Structural PANDA

User Guide Version 1

For release 1.3.2

Structural PANDA

© Structural PANDA 2022

Contents

- ❑ 1. Introduction to PANDA
- ❑ 2. Getting started
- ❑ 3. Building Layout Inputs
- ❑ 4. Model Scope
- ❑ 5. Input Parameters
- ❑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

1. Introduction to PANDA

© Structural PANDA 2022

1.1 Hi, I am PANDA

Welcome to PANDA

- 50% of embodied emissions and 20% of costs from multi-storey buildings could be prevented through better early-stage design decisions.
- PANDA has codified the early-stage design process so is able to generate 1000's of detailed design solutions in a few minutes.
- PANDA provides a cost and carbon analysis for every solution to reveal better solutions, cheaper with less embodied carbon
- PANDA saves time, reducing the early-stage design process reduced by an average of two weeks reducing the direct design costs
- Organisations who use PANDA will win new project tenders in favour of those who don't.
- Other software solutions rely on existing designs to provide cost and carbon analysis. PANDA is in a unique space of being able to generate detailed design solutions and to provide the cost and carbon analysis for every option.

P arametric

A nalysis &

N umerical

D esign

A ssessment

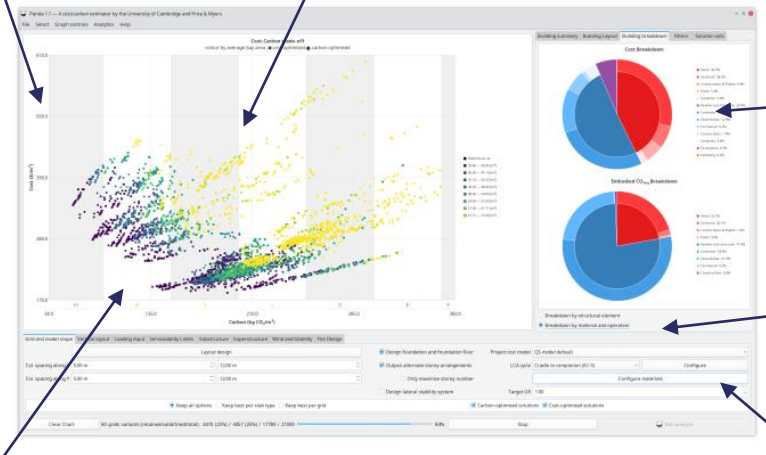
© Structural PANDA 2022

1.2 PANDA gives you options

There are 1000's of options for every client brief, so how do you know that the concepts you select to develop are the best ones? PANDA lets you explore all the options so your team can make fast and informed decisions.

Feasible designs plotted for carbon & cost

Visualisation options to investigate the effect of different design decisions



View cost & carbon breakdown

View and export chosen design detail

Code compliant design created for each point

Option to input your own LCA, cost and material data

© Structural PANDA 2022

1.3 What can PANDA do?

Automated generation of cost and carbon for all possible design options

- Full engineering report giving the complete design specs of every bay
- Embodied emission and cost breakdown for each design
- Visualise and filter results by brief requirements such as cost, carbon, layouts, foundation types, decking types,
- Export PANDA generated results in report format for client meetings

Automated Full Eurocode compliant design

- steel, composite, CLT, softwood and precast frames concrete 2-way flat slabs and fabricated sections
- foundation design, including pad, piles and raft options
- flexible arrangement of facade loading and service integration options
- design for lateral stability and fire safety requirements
- vertical space optimization options
- circularity assessment

Use pre-set material, cost and carbon data or input your own datasets

- euro, british and westok steel sections
- cost model validated by a QS,
- carbon data based on ICE and IStructE databases

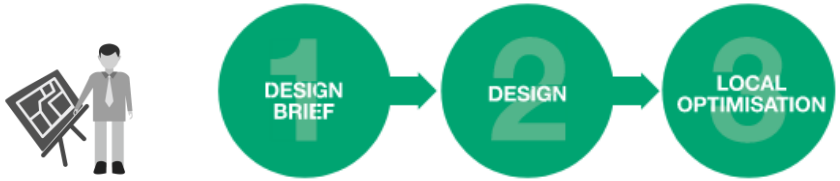
© Structural PANDA 2022

1.4 PANDA can get involved early

PANDA can quantify the influence of early stage design decisions

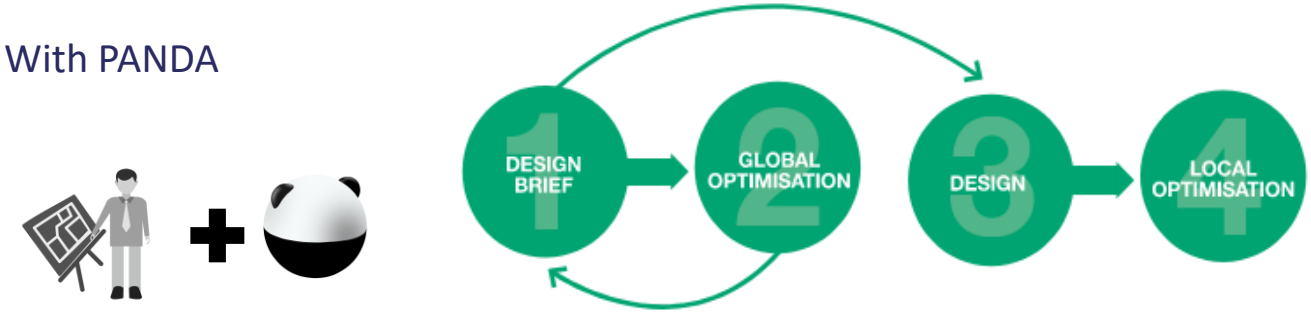
- The decisions taken in early design stages (RIBA 0-1) have most influence on embodied carbon and cost
- PANDA allows you to generate scheme designs for many different options to make better early stage design decisions and saving weeks of early stage design calculations
- PANDA can output reports to communicate the impact of these decisions to the wider team including the client, architect and QS enabling a more collaborative way of working.

Before PANDA



Traditional workflow is linear meaning early design decision lock in higher cost and carbon

With PANDA



PANDA generates 1000's of solutions in minutes allowing for an iterative design process and the opportunity to optimise the early design for cost and carbon

© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ❑ 2. Getting started
- ❑ 3. Building Layout Inputs
- ❑ 4. Model Scope
- ❑ 5. Input Parameters
- ❑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

2. Getting Started

© Structural PANDA 2022

2.Getting Started

This section will show you how to:

- ❑ 2.1 Install and update PANDA
- ❑ 2.2 Insert a licence key and request/release a seat
- ❑ 2.3 Connect to PANDA whilst off-line
- ❑ 2.4 Configure customer specific text files

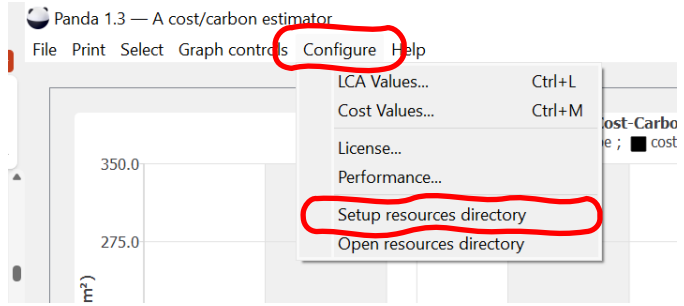
© Structural PANDA 2022

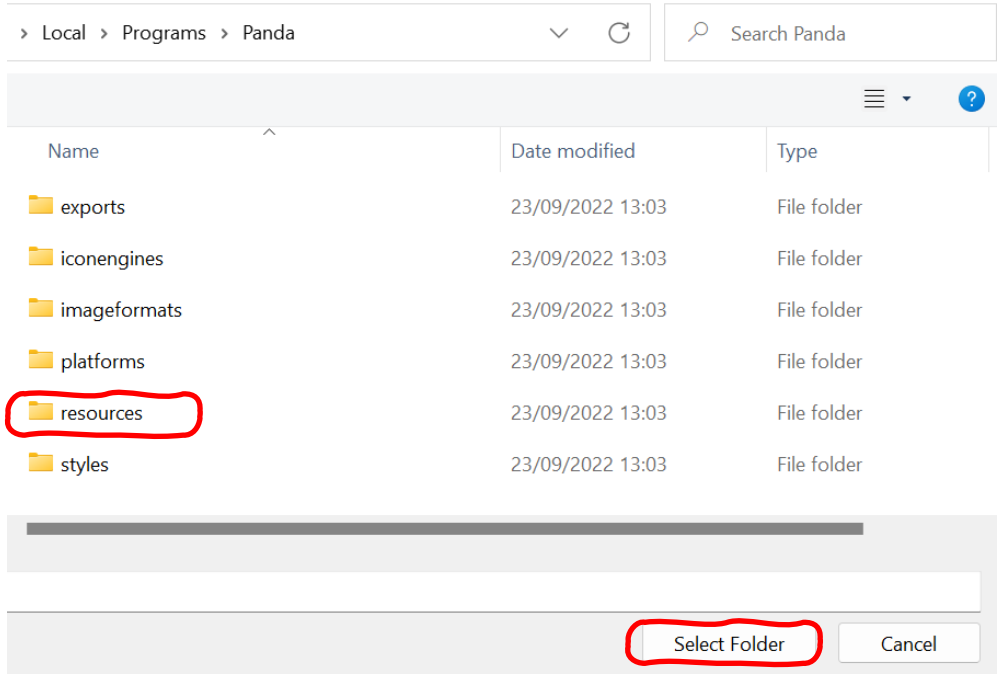
2.1 Installation

- Panda can be installed by downloading the latest version from: https://drive.google.com/file/d/1oh9exOKaxScK_LRyIuAkXxBfoqAfI4BO/view?ts=62723916
- PANDA will be updated with new features periodically, to install the updated version download the installer from the same link and override the previous file locations.
- After installing, you may need to set the resources directory

To set the resources directory location:

- click, 'configure' then 'set resources directory' from the main menu.
- Open the newly installed folder called 'Panda', and the subfolder 'resources'
- Click 'select folder'





© Structural PANDA 2022

2.2 Licence Key & Seat Requests

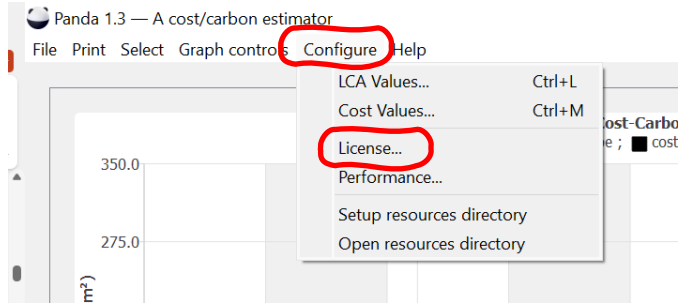
- After installation you will need to configure the licence key and request a seat. The number of seats available is determined by your licence plan.

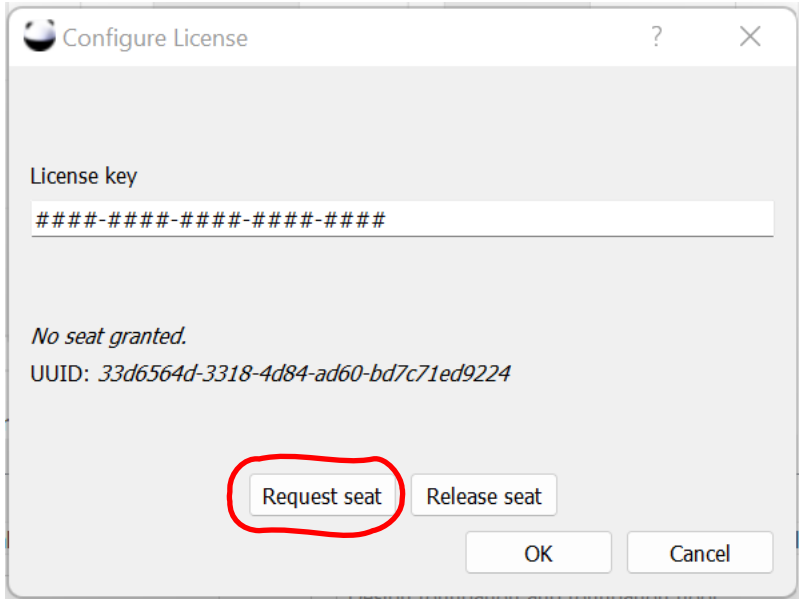
To set the liecnce key:

- click, ‘configure’ then ‘licence’ from the main menu.
- Enter your 16 digit licence key in the dialogue box
- Click ‘request seat’ then ‘ok’

To release the licence key, to enable another user to access PANDA

- Open the configure licence dialogue box and click ‘release seat’





© Structural PANDA 2022

2.3 Connecting to PANDA offline

To support site visits, and internet instability it is possible to use PANDA offline.

To use PANDA offline:

- Request a seat whilst connected to the interned. This is required to validate your licence key.
- The licence key will remain active for 48 hours, even if you are not connected to the internet
- You must keep the PANDA application open whilst working offline

If you do not have internet access to validate your licence key, PANDA can not configure new solutions

© Structural PANDA 2022

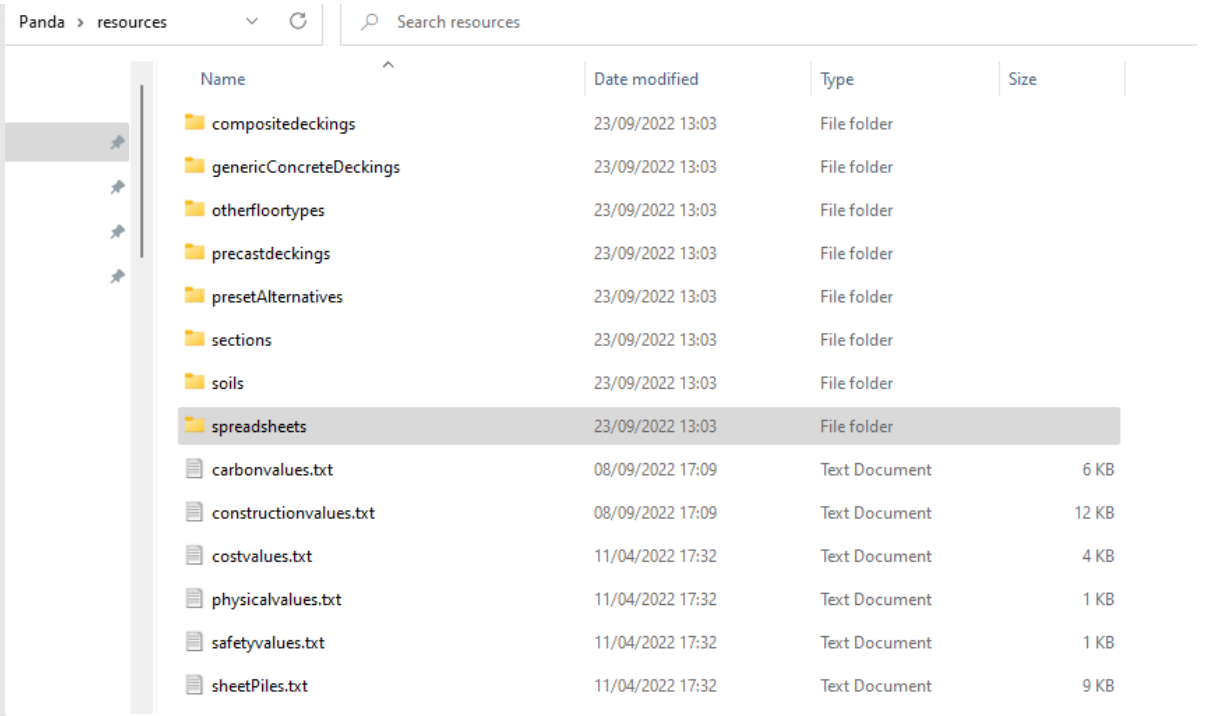
2.4 Configuring customer specific text files

PANDA is not designed to be a black box. We encourage users to adapt the input files with your own data. It is possible to modify the input files for materials, carbon value and cost values using text files.

To use configure specific text files:

- Open the panda resources directory and click on ‘resources’
- Individual text files can be edited and replaced with company specific values.
- Pre-set alternatives can be added to provide alternative cost/carbon models which can be loaded as per sections 4.5 & 4.6
- If you would like support in editing these files please send an email to:

cyrille.dunant@structuralpanda.co.uk



© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ❑ 3. Building Layout Inputs
- ❑ 4. Model Scope
- ❑ 5. Input Parameters
- ❑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

3. Building Layout Inputs

© Structural PANDA 2022

3. Building Layout Inputs

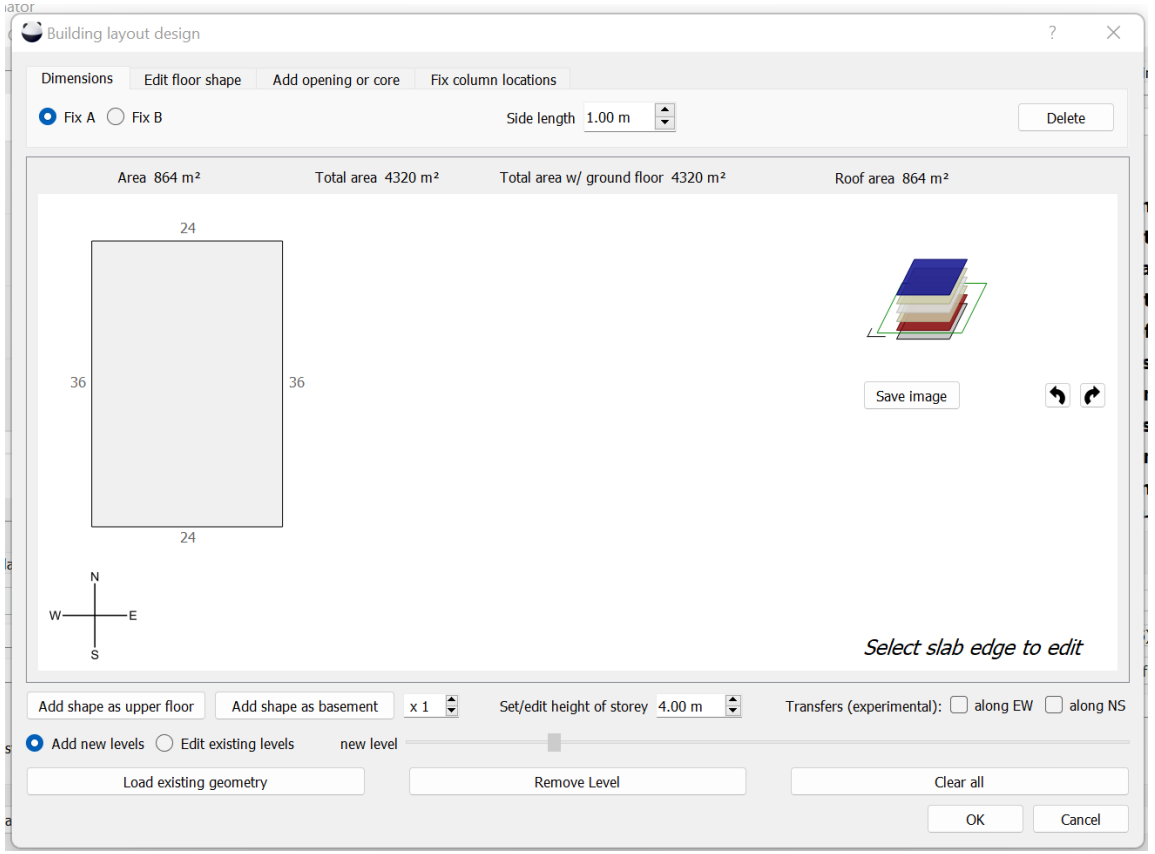
This section will show you how to:

- ❑ 3.1 Create a layout
- ❑ 3.2 Fix column positions
- ❑ 3.3 Set column spacing range
- ❑ 3.4 Match grid layout to a saved option

© Structural PANDA 2022

3.1 Layouts

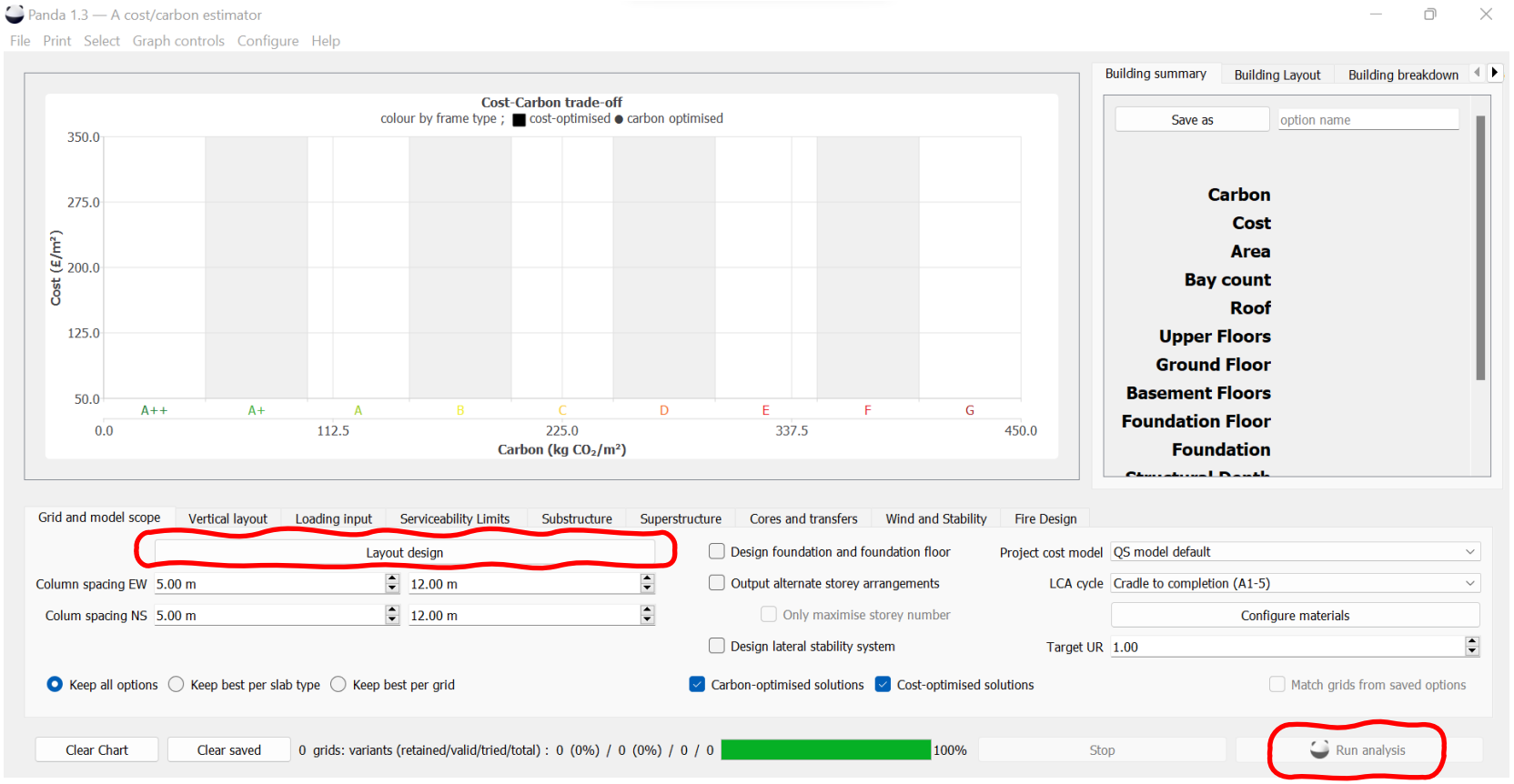
- PANDA can handle any rectilinear shape
- Shapes can be changed from floor to floor (overhangs are not handled yet)
- PANDA will try all combinations of regular grids within column spacing limits
- Simpler shapes have higher potential for efficiency



© Structural PANDA 2022

3.1 Layouts

- Start PANDA
- Select the tab “Grid and model scope”
- Select “Layout design”:
- To input the pre-set geometry
  - Click “Add shape as upper floor” 4 times for a simple 4 storey building
  - Click “OK”
- Click “run analysis” to run PANDA for this geometry

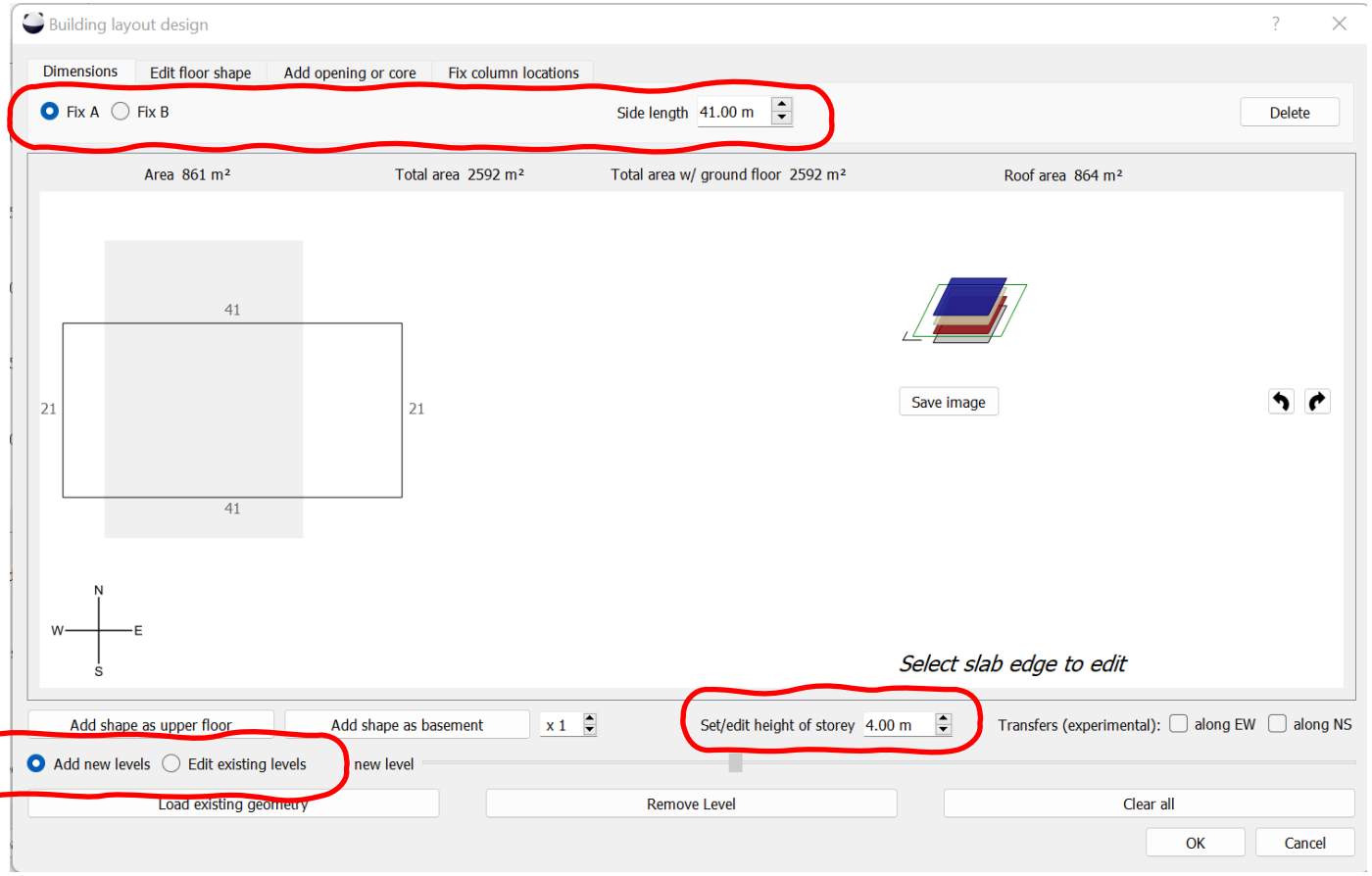


© Structural PANDA 2022

3.1 Layouts

To edit the geometry

- Select “Layout design”
- Select either ‘add new levels’ or ‘edit existing levels’
- Click on an edge,
  - Select offset point from ‘Fix A’ or ‘Fix B’ to set measurement direction
  - Input new “side length”
  - Set the height of the selected story
  - Click “Add shape as upper floor” or “add shape as basement to add the new geometry to the building
- Click “run analysis” to run PANDA for this geometry

