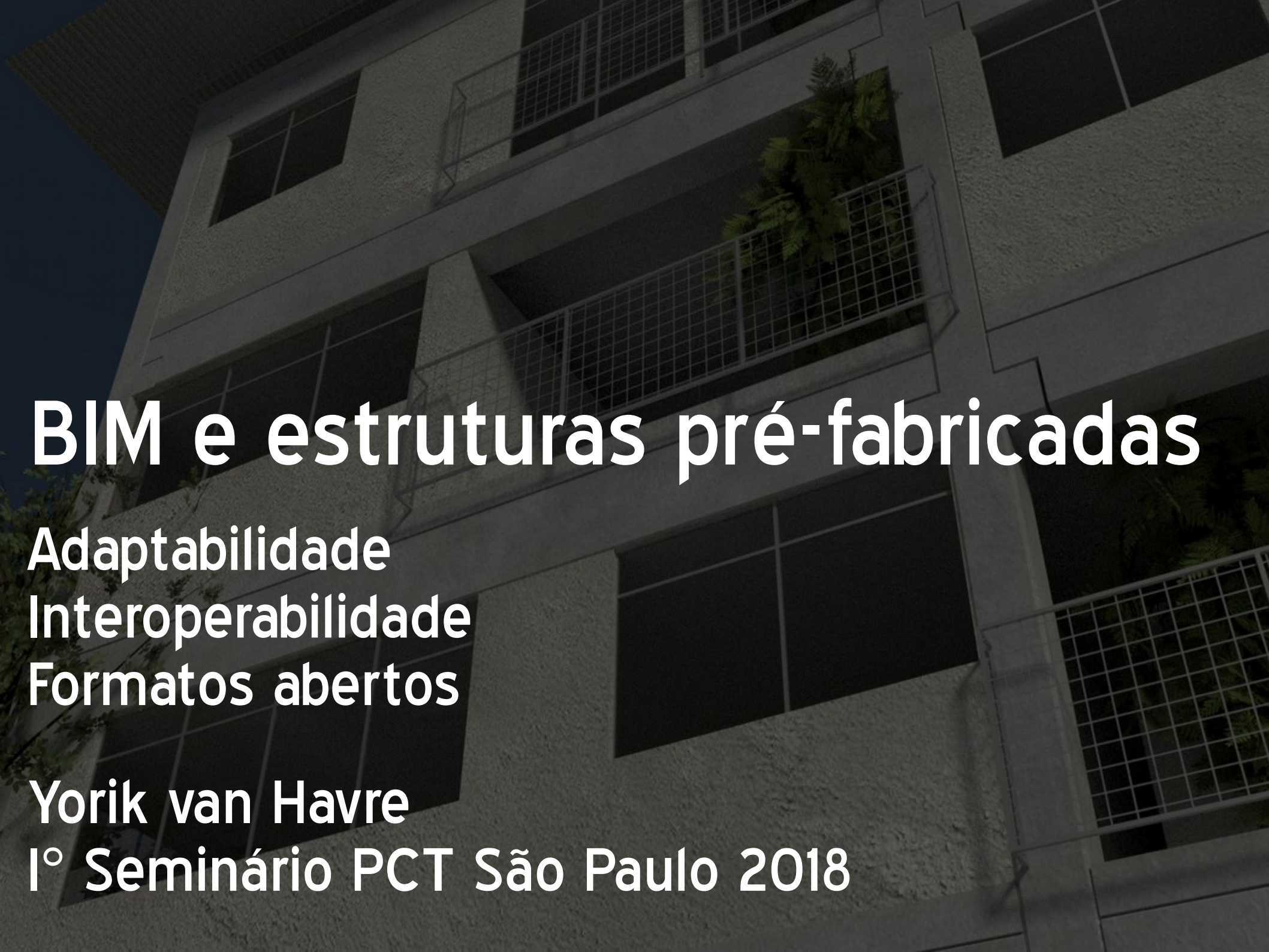


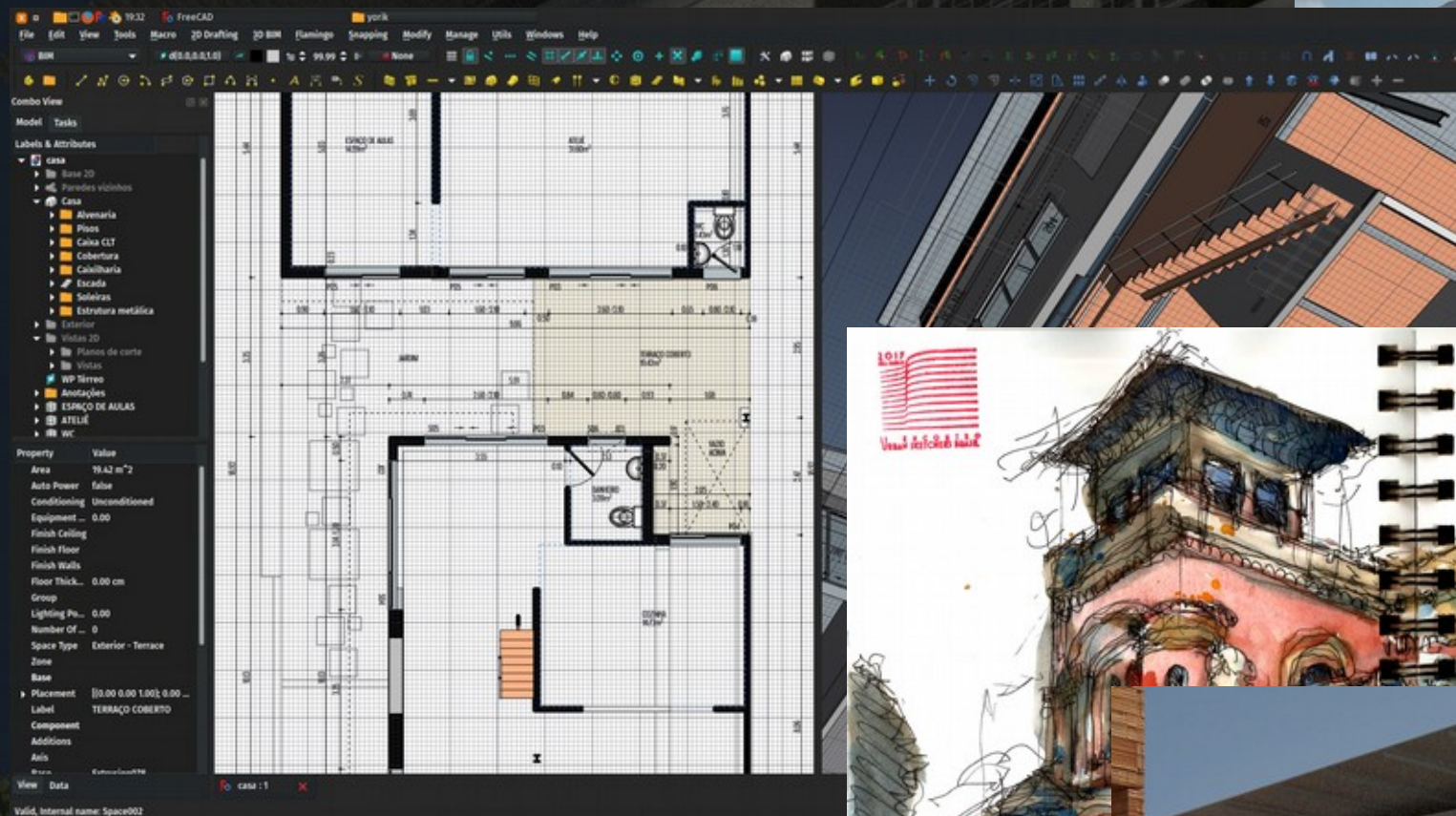


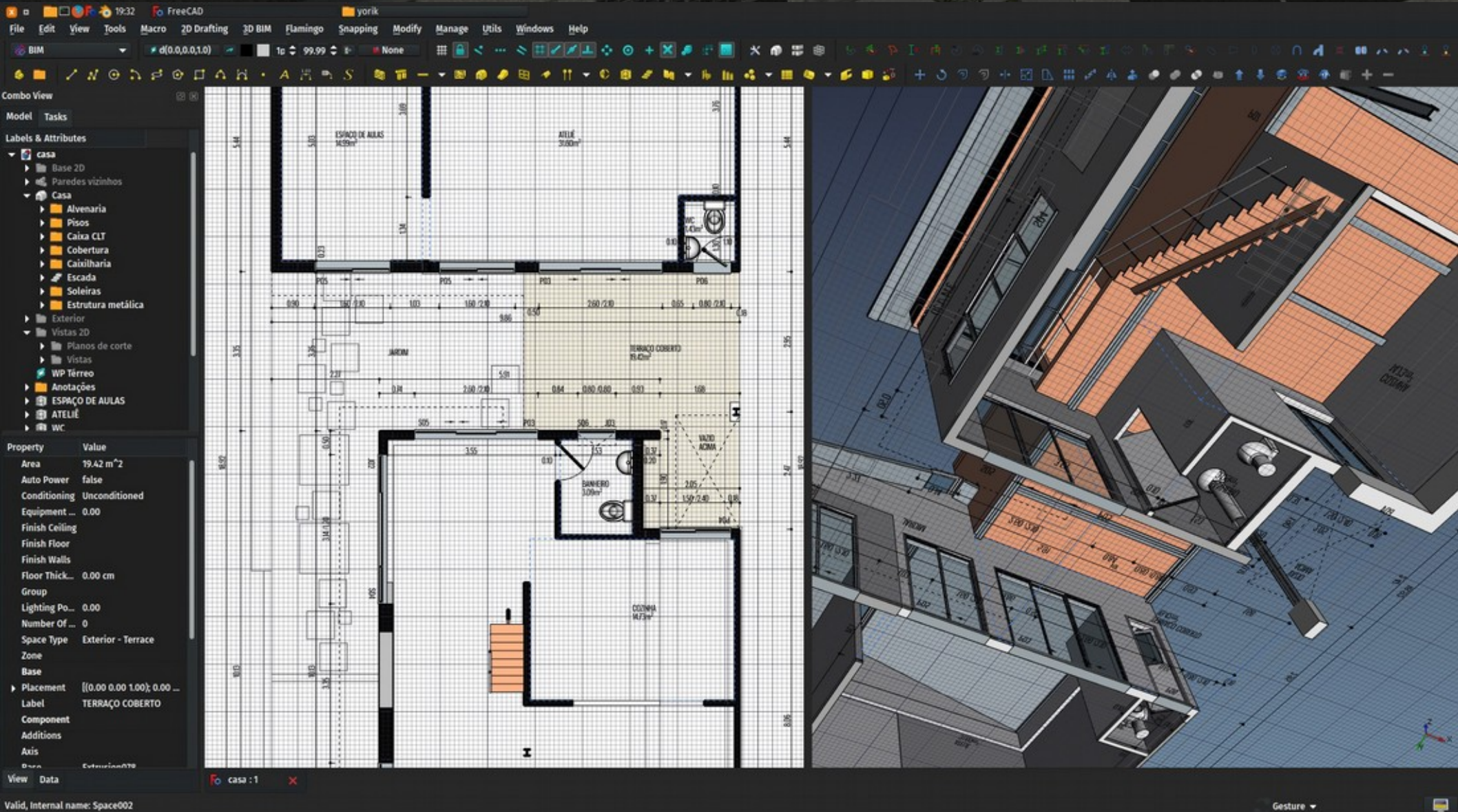
BIM e estruturas pré-fabricadas

Adaptabilidade
Interoperabilidade
Formatos abertos

Yorik van Havre

1º Seminário PCT São Paulo 2018





