BAMB
BUILDINGS AS MATERIAL BANKS

Co-funded by the Horizon 2020
Framework Programme
of the European Union

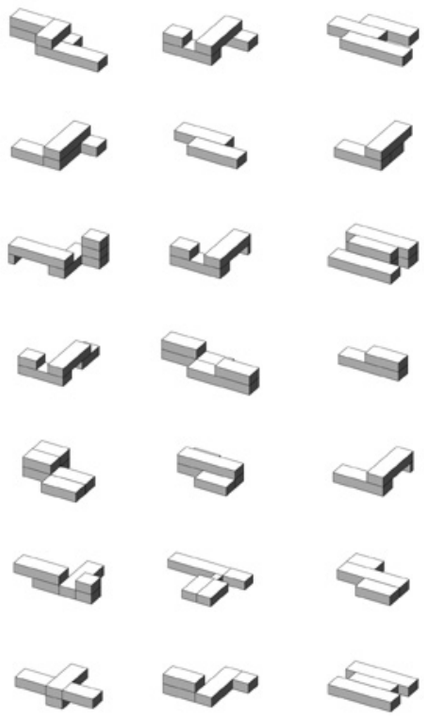
GTB LAB

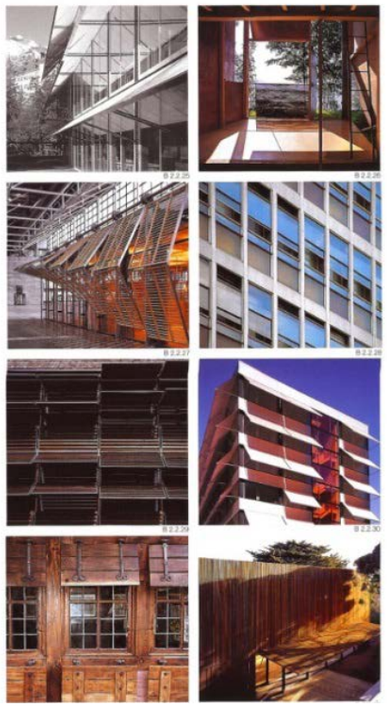
PRESENTATIONS & VISITS pilot projects BAMB - 13/10/2017

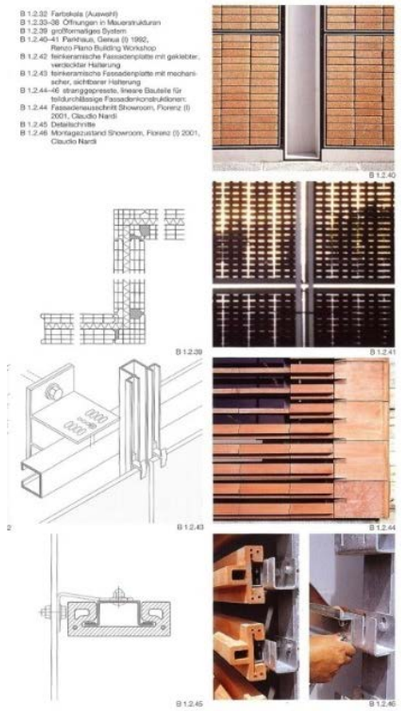
Dr. Elma Durmisevic, 4D architects / ZUYD

Co-funded by the Horizon 2020 Framework Programme of the European Union

Laboratory for Green Transformable Building



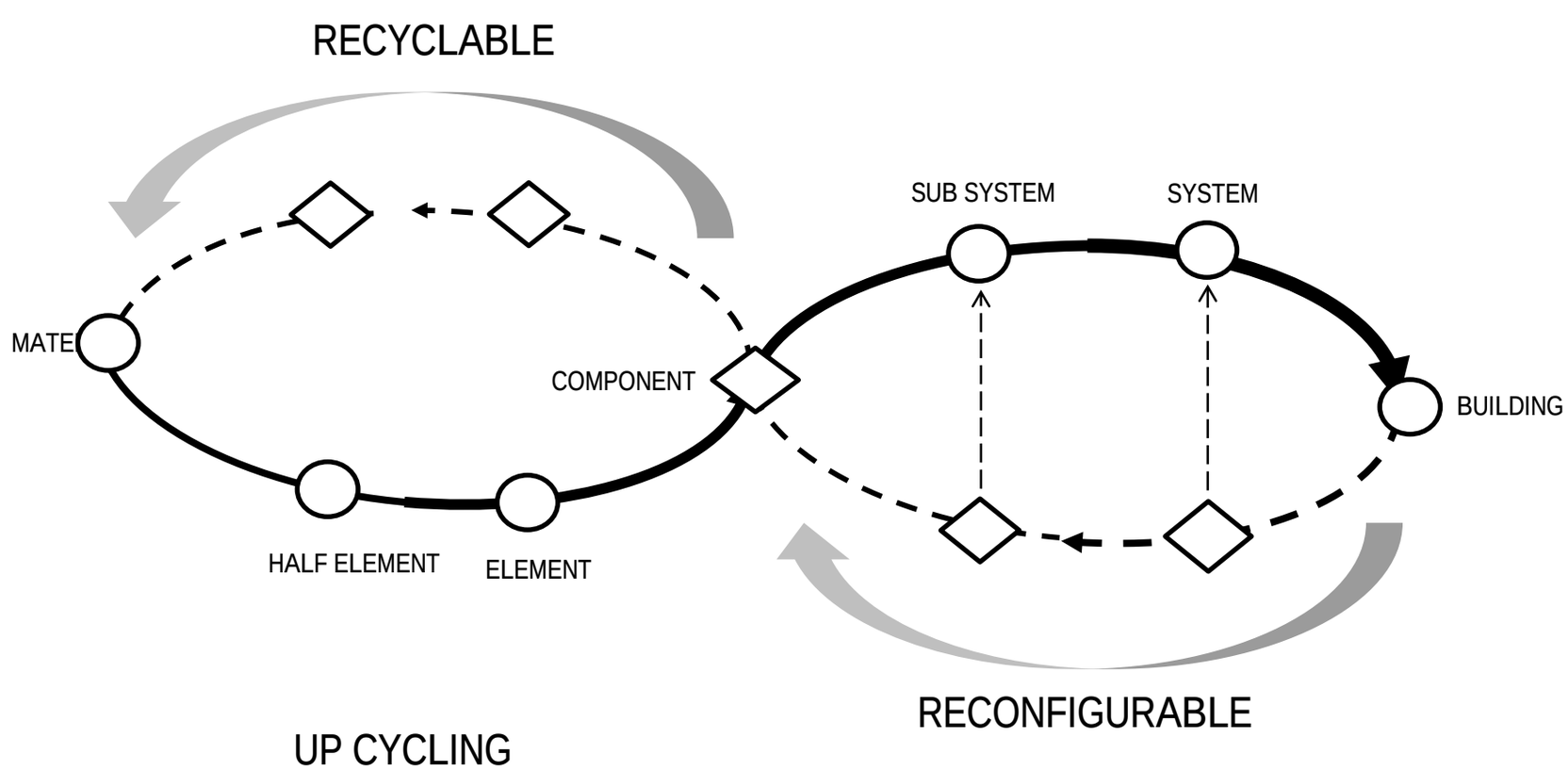




Paradigm Shift towards Circular Buildings and Economy

AIM

<u>The aim</u> of GTBL is to **demonstrate** reversible building concepts and **the impact that design** of such transformable buildings has on new value propositions for **upgradable build environment based on reversibility of buildings and its systems.** Monitoring of economic, environmental, process impacts will be done by BRE, IBM, VITO, and UT.



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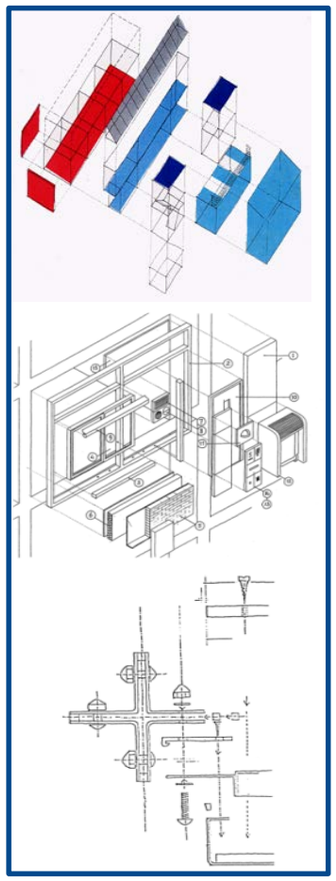
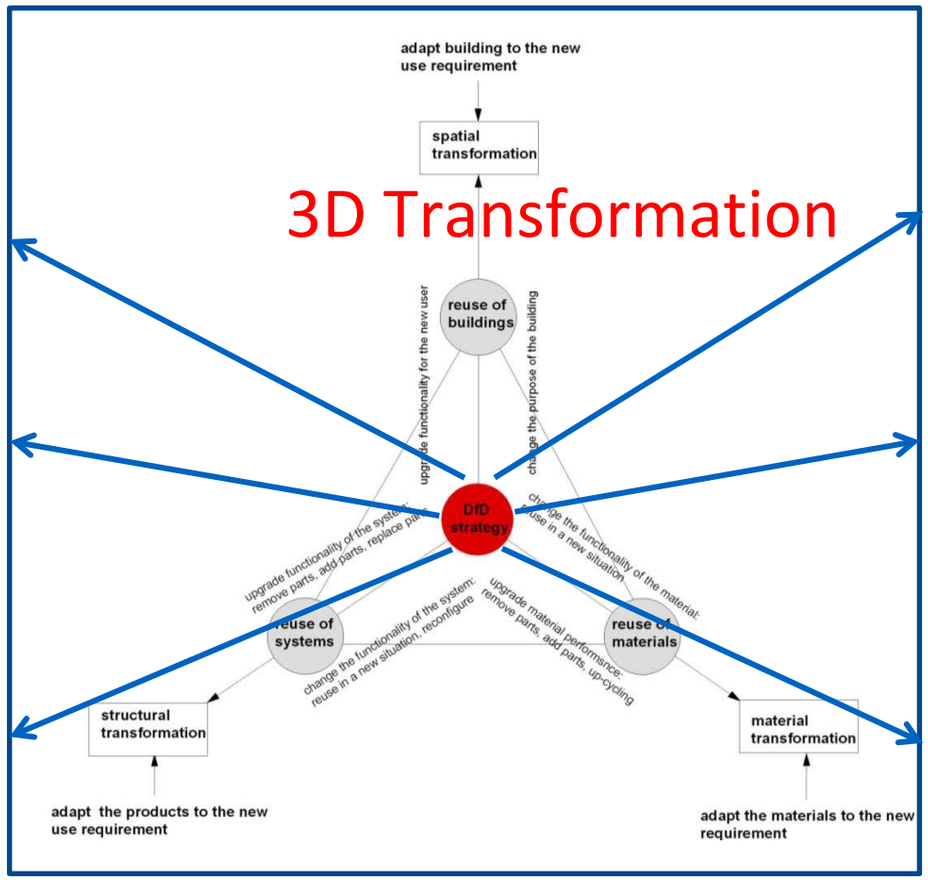
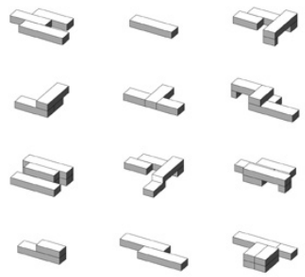
Design Task for GTB Lab:
To embody multiple value propositions through multiple dimensions of transformation of buildings







Demolition
=
Design Mistake

Dr. Elma Durmisevic, 4D architects, Head of the research EU Horizon 2020/BAMB Revisable Buildings Design, Chief architect of the EU projects GTB Lab and GDC pilots, Founder Sarajevo Green Design Foundation

Co-funded by the Horizon 2020 Framework Programme of the European Union

design studios

GTBLab – innovatie platform voor reversible building :

value network

research

GTB Lab IQ opbouw
Wetenschappelijke Ondersteuning :

1/ Systems integratie / BIM
BRE, Cairo,Achen, VUB, ZUYD, UT,

Ondersteuningen modellen voor GTB- Circuleer ontwikkeling: Reuse potential evaluatie tool/transformatie potential/ reverisble 3D, 4D en 5D BIM/ Ondersteuning modelen voor de Selectie van de reuse opties

2/ Standaardisatie en modellen en protocollen dat circulair bouw ondersteunt
UT, TUM, VUB

3/ Circuleer Business modellen
IBM, VITO, EPEA, BRE, RCS,

Verkenning van processen achter, reversible design en ontwerp van circuleer industriële systeem rond iedere reversibel deisgn (reuse option selection) strategie en hun warde proposities
Added value van GTB lab producten en concepten inzichtelijk maken.

Onderwijs Ondersteuning:

Testing van modellen en concepten
1/ International Design Studios. IBA, TU DELFT , ZUYD, UTWENTE, SGDF VUB

2/ Afstudeer ateliers , onderwijs
TU DELFT, ZUYD, UTWENTE, SGDF,

realisation

Re-design / re-manufacturing /realisatie:

Prototyping circuleer bouw concepten door GTB Lab transformatie en monitoring

Redesign : Architect, Constructeur, Klimaat installatie advies,

Remanufacturing: Bouw management
Bouw Industrie partners
Potentiele opdrachtgevers

Broad implementation

Implementatie en communicatie Ondersteuning:

IBA Parkstad, Provincie, Gemeenten, corporaties,

Comunicatie/coordinatie industrie
IBA, BAMB, Booosting

Centrum Duurzaam Bouw België

DESCRIPTION OF THE PILOT PROJECT

- Type of construction (refurbishment / new construction)
- 150m2
- Innovation center / testing and demonstration place (laboratory for Green Transformbale Buildings
- The Netherlands
- Euro 585.000,-

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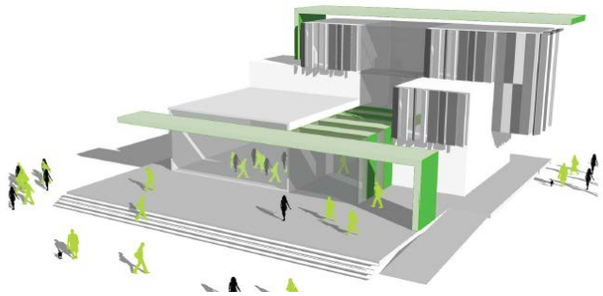
OBJECTIVE of LABORATORY FOR GREEN TRANSFORMABLE BUILDINGS (GTB Lab)

- Demonstrate that waste generated from changing buildings, can be reduced by at least 70% through the use of upgradable modular and exchangeable components.
- Demonstrate that by GTB approach use of virgin materials will be reduced by at least 60%.
- Development and integration of flexible comfort and energy concepts into upgradable buildings and components
- Development of BIM framework for GTB/ circular
- New Business models for reversible buildings and products
- Reuse of water/energy/heat/material

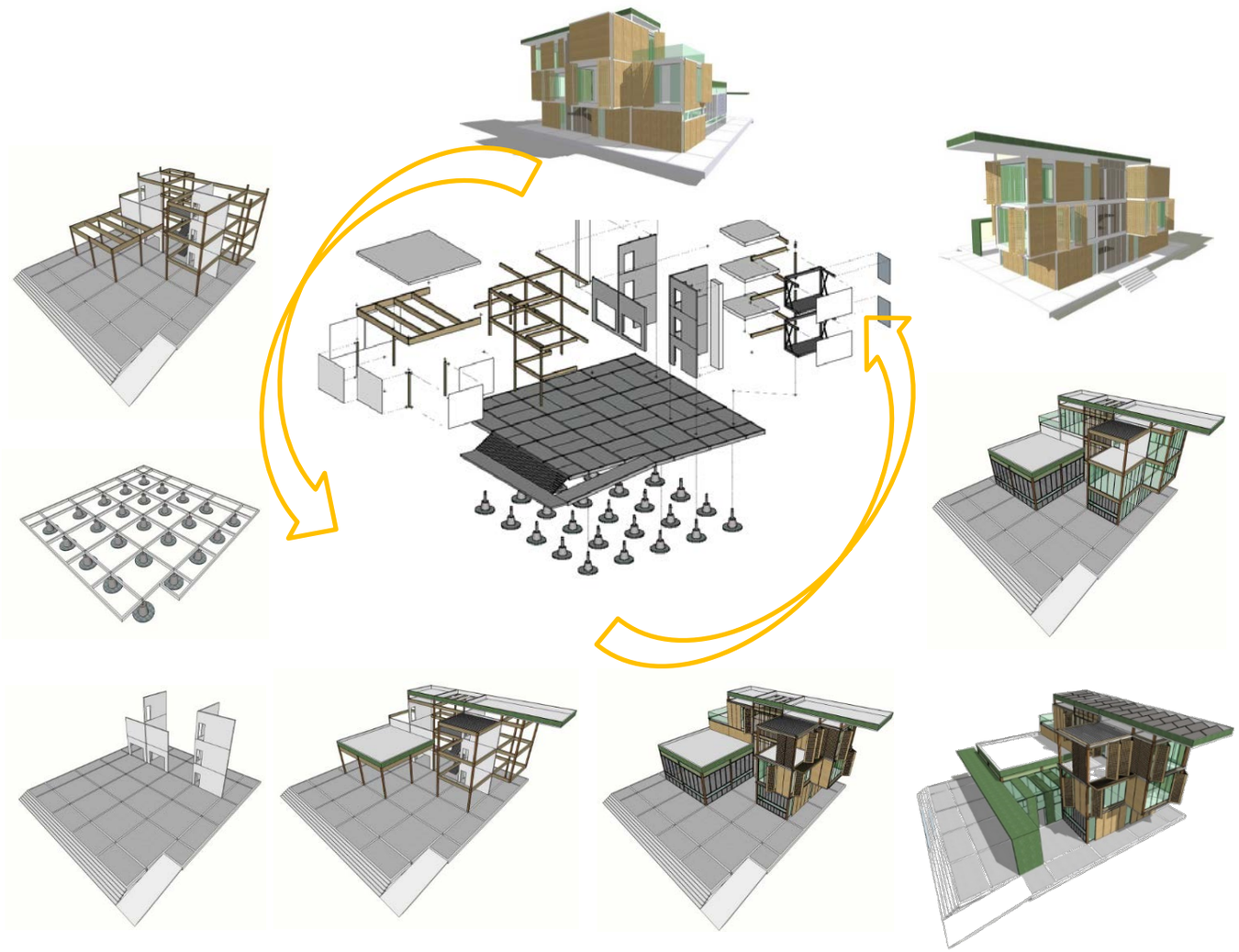
Design/engineering team

- Architect: Chief Elma Durmisevic , 4D architects
- Structural engineer : Tom Feijen, Palte
- Climate design /installation : Jaap Wiedenhoff, ABT
- Business model – IBA Parkstad/Rabobank



