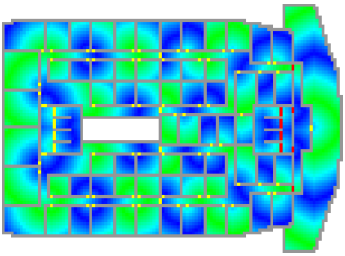
Step 3: Passing the last marked door the potential reaches the cabins.



Step 4: There are no further marked route cells. Hence the potential passes through the door cells not marked by a route.



Step 5: The potential spreads across all accessible cells.



Step 6: The spread of the potential is finished.

Fig. 11 shows another example for the spread of the potential. The exit lies at the top right corner of the floor plan. Without the use of route markings, agents in the centre room would exit via the dotted line. If the doors along the continuous line would be marked, the potential would spread as shown, so agents of the centre room would choose the door at the lower side of the room.

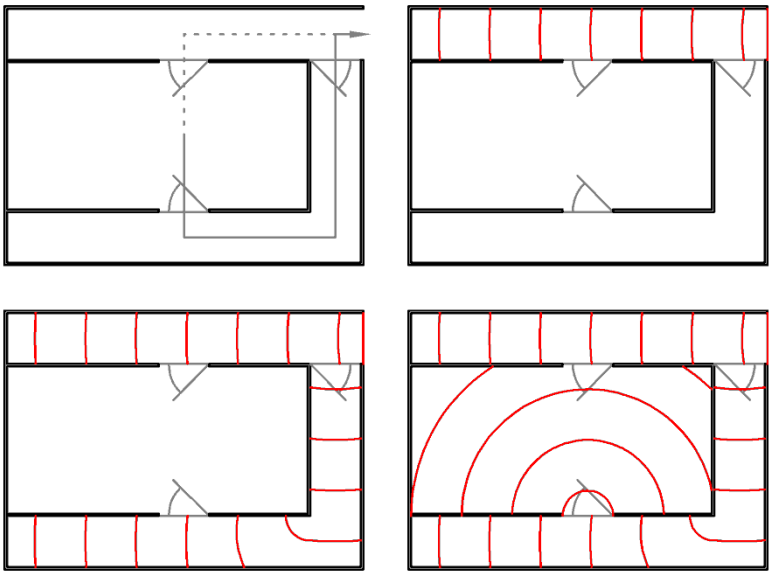


Fig. 11: Spread of the potential in a simplified example (from top left to lower right)

3.3.2 Parameters

Per route, the following set of parameters can be used to influence the agents behaviour when reaching the goal cells.

Preparation: During the preparation duration, the goal cells of a route are blocked, so agents stop on these cells and wait for the preparation duration to pass.

Per Agent: This duration defines, how long an agent will

individually wait on the goal cells before it is saved or switches to a followup route.

Max. Capacity: This value determines, how many agents can be saved via the goal cells of a route. If the parameter *Max. Cycles* is used, the goal cells will be blocked for the duration of *Amid Time*. If *Max Cycles* is not defined, the following cycle will immediately start, meaning that *Max. Capacity* has no influence.

Open Duration: *Open Duration* determines, how long goal cells will be accessible before being blocked. If *Max Cycles* is not defined, the following cycle will immediately start, meaning that *Open Duration* has no influence.

Amid Time: If goal cells are blocked due to *Max. Capacity* or *Open Time*, *Amid Time* defines the duration until the goal cells are accessible again.

Max. Cycles: *Max. Cycles* defines the number of cycles for which the above named parameters work. If no value is defined, the amount of cycles is endless.

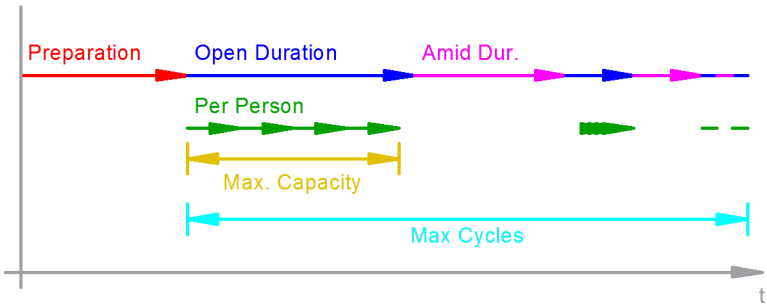


Fig. 12: Route parameters and their influence.

Agents will stop on the goal cells, if the above named parameters take effect and agents will be saved. If agents will move on to an-

other route (follow up), they will move one cell per second in a random direction.

3.3.3 Alternative Routes

For every route, a list of alternative routes can be defined. These alternative routes are chosen, whenever the route of an agent leads into a blocked room (due to a hazard). The alternative route is chosen according to the probabilities defined by the user.

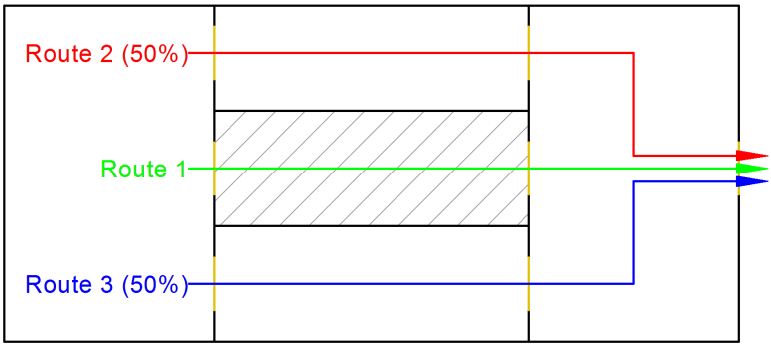


Fig. 13: Schematic example for the use of alternative routes.

Fig. 13 shows a schematic example for the use of alternative routes. Primarily, the agents would follow *Route 1* from the left to the right room. *Route 2* and *Route 3* are defined as alternative routes to *Route 1*. If the center room is blocked due to a hazard (hachures), agents trying to enter it will choose *Route 2* or *Route 3*, each with a probability of 50% and follow these alternatives to the right room.

If no alternative routes are defined, agents will continue to use *Route 1* through the blocked room.

3.3.4 Followup Routes

When an agent reaches the goal cells of its route, the following options exist, depending on the route settings: With a certain prob-

ability, the agent will be saved and taken out of the simulation, or it chooses a following route according to given probabilities.

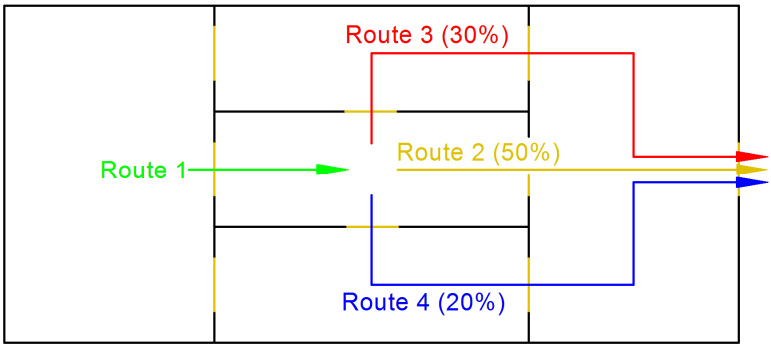


Fig. 14: Schematic example for the use of followup routes.

Fig. 14 shows a schematic example for the use of followup routes. An agent following *Route 1* and reaching its goal cells will choose *Route 2*, *3* or *4* as next route to follow, according to the given probabilities. It will then follow this route to the final goal on the right.

3.4 Agents

The simulated persons (=agents) can enter all cells except for wall cells. Only one agent per cell is allowed. When an agent stands still or moves with 1 c/s (=cell per second), it occupies only one cell. At higher speeds, the agent will block the cells it has passed in one time step (=1 second).

Through this, a correlation between walking speed and needed space, the curve of the fundamental diagram is formed (see Fig. 5). This so called self organisation cannot be manipulated by the user.

3.4.1 Parameters

Each agent possesses its individual parameters which are assigned at the beginning of each simulation run.

The following parameters are applied:

V_{max}:	The amount of cells an agent can cover at max within one time step (cells per second).
Patience:	The maximum duration, an agent can stand still (e.g. in a congestion) before changing its route and attempting to find an escape route leading in the opposite direction.
Sway:	The accuracy, with which an agent follows the course of the potential (see 1).
Reaction:	The duration, an agent needs to respond to the evacuation signal, e.g. start moving.
Dawdle:	The probability, for an agent to reduce its walking speed, e.g. to stand still for the rest of a sub time step.
Inertia:	The agents try to continue on its walking direction (see 1).
Clustering:	The grade of cohesion in a group (e.g. families, groups).

The parameters can be assigned by normal or equal distributions. They are defined by a maximum and minimum value and in case of a normal distribution by the mean and standard deviation.

In addition the simulation offers several fixed parameter settings:

1. Parameter settings for the day and night case for passengers and crew according to the IMO guideline MSC.1/Circ.1238 [4].
2. Parameter settings of the standard population defined in the RiMEA guideline [22].

3.4.2 Orientation

The orientation of the agents is explained in the following example ([8], [9]):

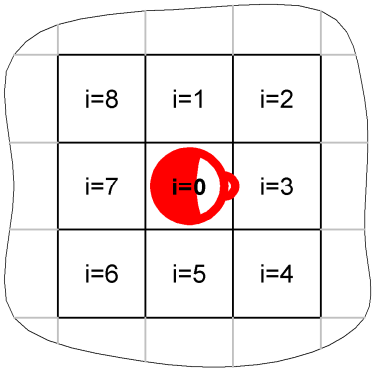


Fig. 15: The cells are marked by indices. The agent is standing on the cell with the index 0 and is turned to the right.

The agent can choose between 8 cells in the next step. The probability p_i for the choice of each cell *i* is calculated as follows:

$$p_i = e^{-\frac{(P_i - P_0) + S}{S}}$$

Thereby being:

p_i	Probability for the choice of the cell i.
P_i	Potential value for the cell i.
P_0	Potential value for the cell i=0.
S	Parameter *Sway*

S is the value for swaying (*Sway*). The greater this value, the bigger the similarity of the eight probabilities. Hence the agent orientates less by the decline of the potential, but instead moves more randomly.

After calculating the probabilities for the eight different directions the probability of the current direction is being multiplied by the value for inertia Θ. Hence the current walking direction has a bigger influence and this is more likely to be chosen.

$$p_{direction,new} = p_{direction} \cdot \Theta$$

$p_{direction,new}$	Probability for the choice of the next cell in running direction considering inertia
$p_{direction}$	Probability for the choice of the next cell in direction of movement
Θ	Inertia

3.4.3 Movement and Update

The way and order the agents are moved is called *update*. There are different versions, differing not only in degree of complexity but also diversely affecting the fundamental diagram of the model (see Fig. 5). The simulation uses a so called *Random Shuffle* Update, which in its result is similar to a *Parallel Update*, but leads to higher computational rates. In one time step (= one second), the agents are moved in a certain number of sub updates. This number equals the maximum walking speed of the whole population (e.g. 5 cells per second leads to 5 sub updates). In one sub update the agents are moved in a constant changing order by one cell until they are blocked by the surrounding or they reached their maximum walking speed.