FreeCAD

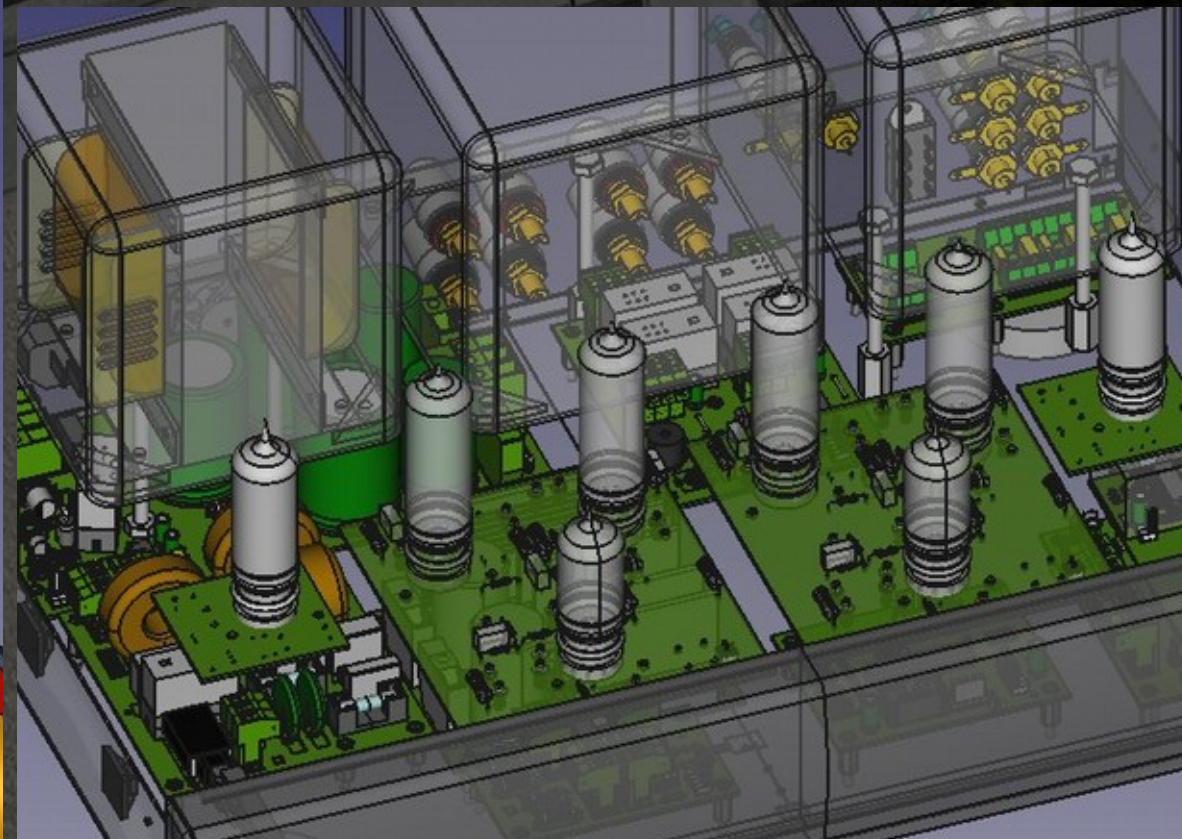
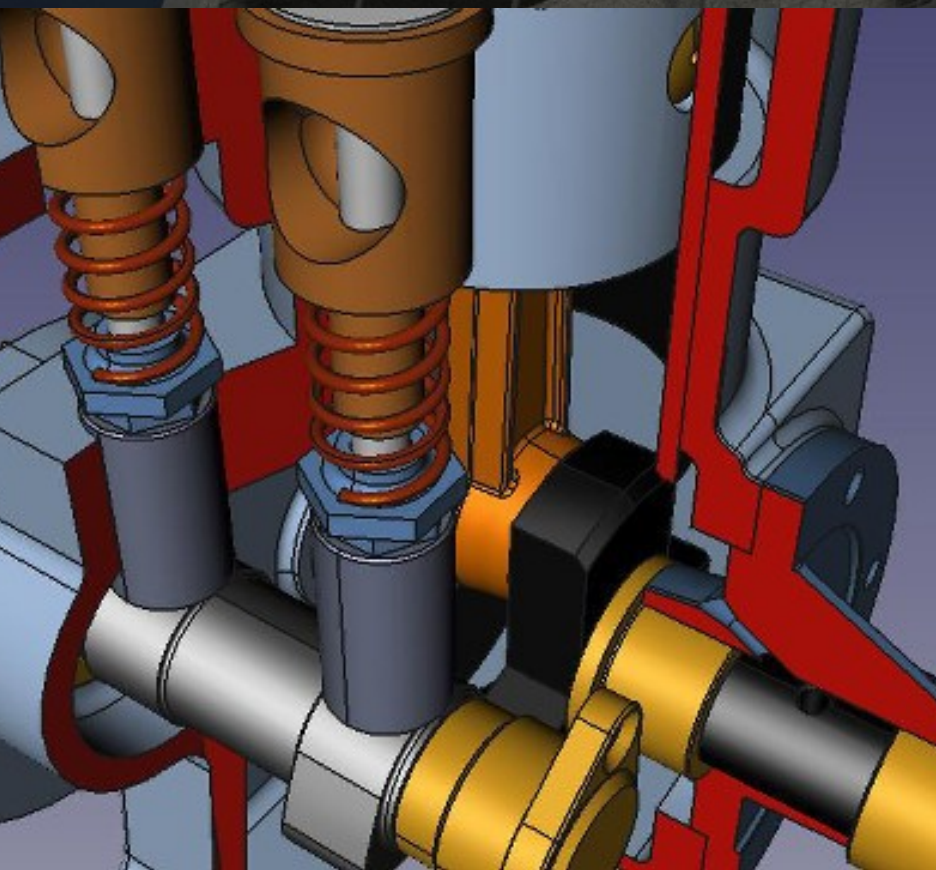
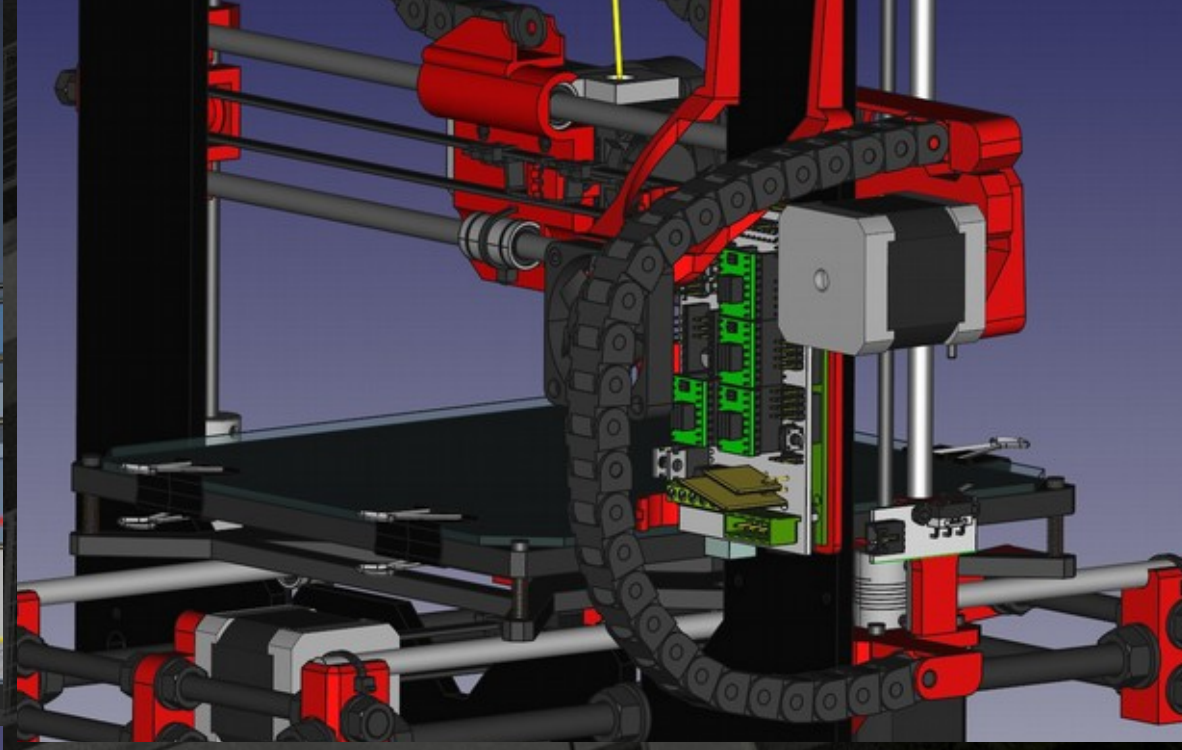
FreeCAD

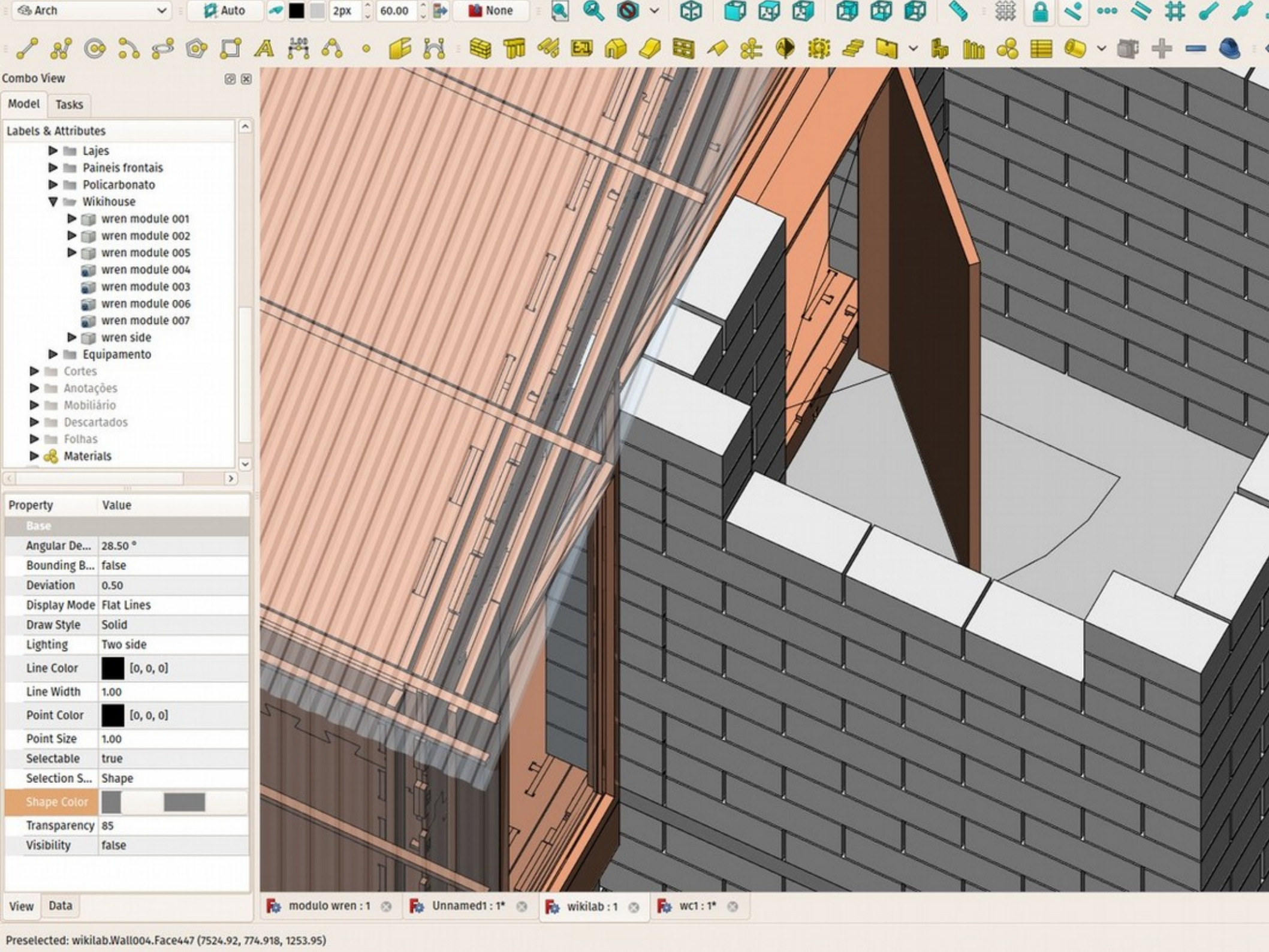
Software livre (gratuito, sem restrições de uso)