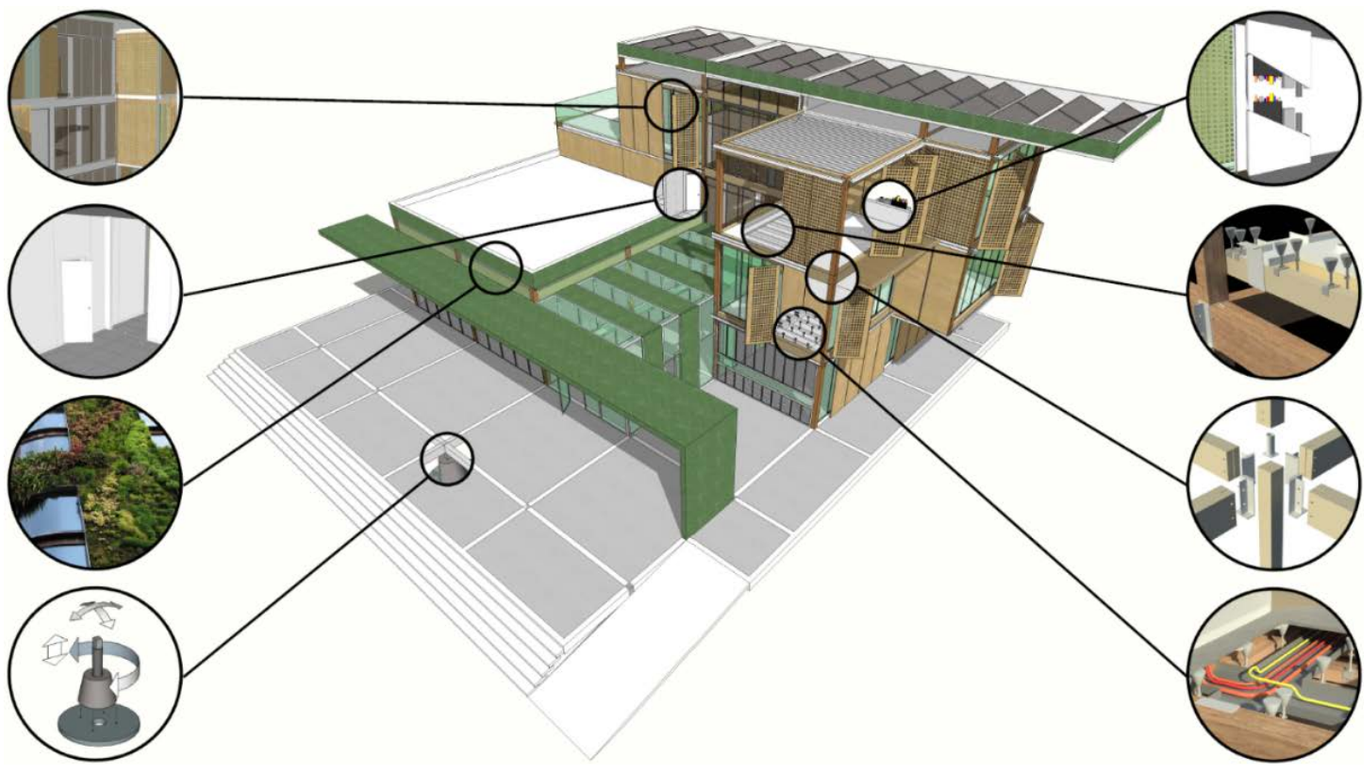
OBJECTIVES

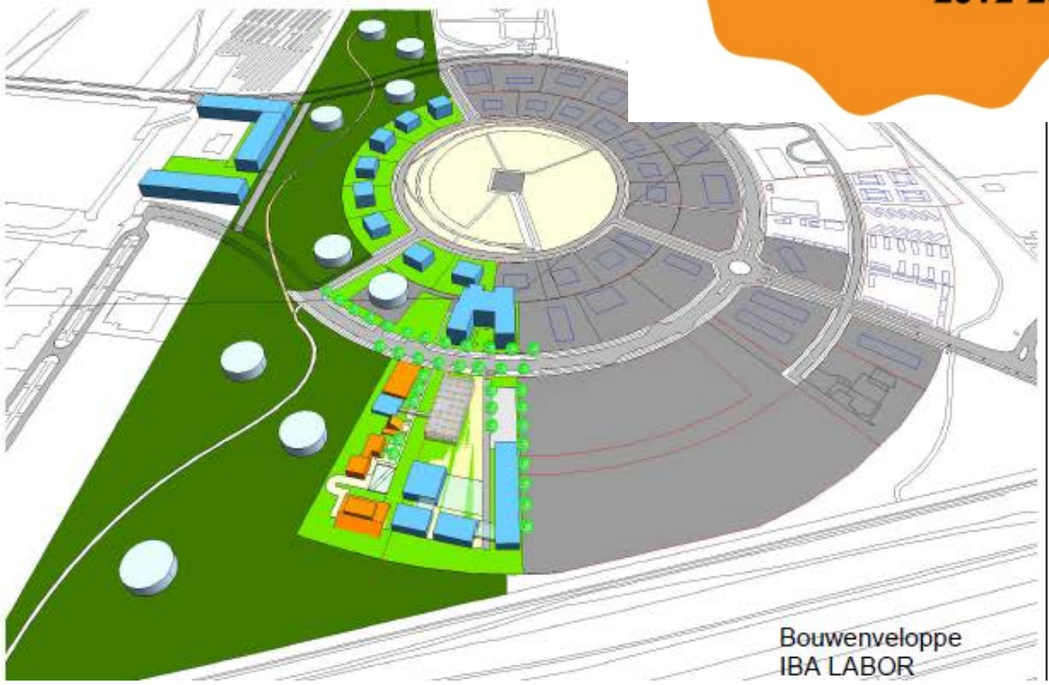
REVERSIBLE BUILDING DESIGN



Envisioned as DYNAMIC STRUCTURE

Laboratory for Green Transformable Buildings - GTB Lab Partners

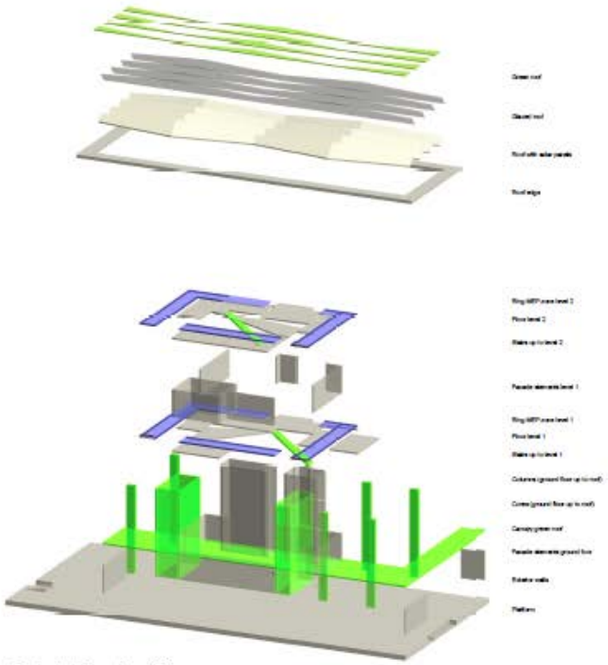




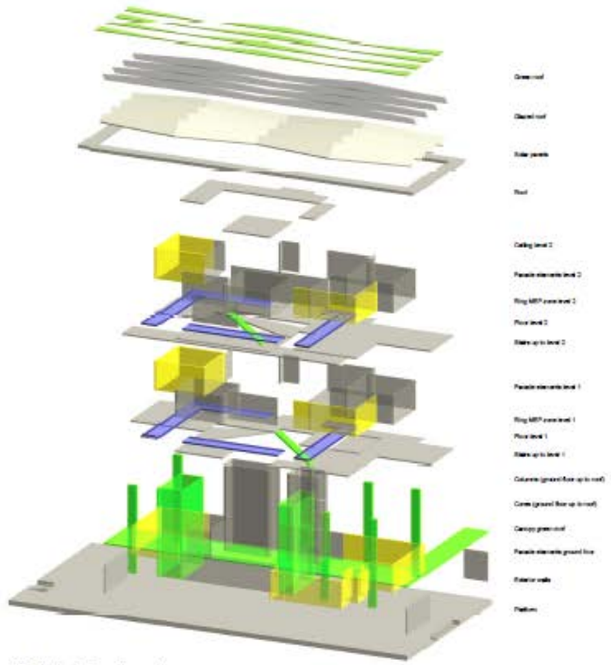
gtb lab

iba parkstad 2012-2020

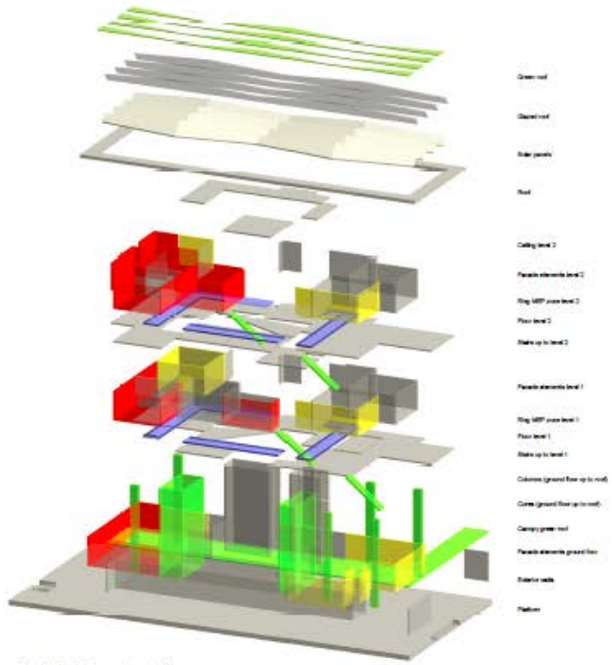
	Scenario 0: Core/Carrier of tranformation model			Scenario 1: Education and research facility for dynamic and circular buildings			Scenario 2: Education and research facility for dynamic and circular buildings			Scenario 3: Education and research facility + office hub for dynamic and circular buildings + appartments			Scenario 4: Education and research facility		
	Function	nr	m2	Function	nr	m2	Function	nr	m2	Function	nr	m2	Function	nr	m2
VARIABLE				teamwork/mini classroom space	1	30	teamwork/mini classroom space	2	30	teamwork/mini classroom space	2	30	teamwork/mini classroom space	2	30
							office space	2	15	open office space for 20 work places	1	160	office space	2	15
	Subtotal		*0*	*Subtotal*		*30*	*Subtotal*		*90*	*Subtotal*		*220*	*Subtotal*		*90*
	vertical communication		0	vertical communication	1	15	vertical communication	1	30						
	Subtotal		*0*	*Subtotal*		*15*	*Subtotal*		*30*	*Subtotal*		*0*	*Subtotal*		*0*
				apartment/studio with possible integration into one and extendibility in the second phase to 160m2 (internal transformation scenarios of appartment units)	2	35	senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	2	70	senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	2	70	senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	2	70
							senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	1	120	senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	1	120	senior appartment (internal transformation scenarios of appartment units) (1st/2nd floor)	1	120
							appartment	1	115						
	Subtotal		*0*	*Subtotal*		*70*	*Subtotal*		*375*	*Subtotal*		*260*	*Subtotal*		*260*
FIXED	public lounge (meeting, lecture, exhibition) with attached snack, coffee, copy, wifi facility	1	70	public lounge (meeting, lecture, exhibition) with attached snack, coffee, copy, wifi facility	1	70	public lounge (meeting, lecture, exhibition) with attached snack, coffee, copy, wifi facility	1	70	public lounge (meeting, lecture, exhibition) with attached snack, coffee, copy, wifi facility	1	70	public lounge (meeting, lecture, exhibition) with attached snack, coffee, copy, wifi facility	1	70
	Subtotal		*70*	*Subtotal*		*70*	*Subtotal*		*70*	*Subtotal*		*70*	*Subtotal*		*70*
	technical spaces including vertical installations	1	20	technical spaces including vertical installations	1	20	technical spaces including vertical installations	1	20	technical spaces including vertical installations	1	20	technical spaces including vertical installations	1	20
	storage	1	10	storage	1	10	storage	1	10	storage	1	10	storage	1	10
	toilet groups	2	15	toilet groups	2	15	toilet groups	2	15	toilet groups	2	15	toilet groups	4	15
	green garden 1st floor			green garden 1st floor			green garden 1st floor			green garden 1st floor			green garden 1st floor		
	energy/climate roof			energy/climate roof			energy/climate roof			energy/climate roof			energy/climate roof		
	water storage below deck			water storage below deck			water storage below deck			water storage below deck			water storage below deck		
	Subtotal		*60*	*Subtotal*		*60*	*Subtotal*		*60*	*Subtotal*		*60*	*Subtotal*		*90*
	Total		**160**	**Total**		**260**	**Total**		**625**	**Total**		**610**	**Total**		**510**



