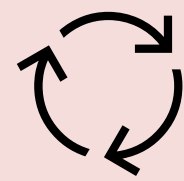


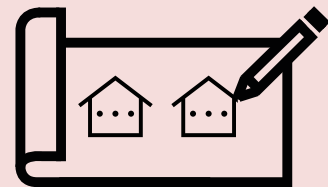
**CIRCULAR
ADAPTABLE
INDUSTRIALISED
FAÇADE SYSTEM
FOR BUILDING RENOVATIONS**

Russ Daverveld
5733138
30-06-2025

Index



Introduction



Design process



Evaluation



Real case

INTRODUCTION





Problem statement

PROBLEMS

Built environment in the Netherlands



Build 900.000 new homes by 2030



Insulate 2.5 million homes by 2030

Construction industry in the Netherlands



11% of emissions (1/3 from renovations)



50% of all raw materials



25% of total waste

Problem statement

PROBLEMS

Built environment in the Netherlands



Build 900.000 new homes by 2030



Insulate 2.5 million homes by 2030

Construction industry in the Netherlands



11% of emissions (1/3 from renovations)



50% of all raw materials



25% of total waste

GOVERNMENT STRATEGIES

Housing stock



Optimising existing buildings

Materials



Bio-based, reused & recycled

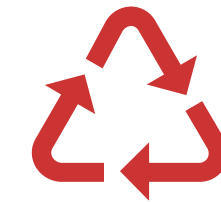
Construction



Industrialisation



Circular economy by 2050

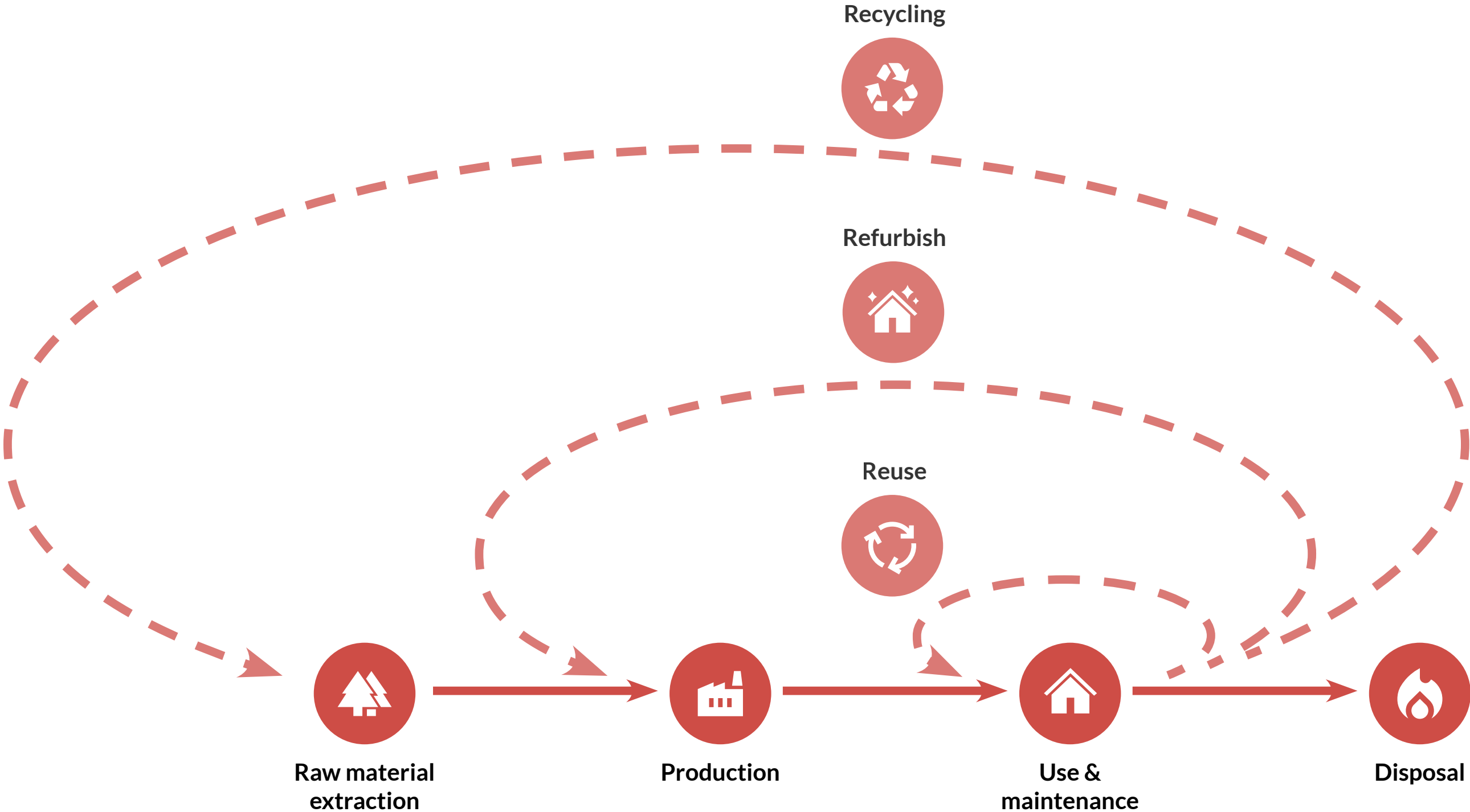


Reduce CO2 with 55% by 2030 and to zero by 2050

Linear economy



Circular economy



Close the loop
Reuse materials

Narrow the loop
Building reuse

Slow the loop
Less materials

Substitute
Renewable materials

Industrialisation

Prefabrication, mechanisation, automation & reproduction



Less room for errors



Less logistical movements



Reduced construction time



Decreased waste



Less overall costs

Research question

How can an industrialised façade renovation system incorporate future component reuse while being adaptable to different façade layouts?

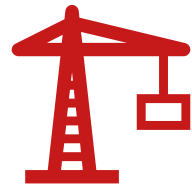


Objectives

How can an industrialised façade renovation system incorporate future component reuse while being adaptable to different façade layouts?



Renovation of
row houses



Prefabrication on
a large scale



Circular economy
principles



Adaptable design



Current building
regulations



Keep the costs down

DESIGN PROCESS



Case study façades

Post-war row houses



Fuutstraat Nijmegen (1949)

Renovated façades



Renovated roofs



Case study façade 1



Case study façade 2

Materials



























Criteria
















Materials

Output

FRAMEWORK OUTPUT

SUBJECT	RANGE
Cycle	 
CO2 emissions	   
End-of-life	    
Service life	  
Connections	  
Price	  
Adaptability	  
Reusability	  

<p>Cladding</p> <ul style="list-style-type: none">  ClickBrick  Pretty plastic  Accoya  Textile façade 	<p>Cladding structure</p> <ul style="list-style-type: none">  Timber frame  Aluminium frame  Wall ties 	<p>Main structure</p> <ul style="list-style-type: none">  Timber beams  Timber blocks  Aluminium brackets 	<p>Insulation</p> <ul style="list-style-type: none">  Flax  Glass wool  EPS
---	---	--	--