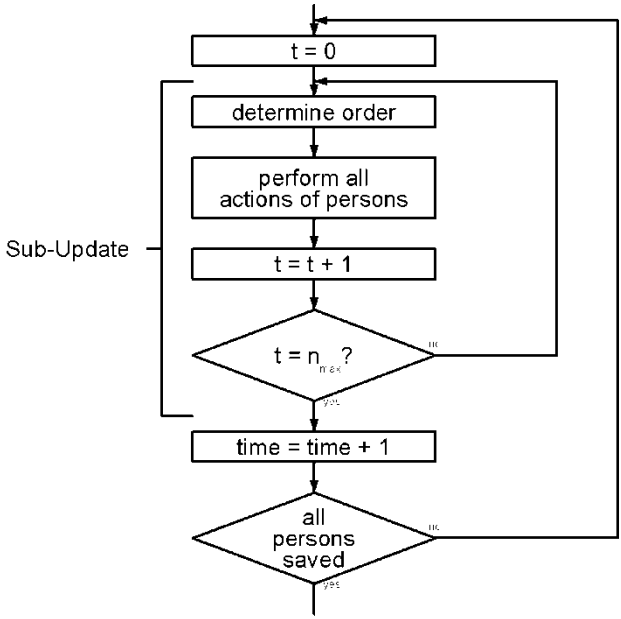


Fig. 16: Flow diagram of the random shuffle update.

t Sub Update

n maximum number of cells per time step

time time step (1 second)

Fig. 17 shows a schematic example for the random shuffle update:

At time = 0, both agents are standing in a row in a corridor with the width of one cell. At time = 1, the black agent moves over two cells (being its maximum speed), while the white one has to wait due to the blocked cells. At time = 3, the cells formerly blocked by the black agent are released, so both agents can walk.

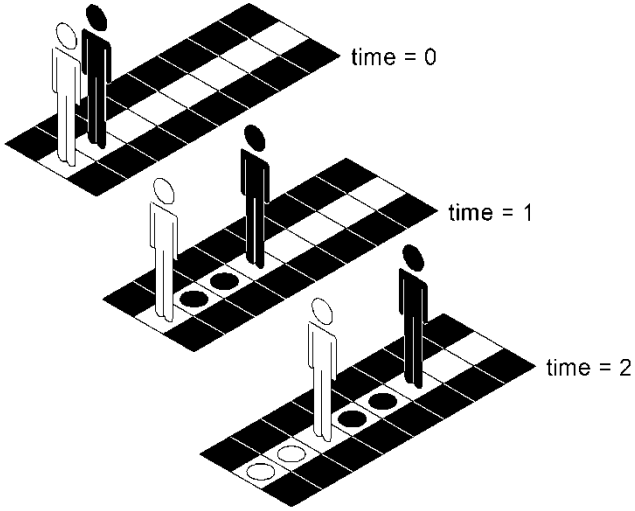


Fig. 17: Example for the update:

The sub update of an agent is shown in the following flow chart:

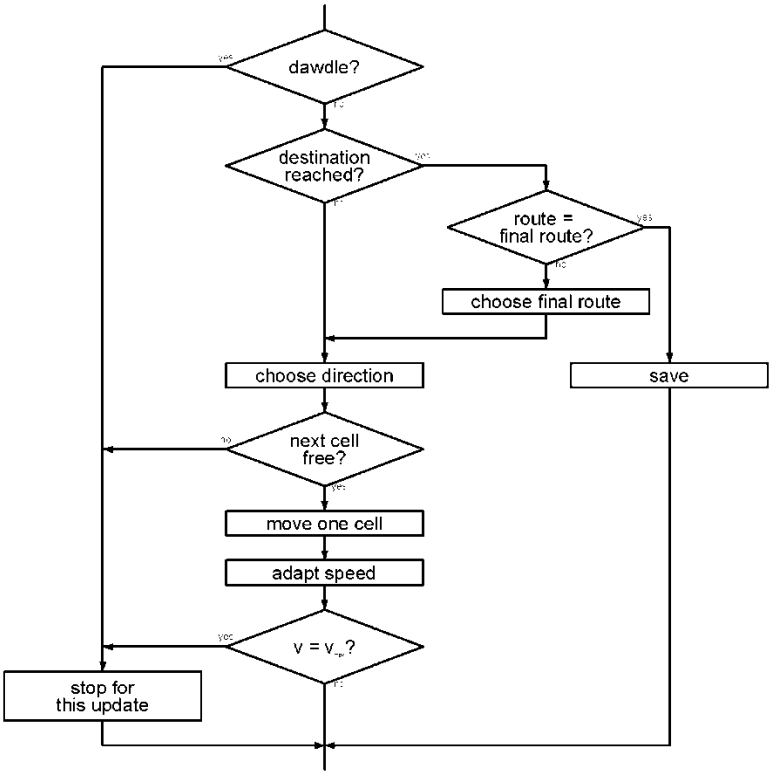


Fig. 18: The movement algorithm of one agent in one sub update.

4 Editor

The Editor is an independent program, which can import CAD drawings in dxf format and convert them automatically into the simulations grid. Floor plans can be edited by hand, for example by moving or drawing lines.

The Editor is not limited by your licence agreement, so you can use it on a s many computers as needed.

The editor consists of three main elements, which control each of its functions: the two control windows (*View* und *Tools*), which can be placed arbitrarily and the menu on the top of the editor window.

Each level is imported individually and appears on its own tab sheet, which can be selected through the tab-field on the right side of the window.

4.2 Main Menu

4.2.1 Buttons

 Start a new project (erase old data).

 Open an existing project.

 Reload the actual project.

 Save current project.

 Rapid saving (only tdf-files).

 Define colour coding.

 Import a level as a dxf file.

 Move active level up.

 Move active level down

 Display the grid.

 Display cell information.

 Display original dxf- elements

 Display filtered and rounded dxf-elements.

 Show route tags.

 Show bottlenecks.

4.2.2 Menu Item *Project*

Save as… Saves the project under a new name.

Exit Close the Editor.

4.2.3 Menu Item *Floor/Deck*

Rename Rename the active level.

Reverse order	Reverse the order of the levels.
Duplicate	Duplicate the active level.
Remove	Remove the active level.
New	Insert a new level.
Update extends	Refresh of the maximum extends of the project.
Statistics	Shows you statistics of the project.
Cleanup	Checks all drawing elements and selects all which are superfluous. By pressing *Del*, you can delete them and thus clean up a project.

4.2.4 Menu Item *Cells*

Go to cell…	Sets the focus on the specified cell.
Autocalc cells	Calculates the cell information automatically, when elements are edited.
Autofill stairs	Marks cells as stair cells, when surrounded by stair elements.
Calculate cells	Calculates the cell information.
Clear	Deletes the cell information.

4.2.5 Dialogs of Menu Items

4.2.5.1 Project→Color Coding

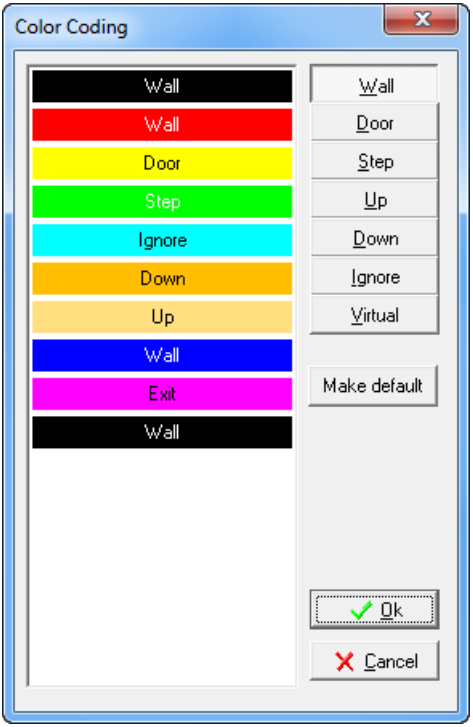


Fig. 19: The colour coding dialog for defining colour attributes.

Attributes like wall or door can be assigned to the colours used in the dxf file. Hence the workflow is accelerated and automated.

Select a colour and push the button to assign an attribute. The following attributes are available: *Wall, Door, Step, Up, Down, Ignore* and *Virtual.* Repeatedly pressing the button cancels the assignment.

By using the button *Make default* the defined colours can be fixed for upcoming plans.

4.2.5.2 *Floor → Import*

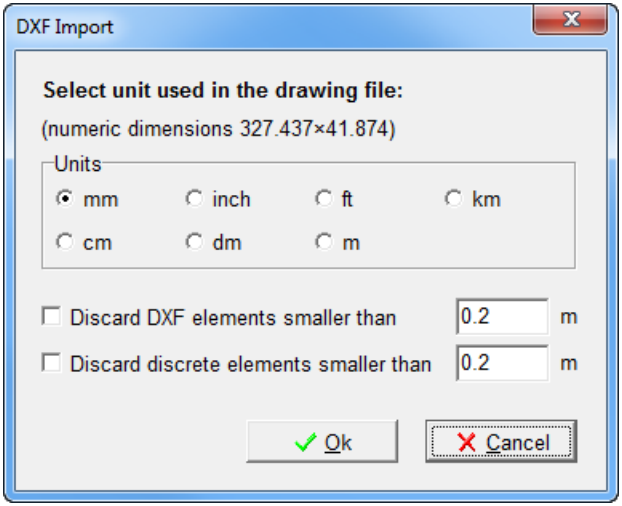


Fig. 20: Dialog for importing dxf files.

When importing dxf files, the dialog shown in Fig. 20 occurs. By selecting an entity, the Editor can scale the dxf file onto the cellular grid. Since some CAD programs tend to scale CAD drawings when exporting dxf files, the *numeric dimensions* help you to find the correct entity.

When importing dxf files, elements smaller in size then a given threshold can be filtered. Filtered dxf elements are deleted and will not show up, when the dxf file is shown in the background.

When filtering discrete elements, they will remain in the dxf file, but they will not be imported, so no cells are influenced.

4.2.5.3 Floor/Deck → Rename

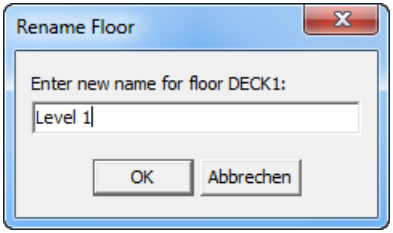


Fig. 21: Dialog for renaming a level.

Imported levels can be renamed by this function. Floor names must be unique.

4.2.5.4 Floor/Deck→Duplicate

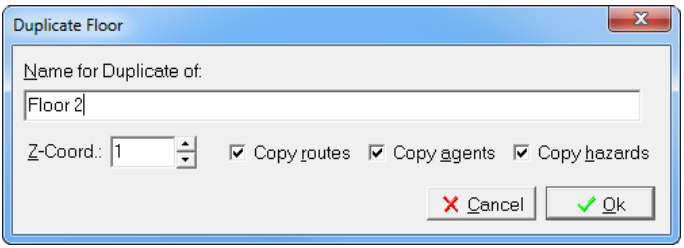


Fig. 22: Dialog for copying levels.

Levels can be duplicated by this function, after a new name and z-coordinate have been entered. Furthermore, the user can choose, which elements of a level he wants to duplicate.

4.2.5.5 Floor/Deck → New Floor

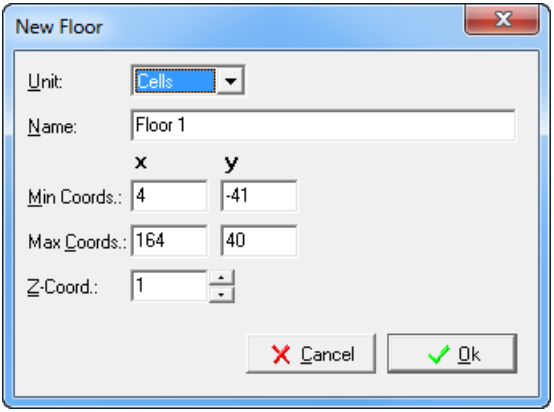


Fig. 23: Dialog for adding a new layer.