1 Exploded view phase 0

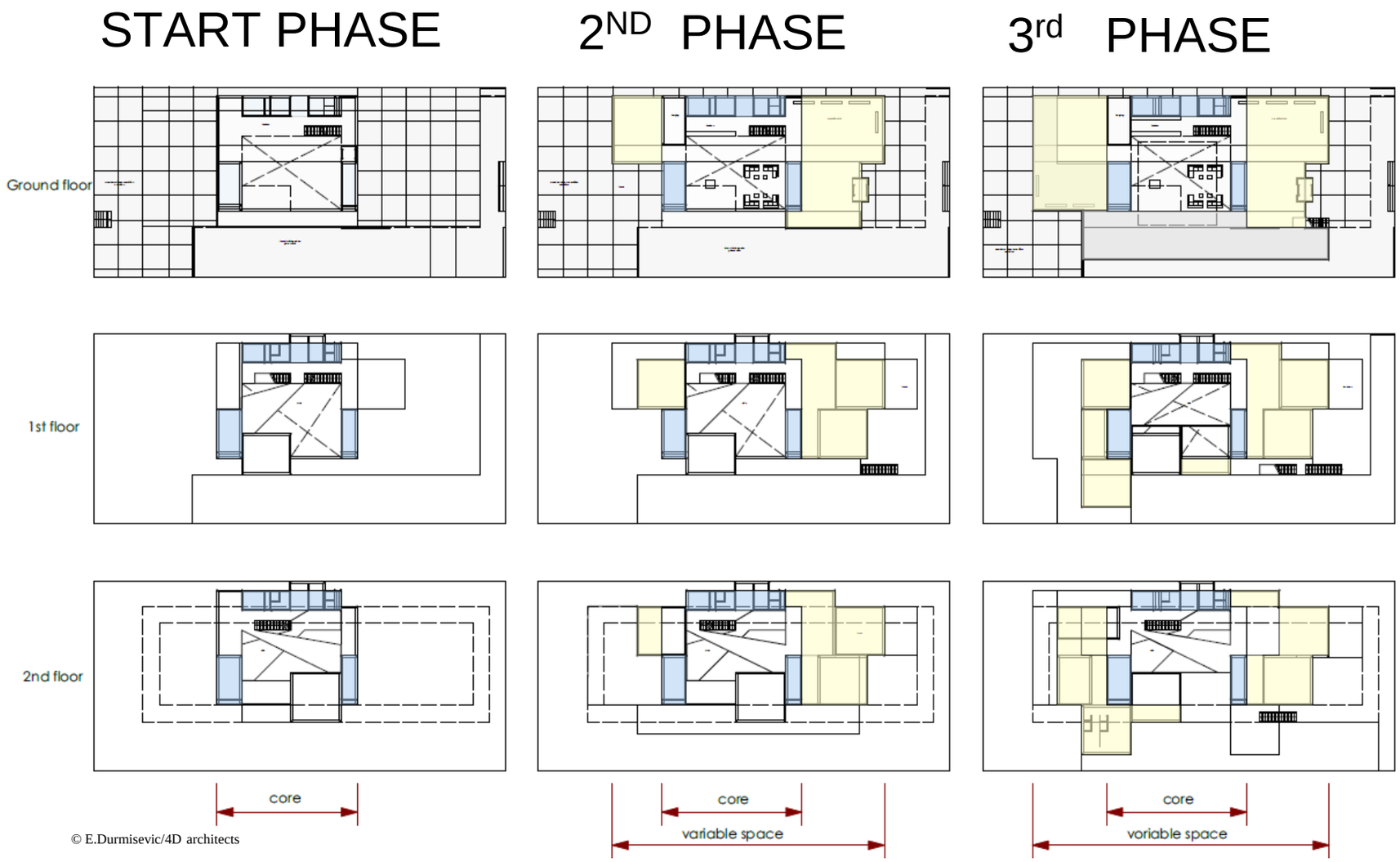


2 Exploded view phase 1

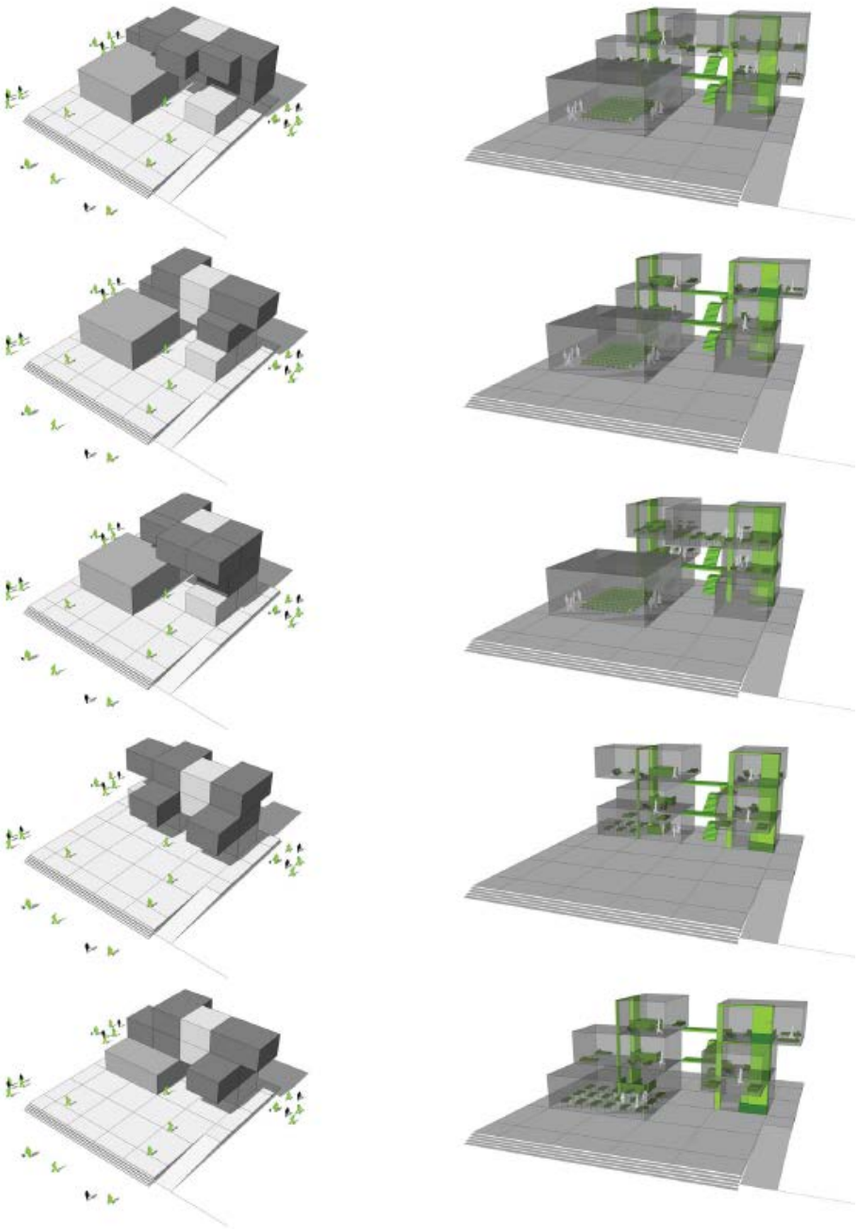


3 Exploded view phase 2

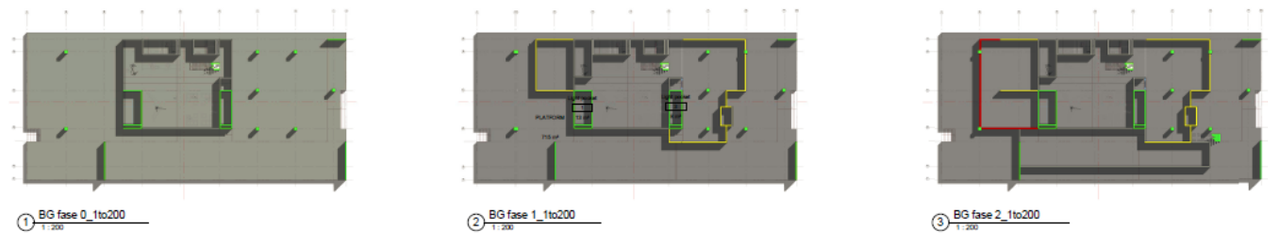
Transformation matrix



Dr. Elma Durmisevic, founder and chief architect of GTB Lab (4Darchitects)/ZUYD



GROUND FLOOR

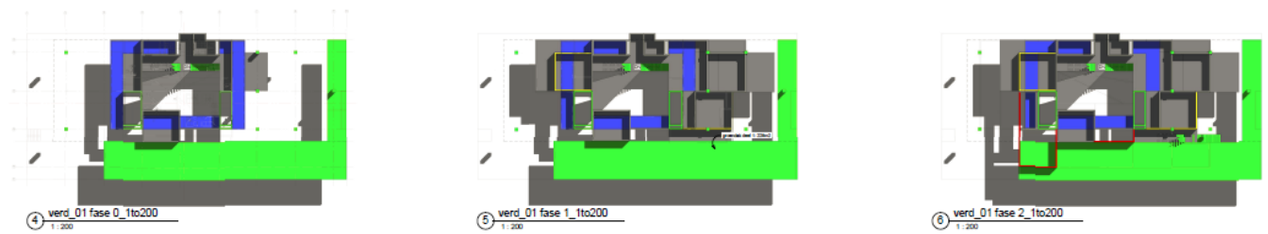


1 BG fase 0_1to200 1 : 200

2 BG fase 1_1to200 1 : 200

3 BG fase 2_1to200 1 : 200

FIRST FLOOR

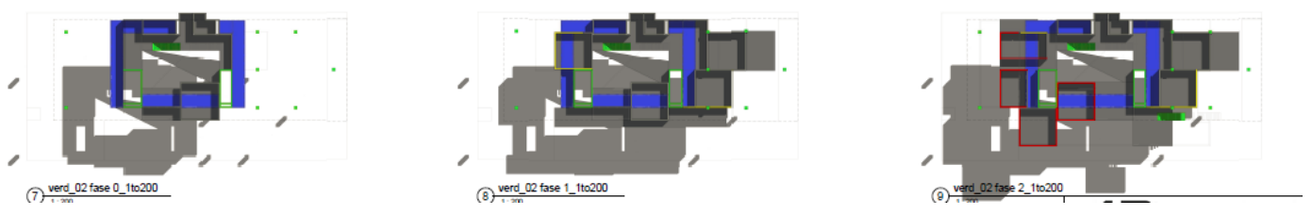


4 verd_01 fase 0_1to200 1 : 200

5 verd_01 fase 1_1to200 1 : 200

6 verd_01 fase 2_1to200 1 : 200

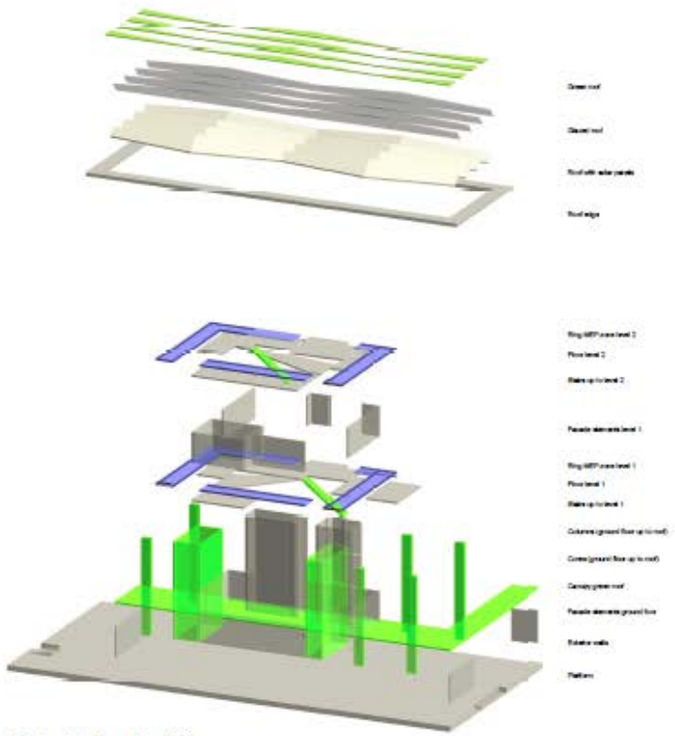
THIRD FLOOR



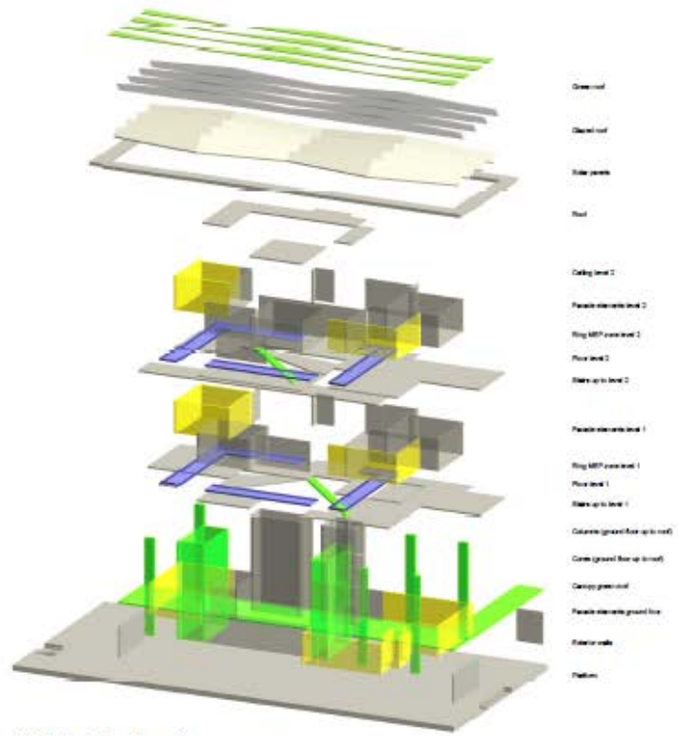
7 verd_02 fase 0_1to200

8 verd_02 fase 1_1to200

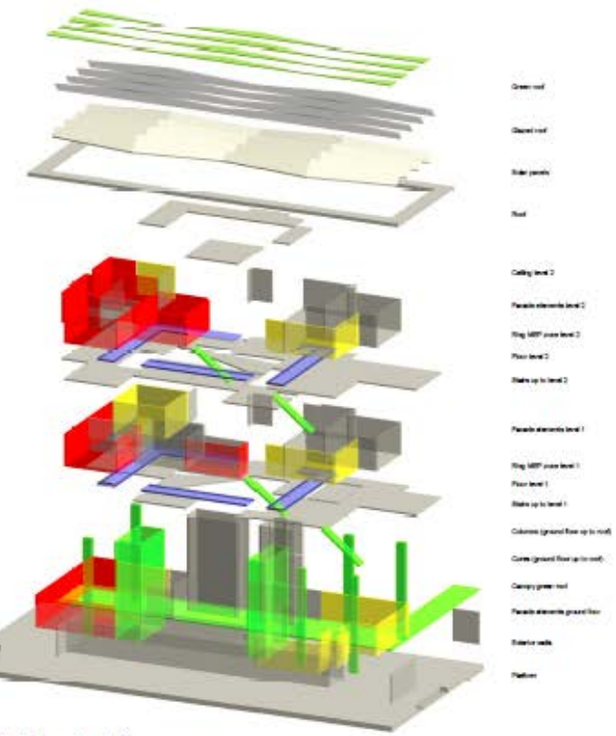
9 verd_02 fase 2_1to200



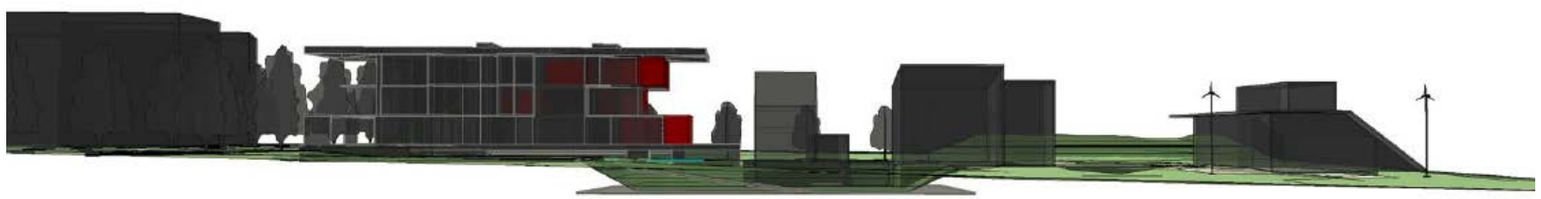
1 Exploded view phase 0



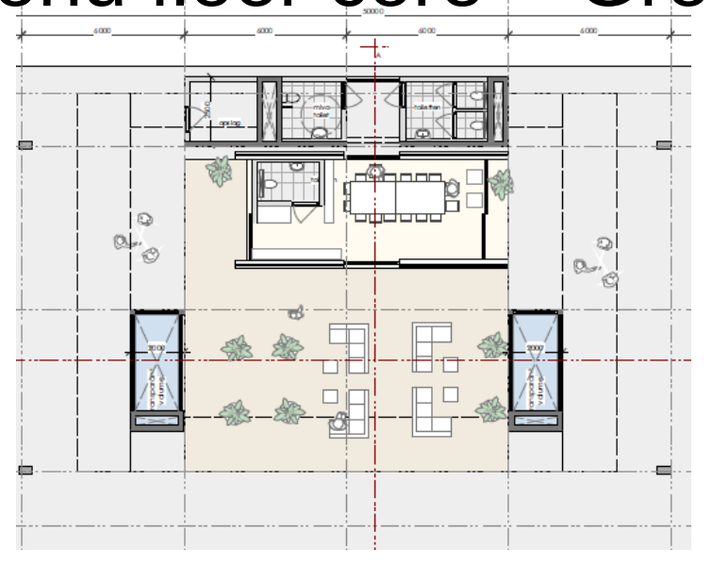
2 Exploded view phase 1



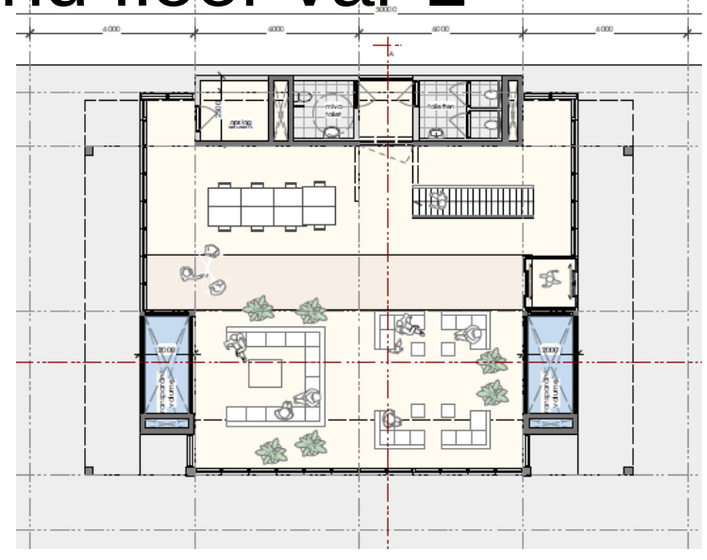
3 Exploded view phase 2



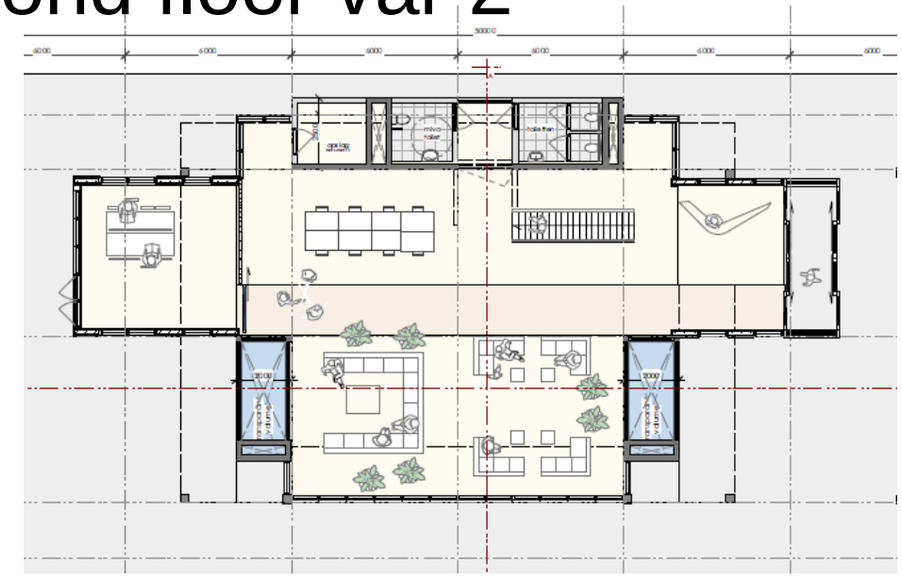
Grond floor core



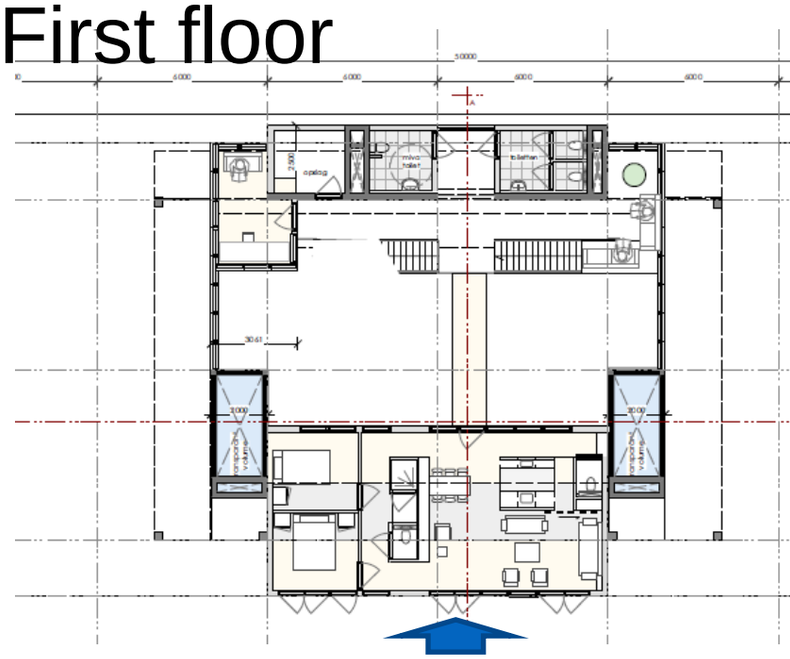
Grond floor var 1



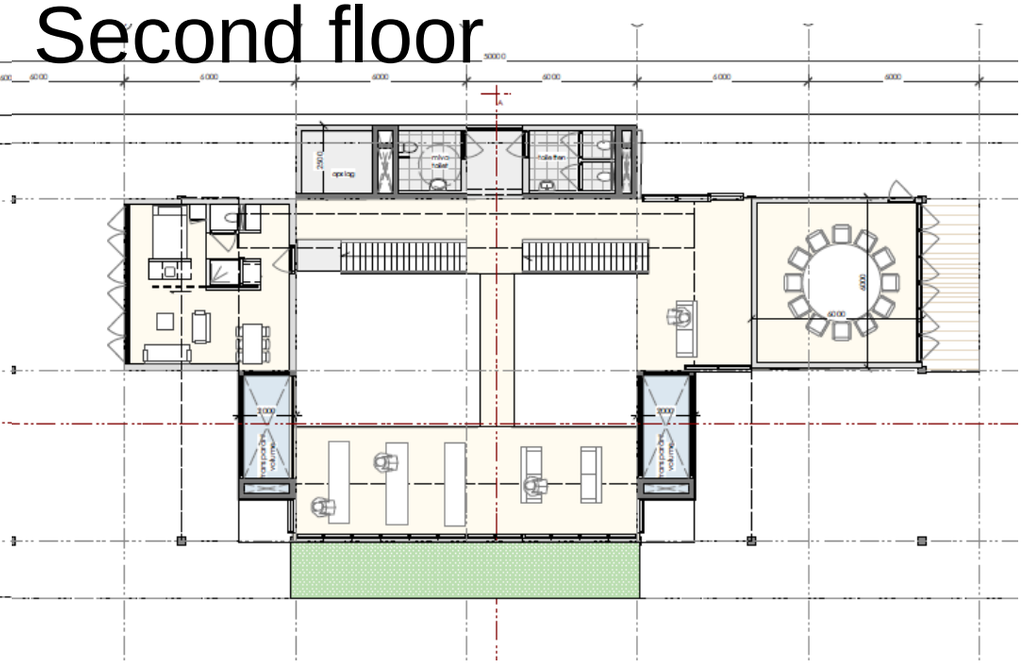
Grond floor var 2



First floor



Second floor



Two units of (2x36 m2) connected

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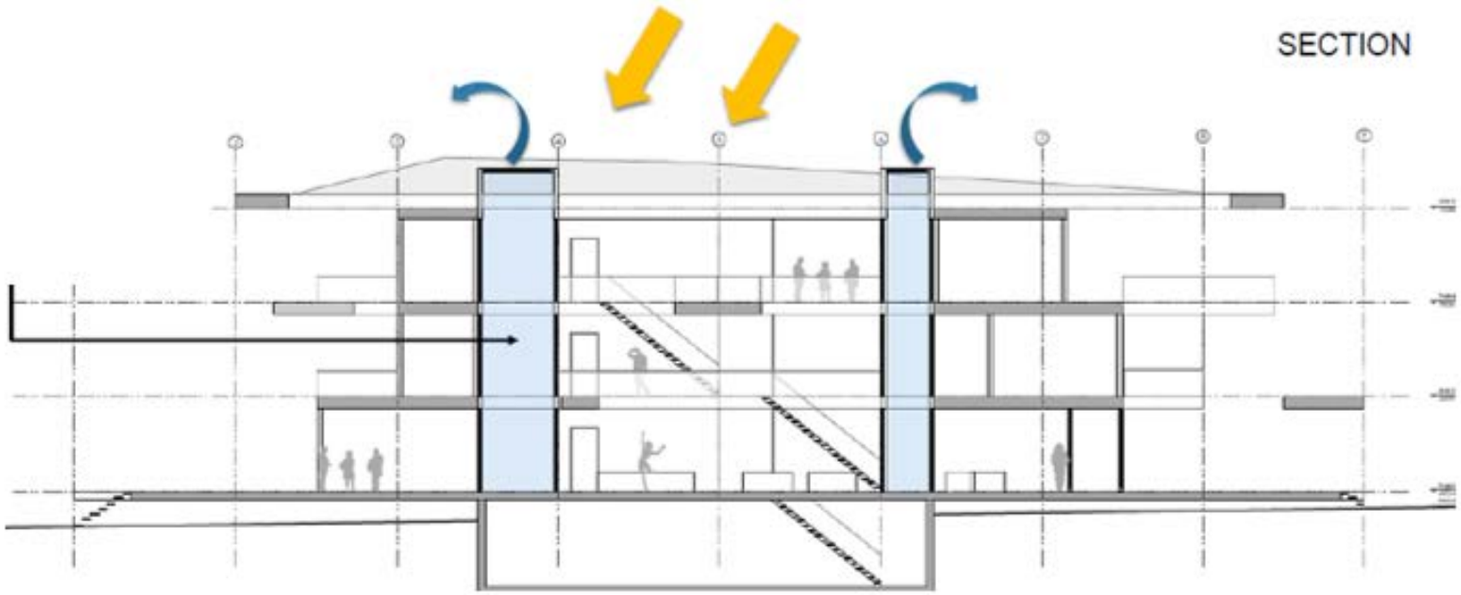
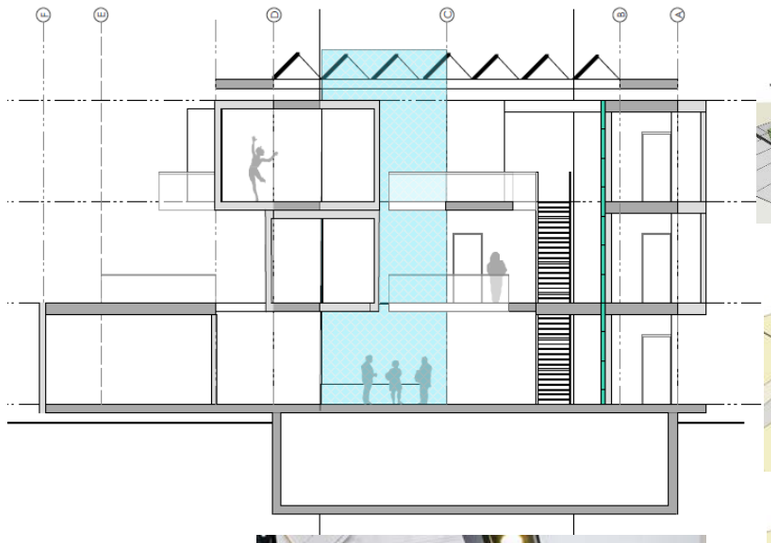
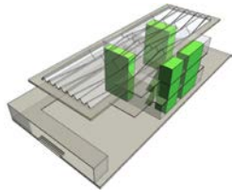
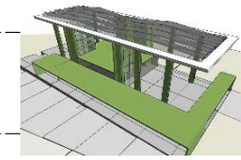
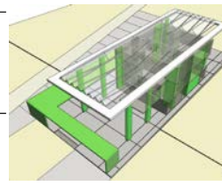
Technical requirements climate core overview

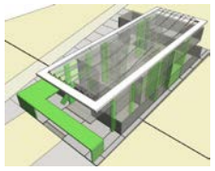


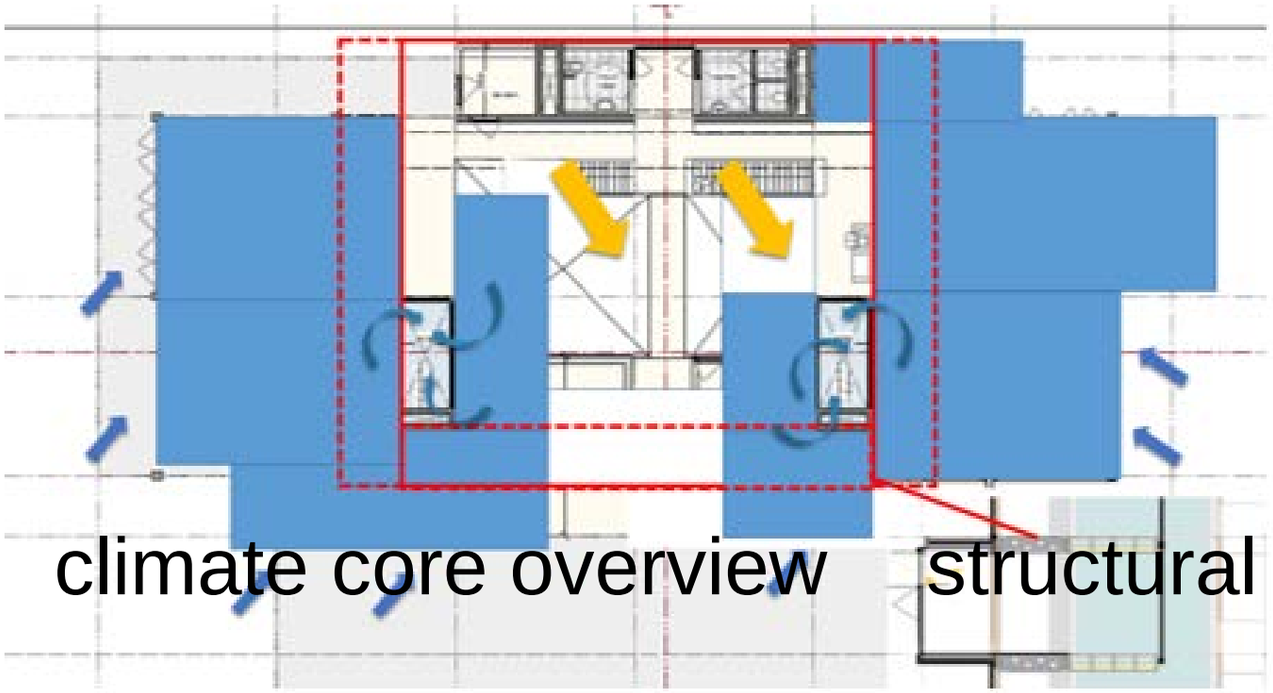








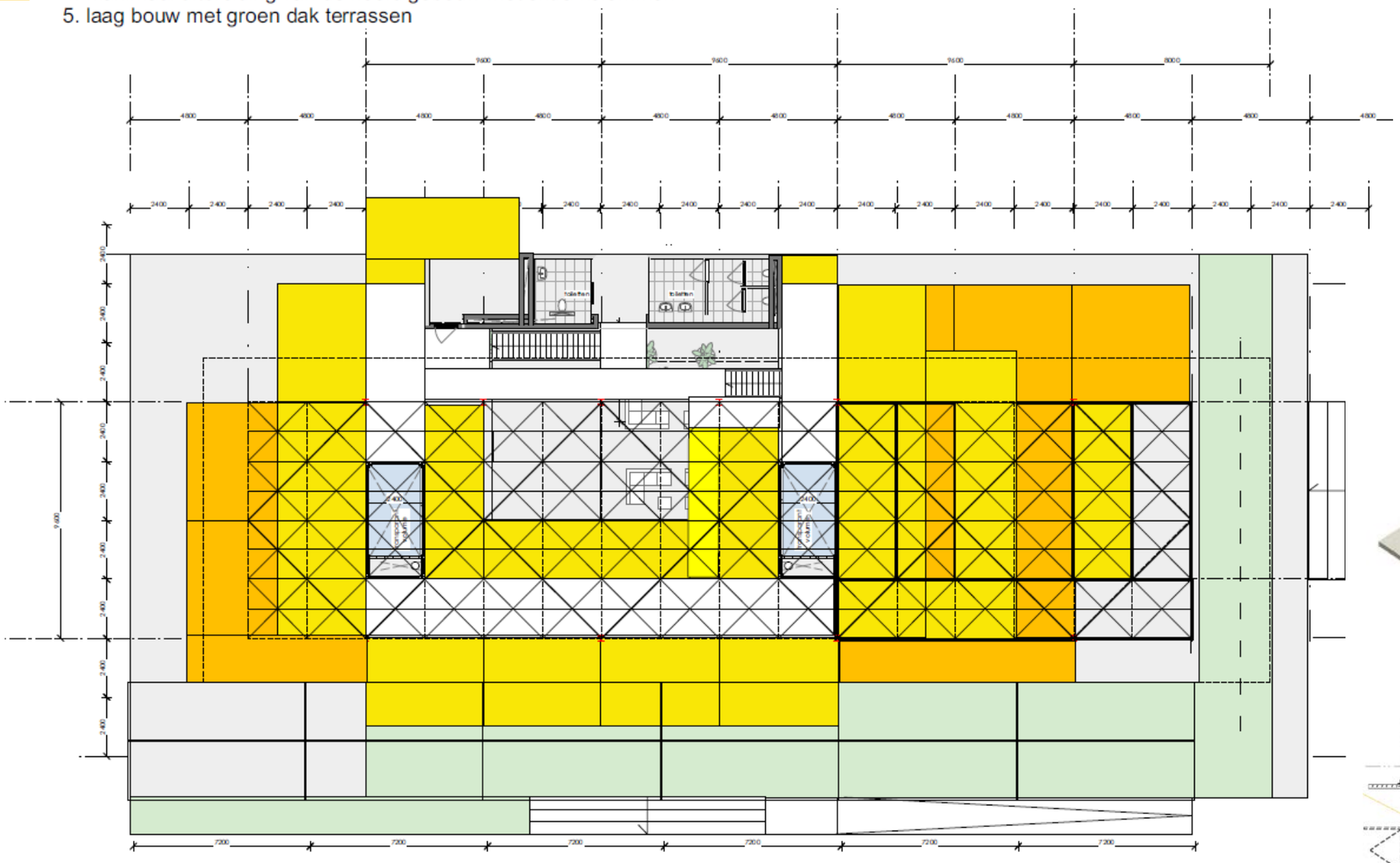


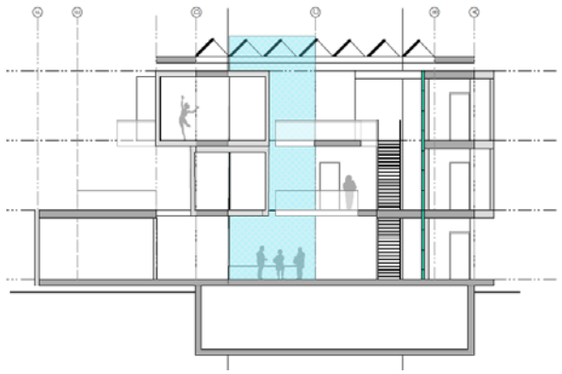


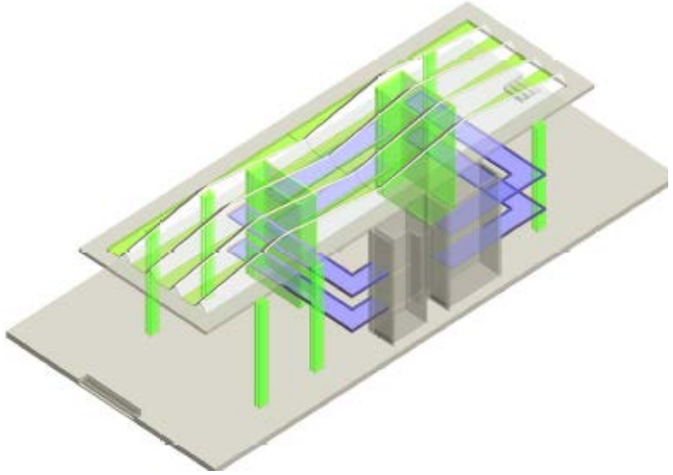
climate core overview structural core overv

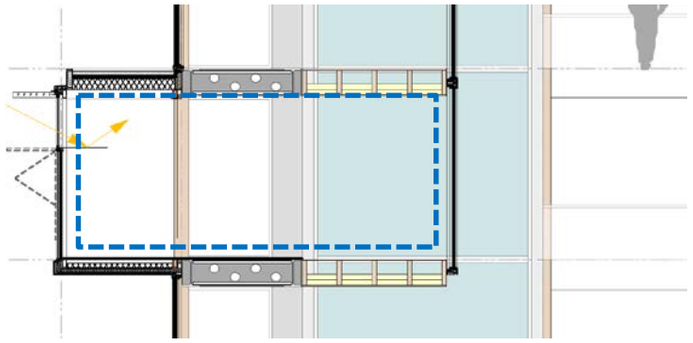
Technical requirements - structural core overview

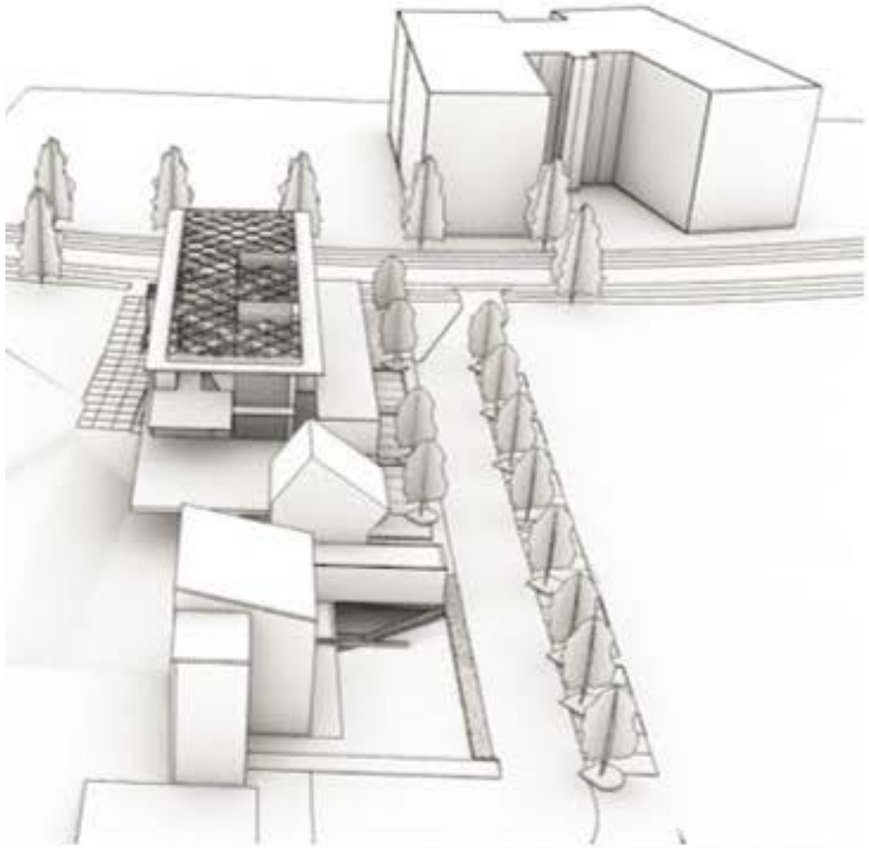
overzicht uitbreiding constructie (5 zones)
1. verticaal core
2. horizontaal distributie zone met HE dragers van uitbreiding zone (zone3)
3. eerste uitbreiding zone van de hooft gebouw
4. maximaal uitbreiding van de hoofd gebouw met extra kolommen
5. laag bouw met groen dak terrassen