CLADDING



ClickBrick



Accoya wood



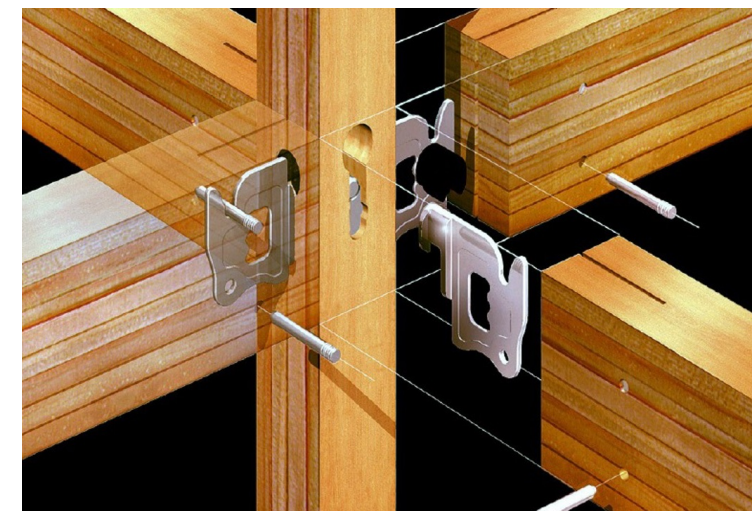
Pretty Plastic tiles

INSULATION

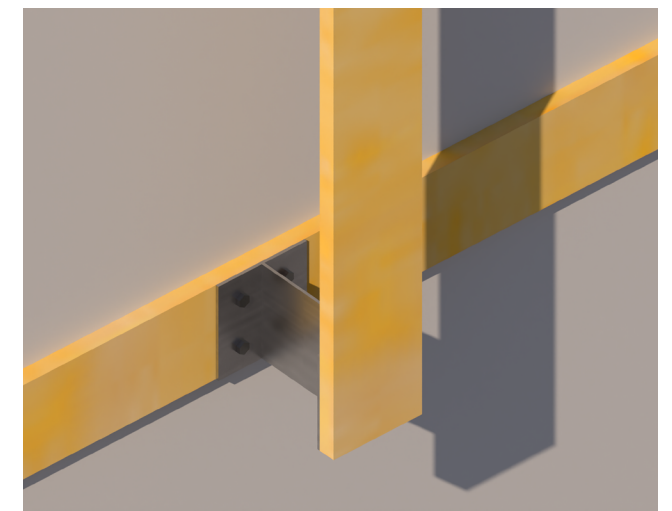


Flax

STRUCTURE



Structural timber & WOODinc connections

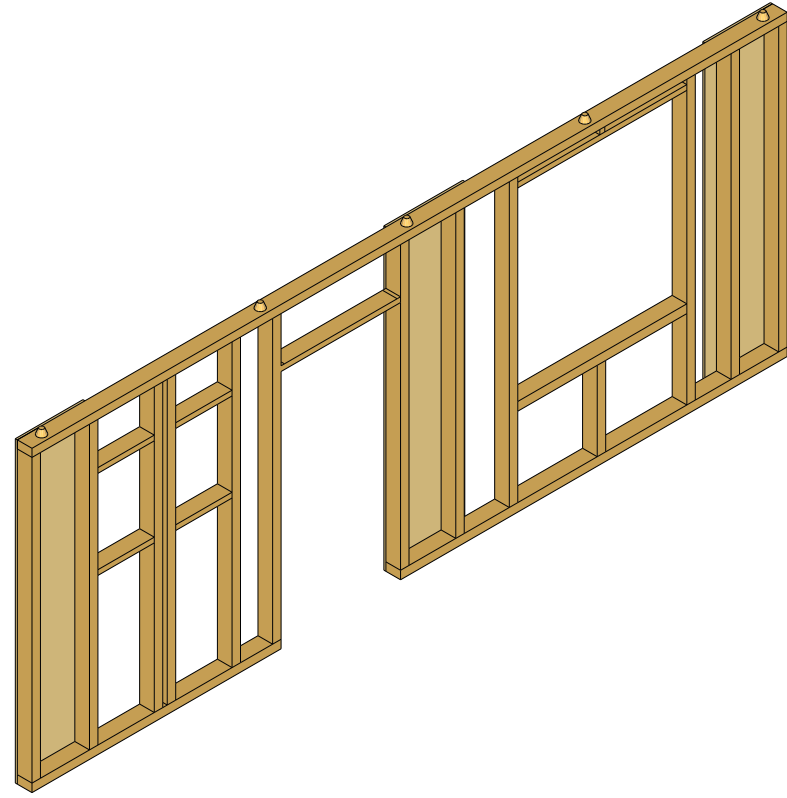


Plywood & aluminium frame

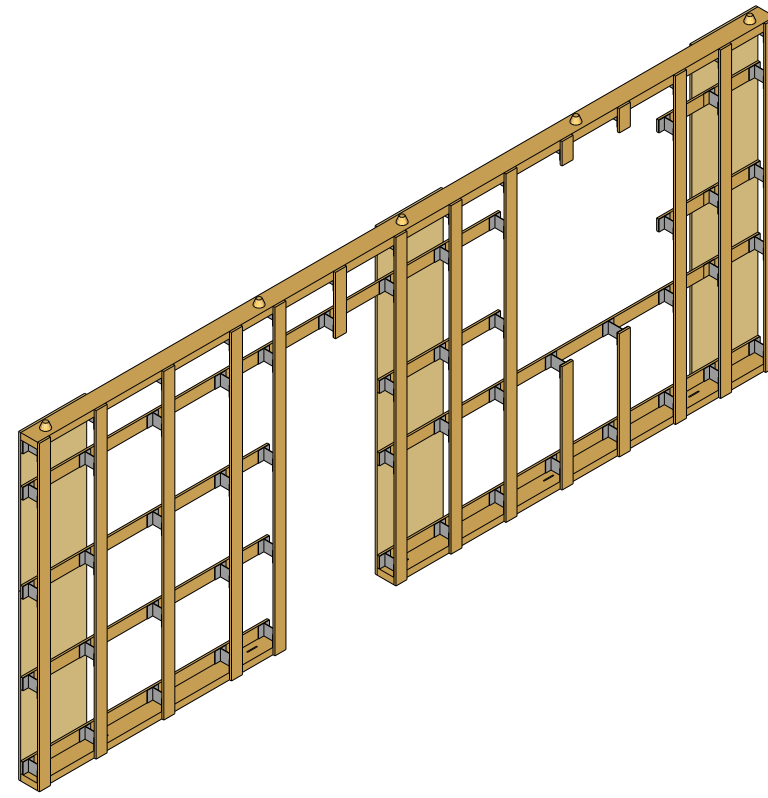
Preliminary designs

Structures & Cladding

Structures

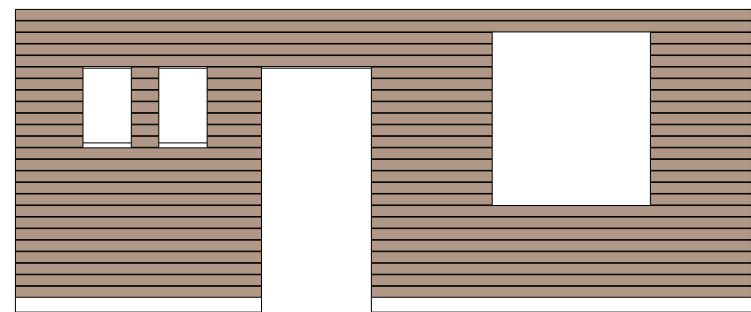


Timber frame

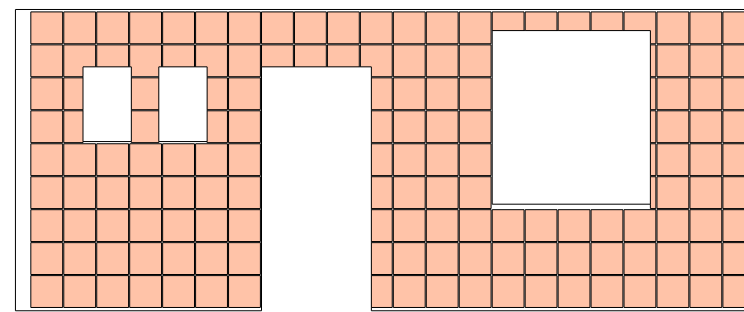


Plywood & aluminium frame

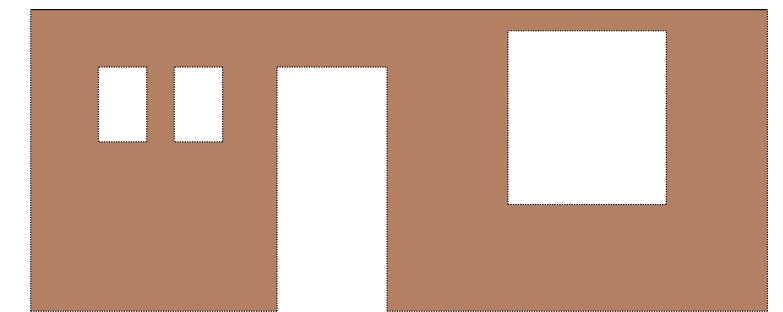
Cladding



Accoya wood



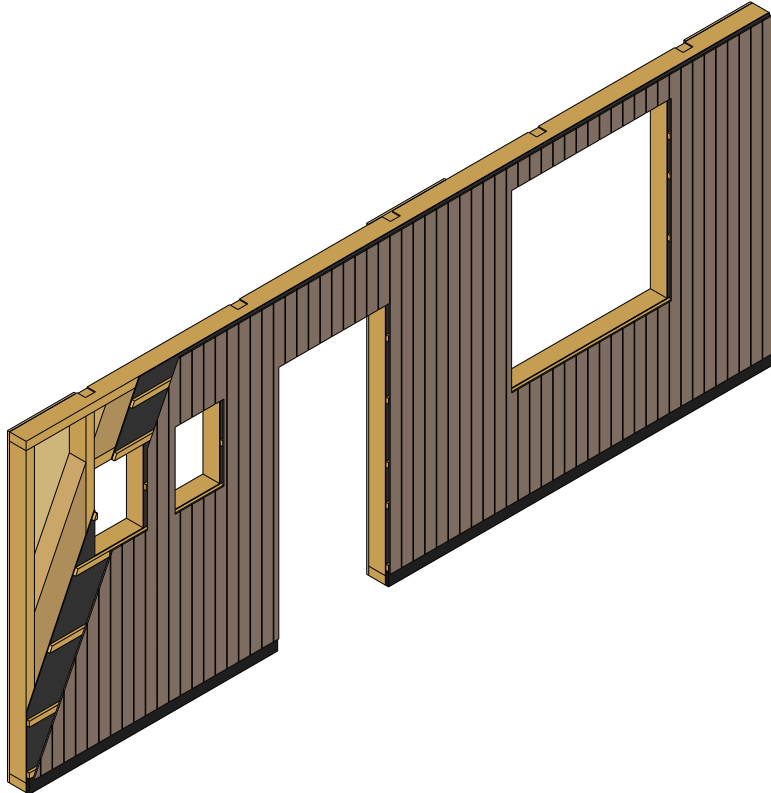
Pretty Plastic tiles



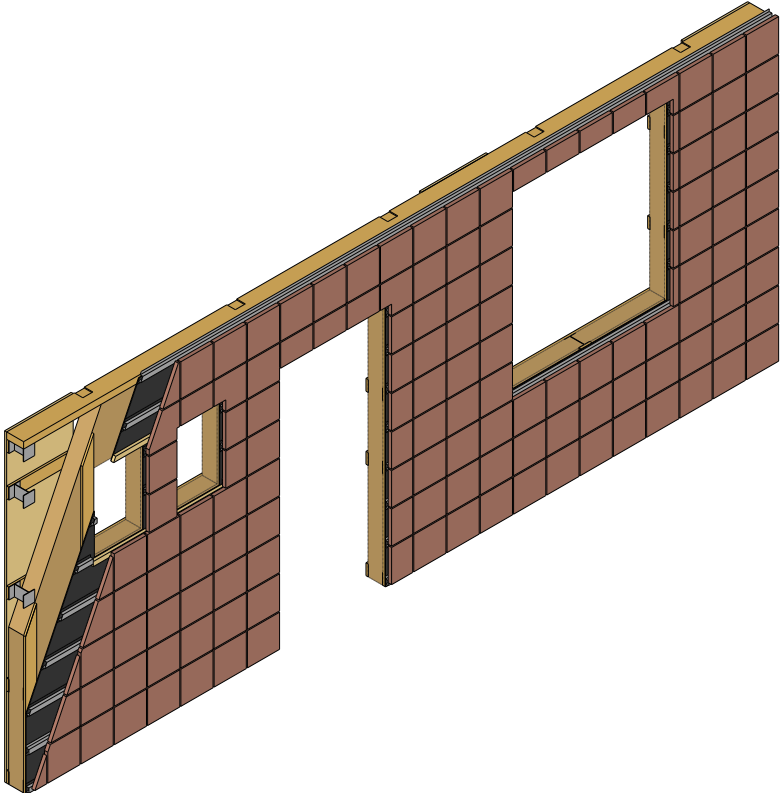
ClickBrick

Total configuration

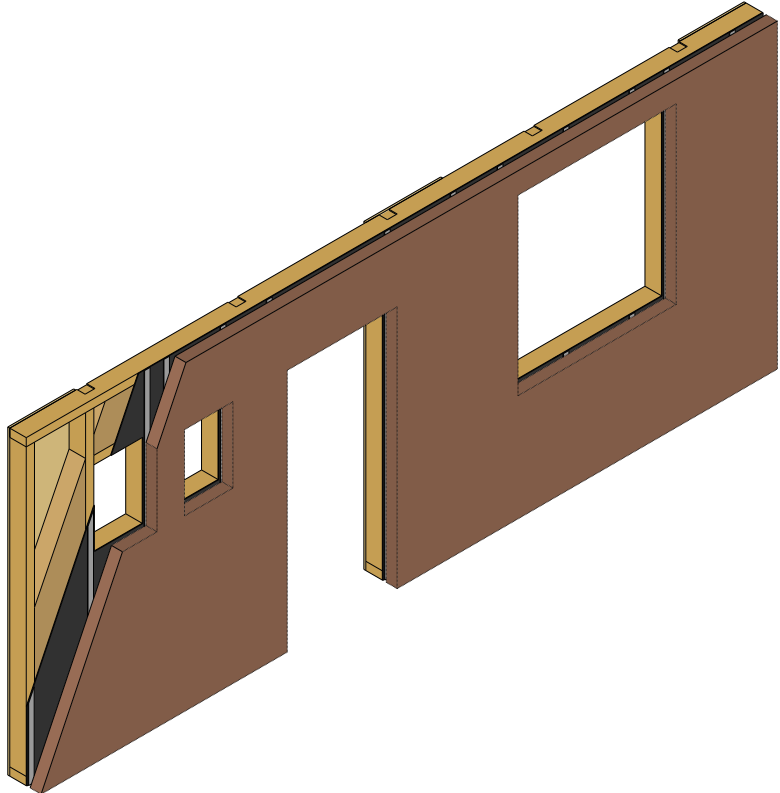
Three examples



Timber & Accoya



Plywood-aluminium & Pretty Plastic



Timber & ClickBrick

Second façade test

From 1st to 2nd



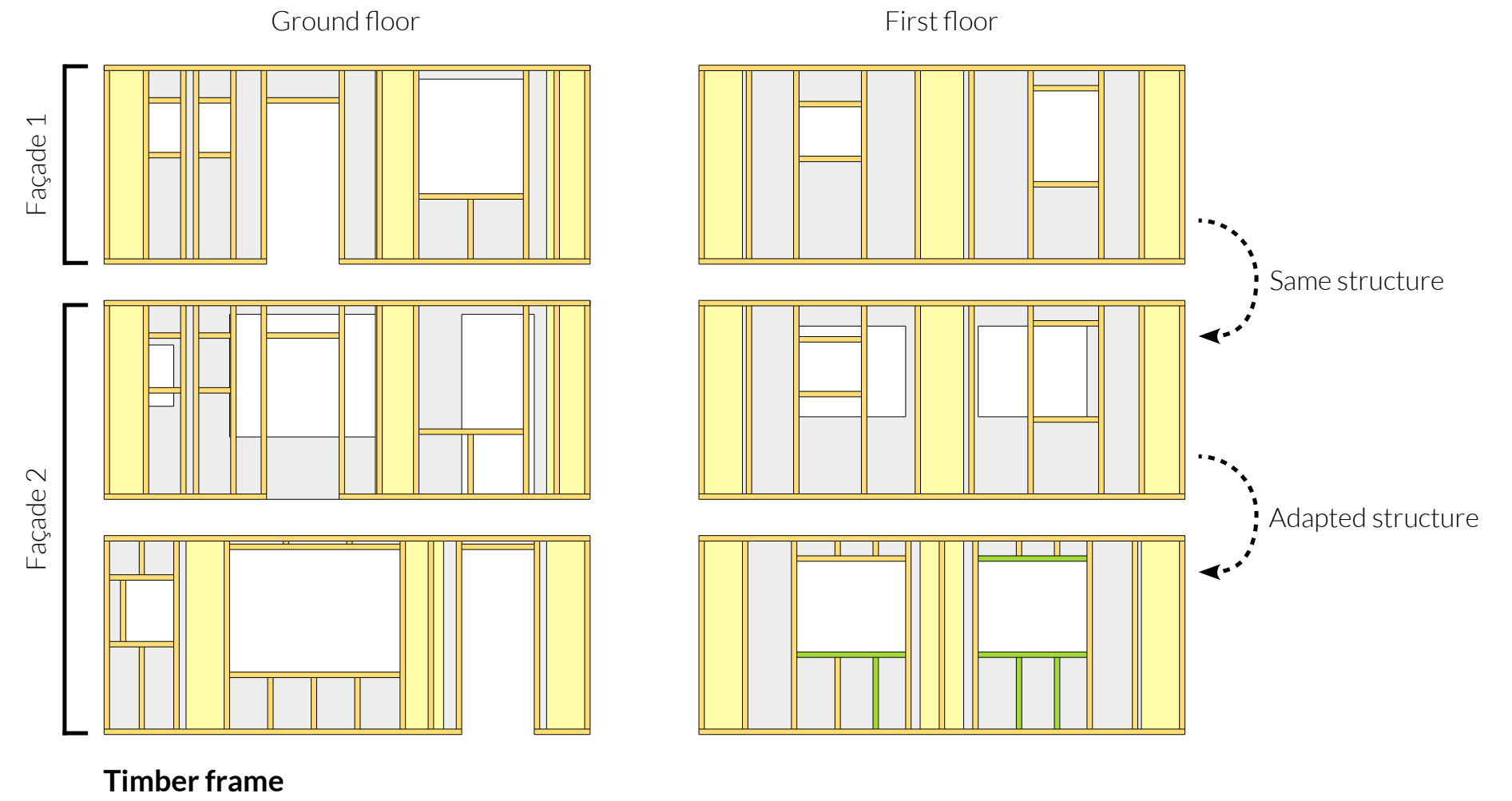
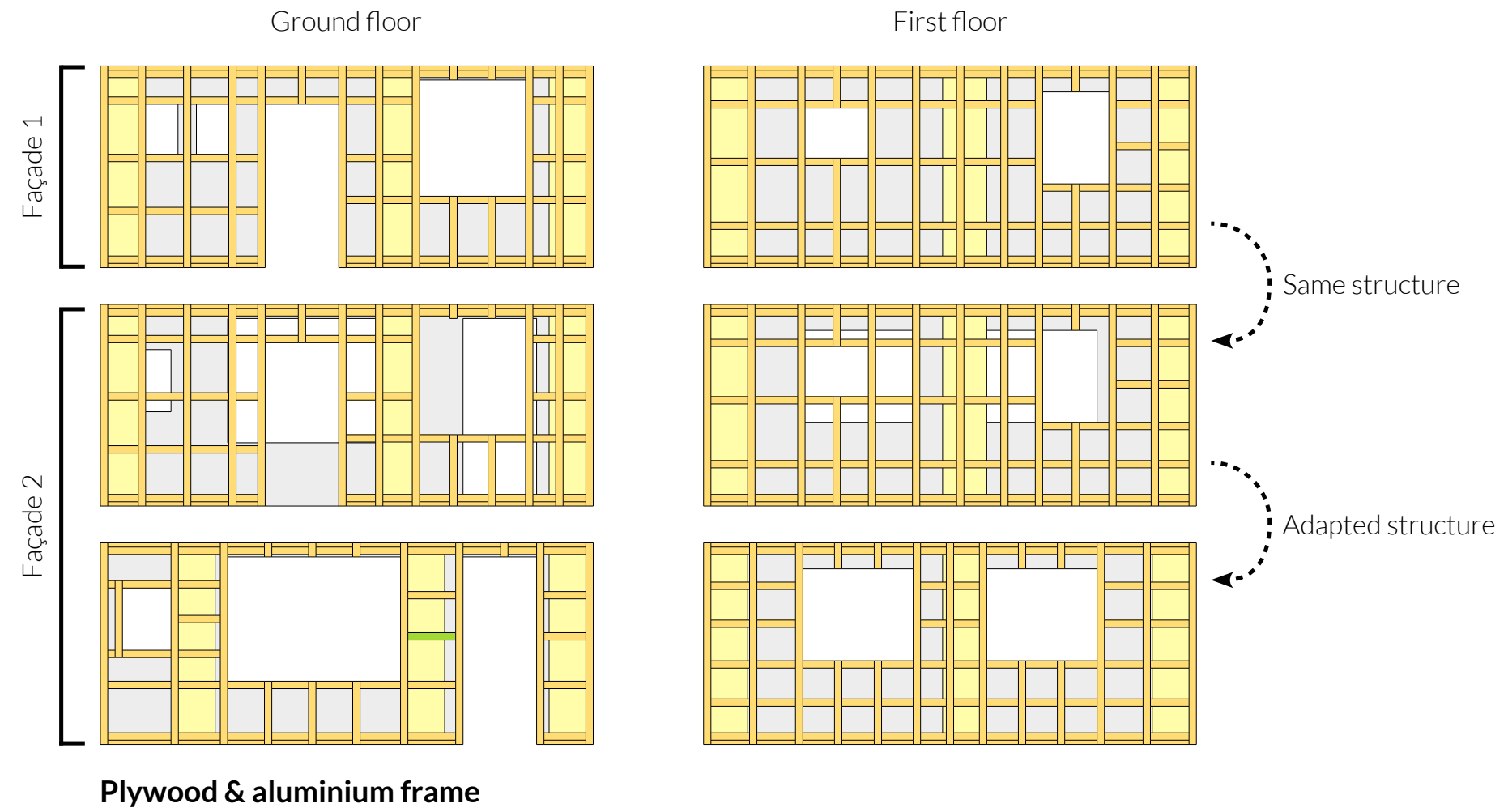
Case study façade 1