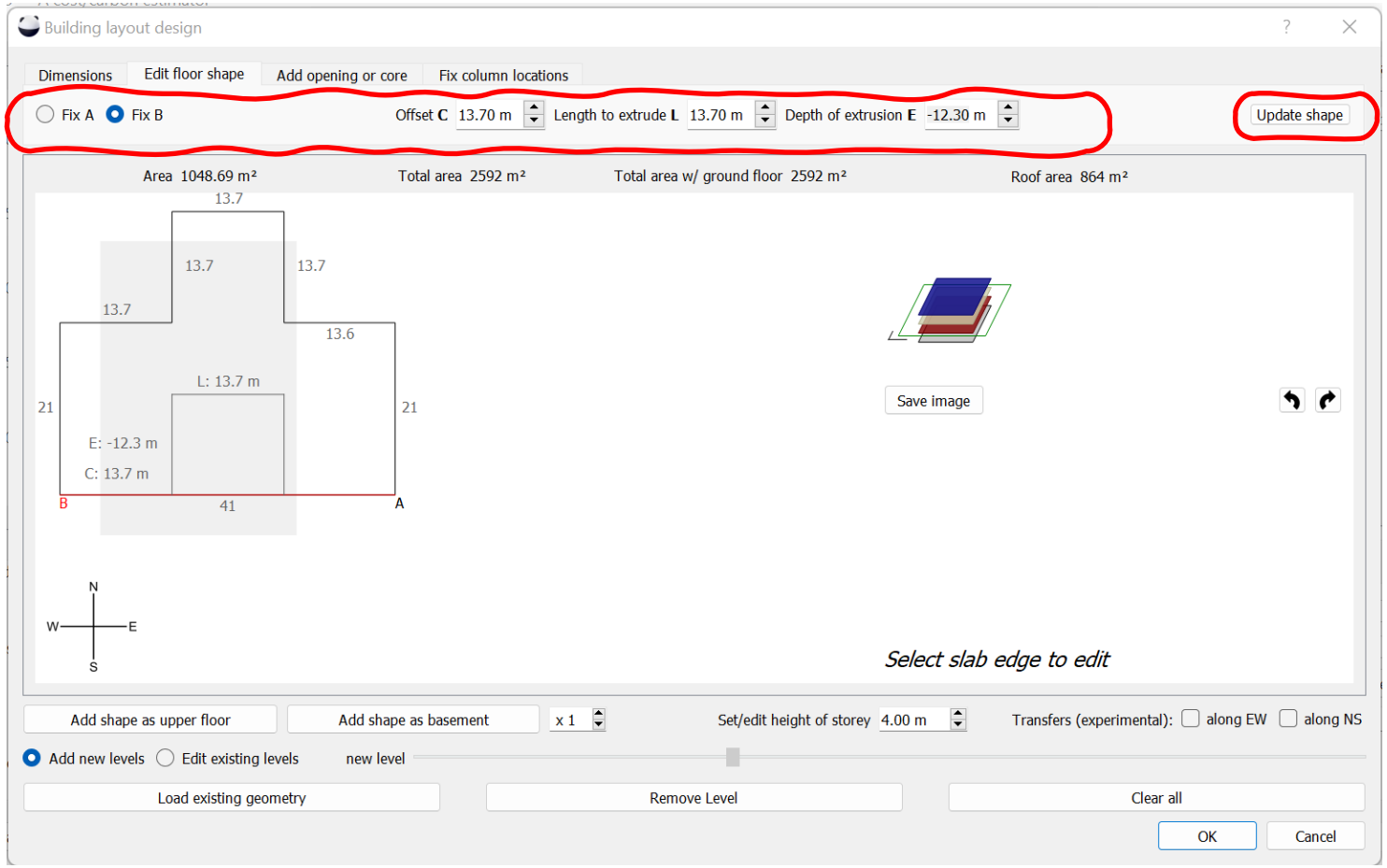


© Structural PANDA 2022

3.1 Layouts

To create an non rectangular shape

- Select “Edit floor shape” tab
- Click on an edge,
  - Select offset point from A or B to set measurement direction
  - Input offset dimensions “C”, “L” and “E” to create and position the new shapes
  - Click “update shape” before selecting the next edge to edit
  - Click “Add shape as upper floor” to add the new geometry to the building
  - Click “OK”
- Click “run analysis” to run PANDA for this geometry

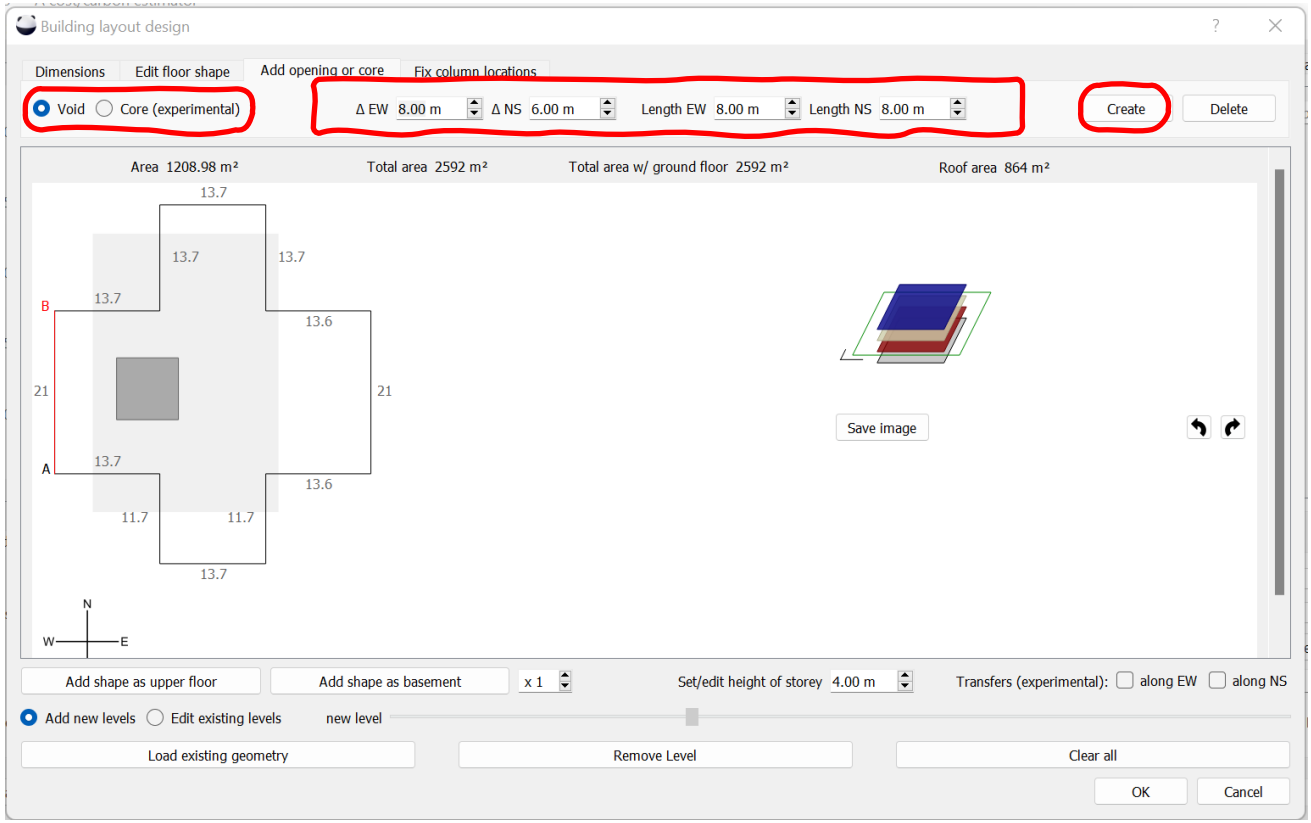


© Structural PANDA 2022

3.1 Layouts

To create an opening or core

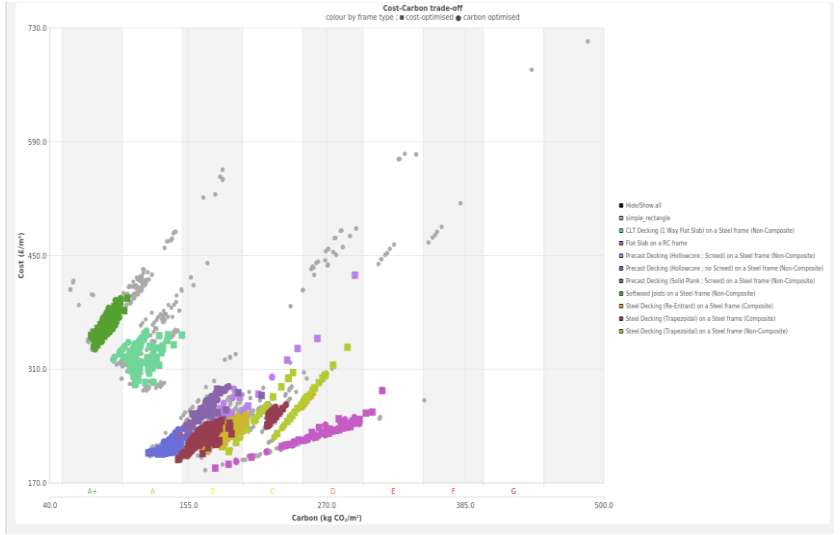
- Select “Add opening or core” tab
- Select ‘void’ or ‘core’ and click on a reference edge
- The void or core is drawn on the shape to set the geometry and location:
  - Set the values for “ΔEW”, “ΔNS”, “Length EW” and “Length NS”
  - Click “create”
  - Set the height of the selected story
  - Click “Add shape as upper floor” to add the new geometry to the building
  - Click “OK”
- Click “run analysis” to run PANDA for this geometry

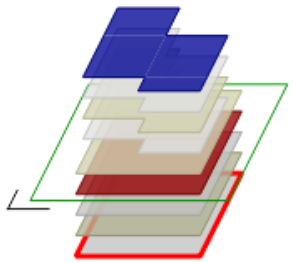


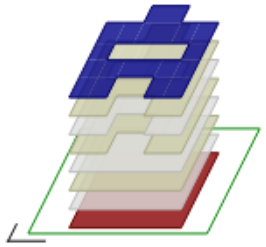
© Structural PANDA 2022

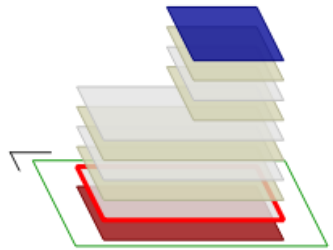
3.1 Layouts

- Use “Layout design” to create buildings of various shapes
- Compare the graph of results for different shapes to see the impact geometry changes have on cost and carbon





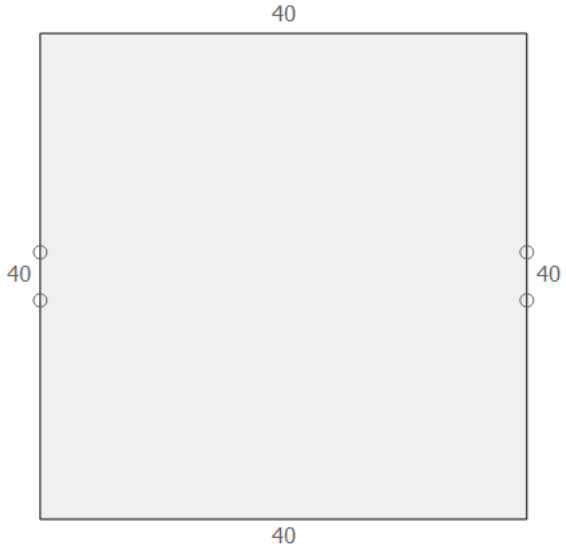


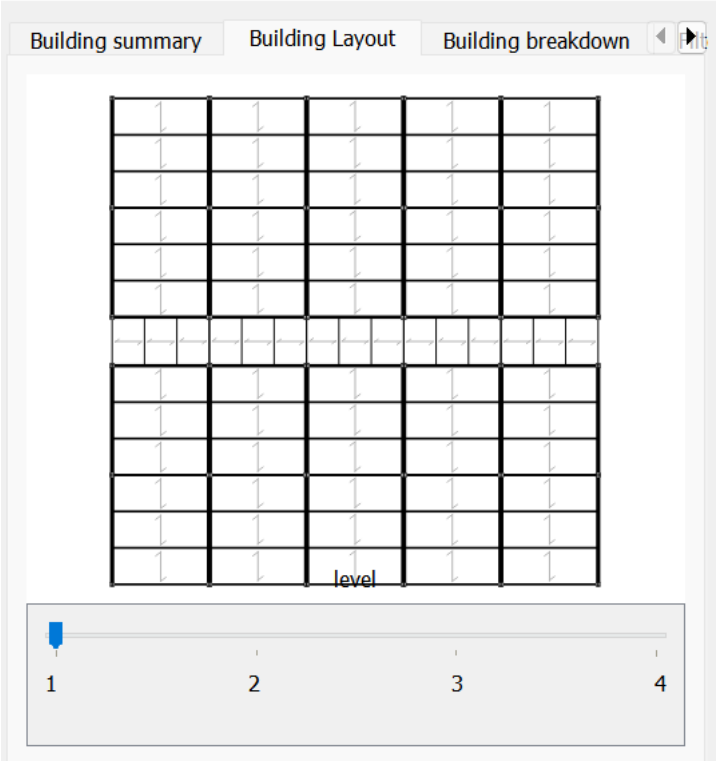


© Structural PANDA 2022

3.2 Fix column positions

- Sometimes, the grid is only partially “free”
- Sometimes, you wish to represent non-square connections
- The key is to only add the minimum number of fixed columns: PANDA will automatically account for the implied other constraints.
- A single column fixed on a single floor will fix it for all floors and on the opposite wall.



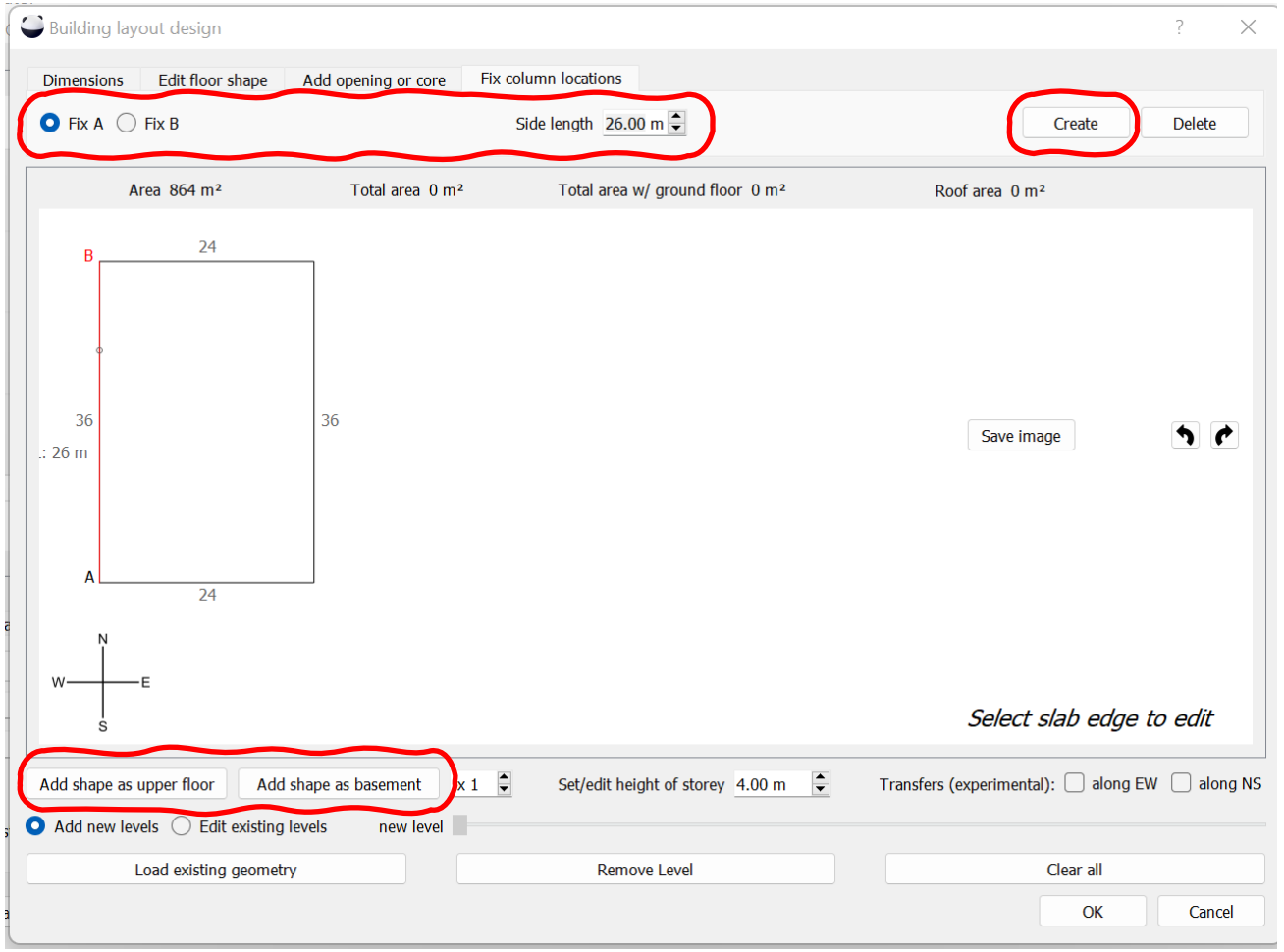


© Structural PANDA 2022

3.2 Fix column positions

To fix a column location in the “layout design” window:

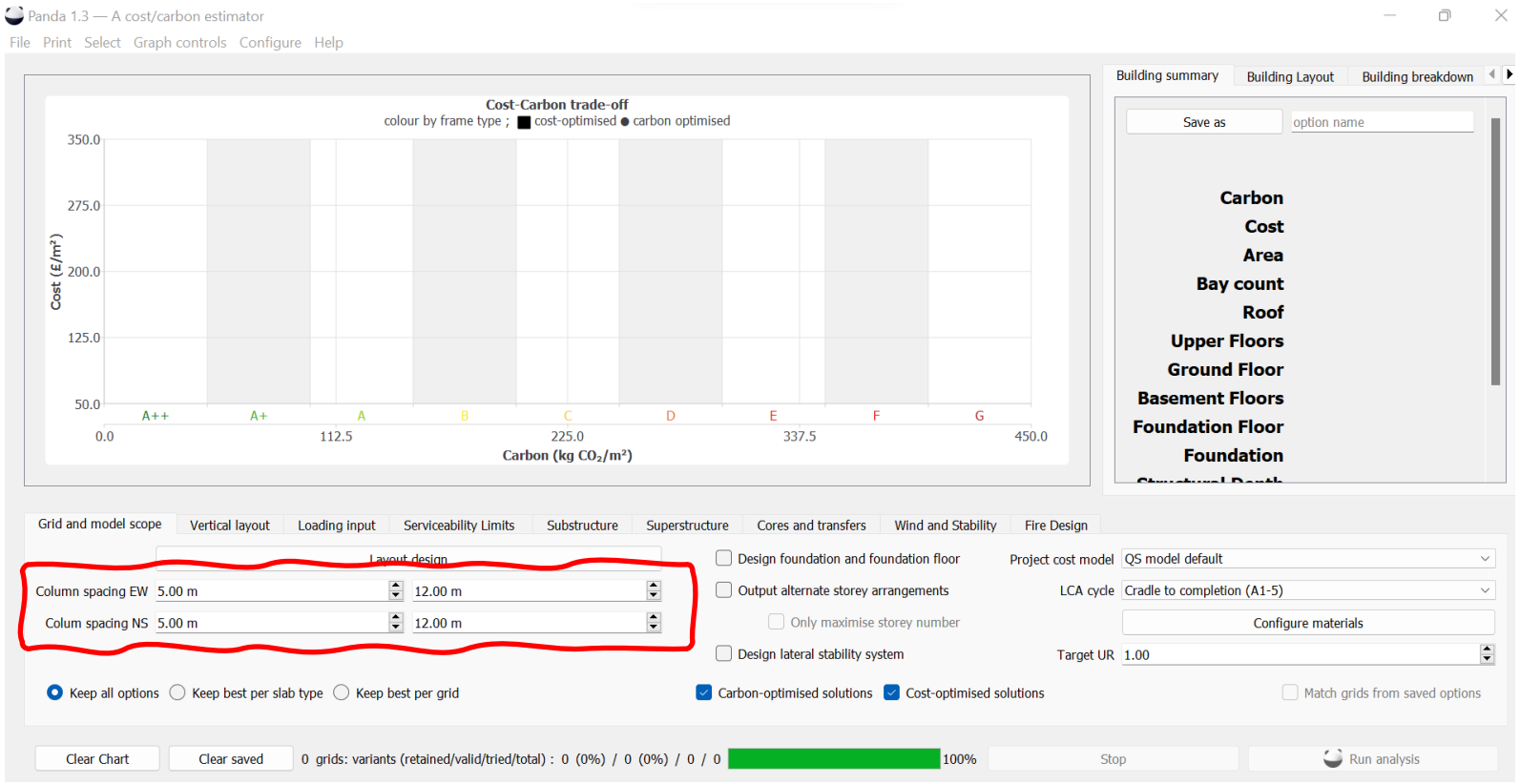
- Select “Fix column location” tab
- Click on an edge
  - Select “Fix A” or “Fix B” to set the measurement direction
  - Input side length to position column as desired
  - Click “create” before adding more fixed columns
- Click “Add shape as upper floor” or ‘add shape as basement’ to add the new geometry to the building
- Click “OK”



© Structural PANDA 2022

3.3 Set column spacing range

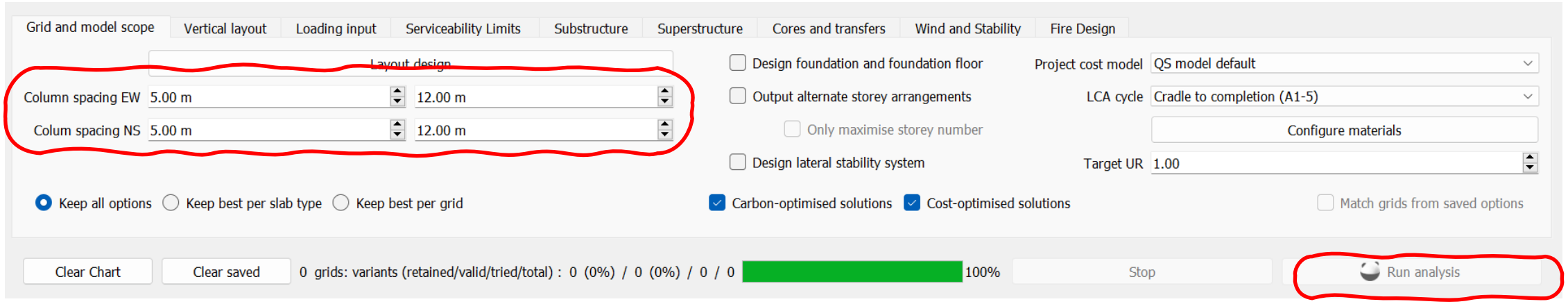
- There are frequently more options possible than you'd think if column spacing constraints are relaxed
- It may be useful to show the client the trade-offs for different spans in order to inform design decisions
- Most CO2 is lost because decks and spans don't match



© Structural PANDA 2022

3.3 Set column spacing range

- Select the tab “Grid and model scope”
- Set “Col. Spacing along EW” and “Col. Spacing along NS” to the minimum and maximum values you are willing to consider in each direction
  - If you set the same value for min and max, the grid will be fixed at that value
  - If you have a more complex geometry, it is advisable to leave this wide and use the fixed columns where required
- Click “compute” to re-run PANDA with these column spacing settings

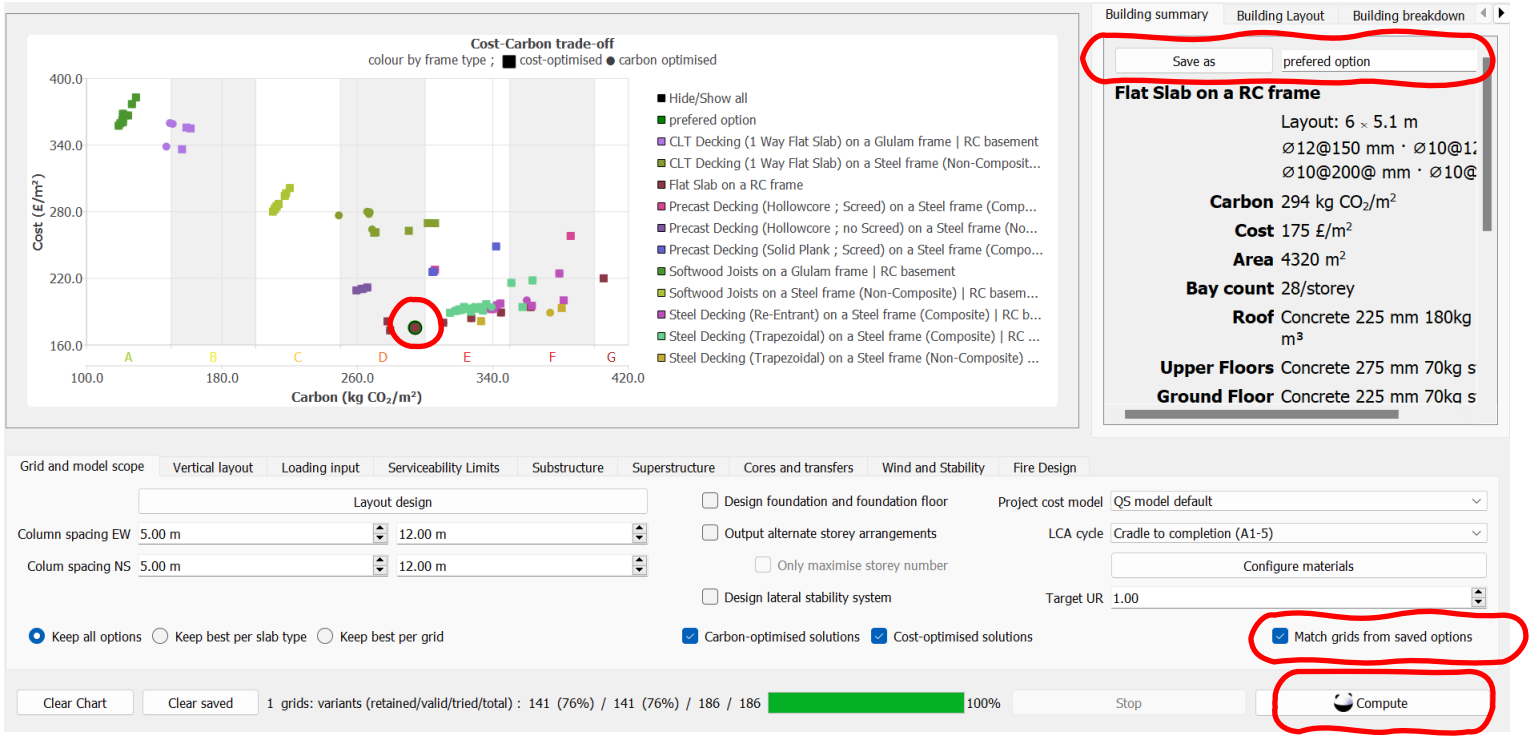


© Structural PANDA 2022

3.4 Matching a grid from a saved option

To run PANDA with a specific grid option:

- Set the layout geometry and click ‘compute’ to run PANDA for all grid options
- Save the preferred grid options
  - Select the preferred option by clicking the marker on the graph
  - In ‘building summary’ type in the name of the selection and click ‘save as’
  - Repeat the process for all required grid options
- Tick ‘Match grids from saved options’ and click ‘compute’ to re-run PANDA for all possible designs or the selected grid options.
- The graph will limit the results to match the grid layout, the saved option is highlighted with a circle on the graph



© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ☑ 3. Building Layout Inputs
- ❑ 4. Model Scope
- ❑ 5. Input Parameters
- ❑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

4. Model Scope

© Structural PANDA 2022

4. Model Scope

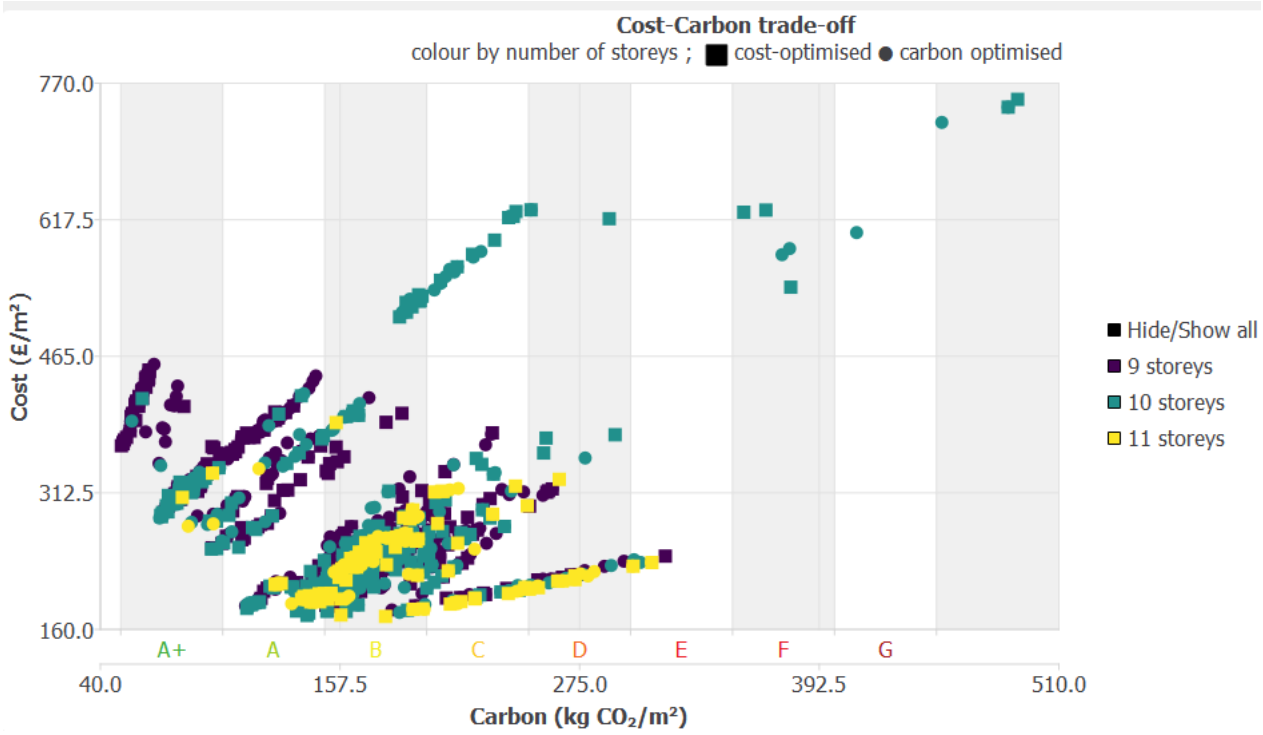
This section will show you how to:

- ❑ 4.1 Run vertical optimisation
- ❑ 4.2 Design foundation and foundation floor
- ❑ 4.3 Design a lateral stability system
- ❑ 4.4 Configure materials
- ❑ 4.5 Configure Cost Model
- ❑ 4.6 Configure LCA inputs
- ❑ 4.7 Set target utilisation ratio
- ❑ 4.8 Rationalising results

© Structural PANDA 2022

4.1 Run vertical optimisation

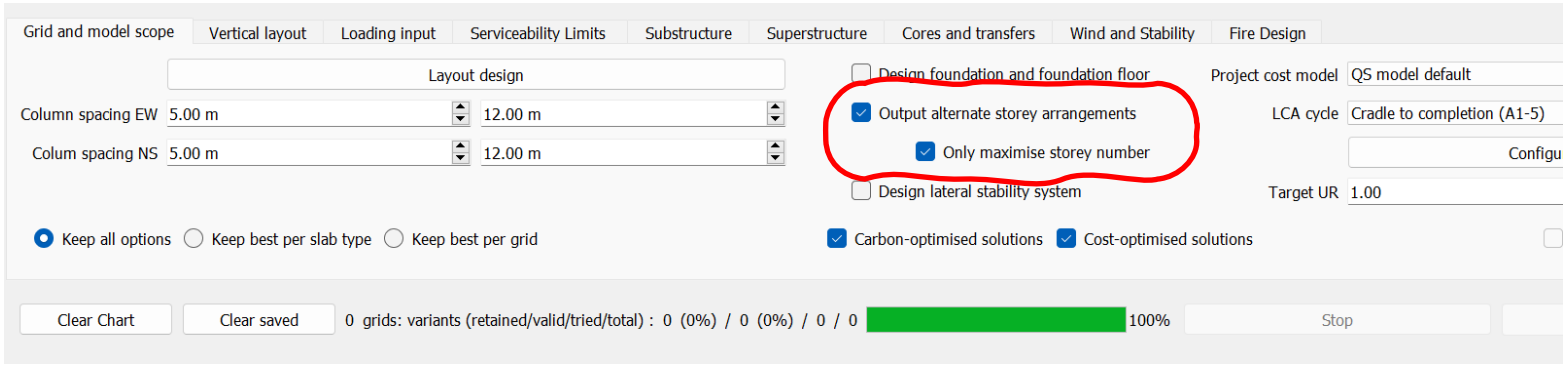
- On many projects the total building height is strictly limited
- This might lead to little space for structural zones
- Often, larger structural zone means higher efficiency
- But wouldn’t a building with more storeys for the same height be more efficient?
- PANDA can give you answers

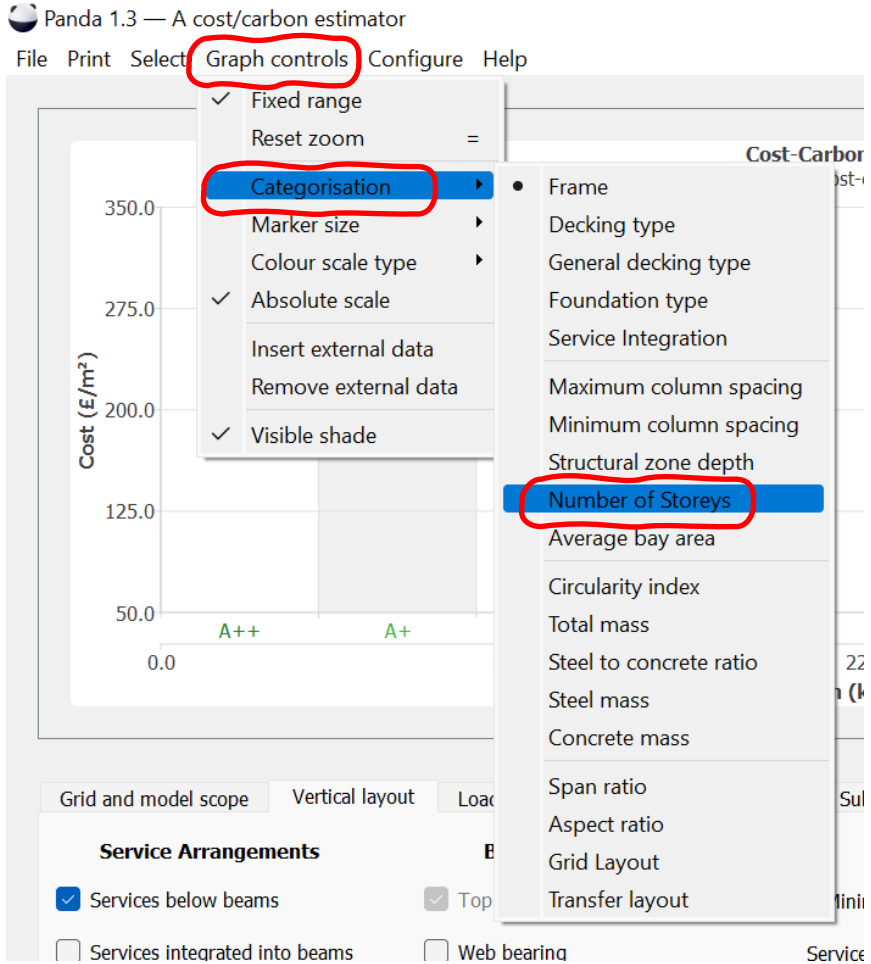


© Structural PANDA 2022

4.1 Run vertical optimisation

- In the “Grid and model scope” tab enable “Output alternate storey number”
- If you want to maximise the number of stories tick the additional box ‘only maximise story number’
- In “Layout Design” create a building with multiple storeys
- Click “compute” to re-run PANDA with vertical optimisation
- To view the vertical optimisation results select “Graph controls” then “Categorisation” and select “Number of Storeys”

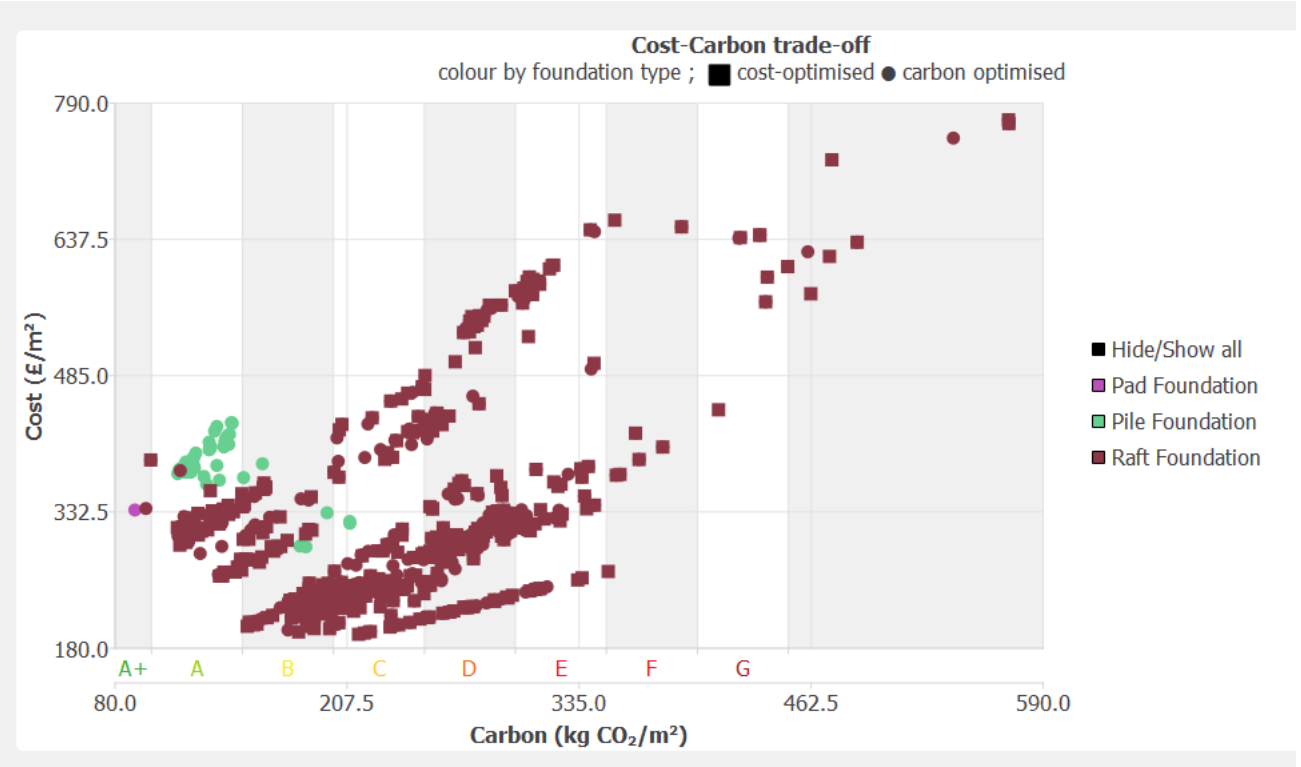




© Structural PANDA 2022

4.2 Design foundation and foundation floor

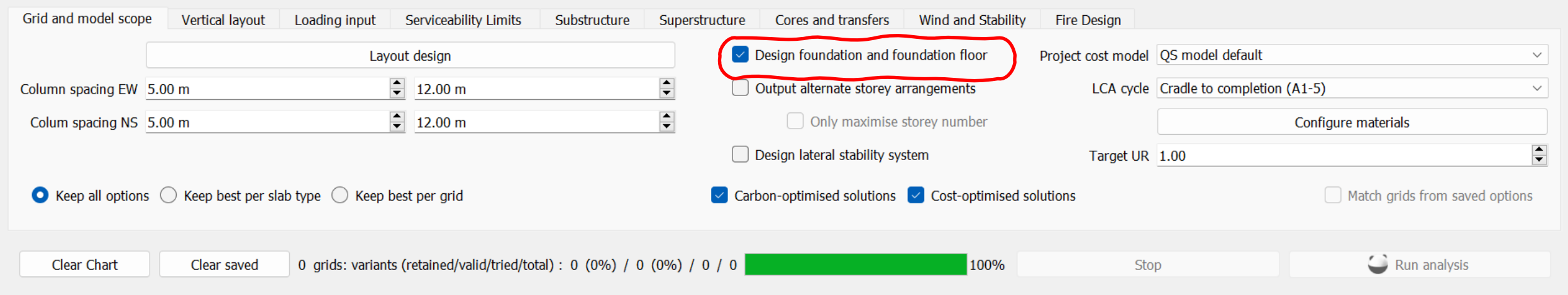
- PANDA designs foundations to EC
- It can use the results of a detailed geotech survey
- More commonly, use pile capacity table
- You'll find that using the reduced factor method combined with doing a survey will increase the number of piled options



© Structural PANDA 2022

4.2 Design foundation and foundation floor

- In the “Grid and model scope” tick to enable “Design foundation and foundation floor”
  - By default, the soil is a poor quality London clay, Retaining wall options are simple (just a wall) or piles, overlapping or not. Configuring the detailed substructure is covered in section 5.4
- Click “compute” to re-run PANDA with foundation design enabled
- To view the foundation design results select “Graph controls” then “Categorisation” and select “Foundation type”



© Structural PANDA 2022

4.3 Design a lateral stability system

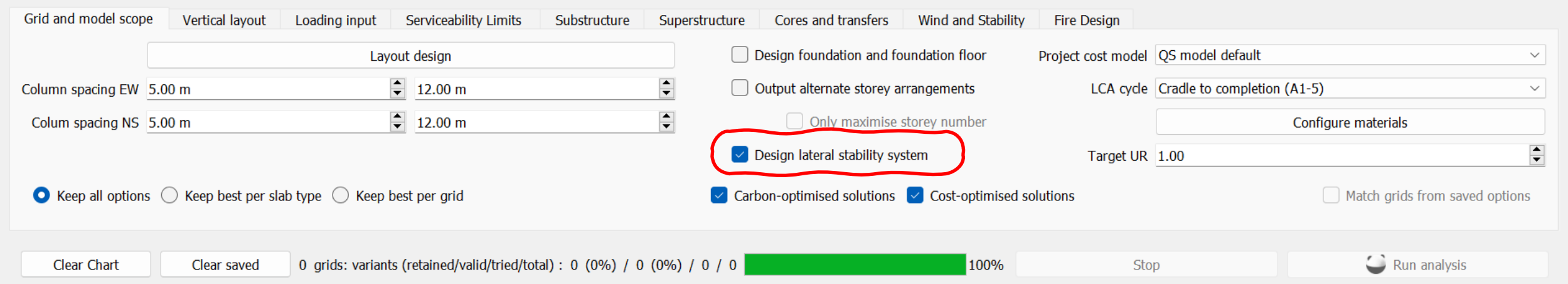
- Lateral stability systems are designed according to their type: concrete and timber shear walls or steel bracing. The latter will also redesign columns to take the load
- Lateral stability can be:
  - None (assume a core does it)
  - Concrete shear walls (works on any structure)
  - Timber shear walls (for CLT frames)
  - Steel bracing (for steel frames)
- You can either force the choice, or let PANDA do it
- It may be useful to add this to have a more complete picture, but the impact is small and takes time to calculate.
- It is for the designer to know whether the core will provide stability.

© Structural PANDA 2022

4.3 Design a lateral stability system

To enable lateral stability in the model:

- In the “Grid and model scope” tab enable “Design lateral stability system”
- Input of specific stability requirements is covered in section 5.7
- Click “compute” to re-run PANDA with lateral stability design enabled
- Stability design detail can be viewed in the Engineering Report,
  - exporting the engineering report is described in section 8.2



© Structural PANDA 2022

4.4, 4.5, 4.6 Configure materials, cost, LCA inputs

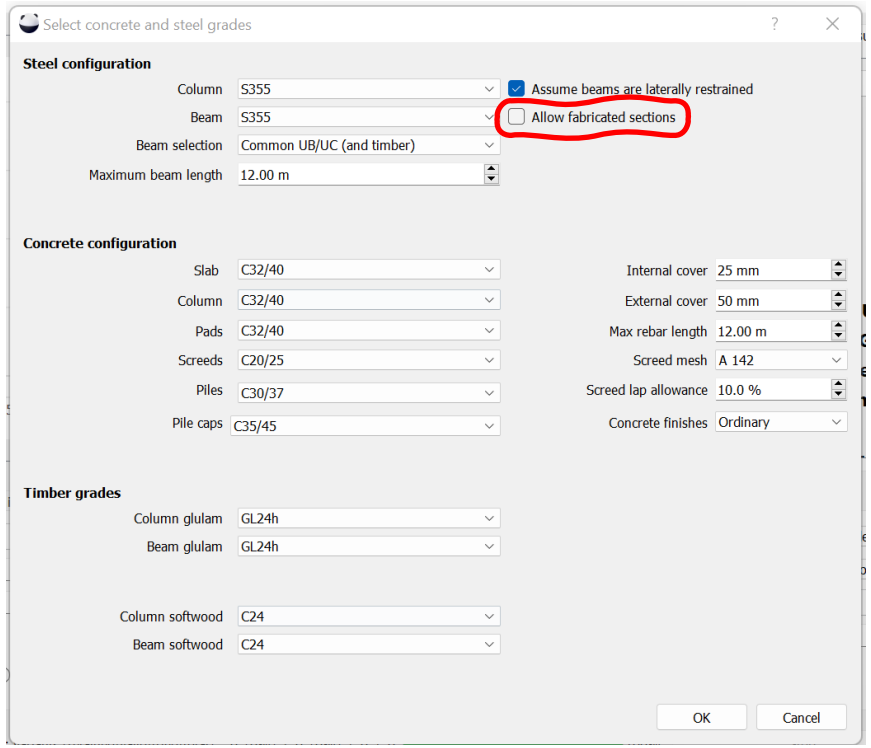
- Material, cost and LCA libraries are provided by PANDA, these can be edited by the user using the text input files, section 2.4
- The configure materials function enables the user to limit the choice of materials available to PANDA in each run
- The cost model has been developed with Gardiner and Theobald, and should reflect current pricing in the South of England, it is updated every 6 months.
- Configure costs allow preselection and customisation of alternative cost models
- LCA data is take from the ICE v3 database, and applies the IstructE methodology. It uses average values as these are best to rank options
- Configure LCA allows preselection of the required LCA cycle and customisation of individual values

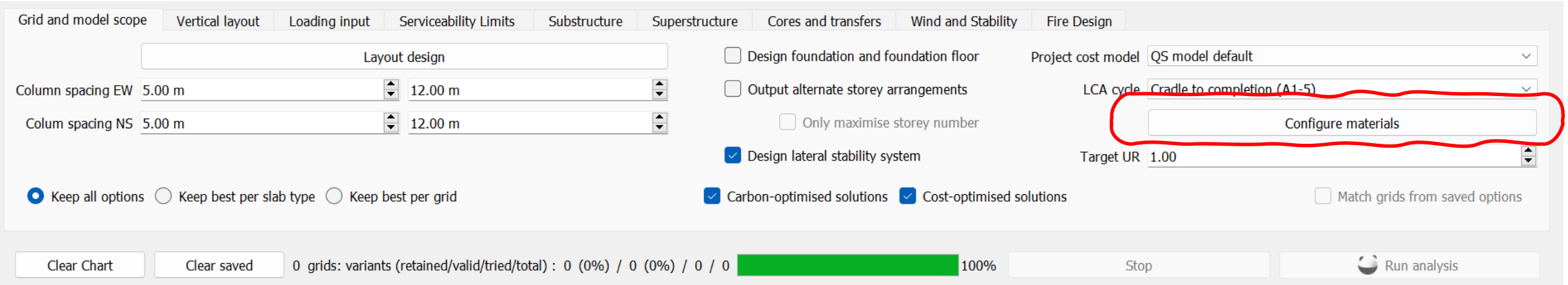
© Structural PANDA 2022

4.4 Configure materials

To configure materials:

- In the “Grid and model scope” tab click “Configure materials”
- Use the drop down menu’s to configure the material settings to meet your project requirements
- Select “Allow fabricated sections” option to increase the number of beam sized analysed



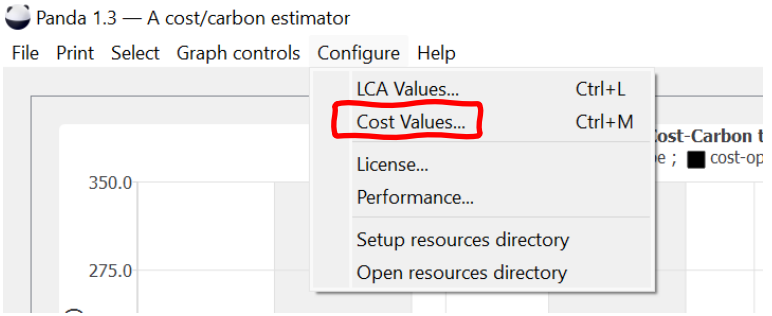


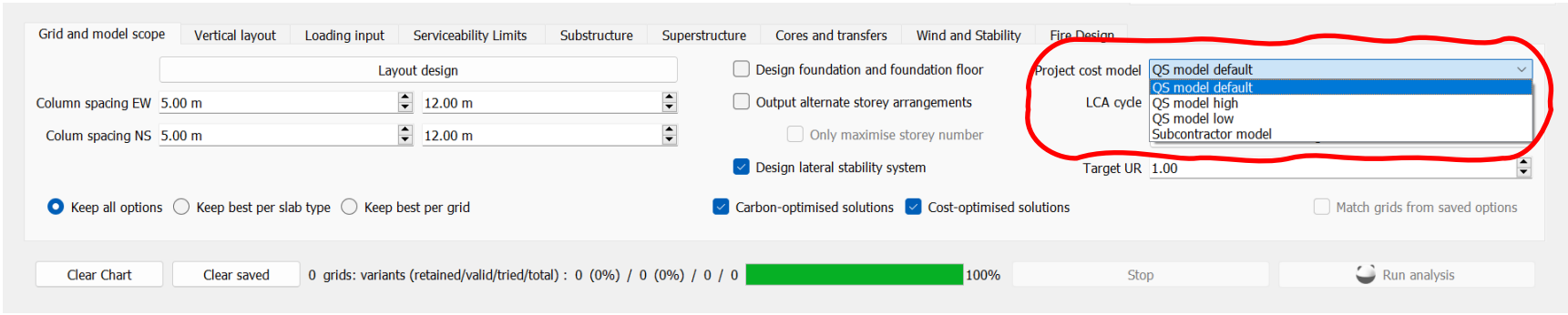
© Structural PANDA 2022

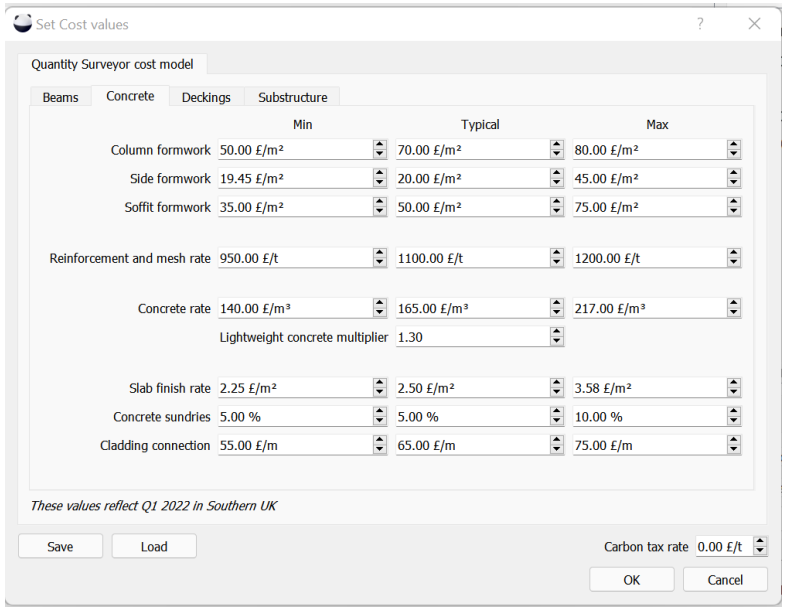
4.5 Configure cost model

To set the QS Model:

- In the “Grid and model scope” tab select from the default “project cost model” options using the drop down menu
- Alternatively input your own values using the “configure” and “Cost Values” main menu options
- Navigate through the “Set cost value” tabs to input your own SQ information for “Beams”, “Concrete”, “Deckings” and “Substructures”
- Click ‘load’ to select from alternative input files in the resource directory





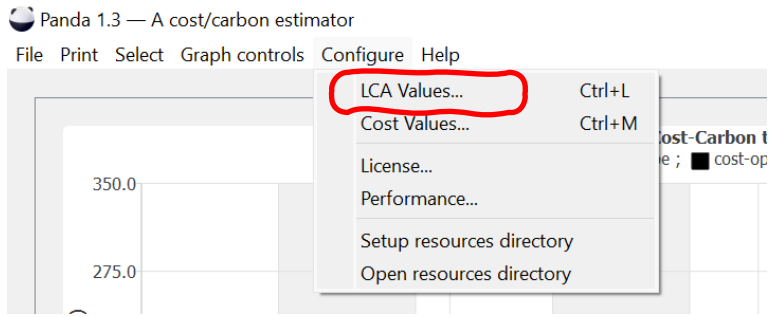


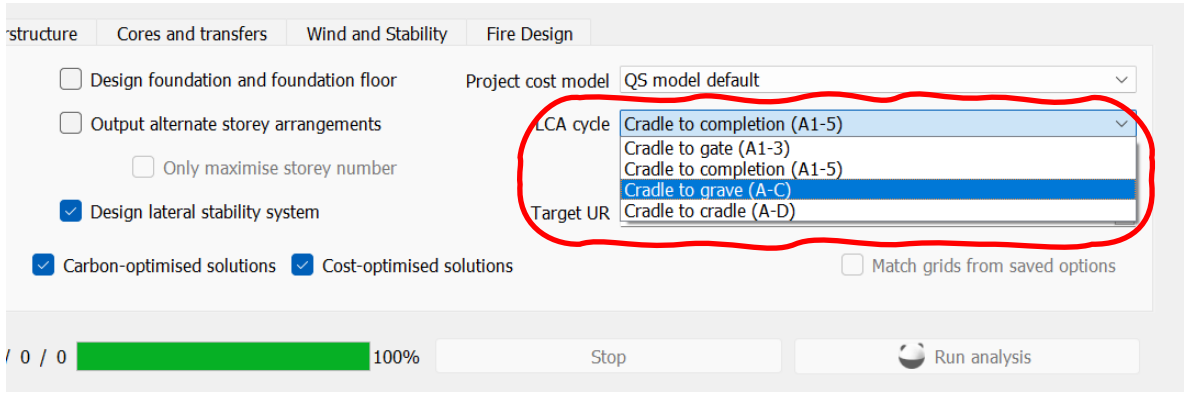
© Structural PANDA 2022

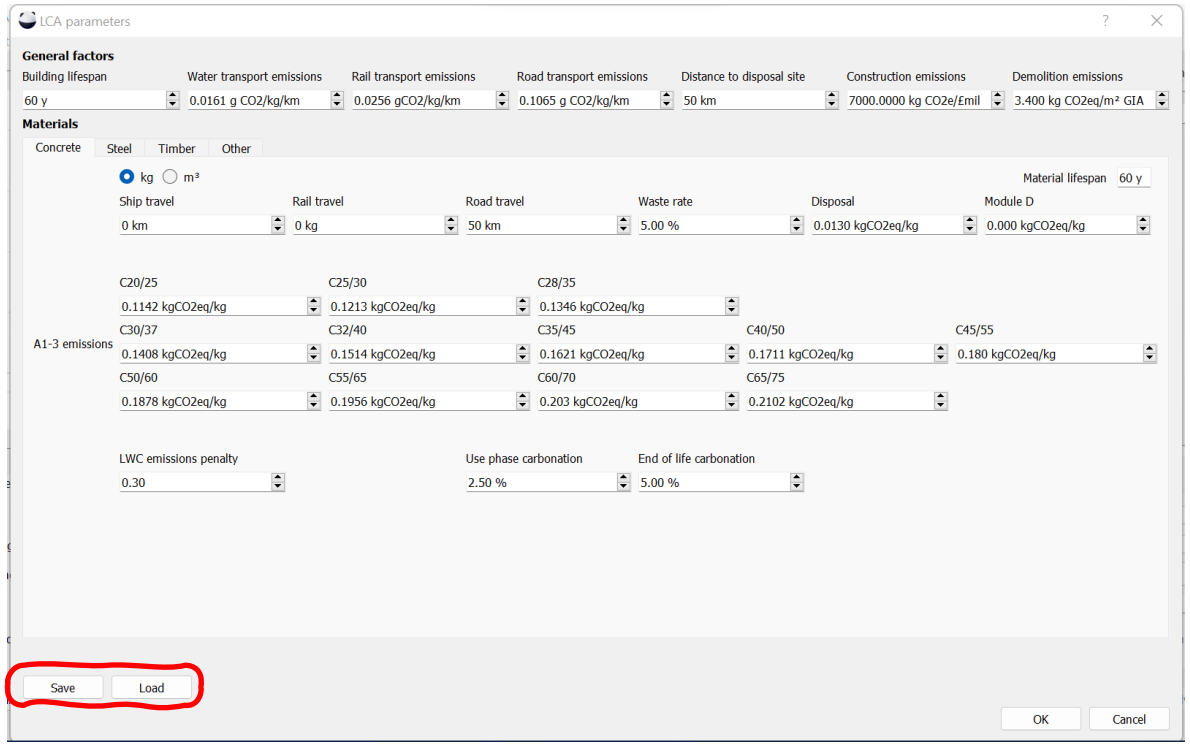
4.6 Configure LCA inputs

To set the LCA Model:

- In the “Grid and model scope” tab select from the default “LCA cycle” models using the drop down menu
- Alternatively input your own values using the “configure” and “LCA Values” main menu options
- Navigate through the “material” tabs to input your own LCA information for “Concrete”, “Steel”, “Timber” and “Other” materials. Click ‘save’ and ‘ok’.
- Click ‘load’ to select from alternative input files in the resource directory



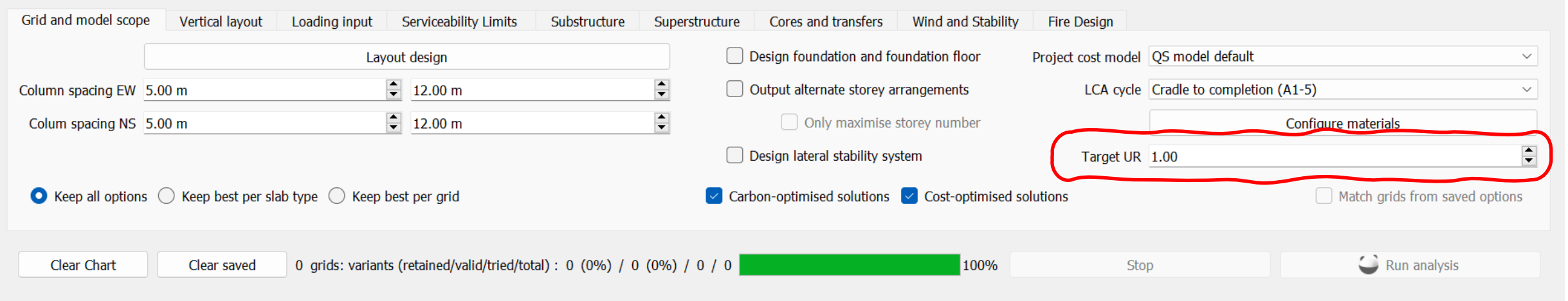




© Structural PANDA 2022

4.7 Set target utilisation ratio

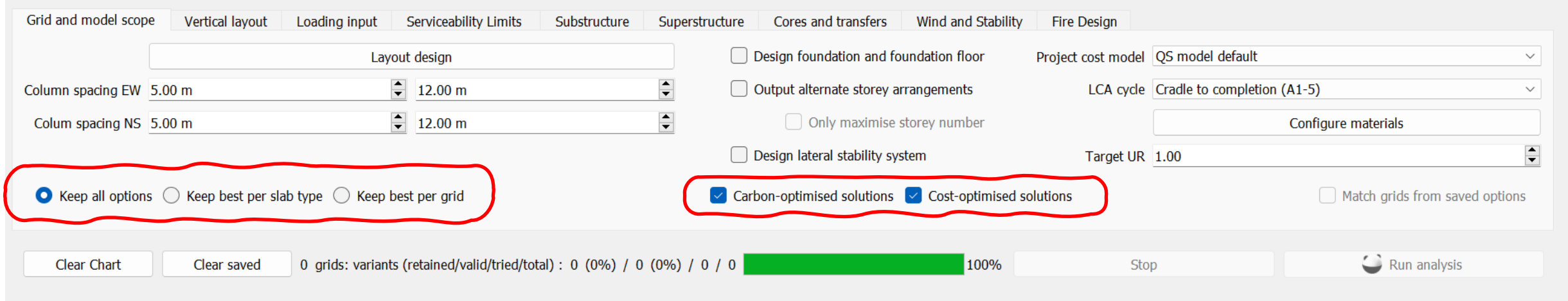
- By default, PANDA will return solutions with a target utilisation ratio (UR) of 1.00
- The UR can be changed in the ‘grid and model scop’ interface to limit solutions to lower utilisation ratios as per the safety requirements of your design criteria.