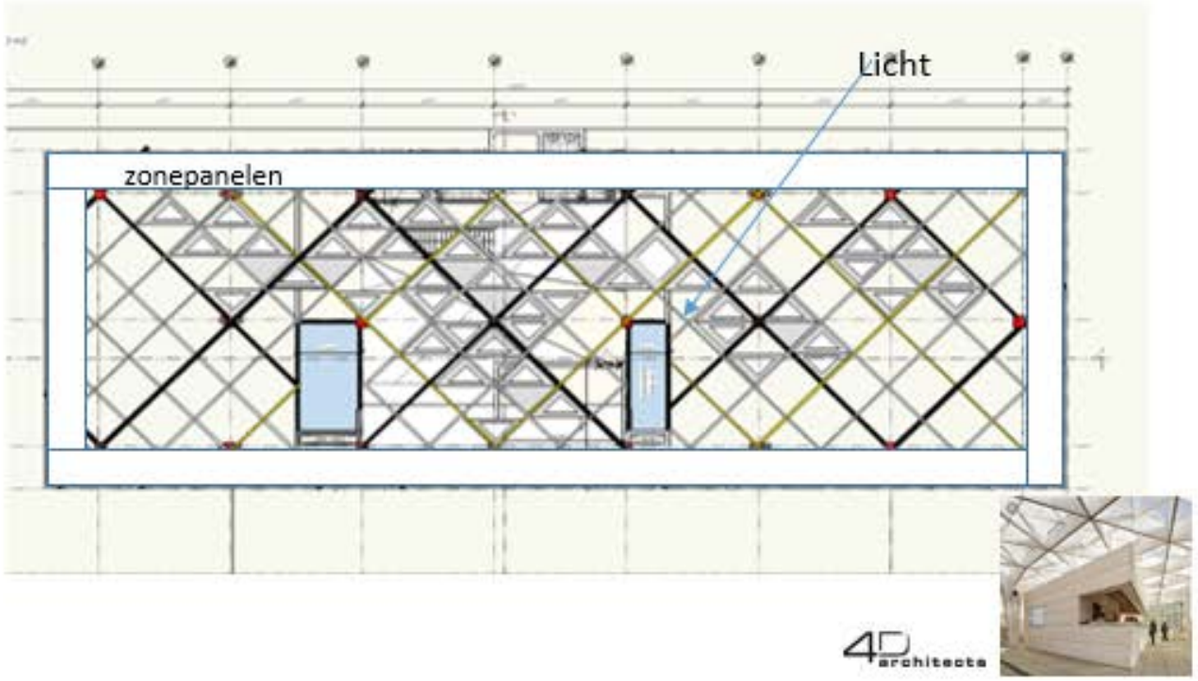


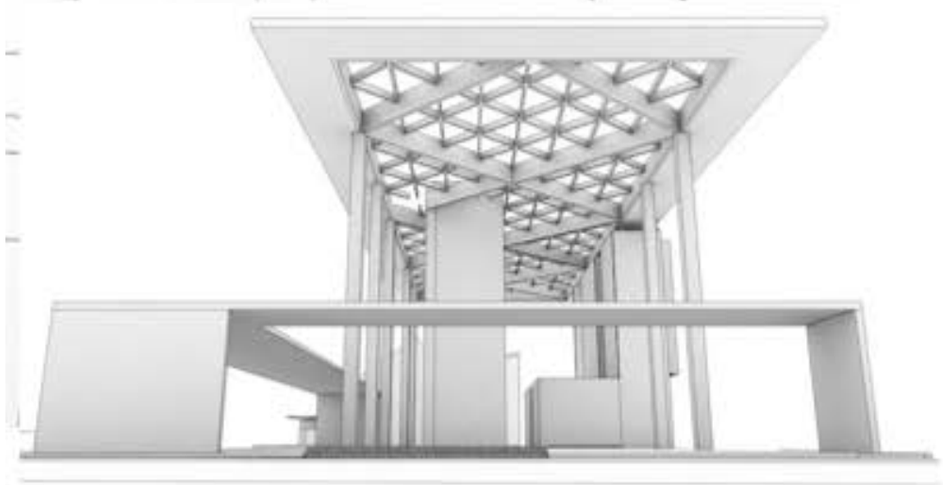


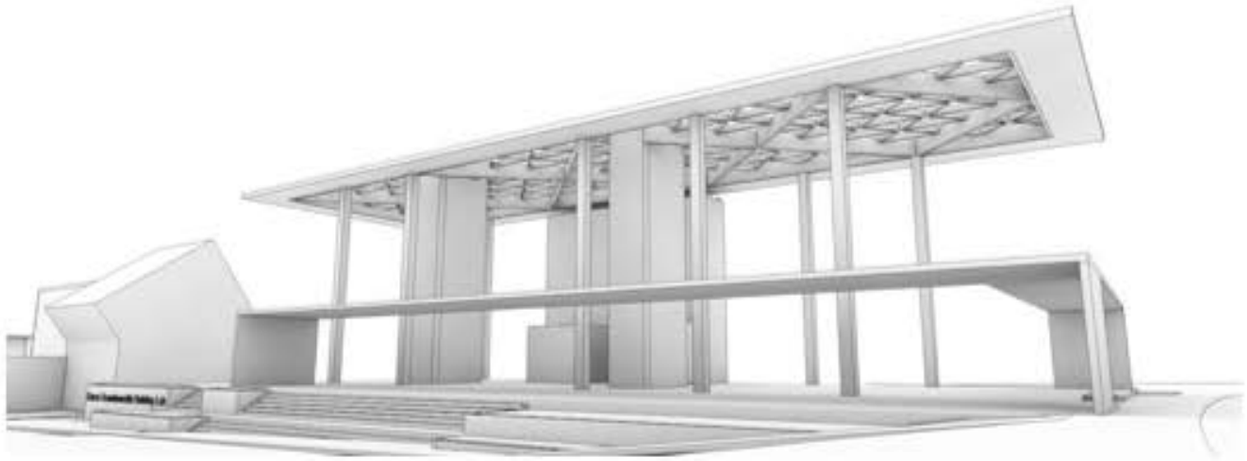


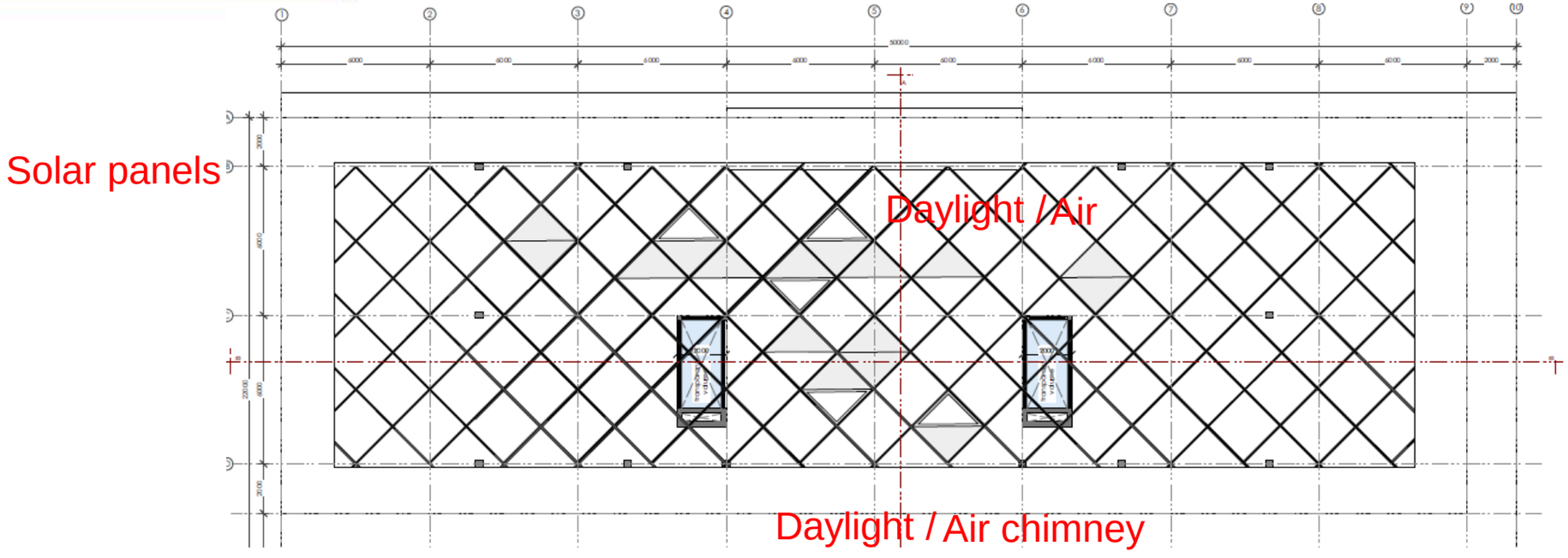


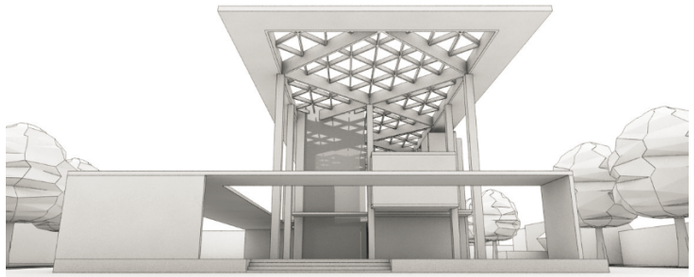


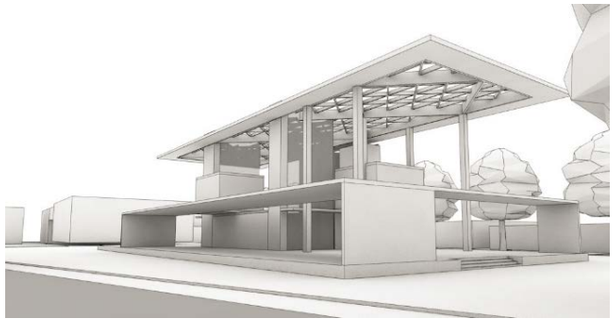

Licht
zonepanelen
4D architects

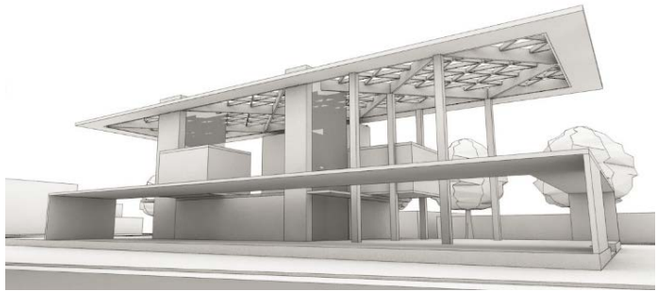


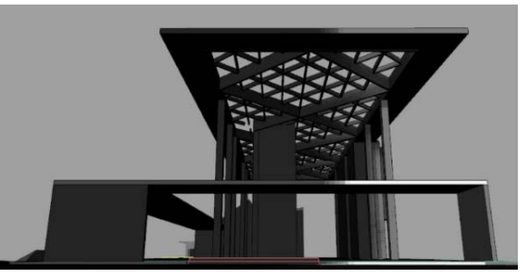


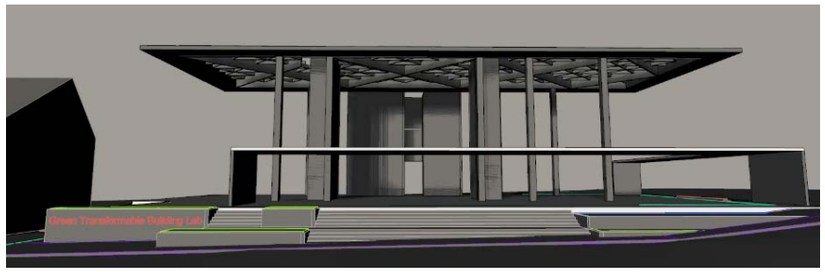

Solar panels
Daylight / Air
Daylight / Air chimney

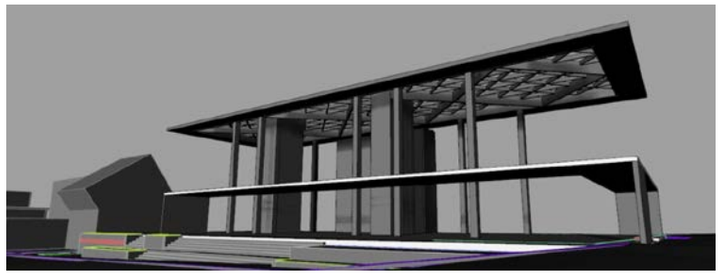


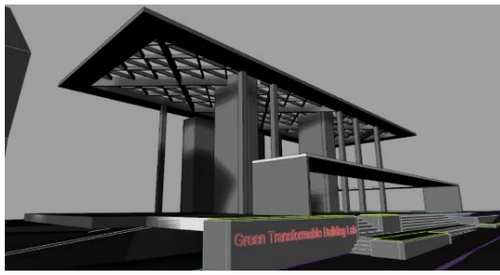


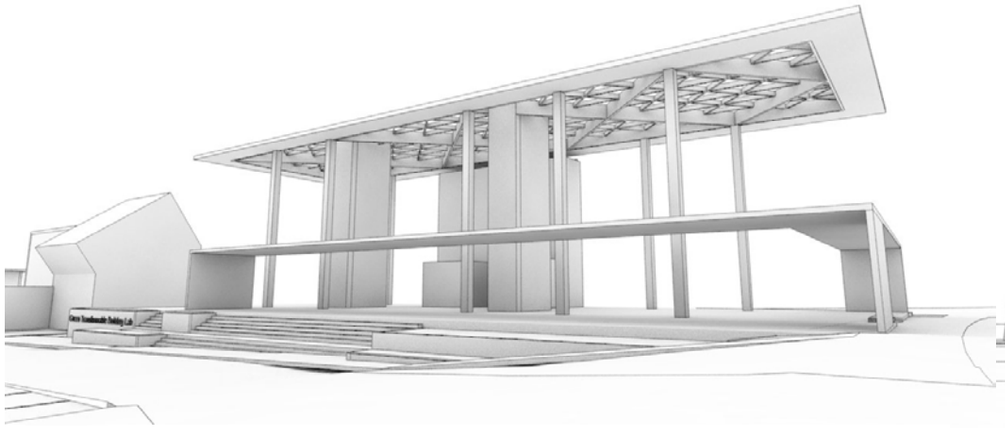


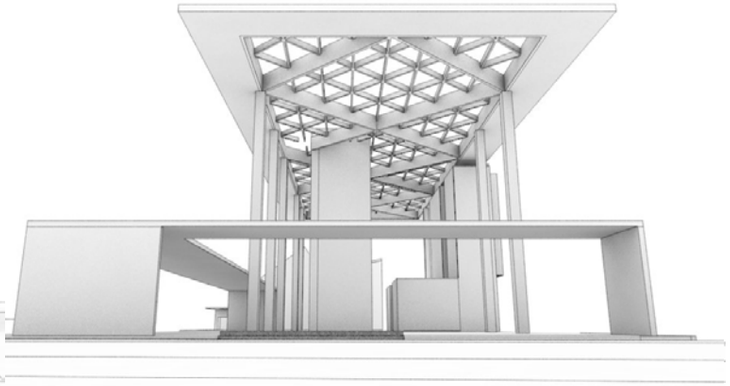




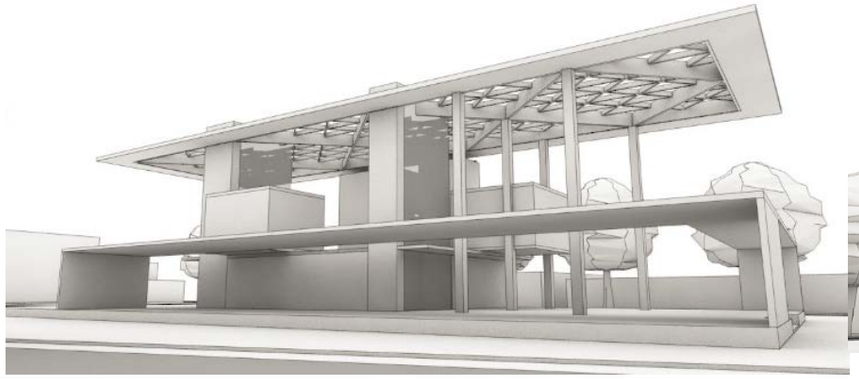


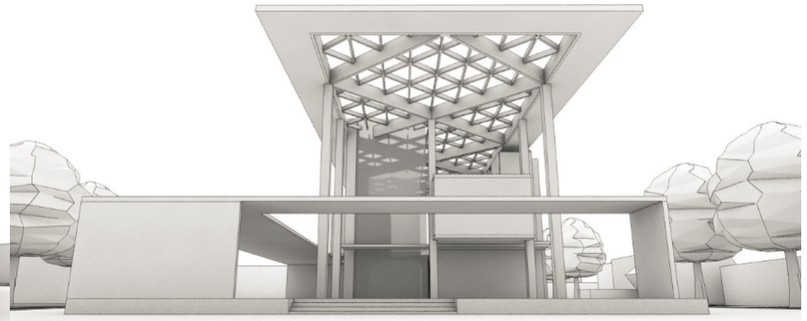






Start PHASE





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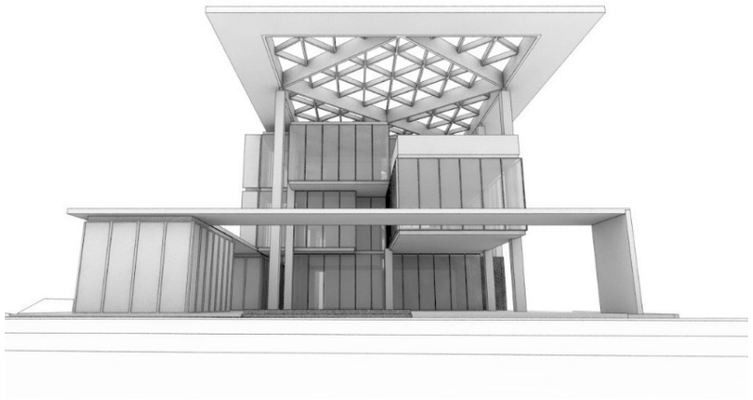
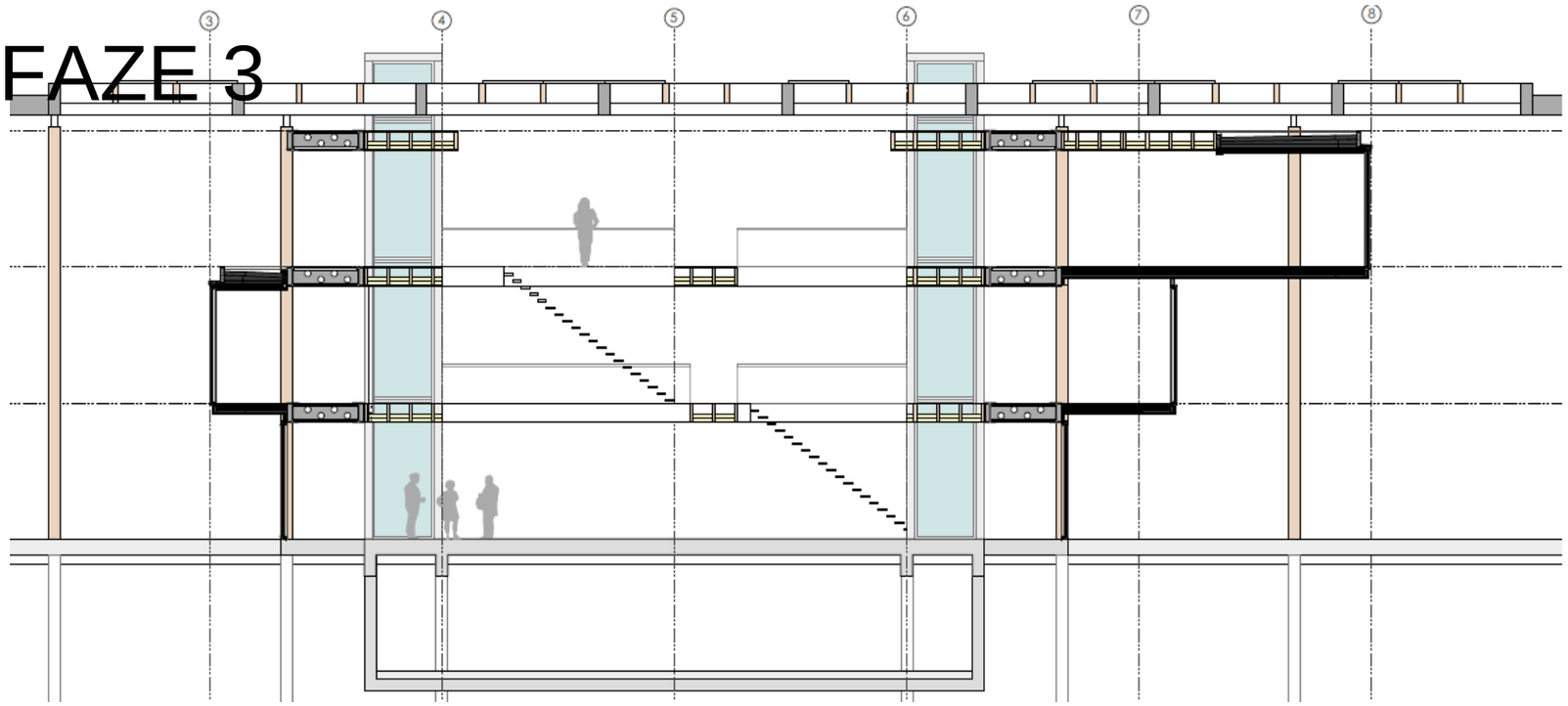