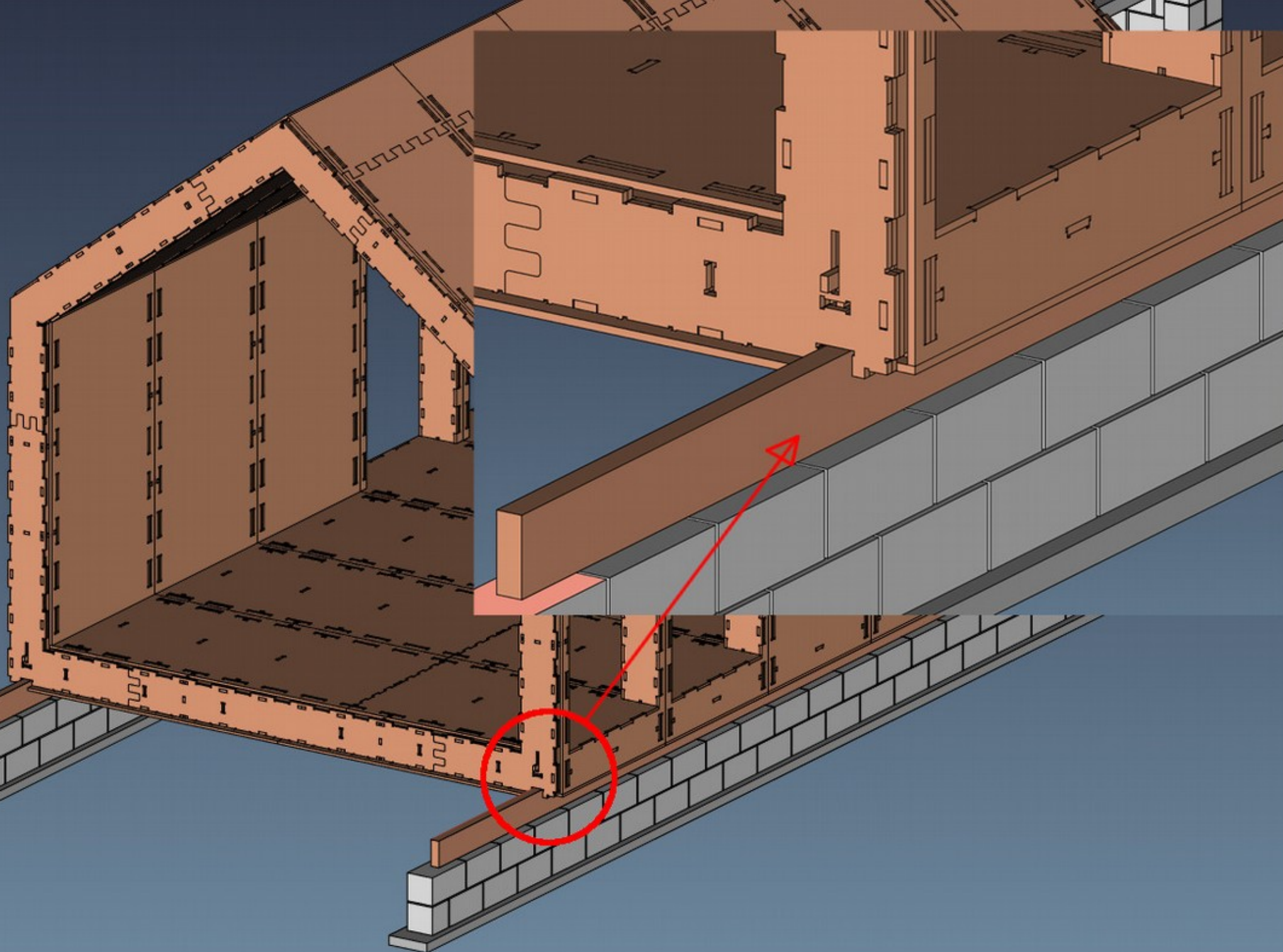
Modelagem 3D “técnica” (precisa)

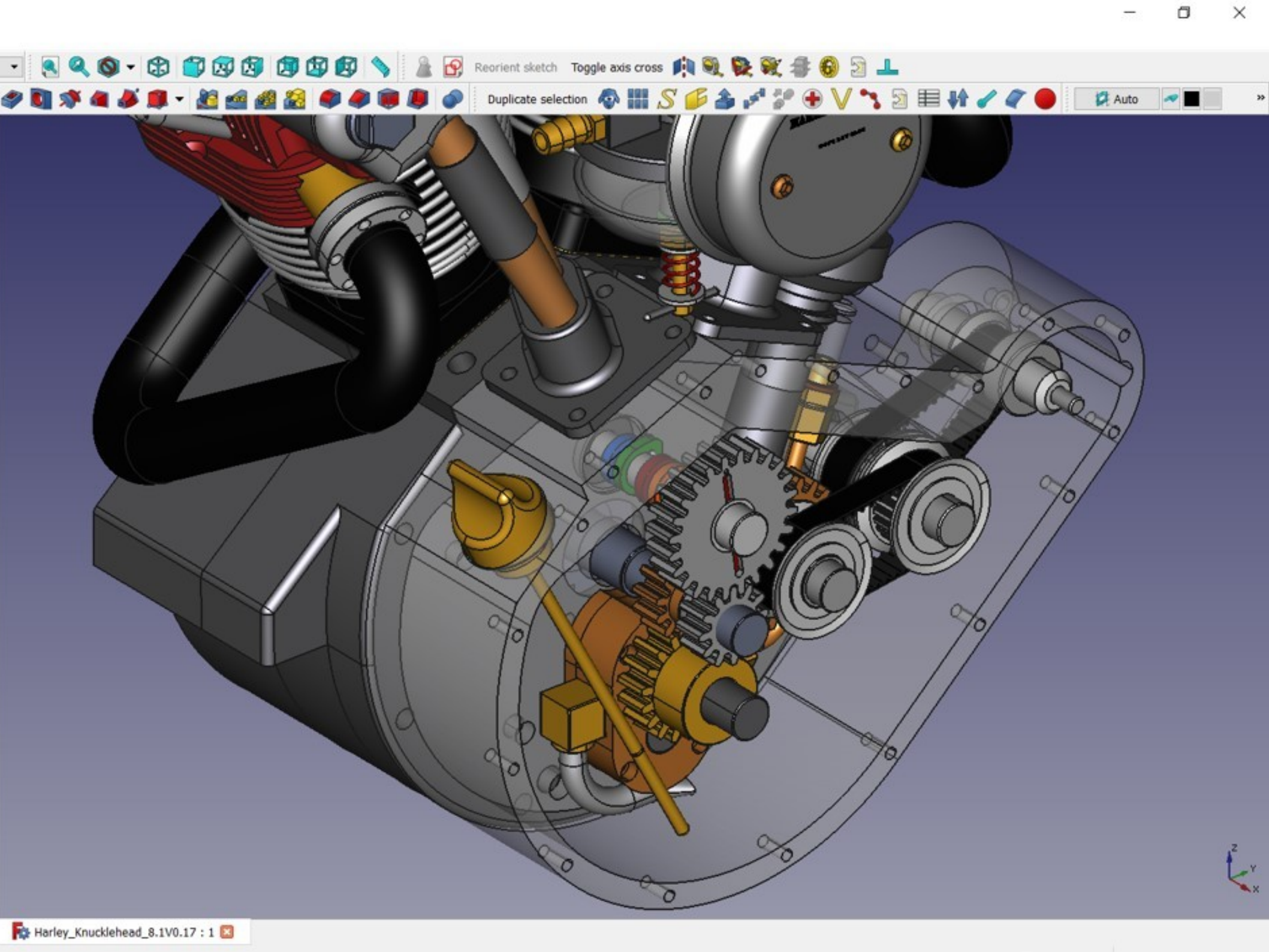
Desenvolvido por indivíduos ao redor do mundo

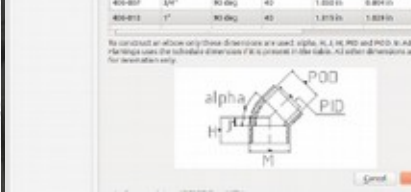
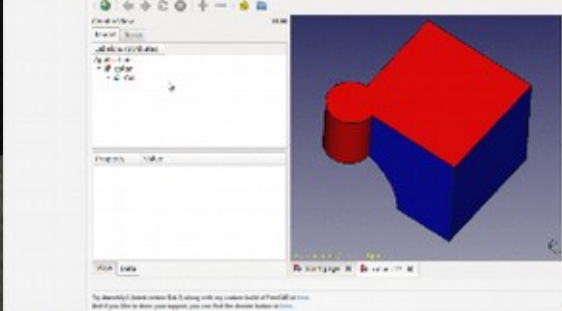
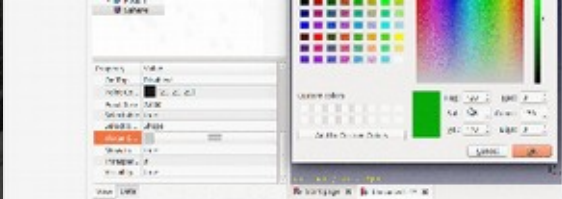
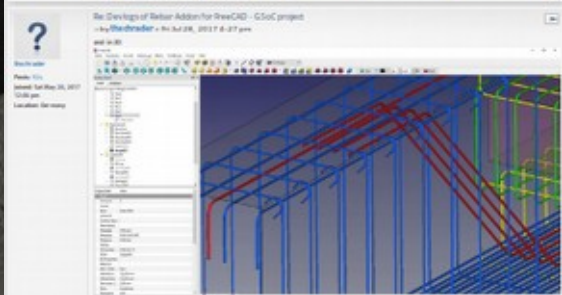
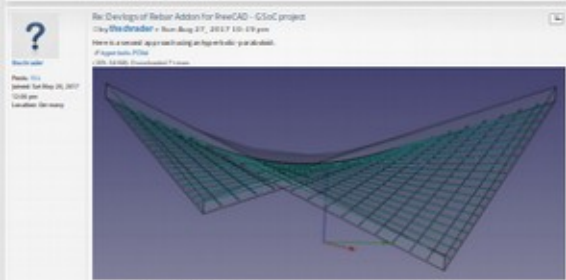
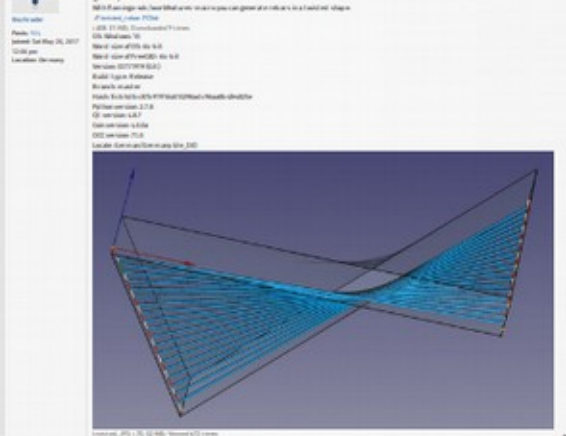
Multi-especialidade (arquitetura, engenharia, eletrônica, fabricação 3D, etc...)











Software livre

O código fonte é disponível on-line

Pode ser usado, modificado, redistribuído,
ou até vendido, sem restrição

Gratuito

Protegido contra possível compra (ficará livre
para sempre)

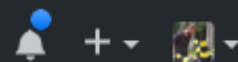
Quem desenvolve?

Pessoas ao redor do mundo

Ex-usuários insatisfeitos de soluções comerciais similares

Entusiastas de programação, fabricação 3D, etc

Programadores profissionais interessados pela dinâmica do projeto e o desafio

[Pull requests](#) [Issues](#) [Marketplace](#) [Explore](#)[FreeCAD](#) / [FreeCAD](#)[Unwatch](#) 376[★ Unstar](#) 2,577[Fork](#) 979[Code](#) [Pull requests 9](#) [Projects 0](#) [Insights](#) [Settings](#)

This is the official source code of FreeCAD, a free and opensource multiplatform 3D parametric modeler

[Edit](#)<http://www.freecadweb.org>[freecad](#) [engineering](#) [opencascade](#) [architecture](#) [cad](#) [bim](#) [fem](#) [3d](#) [3d-printing](#) [mac-osx](#) [linux](#) [coin](#) [windows](#) [Manage topics](#)[13,919 commits](#)[6 branches](#)[6 releases](#)[155 contributors](#)Branch: [master](#)[New pull request](#)[Create new file](#)[Upload files](#)[Find file](#)[Clone or download](#)[berndhahnebach](#) and [yorikvanhavre](#) Materials: use material directory pref from FEMLatest commit [05bee3a](#) 15 hours ago

.circleci	update circle-ci	5 months ago
.github	Misc. typos	6 months ago
cMake	fix cmake warning due to inconsistent naming	5 days ago
data	Fixed ArchDetail example	a month ago
package	Fix base number of commits	8 days ago
src	Materials: use material directory pref from FEM	3 hours ago
subuser/freecad-dev	Add subuser files for developing freecad within a Docker container.	2 years ago
vagrant	Misc. typos	5 months ago
.arconfig	add config for arcanist	3 years ago
.gitattributes	+ Shared library of Mefisto2F	4 years ago