Case study façade 2

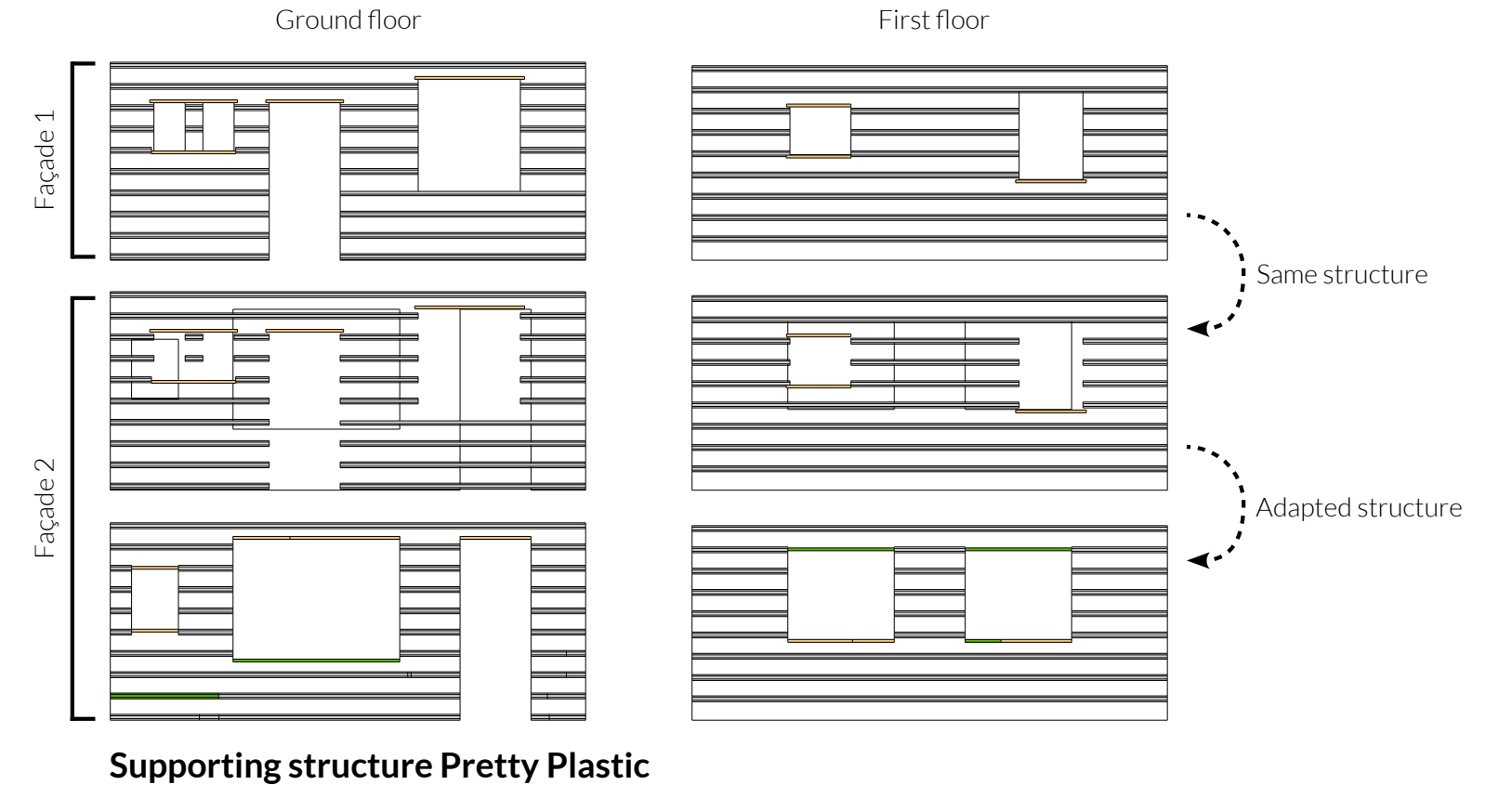
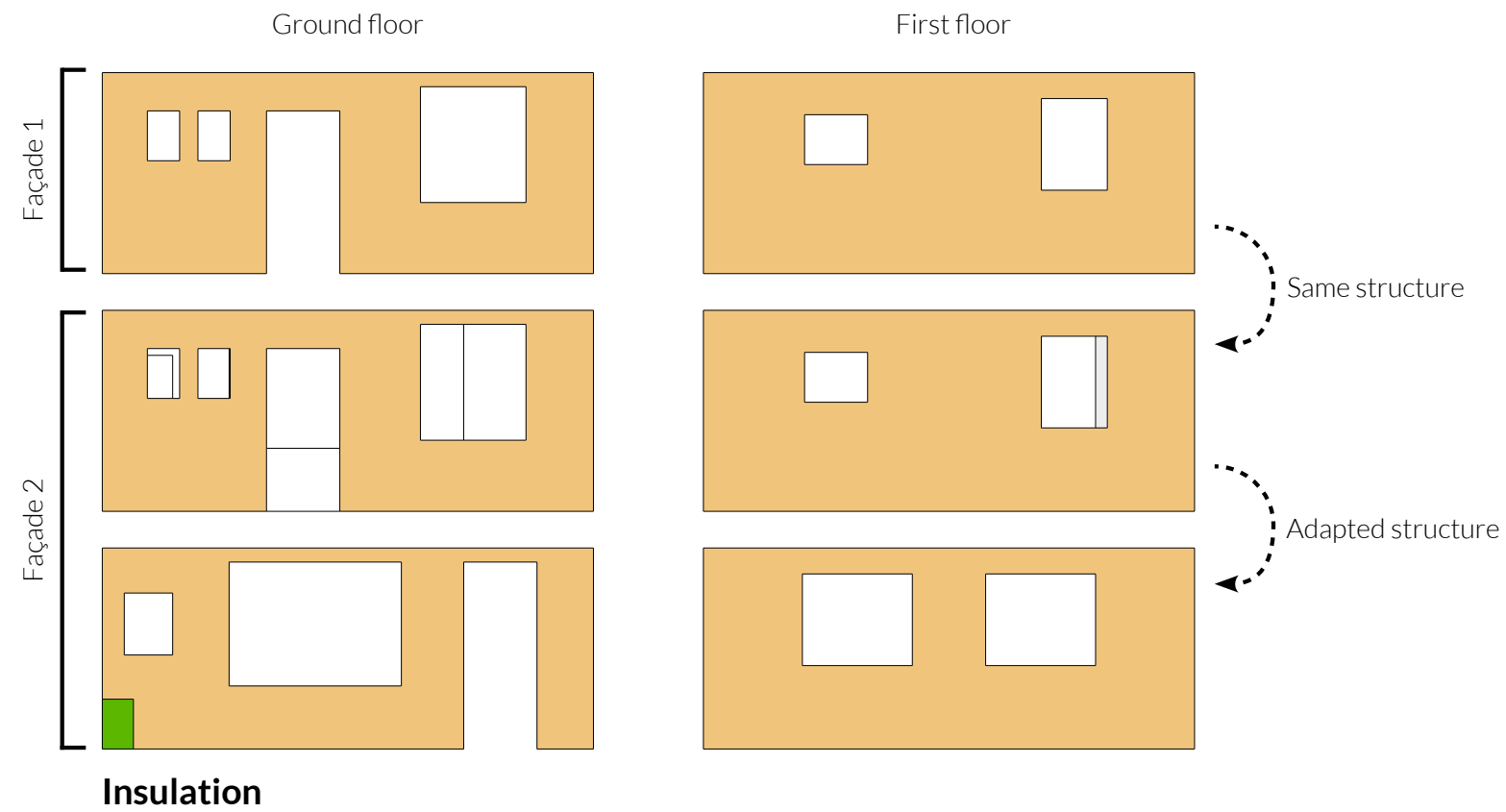
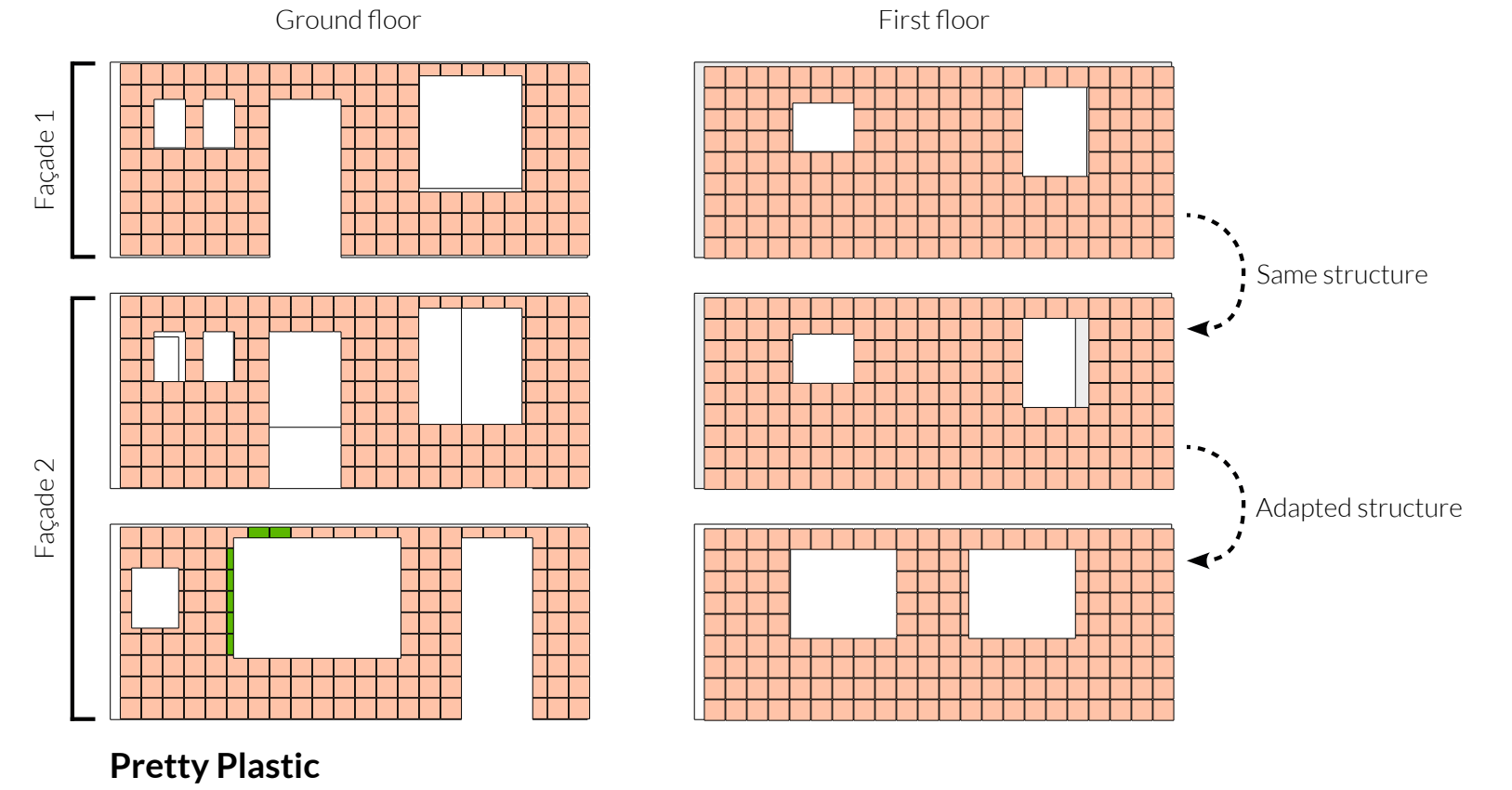
Second façade test