© Structural PANDA 2022

4.8 Rationalising results

- By default, PANDA will return two solutions for every iteration of design one optimised for cost, and the other optimised for carbon. PANDA will display all of these options generated.
- In order to reduce the number of options available to only those you are interested it may be useful to rationalise the results returned to the best solution for each slab type or each grid type. This can be done by ticking ‘keep best per slab type’ or ‘keep best per grid’
- If you are only interested in optimising for cost or carbon, you can un-tick the box for either ‘carbon-optimised solutions’ or ‘cost optimised solutions’



© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ☑ 3. Building Layout Inputs
- ☑ 4. Model Scope
- ❑ 5. Input Parameters
- ❑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

5. Input Parameters

© Structural PANDA 2022

5. Setting Inputs & Parameters

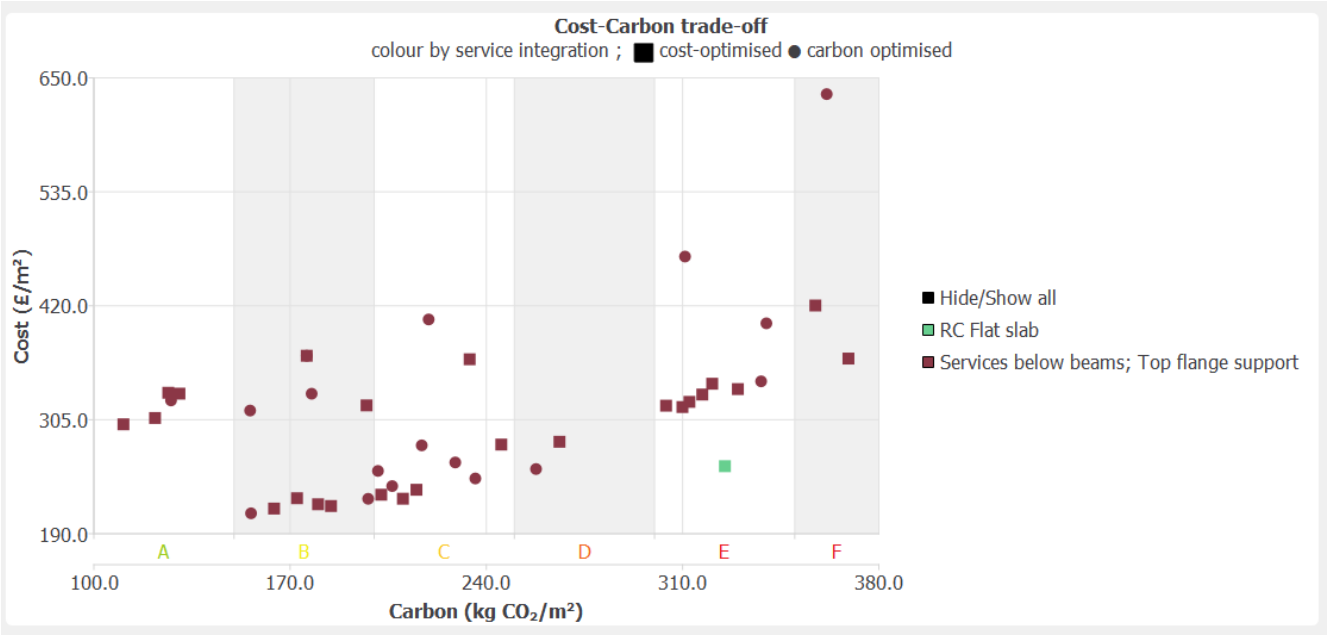
This section will show you how to:

- ❑ 5.1 Set the vertical layout
- ❑ 5.2 Set loading inputs
- ❑ 5.3 Set serviceability limits
- ❑ 5.4 Configure the substructure
- ❑ 5.5 Configure the superstructure
- ❑ 5.6 Add cores and transfers
- ❑ 5.7 Set wind & stability parameters
- ❑ 5.8 Set fire design parameters

© Structural PANDA 2022

5.1 Set the vertical layout

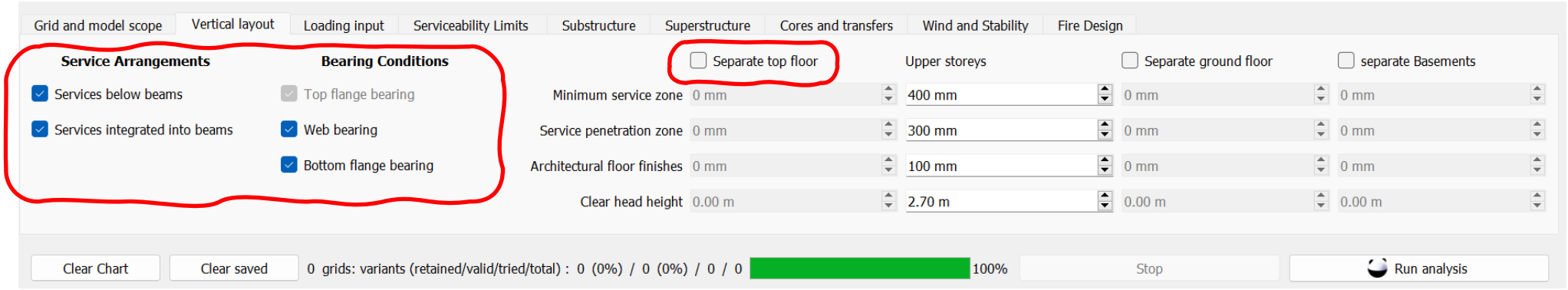
- PANDA can calculate service arrangement options below and/or integrated into the beams
- Bearing conditions can be set as top flange bearing and web bearing and/or bottom flange bearing
- The minimum service zone, service penetration zone, architectural floor finishes depth and clear head height can be set for all floors, or with separate values for the top floor, ground floor and basement.



© Structural PANDA 2022

5.1 Set the vertical layout

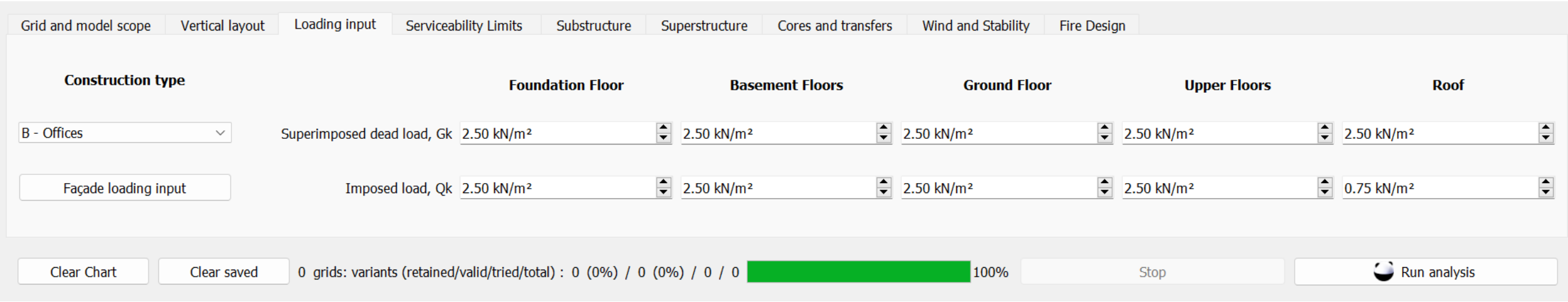
- Input a building geometry
- Select the “Vertical Layout” tab
- Tick the options for “Services below beams” and “Services integrated into beams” to include all service arrangement options in the analysis
- Tick the options for “Web bearing” and “bottom flange bearing” to include all bearing conditions in the analysis
- The default setting applies the same service values for each floor. Tick the “separate top floor” option and input a different set of values. This can also be done for a ‘separate ground floor’ and ‘separate basement’
- Re-run PANDA and colour the graph by “service integration” options to view the options



© Structural PANDA 2022

5.2 Set loading inputs

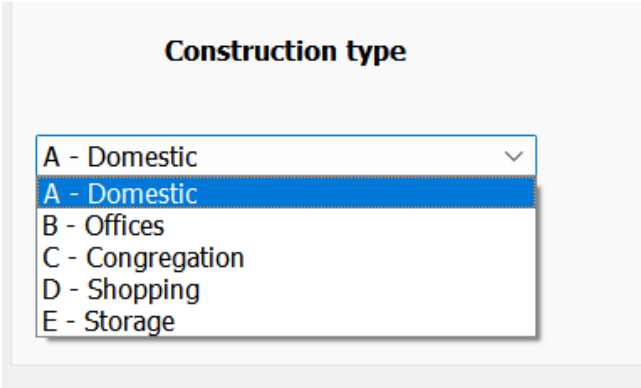
- PANDA will calculate loading inputs for different building types
- Façade loading can be accounted for
- The superimposed dead load and imposed load can be set with separate values for the basement floor, ground floor, top floor and roof

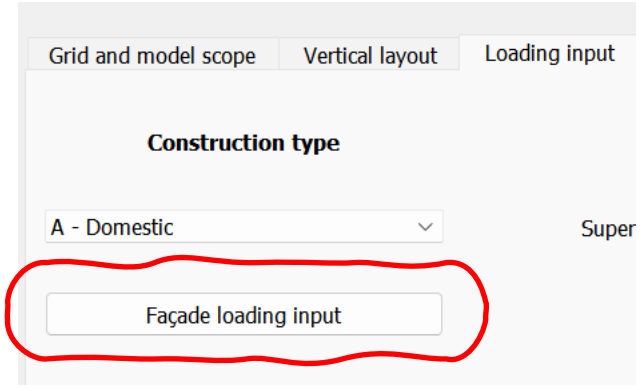


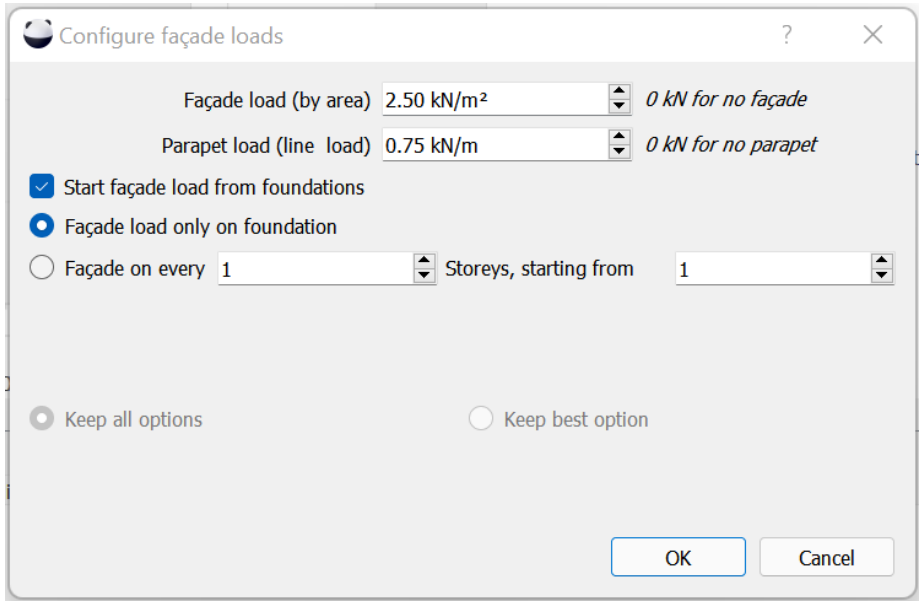
© Structural PANDA 2022

5.2 Set loading inputs

- Input a building geometry and select the “Loading input” tab
- In the drop down menu change the “construction type” to select the building purpose
- Click on “Façade loading input” to add loading to represent a façade.
  - Set the façade load by area
  - Set the parapet load by area
  - Select which floors the façade should be applied to
- Set the superimposed dead load and the imposed load values for each floor
- Click “compute to re-run PANDA with the loading inputs set







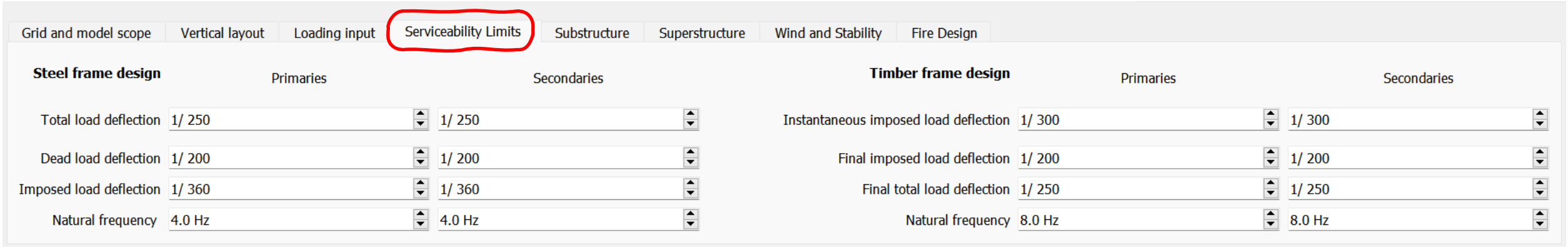
© Structural PANDA 2022

5.3 Set serviceability limits

- Timber design has different recommended serviceability limit values from steel
- Look at the decking selection to check it matches your vibration target
- Concrete is designed following a d/s approach so does not have specific serviceability inputs in this tab.

Frequently serviceability limit values are set too high

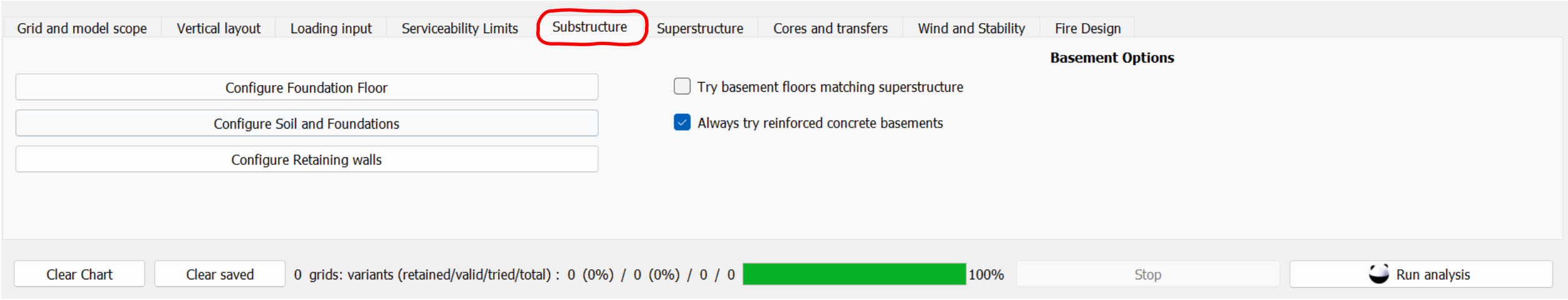
- Input a building geometry and select the “Serviceability limits” tab
- Change the values and generate a new solution sets to get a feel of the impact of different serviceability limits on cost and carbon
- Different serviceability limits can be compared by overlaying saved graphs as per section 7.4



© Structural PANDA 2022

5.4 Configure the substructure

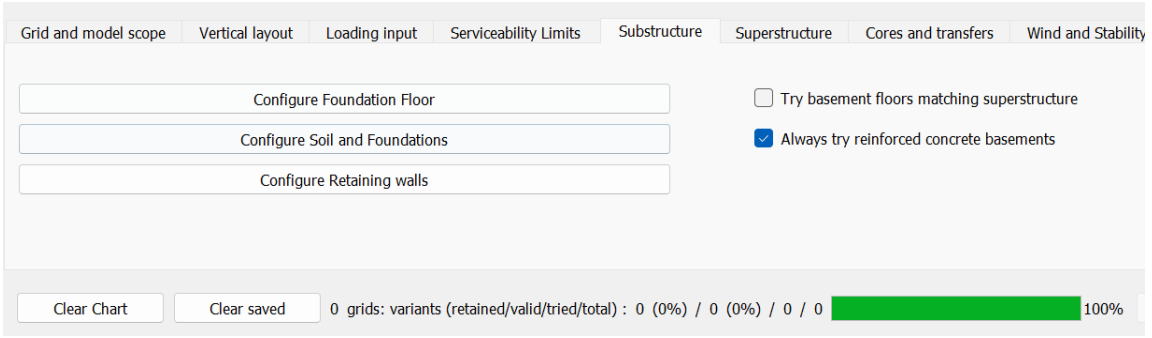
- PANDA is the only software available which automates the design for the substructure
- PANDA designs the:
  - Foundation floor
  - Soil and foundations
  - Retaining walls
  - Basement matching superstructure, or always concrete options

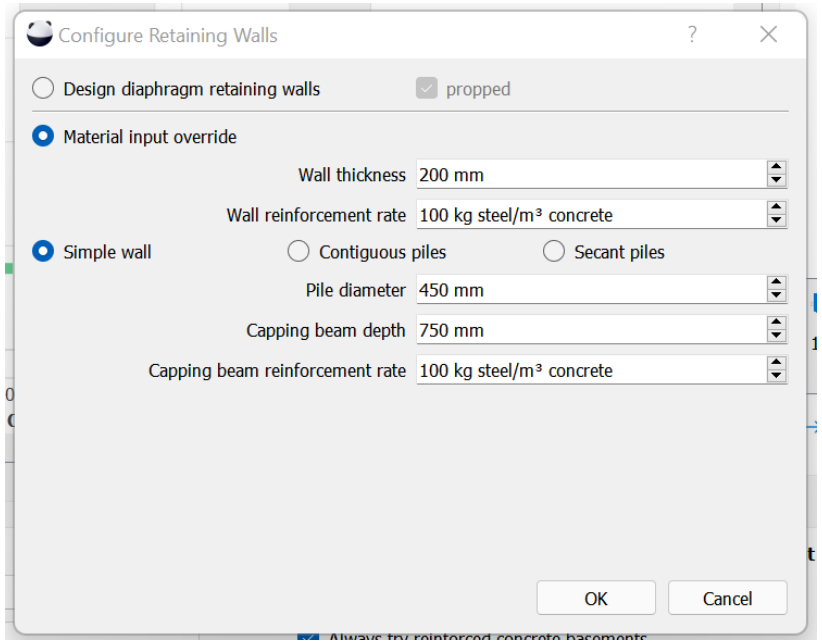


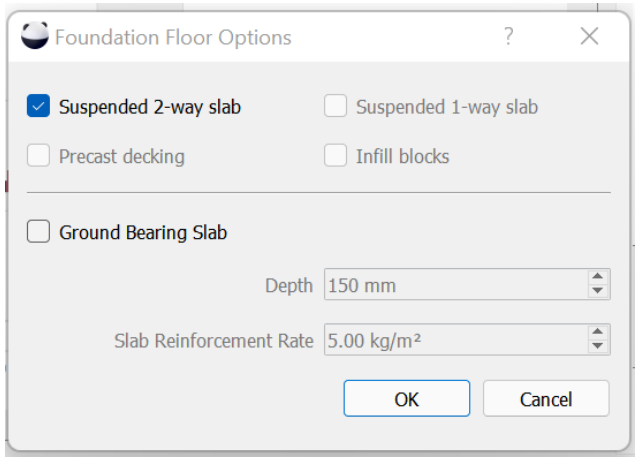
© Structural PANDA 2022

5.4 Configure the substructure

- Input a building geometry and select the “Substructure” tab
- The buttons launch dialogues where you select the allowable options for
  - Configure Foundation floor
  - Configure Soil and foundations
  - Configure Retaining walls
- Change the basement options to include both “basement floors matching superstructure” and “reinforced concrete basements” to include all options in the analysis
- Click “compute to re-run PANDA with different substructure inputs set



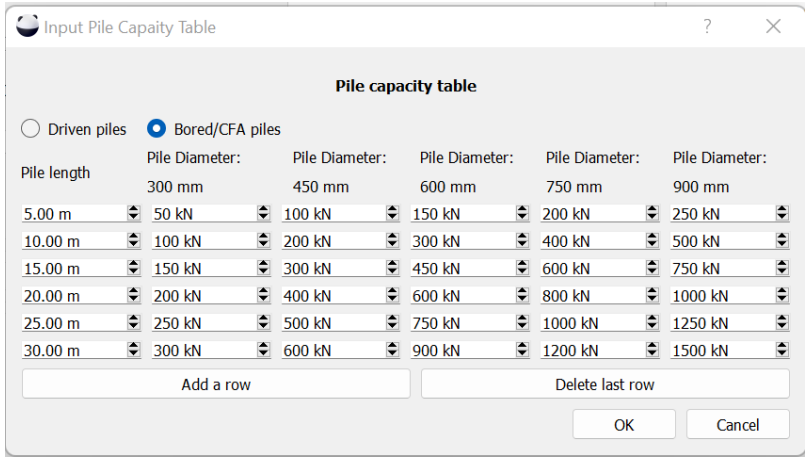


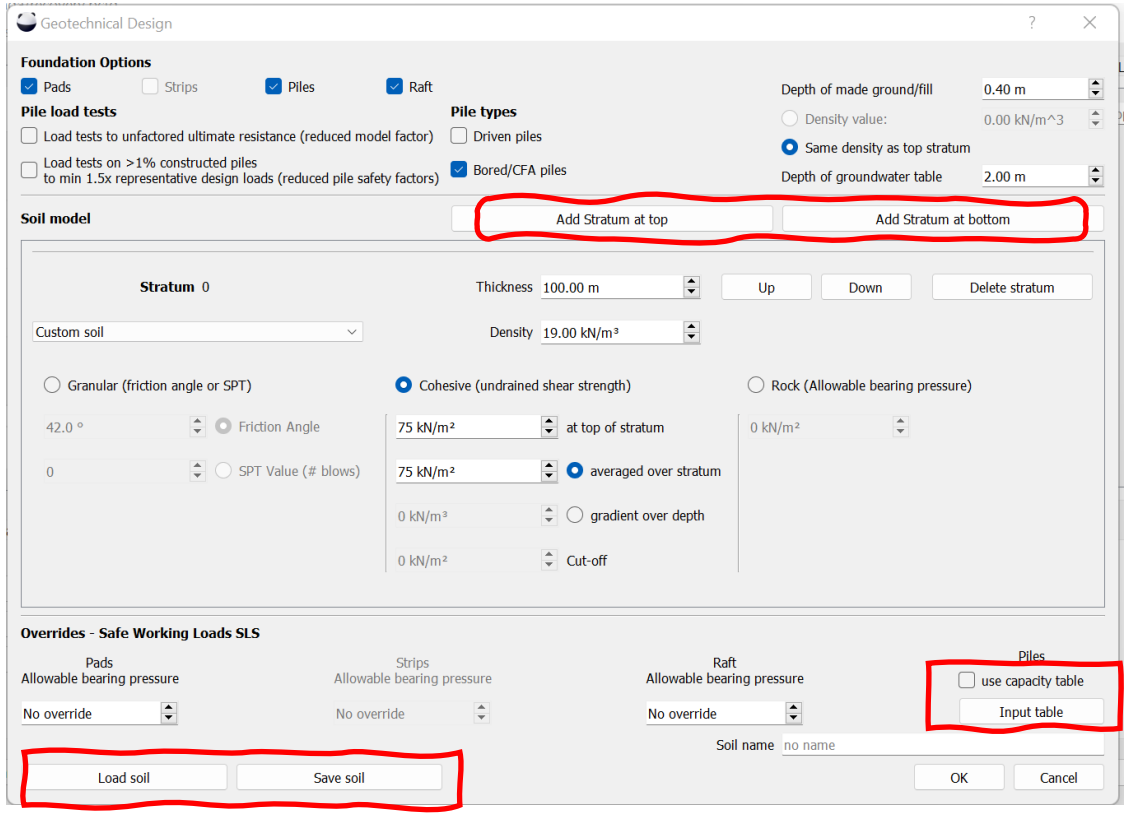


© Structural PANDA 2022

5.4 Configure the substructure

- Click on ‘Configure Soil and foundations’ to open the geotechnical design tab
- Select preferred ‘foundation options’, ’pile load tests’ and ‘pile types’
- Add stratum layers to build up a soil model
- Soil models can be input manually or using a capacity table by ticking ‘use capacity table’ and selecting ‘input table
- Set the ‘override’ value for each option
- Soil configurations can be saved and loaded by clicking ‘save soil’