New layers without content can be added through the function Floor → New Floor. You can give the new layer an individual name and define it's dimensions. Minimum and maximum coordinates are thereby oriented according to the coordinate origin. If the project has other layers, their coordinates are shown.

4.2.5.6 Cells → Go to cell

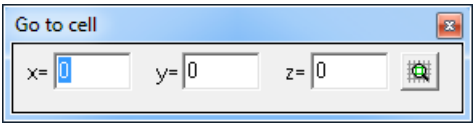


Fig. 24: Dialog to focus on a chosen cell.

In most cases of the simulation giving error messages, coordinates for the cell in question are given. Enter these coordinates in this dialog and the focus will be set onto this cell.

4.3 View Window

Fig. 25: The view window.

The *View* window can be used to position and to enlarge the view of the floor plan.

The buttons of the *view* window allow for the following functions:

	Zoom in and out.
	Zoom in on the complete level
	Zoom in on the height of the level
	Move the view according to the direction of the arrow.
	Set the zoom to its last value.

4.4 Tools Window

The tools window is used to edit the floor plan. It includes the tab-sheets *Geometry, Routes* and *Agents*. Depending on the selected tab, the buttons change and different actions can be conducted.

4.4.1 Tab sheet “Geometry“

The tab sheet *Geometry* contains buttons to edit the geometry of the floor plan.

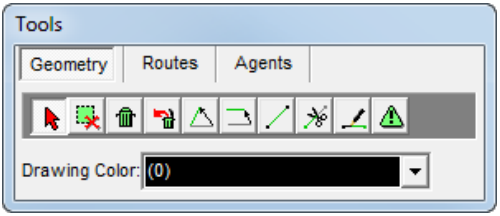


Fig. 26: The tools window with the tab sheet Geometry selected.

The tab sheet *Geometry* offers the following functions:


Selecting elements. If elements are selected, the actions affect only these elements, until they are unselected. By clicking on an element, it will be unselected.


Unselect elements.


Delete element by clicking on it.


Undelete.


Move a node of an element. If elements are selected only the nodes of the selected element are affected.


Move elements. If elements are selected, only selected elements are moved.


Draw a new element in the chosen colour.


Break elements.


Recolor an element.


Block a room at a stochastically chosen duration.

4.4.1.1 Adding a Hazard 

By “Hazard”, a general hazard endangering the person is meant. It can be caused by e.g. smoke, fire and flooding. If a hazard occurs, it marks all cells of its room as blocked. “Room” thereby means the

adjacent cells of the same type as the cell the hazard element is defined on.

Agents coming across blocked cells will search for an alternative route. If none is available, the agent will continue on the actual route and the time it spends in the blocked room is logged and saved in the results.

Fig. 27: Hazard dialog for blocking a room.

With the hazard dialog, you can name the hazard and stochastically define the time at which it occurs. You can choose between a normal and an equal distribution.

4.4.2 Tab Sheet Routes

The tab-sheet *Routes* is used to insert and edit egress routes.

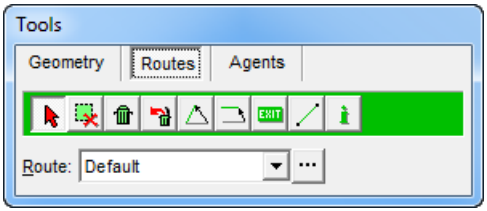


Fig. 28: The tool window with the selected tab sheet Routes.

The following menu items different to the tab *Geometry* are offered:

Define goal cells for the selected route.

Mark doors and jump points for the selected route.

Show information of chosen routes.

Choose or define new routes.

Open route dialog.

In the route list, one entry called “shortest” is available. When chosen, agents assigned to this route will chose the route with the smallest potential value.

4.4.2.1 Route Dialog

The route dialog is used to administer the route data (create/delete) and to define alternative and followup routes.

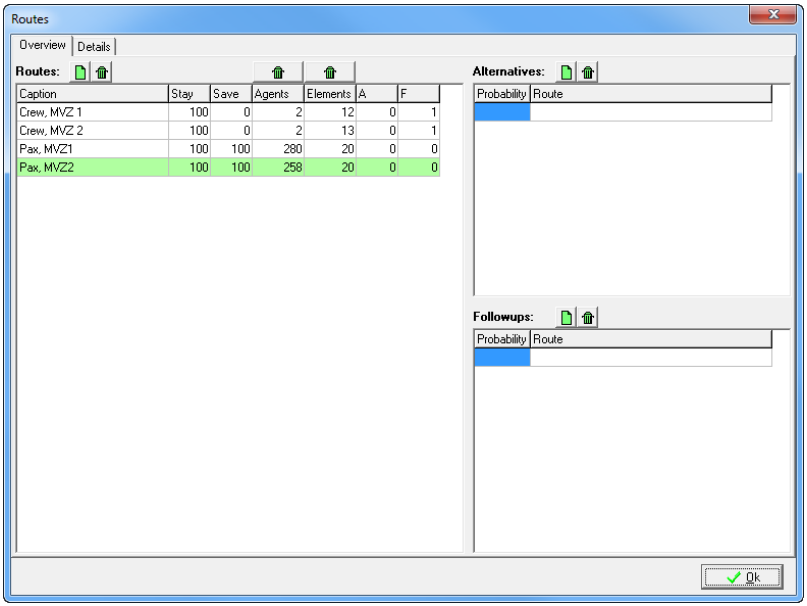


Fig. 29: Route dialog to administer your routes.

The table on the left of the dialog window lists all routes defined by the user and the two tables on the right show the alternative and followup routes of the selected route.

The available buttons have the following functions:

Define a new route or add alternative/followup routes.

Delete a route, alternative/followup route, agents or elements of the selected route. Route.

After adding a new route, you will have to name it. However, you can always rename routes by clicking on the corresponding table.

The *Route* table contains the following columns:

Caption	Name of the route..
Stay	Probability to stay on its route when an agent comes across a blocked room.
Save	Probability to be saved when reaching goal cells.
Agents	Amount of agents currently assigned to this route.
Elements	Amount of route elements (goals and route lines).
A	Amount of assigned alternative routes.
F	Amount of assigned followup routes.

The two tables on the right side contain the followup and alternative routes assigned to the route currently selected on the left table. For each route, the probability to choose it is defined by the user.

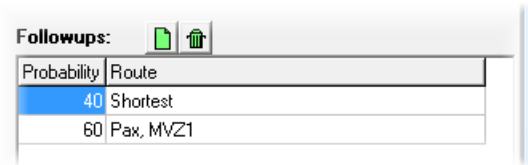


Fig. 30: Example for the definition of followup routes.

Fig. 30 shows the example for the use of followup routes. In this case, agents reaching the goal cells of the given route will choose the route “Pax, MVZ1” with 60% probability, while they will choose the route closest by with 40% probability.

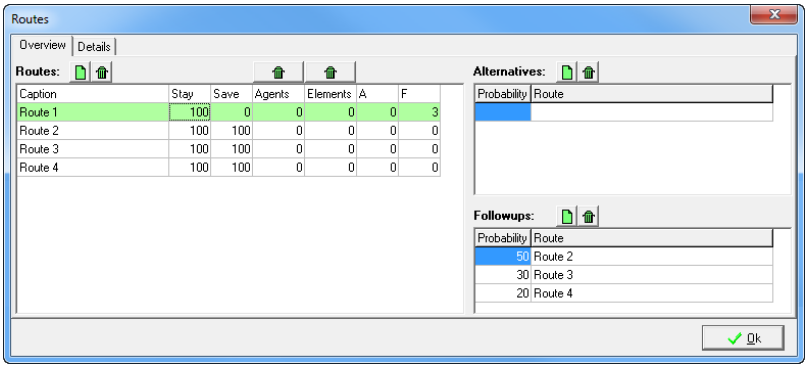


Fig. 31: Example corresponding to Fig. 14.

Fig. 31 shows, how the example shown in Fig. 14 would be modelled. All routes used must be defined in the left table. Since agents will not be saved when reaching the goal cells of *Route 1*, the corresponding save value is set to 0. When *Route 1* is selected, the followup routes 2 to 4 are displayed on the right side in the followup table with the appropriate probabilities.

4.4.3 Tab Sheet Agents

The tab-sheet *Agents* is used to insert and edit groups of agents.

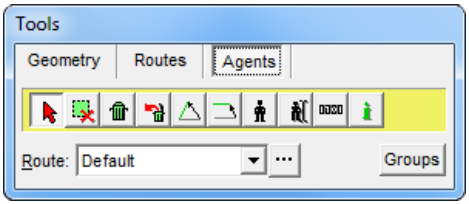


Fig. 32: The tool window with the selected tab sheet Agents.

It offers the following additional functions to *Geometry*:

 Add new agents.

 Change agent data.

 Insert a log point to record the number of agents per time for the marked room.

 Show information of chosen groups.

Active route to which the agents are assigned.

 Open route dialog.

Define agent groups.

4.4.3.1 Adding Agents 

When clicking on the floor plan, you will select the cell and thus the room in which the agents are distributed. With the opening dialog, you can determine the amount of agents to be distributed, the route they will be assigned to and the group they will belong to.

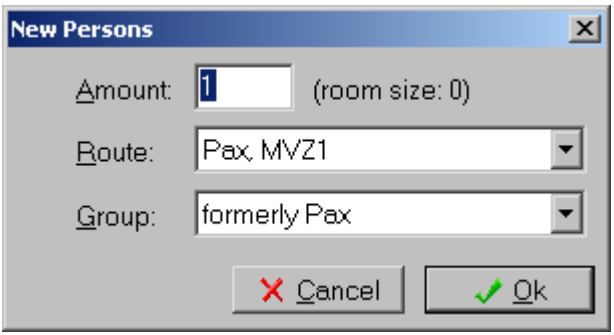


Fig. 33: The dialog window to insert agents.

The parameter “Group” allows you to define groups with different demographic parameters (e.g. old/young, fast/slow).

Next to the routes defined, the parameter “shortest” can be chosen as route, so the agent will use the route with the smallest potential amount on the cell it is standing on.

Agents can be assigned to either a room or an area (see Fig. 34). A room is thereby defined by all neighbouring cells with the same property as the cell with the agent element. To define the area, a rectangle can be created by enlarging the definition-rectangle through pulling it, after the button for moving nodes  has been chosen in the *Tools*-window. To do this, the actual route has to be selected in the same window.

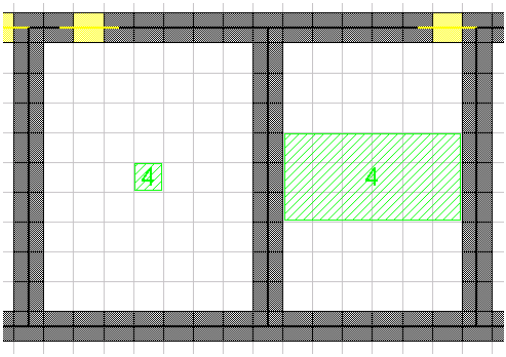


Fig. 34: Two possibilities of agent distributions: On the left, four agents are assigned stochastically over all cells of the room. On the right, they are assigned on the marked area.

4.4.3.2 Editing Agents

Agent elements can be edited by clicking on them. You can edit the amount, the assigned route and the group. Several agent elements can be edited in one step by selecting them. The following window for editing the agents (Fig. 35) opens.