Structures



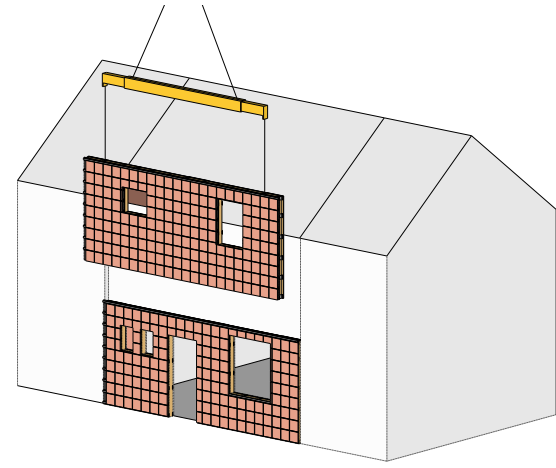
Second façade test

Insulation, cladding & supporting structure

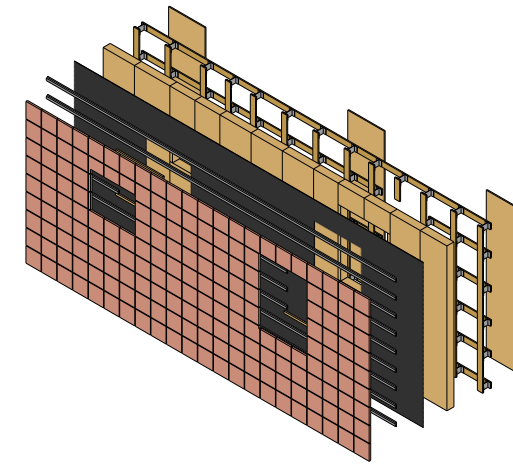


Reuse sequence

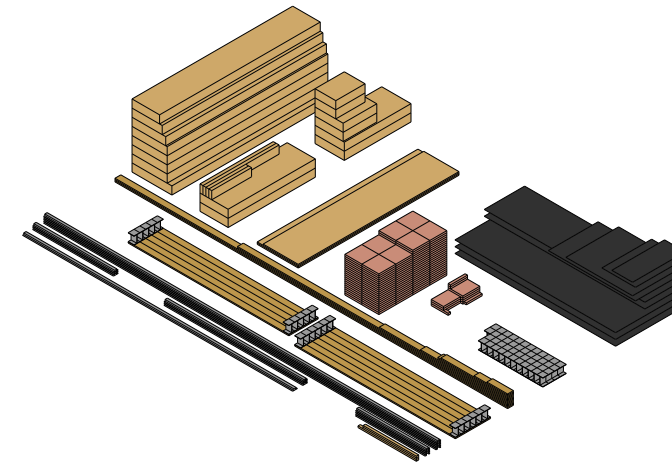
Case study facade 1 to 2



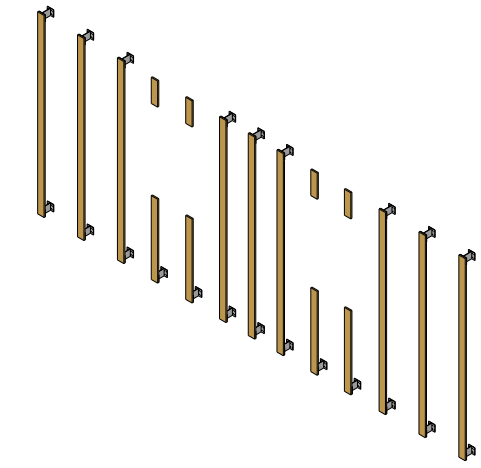
1. The old façade system is removed.



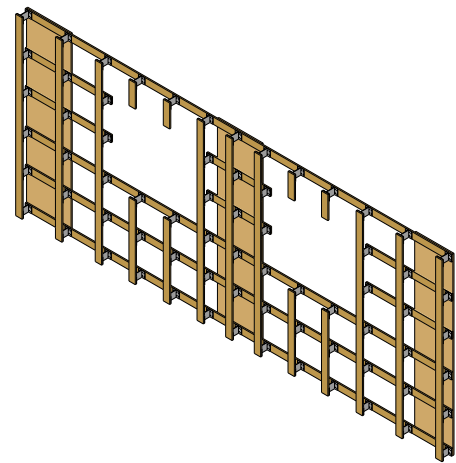
2. All the layers are brought to the factory and separated.



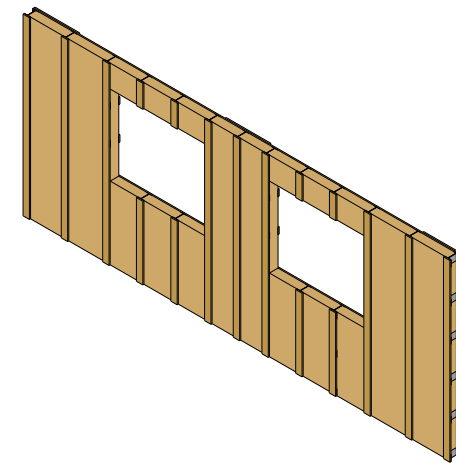
3. Some components don't need total disassembly.



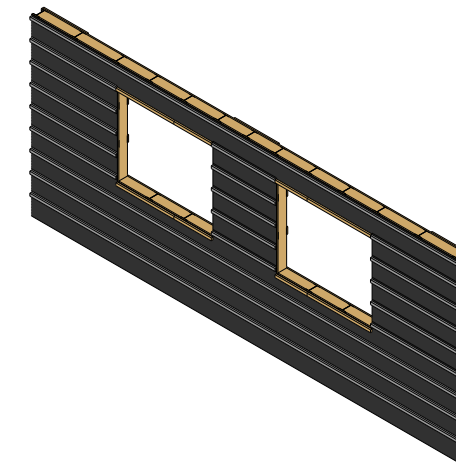
4. The new façade layout is being constructed.



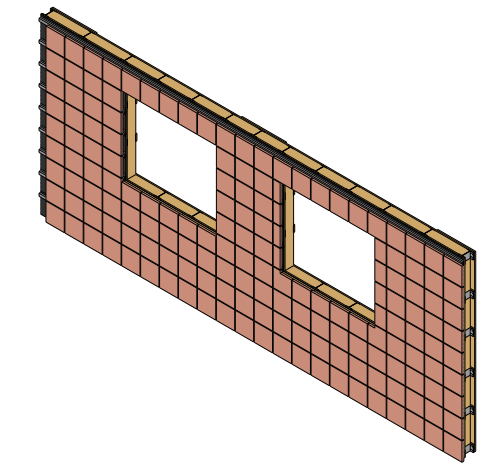
5. The new structure is complete.



6. The compressible insulation is easy to reuse.

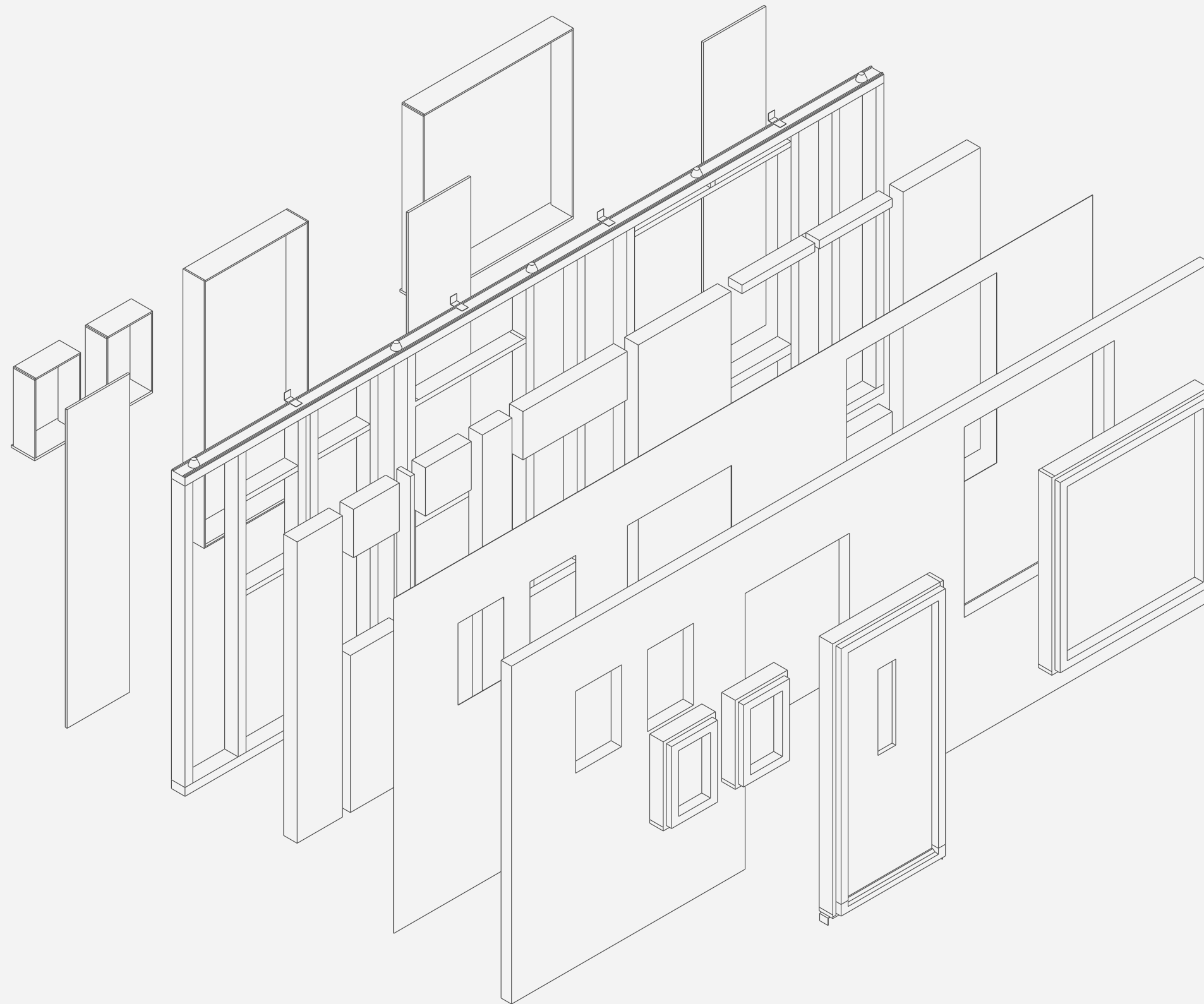


7. The water-repellent foil and supporting structure are next.



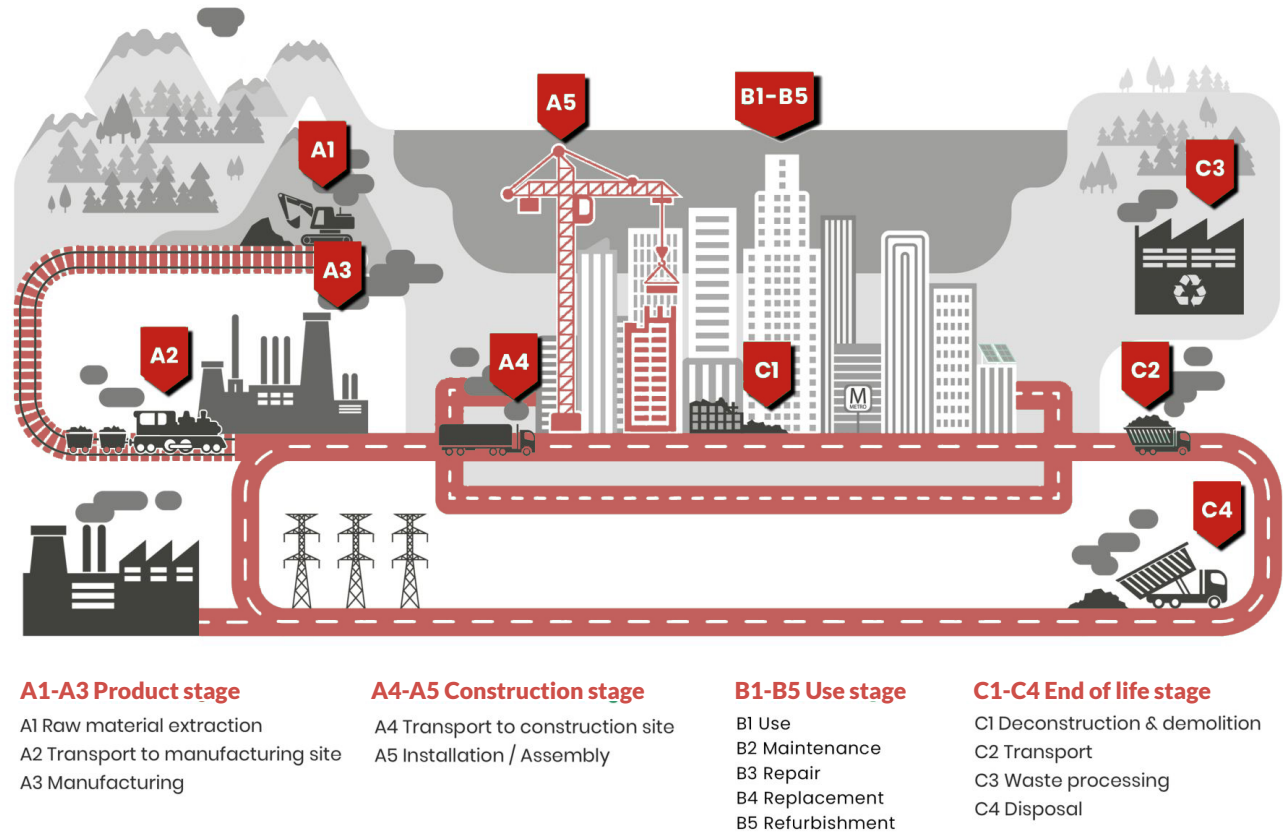
8. The final part is the cladding.