PHASE 3

FAZE 3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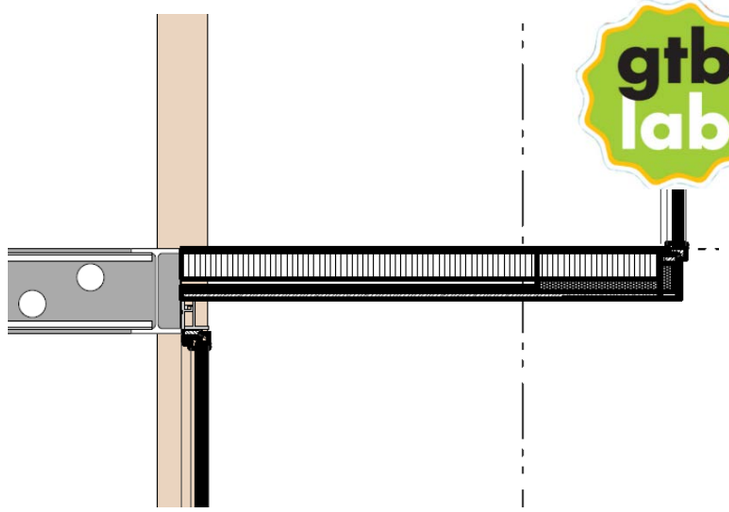
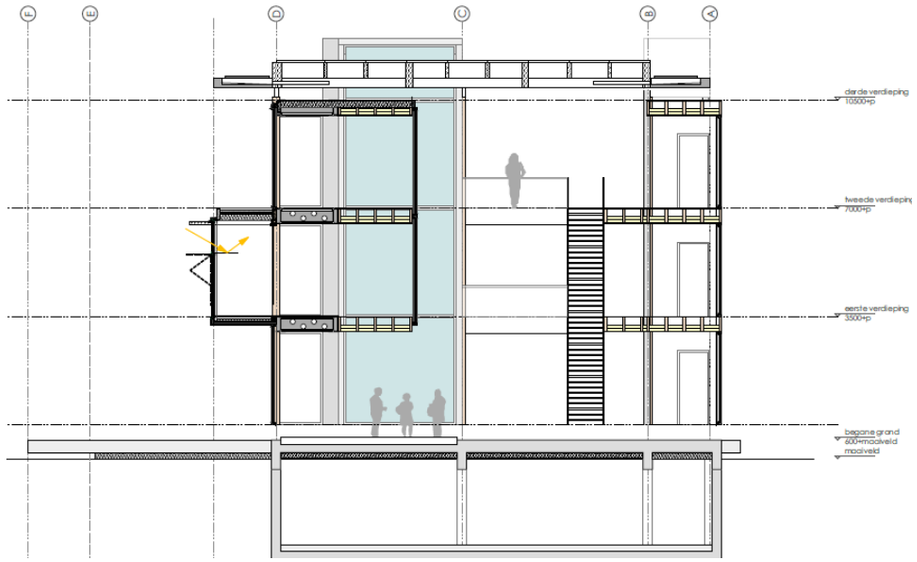
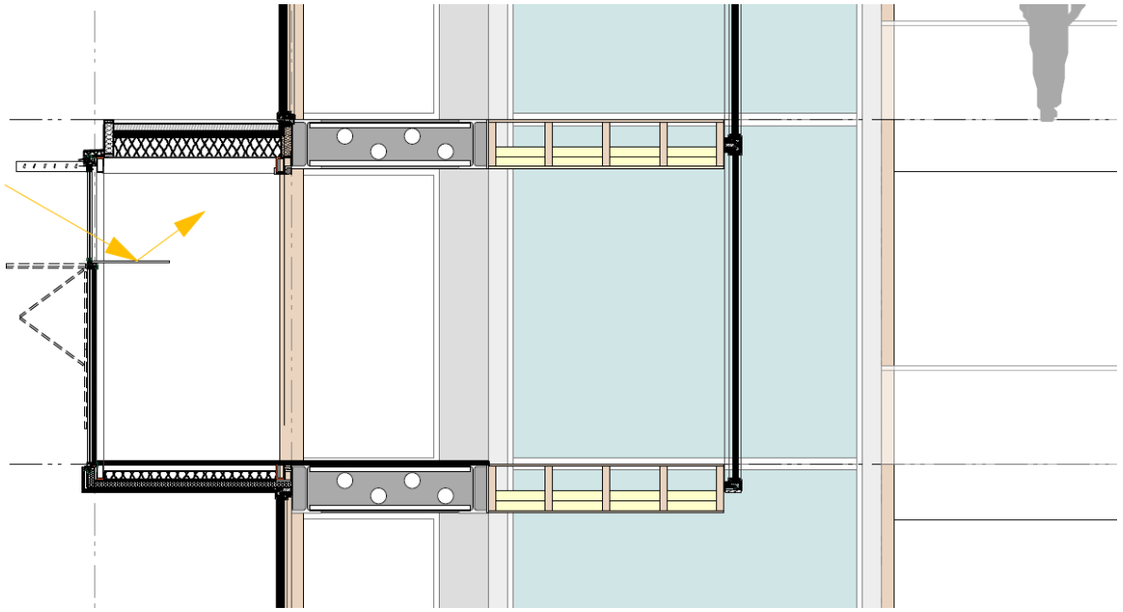
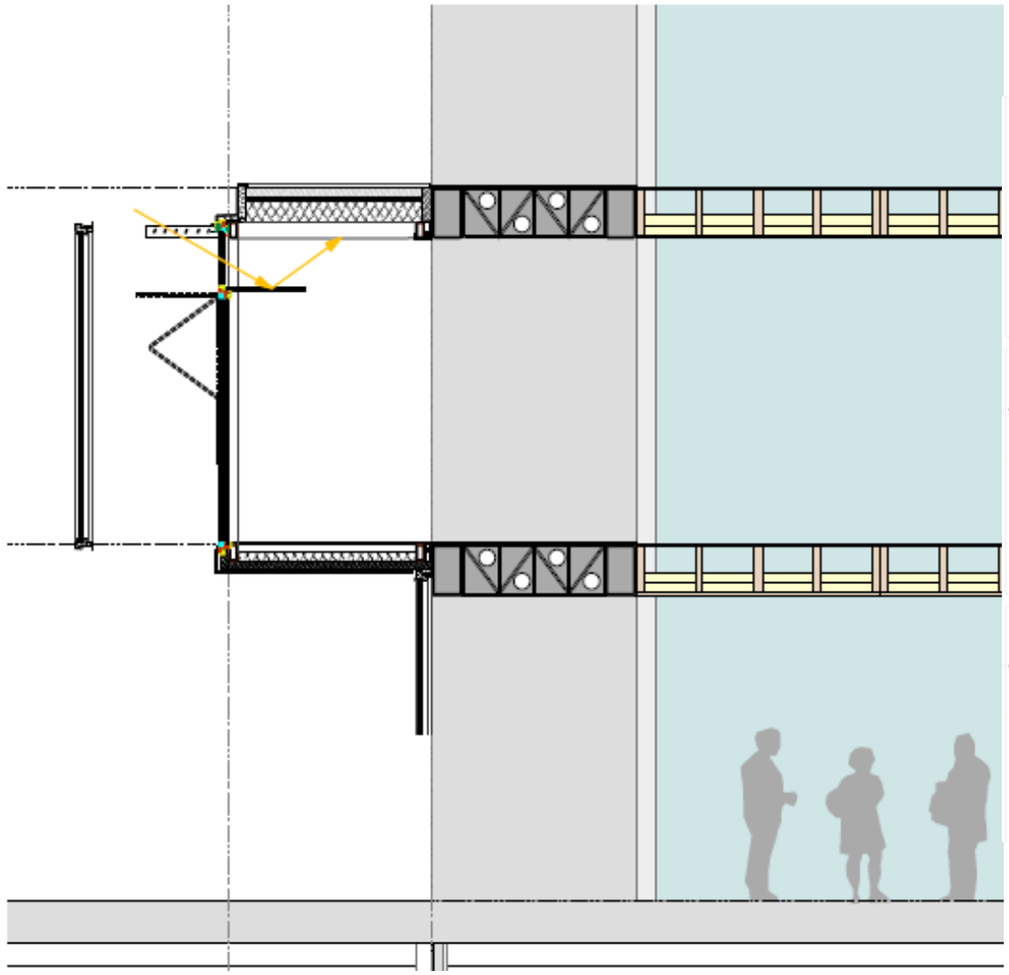
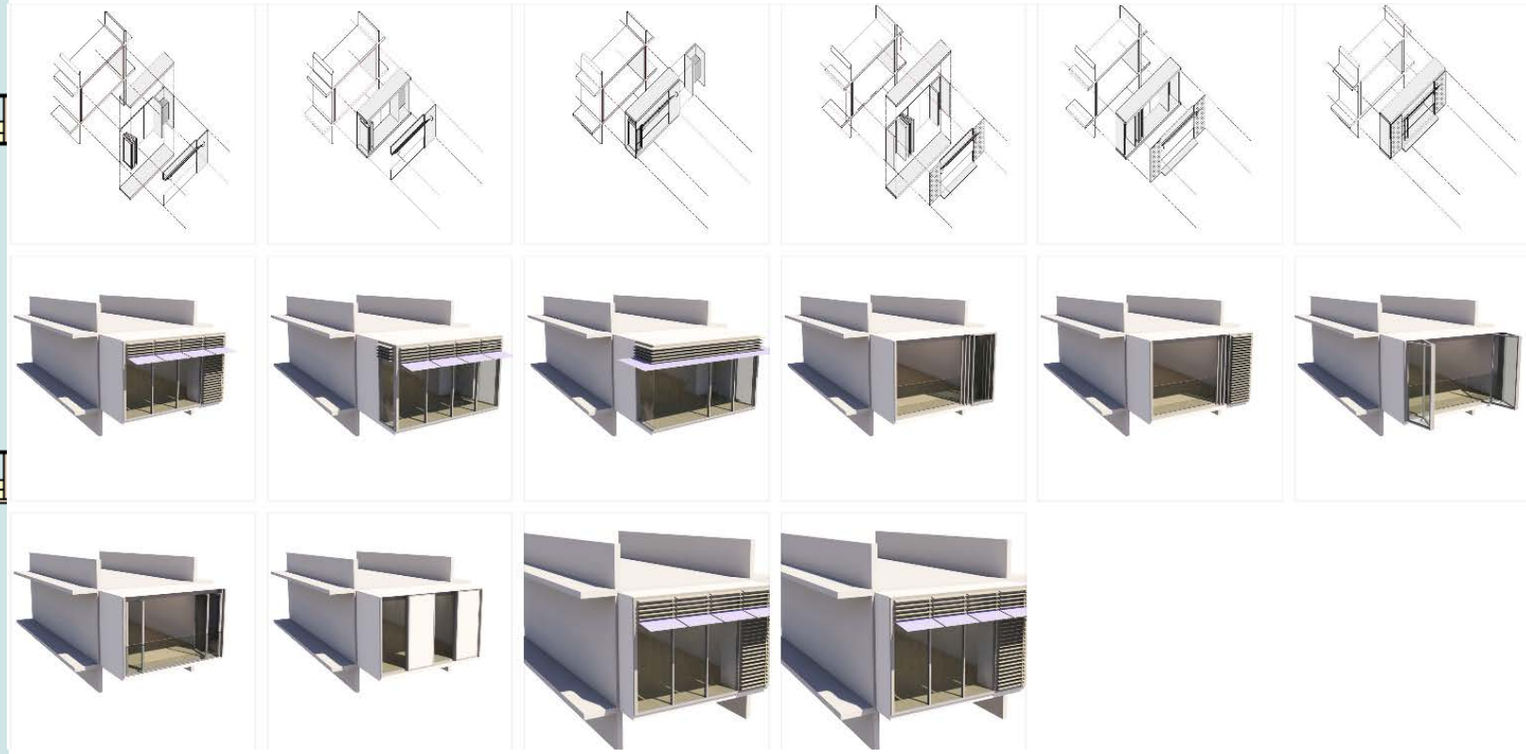



derde verdieping
10500+p
tweede verdieping
7000+p
eerste verdieping
3500+p
begane grond
600+maaiveld
maaiveld



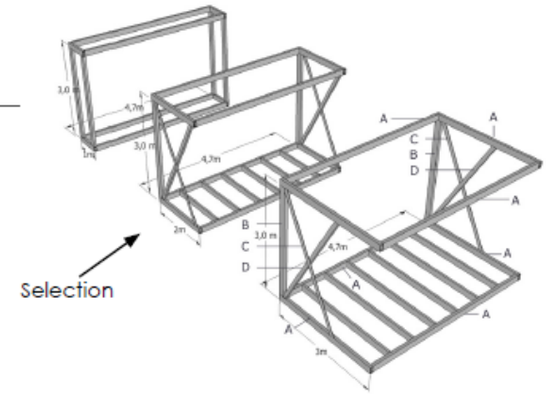
GTB-Lab - extension module

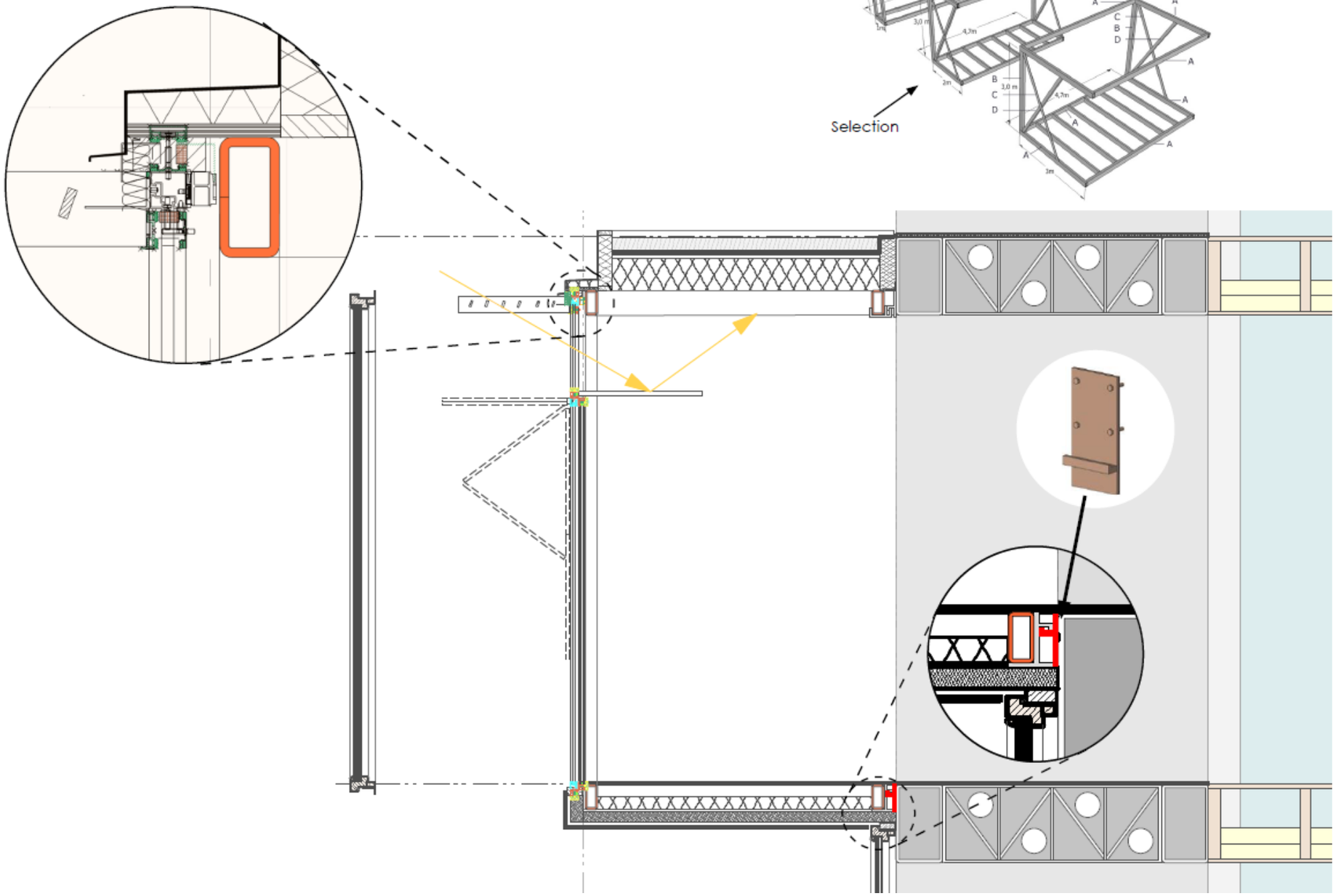


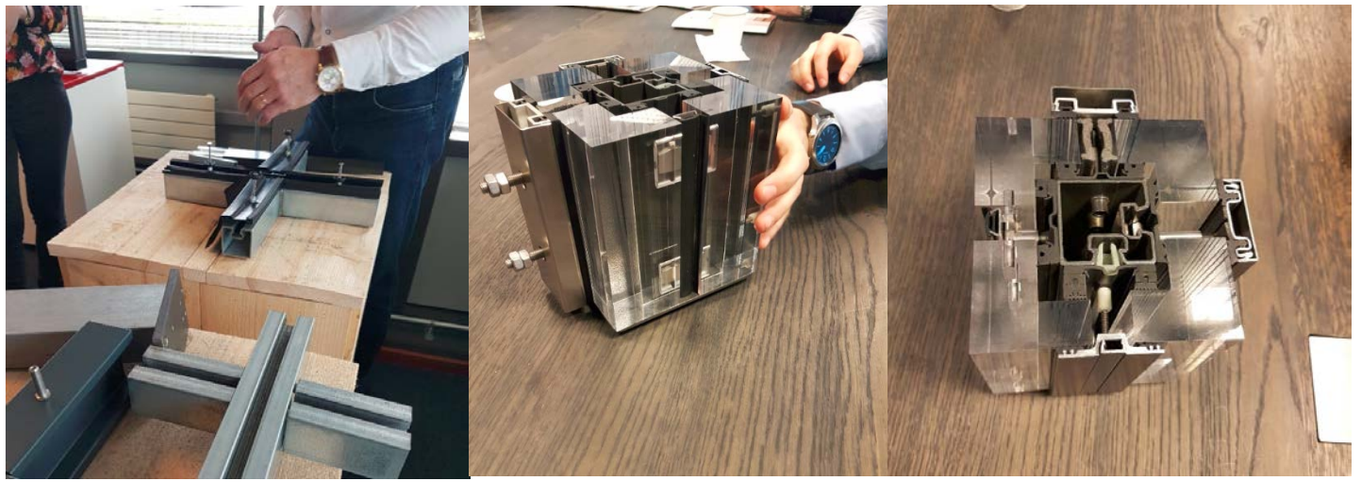


GTB-Lab - extension module

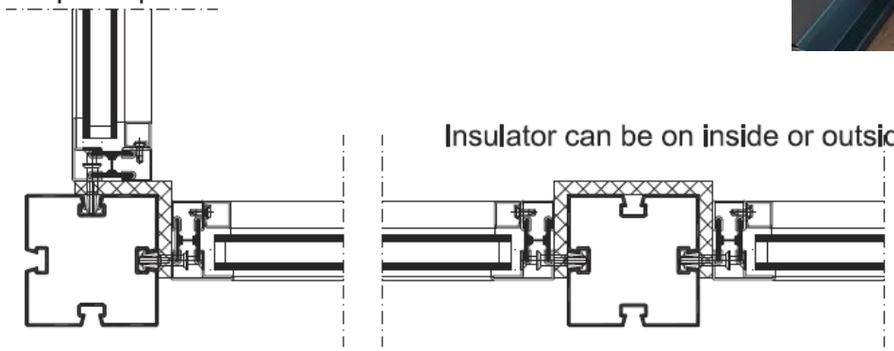
Extension structure variants



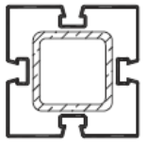




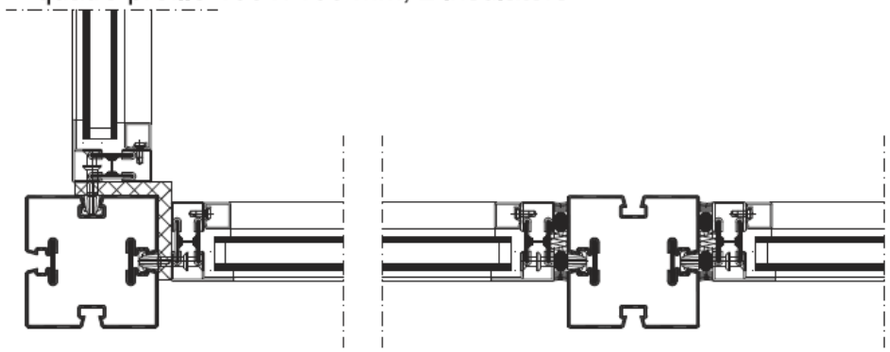
quatro profile 100 x 100 mm



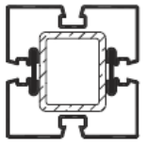
quatro profile 100 x 100 mm
square hollow section 60mm x 5mm



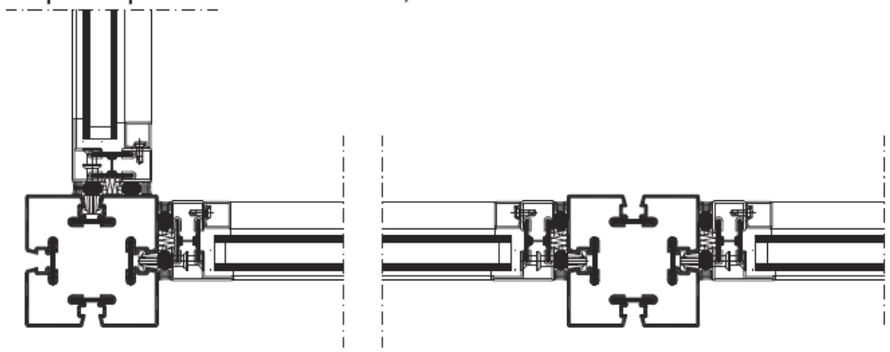
quatro profile 100 x 100 mm, 2 insulators



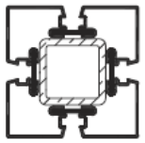
quatro profile 100 x 100 mm, 2 insulators
rectengular hollow section 50 x 60 x 5mm

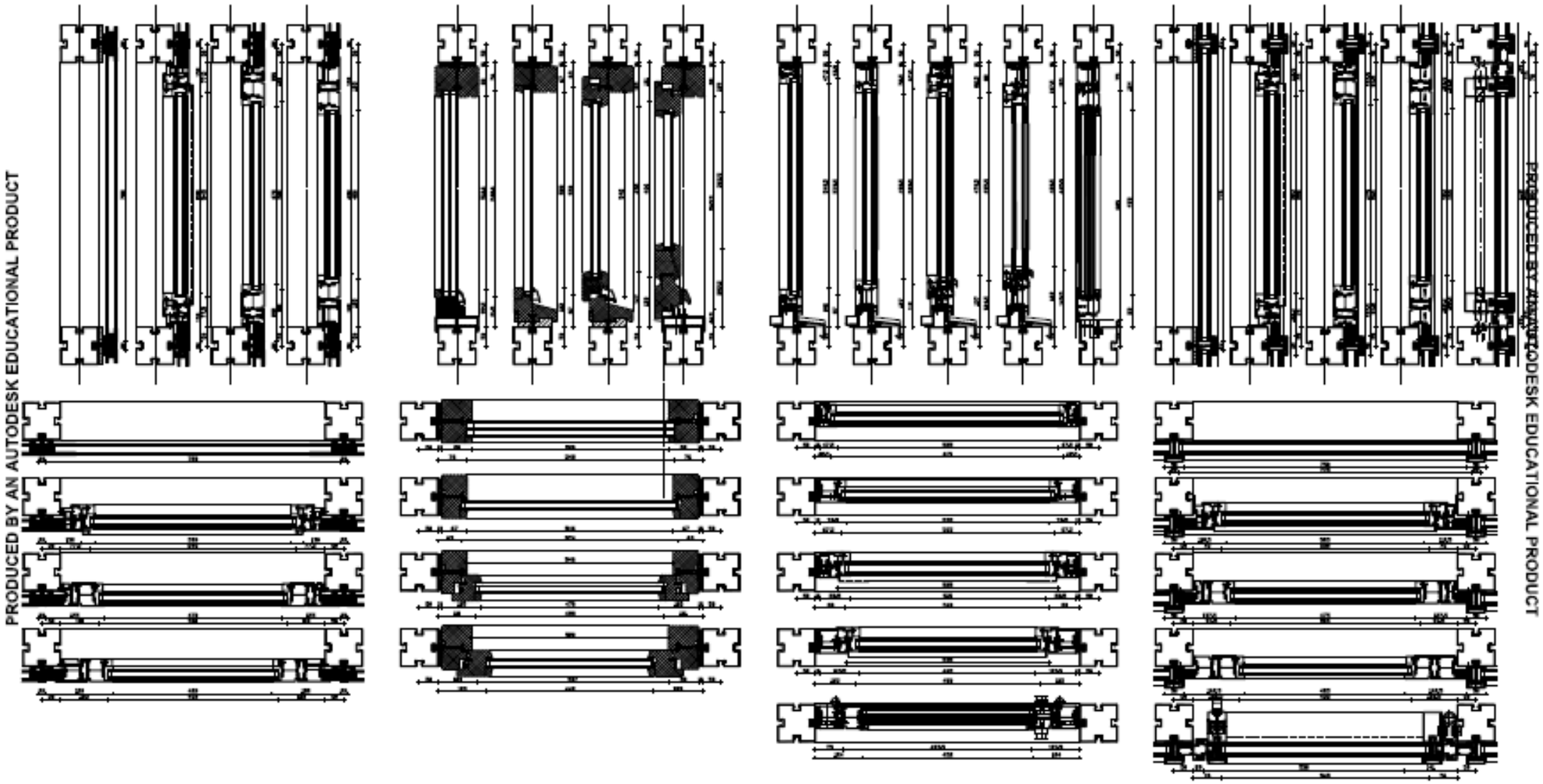


quatro profile 100 x 100 mm, 4 insulators



quatro profile 100 x 100 mm, 4 insulators
square hollow section 50mm x 5mm





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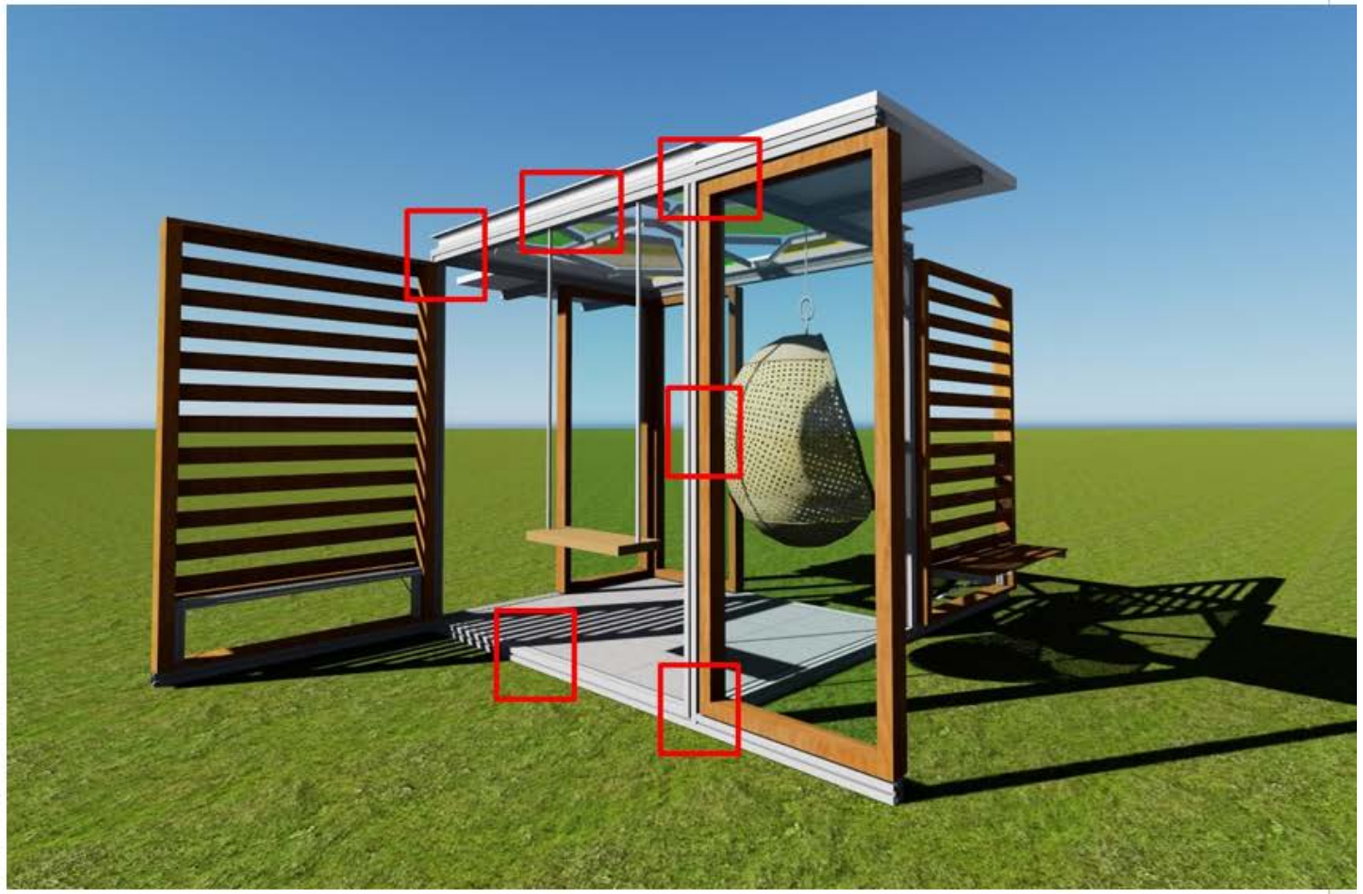
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