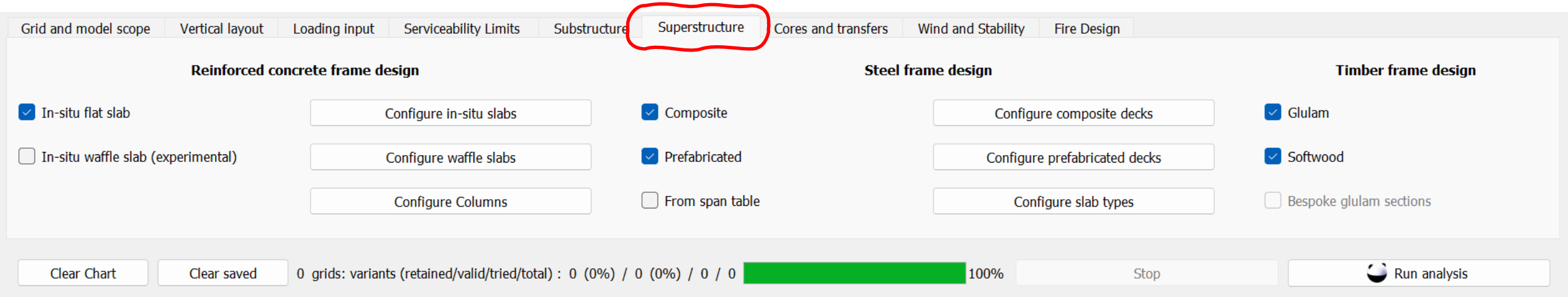




© Structural PANDA 2022

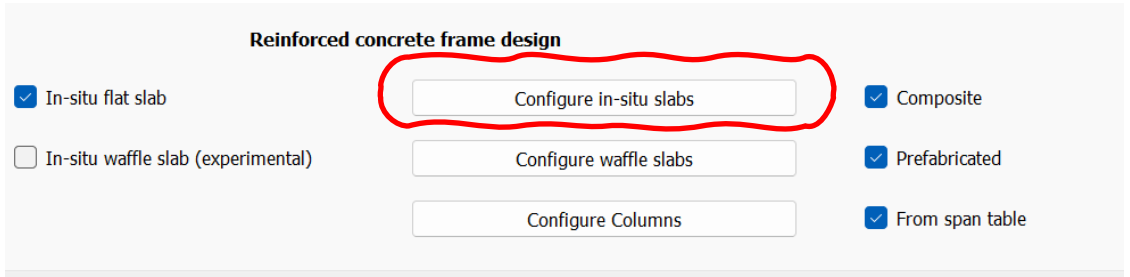
5.5 Configure the superstructure

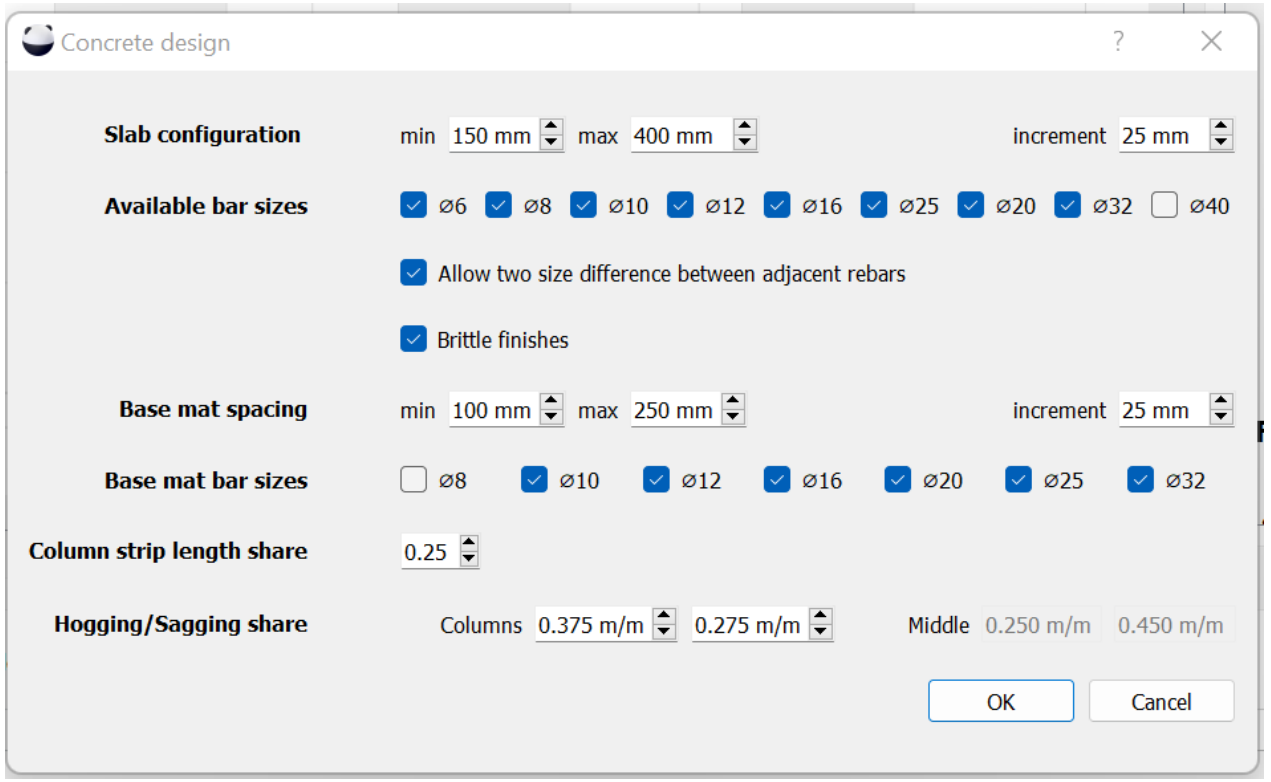
- PANDA will default to look at all possible super structure options
- If required, superstructure options can be narrowed down by unticking superstructure options in this interface
- In some circumstances certain materials may need to be excluded from the analysis , for example is supply constrains mean it is not possible to access the material. These options can excluded from PANDA's analysis using the configure options in the super structure tab



© Structural PANDA 2022

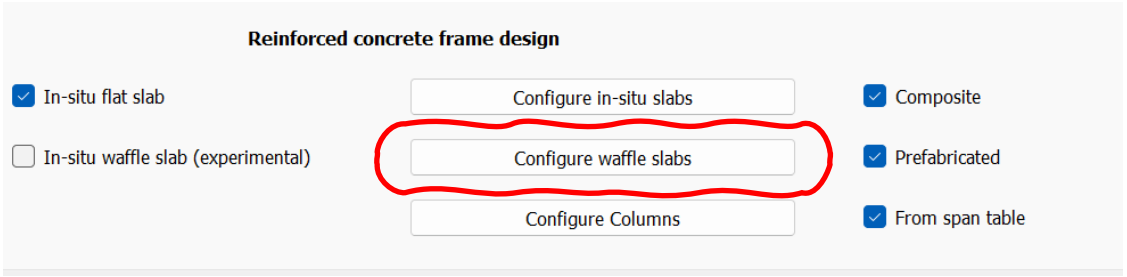
5.5 Configure the superstructure

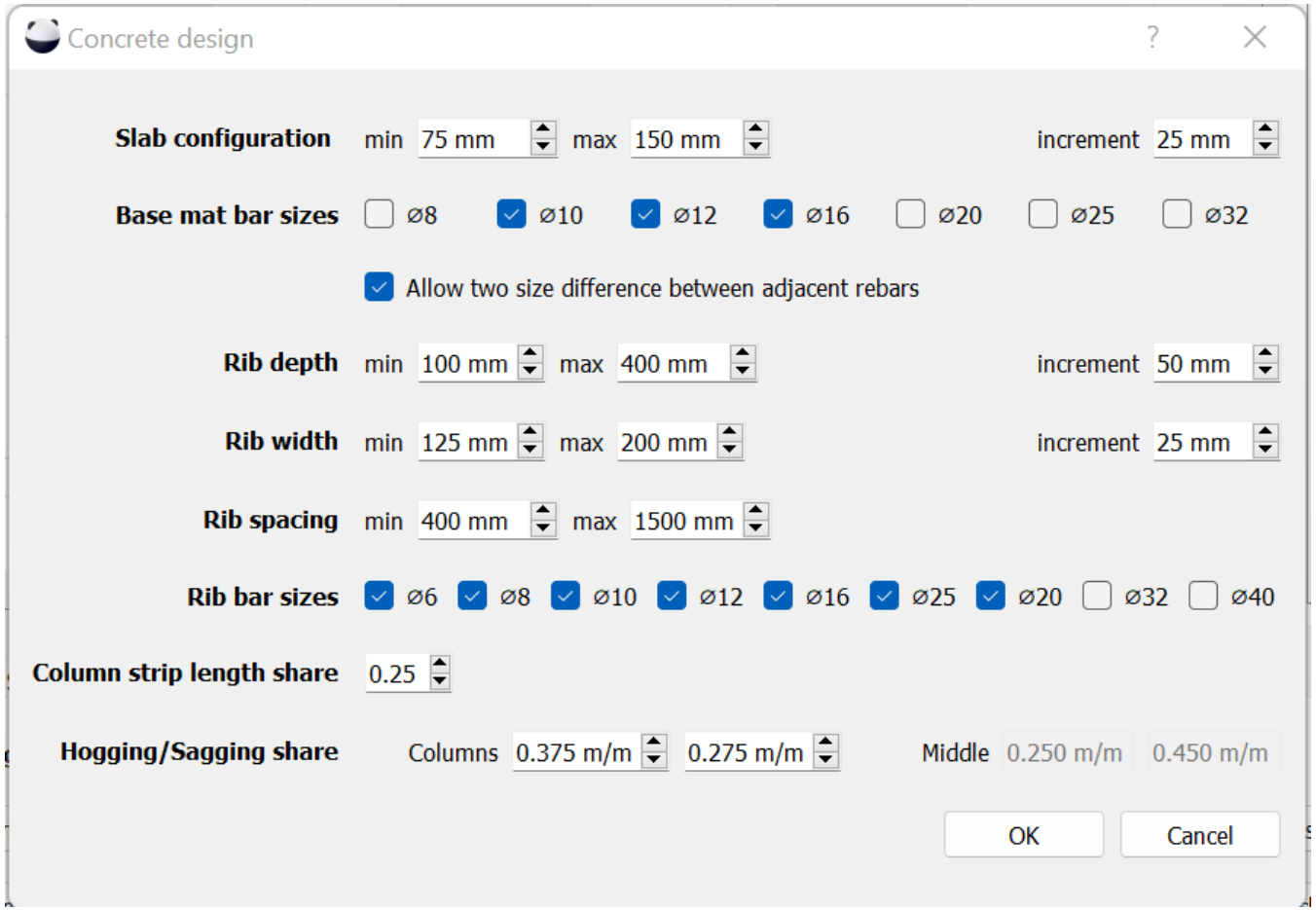




© Structural PANDA 2022

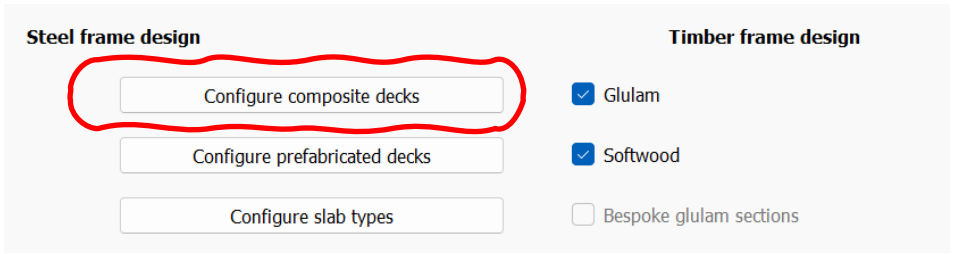
5.5 Configure the superstructure





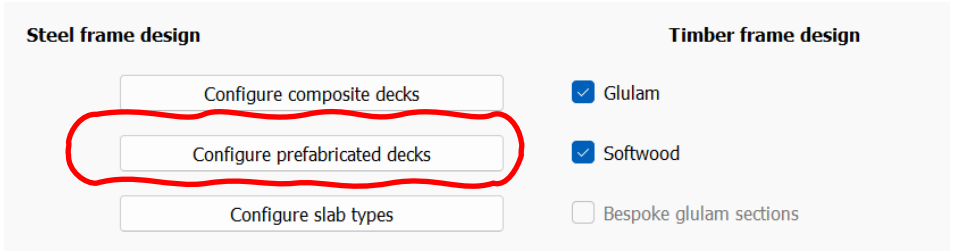
© Structural PANDA 2022

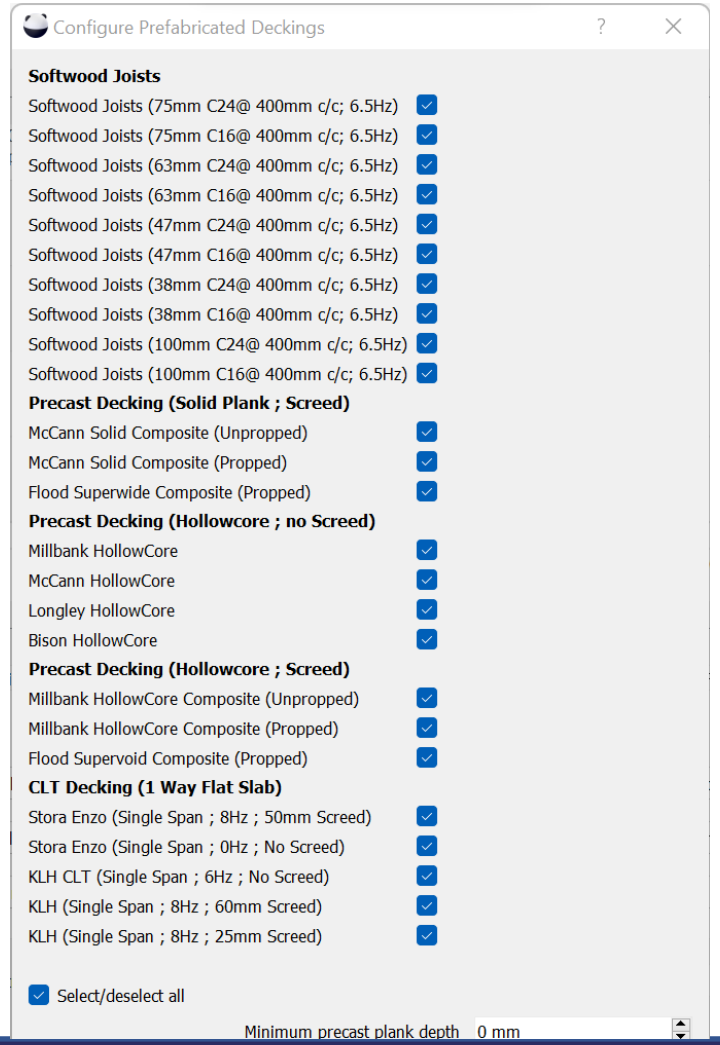
5.5 Configure the superstructure



© Structural PANDA 2022

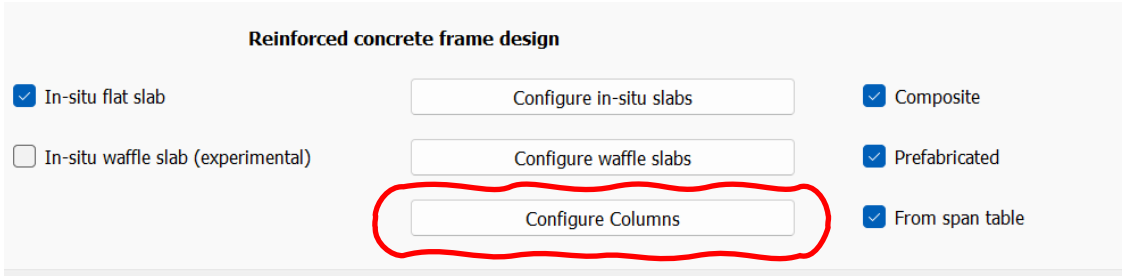
5.5 Configure the superstructure

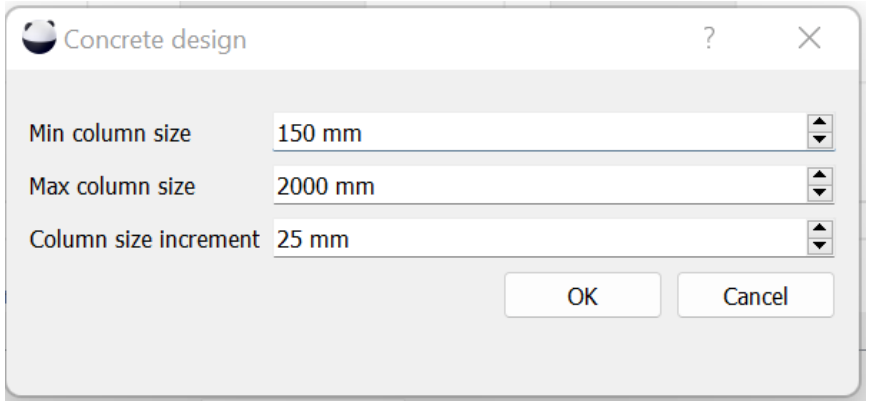


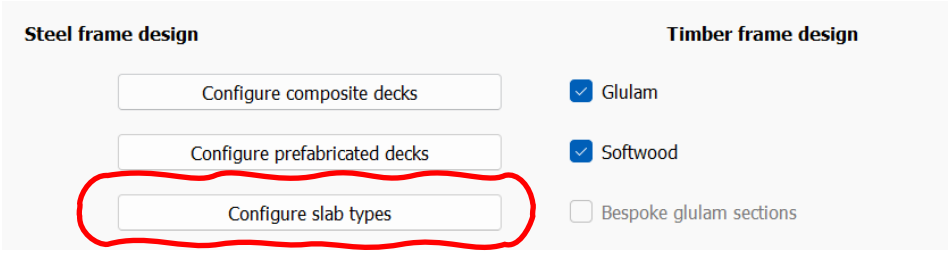


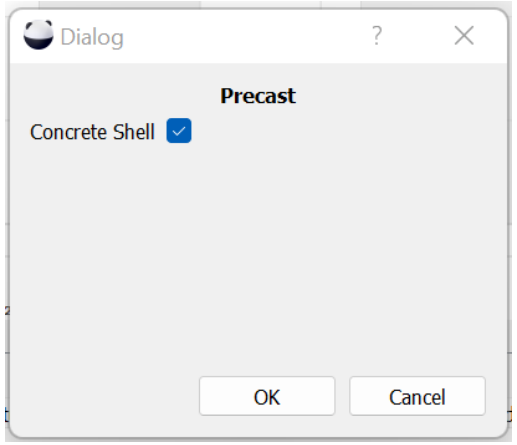
© Structural PANDA 2022

5.5 Configure the superstructure







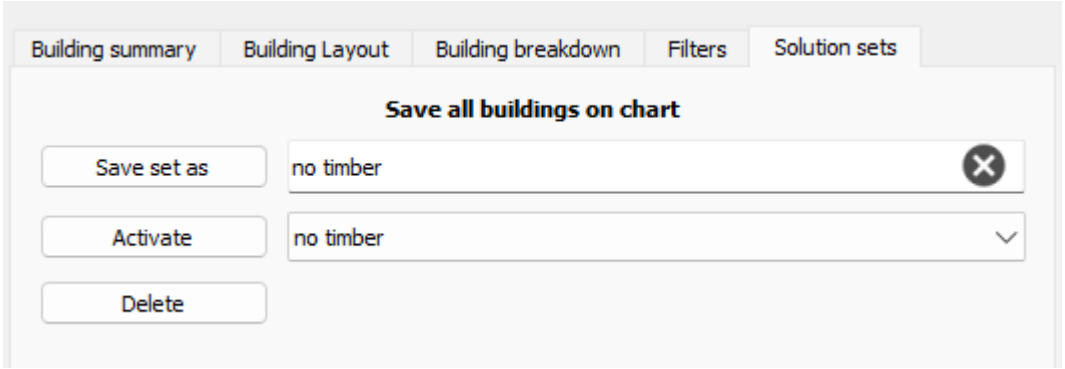


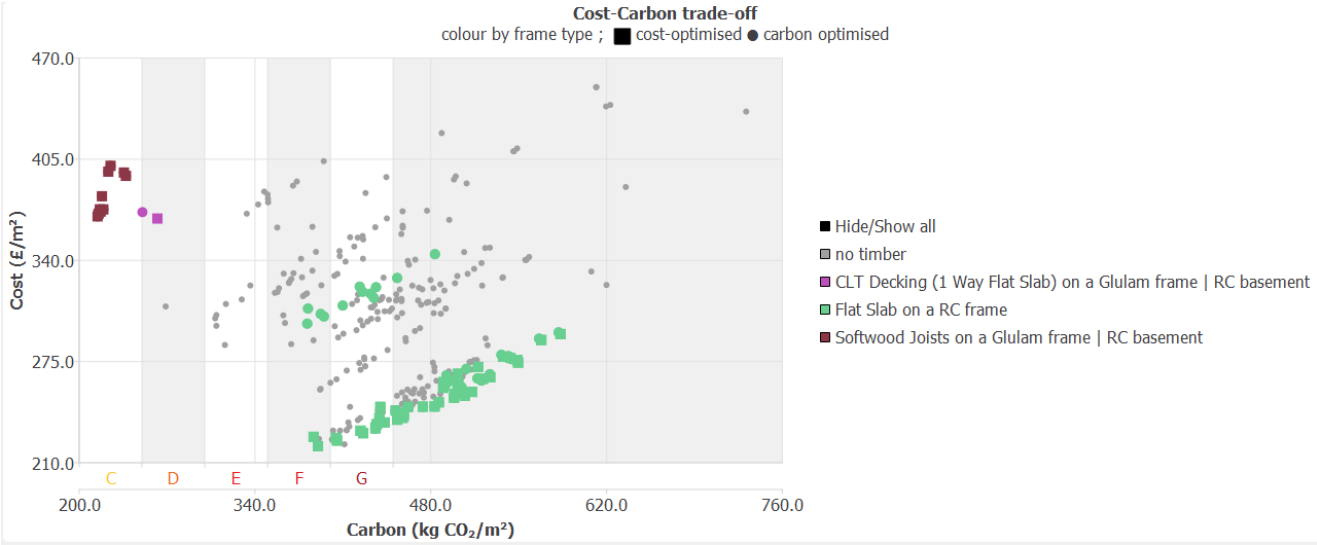
© Structural PANDA 2022

5.5 Configure the superstructure

To compare results with different superstructure configurations

- Input a building geometry and select the “Superstructure” tab
- Open each of the “configure…” options and remove materials which are not required
- Run PANDA and save the solution set as per section 7.4
- Use the “configure…” options to reduce the number of options further
- Click “compute” to re-run PANDA with the new superstructure inputs set
- The new results will appear on the graph as an overlay to allow the impact of reducing the number of superstructure options to be clearly seen against the original points (in grey)





© Structural PANDA 2022

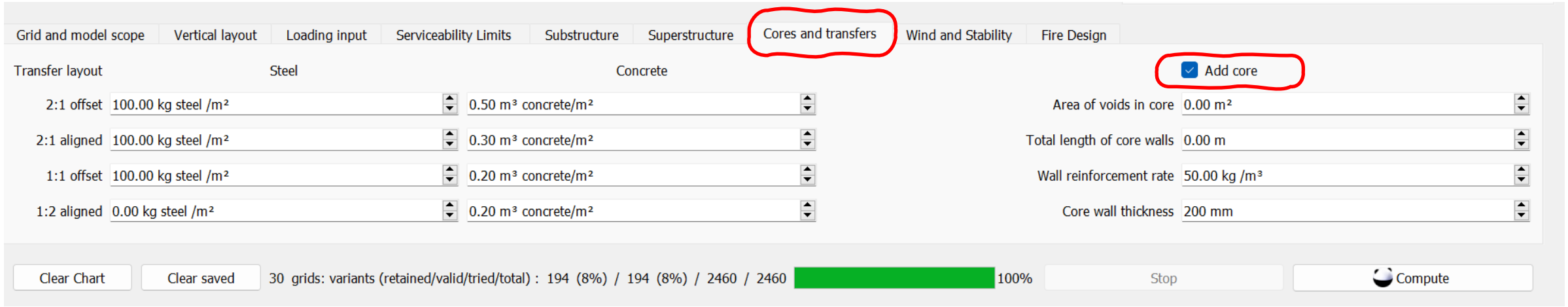
5.6 Cores & transfers

A core's dimensions can be added so that the cost and carbon for the core are included in the analysis, but the core is not designed within PANDA.

Information for transfers can also be added, though this feature is still in development in v3.1

Inserting a core to the superstructure:

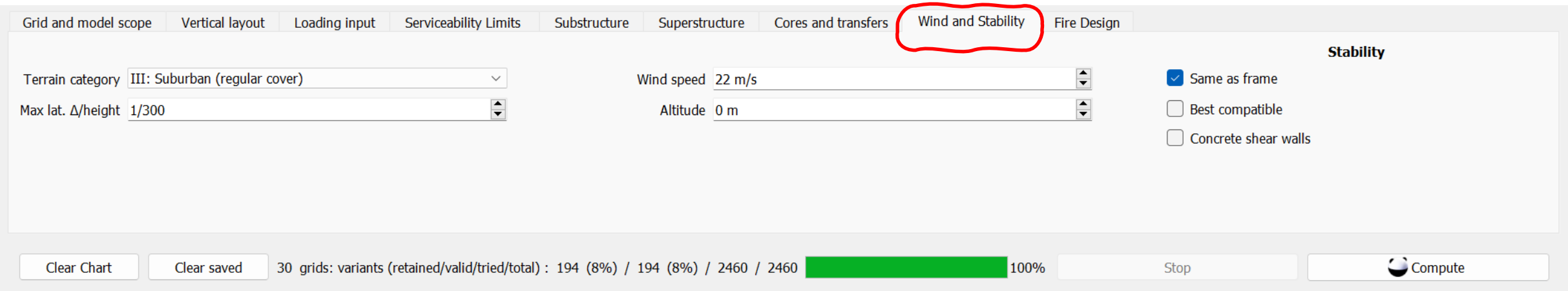
- Input a building geometry and select the "Cores and transfers" tab
- Click "add core"
- Input the core geometry
- Click "compute" to re-run PANDA with the addition of the core



© Structural PANDA 2022

5.7 Set wind & stability parameters

- PANDA enables different terrains to be selected
- Values for the maximum lateral deflection, wind speed and altitude can be inputted
- Stability systems can be set to match the frame or be concrete shear walls
- To apply the wind and stability settings in computation, the ‘design lateral stability system’ must be ticked in the ‘grid and model scope’ tab.

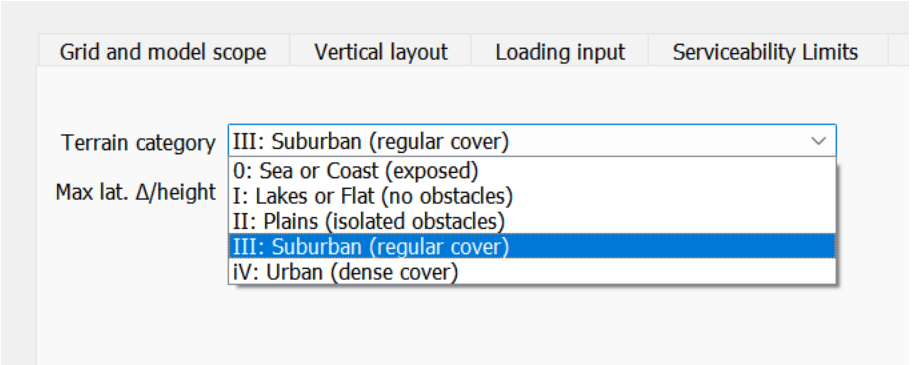


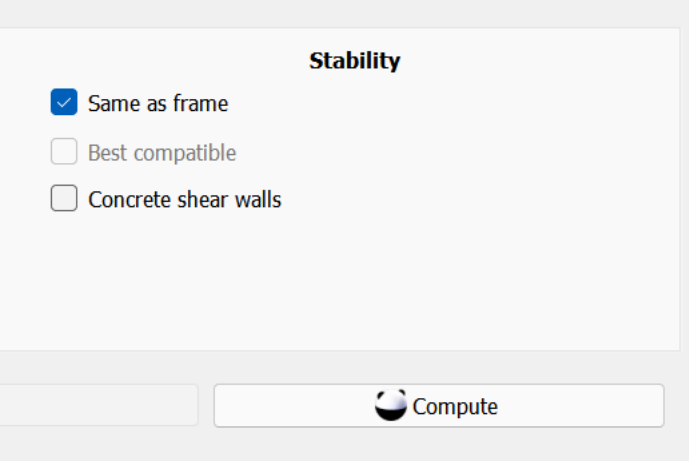
© Structural PANDA 2022

5.7 Set wind & stability parameters

To include wind and stability parameters in the analysis

- Input a building geometry and tick the ‘design lateral stability system’ option
- select the ‘Wind and Stability’ tab
- Select the ‘terrain category’ from the dropdown menu
- Set the values for the ‘max lat.’, ‘wind speed’ and ‘altitude’
- Set the ‘stability’ option to “concrete shear walls”
- Click ‘compute’ to re-run PANDA and compare the results with the original analysis with the default stability setting of ‘same as frame’ or ‘best compatible’

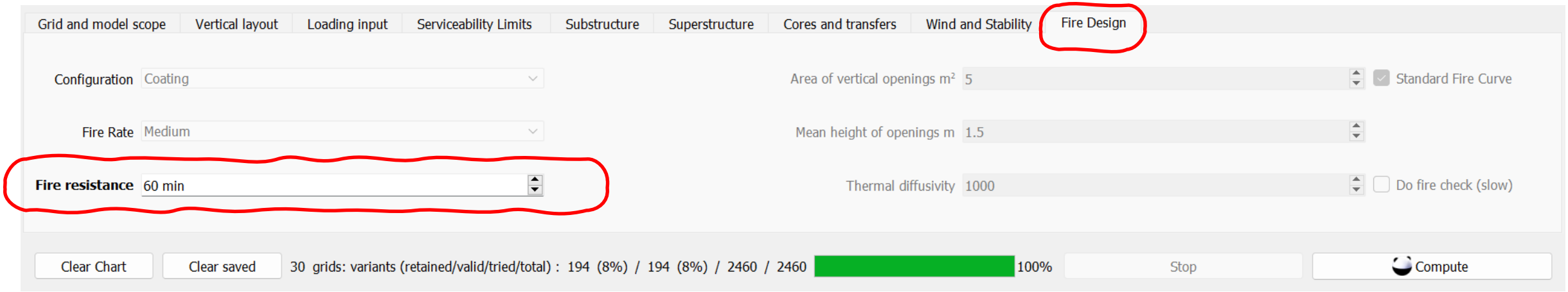




© Structural PANDA 2022

5.8 Set fire design parameters

- Fire design is intrinsic to concrete design in the EC
- For steel, the appropriate layers of intumescent paint are accounted for
- For timber, layers of plasterboard are added as appropriate
- Currently a fire resistance of more than 60 min will return no timber options
- You can only select the fire resistance currently. In principle, advanced fire design can be done by PANDA but it's not currently found to be beneficial so it is not activated I the user interface.



© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ☑ 3. Building Layout Inputs
- ☑ 4. Model Scope
- ☑ 5. Input Parameters
- ☐ 6. Running Parametric Analysis
- ☐ 7. Viewing Results
- ☐ 8. Exporting Results
- ☐ 9. Troubleshooting

© Structural PANDA 2022

6. Running Parametric Analysis

© Structural PANDA 2022

6. Running Parametric Analysis

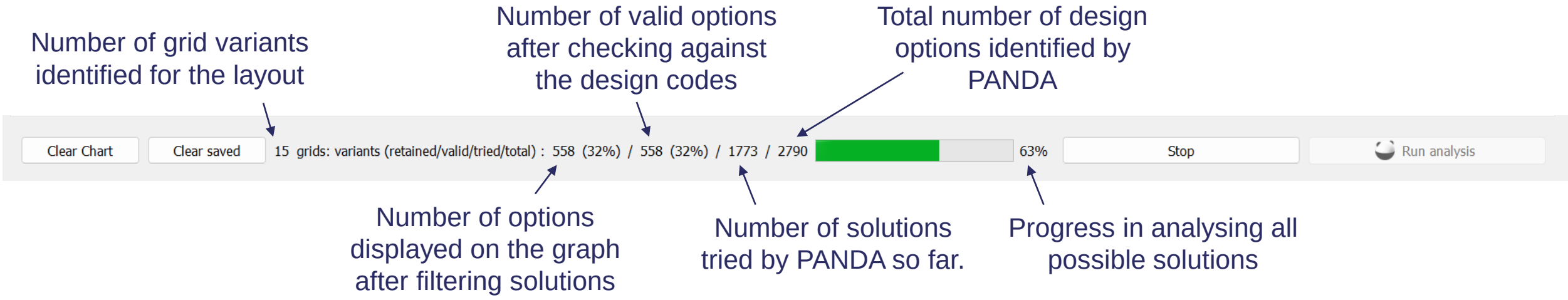
This section will show you how PANDA can:

- ❑ 6.1 Calculate all possible solutions
- ❑ 6.2 Optimise for cost and carbon
- ❑ 6.3 Save and load previous analysis

© Structural PANDA 2022

6.1 Calculating all possible solutions

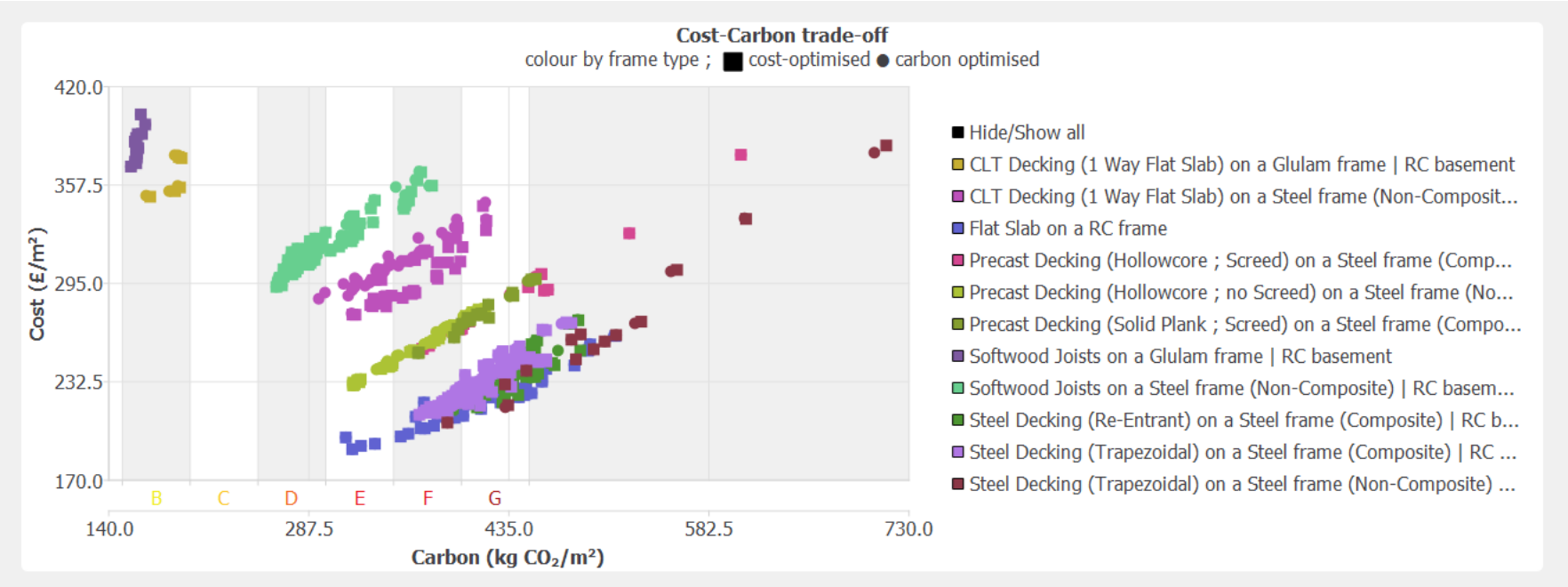
- PANDA does not read from a database and select possible solutions, it designs the building from scratch and checks compliance with Eurocodes for each design option.
- This is what makes PANDA unique and able to identify low carbon and low cost options which may have otherwise been missed.
- The number of possible grid layouts and design layouts are displayed next to the progress bar.



© Structural PANDA 2022

6.2 Optimising for cost and carbon

- For each possible solution, PANDA optimised the design for both cost and carbon
- Cost-optimised solutions are displayed on the graph with a square marker, carbon-optimised solutions have a circle marker
- You can chose to filter by either cost or carbon optimised solutions using the filter options in the information window



© Structural PANDA 2022

6.3 Save and load previous analysis

Each set up in PANDA can be saved and reloaded. To do this:

- Click ‘file’ then ‘save building from the main menu
- Select from ‘save building and soil configuration’ or ‘save building only’. Alternatively to save just the soil configuration select ‘save coil configuration’
- Previously saved or soil configurations can be opened by selecting ‘load…’ from this menu
- Close PANDA and reopen the solution sets through activating the “saved solution set” option in the information tab, described in section 7.3
- PANDA does not save the results, you must recompute the analysis each time you open it.

© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ☑ 3. Building Layout Inputs
- ☑ 4. Model Scope
- ☑ 5. Input Parameters
- ☑ 6. Running Parametric Analysis
- ❑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

7. Viewing results

© Structural PANDA 2022

7. Viewing Results

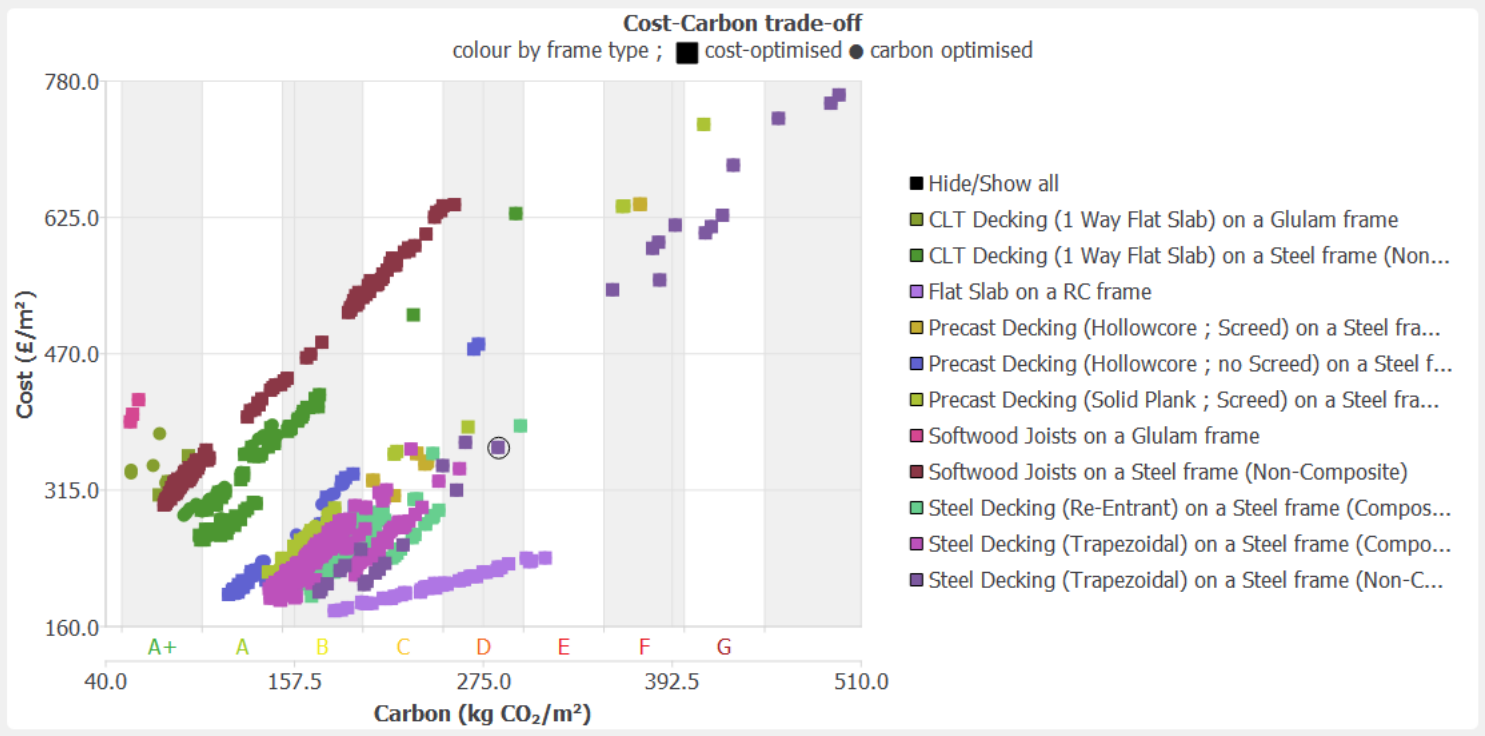
This section will show you how to view:

- ❑ 7.1 Building summary, layout & breakdown
- ❑ 7.2 Filter results
- ❑ 7.3 Save and compare solution sets
- ❑ 7.4 Select options
- ❑ 7.5 Change the graph display controls
- ❑ 7.6 External data for comparison

© Structural PANDA 2022

7.1 Building summary, layout & breakdown

- Results are all displayed on the cost/carbon graph and colour-coded according to the information you wish
- Selecting an individual point on the graph will provide more information for that solution

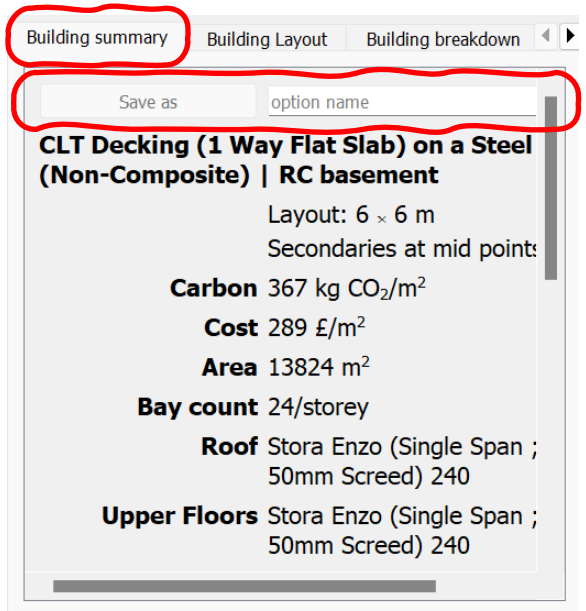


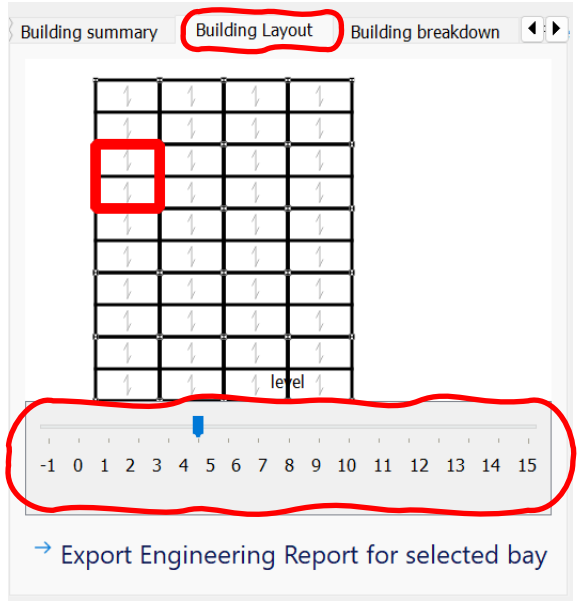
© Structural PANDA 2022

7.1 Building summary, layout & breakdown

Select an individual solution by clicking on the point on the graph review the information panel on the right of the screen:

- Browse through the “Building summary”, “Building layout” and “Building breakdown” tabs to view information on the selected solution
- Name and save an individual building using the ‘save as’ function in the ‘building summary’ tab, this enables you to select this option for report generation as described in section 8.
- The building layout tab shows the grid lay out for each floor
- Change floor by moving the slider left and right
- Select any bay to export the engineering report for the selected bay



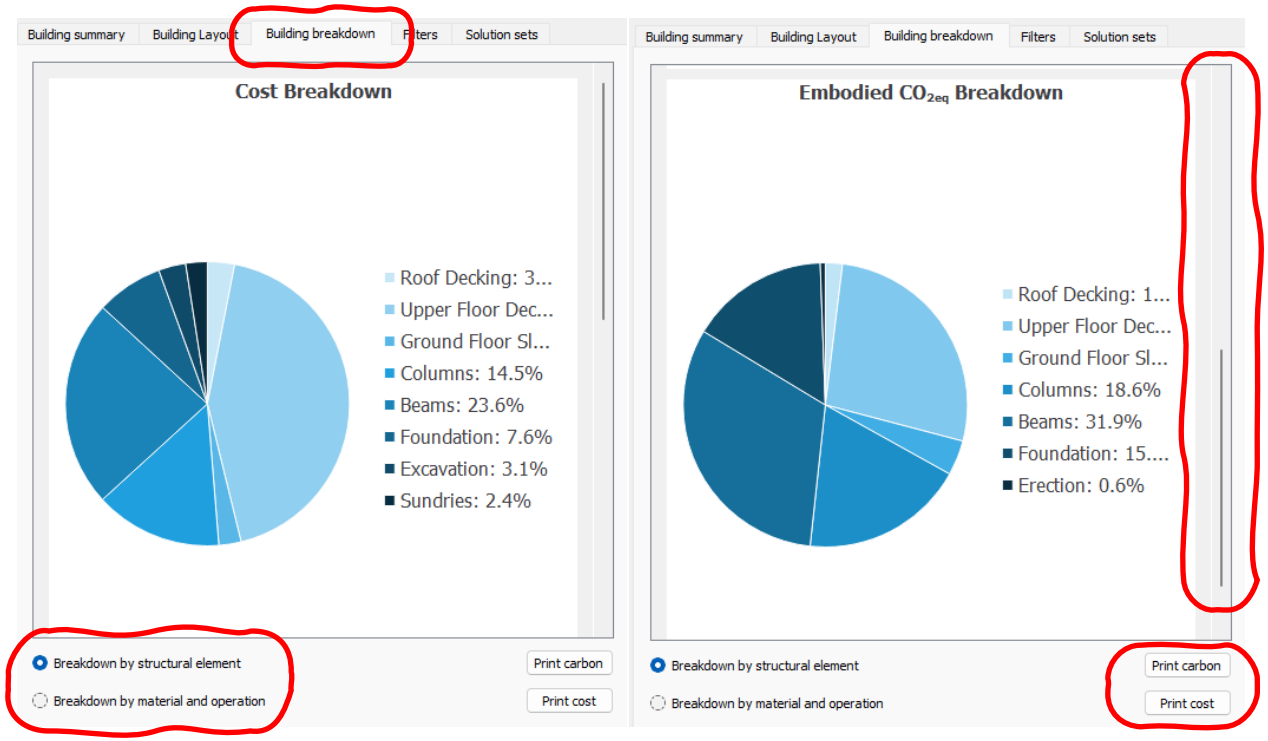


© Structural PANDA 2022

7.1 Building summary, layout & breakdown

To evaluate the costa and carbon breakdown for a selected solution:

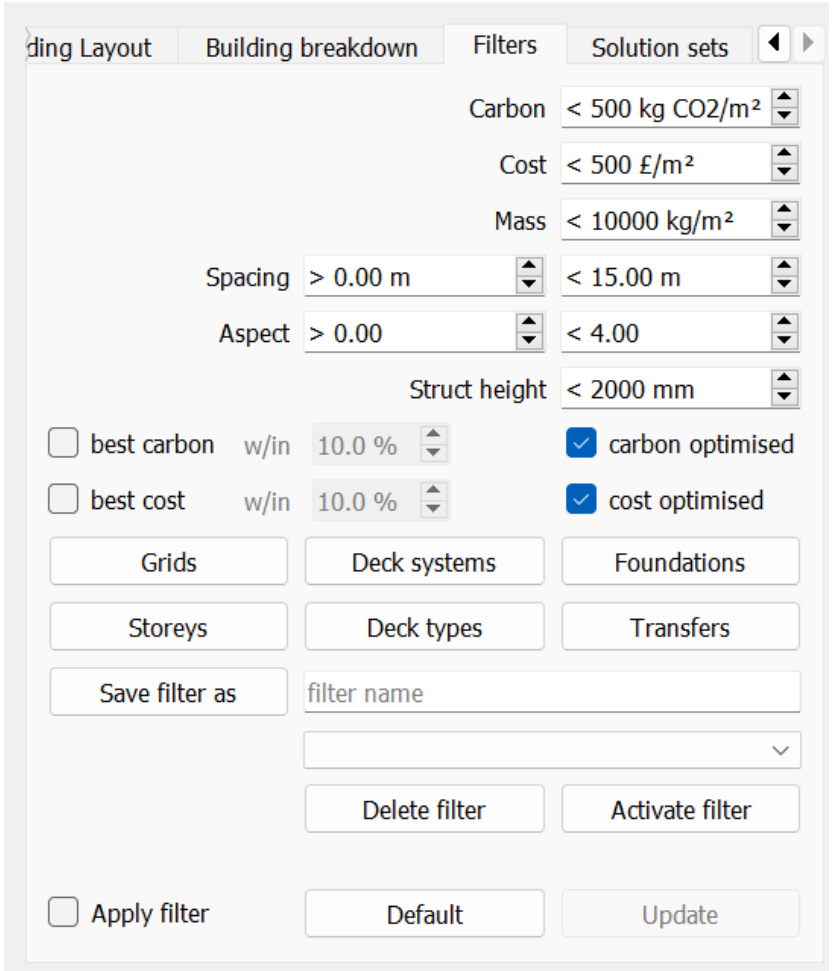
- Click on the desired solution on the graph
- Select the ‘building breakdown tab’
- Chose either ‘breakdown by structural element’ or ‘breakdown by material and operation’ to select the required display options.
- Use the scroll bar on the right hand side of the window to view the pie chart for the breakdown of embodied CO2



© Structural PANDA 2022

7.2 Filter the results

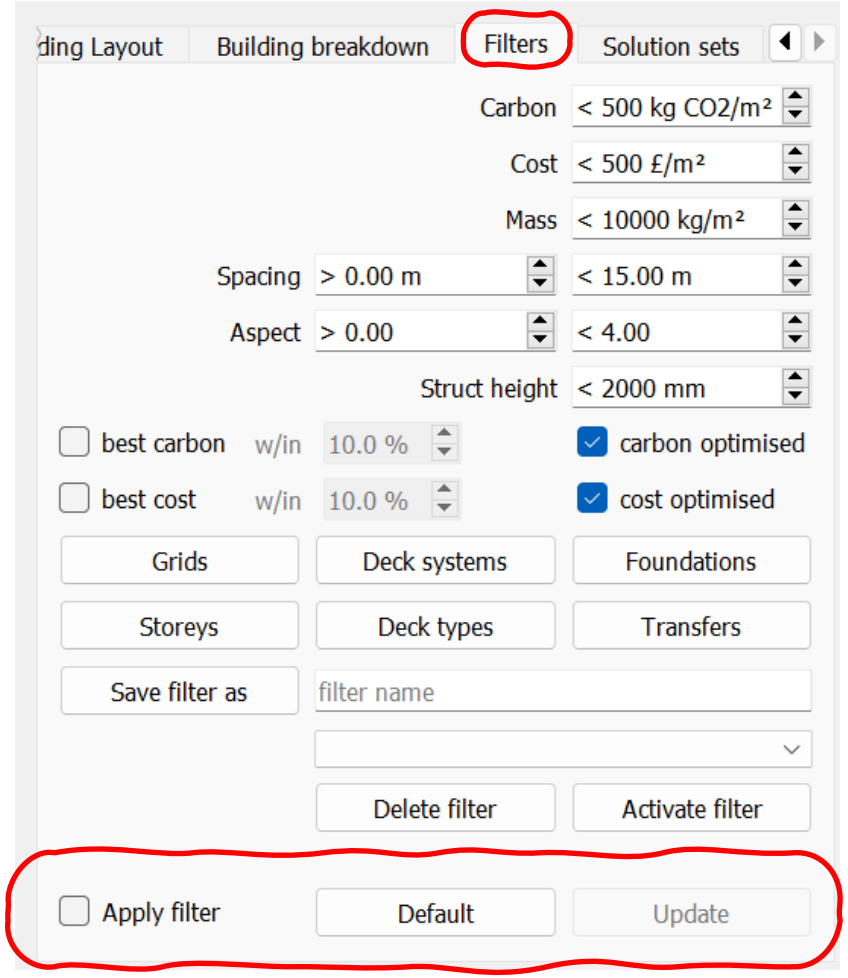
- Filtering solutions is key to narrowing down the schemes to bring forward to detailed design
- Cost and carbon are obvious high level filters, but in med-highrises storeys can be critical
- Structural height, grids, foundations are important when discussing with the team: architects, foundation and HVAC specialists may require different filter combinations
- If PANDA is open on a small screen, use the arrows to scroll across to the ‘filters’ and ‘solution sets’ tabs



© Structural PANDA 2022

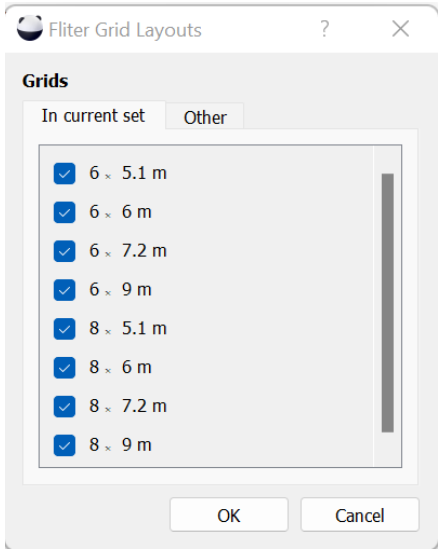
7.2 Filter the results

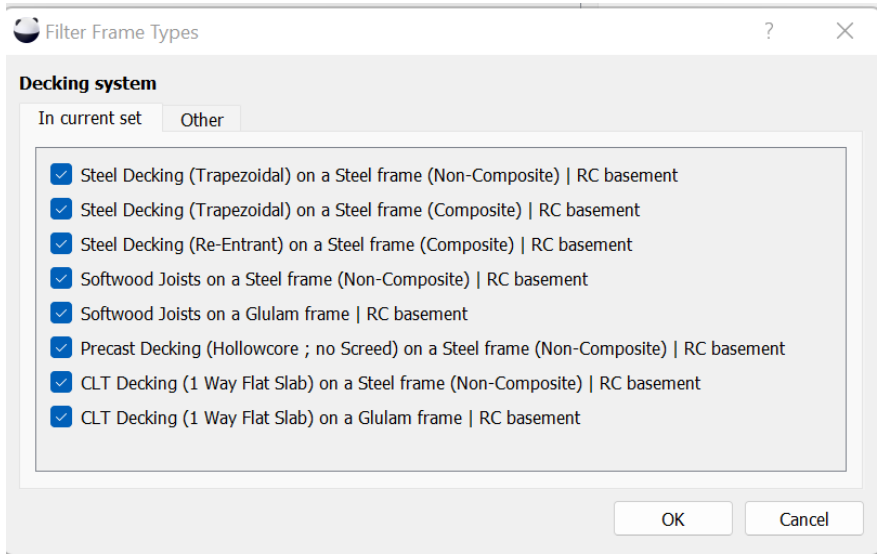
- Input geometry and run PANDA analysis and select ‘Filters’ tab in the information pane
- Edit the maximum allowable ‘Carbon’, ‘Cost’, ‘Mass’ and ‘struct height’ values
- Edit the range of allowable “spacing” and “aspect” values
- Check the ‘best carbon’ and ‘best cost’ options to display only solutions which are within a given percentage of the best result
- Limit solutions to display those optimised by cost or carbon by checking the “carbon optimised” and “cost optimised” options. Or set percentage values to only show solutions within a given range of the best possible solution
- Select “Grids”, “Decking systems”, “Foundations”, “Storeys” and “Deck types” to limit the solutions displayed (images on next page)
- Check “apply filter” to apply the filter on the current solutions and those being calculated and click “update” to update the graph