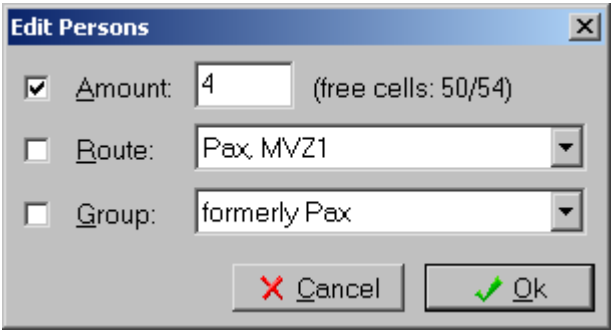


Fig. 35: Window for editing agents if several agents are selected

By selecting the appropriate check mark, you can choose, which attribute should be edited.

4.4.4 Groups Dialog

Groups help to assign different characteristics to agents, like a passenger and a crew group which will react in different speeds.

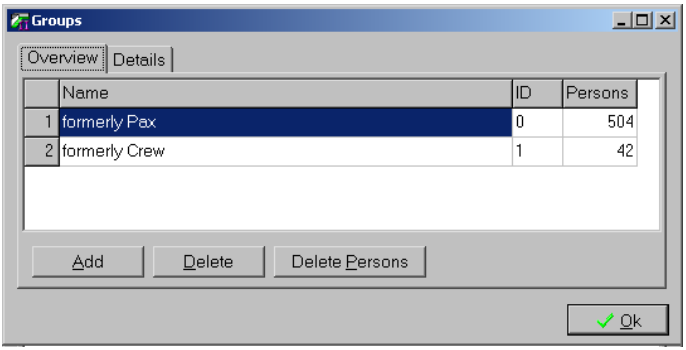


Fig. 36: The dialog for defining groups and their attributes.

By pressing the groups button in the tab sheet *Agents* a new window is opened (Fig. 36) in which you can define groups or edit groups that are already defined. The demographic parameters of a group are defined in the simulation.

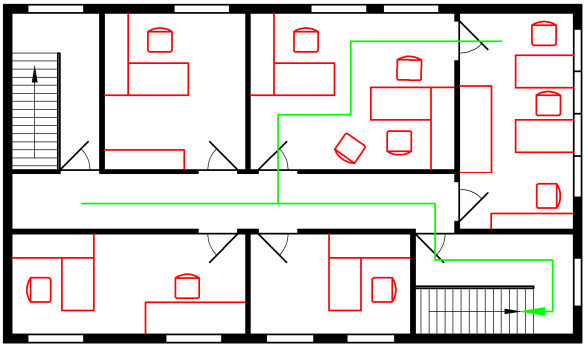
4.5 Hotkeys

The following functions help to improve handling:

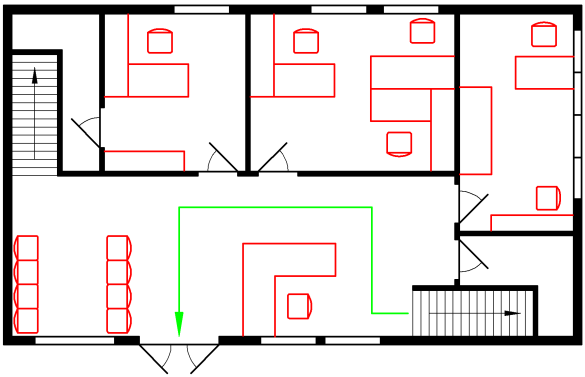
‘right mouse button’	Zoom into the rectangle created by moving the mouse.
‘alt’ + ‘right mouse button’:	Pan the plan by moving the mouse.
‘ctrl’ + ‘left mouse button’:	Select all elements within the rectangle created by moving the mouse.
‘shift’ + ‘left mouse button’:	Elements can be selected or unselected by clicking on them.
‘del’:	Delete selected elements.
turn mouse wheel	Zoom in/out
Press mouse wheel	Pan the plan by moving the mouse.

4.6 Generating the project

The handling of the editor can best be learned by practical appliance. In the following example, modelling and defining a project is explained by a virtual office building.



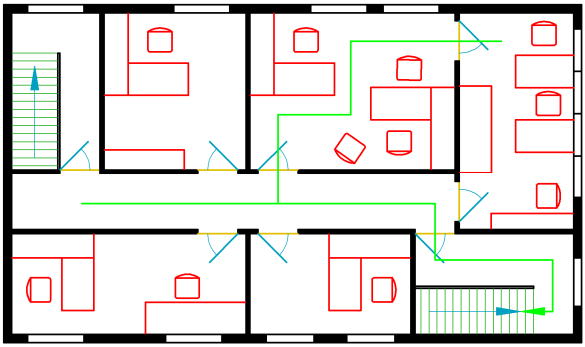
1st floor



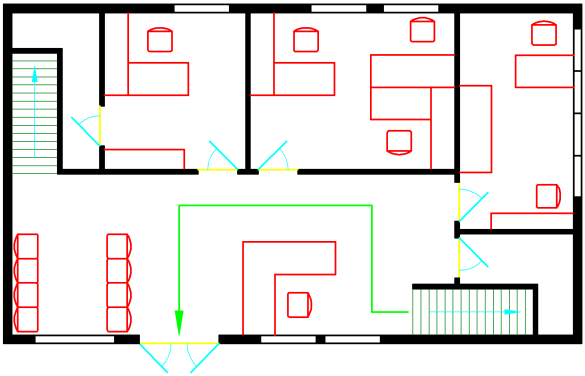
ground floor

Fig. 37: The virtual office building used as a simplified example. Furniture is displayed in red, escape routes in green.

Since the editor assigns the characteristics of the elements in accordance to their colours, you can save time by using appropriate colours in the CAD file, e.g. one colour for stairs, another one for doors and so on.



1st floor



ground floor

Fig. 38: The correctly dyed office building. In this case the colours mark the following characteristics: black = wall, red = wall, dark green = stair, turquoise = ignore, yellow = door, light-green = escape routes.

To explain the function of the escape routes (see 4.6.2), the routes run out of the room on the upper right through the bordering room instead of leading directly towards the corridor.

4.6.1 Import Floors/Decks

To import a level, the corresponding file has to be selected after pressing the key. Start importing from the lowest deck on, since new levels are positioned on top of the actual level.

In order for the agents to jump correctly between levels (via step/down cells), the levels have to be positioned precisely on top of each other. This can be achieved by positioning the origin of each CAD drawing at the exact same spot.

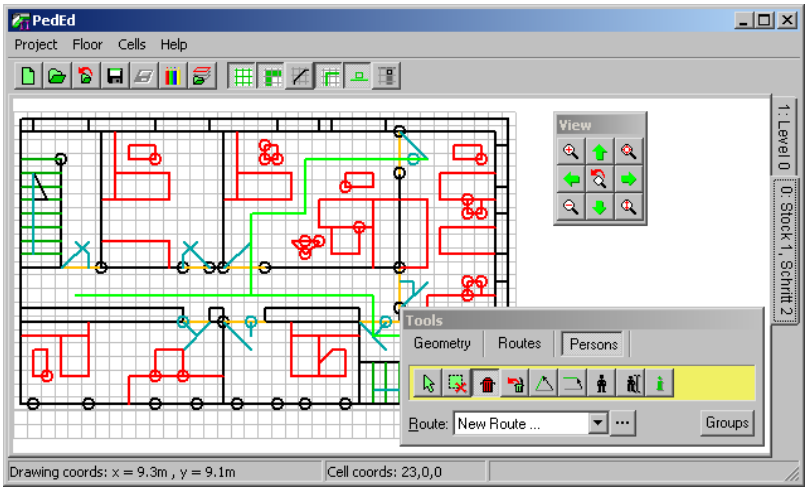


Fig. 39: View of the first imported floor. Since the button „dxf“ is not pressed only rounded elements are shown. Projection errors may occur.

After all levels have been imported the original dxf-elements can be viewed by pressing the button. The button displays the same elements but they are rounded onto the cells. This may lead to rounding errors, e.g. a wall might be shifted. This can be repaired with the use of the button of the Editor.

After the colours of the elements have been defined through the use of the dialog *Colour Coding*, the *Editor* assigns the corresponding attributes to the cells and they appear coloured.

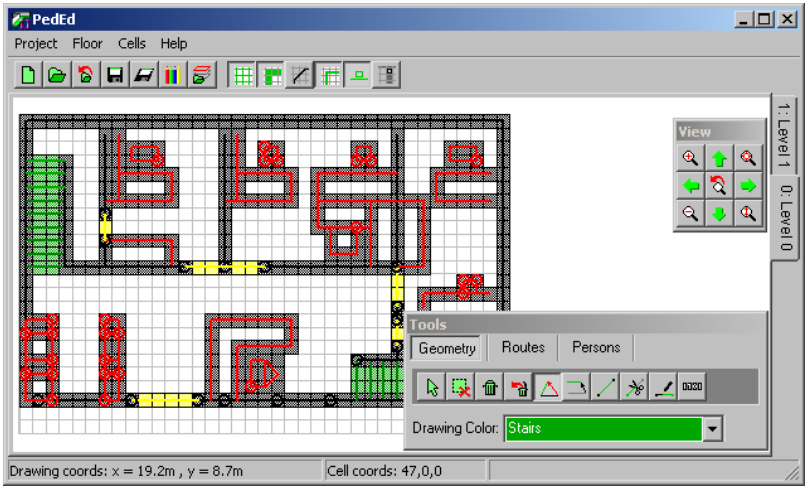


Fig. 40: The calculated cells, after the colours have been defined with Colour Coding. Turquoise and light green elements have been filtered out. Rounding errors were removed.

4.6.2 Stairs and Jump Points

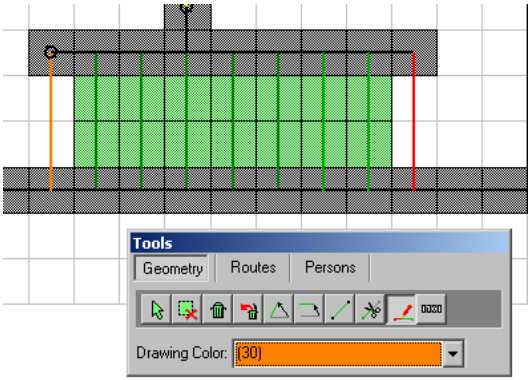


Fig. 41: Bottom and top of the stair are marked with new colours.

Due to the dark green lines denoting steps in the dxf-file the editor automatically assigned the characteristic ‘steps’ to the corresponding cells.

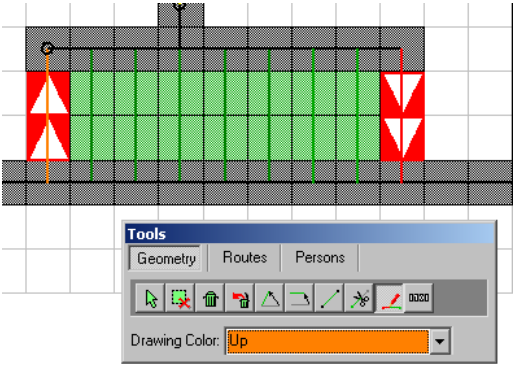


Fig. 42: After allocating the attributes to the colours the adequate symbols appear in the corresponding cells.

Choose a new colour (*Drawing Colour* in the tools window) and draw lines for the up and down cells. After allocating the attributes to the colours with the use of the dialog window *Colour Coding*, the adequate symbols appear:

Up-Cells: 

Down-Cells: 

Since the staircase ends on the upper floor, the cell information is restrained to the downward directing cells and the adjacent stair cell.