EVALUATION



Evaluation

LCA, MCI & 3DR



Life Cycle Assessment (LCA)



Material Circularity Indicator (MCI)



Tools required

- NO TOOL
- HAND TOOL
- POWER TOOL
- GAS TOOL
- HYDRAULIC TOOL

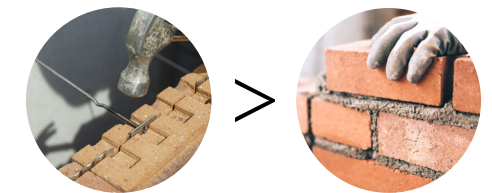
People/equipment

- ONE PERSON
- TWO PEOPLE
- HAND TROLLEY
- FORKLIFT
- CRANE

Resilience

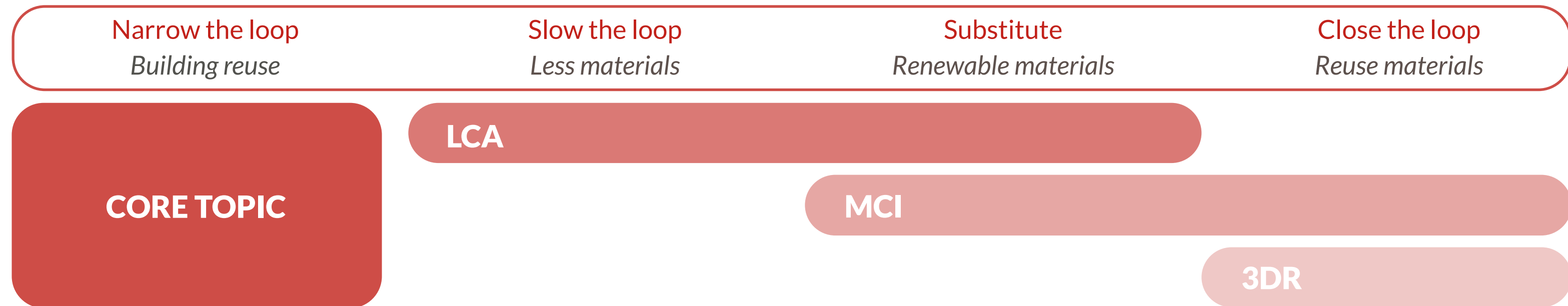
- REUSABLE 3>
- REUSABLE 2/3
- REUSABLE 1x
- RECYCLE
- DOWNCYCLE

Disassembly, deconstruction and resilience method (3DR)