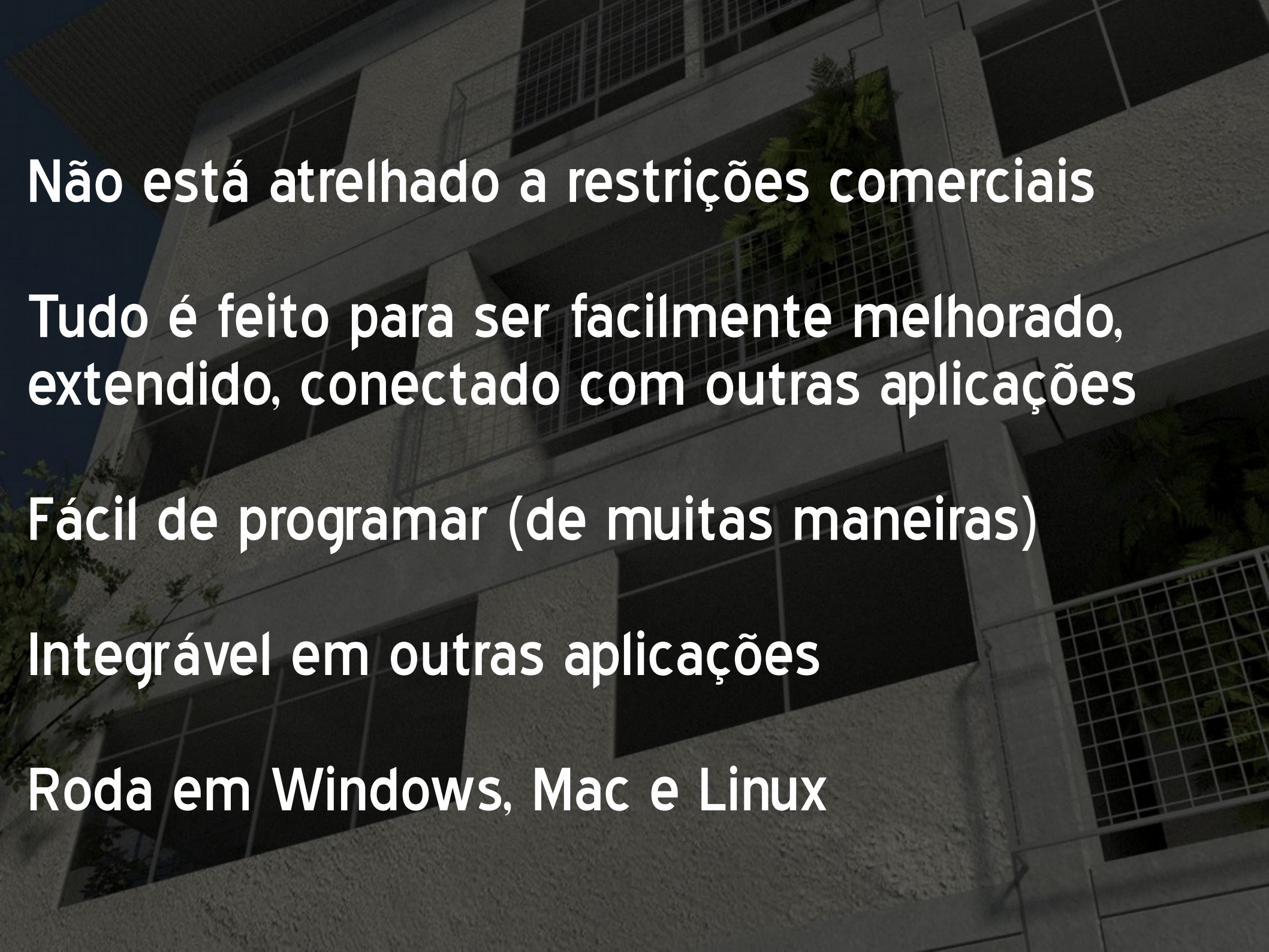
Import Export

This page gathers the different file formats that can be imported or exported from FreeCAD. Most of these file formats are implemented by a specific module. This module doesn't need to be loaded in order to import or export to that format.

Format	Description	Import	Export	Module	
FCStd	FreeCAD's native file format	yes	yes	Built-in	no
FCMat	FreeCAD Material Card	yes	yes	Built-in	no
FCMacro	FreeCAD Macro	yes	yes	Built-in	no
STEP	One of the most widely used exchange format for engineering models	yes	yes	Part	yes
STPZ	Compressed version of STEP exchange format for engineering models	yes	yes	Part	yes
IGES	A bit older but still much in use solid-based format	yes	yes	Part	yes
BREP	OpenCasCade's native format	yes	yes	Part	no
DXF	Autodesk Exchange Format. Only 2D geometry is supported	yes	yes	Draft	yes
DWG	Autocad main format. Only 2D geometry is supported. Requires the installation of external software.	yes	yes	Draft	yes
SVG	2D format widely used for vector graphics	yes	yes	Draft / Drawing	yes
OCA	Open CAD Format (obsolete, 2D-only format)	yes	yes	Draft	yes
IFC	Industry Foundation Classes, used to exchange BIM models. Requires the installation of external software.	yes	yes	Arch	yes
DAE	Collada format, used for exchange of mesh geometry	yes	yes	Arch	yes
OBJ	Mesh exchange format	yes	yes	Arch / Mesh	no
STL	Mesh exchange format mostly used for 3D printing	yes	yes	Mesh	no
BMS	Binary mesh exchange format	yes	yes	Mesh	no
AST	Mesh exchange format	yes	yes	Mesh	no
OFF	Mesh exchange format	yes	yes	Mesh	no
PLY	Mesh exchange format / Points cloud	yes	yes	Mesh / Points	no
INP	Abaqus format	yes	yes	FEM	no
POLY	Tetgen format	no	yes	FEM	no
UNV	FEM exchange format	yes	yes	FEM	no
MED	FEM exchange format	yes	yes	FEM	no
DAT	FEM exchange format (FEM) or 2D airfoil profile (Draft)	yes	yes	FEM / Draft	no
BDF	FEM exchange format	yes	no	FEM	no
FRD	CalculiX result format	yes	no	FEM	no
NC	G-Code file format	yes	yes	Path	no
GC	G-Code file format	yes	yes	Path	no
NCC	G-Code file format	yes	yes	Path	no
NGC	G-Code file format	yes	yes	Path	no
CNC	G-Code file format	yes	yes	Path	no
TAP	G-Code file format	yes	yes	Path	no
GCODE	G-Code file format	yes	yes	Path	no
EMN	IDF file format	yes	no	Idf	no
IV	OpenInventor file format	yes	yes	Built-in	no
VRML	Web 3D format	yes	yes	Built-in	no
WebGL (HTML)	Web 3D format	no	yes	Arch	no
SCAD	OpenSCAD file format	yes	yes	OpenSCAD	no
CSG	OpenSCAD Constructive Solid Geometry	yes	yes	OpenSCAD	no
ASC	Points cloud format	yes	no	Points	no
POV	Povray format	no	yes	Raytracing	no
CSV	Comma-separated values spreadsheet	yes	yes	Spreadsheet	no
PDF	Adobe portable document format	no	yes	Built-in	no

Other languages:

Deutsch • English • español • français • italiano • português • русский • 中文 (中国大陆)



Não está atrelado a restrições comerciais

Tudo é feito para ser facilmente melhorado,
extendido, conectado com outras aplicações

Fácil de programar (de muitas maneiras)

Integrável em outras aplicações

Roda em Windows, Mac e Linux

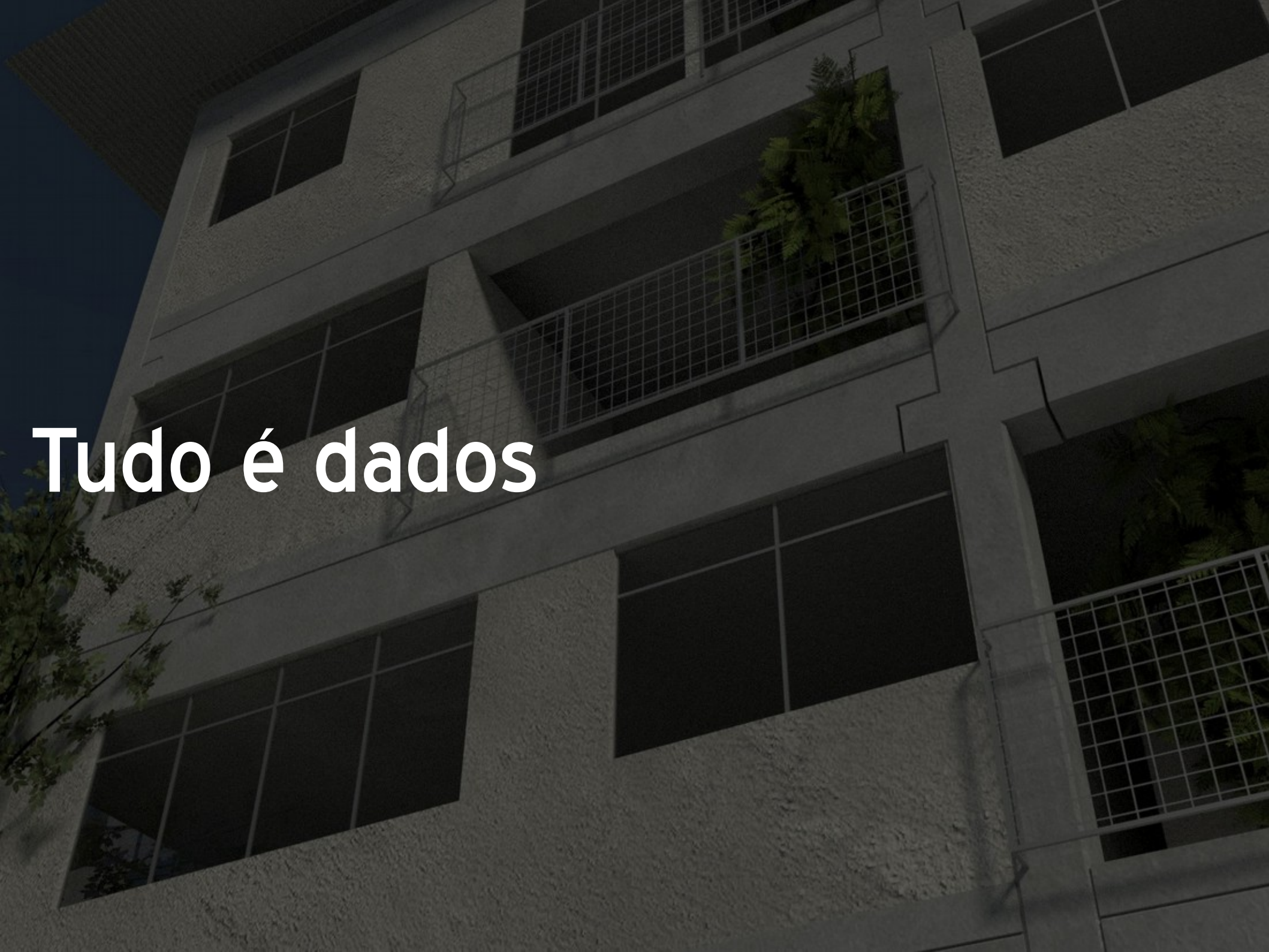
Formatos abertos

O formato nativo do FreeCAD é um ZIP

Arquivos novos abrem em versões antigas do programa

Muito boa compatibilidade com formatos abertos (IFC, STEP, DXF, DAE, CSV, etc...)