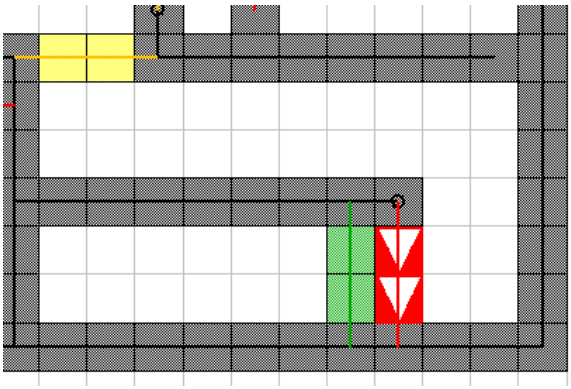


Fig. 43: Modelling the stairway in the upper floor. Since it just leads down a cell line of 'down'-cells and a following row of 'step' cells is sufficient.

4.6.3 Define Routes

Routes have to be defined before they can be assigned in the floor plan. Pressing the button ··· opens the corresponding dialog window (Fig. 44). In this case, one route leads along the left stair case (*Left staircase*) and the other via the right (*Right staircase*). In order to demonstrate the possibilities, another route leads along both stair cases to the upper floor (*Counter-flow*). Arriving there, the agents will choose the closest route to the exit.

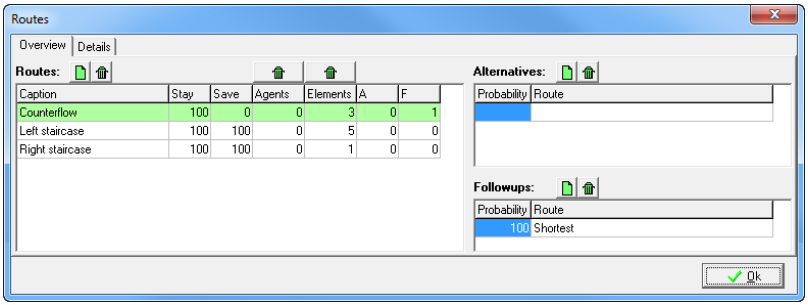


Fig. 44: The route window with all defined routes.

In order to define a destination of a chosen route, draw a line while the button *Exit* is pressed. The destination elements are displayed in thicker lines compared to the lines marking the routes.

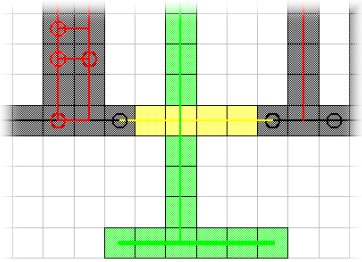


Fig. 45: Goal cells of a route.

It is useful to position goal cells of an exit not adjacent to the door cells, but with a distance of three cells. This reduces the influence of the agents being taken out of the floor plan onto the flow through the door.

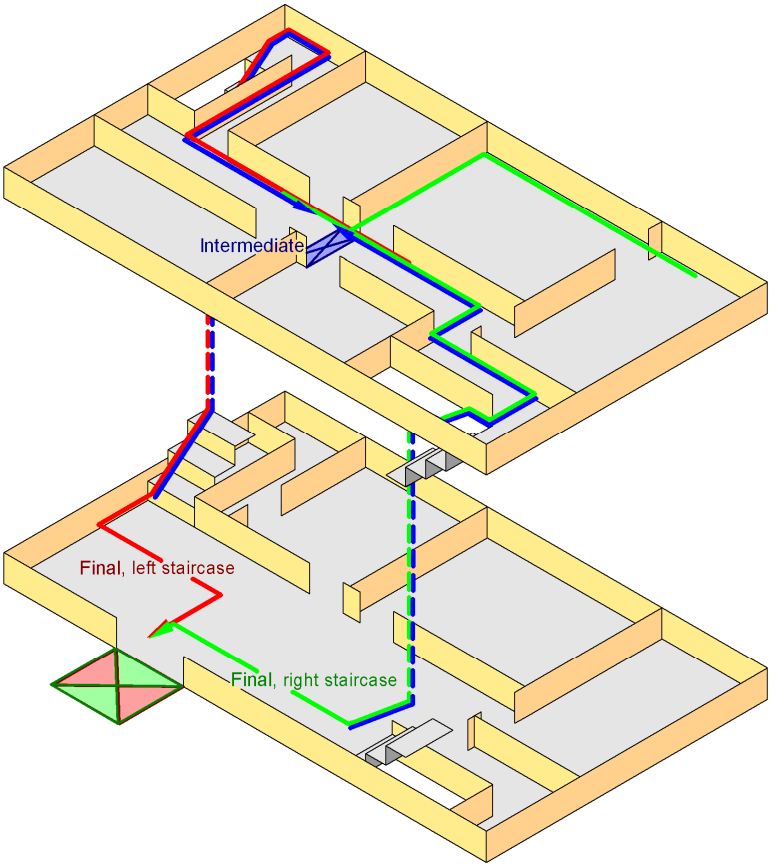


Fig. 46: All three routes in the floor plan.

The definition of the routes influences the spread of the potential. Using the route lines, doors and stairs are marked, by which the potential primarily spreads. If no further marked door and jump cells can be identified the potential spreads through the remaining rooms (see 3.3.1).

In this example, the route lines mark the necessary doors and stairs, so the potentials of the route are spread as shown in Fig. 46.

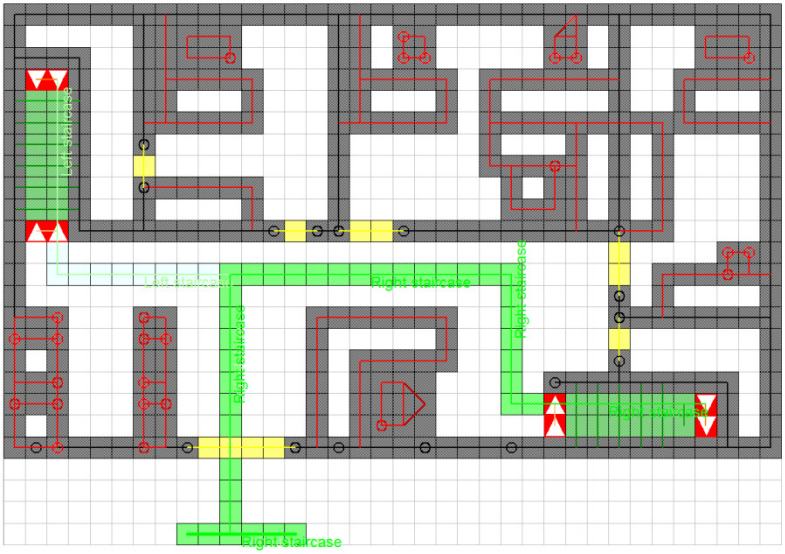


Fig. 47: The completely modelled level including defined escape routes and destinations Route "Right stair case" is selected.

4.6.4 Add agents

Agents are distributed per room as explained in chapter 4.4.3.1. As an example, five agents per room are distributed. Depending on their initial position, they are assigned one of the available routes.

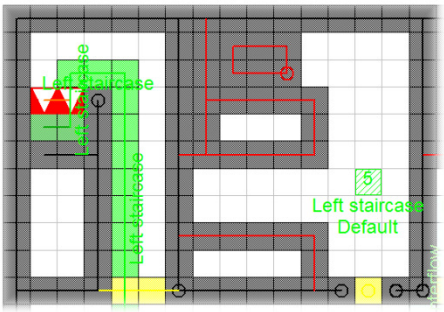


Fig. 48: Five agents distributed in the room, belonging to group "Default" and following route "Stair case left".

4.6.5 Saving the project

When saving the project, the editor creates the following directory structure in the project directory (here: */Projectname*):

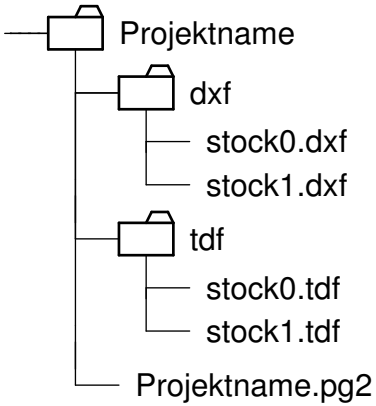


Fig. 49: The directory and file structure of simulation-projects.

All paths of the project are saved relative to each other, so you can copy the complete directory without causing problems. Simplified dxf files are saved in the directory */dxf*, while the data of the rounded elements as well as all newly drawn elements, route and agent data are saved in the directory */tdf*. The project file (*Projectname.pg2*), which provides all the data necessary for the simulation, is situated in the project directory. It can be opened by PedGo or AENEASsim.

Each project should be saved in its own directory in order to avoid overwriting of existing tdf files.

5 PedGo/AENEASsim

The simulation is the core of the software package. It runs the simulation and allows for analysing, evaluating and saving the results. Since each real evacuation varies in its sequence, the simulation is not just run once but several times (typically 500 times). Thereby, the demographic parameters are newly assigned before every run, stochastic decisions happen and events like hazards also happen at stochastical times. The results are analyzed statistically and each run can be repeated to get more detailed information.

5.1 Licencing

5.1.1 Activation

The software is activated by a dongle, which means that it is not linked to one computer. As long as the licence duration (saved on the dongle) is valid and the dongle is plugged into the USB port of your computer, the software runs for an unlimited amount of agents. With the dongle missing, projects with up to twenty agents can be simulated.

Fig. 50: Dongle to activate the software.

The duration of usage, the customer name, number and the dongle number are saved on the dongle.

To use the software, please plug the dongle into a free USB port of your computer and start the software. The data saved on the dongle can be shown by clicking *Settings* → *Licence* in the menu.

Fig. 51: Window showing the dongle information.

In the status bar of the simulation window, you can see, if the dongle is plugged into your computer and is recognized (*Dongle: ok*) and if the licence is valid (*Lic: ok*).

5.1.2 Updating the Dongle

To update the dongle, you get a license file (*.lic) via email. Plug the dongle into a free USB port of your computer. Start the software and choose *Settings* → *Licence* in the menu. The licence window (see Fig. 51) opens. Click the -Button to select and open the licence file.

5.2 Elements

The program window consists of two main elements by which you can controle all functions: The menu buttons at the upper end of the window and the three tab sheets *Situation, Density* and *Dir. Index*.

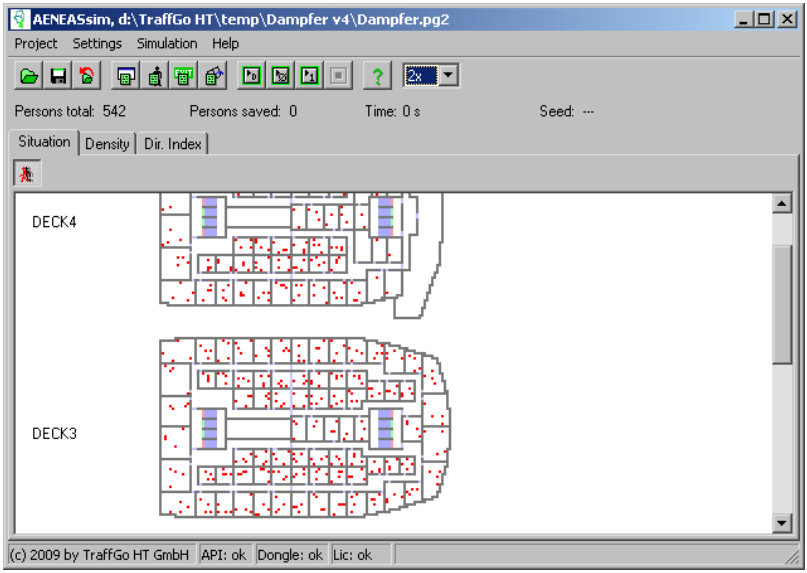


Fig. 52: Screenshot of the simulation software.