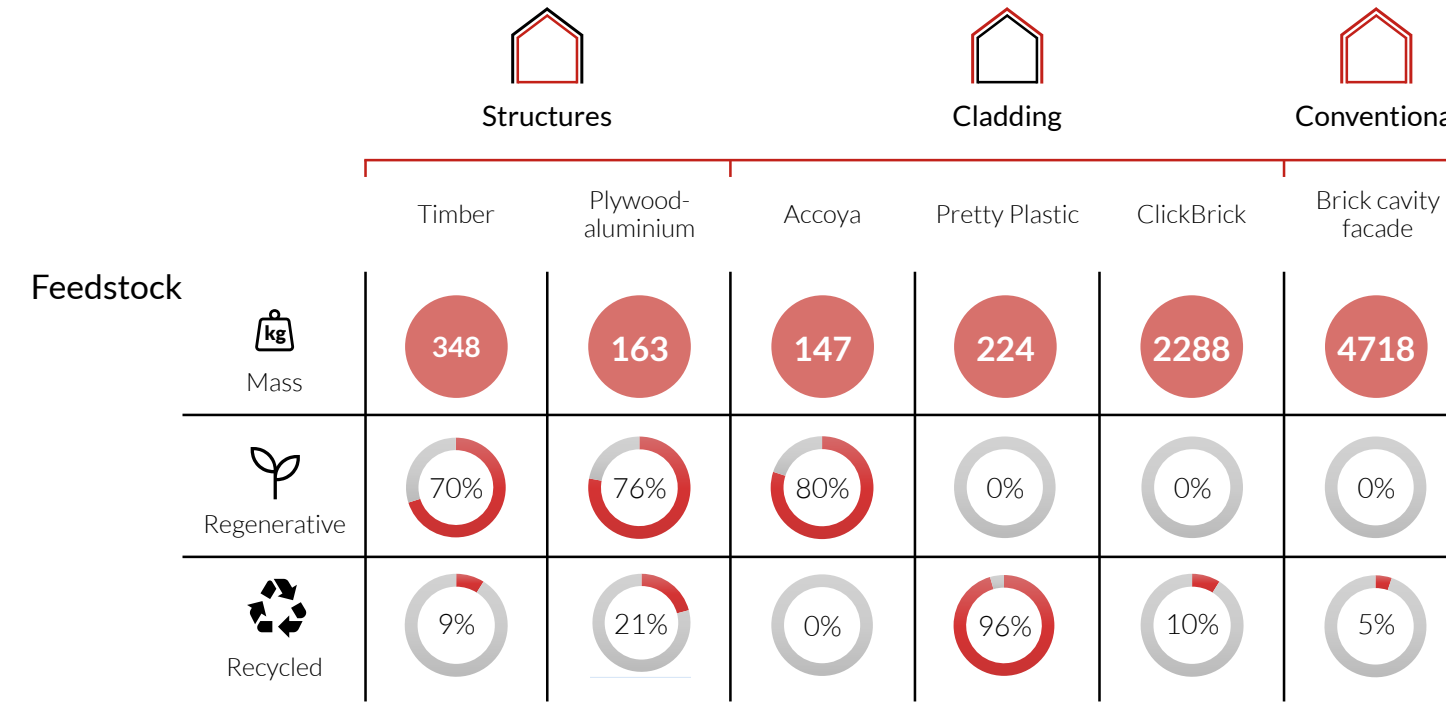
Four principles of the circular economy

LCA, MCI & 3DR



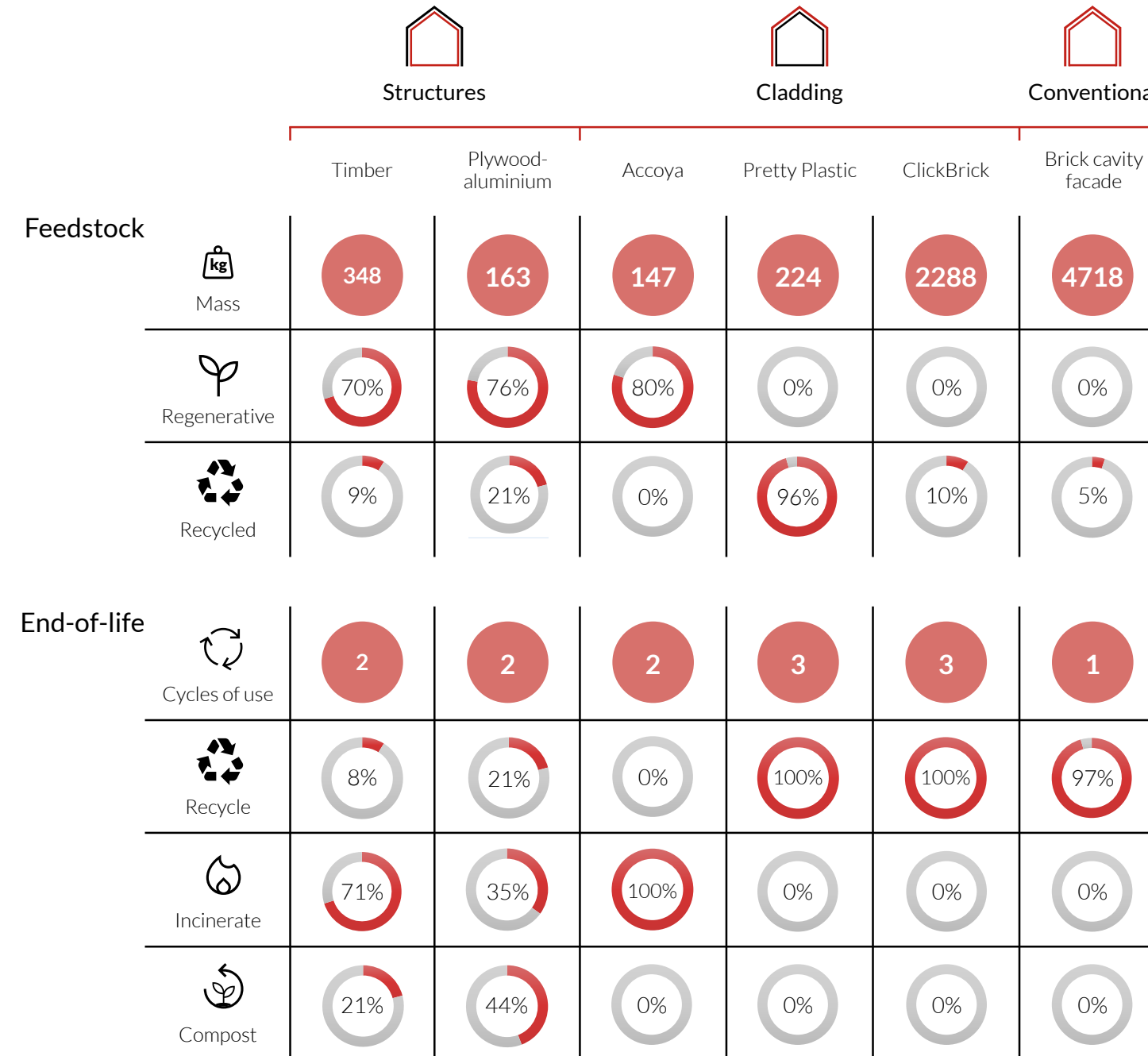
Comparison

LCA, MCI & 3DR



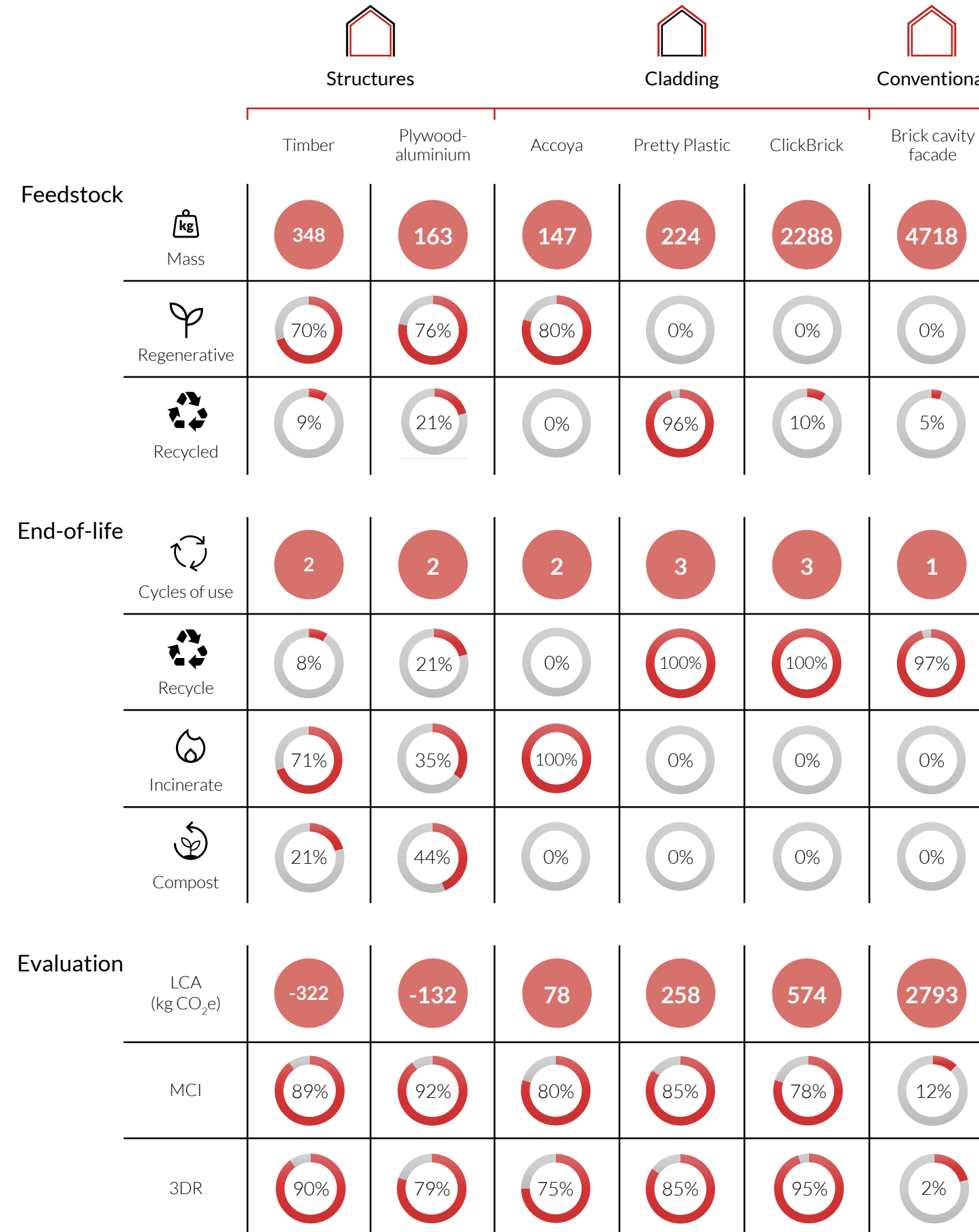
Comparison

LCA, MCI & 3DR



Comparison

LCA, MCI & 3DR

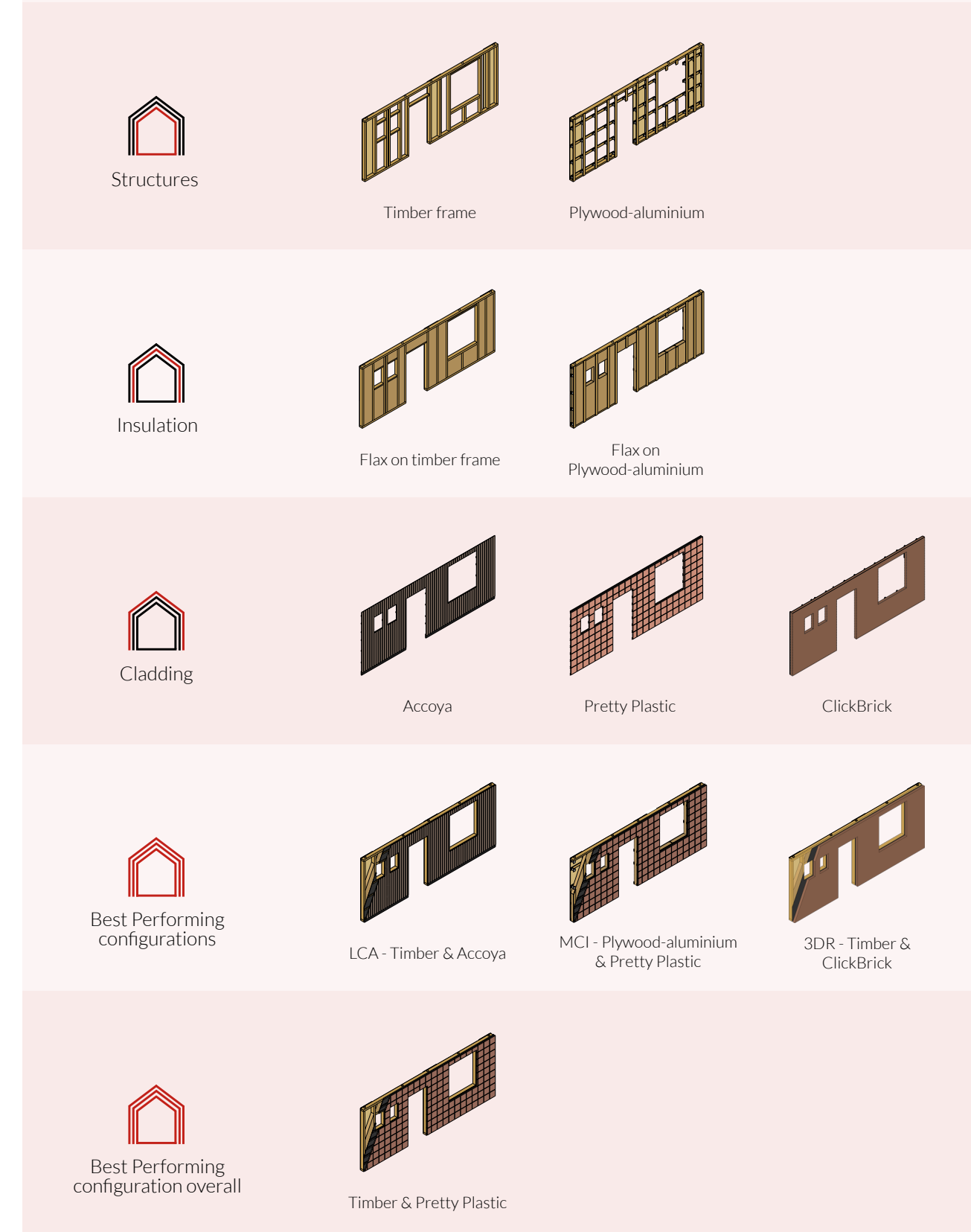


Comparison

LCA, MCI & 3DR

		Structures		Cladding		Conventional	
		Timber	Plywood-aluminium	Accoya	Pretty Plastic	ClickBrick	Brick cavity facade
Feedstock	Mass	348	163	147	224	2288	4718
	Regenerative	70%	76%	80%	0%	0%	0%
	Recycled	9%	21%	0%	96%	10%	5%
End-of-life	Cycles of use	2	2	2	3	3	1
	Recycle	8%	21%	0%	100%	100%	97%
	Incinerate	71%	35%	100%	0%	0%	0%
	Compost	21%	44%	0%	0%	0%	0%
Evaluation	LCA (kg CO ₂ e)	-322	-132	78	258	574	2793
	MCI	89%	92%	80%	85%	78%	12%
	3DR	90%	79%	75%	85%	95%	2%

FACADE SYSTEM CONFIGURATION



REAL CASE DEMONSTRATION



Real case demonstration

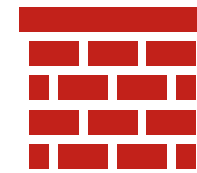
With the priorities of a general housing association



**Bio-based insulation
with R-value of 3.5**



Triple glazing



Durable materials



**Facade system
retains value**

Real case demonstration

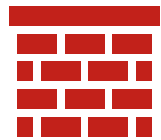
Subsidies & take-back guarantee



Bio-based insulation
with R-value of 3.5



Triple glazing



Durable materials



Facade system
retains value

	Subsidiebedrag per m ² voor maatregelen uitgevoerd tot en met 31-12-2024	Subsidiebedrag per m ² voor maatregelen uitgevoerd vanaf 1-1-2025	Aantal m ² waarvoor u subsidie kunt krijgen
HR++ glas	€ 23	€ 25	3 t/m 45m ² voor plaatsing in 2025 8 t/m 45m ² voor plaatsing in 2023 of 2024
Triple glas	€ 65,50	€ 111	
Nieuwe isolerende panelen in kozijnen met een isolatiewaarde ≤ 1,2 en > 0,7 *	€ 10	€ 10	
Nieuwe isolerende panelen in kozijnen met een isolatiewaarde ≤ 0,7 *	€ 45	€ 45	
Nieuwe isolerende deuren met een isolatiewaarde ≤ 1,5 en > 1,0 *	€ 23	€ 25	
Nieuwe isolerende deuren met een isolatiewaarde ≤ 1,0 *	€ 65,50	€ 111	

*Alleen mogelijk samen met HR++ glas of Triple glas.

	Subsidiebedrag per m ² , uitvoering 2024	Subsidiebedrag per m ² , uitvoering 2025	Mogelijke Duurzame bonus***	Aantal m ² waarvoor u subsidie kunt krijgen
Spouwmuurisolatie	€ 4	€ 5,25	€ 1,50	Vanaf 10 t/m 170 m ²
Gevelisolatie	€ 19	€ 20,25	€ 6	Vanaf 10 t/m 170 m ²
Bodemisolatie *	€ 3	€ 3	€ 1	Vanaf 20 t/m 130 m ²
Vloerisolatie *	€ 5,50	€ 5,50	€ 2	Vanaf 20 t/m 130 m ²
Dakisolatie **	€ 15	€ 16,25	€ 5	Vanaf 20 t/m 200 m ²
Zolder/vlieringvloerisolatie **	€ 4	€ 4	€ 1,50	Vanaf 20 t/m 130 m ²

* Let op: Als bodem- en vloerisolatie direct boven elkaar zijn toegepast, ontvangt u maar voor een van deze soorten het subsidiebedrag.
 ** Let op: Als dakisolatie en zolder-/vlieringvloerisolatie direct boven elkaar zijn toegepast, ontvangt u maar voor een van deze soorten het subsidiebedrag.
 *** De duurzame bonus is de bonus die u ontvangt als u gebruikmaakt van biobased milieuvriendelijk isolatiemateriaal.

Retournamegarantie



Brick as a Service
 wienerberger ClickBrick is een uniek, remontabel gevelsysteem voor het droogstapelen van bakstenen. Uniek omdat ClickBrick volledig circulair is en omdat je met ClickBrick verzekerd bent van een innovatief gevelsysteem met restwaarde en retournamegarantie. In deze hand-out zetten we de uitgangspunten voor jou op een rij. Voor elk nieuw ClickBrick-project wordt een specifieke overeenkomst opgesteld.

Garantie
 De garantie wordt door wienerberger verleend aan haar debiteur, op basis van de voorwaarden omschreven in de ClickBrick retournamegarantie welke vooraf overeengekomen wordt en geldt voor het specifieke project waarin de bakstenen zijn toegepast.

Restwaarde
 De restwaarde is afhankelijk van de ouderdom van de bakstenen. We hanteren de volgende percentages:

- Tot 10 jaar: 30%
- Van 10 - 20 jaar: 20%
- Van 20 - 30 jaar: 10%

Retourprocedure
 Na inspectie door wienerberger zorg je zelf voor demontage. Wij zorgen voor pallets en dozen voor de stenen, passtukken, ankers en clips. Binnen 14 dagen controleren wij de retour-genomen producten. Als alles akkoord is, ontvang je een creditnota die binnen 30 dagen door ons wordt voldaan.

Goed om te weten
 In deze hand-out zijn de uitgangspunten globaal beschreven. De exacte voorwaarden en bepalingen nemen we graag met je door als je besluit met ClickBrick te gaan bouwen.