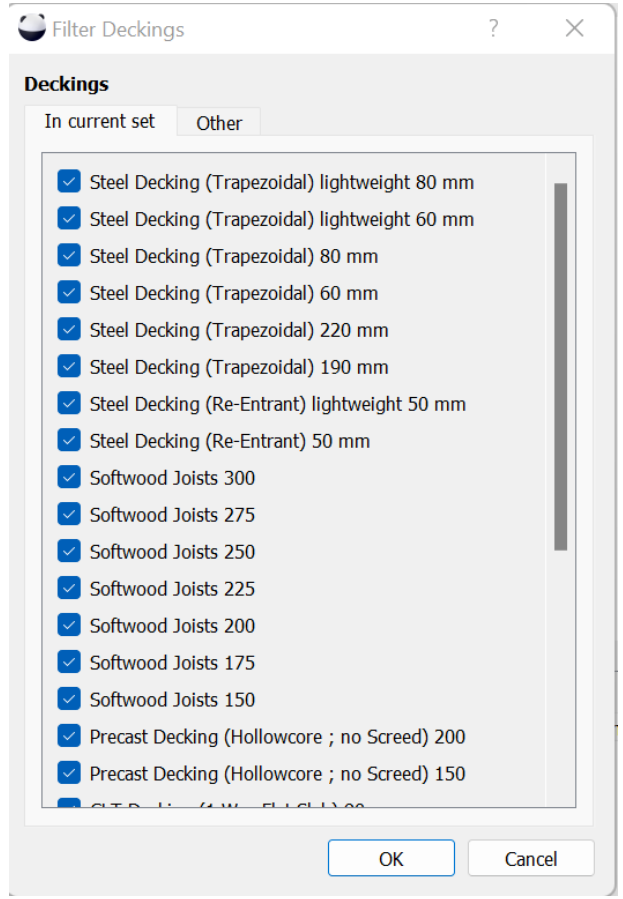


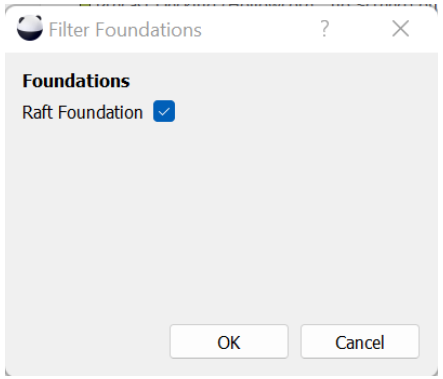
© Structural PANDA 2022

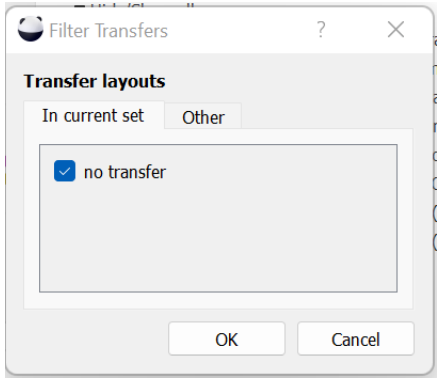
7.2 Filter the results

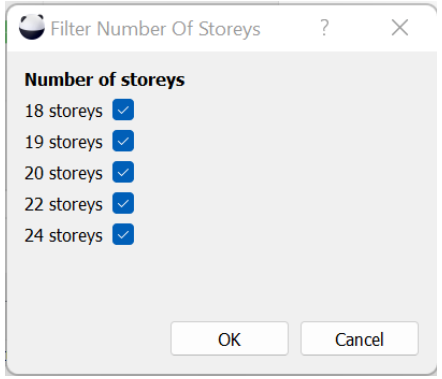










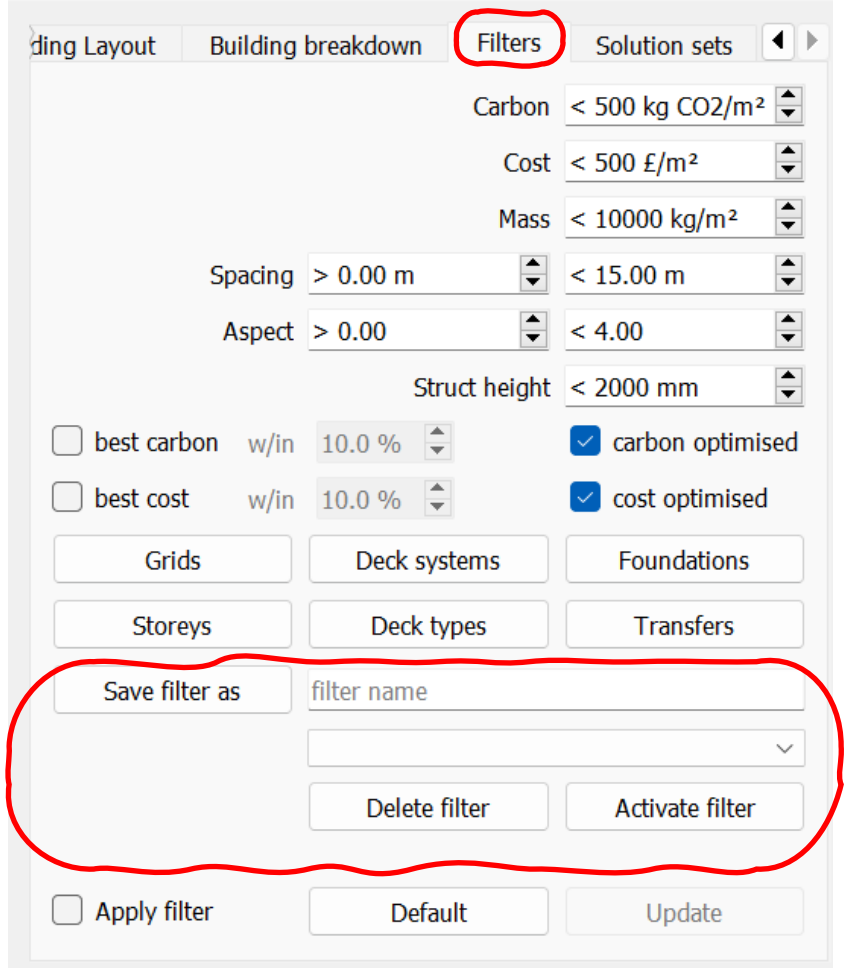


© Structural PANDA 2022

7.2 Filter the results

Saving filter options:

- Select the “Filters” tab in the information pane
- Input filter settings to suit the analysis
- Add a description for your filter to the “save filter as” box
  - Alternatively, select a previously saved solution from the drop down menu
- Click “Activate filters” to apply previously saved filter settings
- Check “apply filter’ to apply the filter on the current solutions and those being calculated
- Press “update” to apply the new filter to the graph

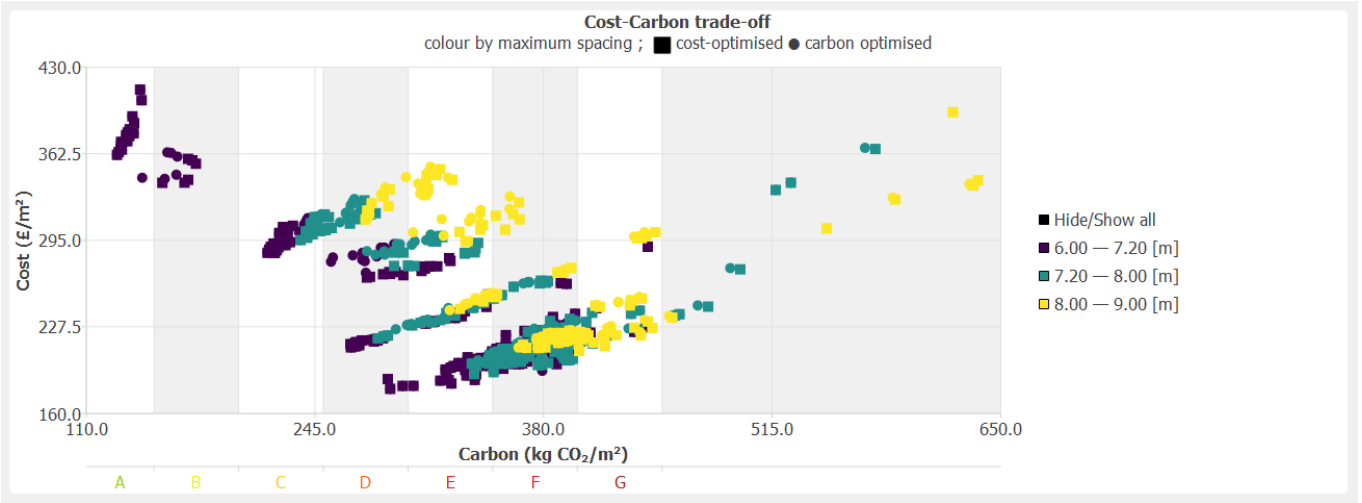


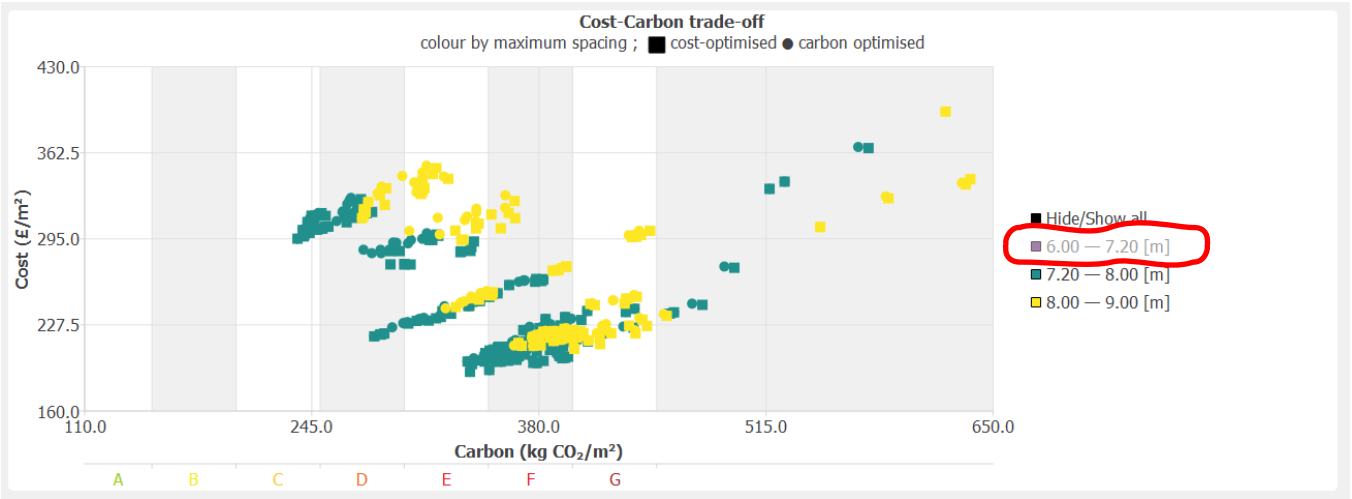
© Structural PANDA 2022

7.2 Filter the results

Results can also be filtered directly on the graph by clicking on the legend.

- Click the legend label to filter directly on the graph to hide results with that categorisation
- Click on the label again to redisplay these points on the graph.
- This function does not work whilst PANDA is still computing results, you must wait for the computation to finish before filtering results.



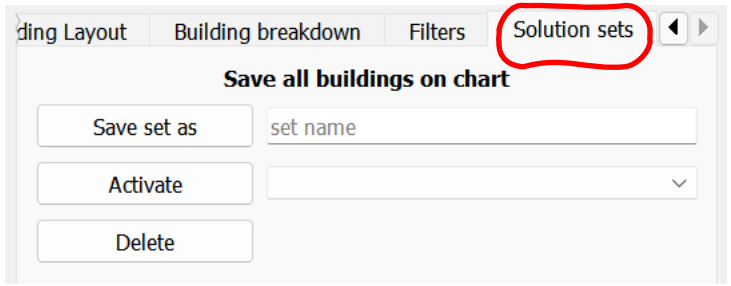


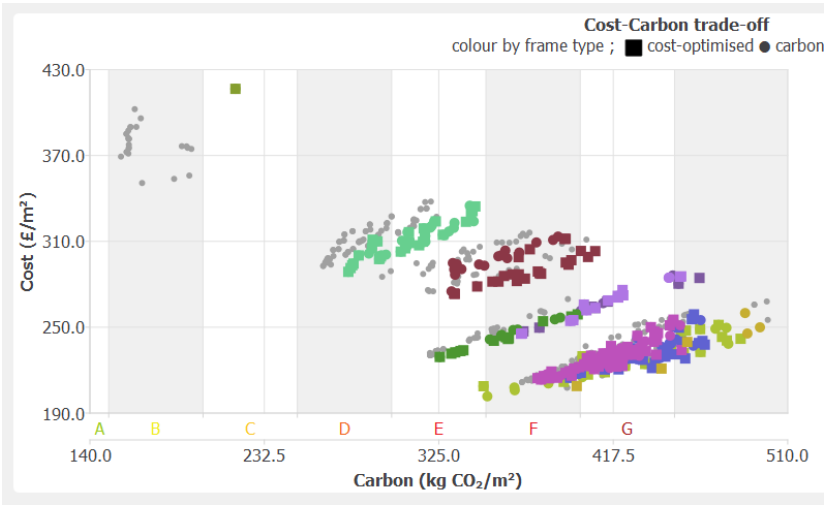
© Structural PANDA 2022

7.3 Save and compare solution sets

After filtering, the resulting solution sets can be saved

- Select the “Solution sets” tab in the information pane
- Add a description for your solution set to the “save set as” box
  - Or select a previously saved solution set from the drop down menu
  - Select activate to apply the selected solution set
- Individual buildings can be saved in the building summary tab.
- Close PANDA and reopen the solution set through activating the “saved solution set”
- If PANDA is rerun with a different configuration, the new results are overlayed with the saved set being shown as a reference (in grey)





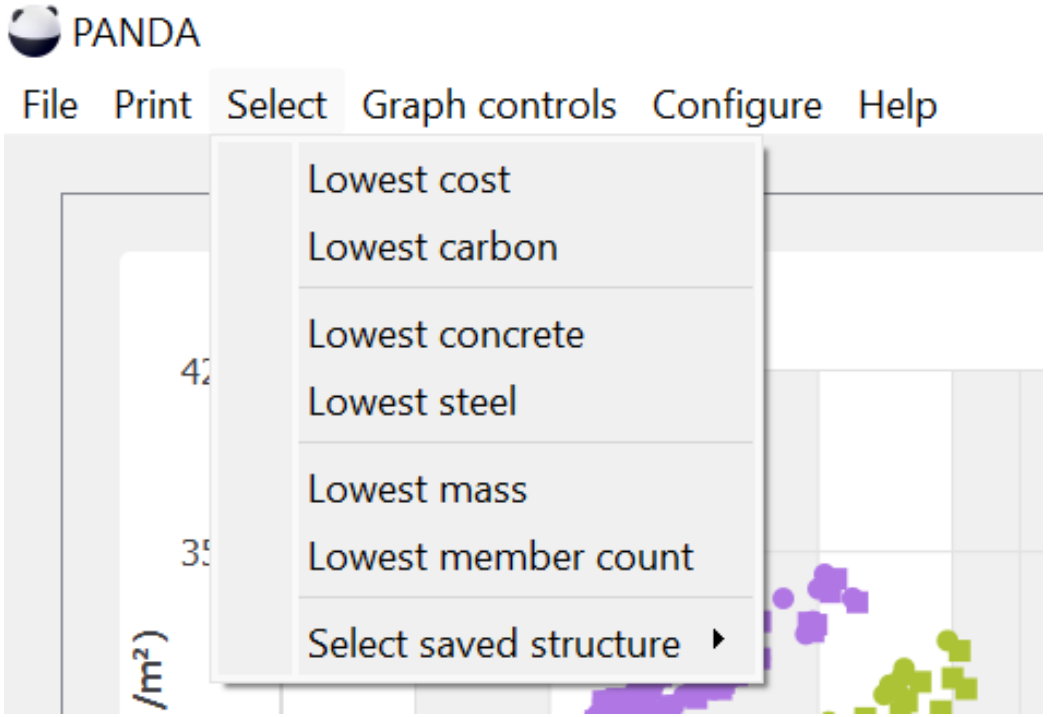
© Structural PANDA 2022

7.4 Select options

The select menu is a shortcut to select “remarkable” solutions. These are automatically identified by PANDA. Or can be added by the user using the ‘select saved structure’ option

To select a ‘remarkable solution’

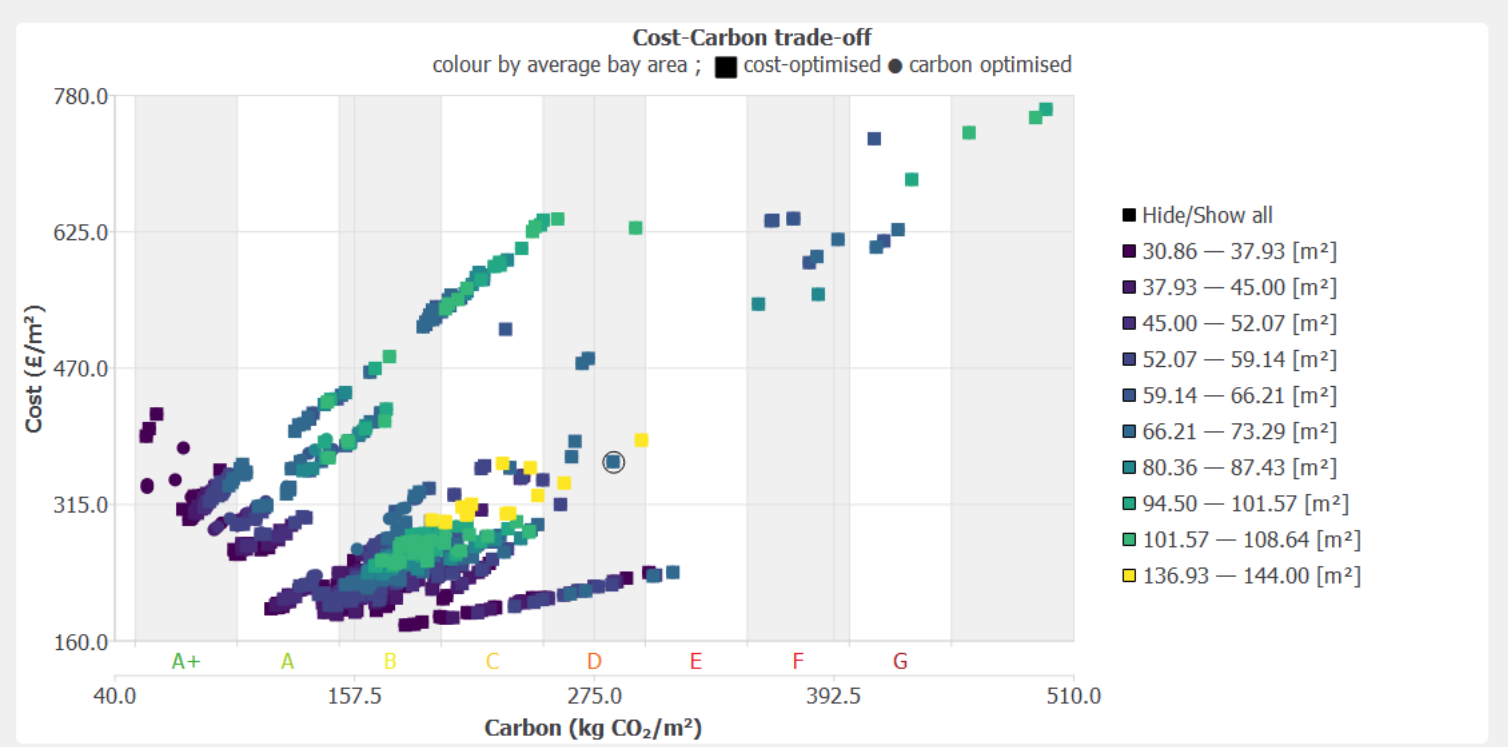
- Click ‘select’ from the main
- Chose the required solution from the list
- The solution will be highlighted with a black circle to identify it on the graph
- Individual buildings can be saved in the building summary tab. These solutions will then be displayed under the ‘select saved structure’ option.



© Structural PANDA 2022

7.5 Change the graph display controls

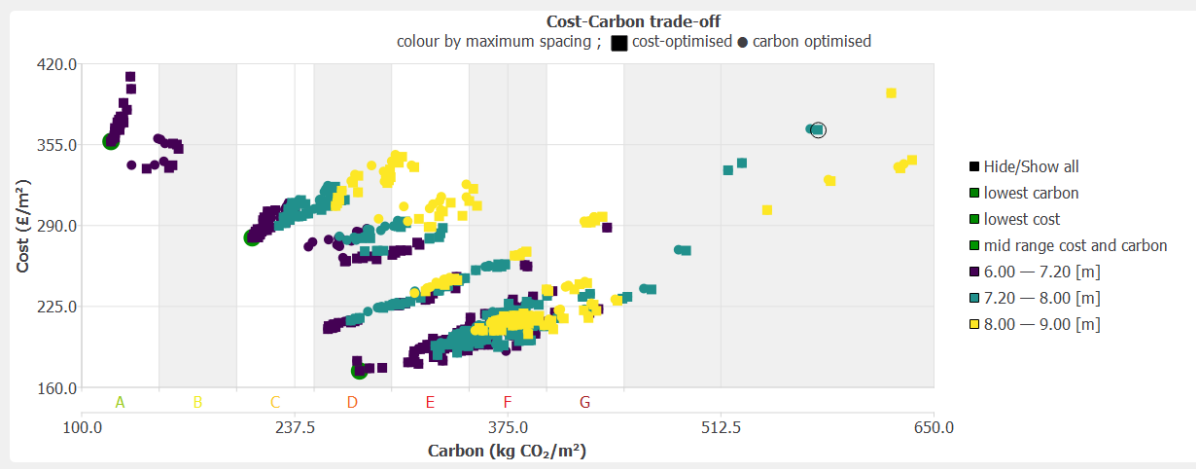
- Under graph control, you can adjust the size of the symbols, and colour-cade the solutions according to various variables of interest
- Colour-scale is useful to have the colour reflect the value of the variable (as opposed to the decile)
- For example this image has the colour code displayed by average bay area.

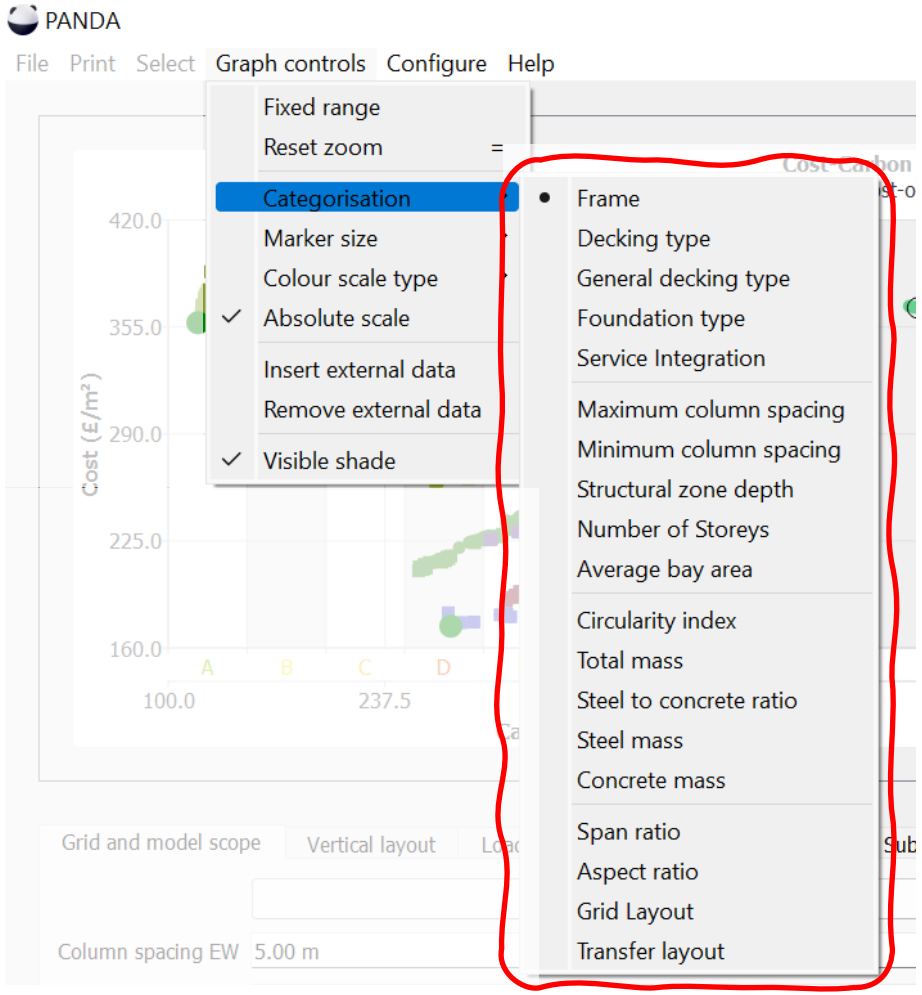


© Structural PANDA 2022

7.5 Change the graph display controls

- Input geometry and run PANDA analysis
- Inspect Carbon-Cost plot
- Click on “Graph controls” and “categorisation” to display the results on the graph as per the different categorisation options
- The example below displays the results by maximum column spacing, which will be useful to discuss the cost and carbon impact of changing the maximum column spacing in the design.

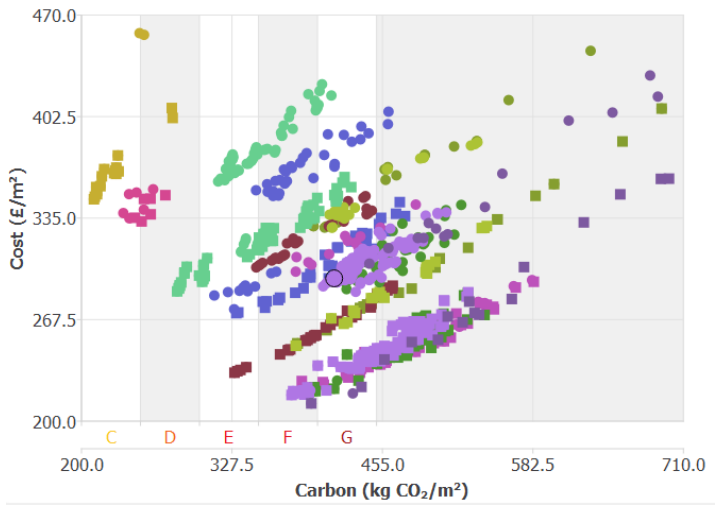


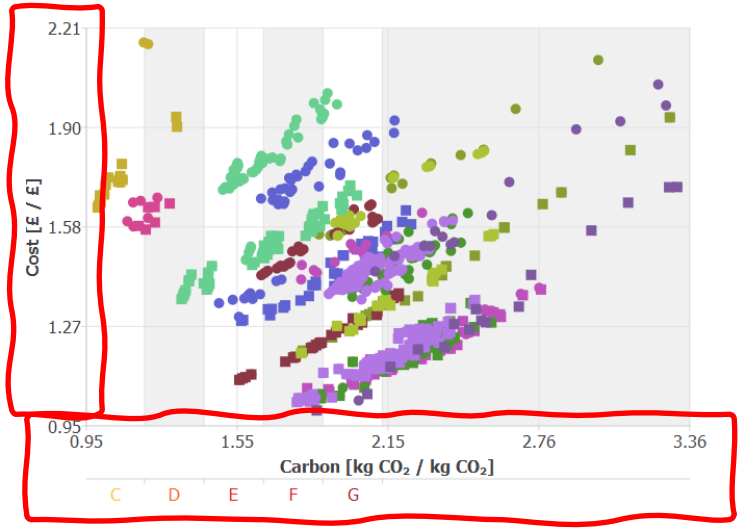


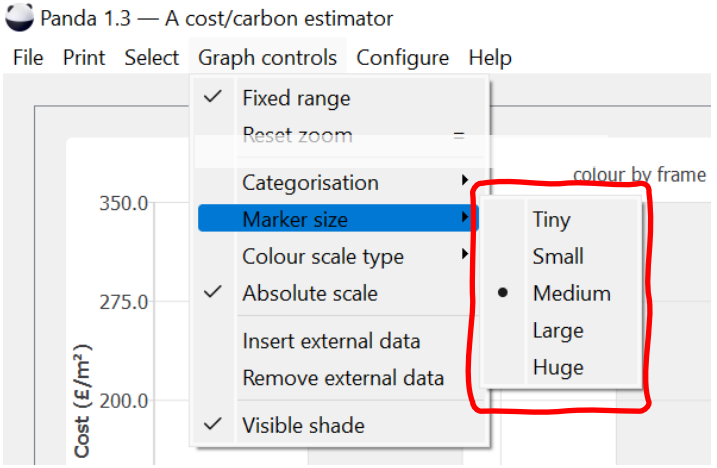
© Structural PANDA 2022

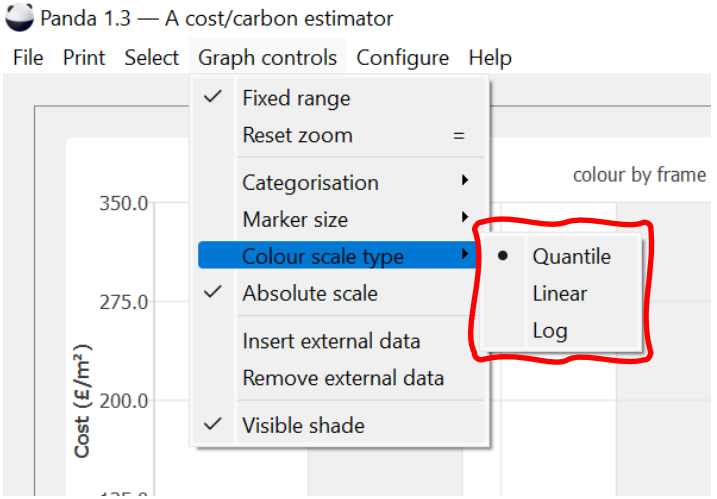
7.5 Change the graph display controls

- Input geometry and run PANDA analysis
- Change the “marker size” to meet your preference
- Select “colour scale type” to switch between ‘quantile’, ‘linear’ and ‘log’ scales on the graph
- Select and deselect ‘absolute scale’ to change the axis from an absolute to a relative result.