O usuário é o dono dos dados



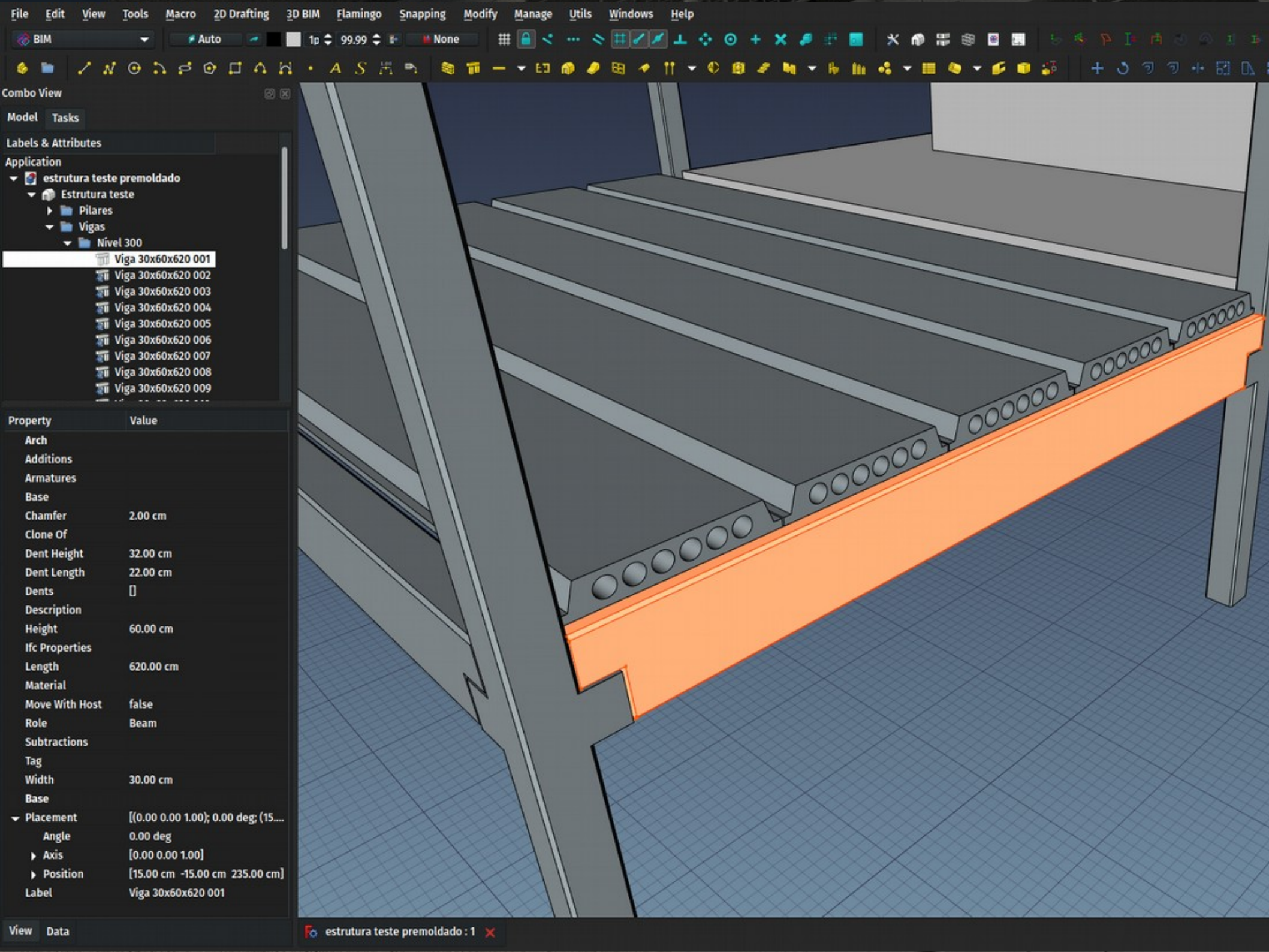
Tudo é dados







View Data



Combo View

Model Tasks

Labels & Attributes

Application

▼ estrutura teste premoldado

▼ Estrutura teste

► Pilares

► Vigas

▼ Nível 300

Viga 30x60x620 001

Viga 30x60x620 002

Viga 30x60x620 003

Viga 30x60x620 004

Viga 30x60x620 005

Viga 30x60x620 006

Viga 30x60x620 007

Viga 30x60x620 008

Viga 30x60x620 009

Viga 30x60x620 010

Viga 30x60x620 011

Viga 30x60x620 012

Viga 30x60x620 013

Viga 30x60x620 014

Viga 30x60x620 015

Viga 30x60x620 016

Viga 30x60x620 017

Viga 30x60x620 018

Viga 30x60x620 019

Viga 30x60x620 020

Viga 30x60x620 021

Viga 30x60x620 022

Viga 30x60x620 023

Viga 30x60x620 024

Viga 30x60x620 025

Viga 30x60x620 026

Viga 30x60x620 027

Viga 30x60x620 028

Viga 30x60x620 029

Viga 30x60x620 030

Viga 30x60x620 031

Viga 30x60x620 032

Viga 30x60x620 033

Viga 30x60x620 034

Viga 30x60x620 035

Viga 30x60x620 036

Viga 30x60x620 037

Viga 30x60x620 038

Viga 30x60x620 039

Viga 30x60x620 040

Viga 30x60x620 041

Viga 30x60x620 042

Viga 30x60x620 043

Viga 30x60x620 044

Property Value

Arch

Additions

Armatures

Base

Chamfer 2.00 cm

Clone Of

Dent Height 32.00 cm

Dent Length 22.00 cm

Dents []

Description

Height 60.00 cm

Ifc Properties

Length 620.00 cm

Material

Move With Host false

Role Beam

Subtractions

Tag

Width 30.00 cm

Base

▼ Placement [(0.00 0.00 1.00); 0.00 deg; (15....

Angle 0.00 deg

► Axis [0.00 0.00 1.00]

► Position [15.00 cm -15.00 cm 235.00 cm]

Label Viga 30x60x620 001

View Data

estrutura teste premoldado : 1

Combo View

Model Tasks

Drawing mode:

☐ Beam ☒ Column

Category: Precast concrete

Preset: Beam

Length: 20.00 cm ✓

Width: 20.00 cm ✓

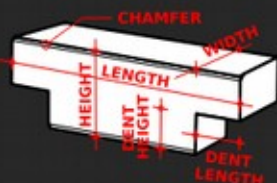
Height: 200.00 cm ✓

Switch L/H

Switch L/W

Continue ☐

 Precast elements



Chamfer: 0.00 ✓

Dent length: 0.00 ✓

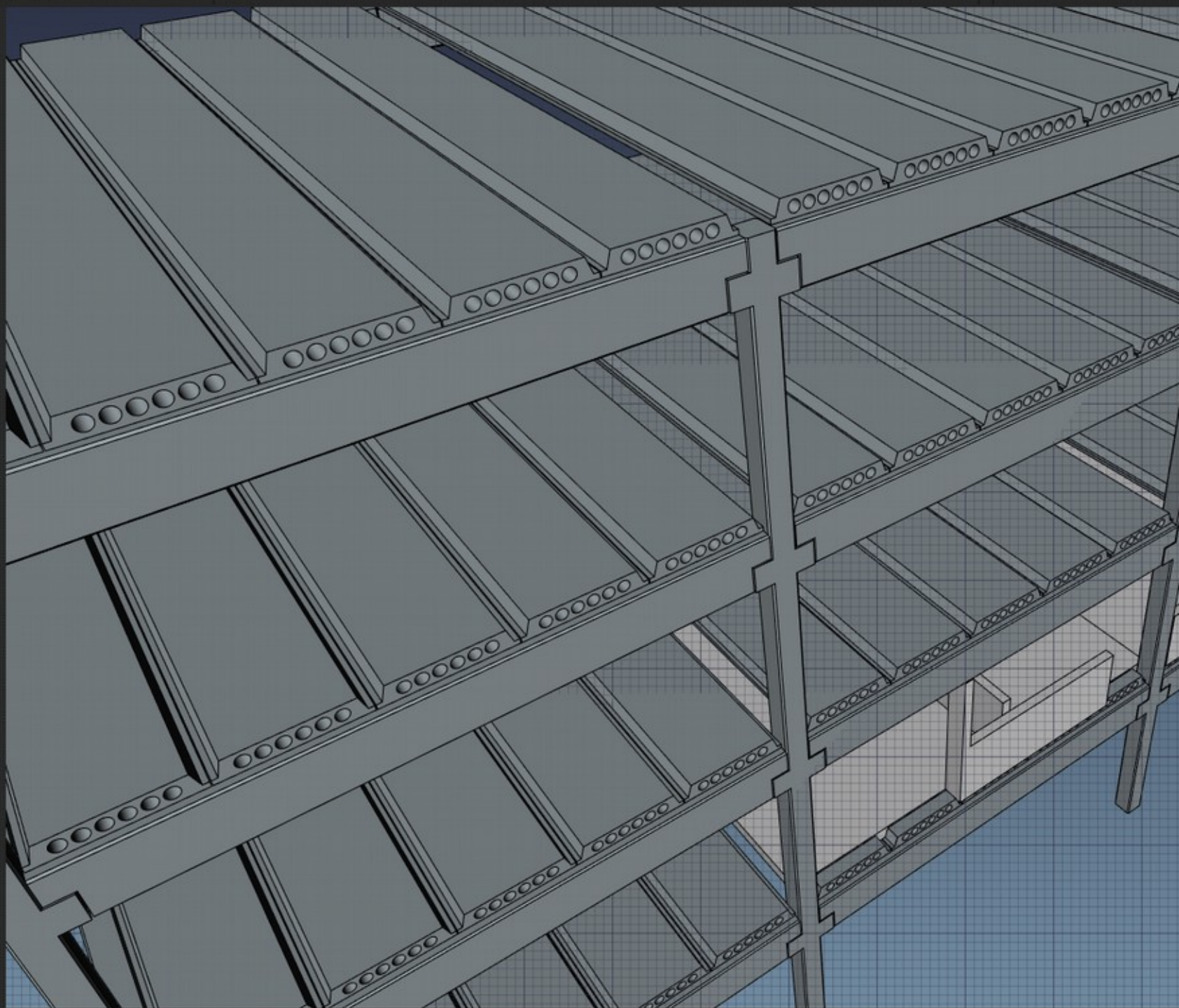
Dent height: 0.00 ✓

 Precast options

Dents list

Add dent

Remove dent



 estrutura teste premoldado : 1 ✕

Combo View

ModelTasks

Local Z0.00 cm

Enter point

Structure options

Drawing mode:
☐ Beam ☒ Column

CategoryPrestcast concrete

PresetSlab

Length20.00 cm

Width20.00 cm

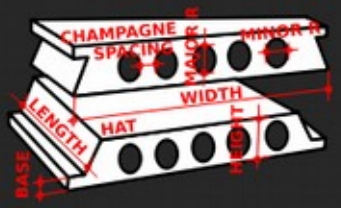
Height200.00 cm

Switch L/H

Switch L/W

Continue

Precast elements



Slab typeChampagne

Slab base0.00

Number of holes0

Major diameter of holes0.00

Minor diameter of holes0.00

Spacing between holes0.00

Precast options

Combo View

ModelTasks

Close

Point

Local X-240.03 cm

Local Y1322.57 cm

Local Z0.00 cm

Enter point

Structure options

Drawing mode:
☐ Beam ☒ Column

CategoryPrestcast concrete

PresetI-Beam

Length20.00 cm

Width20.00 cm

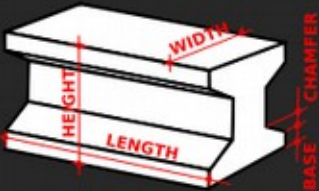
Height200.00 cm

Switch L/H

Switch L/W

Continue

Precast elements



Chamfer0.00

Slab base0.00

Precast options

Combo View

ModelTasks

PresetPillar

Length20.00 cm

Width20.00 cm

Height200.00 cm

Switch L/H

Switch L/W

Continue

Precast elements



Chamfer0.00

Number of grooves0

Depth of grooves0.00

Height of grooves0.00

Spacing between grooves0.00

Precast options

Dents list

Add dent

Remove dent



Length0.00

Combo View

ModelTasks

Point

Local X-370.59 cm

Local Y673.42 cm

Local Z0.00 cm

Enter point

Structure options

Drawing mode:
☐ Beam ☒ Column

CategoryPrestcast concrete

PresetPanel

Length20.00 cm

Width20.00 cm

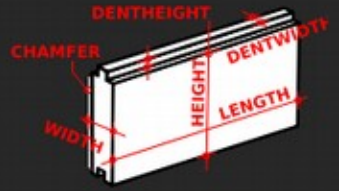
Height200.00 cm

Switch L/H

Switch L/W

Continue

Precast elements



Chamfer0.00

Dent width0.00

Dent height0.00

Precast options

Tudo é dados

Altura

Comprimento

Espessura

Nome

Tipo

Chamfro

Número de furos

Diâmetro dos furos

Perfil

medida

medida

medida

texto

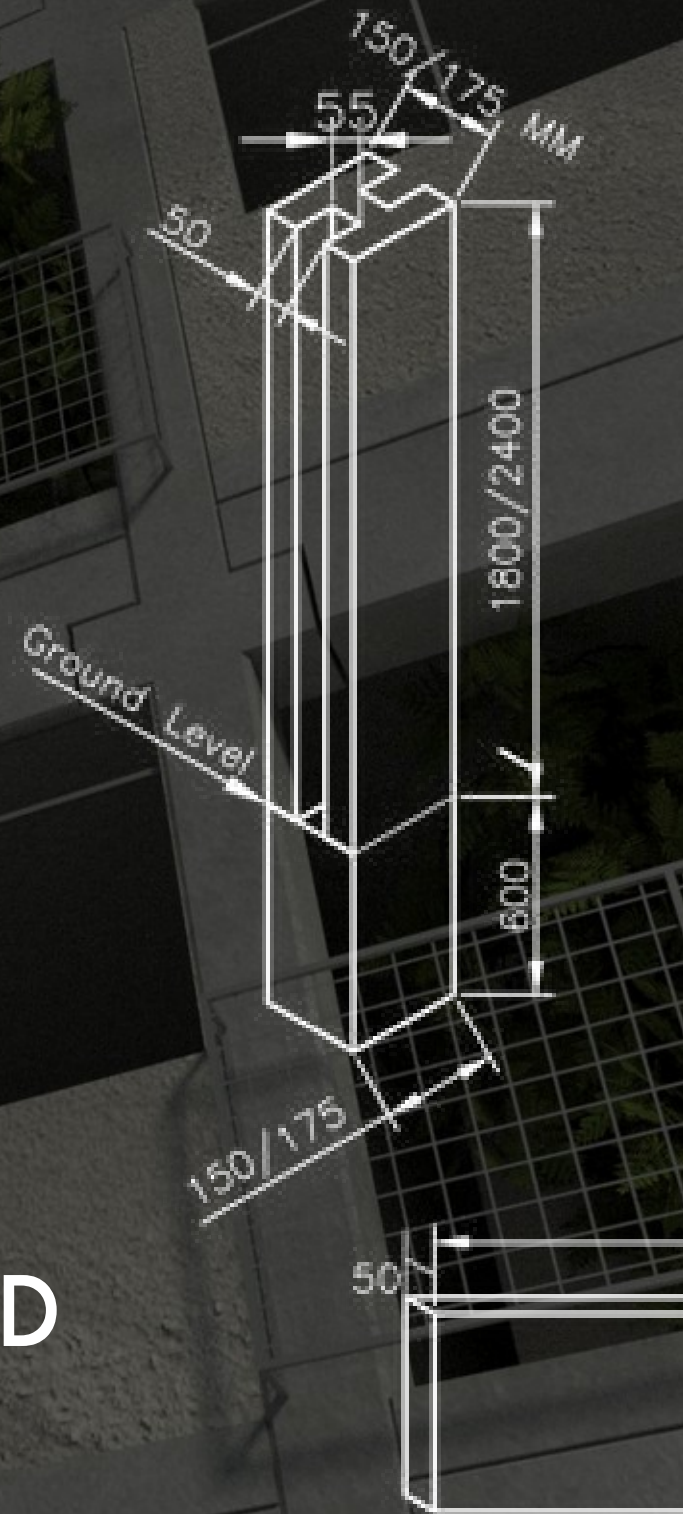
texto

medida

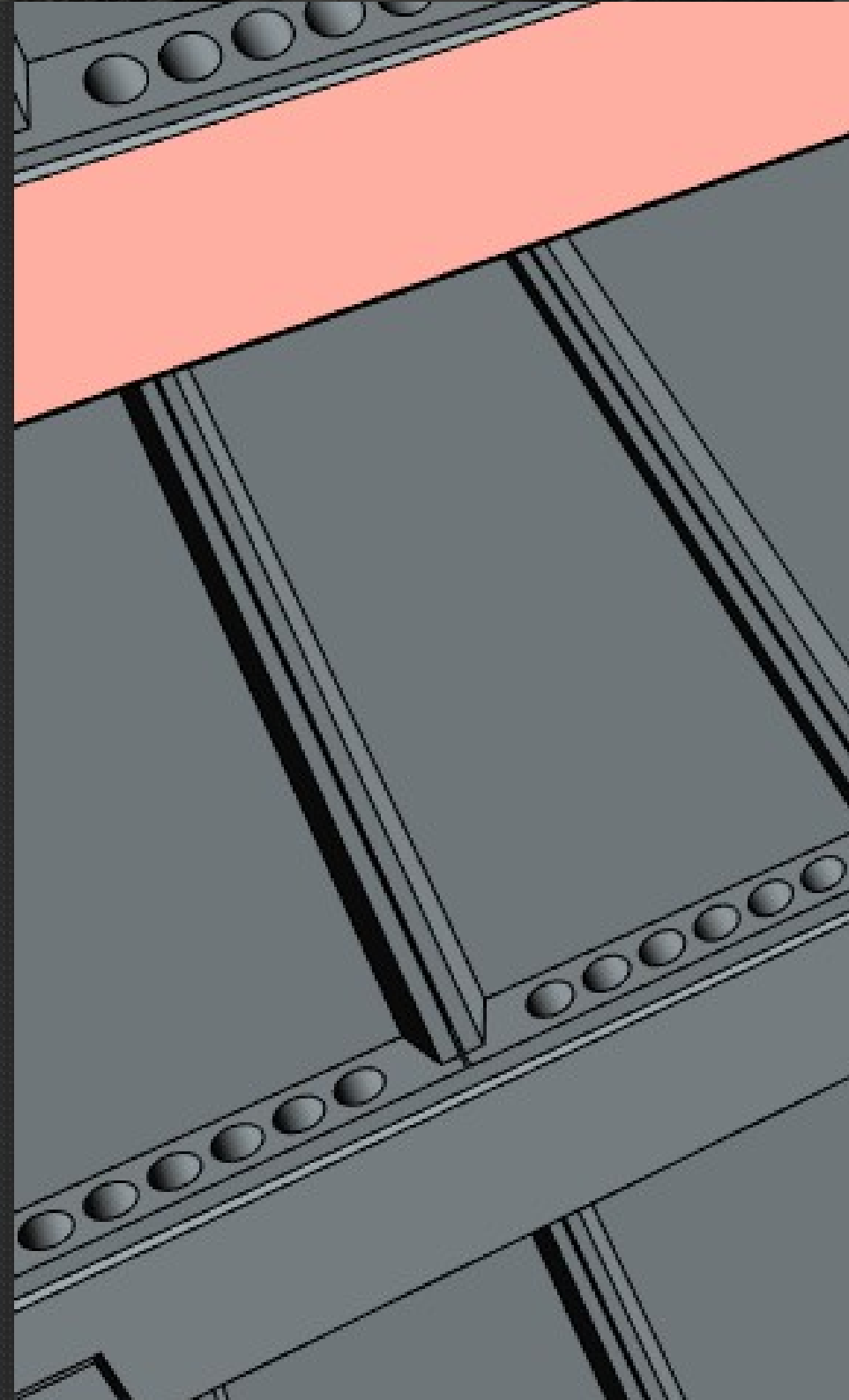
número

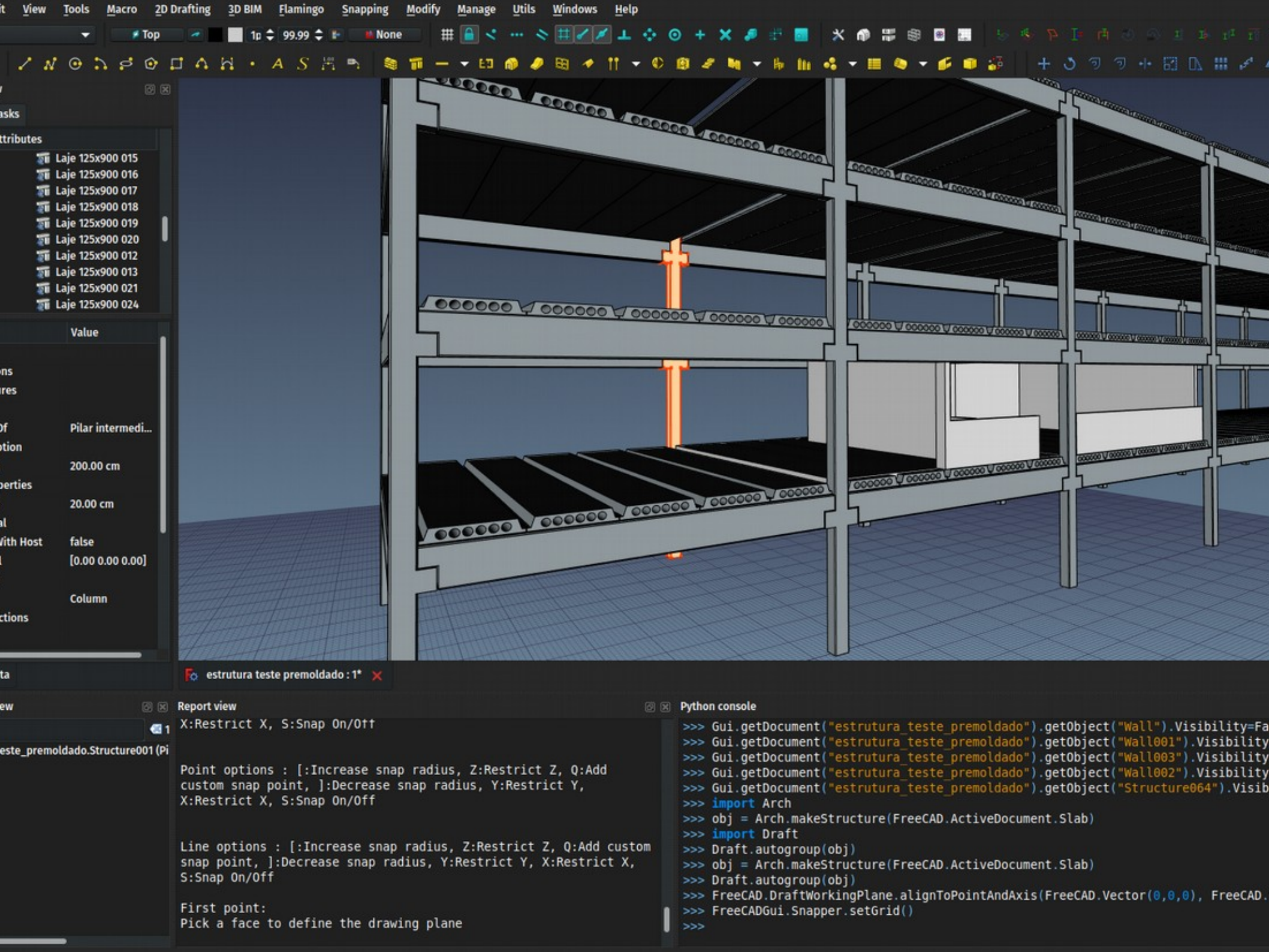
medida

desenho 2D



Property	Value
Arch	
Additions	
Armatures	
Base	
Clone Of	
Description	
Height	20.00 cm
Hole Major	12.00 cm
Hole Minor	12.00 cm
Hole Number	6
Hole Spacing	3.00 cm
Ifc Properties	
Length	910.00 cm
Material	
Move With Host	false
Role	Slab
Slab Base	5.00 cm
Slab Type	Hat
Subtractions	
Tag	
Width	123.00 cm







```
Python console

>>> FreeCAD.DraftWorkingPlane.alignToPointAndAxis(FreeCAD.Vector(0,0,0))
>>> FreeCADGui.Snapper.setGrid()
>>>
>>> selection = FreeCADGui.Selection.getSelection()
>>>
>>> for obj in selection:
...     print obj.Label, " : ",obj.Height
...
Pilar de canto 30x30x1200 001 : 12000 mm
Pilar intermediário 30x30x1200 001 : 12000 mm
Pilar intermediário 30x30x1200 003 : 12000 mm
Pilar intermediário 30x30x1200 005 : 12000 mm
Pilar intermediário 30x30x1200 007 : 12000 mm
>>>
```


File Edit View Insert Format Styles Sheet Data Tools Window Help					
D18					
	A	B	C	D	
1	Label	Altura	Largura	Comprimento	
2					
3	Pilar de canto 30x30x1200 001	12000	300	300	
4	Pilar intermediário 30x30x1200 001	12000	300	300	
5	Pilar intermediário 30x30x1200 003	12000	300	300	
6	Pilar intermediário 30x30x1200 005	12000	300	300	
7	Pilar intermediário 30x30x1200 007	12000	300	300	
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					