5.2.1 Menu

The menu of the main window consists of the following buttons:


Load project.


Save project.


Refresh project. Reload it after implementing changes in the Editor


Modify simulation settings.


Modify demographic settings.


Modify exit settings.


Only AENEAS: Add ship motion.


Perform demo simulation.


Perform mean value simulation.


Perform single simulation.


Stop current simulation.


Show start window.


Set zoom.

5.2.2 Tab Sheet Situation

The tab sheet *Situation* shows the current situation. Cells representing walls are displayed grey, stairs and doors in various shades of blue. Agents are visualized by moving dots, changing their colour according to their walking speed. The colour gradient varies from green (maximum walking speed) via orange to red (no speed). The cellular structure gets visible when you increase the zoom level.

Fig. 53: Screenshot of the tab sheet 'Situation'. It visualizes the actual situation.

The Situation tab offers the following buttons:

Do/do not update the visualization. If it is not updated, computational speeds are increased (used for mean run).

5.2.3 Tab Sheet Density

The tab sheet *Density* visualizes significant congestions. Significant congestions are defined in the appropriate guidelines ([4], [22]).

Because of the discrete grid, the density for one cell can easily be calculated, taking this cell and its surrounding eight cells into account (see Fig. 54). The result is a value with the entity agents per square meter.

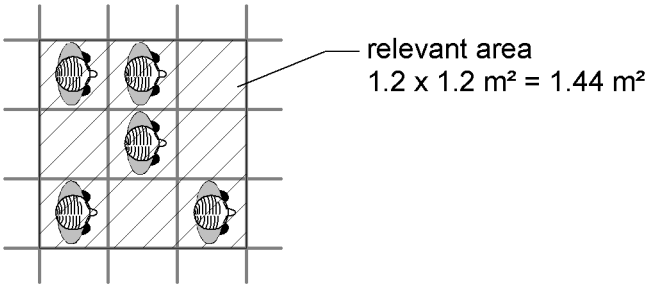


Fig. 54: Example for the calculation of densities in the cellular grid. In this case, the density is 3,5 P/m².

In order to accentuate significant congestions (=congestions significantly influencing the result), the following steps are made: According to the definitions ([4], [7]), a significant congestion occurs, when the agent density is 4 P/m² or higher during 10% of theevacuation duration.

After each time step, the density for all cells is calculated. If it is equal or higher than the threshold mentioned above, the counter of the cell is increased by one. After the simulation is completed, it can be evaluated, how many seconds the marginal value per cell was exceeded. This value is visualized through a colour gradient from red to green.

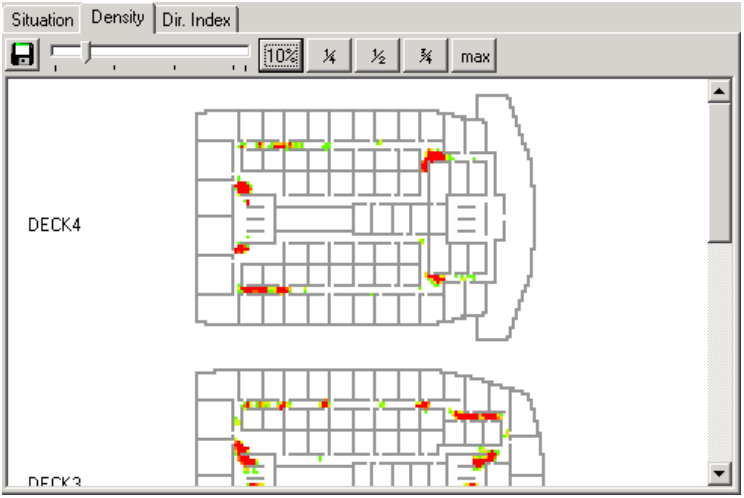


Fig. 55: Screenshot of the tab sheet ‚Density', that shows the exceeding of the marginal density value.

The track bar and the buttons at the top of the tab sheet allow for a more detailed analysis of the simulation. E.g. if the ten percent button is pressed, the cells having a local density of 4 P/m² or more during 10 % of the evacuation duration are displayed red. These areas are called "significant congestion" [4]. The track bar moves according to the pressed button. The save button stores the displayed picture.

To achieve higher computational rates the density plot is not being updated during the mean calculation.

5.2.4 Tab Sheet Directional Index

The *directional index* (Dir. index) visualizes the course of the lines connecting cells with equal potential value through the blue-green colour gradient of a chosen route. It can be selected from the menu on top of the tab sheet. Walls are displayed grey and cells not recorded or cells having a value of zero are displayed white.

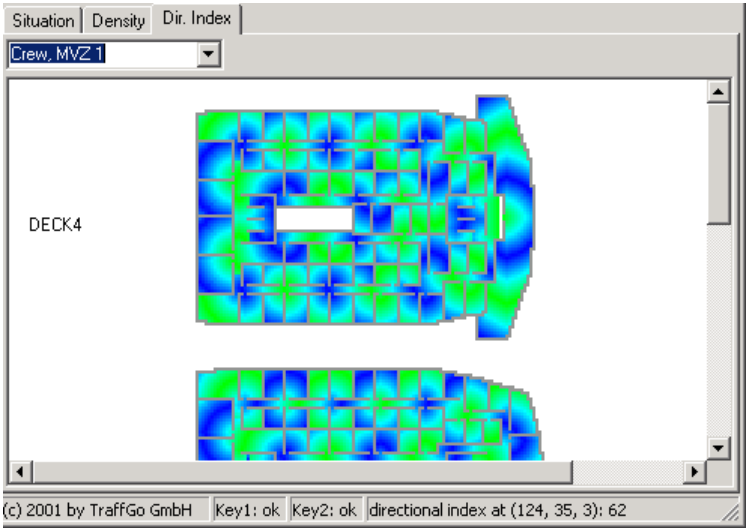


Fig. 56: Screenshot of the tab sheet "Directional Index", that shows the information of the direction.

By clicking on the cells of the floor plan, the potential value of the cell is shown in the status bar at the bottom of the window.

5.3 Configurations

5.3.1 Program

In the dialog window *Settings*, you can select which levels should be displayed. However, the result files (animations and screen-shots) only show the floors selected.

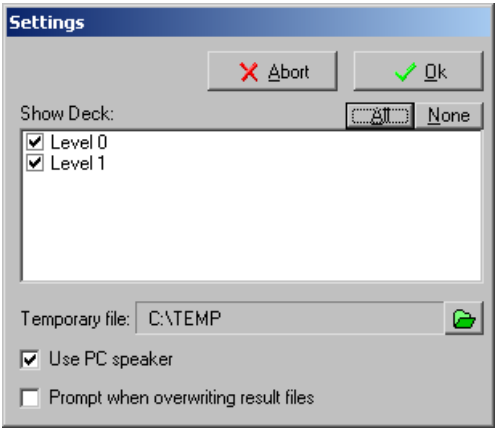


Fig. 57: Screenshot of the dialog window "Settings".

Additionally, the following settings are available:

Temporary file: Directory used to save temporary files.

PC speaker: Your PC will make a sound, when a simulation run has ended.

Prompt…: When an existing result file is overwritten, you will be prompted.

5.3.2 Agents

In the *Demographics* dialog, the demographic parameters for the defined population groups are adjusted.

Except for the parameter *Clustering* all parameters can be assigned equal or normal distributed. The normal distribution is defined by a minimum-, maximum-, mean and the standard deviation value, the equal distribution by the minimum and maximum value.

Additionally, predefined parameters settings (IMO [4], RiMEA [22]) can also be assigned.

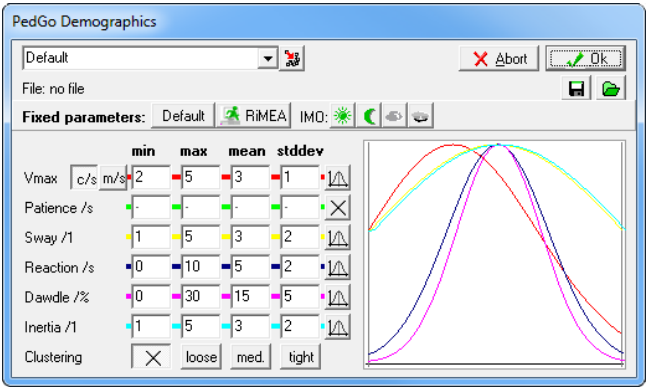


Fig. 58: Screenshot of the demographics dialog.

The dialog offers the following buttons and functions:

Personengruppe	Select agent group.
	Assign the chosen parameter set to selected groups.
	Save demographics.
	Load demographics.
Default	Reset to default parameters.
RiMEA	Parameters according to RiMEA [22].
	IMO parameters (day/night/pax/crew).
	Assign normal distribution.
	Assign equal distribution.

5.3.3 Exits

Interval- and blocking times can be assigned to the destination cells of each route to simulate different situations.

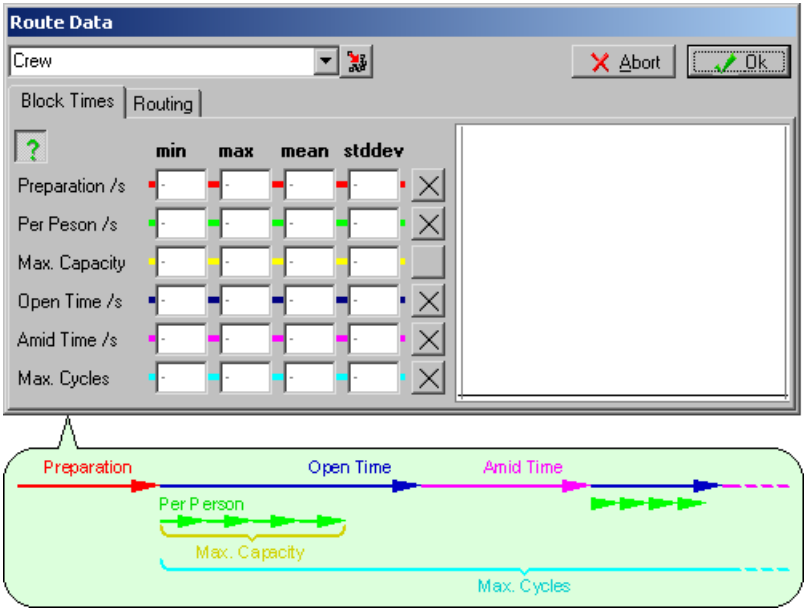


Fig. 59: Screenshot of the dialog window for blocking times.

The dialog window *Route Data* has the following buttons:

Crew	Select route.
	Assign the chosen parameter set to selected routes.
	Assign normal distribution.
	Assign equal distribution.
	Open help window.

5.3.4 Ship motion (only AENEAS)

With the software AENEAS you can “move” the floor plan according to a file or to predefined parameters (periodic movement) in order to simulate the rolling and pitching of a ship. As long as the window is

shown, the motion will be carried out. If the window is closed, the floor plan does not move.

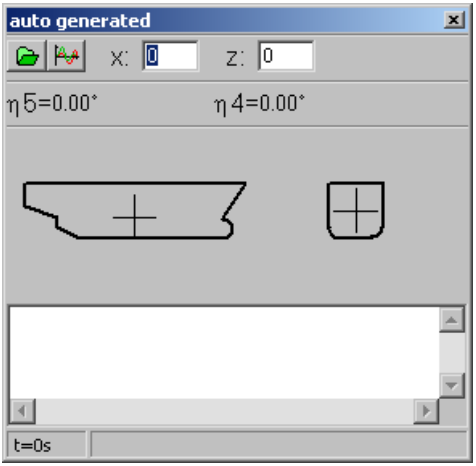
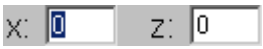


Fig. 60: Screenshot of the window „ship motion“.