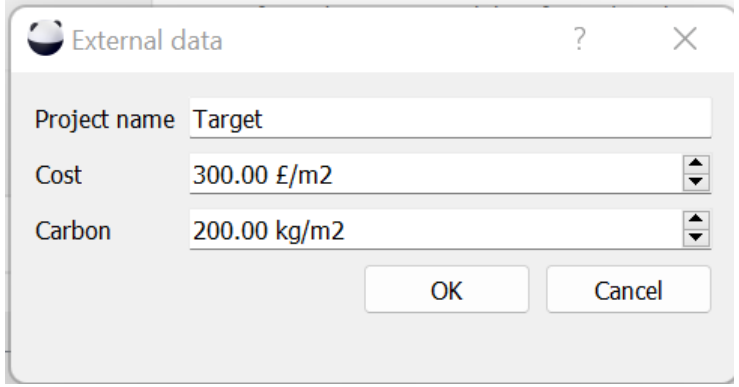


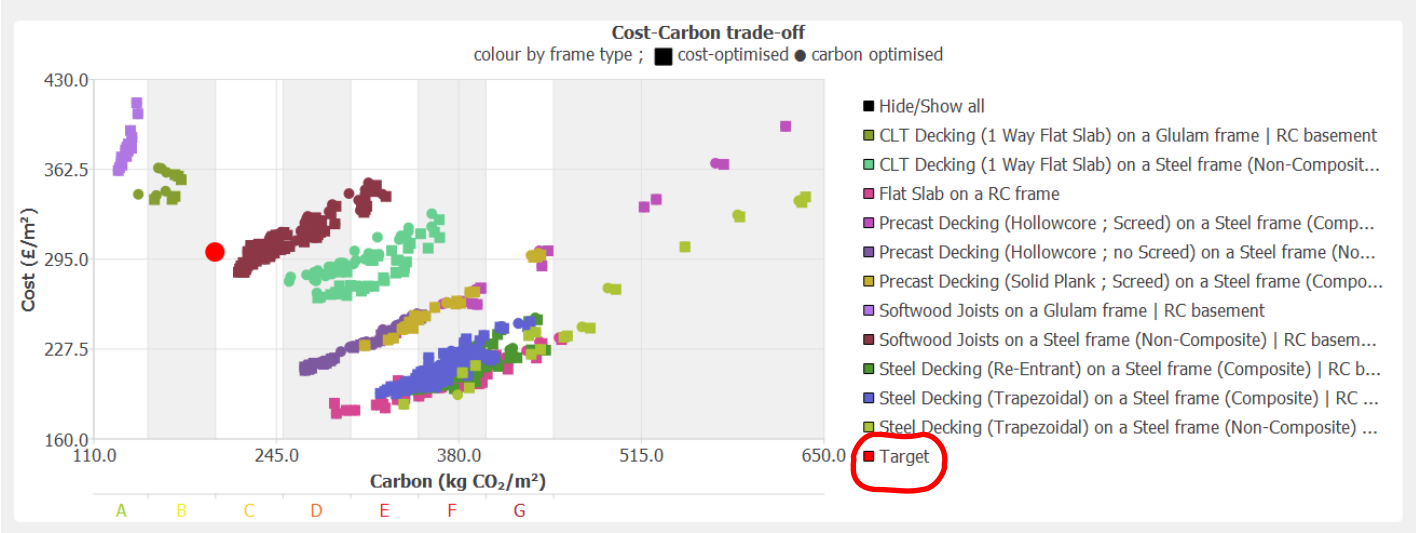


© Structural PANDA 2022

7.5 External data for comparison

- Input geometry and run PANDA analysis
- Inspect Carbon-Cost plot
- Select ‘graph controls’ from the main menu
- Use the dialogue box for ‘Insert external data’ to manually add points to the graph. This is especially useful if you want to set a target performance and compare it to the results from PANDA
- To delete these points select ‘remove external data’





© Structural PANDA 2022

Contents

- ☑ 1. Introduction to PANDA
- ☑ 2. Getting started
- ☑ 3. Building Layout Inputs
- ☑ 4. Model Scope
- ☑ 5. Input Parameters
- ☑ 6. Running Parametric Analysis
- ☑ 7. Viewing Results
- ❑ 8. Exporting Results
- ❑ 9. Troubleshooting

© Structural PANDA 2022

8. Exporting results

© Structural PANDA 2022

8. Exporting results

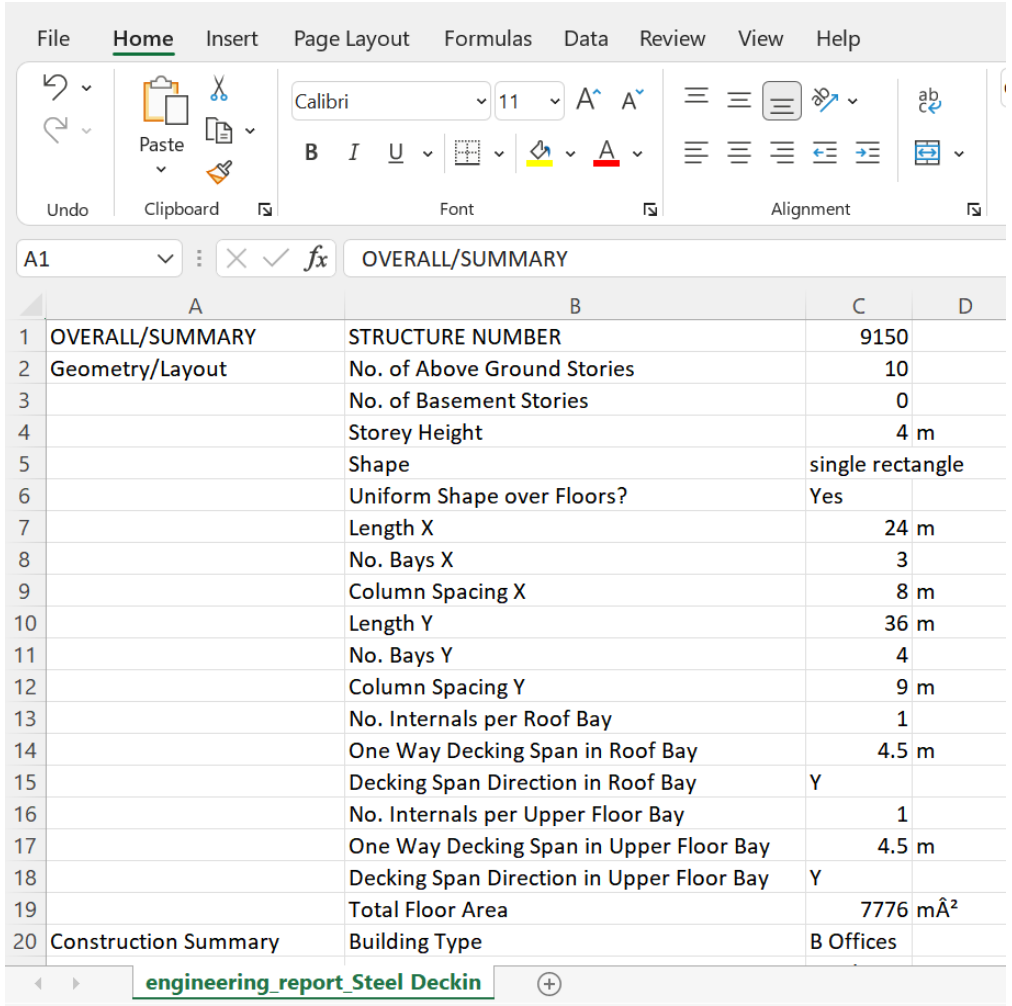
This section will show you how to:

- ❑ 8.1 Export engineering reports for a selected bay
- ❑ 8.2 Print carbon & cost pie charts
- ❑ 8.3 Export Bill of Materials
- ❑ 8.4 Export chart data
- ❑ 8.5 Output summary data reports

© Structural PANDA 2022

8.1 Export engineering reports for a selected bay

- PANDA does not read results from a database. It actually does engineering calculations
- You can select any bay in a building and print an engineering report which will give all the checks and their values
- That allows you to check that PANDA did an adequate job, but can also guide you for the more irregular parts of your building
- You can use PANDA as a quick and dirty engineering calculator...



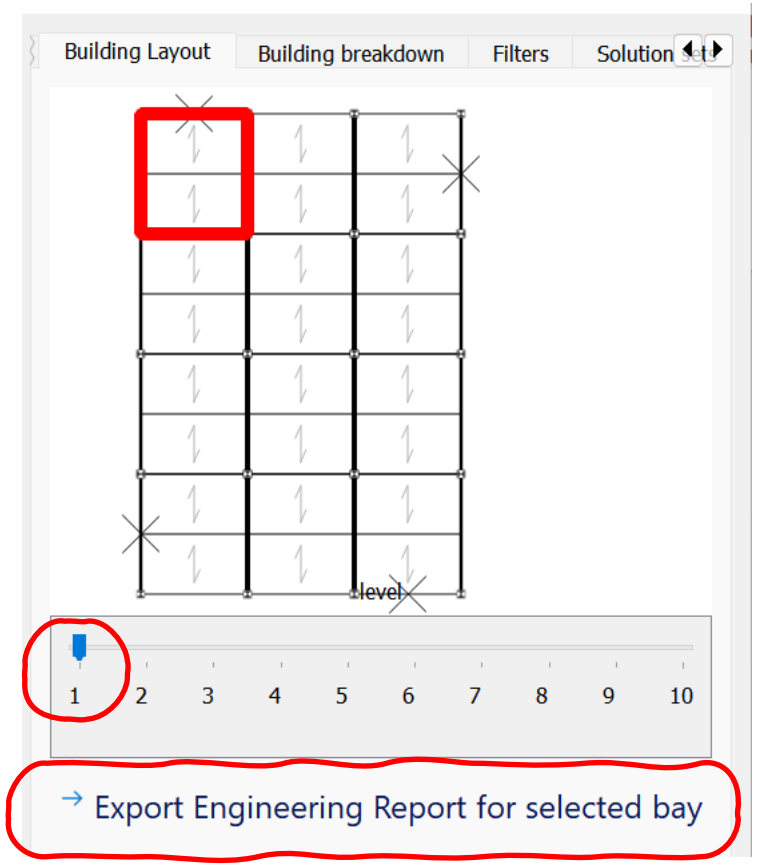
	A	B	C	D
1	OVERALL/SUMMARY	STRUCTURE NUMBER	9150	
2	Geometry/Layout	No. of Above Ground Stories	10	
3		No. of Basement Stories	0	
4		Storey Height	4	m
5		Shape	single rectangle	
6		Uniform Shape over Floors?	Yes	
7		Length X	24	m
8		No. Bays X	3	
9		Column Spacing X	8	m
10		Length Y	36	m
11		No. Bays Y	4	
12		Column Spacing Y	9	m
13		No. Internals per Roof Bay	1	
14		One Way Decking Span in Roof Bay	4.5	m
15		Decking Span Direction in Roof Bay	Y	
16		No. Internals per Upper Floor Bay	1	
17		One Way Decking Span in Upper Floor Bay	4.5	m
18		Decking Span Direction in Upper Floor Bay	Y	
19		Total Floor Area	7776	mÂ²
20	Construction Summary	Building Type	B Offices	

engineering_report_Steel Deckin

© Structural PANDA 2022

8.1 Export engineering reports for a selected bay

- Input geometry and run PANDA analysis
- Inspect Carbon-Cost plot and select an individual solution
- Select “Building Layout” tab in the information pane
- Select the individual bay which the report will be focused on
    - Change floor in the bay visualisation using the slider
- Select “export Engineering Report for selected bay”
- Engineering reports are CSV files. Import them in Excel telling it that they’re UTF-8 encoded.
- The files have a header giving general information, then detail the decking, then the columns

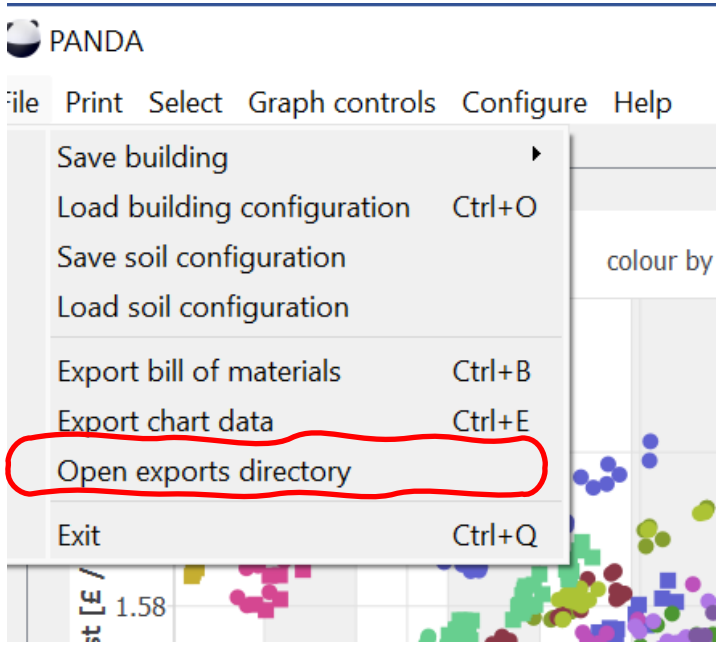


© Structural PANDA 2022

8.1 Export engineering reports for a selected bay

Opening the Engineering Report:

- Engineering Reports are saved in a folder called “exports” located in the PANDA program files
- Quick access to the reports can be navigated using the “Open exports directory” option on the main “File” menu
- Export other information by clicking “file” then “Export bill of materials”, “Export chart data” or “Export chart image”
- Open and view these files from the export directory



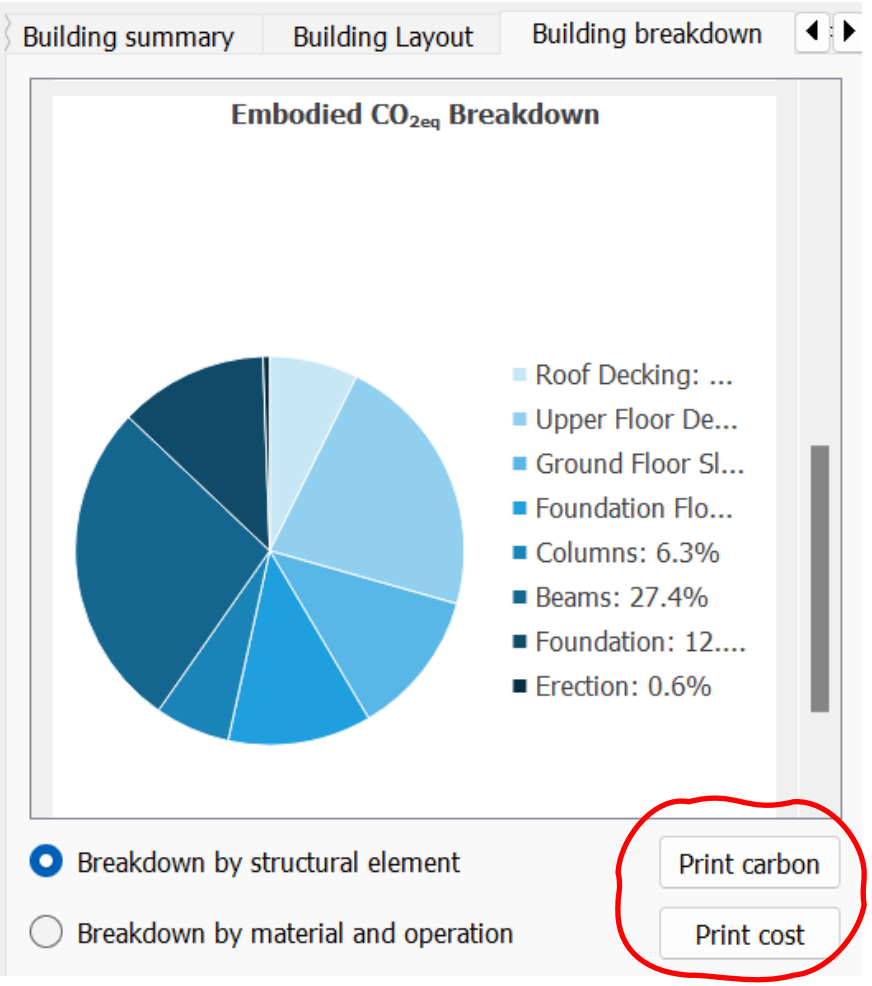
© Structural PANDA 2022

8.2 Print carbon & cost pie charts

- Images displayed for the cost and carbon pie charts can be printed and saved.

Printing the carbon and cost pie charts:

- Select the required point on the graph
- In the information window select ‘building breakdown’
- Select ‘print carbon’ or ‘print cost’ to save the image as a separate file.
- Images are exported as a png file

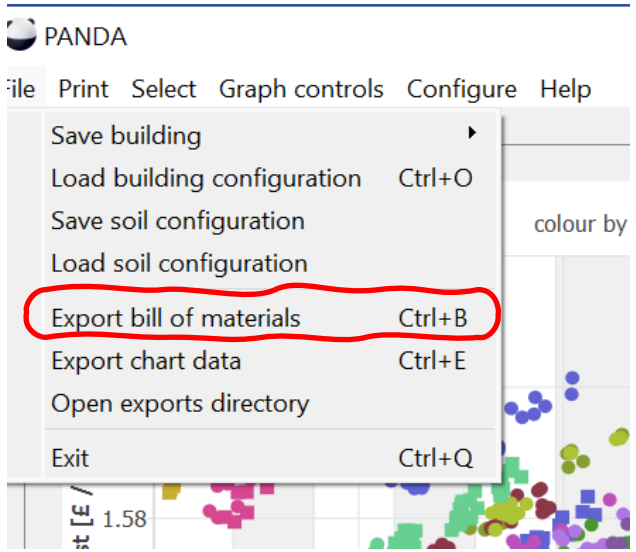


© Structural PANDA 2022

8.3 Export bill of materials

To export the Bill of materials:

- Select the required point on the graph
- Clicking “file” then “Export bill of materials”,
- Open and view these files from the export directory



	A	B	C	D	E
1	OVERALL/SUMMARY	STRUCTURE NUMBER	1612		
2	Geometry/Layout	No. of Above Ground Stories	4		
3		No. of Basement Stories	1		
4		Storey Height	4	m	
5		Shape	single rectangle		
6		Uniform Shape over Floors?	Yes		
7		Length EW	24	m	
8		No. Bays EW	4		
9		Column Spacing EW	6	m	
10		Length NS	36	m	
11		No. Bays NS	7		
12		Column Spacing NS	5.14286	m	
13		No. Internals per Roof Bay	2		
14		One Way Decking Span in Roof Bay	2.57143	m	
15		Decking Span Direction in Roof Bay	NS		
16		No. Internals per Upper Floor Bay	2		
17		One Way Decking Span in Upper Floor Bay	3	m	
18		Decking Span Direction in Upper Floor Bay	EW		
19		Total Floor Area	4320	mÂ²	
20	Construction Summary	Building Type	B Offices		

bill_of_material_Softwood Joist

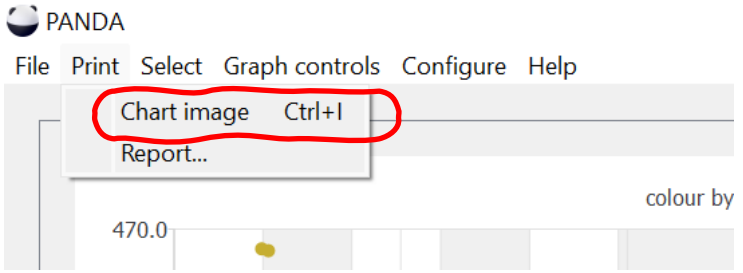
© Structural PANDA 2022

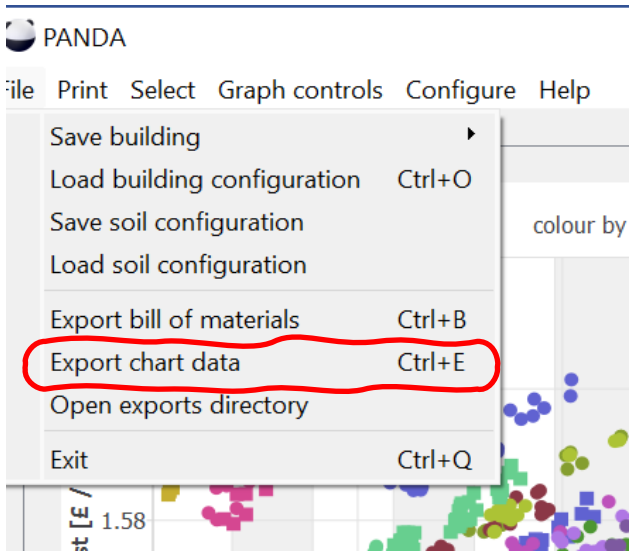
8.4 Export Chart data

Chart data can be down loaded to enable your own graphs and plots to be created.

To export the Chart Data:

- Select the required point on the graph
- Clicking “file” then “Export chart data”,
- Open and view these files from the export directory
- To save a copy of the chart image click ‘print’ and ‘chart image’





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	current																		
2	Life-cycle	Cradle to completion A1-5																	
3	Cost model	Default QS rates																	
4	Floor Area [m²]	Carbon [k	Cost [£/m	Carbon O	Decking T	Decking S	General D	General D	Frame typ	Superstru	Basement	Foundatio	Foundatio	Max Span	Min Span	Avg Bay A	Avg Bay A:	Structural	Steel Ma
5	4320	374.6	317.837	Yes	Millbank H	Millbank H	Precast De	Precast De	Precast De	Steel	RC	Pile Found	Suspende	7.2	6	43.2	0.833333	0.6546	16418
6	4320	303.695	294.416	No	Softwood	Softwood	Softwood	Softwood	Softwood	Steel	RC	Pad Founc	Suspende	6	6	36	1	0.698	12665
7	4320	462.296	245.502	Yes	Concrete :	Flat Slab	RC Deckin	Flat Slab	Flat Slab o	RC	RC	Raft Foun	Raft	8	6	48	0.75	0.3	16970
8	4320	350.201	316.358	No	Softwood	Softwood	Softwood	Softwood	Softwood	Steel	RC	Raft Foun	Raft	7.2	6	43.2	0.833333	0.6282	14996
9	4320	402.191	419.161	Yes	Softwood	Softwood	Softwood	Softwood	Softwood	Steel	RC	Pile Found	Suspende	9	8	72	0.888889	0.8081	19577
10	4320	456.249	312.871	Yes	Tata Comf	Tata Comf	Steel Deck	Steel Deck	Steel Deck	Steel	RC	Pile Found	Suspende	8	6	48	0.75	0.5508	29621
11	4320	409.978	303.263	No	KLH CLT (S	KLH CLT (S	CLT Deckir	CLT Deckir	CLT Deckir	Steel	RC	Raft Foun	Raft	8	5.14286	41.1429	0.642857	0.6498	17196
12	4320	489.907	374.672	Yes	McCann S	McCann S	Precast De	Precast De	Precast De	Steel	RC	Pile Found	Suspende	9	6	54	0.666667	0.8276	23236
13	4320	476.338	246.083	No	CMF MetF	CMF MetF	Steel Deck	Steel Deck	Steel Deck	Steel	RC	Raft Foun	Raft	8	7.2	57.6	0.9	0.5498	20733
14	4320	351.135	315.557	No	Softwood	Softwood	Softwood	Softwood	Softwood	Steel	RC	Raft Foun	Raft	7.2	6	43.2	0.833333	0.598	15149
15	4320	427.904	234.884	No	CMF MetF	CMF MetF	Steel Deck	Steel Deck	Steel Deck	Steel	RC	Pad Founc	Suspende	6	6	36	1	0.538	18715
16	4320	492.966	262.512	No	Tata Comf	Tata Comf	Steel Deck	Steel Deck	Steel Deck	Steel	RC	Raft Foun	Raft	9	6	54	0.666667	0.6	22899
17	4320	407.974	220.061	No	SMD TR80	SMD TR80	Steel Deck	Steel Deck	Steel Deck	Steel	RC	Pad Founc	Suspende	6	5.14286	30.8571	0.857143	0.3914	18443
18	4320	353.897	304.877	Yes	Millbank H	Millbank H	Precast De	Precast De	Precast De	Steel	RC	Pile Found	Suspende	6	6	36	1	0.505	15295
19	4320	544.274	276.303	Yes	Concrete ⁄	Flat Slab	RC Deckin	Flat Slab	Flat Slab o	RC	RC	Raft Foun	Raft	8	7.2	57.6	0.9	0.4	22425
20	4320	277.005	407.842	No	Softwood	Softwood	Softwood	Softwood	Softwood	Glulam	RC	Raft Foun	Raft	7.2	6	43.2	0.833333	1.025	65155

chart_data

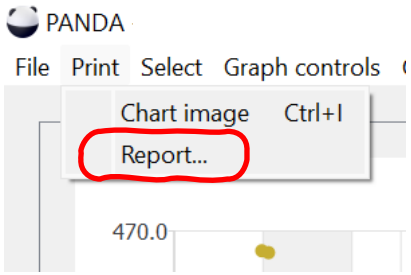
© Structural PANDA 2022

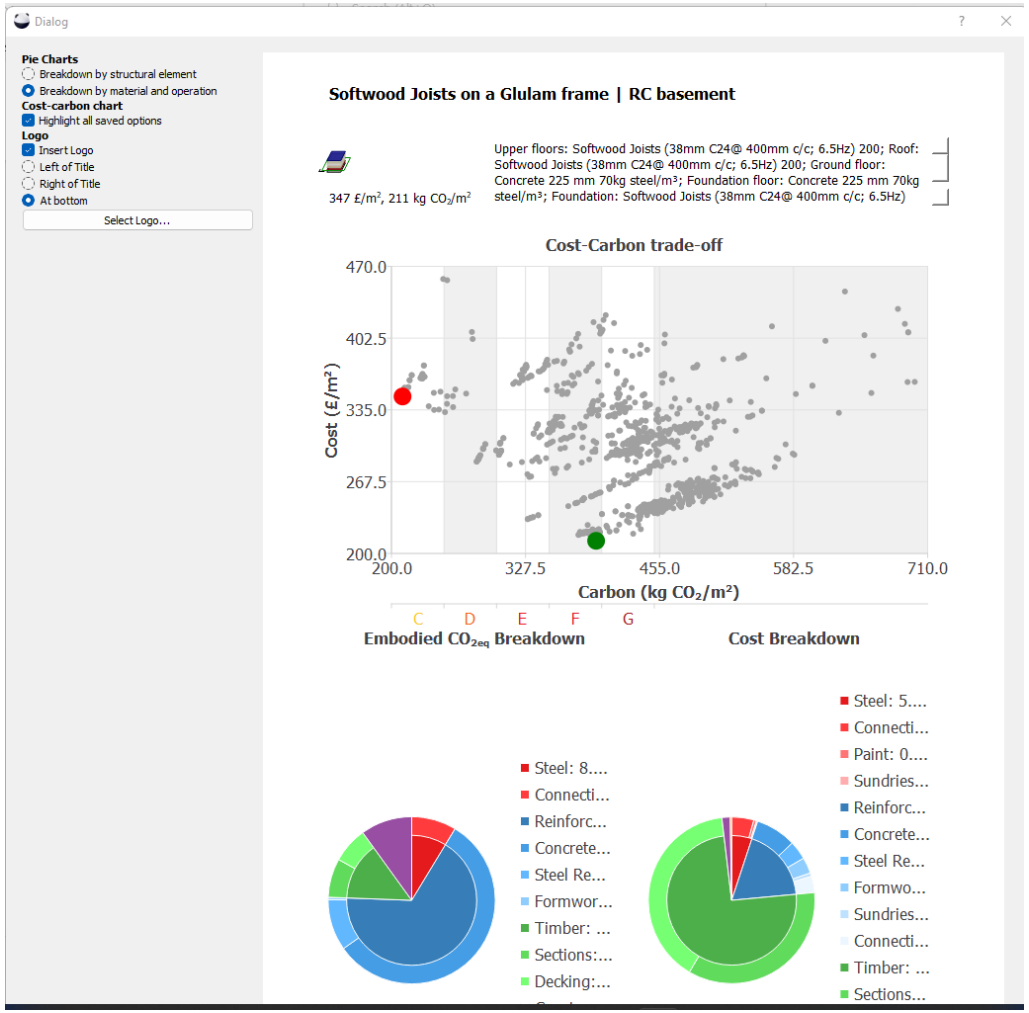
8.5 Output a summary data report

We have included a report generation feature to support meetings with clients and other stakeholders.

To export a summary data report:

- Select and save the solutions you'd like to include in the report.
- Click "print" then "report", to open the report dialogue
- Edit the report to add a logo, change the pie charts, and highlight saved options on the graph





© Structural PANDA 2022

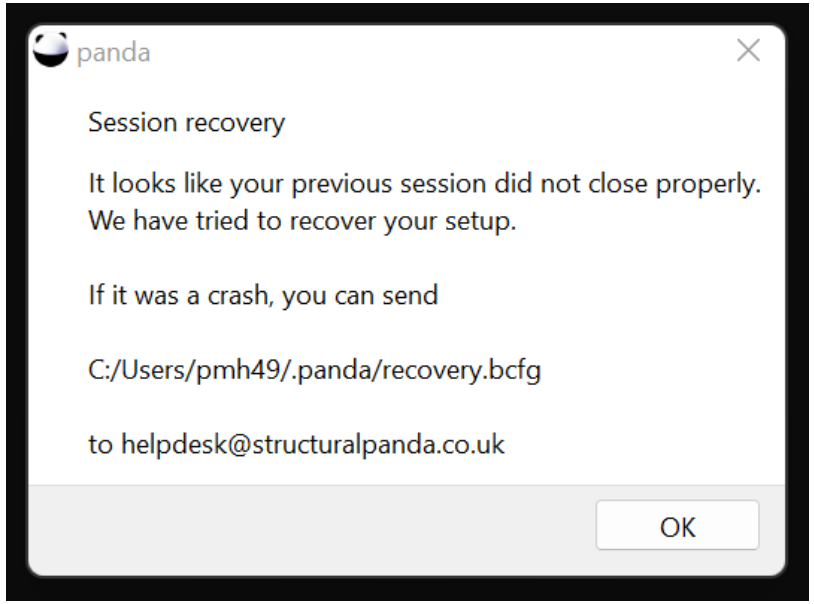
9. Troubleshooting

© Structural PANDA 2022

9.1 Crash reports

We are regularly developing PANDA and value your feedback

- when crashes occur, please let us know so we can investigate and fix problems.



© Structural PANDA 2022

9.2 Contact us for help

If you can’t find the information you need in this guide, please don’t hesitate to get in touch with us at:

helpdesk@structuralpanda.co.uk

We are always working to improve PANDA, if you have ideas for new features or improvements please get in touch. We’d love to hear them!

© Structural PANDA 2022