Possibilidades ilimitadas

Volume de concreto

Tipo de concreto

Tipo de ferragem

Comprimento de barras

Volume de aço

Peso total

Data da concretagem

Ensaio

Responsável concretagem

Acabamento

Forma

Esperas

Ganchos

Lote

Usina

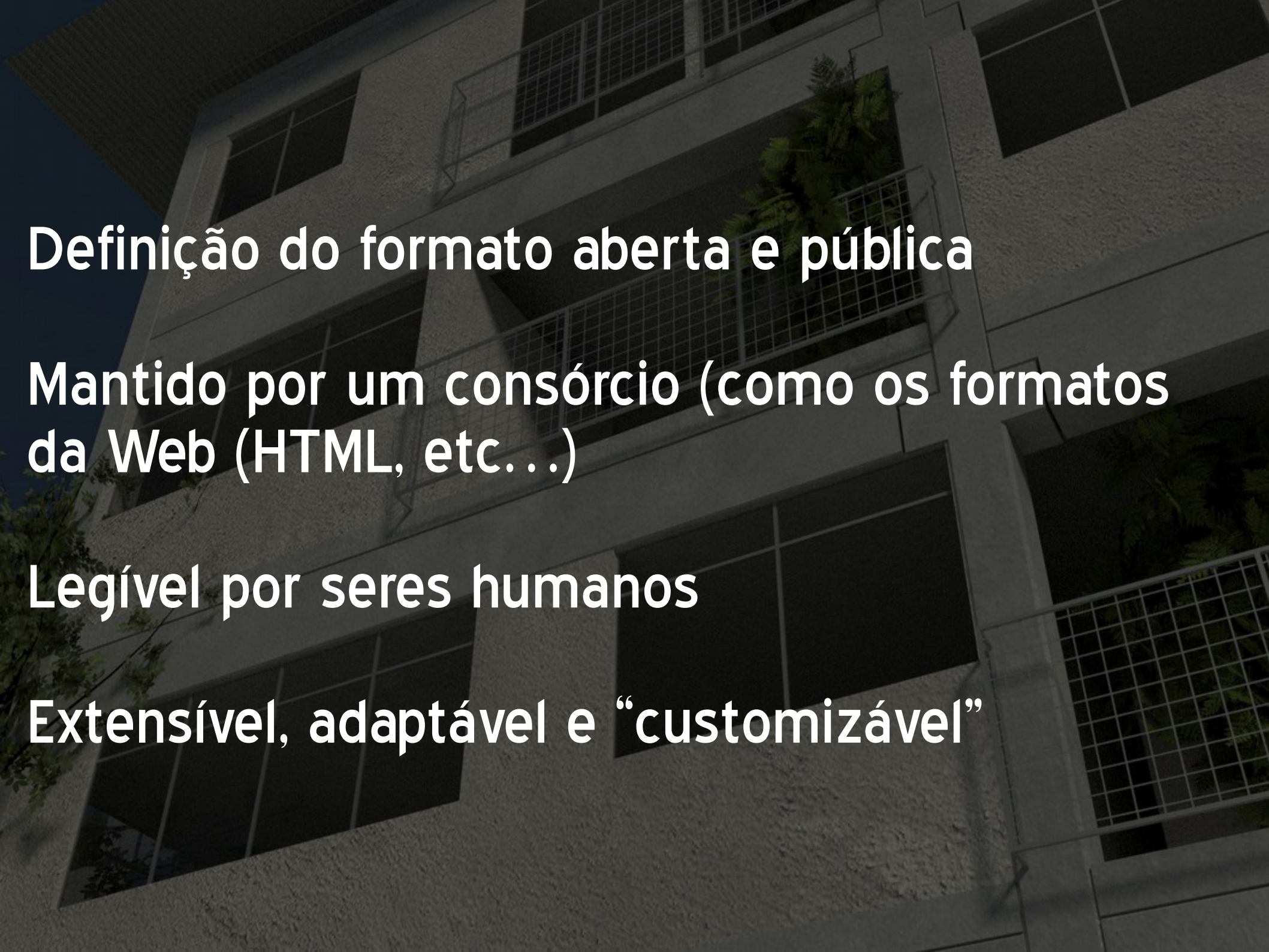
Obra

Data de montagem

Aditivos



O formato IFC



Definição do formato aberta e pública

Mantido por um consórcio (como os formatos da Web (HTML, etc...))

Legível por seres humanos

Extensível, adaptável e “customizável”


```
#513=IFCPRESENTATIONSTYLEASSIGNMENT((#512));  
#514=IFCSTYLEDITEM(#509,(#513),$);  
#515=IFCDIRECTION((1.,0.,0.));  
#516=IFCDIRECTION((0.,0.,1.));  
#517=IFCCARTESIANPOINT((0.,0.,0.));  
#518=IFCAXIS2PLACEMENT3D(#517,#516,#515);  
#519=IFCLOCALPLACEMENT($,#518);
```

```
#520=IFCSHAPEREPRESENTATION(#11,'Body','MappedRepresentation',(#509));
```

```
#521=IFCPRODUCTDEFINITIONSHAPE($,$,(#520));
```

```
#522=IFCCOLUMN('2$7bS CfeHvfUy093rt3ko',#5,'Pilar de canto 30x30x1200 001','',,$,#5
```

```
#523=IFCDIRECTION((0.,-1.,0.));
```

```
#524=IFCDIRECTION((1.,0.,0.));
```

```
#525=IFCDIRECTION((0.,0.,1.));
```

```
#526=IFCCARTESIANPOINT((-0.15,9.15,0.));
```

```
#527=IFCCARTESIANTRANSFORMATIONOPERATOR3D(#523,#524,#526,1.,#525);
```

```
#528=IFCMAPPEDITEM(#503,#527);
```

```
#529=IFCSTYLEDITEM(#528,(#513),$);
```

```
#530=IFCDIRECTION((1.,0.,0.));
```

```
#531=IFCDIRECTION((0.,0.,1.));
```

```
#532=IFCCARTESIANPOINT((0.,0.,0.));
```

```
#533=IFCAXIS2PLACEMENT3D(#532,#531,#530);
```

```
#534=IFCLOCALPLACEMENT($,#533);
```

```
#551=IFCPROPERTYSINGLEVALUE('Role',$,IFCTEXT('Column'),$);
```

```
#552=IFCPROPERTYSINGLEVALUE('Height',$,IFCLENGTHMEASURE(12.),$);
```

```
#553=IFCPROPERTYSINGLEVALUE('Width',$,IFCLENGTHMEASURE(0.3),$);
```

```
#554=IFCPROPERTYSINGLEVALUE('Length',$,IFCLENGTHMEASURE(0.3),$);
```



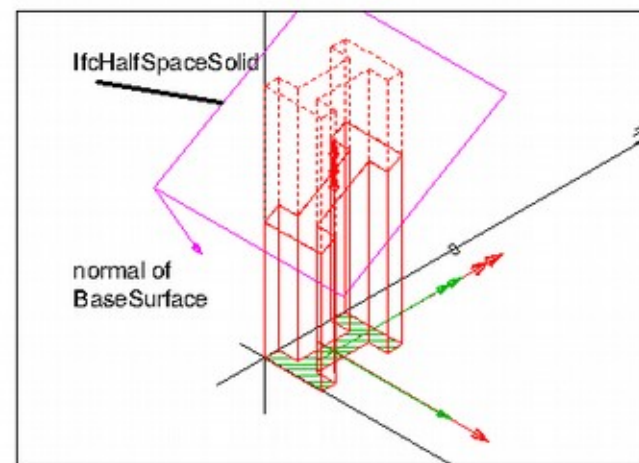

Clipping Representation Type

The following attribute values for the [IfcShapeRepresentation](#) holding this geometric representation shall be used:

- *RepresentationIdentifier* : 'Body'
- *RepresentationType* : 'Clipping'

The following constraints apply to the advanced representation:

- **Solid**: see 'SweptSolid' geometric representation
- **Profile**: see 'SweptSolid' geometric representation
- **Extrusion**: see 'SweptSolid' geometric representation
- **Boolean result**: The [IfcBooleanClippingResult](#) shall be supported, allowing for Boolean differences between the swept solid (here [IfcExtrudedAreaSolid](#)) and one or several [IfcHalfSpaceSolid](#).



EXAMPLE 'Clipping' geometric representation.

Use of [IfcBooleanClippingResult](#) between an [IfcExtrudedAreaSolid](#) and an [IfcHalfSpaceSolid](#) to create a clipped body.

AdvancedSweptSolid Representation Type

The following attribute values for the [IfcShapeRepresentation](#) holding this geometric representation shall be used:

- *RepresentationIdentifier* : 'Body'
- *RepresentationType* : 'AdvancedSweptSolid'

The following additional constraints apply to the 'AdvancedSweptSolid' representation type:

- **Solid**: [IfcSurfaceCurveSweptAreaSolid](#), [IfcFixedReferenceSweptAreaSolid](#), [IfcExtrudedAreaSolidTapered](#), [IfcRevolvedAreaSolidTapered](#) shall be supported.

NOTE View definitions and implementer agreements can further constrain the allowed swept solid types.

- **Profile**: see 'SweptSolid' geometric representation
- **Extrusion**: not applicable

MappedRepresentation Representation Type

File Model Checking Communication Information Takeoff COBie + To-Do (1/6)

Checking

Ruleset

- General Space Check
 - The Model Should Have Spaces OK
 - Space Properties
 - Space Location
 - Space Intersections
 - Space Validation
 - Spaces in Same Building Storey Must Have Sam
- Intersections Between Architectural Components
 - Intersections - Same Kind of Components
 - Intersections - Different Kind of Components**
 - Intersections of Furniture and Other Objects

Results No Filtering Automatic

Please select a checked rule with results.

Info

(A) Wall.0.349

Pset_ManufacturerTypeInformation		Pset_WallCommon		Structural
Identity Data		Materials and Finishes		Other
Analytical Properties		Constraints	Construction	Dimensions
Identification	Location	Issues	Quantities	Material
				Profile
				Relations
				Classification
				Hyperlinks

Issues

- Unallocated Area (20.49 sq ft)
- Unallocated Area (27.54 sq ft)
- Unallocated Area (27.54 sq ft)
- Unallocated Area (20.49 sq ft)
- (A) Wall.0.349
- (A) Wall.0.349
- (B) Space.0.52 : CORRIDOR[2AC3-M]
- (B) Space.0.134 : CORRIDOR[2AC3]
- (A) Space.0.5 : CORRIDOR[2AC3]
- Unallocated Area (20.49 sq ft)
- Unallocated Area (27.54 sq ft)
- Unallocated Area (27.54 sq ft)
- Unallocated Area (20.49 sq ft)
- (A) Wall.0.349 (Reference) and (B) Duct.0.108 (Rectangular Duct:Mitered Elbows / Tees) are int...

3D Spin Info



Main:
All Selected: 1

Layer:
IFC Layer: IFC Import

Element:
Column 1

Geometry Method:

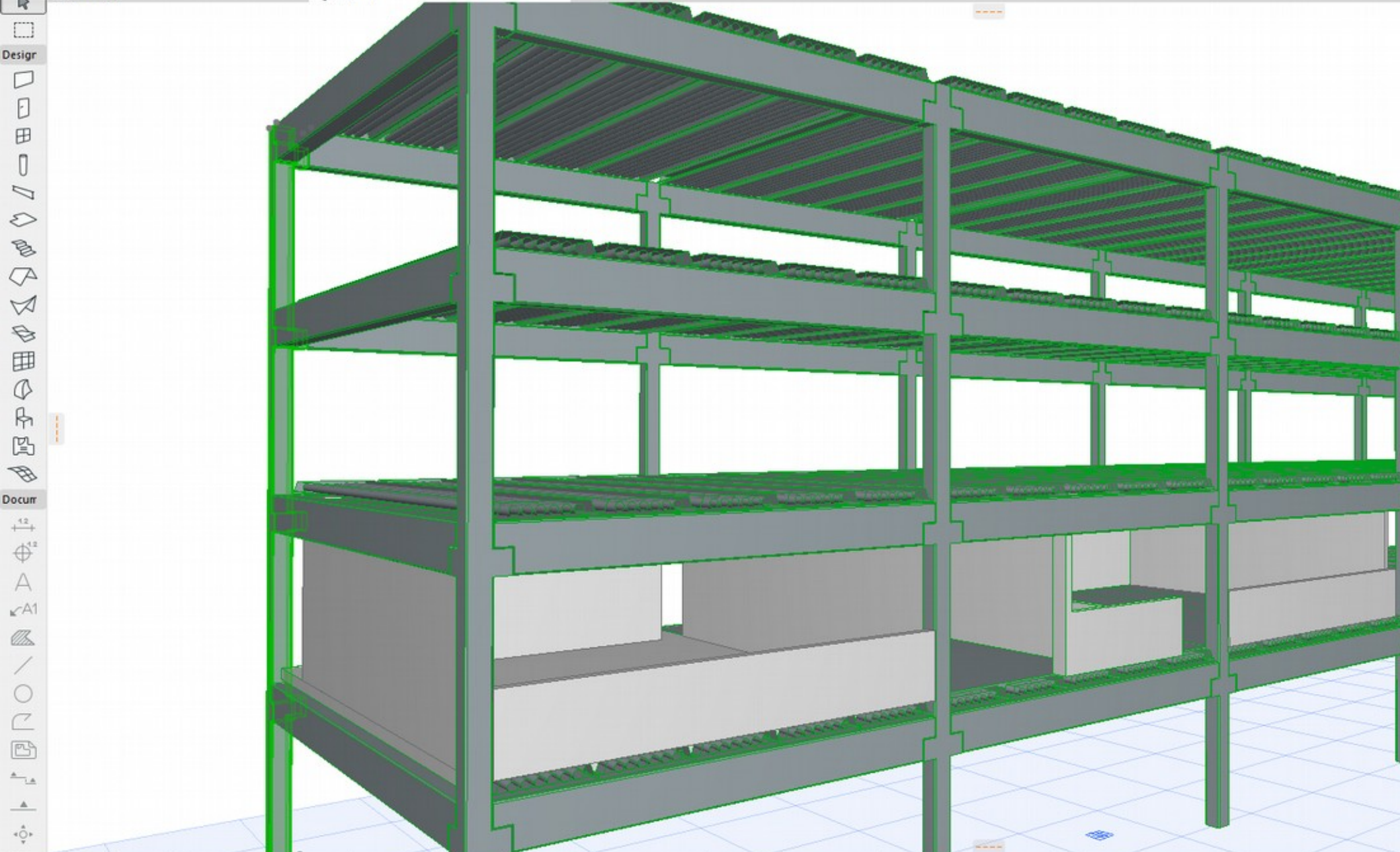
Floor Plan and Section:
Floor Plan and Section...