Meer informatie?
 Kijk op wienerberger.nl/clickbrick



Design process

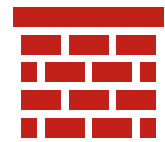
Configuration & evaluation



Bio-based insulation
with R-value of 3.5



Triple glazing

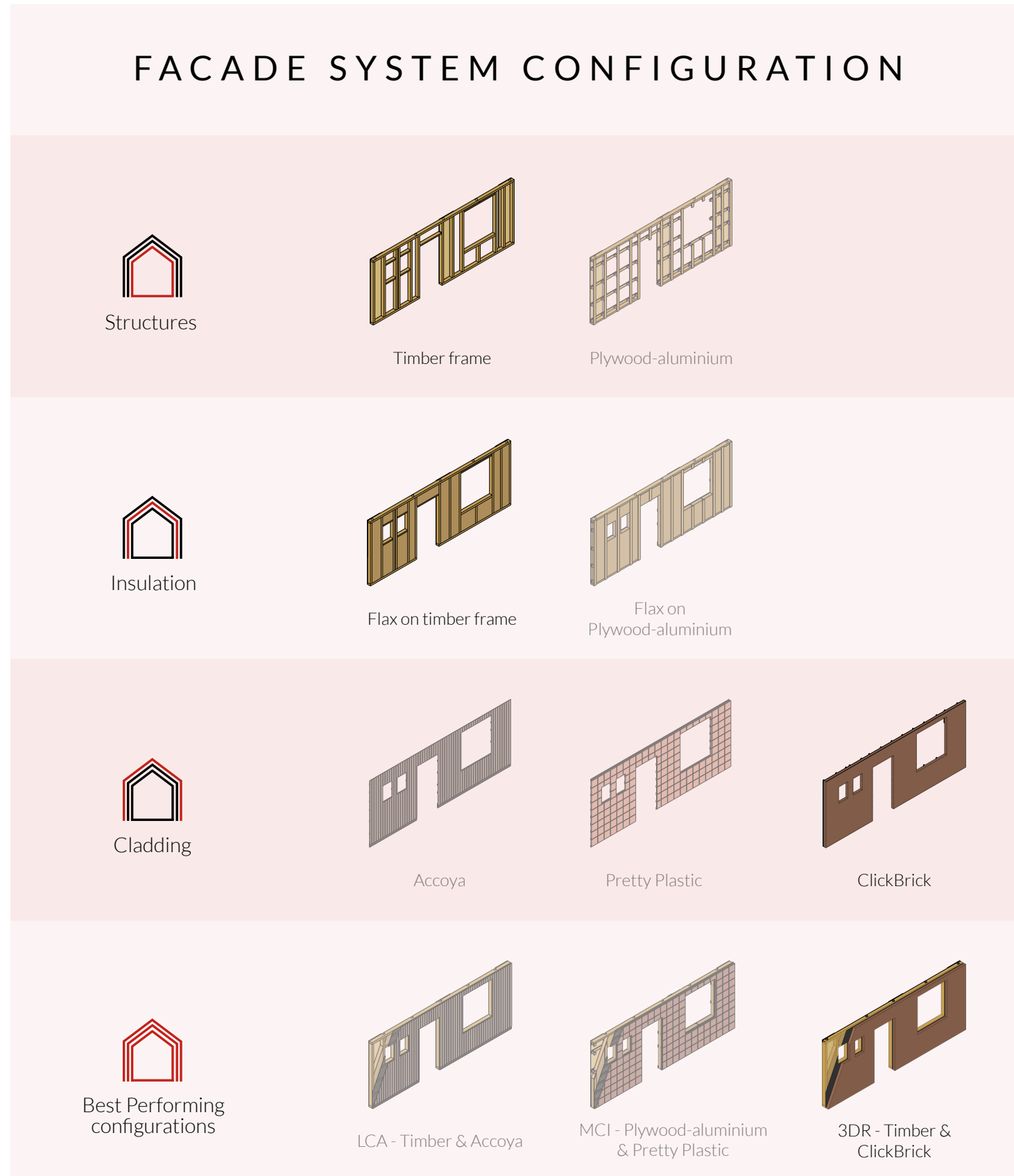


Durable materials



Facade system
retains value

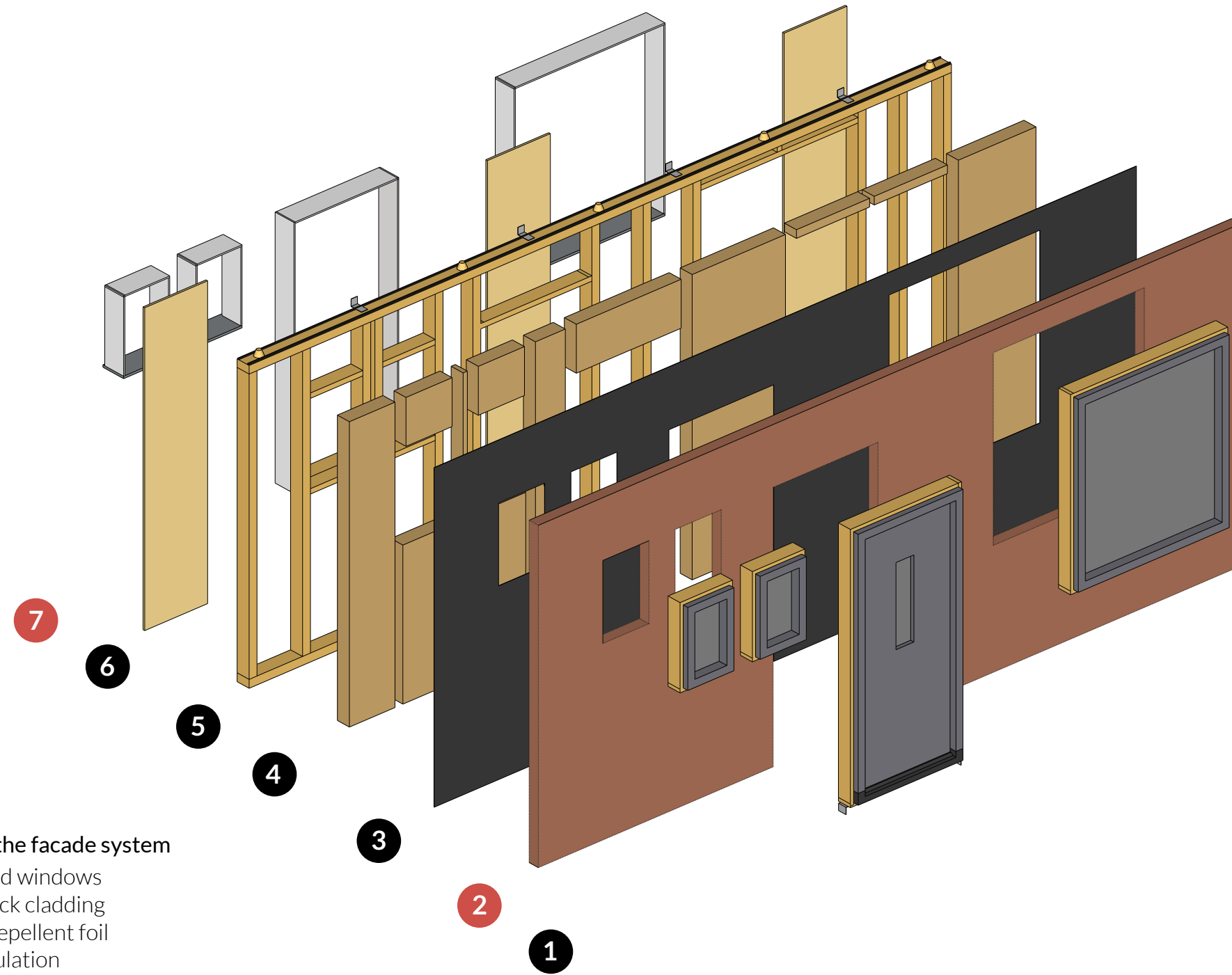
FACADE SYSTEM CONFIGURATION



	Structures		Cladding		Conventional	
	Timber	Plywood-aluminium	Accoya	Pretty Plastic	ClickBrick	Brick cavity facade
Feedstock						
Mass (kg)	348	163	147	224	2288	4718
Regenerative	70%	76%	80%	0%	0%	0%
Recycled	9%	21%	0%	96%	10%	5%
End-of-life						
Cycles of use	2	2	2	3	3	1
Recycle	8%	21%	0%	100%	100%	97%
Incinerate	71%	35%	100%	0%	0%	0%
Compost	21%	44%	0%	0%	0%	0%
Evaluation						
LCA (kg CO ₂ e)	-322	-132	78	258	574	2793
MCI	89%	92%	80%	85%	78%	12%
3DR	90%	79%	75%	85%	95%	2%

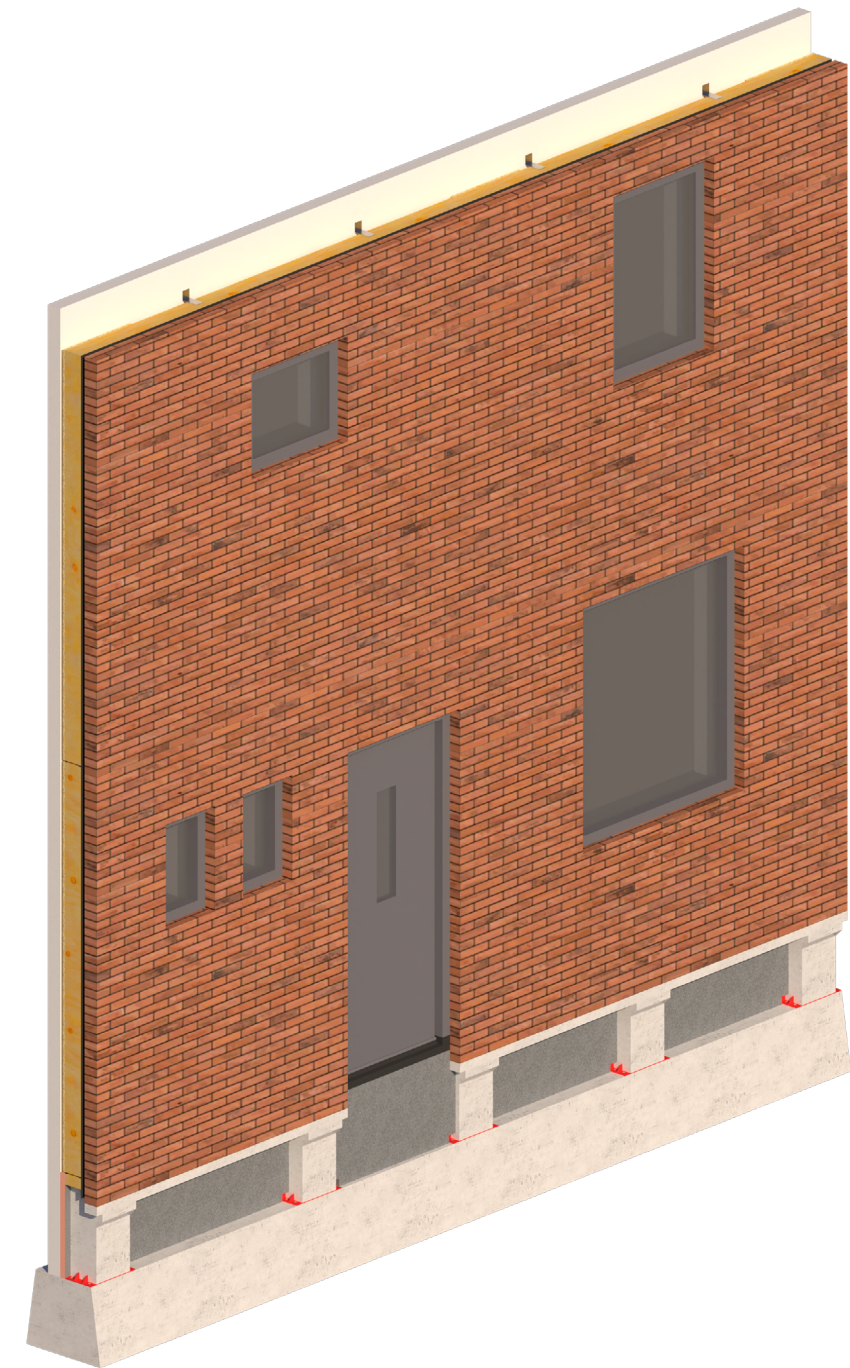
Design process

Final design

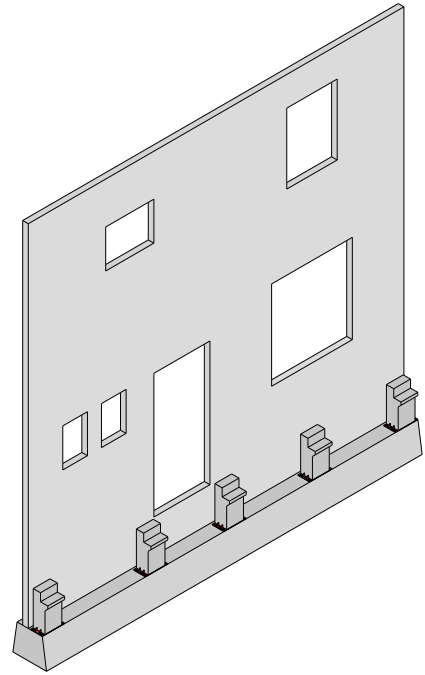


Layers of the facade system

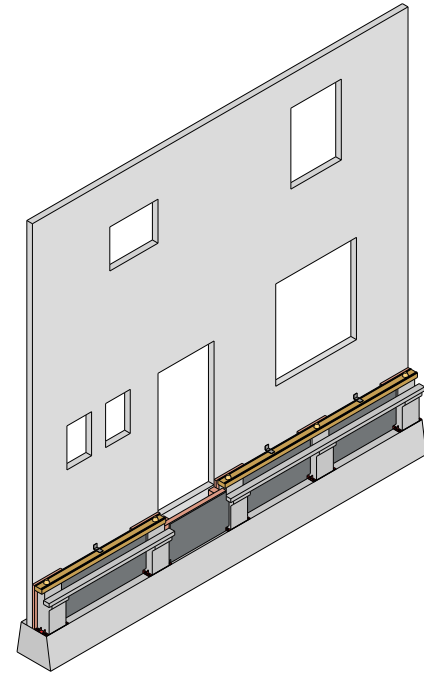
1. Door and windows
2. ClickBrick cladding
3. Water repellent foil
4. Flax insulation
5. Timber frame structure with joints and anchors
6. OSB plates
7. Internal lining



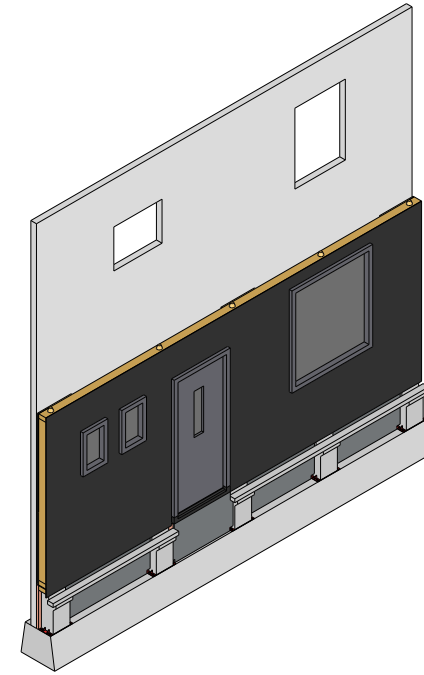
Mounting procedure & placement of joints