The dialog window *Ship Motion* has the following buttons:

Open a ROLLS-file (roll and pitch angle as a function of time).

Define parameters for periodical ship motion.



Simplified coordinates of the centre of gravity (x: cells, z: floors).

5.4 Simulation Run

The software offers three simulation modes, which simplify the realization of an evacuation analysis significantly.

Quick demo run to check for modelling errors.

Mean run for many calculations for statistical analysis.

Single run to evaluate detailed data.

5.4.1 The Seed

The *seed* is the central value for stochastic analyses performed by a computer. It is the value, with which the random generator is initialized. Since computer programs cannot calculate real random numbers, specific algorithms are used and a starting value must be assigned to the random generator. This allows for a specific reproduction of sochastic events. The same seed will always provide the same results independent of all other settings.

Before each run, the random generator algorithm is initialized with the *seed* value. After a mean calculation the software saves a list of evacuation times and the corresponding *seeds.* By defining a *seed*, you can repeat runs in the single calculation run. This means that each run is reproducible.

5.4.2 Quick Demo

The quick demo is used to control the modelling of the floor plan. The *seed* is being determined by the system time, thus each run provides different results. The results are not saved. The density plot (Fig. 55) is being up-dated and can be saved on demand.

5.4.3 Mean

The mean calculation delivers the results of a stochastic analysis. Beginning at the given start-seed the amount of wished calculations is being conducted. Before each simulation run, the seed is increased by one, agents are newly distributed and parameters assigned. Hence each run simulates a different population within predetermined boundaries.

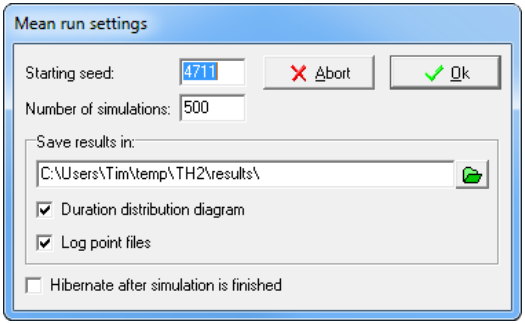


Fig. 61: Dialog window for the choice of parameters for a mean calculation.

The dialog offers the following settings:

Seed:	Start seed which is increased by one before initializing every run.
Number..:	Amount of simulation runs.
Save…:	Directory in which results are saved.
Duration…:	Saving duration distribution diagram.
Log point…:	Saving file with log point results.
Hibernate:	Set computer in hibernation mode, after simulations are finished.

To increase computational rate, the density plot is not updated when performing a mean calculation. To further increase the rate of computation, you can switch off the update button . As a result, that the present evacuation time and the amount of rescued agents is updated. The number of runs carried out is shown in the status bar.

The following files can be generated (see chpt. 7.1):

1. The results of all realizations are saved in an ASCII text file in the chosen directory. The file is formatted with tabs and since it has the extension .xls (Microsoft Excel[2]), Excel automatically

[2] Excel is an official trademark of the Microsoft Corp.

starts and opens the file, when you double click on it in the file explorer. Of course, you can also use other spread sheet programs.

2. For documentation of the used demographic and route parameters, twi text files are generated.
3. A bitmap file showing the statistical distribution of durations.
4. If defined, data of log points can be saved for all runs. Due to the amount of data, one file per room will be generated.

5.4.4 Single Calculation

After determining the distribution of evacuation durations by the mean simulation, further single calculations can be conducted to analyze the appropriate run in more detail. The output file of the mean calculation provides a list of *Seeds* (see chapter 7.1) Thus calculations can be repeated that e.g. represent the mean or the maximum evacuation duration.

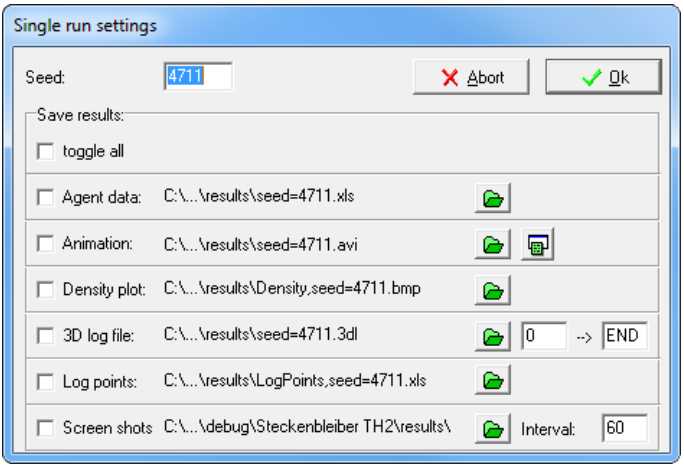


Fig. 62: Screenshot of the dialog window to define the seeds and output data of a single simulation run.

The seed can be defined in the corresponding field, while you can choose, which result files should be saved.

The following output data (see chpt. 7.2) can be generated:

Agent Data: Individual agent data, e.g. start and destination coordinates, individual walking duration etc.

Animation: An animation file of the evacuation process for the shown levels. Through the settings button , you can choose the frame rate as well as displaying the current time within the animation.

Density Plot: An image file showing the significant congestions according to chpt. 5.2.3.

3D Log File: The trajectories of all agents in the specific format 3dl which the viewer opens to visualize the evacuation process in a three dimensional environment. You can limit time interval of the output, since big floor plans with many agents and long durations can lead to very big files.

Logpoints: If you have defined a log point as described in chapter 4.4.3 the number of agents per time for the defined rooms are saved in this file.

Screenshots: Screenshots of the process in arbitrary intervals (seconds).

6 PedView/AENEASview

Like the Editor, the Viewer is an independent program, which visualizes the evacuation process in a three dimensional environment. The simulation generates 3D log files (extension: 3dl) that contain all information that is necessary for the visualisation.

The Viewer is freeware, you can share everything with your customers, so they can watch and analyse the simulation results from an arbitrary point of view. For a documentation or a presentation, you can save screenshots or series of screenshots.

6.1 Handling

The button menu is located at the lower part of the program window by which the Viewer can be handled like a video player. The status bar informs you about the number of lights used (*Lights*), the actual evacuation time (*Time*) and the number of saved agents (*Saved*).

Fig. 63: Program window of the Viewer.

6.1.1 Menu

The menu provides the following functions:

File:

Load Logfile:	Opens the dialog to load a 3dl file.
Single Screen Shot:	Saves the actual view according to the settings (*Settings→Options*).
Screen Shot Series:	Saves the actual view automatically, whenever it is updated.

Views:

Deck Up:	Shows the next floor above.
Deck Down:	Shows the next floor below.
Zoom In:	Zooms in.
Zoom Out:	Zooms out.

Animation:

Run/Pause:	Starts and stops the animation.
Reset To Start:	Resets the animation to the start.
Step Forward:	Sets the animation one second forward.
Step Backward:	Sets the animation one second backward.

Settings:

Show Origin:	Shows the centre of your view by a coordinate cross.
Add Light:	Inserts one of eight possible lights above the position of your view center.
Remove Light:	Removes the light that is closest to your view center.
Options:	Change Viewer options (e.g. screen shot settings).
Statistics:	Statistics of the project.

6.1.2 The buttons

The Viewer has the following buttons:

 Load project.

 Show project statistics.

Choose floor.

 Go back to start.

 Play / Pause.

 One second backward.

 One second forward.

 Single screen shot.

 Screen shot series.

6.1.3 Hotkeys

To improve the Viewers handling the following functions are connected to hotkeys:

left mouse button:	Rotate the view by moving the mouse.
scroll wheel:	Zoom in and out by rotating the wheel.
right mouse button:	Strafe the view by moving the mouse.
Ctrl + L:	Load a 3dl file.
Y:	Single screen shot.
X:	Start a series of screen shots.
W:	Jump up one floor.
S:	Jump down one floor.
Q:	Zoom in.
A:	Zoom out.
1:	Rewind to the beginning.
2:	Play / Pause.

3: One second forward.

4: One second backward.

L: Add a light over the centre of your view.

Shift + L: Remove the light closest to the centre of your view.

7 Results

7.1 Mean calculations

The mean calculation saves the four following files in the chosen directory.

7.1.1 demographics.xls

The demographics file *demographics.xls* documents the demographics parameters of each group of agents. It is structured as follows:

File	Explanation
PedGo demographics log file	
customer: TraffGo HT	Name of the licensee
project file: d:\Example\Example.pg2	Name of the project file
program version: 2.5.0.6	Program version number
Group 0 'All':	Name of the first group
Demographics saved in:	Path of the file (if existent)
min max mean stddev distribution	
VMax: 2 5 3 1 normal	Velocity
Patience: Not distributed	Patience
Sway: 1 5 3 2 normal	Sway
Reaction: 0 10 5 2 normal	Reaction time
Dawdle: 0 30 15 5 normal	Dawdle
Inertia: 1 5 3 2 normal	Inertia
Clustering: none	Clustering
Group 1 'Crew':	Next group (if existent)
…	

7.1.2 routedata.xls

The route file *routedata.xls* documents the route settings of all groups. It is structured as follows:

File	Explanation
PedGo route data file	
customer: TraffGo HT	Name of the licensee
project file: d:\Example\Example.pg2	Name of the project file
program version: 2.5.0.6	Program version number
Route 0 'Pax':	Name of the first route
min max mean stddev dist.	
Preparation: not distributed	Preparation
Per Agent: not distributed	Blocking duration per agent
Max Capa.: not distributed	Maximum capacity
Open Time: not distributed	Open duration
Amid Time: not distributed	Amid duration
Max Cycles: not distributed	Maximum number of cycles
Route 1 'Crew':	Next route (if existent)
…	

7.1.3 durdist,seed=[StartSeed]-[EndSeed].bmp

The frequency distribution shows the distribution of evacuation durations. In most cases the distribution is similar to a normal distribution, but you need a certain amount of runs for a smooth distribution.

The bitmap file is generated automatically and is saved in the chosen directory. Fig. 64 shows an example of a frequency distribution. The green bar marks the significant duration (larger then 95% of the determined durations) and on the duration axis, every multiple of 60 s is marked red.

