Positional Rules:

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Objective:
The aim of this document is to describe the minimum set of positional rules for the macro elements (such as Walls, Slabs and Stairs) of the ZuruTech Product, that allow the final assemblage to undergo a clash-free manufacturing process. This document is intended as an integration of the official PD Documentation.

Premise:
Every structural element is set on a 100x100 mm grid that is derived from the Slab's Rebars distance. This grid also shapes how the Slab behaves and how key elements, such as Structural Walls, Voids and Columns, interact with each other. The following set of Rules ensure that all structural elements are arranged so they make manufacturing compliant configurations.

Lexicon:
Slab's Rebars' Grid: 100x100mm Grid.
Pod's Grid: Described in the Slab chapter.
User's Grid: The grid the User draws on, described in the Strategies chapter.
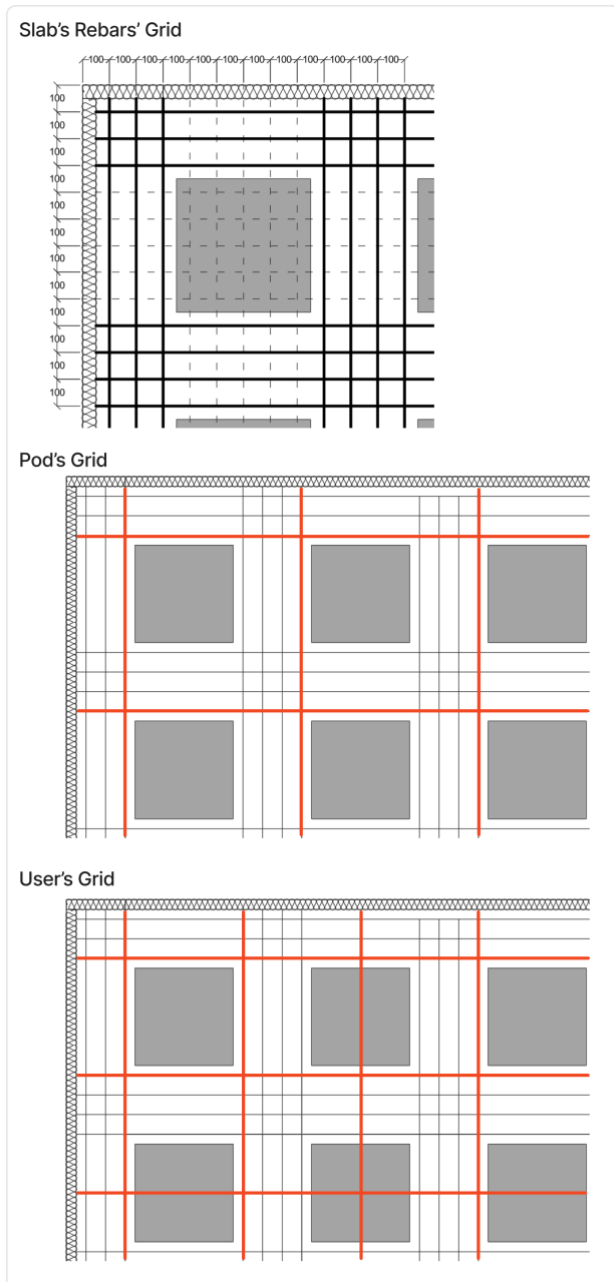
Structural Walls:

AAC Walls use AAC blocks with Steel Columns set along the internal face of the Wall. Every Wall needs at least two Steel Columns, one at each end. Walls have maximum length of 6m. There could be internal columns in the Walls for structural needs. Shall there be an opening – the Wall is split into smaller Walls.

Steel Columns have a 10x10cm 2d basis, which moves on the Slab's Rebars' Grid with its sides; Steel Columns are aligned in the length direction of the Wall.

In the current strategy, Walls can only snap their length to a 60cm grid.

The requirements of this chapter are based on these assumptions:
- Steel Columns are on the side.
- Current Pod catalogue (v1.5).
- A connected Slab has a unique Pod's Grid.
- Walls sit on multiple planes representing floors, that will be called Floor Planes.