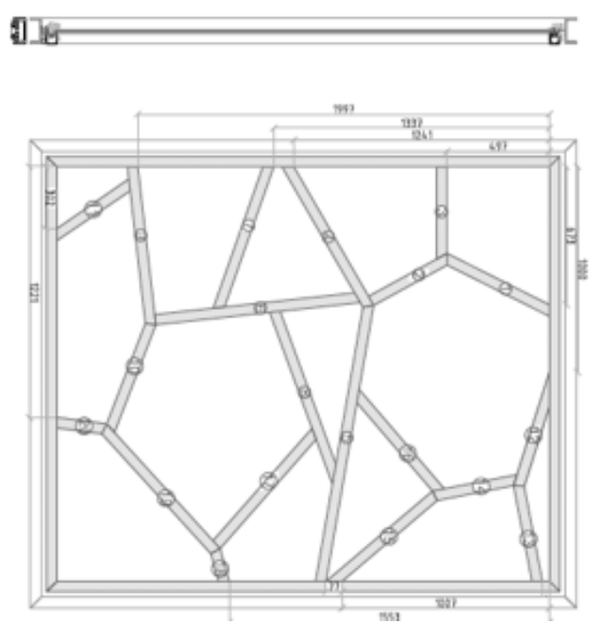


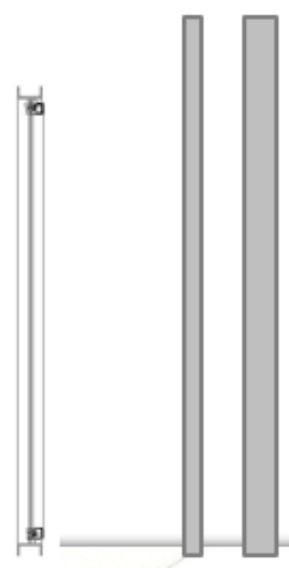
Source: IDC 2017 presentation Merima, Abdurahman, Esma, Amina, Ines, Rolf, Jornt, Reint, Samra, Bas & Bart

2x wooden panel (2230x3465)

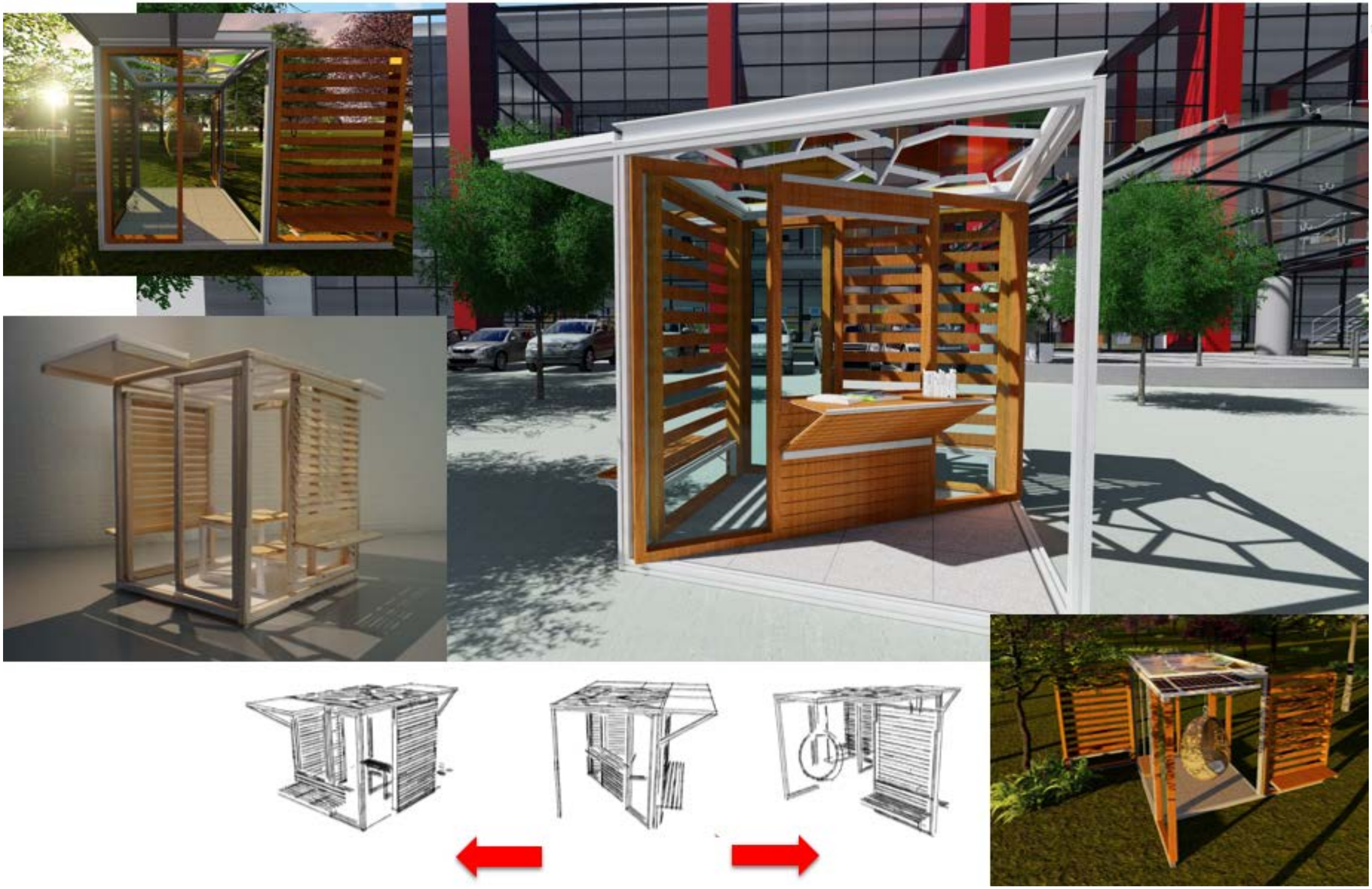
2x window frame (2230x3465)

1x soap frame (2650x2280)





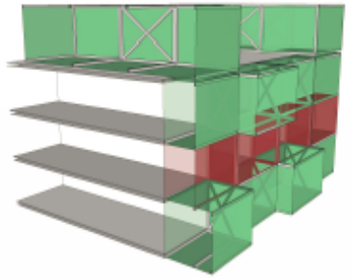
Extrusion Profile (80x80xinfinity)
(50x50xinfinity)


gtb
lab

Vergelijkings matrix

voor uitbreidingsmodule toegepast op flatgebouw

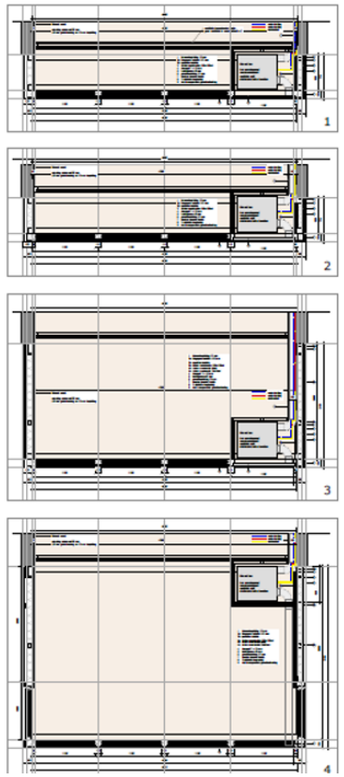
energieconcept, isolatie en EPC waarden



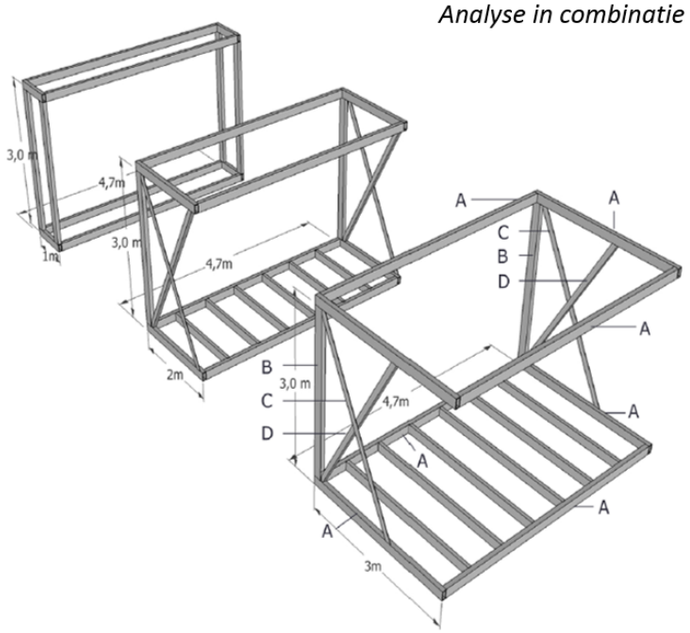
	installatie concept	invoer gegevens	materiaal dikte (mm)
EPC 0,6 Rc 5	ruimte verwarming: lokaal electrisch warm tapwater: WP + lokaal electrisch ventilatie: mechanisch met WW PV(E): PV 4 + PVE 4 m2	gesloten gevelopp: U-waarde: 0,19 transparante gevelopp: U-waarde: 1,60 ZTA waarde: 0,60 infiltratie: 0,181	PUR 143 KINGSPAN 143 MIN. WOL 200
EPC 0,6 Rc 5	ruimte verwarming: laag temperatuur systeem warm tapwater: WP Nilan vp18 ventilatie: natuurlijk PV(E): geen	gesloten gevelopp: U-waarde: 0,19 transparante gevelopp: U-waarde: 1,20 ZTA waarde: 0,36 dubbele gevel: U-waarde: 0,78 ZTA waarde: 0,36 infiltratie: 0,181	PUR 143 KINGSPAN 143 MIN. WOL 200
EPC 0,52 Rc 8	ruimte verwarming: laag temperatuur systeem warm tapwater: combi WP NILAN VP18 ventilatie: balansvent NILAN VP18 WP PV(E): PV 1 + PVE 3 m2	gesloten gevelopp: U-waarde: 0,12 transparante gevelopp: U-waarde: 0,8 ZTA waarde: 0,36 dubbele gevel: U-waarde: 3,12 ZTA waarde: 0,60 infiltratie: 0,181	PUR 321 KINGSPAN 241 MIN. WOL 441
EPC 0,4 Rc 7	ruimte verwarming: laag temperatuur systeem warm tapwater: WP Nilan VP18 met WW ventilatie: balansventilatie mbv WP PV(E): PV 4 + PVE 4 m2	gesloten gevelopp: U-waarde: 0,14 transparante gevelopp: U-waarde: 1,20 ZTA waarde: 0,36 dubbele gevel: U-waarde: 2,2 ZTA waarde: 0,60 infiltratie: 0,181	PUR 250 KINGSPAN 196 MIN. WOL 341
EPC richting 0 Rc 9,6	ruimte verwarming: laag temperatuur systeem warm tapwater: combi WP Nilan VP18 ventilatie: balansventilatie mbv WP PV(E): PV 4 + PVE 6,5 m2	gesloten gevelopp: U-waarde: 0,14 transparante gevelopp: U-waarde: 1,20 ZTA waarde: 0,36 dubbele gevel: U-waarde: 2,2 ZTA waarde: 0,60 infiltratie: 0,181	PUR 321 KINGSPAN 241 MIN. WOL 441

WW: Warmte Wisselaar
WP: Warmtepomp

3 GTB Lab modulen geïntegreerd met hoge energie prestatie ambitie



Analyse in combinatie met staal

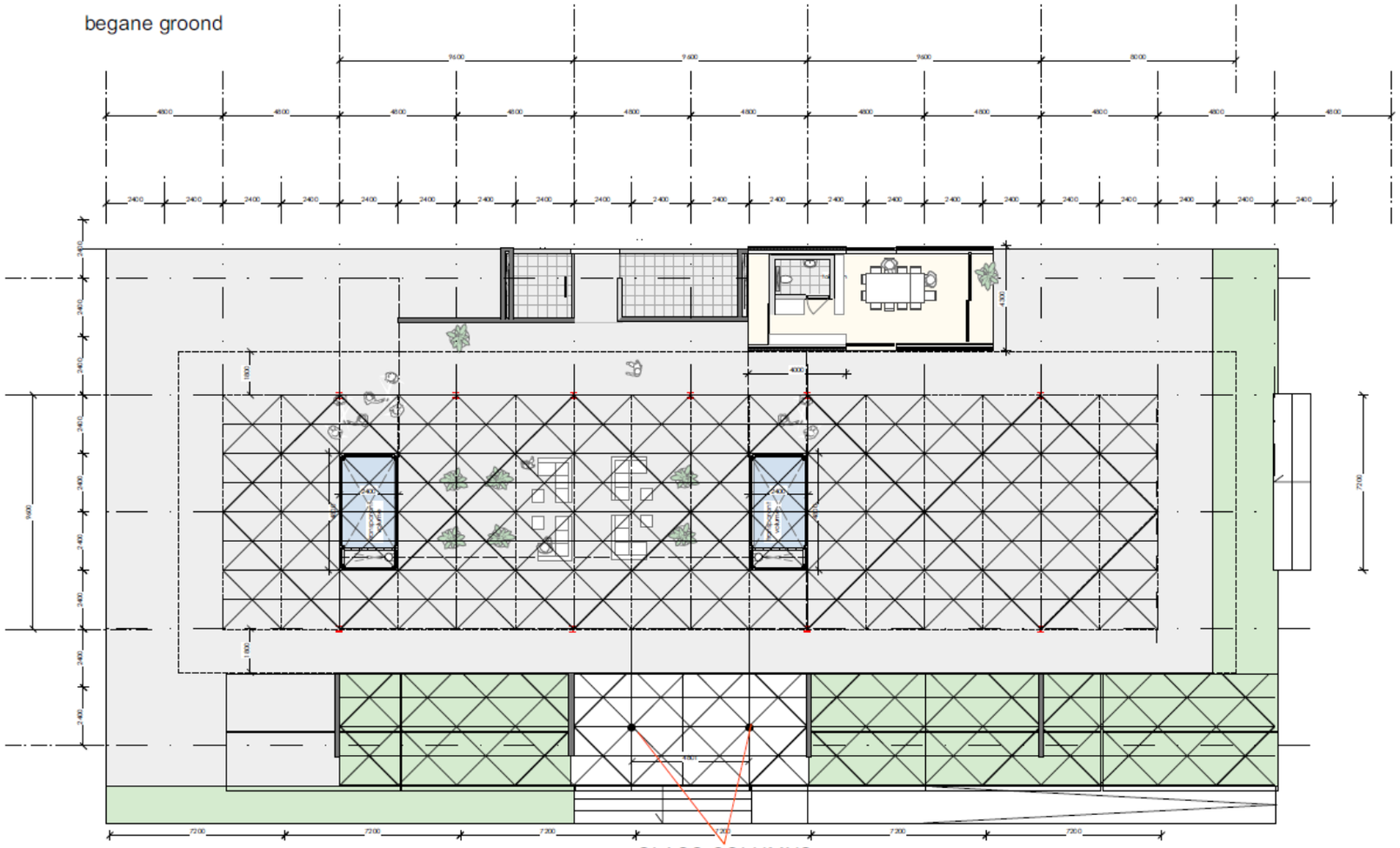


4D architects

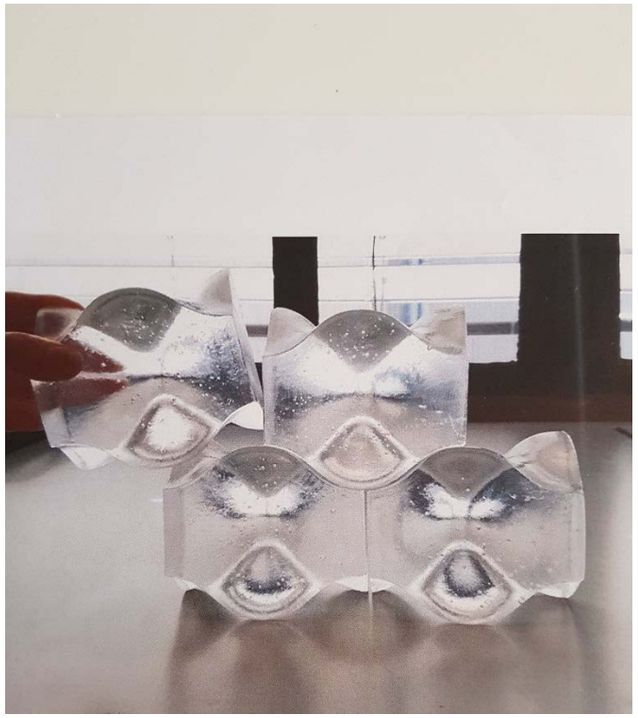
overzicht:
1. verticaal core

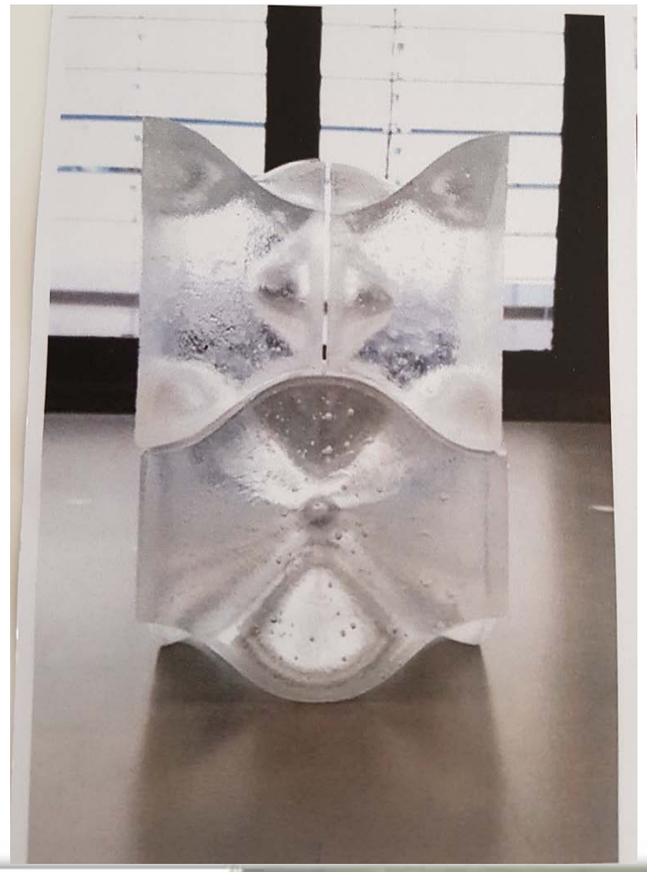
hoofd constructie dak 9600cmx9600cm
secondere grid 4800cm x 7200cm
terciaal 7200cm x 2400cm