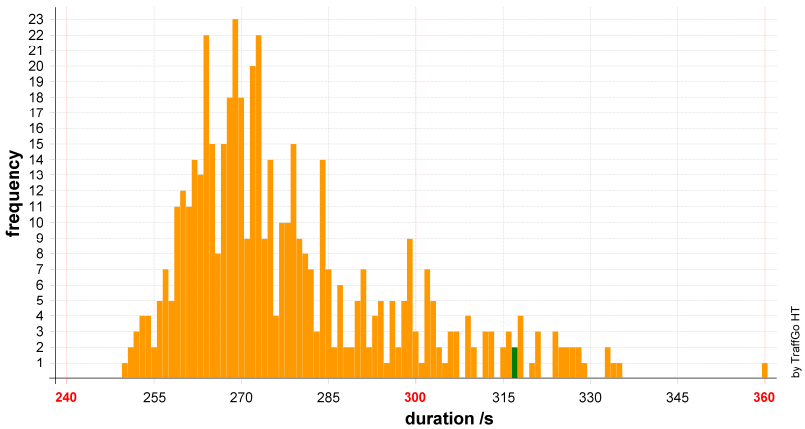


Fig. 64: Example of an automatically generated bitmap for the frequency distribution

7.1.4 seed=[StartSeed]- [EndSeed].xls

The result file can be divided into two parts: The first contains the used input data and a statistical overview of the results, while the second part lists the results of each run. The first part is structured as described below:

File	Explanation
PedGo result file, mean run:	
customer: TraffGo HT	Name of licensee
project file: d:\demo\demo.pg2	Name of the project file
program version: 2.5.0.6	Program version number
simulation time:	System time at the start and end of the simulation
start: 12:21:56	
end: 12:42:49	
statistics:	Statistical results
simulations: 500	Amount of simulation runs
agents: 1019	Amount of simulated agents
success: 500	Amount of successful runs
no success: 0	Amount of unsuccessful runs
/s /(min:s) seed	Statistical durations
mean 295 04:55 4715	Mean duration
stddev 5 00:05 ---	Standard deviation
95% < 303 05:03 4850	Significant duration
min 283 04:43 4934	Minimum duration
max 310 05:10 4870	Maximum duration
Group Data:	Group numbers and names
Number Name File name	
0 Pax no file	
1 Crew no file	
Route Data (see 'routedata.xls' for details):	Route numbers and names
Number Name	
0 Crew	
1 Pax	

File						Explanation
time distribution:						Distribution of the calculated durations
time /s:	741	742	743	744	…	Evacuation duration
frequency:	1	0	0	8	…	Frequency of duration
evacuation curves:						Evacuation curves
agents:	0	31	62	93	…	Amount of saved agents
mean /s:	0	34	44	52	…	Time for the mean run
sign. /s:	0	38	48	53	…	Time for the significant run
max /s:	0	41	49	57	…	Time for the maximum run
min /s:	0	28	38	45	…	Time for the minimum run

calculated durations:			saved agents and times /s:							
seed	duration	saved	0	10	20	30	40	50	…	Amount of saved agents
4711	388	1019	0	26	35	40	46	51	…	One line per run with seed, duration, amount of saved agents and the time when the amount of agents named above where saved.
4712	391	1019	0	31	36	42	48	53	…	
4713	389	1019	0	32	37	42	46	52	…	
4714	396	1019	0	38	45	49	57	61	…	
…	…		…	…	…	…	…	…	…	

7.1.5 /LogPointData Mean Run/[logpointname].xls

For each log point, a file with its name is created containing all statistical data of all runs:

File	Explanation
PedGo mean run log points file:	
customer: TraffGo HT	Name of licensee
project file: C:\logpoint\logpoint.pg2	Name of the project file
program version: 2.5.1.15	Program version number
log point name: Log	Name of logpoint
log point coordinates: (47, 23, 0)	Logpoints coordinates
size /m²: 1.1E3	Size of room
Beware: Older spread sheet calculation programs will have problems…	Reminder
Evaluation for this room only:	
/s /(h:min:s) seed	Statistic data of room
mean 135 00:02:15 4721	Mean duration
significant 158 00:02:38 4790	Significant duration
min 106 00:01:46 4763	Minimum duration
max 174 00:02:54 4731	Maximum duration
time quantil agents/seed	
/s sign. 4711 4712 4713 4714 …	Agent amount for each run and
45 100 100 100 100 100 …	95% quantil of all runs
46 100 99 99 99 99 …	
47 100 96 98 98 97 …	

7.1.6 Evaluation Examples

With the use of a spread sheet software, various diagrams can be created using the output file. One example is the evacuation curve. It shows how many people were saved depending on time.

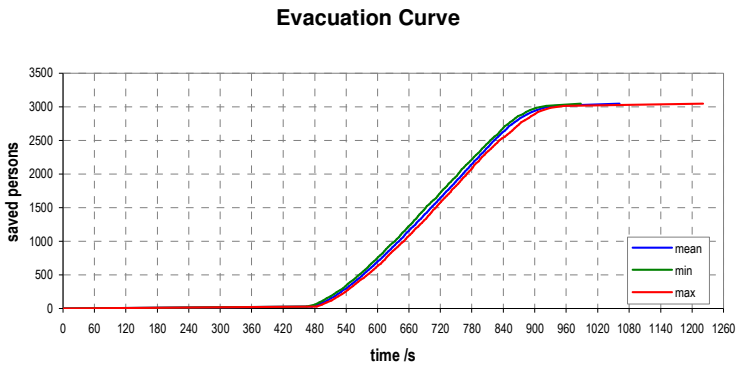


Fig. 65: The evacuation curve can be created using the mean result file.

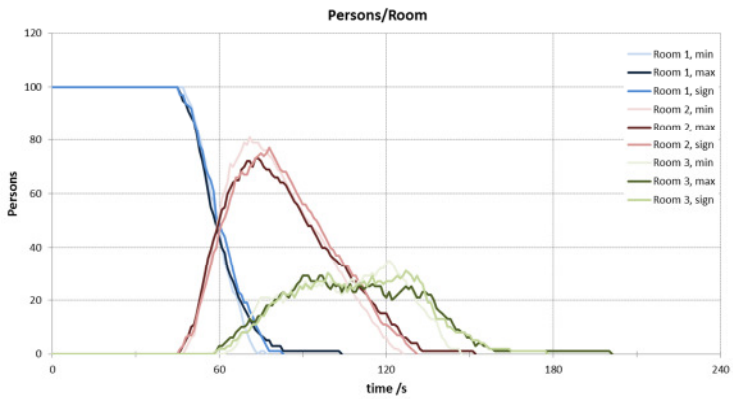


Fig. 66: Agent amounts in three rooms over time, generated from log-point data.

7.2 Single Calculation

Most result files of the single run do not need any further explanation (animation, screenshots) or have already been described (density plot, 3D log file). Hence only the ASCII files of the options *Agent Data* and *Log points* are described in detail. Like the mean calculation the single run automatically creates the files *demographics.xls* and *routedata.xls* for documentation.

7.2.1 seed=[Seed].xls

The result file of a single run summarises the agent data and is divided in the two parts that are described below.

File	Explanation
PedGo result file, single run:	
customer: TraffGo HT	Name of licensee
Project file: c:\demo\demo.pg2	Name of the project file
Program version: 2.5.0.6	Program version number
simulation time:	System time at the start and end of the simulation
start: 12:21:56	
end: 12:42:49	
Seed: 4727	Seed of the calculation
duration /s: 1062	Duration of run in seconds
Duration /(h:min:s):	Duration of run in hours:minutes:seconds
agents: 542	Amount of agents
Group Data:	Group numbers and names
Number Name File Name	
0 Pax no file	
1 Crew no file	
Route Data (see 'routedata.xls' for details):	Route numbers and names
Number Name	
0 Crew	
1 Pax	

The second part contains the data of each agent sorted in lines. The last column with the demographic parameters of each agent is missing in the following table.

			start coord.			dest. coord.			goal	time	dist.	multiple of Vmax					risk timer	density log /s						
	Agent	group	sx	sy	sz	dx	dy	dz	#	[s]	Cells	0	0,25	0,5	0,75	1,0	0	<1 P/m²	<2 P/m²	<3 P/m²	<4 P/m²	<5 P/m²	<6 P/m²	>=6 P/m²
File	mean v.	–	–	–	–	–	–	–	–	450	70	1	1	1	1	18	0	20	18	3	2	0	0	0
	455	0	36	69	2	55	51	1	1	442	44	0	1	0	0	14	0	65	27	20	4	0	0	0
	253	0	111	54	2	115	41	1	1	448	83	0	0	0	0	20	0	36	26	21	1	0	0	0
	195	0	97	31	2	115	41	1	0,1	450	75	1	1	0	3	22	0	26	21	19	4	7	0	0
	8	1	105	59	3	115	40	1	0,1	454	95	2	1	4	0	17	0	28	12	11	2	1	0	0
	296	0	23	39	3	56	33	1	1	454	53	1	0	0	1	17	0	31	18	13	4	2	0	0
Explanation	Number of agent	Group	Start coordinates			Destination coordinates			Addressed destinations	Individual walking duration	Distance walked (in cells)	Frequency at which the multiple of the maximum walking speed was used					Duration, the agent spent in a room, blocked by a hazard.	Duration, each agent spent in the given densities.						

7.2.2 LogPoints,seed=[Seed].xls

In the log point file the amount of agents per time, densities and flows are listed for the defined log points. It is structured as follows:

	Result file	Explanation
File	PedGo log points file:	
	customer: TraffGo HT	Name of licensee
	project file: C:\Users\Tim\temp\debug\logpoint\logpoint.pg2	Name of project file
	program version: 2.5.1.15	Program version
	defined points:	Overview of log points (see below)

Number	x	y	z	name	size /m²	Type
0	15	24	0	Room 1	3.9E2	Floor
1	48	25	0	Room 2	4,00E+02	Door
2	80	25	0	Room 3	3.4E2	Floor

Explanation	Number of log point	Coordinates	Name of log point	Size of room in m²	Cell type

Following, the log point data is listed:

Result file	Time /s	Room 1 Agents /1	in /1	out /1	density /P/m²	flow /P/ms	Room 2 Agents /1	…
	45	100	0	0	0.26	0	0	…
	46	100	0	0	0.26	0.21	0	…
	47	98	0	2	0.25	0.23	2	…
	48	97	0	1	0.25	0.24	3	…
	49	96	0	1	0.25	0.24	4	…
	…	…	…	…	…	…	…	…
Explanation	Time in seconds	Amount of agents in room	Agents entering room	Agents leaving room	Agent density in room	Agent flow in room	⋮	
		First room					Second room	

8 Glossary

Agent	Here: A simulated person.
Cell	The grid area after discretising is called cell.
Cellular automaton	Models used in discrete space to simulate dynamic systems. The development of a cell at the moment t+1 depends on the state of this cell and its neighbouring cells at the time t.
Day case	Demographic parameter distribution for the day case according to IMO MSC./Circ.1238
Demographics	Here: The parameters describing the abilities of a group of agents.
Discrete space	Space divided in finite sections.
Discrete time	Time divided in finite sections.
Discretising	The extraction of a finite amount of data from an infinite quantity of data.
Fundamental diagram	Diagram that shows the connection between agent density and agent flow. The flow rises to a maximum. As soon as a specific density of agents is reached the flow drops.
IMO	International Maritime Organization: www.imo.org
Initialize	Adjust the parameters to an initial situation.
Model	Simplified abstract copy of the reality for scientific analyses.
Multi-agent-model	A system consisting of several similar or different specialized acting agents that

	solve a problem collectively.
Night case	Agent- and parameter distribution for the night case according to IMO MSC.1/Circ.1238
Potential	Here: Value of a cell to calculate the direction. From a destination cell (lowest value) the potential spreads via the neighbour cells with rising value.
Random Shuffle	Here: The agents move in a random order.
Run	A simulation run from initialisation until all agents are “saved”.
Seed	Initial value of a row of random numbers.
Self organisation	In the system theory basically describing a form of system development, where forming, designing and restricting influences come from the elements of the system themselves.
Significant Duration	The duration which is longer then 95% of several determined durations.
Specific flow	Unit: Agents per meter aisle width and second.
Sub update	Part of an update. Each agent is moved at max for one cell in a sub update.
Tdf-file	TraffGo-Data-File; In this file all drawing data rounded on cells is saved.
Time step	The time that elapses during one update step. Here: 1 second.
Trajectory	Path of an agent.
Update	The mode and order in that agents are moved. The update takes one second and consists of several sub update steps.

9 Literature

You can find a broad bibliography on the homepage of TraffGo HT GmbH.

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