A Wall can be described as (Image 1):
- Two Points, A and B:
  - Positioned on the external face of the Wall containing the Steel Columns, at the two corners of the Wall, Floor Plane level.
  - Always positioned so that the Right-Hand cross product between a vertical up vector and $\overrightarrow{AB}$ is a vector with same direction to a vector $\vec{t}$ taken from A or B and going into the direction of the other Wall's face. (Image 2).
- Two vectors, $\vec{d}$ and $\vec{n}$: $\vec{d}$ is equal to $\overrightarrow{AB}$ and $\vec{n}$ is the Right-Hand cross product between $\overrightarrow{AB}$ and is the Right-Hand cross product between a vertical-up vector.
- Two scalar values, h and t: h represents the height: h represents the height of the Wall, which ranges from 2500mm to 3100mm in steps of 100mm and t is the thickness of the Wall, also a discrete of the Wall as a discrete value ranging from 2500 to 3100 mm with 100 mm increments, while t represents the nominal thickness of the Wall, 200 mm or 300 mm
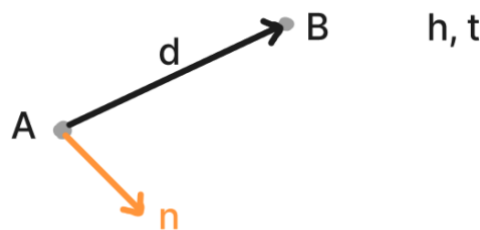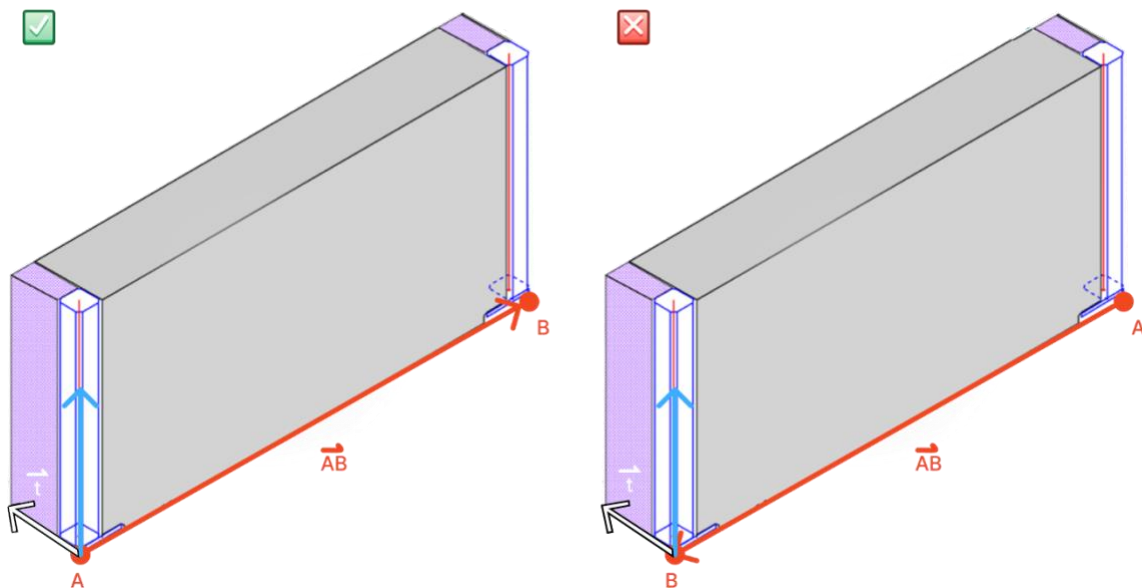

Image 1.

Image 2.

The requirements will be described for any couple of Walls that participate to the same Slab and are either sitting on the same Floor or in two consecutive Floors. Requirements:
1. Across the same Floor Plane each segment is separate and cannot overlap. Aligned Walls must share orientation and thickness.
2. Across different Floor Planes, overlapping segments must share orientation and thickness.
3. Minimum distance:

a. Aligned Walls must comply with requirements 1 and 2. If not aligned, minimum distance between parallel Walls is 600mm, Column's face to Column's face, except for the case of opposite orientation facing opposite, which requires 1200mm.
b. Between Perpendicular Walls there is no need for a minimum distance.
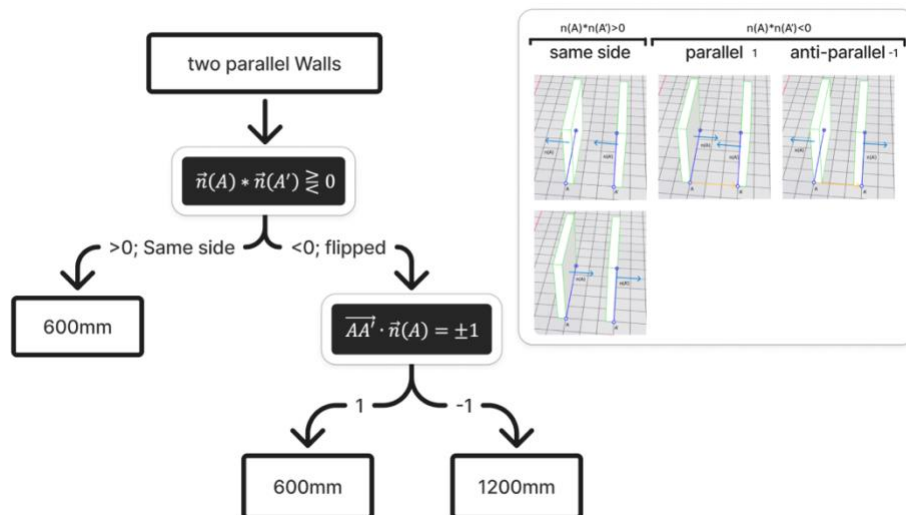
4. Each Wall making up the envelope of the building has its extremes connected with another Wall, either with a 90-degree angle or a 270-degree angle (this requirement excludes Blade Walls as a Product).
5. Minimum Length for a Wall should be 400mm from the 2 faces of the Wall (e.g. Wall between Openings), maximum length is bound to the Container dimension and is currently 6000mm.
6. Interaction with Slab:
   a. When interfacing with a Slab the Structural Wall generates a Beam:
      i. At least as thick as the Wall, with 2 Rebars under the Steel Column, on its sides.
      ii. At least as long as the Wall, terminating on the Pod's Grid.
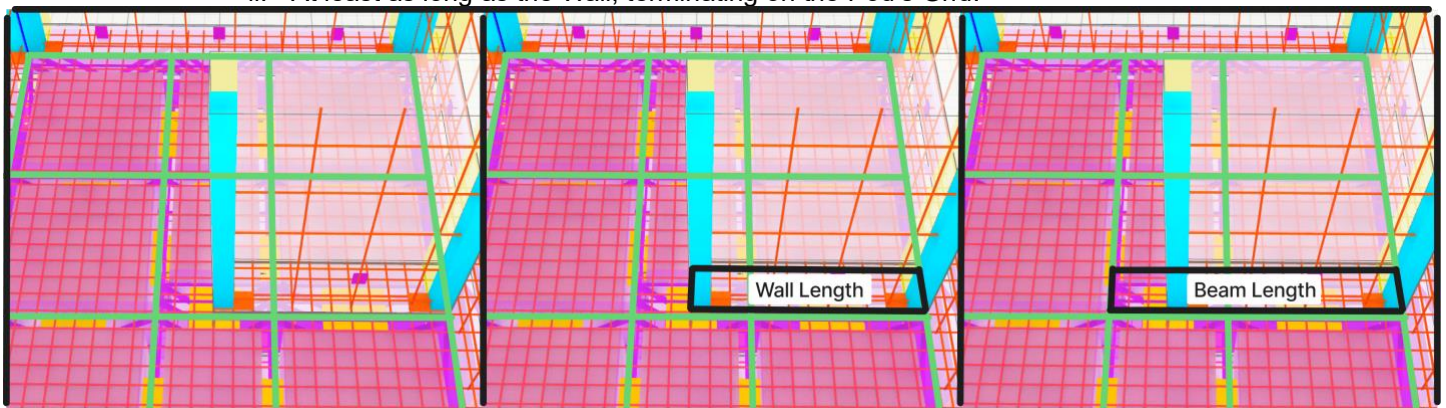
7. Interaction with Voids:
   a. Internal Wall: The Void can be 0mm to the face of the Wall without Steel Column. The Steel Column must be on the opposite face of the Wall.
   b. External Walls: The Void can be 0mm from the face of the Wall that has a Steel Column, interrupting the Edge Beam at the segment's ends and substituting the central part with a prefab Beam, thus forming a flush surface between the 2 consecutive Walls.
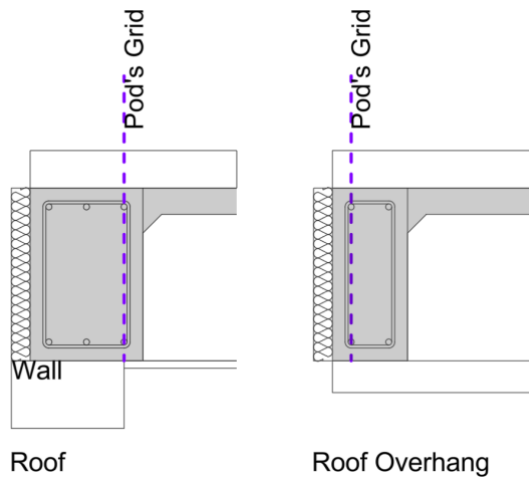
Slab:

A Slab is a Waffle Slab, made by combining concrete Beams and plastic Pods to make up the Pod's Grid. The Pod's Grid is made of rectangular Cells, using these standard sizes:

- 600 × 600 mm
- 600 × 900 mm
- 900 × 900 mm

Inside the Cell a Pod is always present, coherent with the Pod Catalog.