begane groond

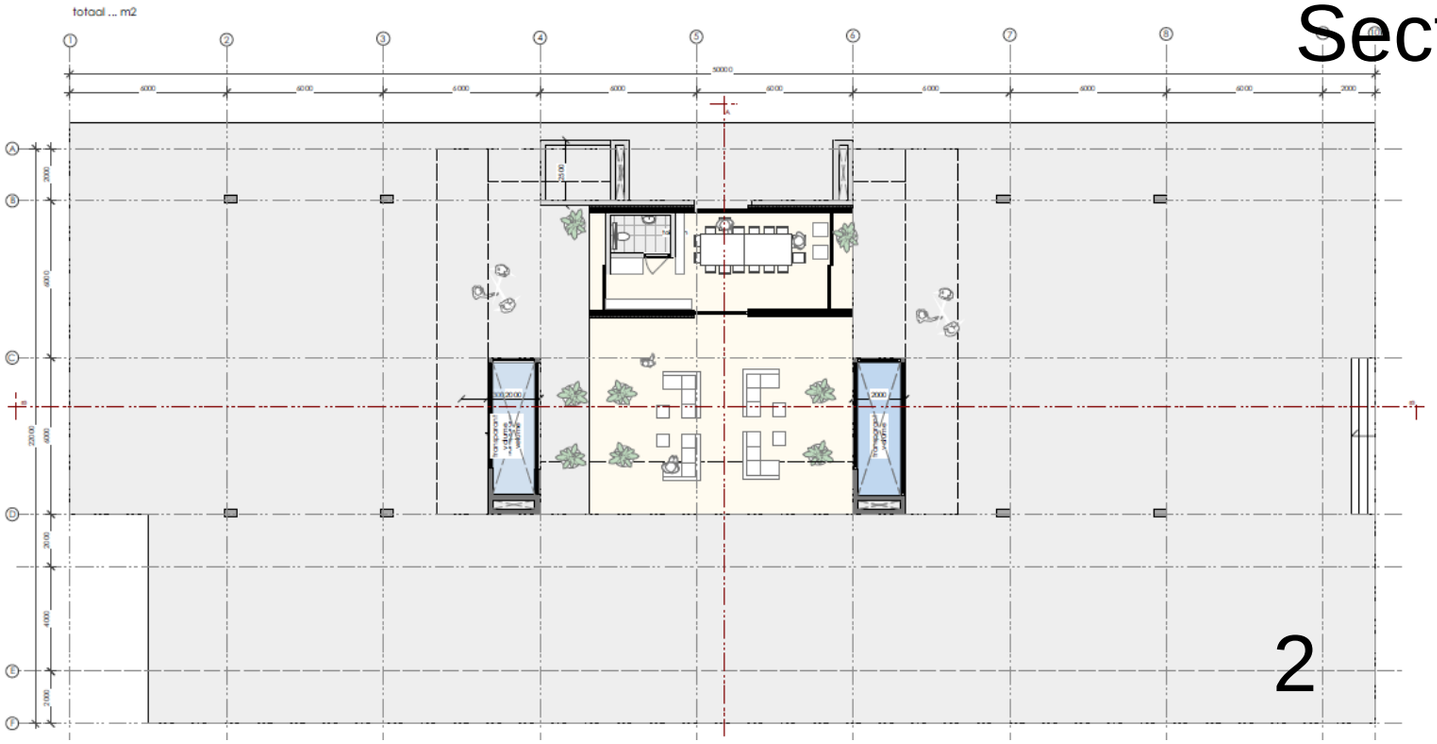


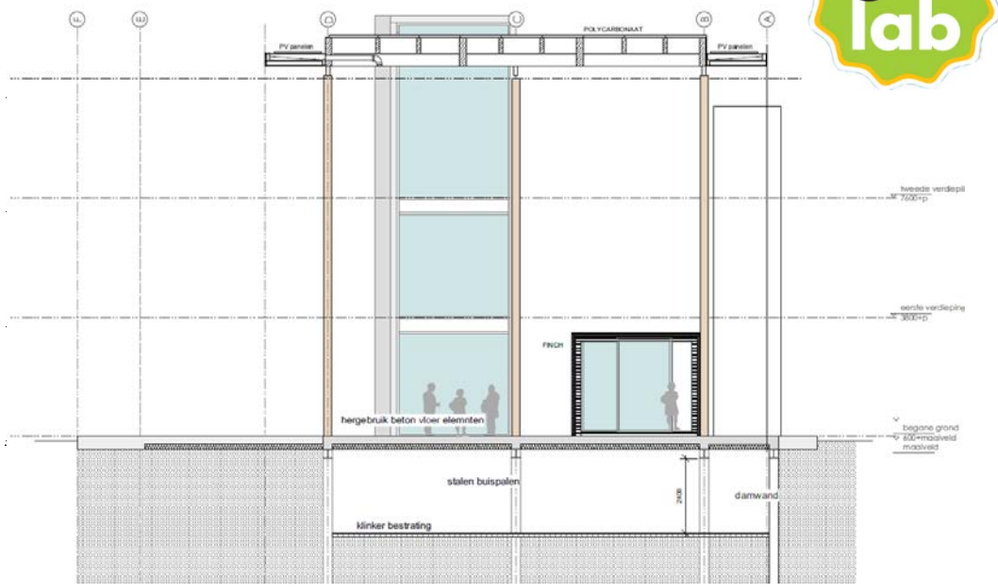
GLASS COLUMNS

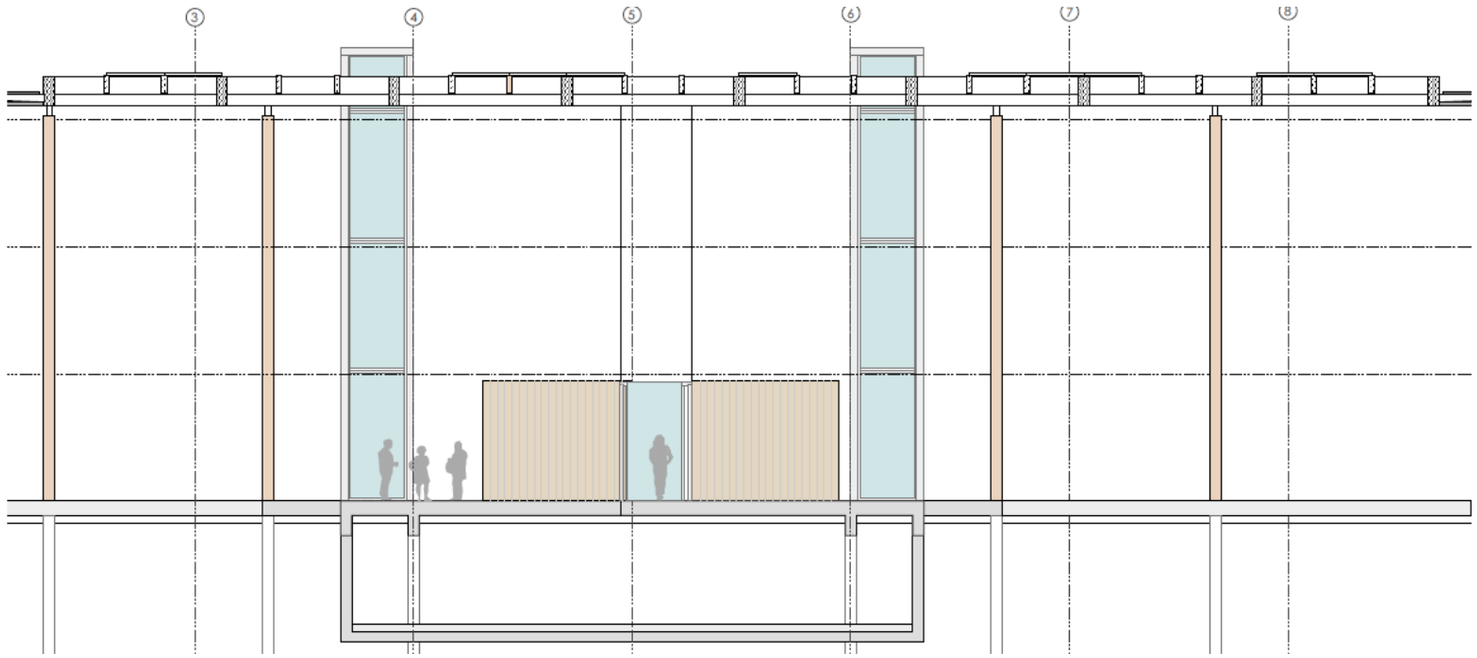




Sections Start PHASE 1

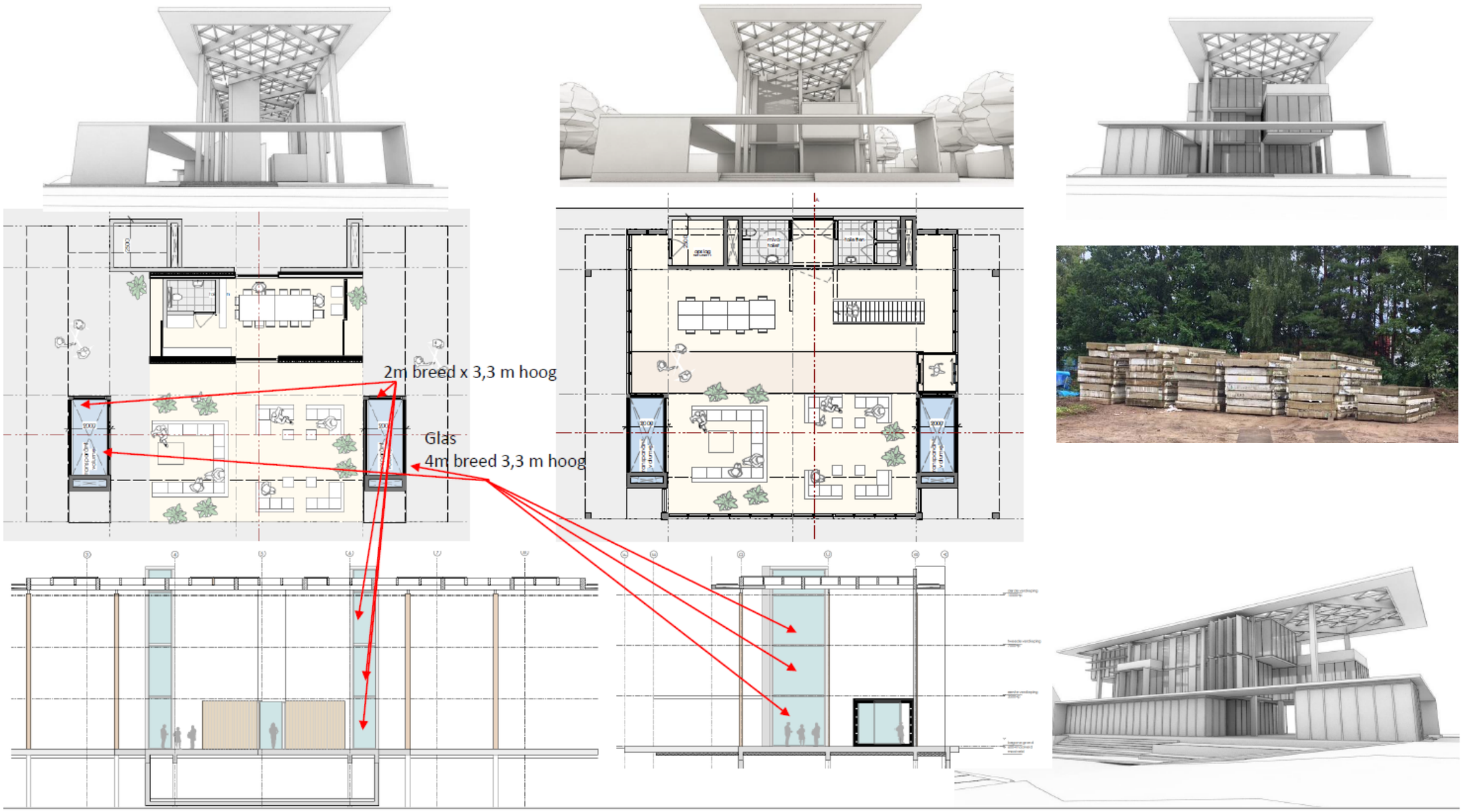






Start PHASE 1:

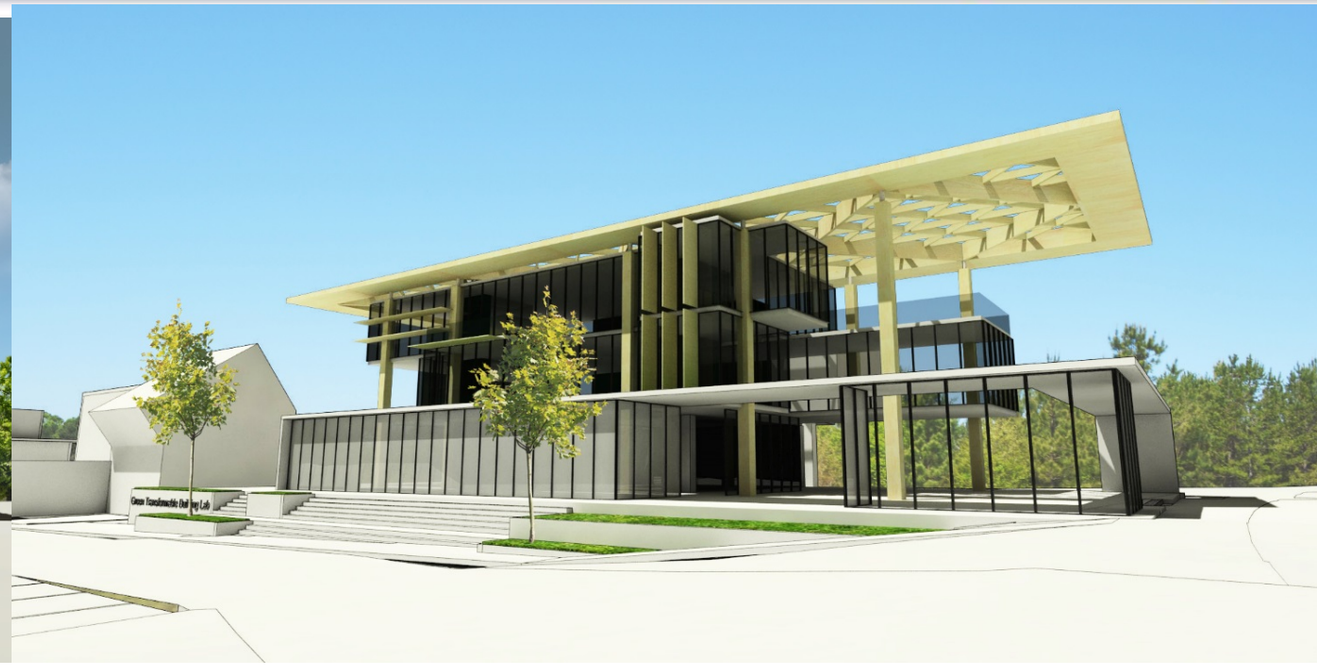
1. Ground works
2. Ground floor deck
3. Air and light columns
4. Structural columns and stability elements
5. Roof



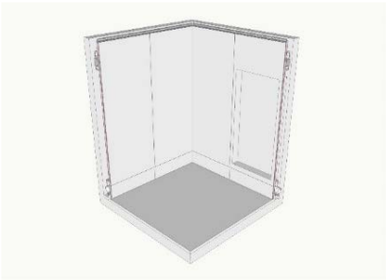
Reuse of concrete floor elements?

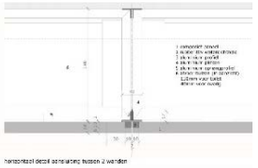
BAMB

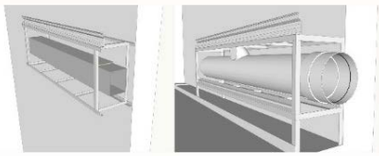
Co-funded by the Horizon 2020 Framework Programme of the European Union

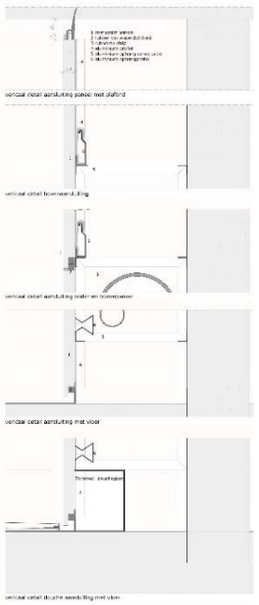


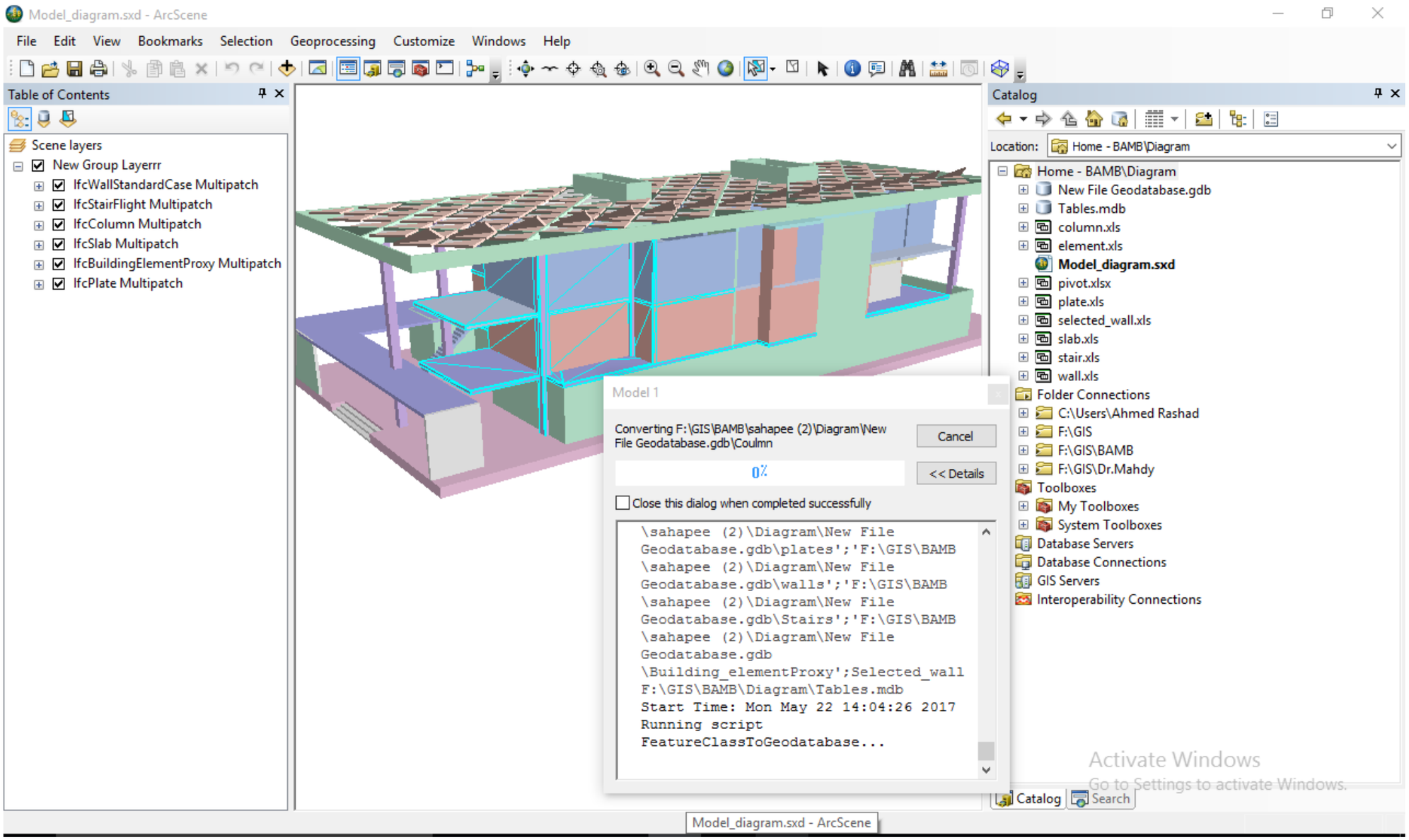
Reversible Façade bathroom module to be tested and developed further







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IfcStairFlight Multipatch
IfcColumn Multipatch
IfcSlab Multipatch
IfcBuildingElementProxy Multipatch
IfcPlate Multipatch
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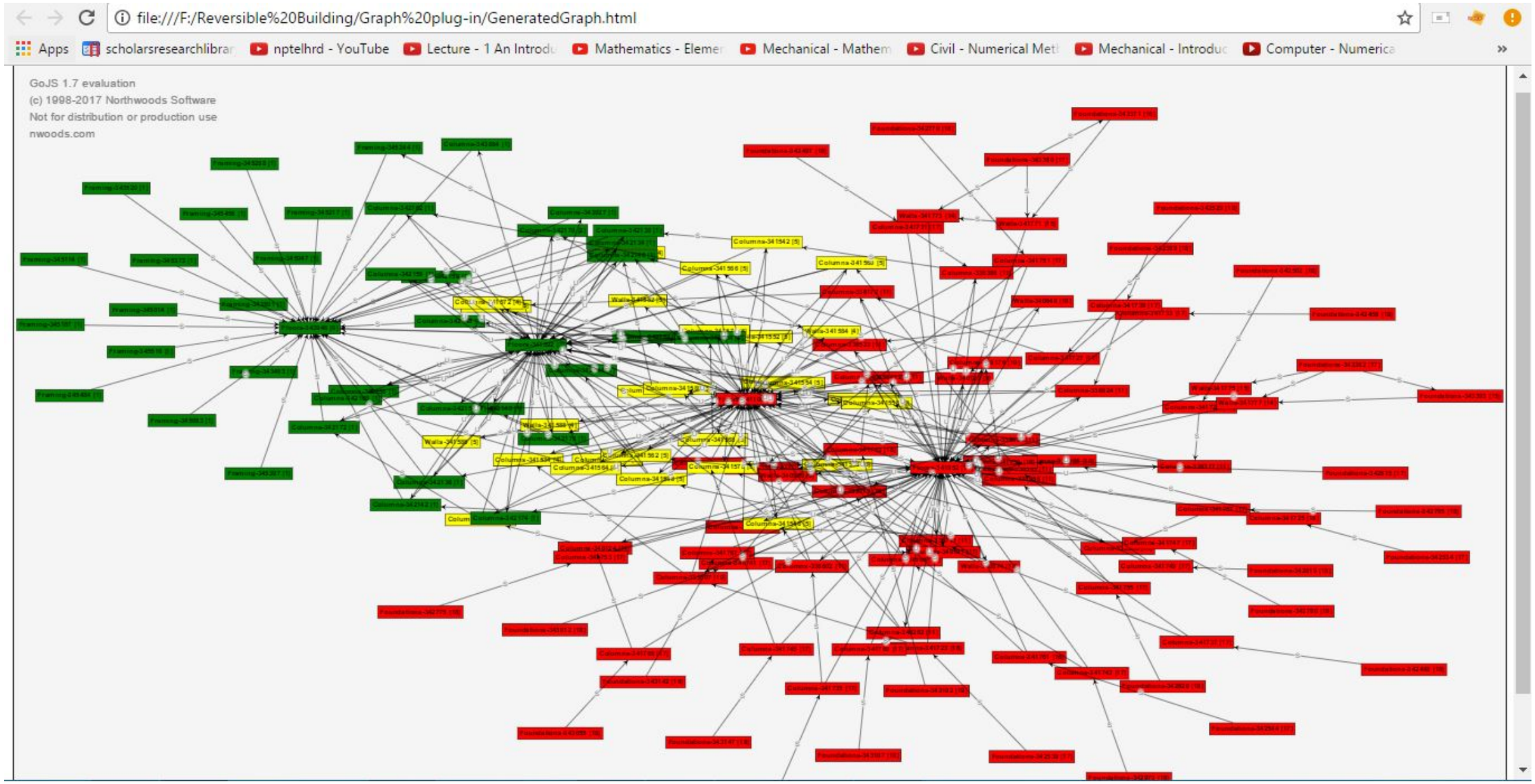
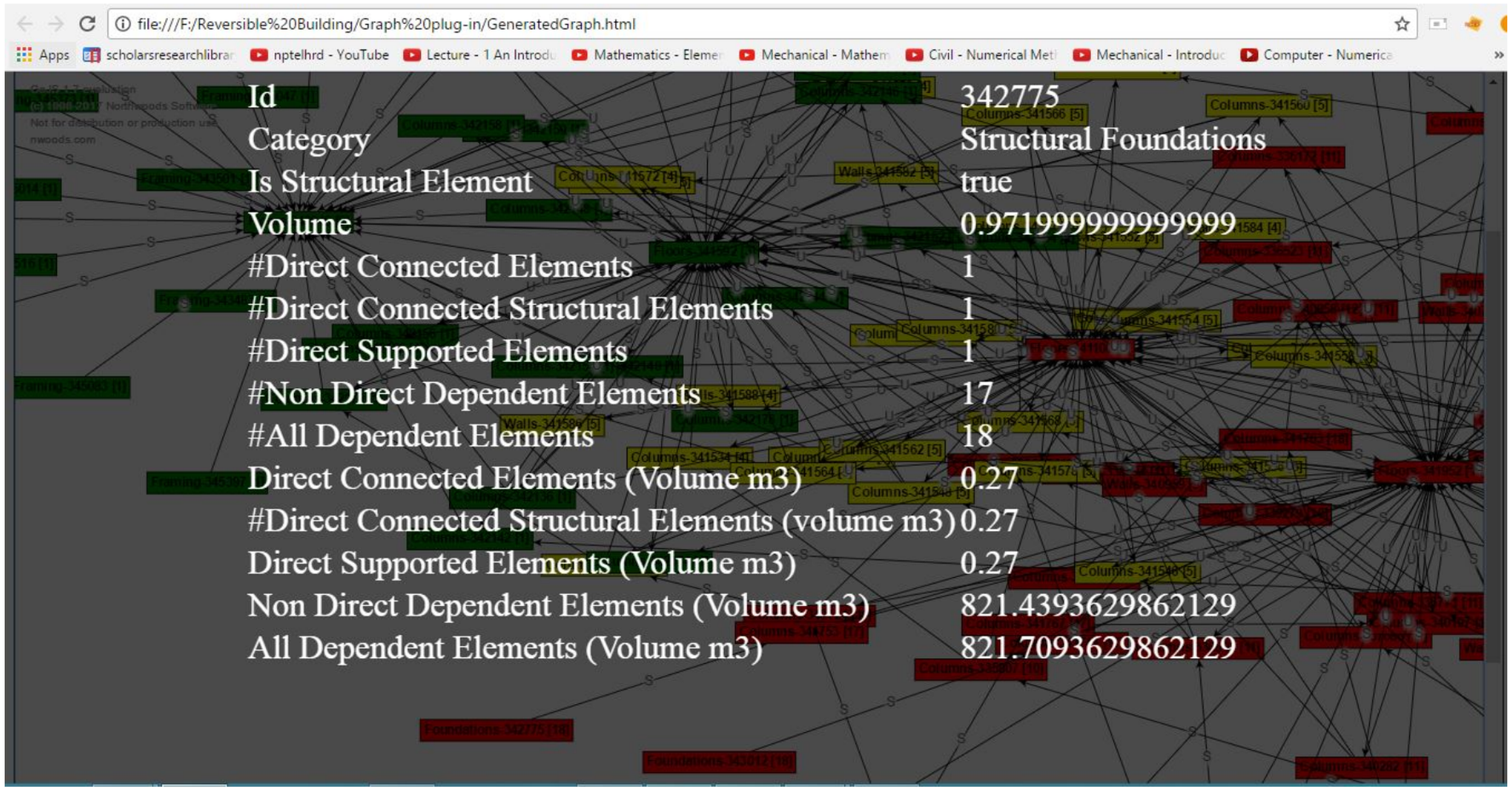
Start Time: Mon May 22 14:04:26 2017
Running script FeatureClassToGeodatabase...
Catalog
Location: Home - BAMB\Diagram
Home - BAMB\Diagram
New File Geodatabase.gdb
Tables.mdb
column.xls
element.xls
Model_diagram.sxd
pivot.xlsx
plate.xls
selected_wall.xls
slab.xls
stair.xls
wall.xls
Folder Connections
C:\Users\Ahmed Rashad
F:\GIS
F:\GIS\BAMB
F:\GIS\Dr.Mahdy
Toolboxes
My Toolboxes
System Toolboxes
Database Servers
Database Connections
GIS Servers
Interoperability Connections
Activate Windows
Go to Settings to activate Windows.
Catalog
Search
Model_diagram.sxd - ArcScene