Linked Stories:
Home:
0. Story

Bottom and Top:
12000
0

Size:
500
500

[0. Story] [3D / All]

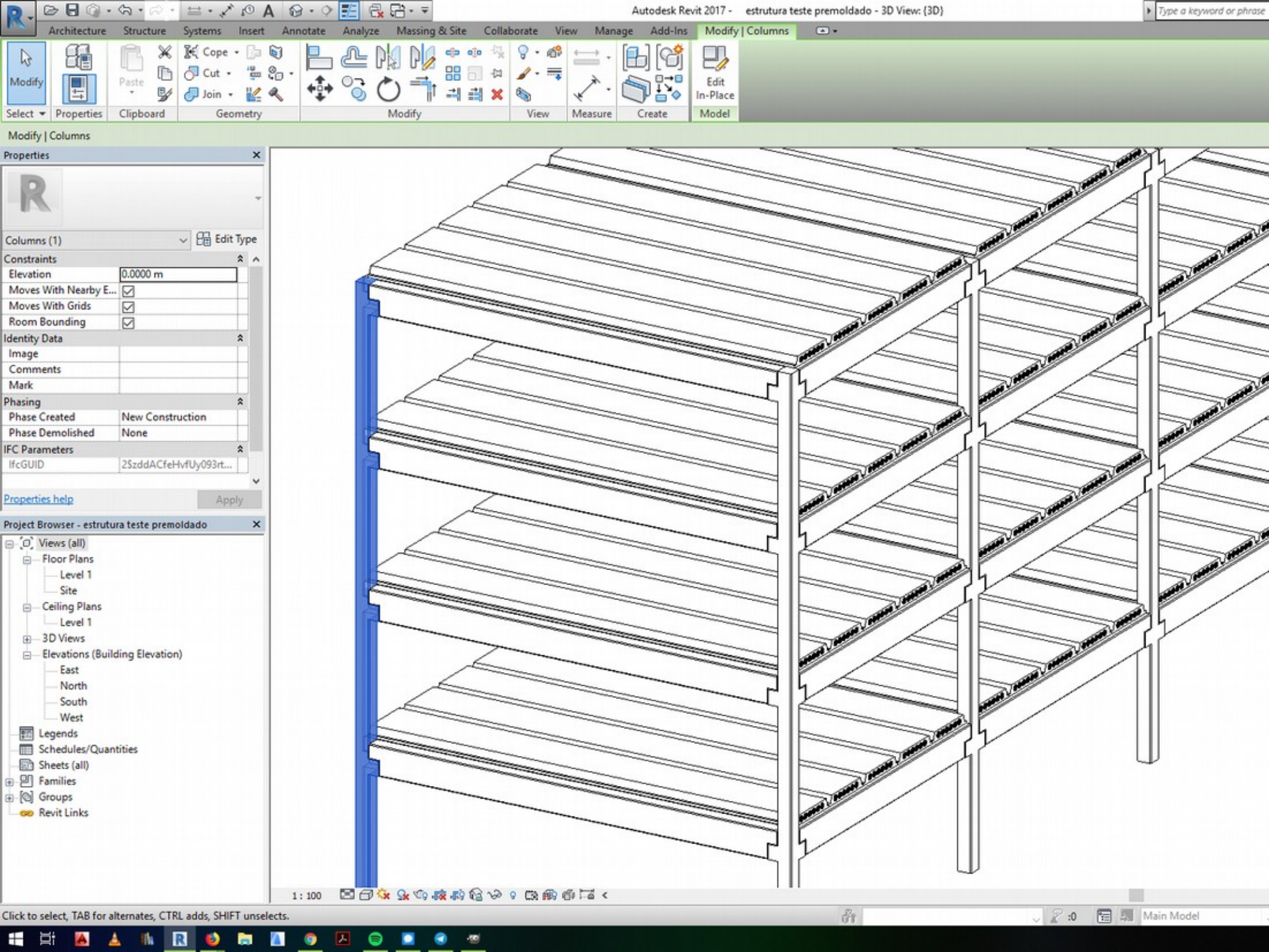
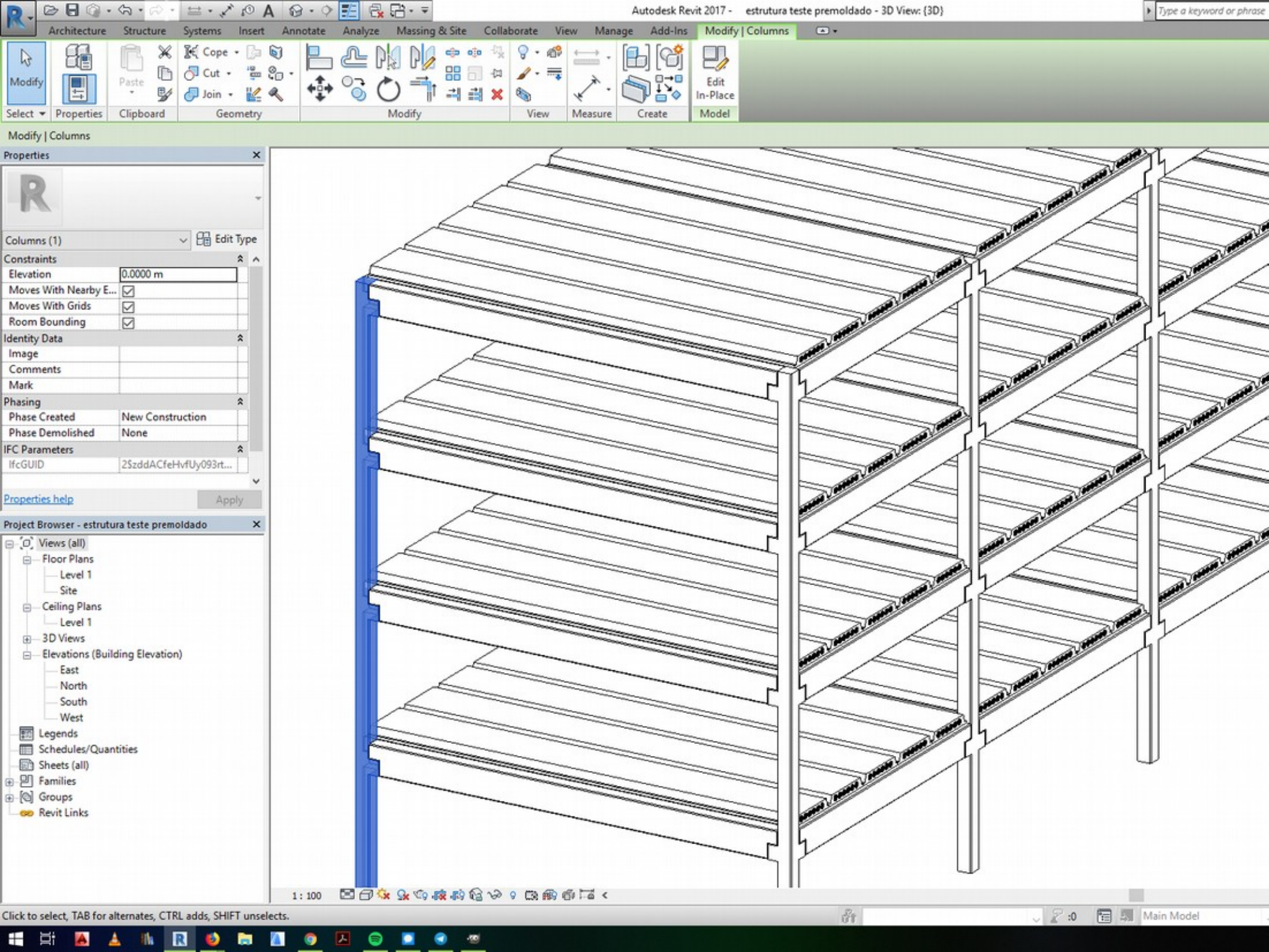


Design



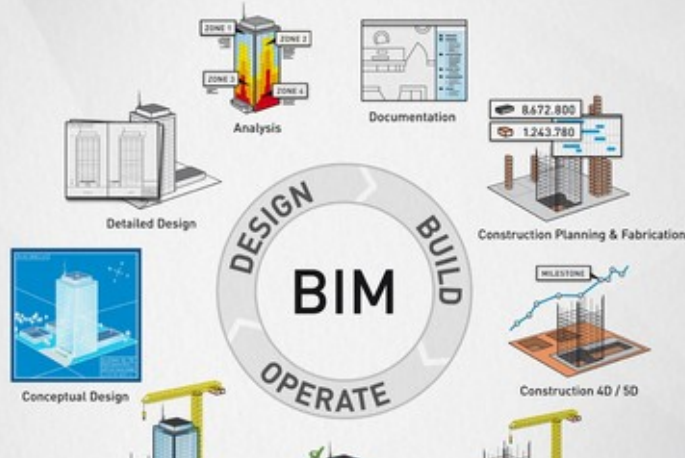
Docur





O que é BIM afinal?

WHAT ARE BIM STANDARDS?

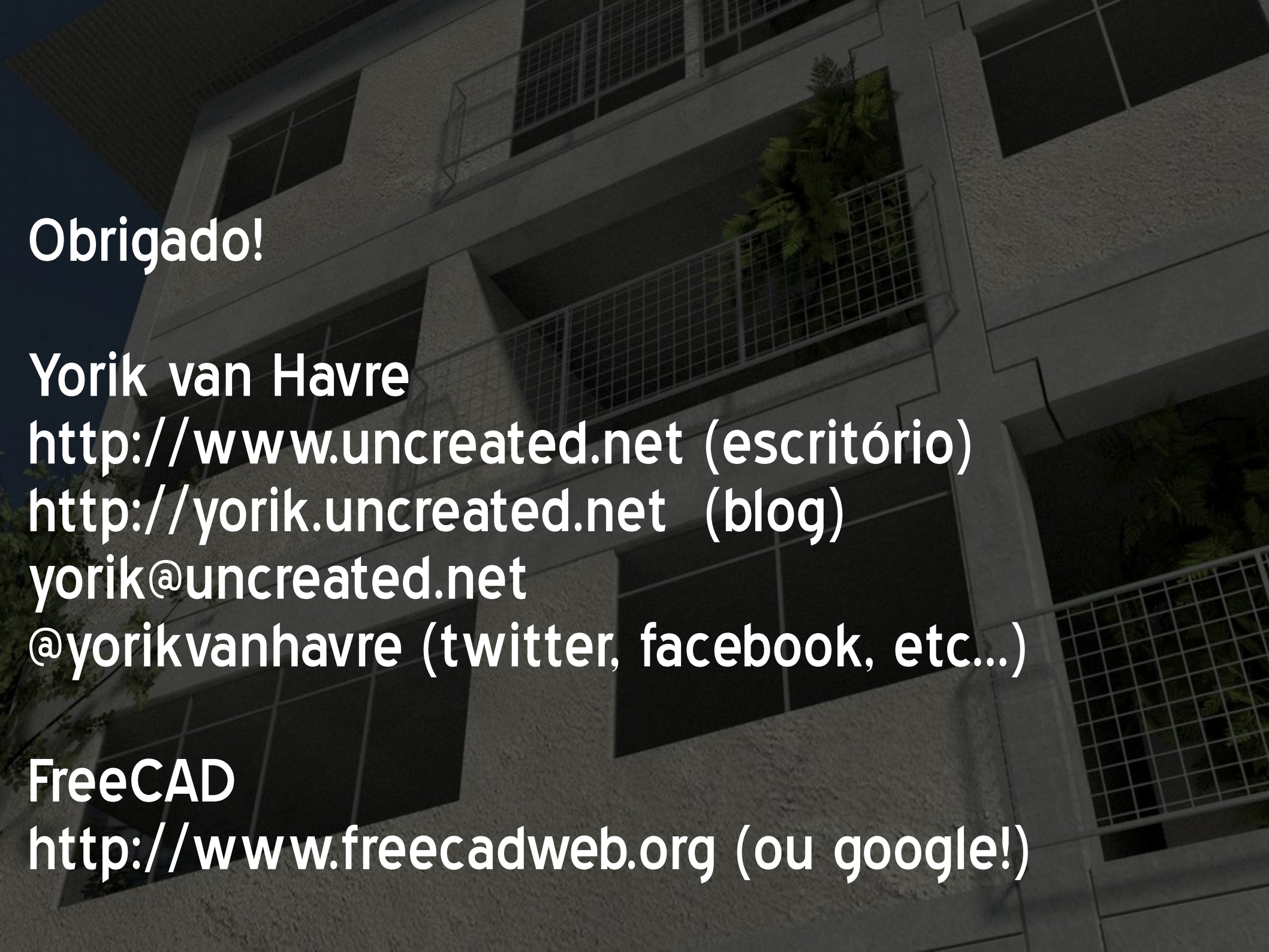


O que é BIM afinal?

Quero definir a informação que vou dar, e o que preciso receber

Quero que minhas informações estejam transmitidas para os outros de maneira clara e verificável

Quero receber informação dos outros de maneira clara e verificável



Obrigado!

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