Requirements are the following:

1. The Pod's Grid must produce a lattice without any rectangle with sides less than 600mm in it. All influencing elements (Walls, Voids, Columns) must combine into a consistent, gap-free grid, with no segments narrower than 600 mm.
2. Each edge of a Slab's perimeter has an Edge Beam, in the following configurations:
   a. Matching a Structural Wall: The Edge Beam has the innermost Rebar (steel reinforcement) on the Pod's Grid.
   b. Free: The Edge Beam has the outermost Rebar on the Pod's Grid.

Roof   Roof Overhang

3. Minimum distances for the Slab refer only to the free edges and are bound to the Pod Catalog.
4. Every Beam that does not terminate with two convex corners has a virtual continuation in the Slab.
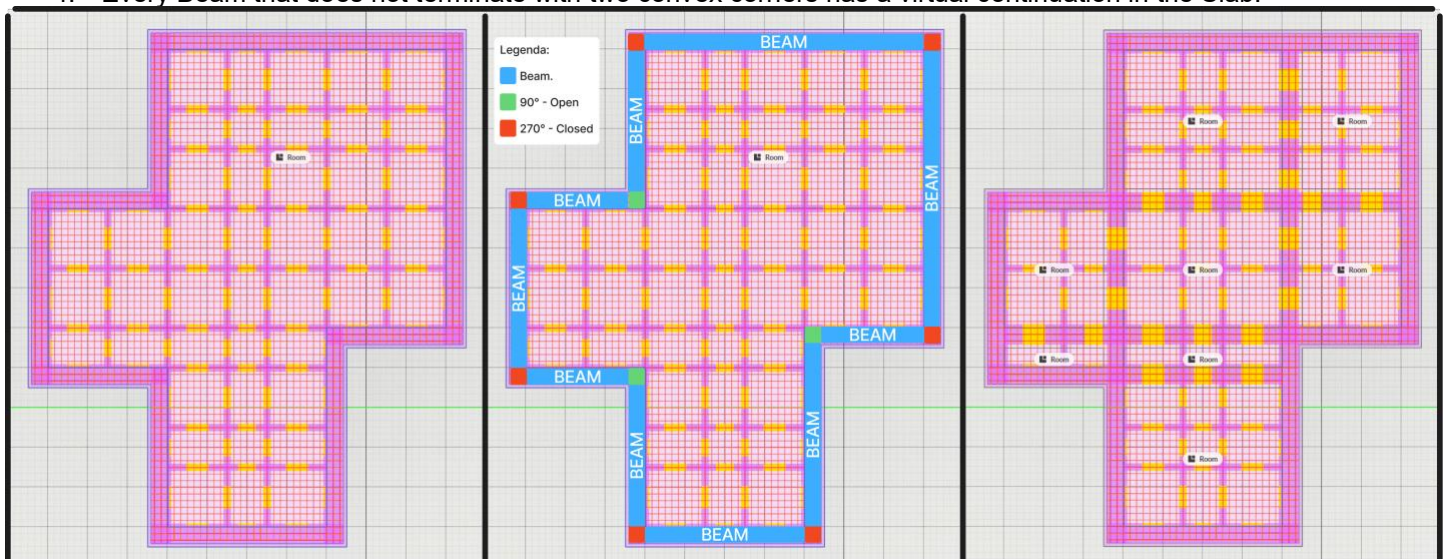
5. ~~The Slab's elements that contain Rebars must comply with the Pod Catalogue. This ensures the layout is factory compliant.~~

Columns:
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Current Strategy:
600mm Grid.

Next Future Strategy:
600mm Grid with additional limitations on the Walls, (requirement 3 needs to be implemented). Minimum dimension on the Slab Extension (requirement 3).

Having a 600mm User Grid already in place and knowing Walls are snapping on said Grid with their Column's face (Interior Side), implementing a minimum distance between Walls (face to face) of 300mm (thickness of the Wall plus external panel) should be sufficient.

Future Strategy:
300mm grid external + 100mm internal with local limitations.

Next Steps:
This document is not suited for company access and consultation, both in form and content. The next step should be to find a database structure to contain these rules and information, allowing for agile consultation and versioning.