Generated Graph



Click on any node to get that report



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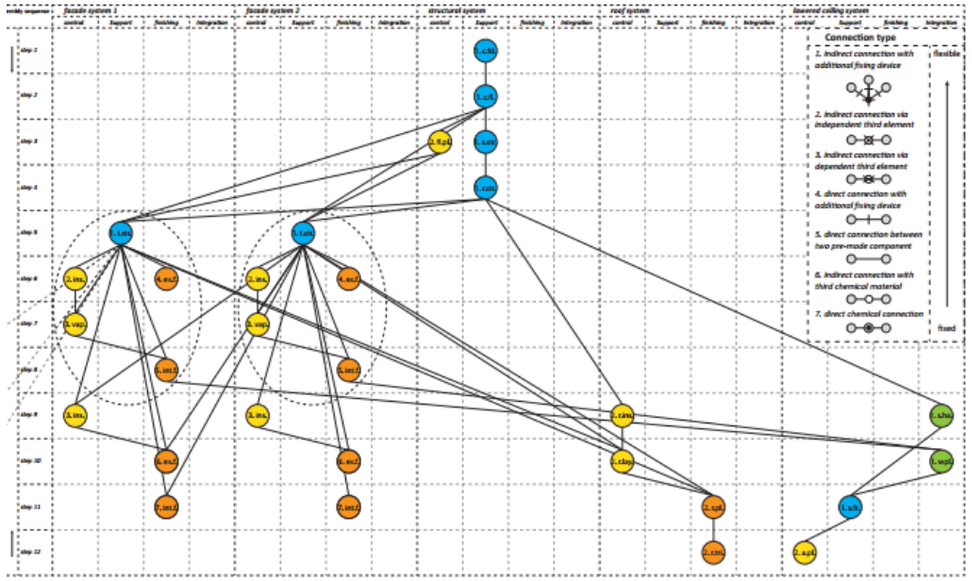
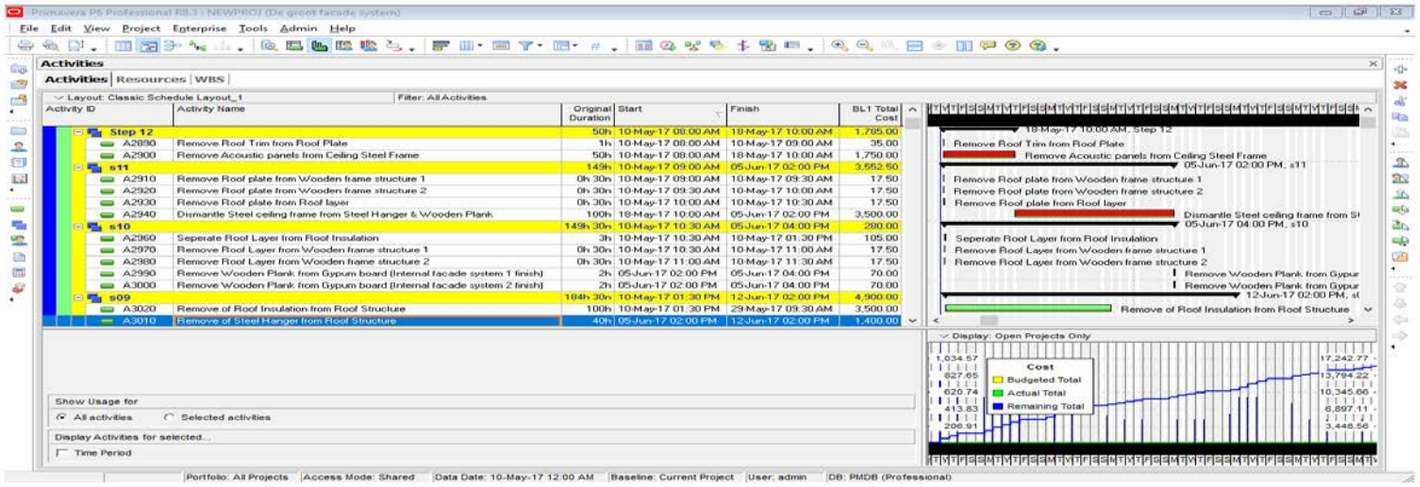
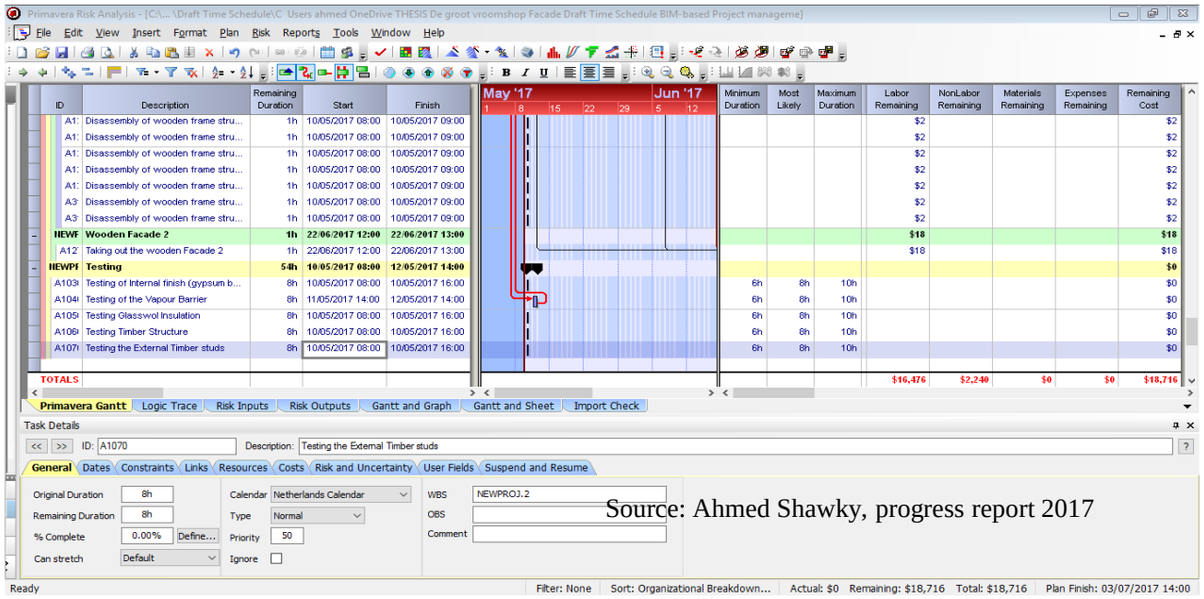
Linking Components relations to Time schedule relations - 4D BIM and costs schedule 5D BIM



Time Schedule for the disassembly phase using Primavera P6



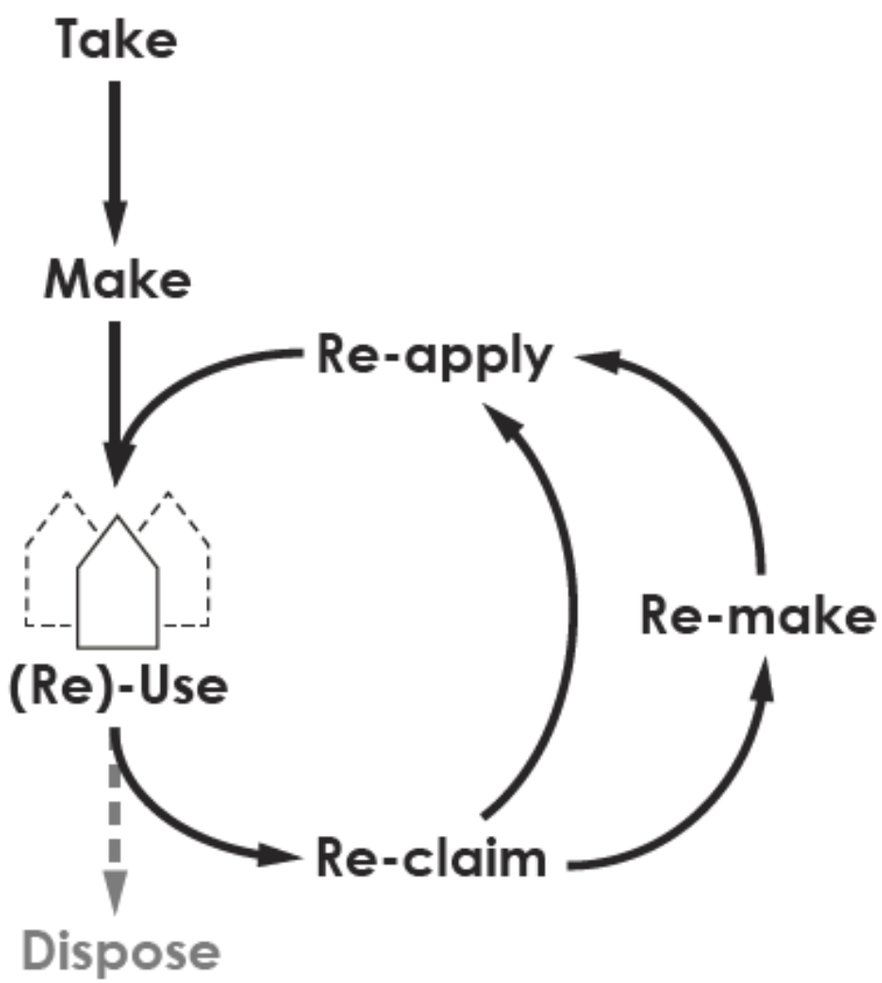
Probabilistic Approach and Risk Management Analysis using Primavera Risk Management

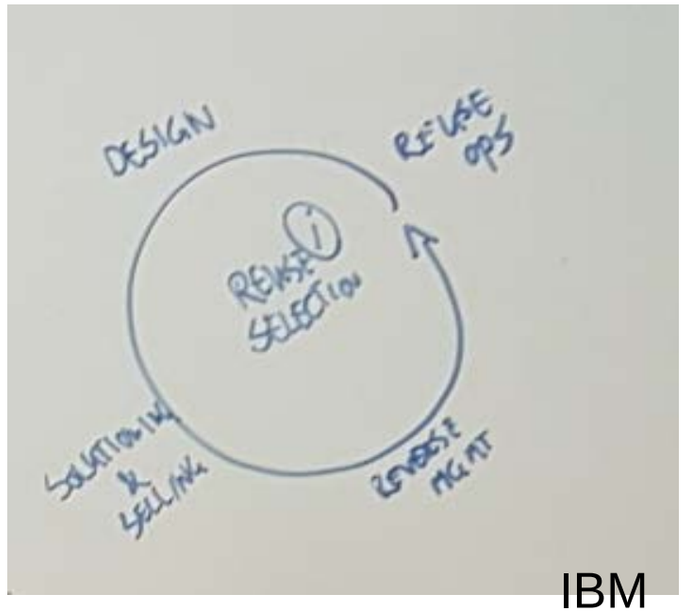


Source: Ahmed Shawky, progress report 2017

Barriers and opportunities:

- Understanding all life cycle stages of reversible buildings and its products
- Understanding the eco system needed to execute these phases per company





IBM

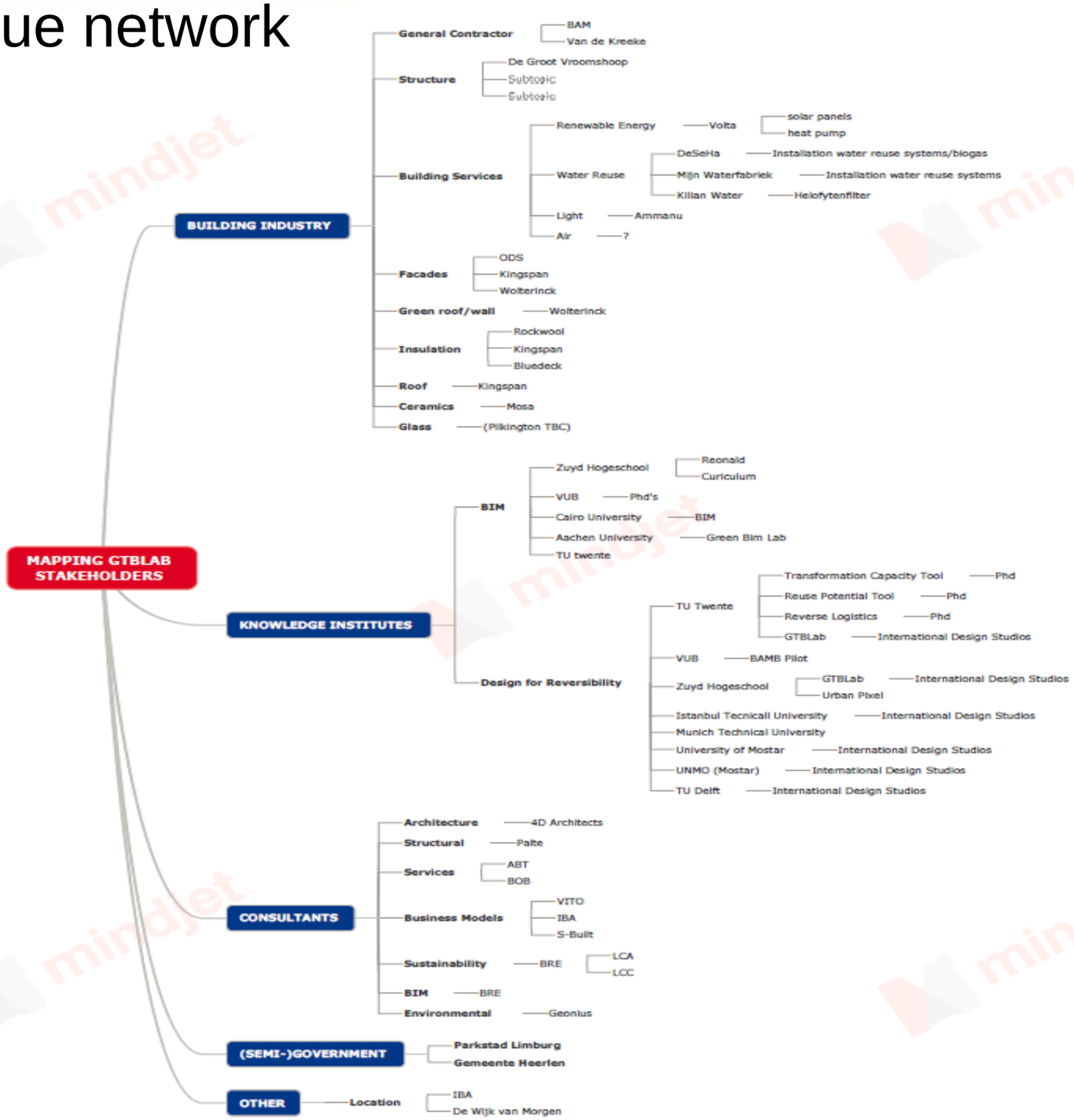
STAKEHOLDERS

Collaboration has been set up with legal and financial institutions as well as industry and design and engineering companies:

- To support development of business case for GTB Lab as a innovation, demonstration and testing platform for the next 10 years.
- To support location choice
- To support legal procedures for the permits
- To support additional effort needed to design and engineer reversible buildings
- To provide materials
- To help building preparation and coordination
- To help integrate GTB lab in the educational studies through design studios and research

value network

STAKEHOLDERS



CONCLUSION

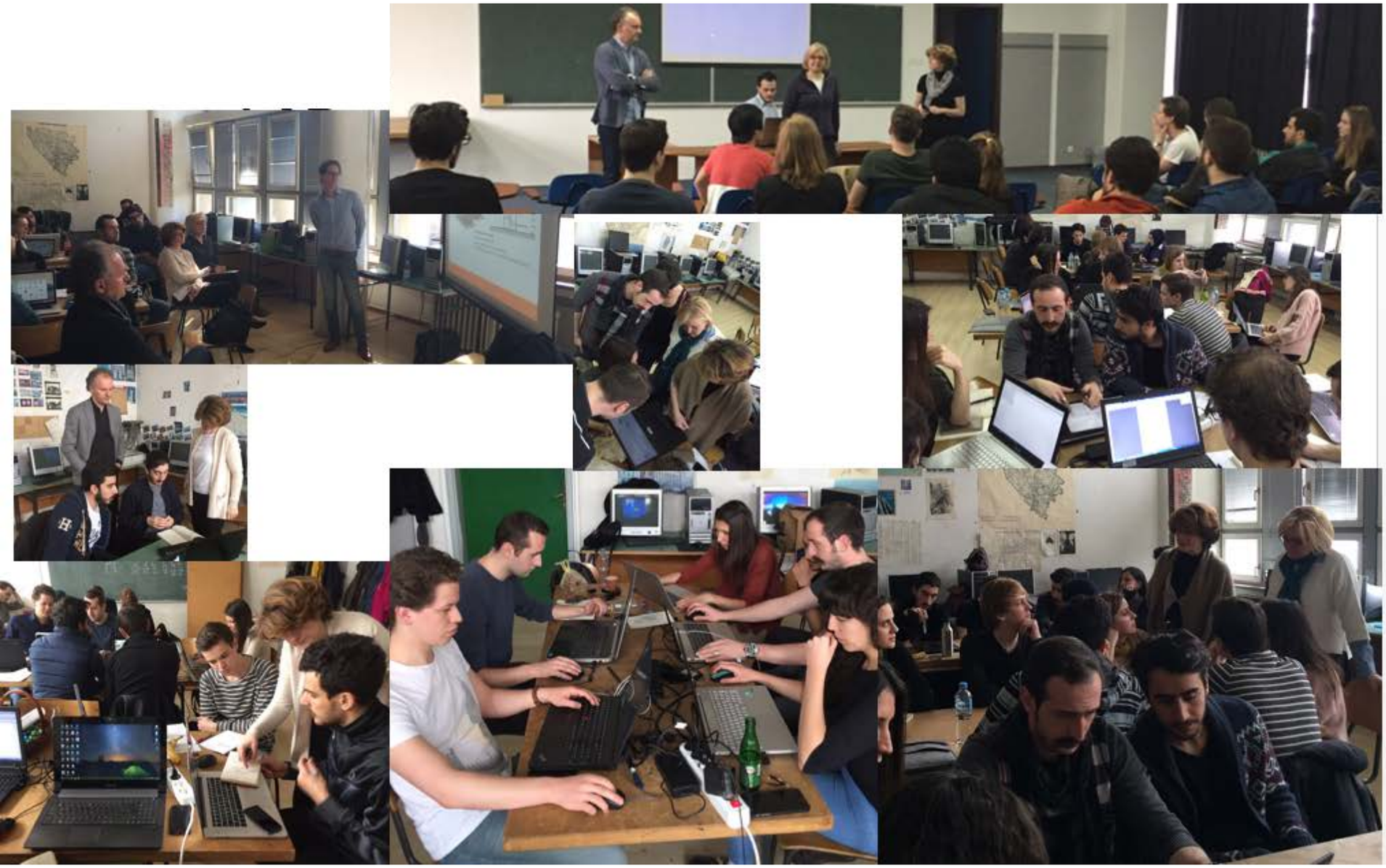
- Eco system per individual company needs to be defined for circular economy
- Design and engineering tasks for development of Transformable / reversible buildings are very intensive and cost much more time than design of traditional “linear” buildings. Standardisation of design process is needed
- Realization of transformable building requires different approaches to each segment of the building. This requires lot of new product development in the future.
- Industry is more and more aware of the need to change

NEXT

- Prototyping:
- Development and produciton of a new profile
- Development of 3D connections between new profiles
- Development of connections between the new profile and panels
- Testing the connections

Start production in November start assembly end January?

GTB LAB International Design Studios



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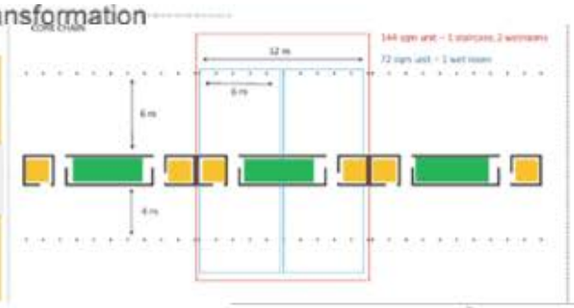
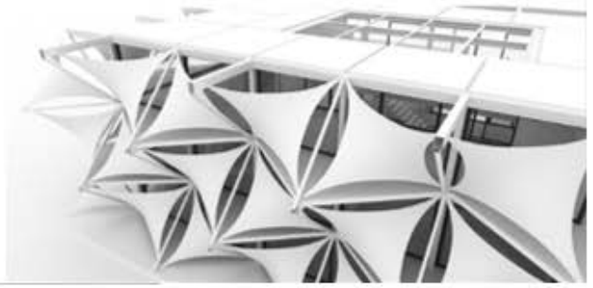
Carrier of Transformation





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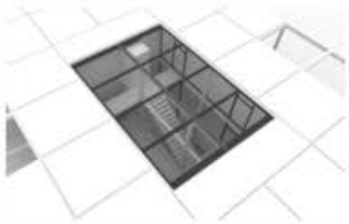

iba parkstad 2012-2020

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4D architects

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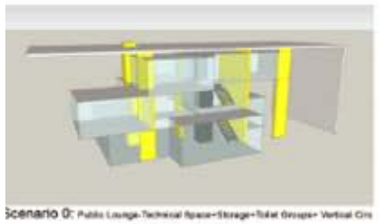
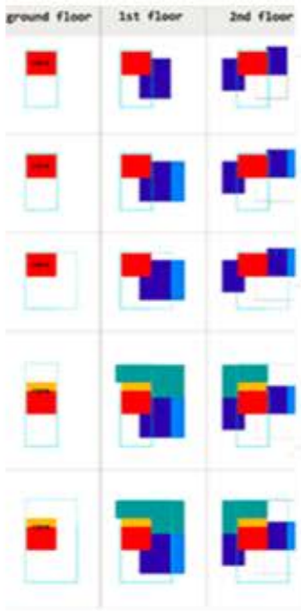
iba parkstad 2013-2020

4D architects

Scenario 0: Public Lounge-Technical Space+Storage+Toilet Groups+ Vertical Circ



Scenario 0: Public Lounge-Technical Space+Storage+Toilet Groups+ Vertical Circ
Teamwork Class+ 2x Apartment



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e.durmisevic@4darchitects.nl

Author 1 | Author 2 | Author 3 | Author 4 | R&D INSTITUTION