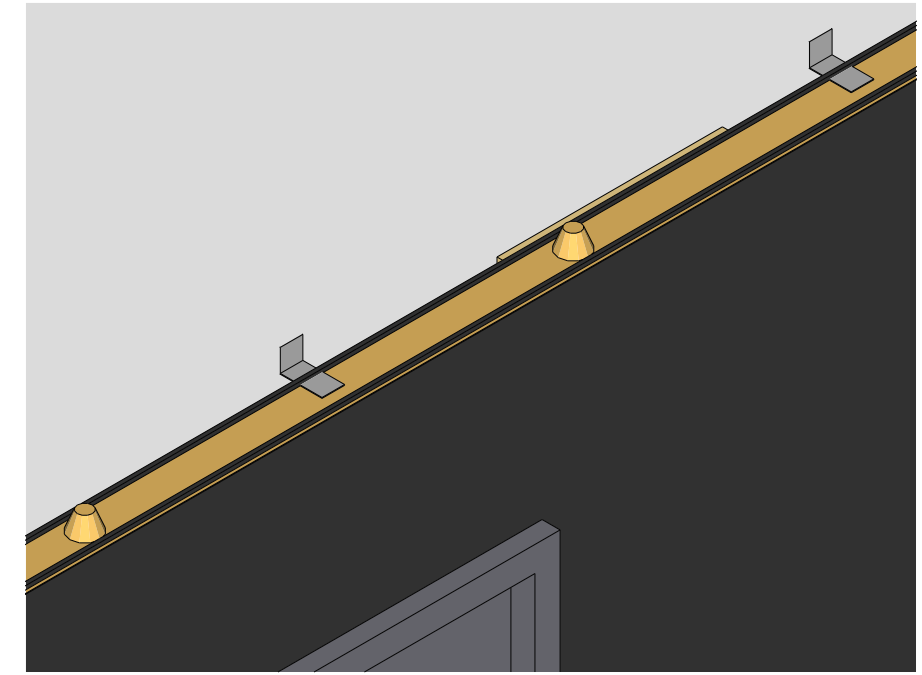
1. The prefabricated concrete footings are placed.



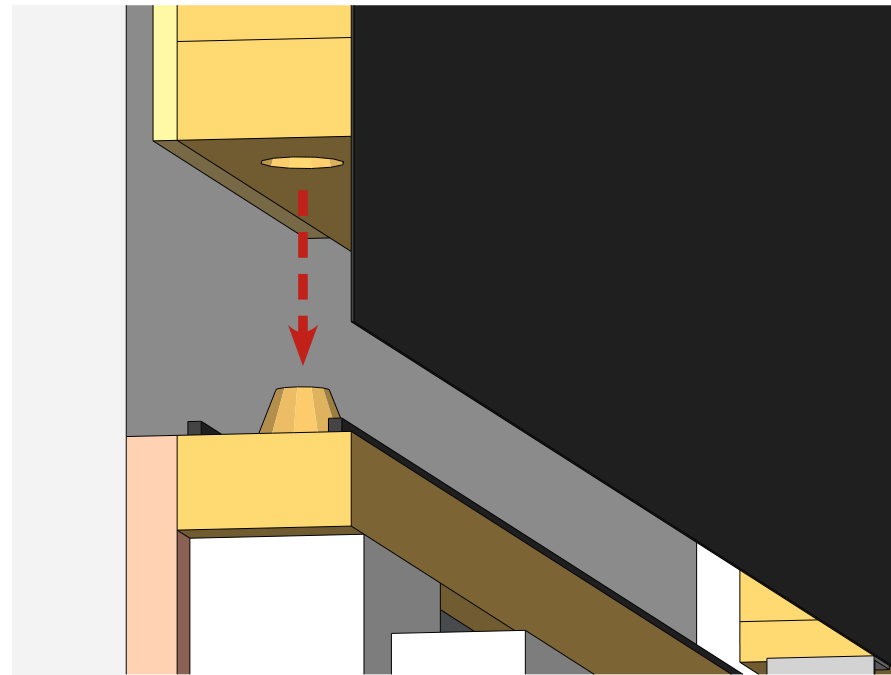
2. Next are the lintels, timber beams and Insulated skirt boards.



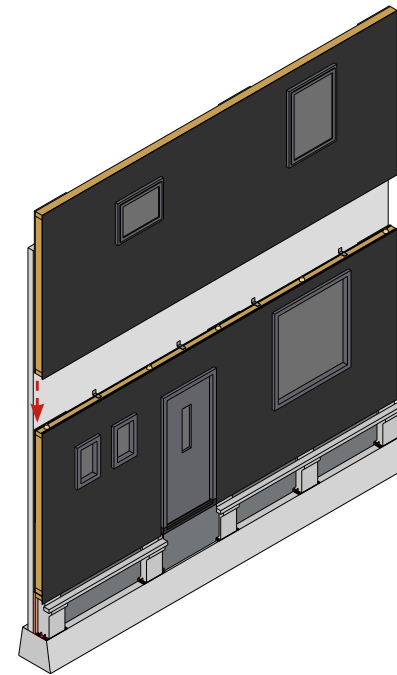
3. The facade system is placed on top of the timber cones.



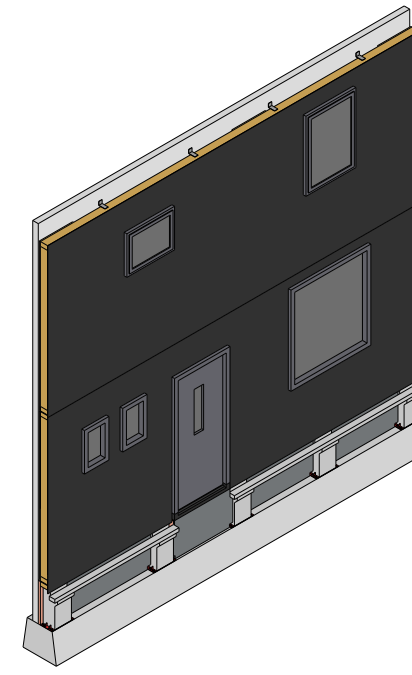
4. Steel brackets connect the facade system to the existing bearing wall, compressible sealing tape is placed on top.



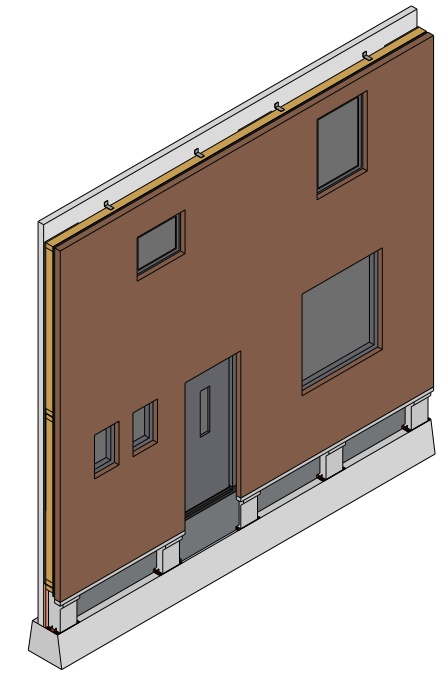
5. Milled holes in the beam at the bottom of the second façade system allow it to slide over the cones.



6. The second facade system is placed on top of the first system.



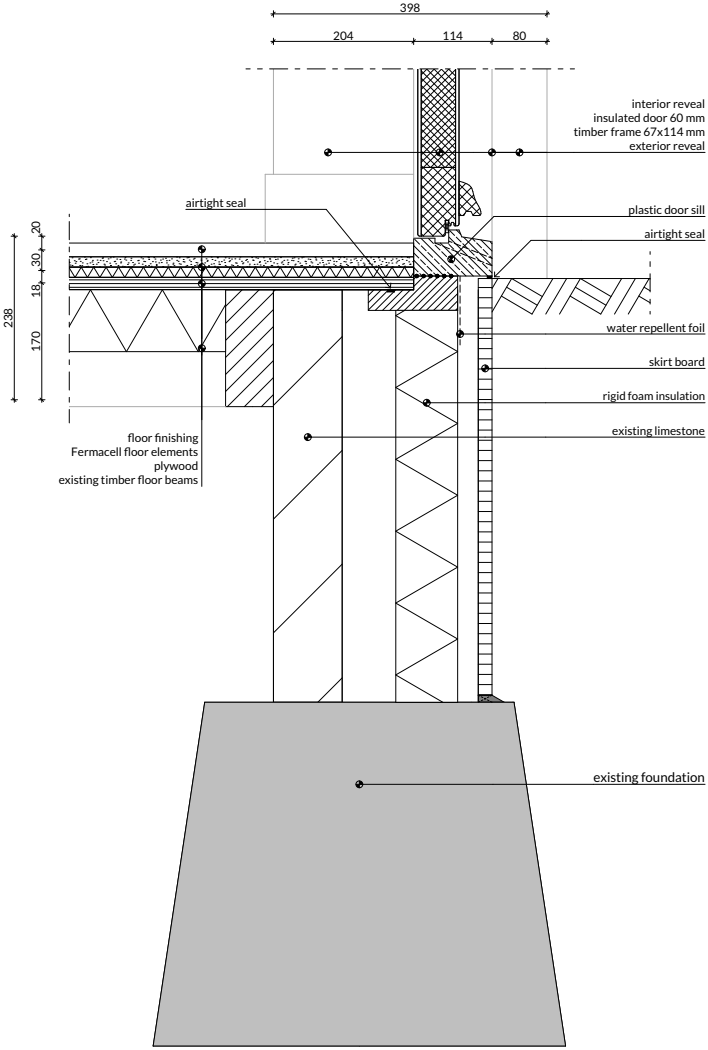
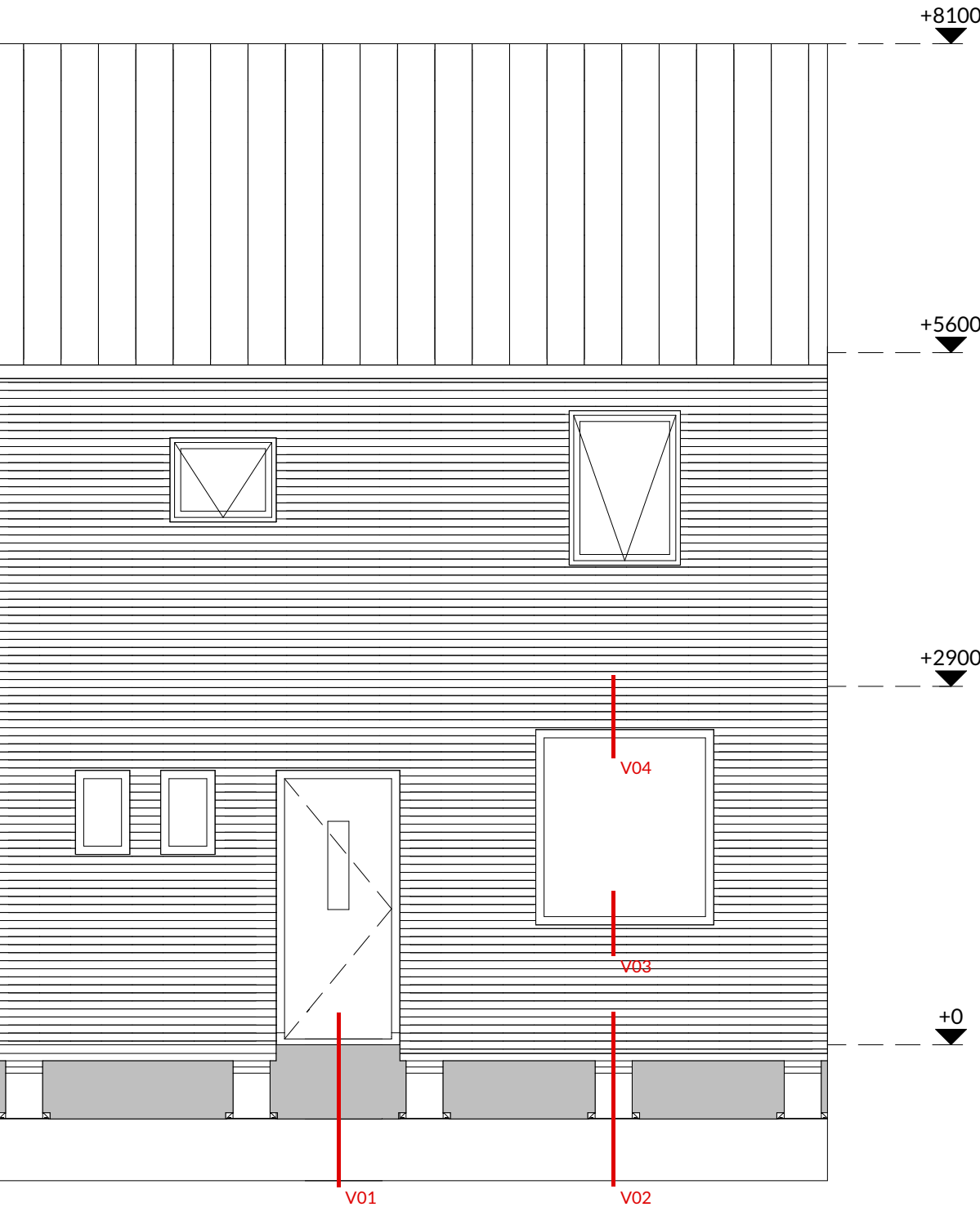
7. Steel brackets are placed on top of the second facade system.



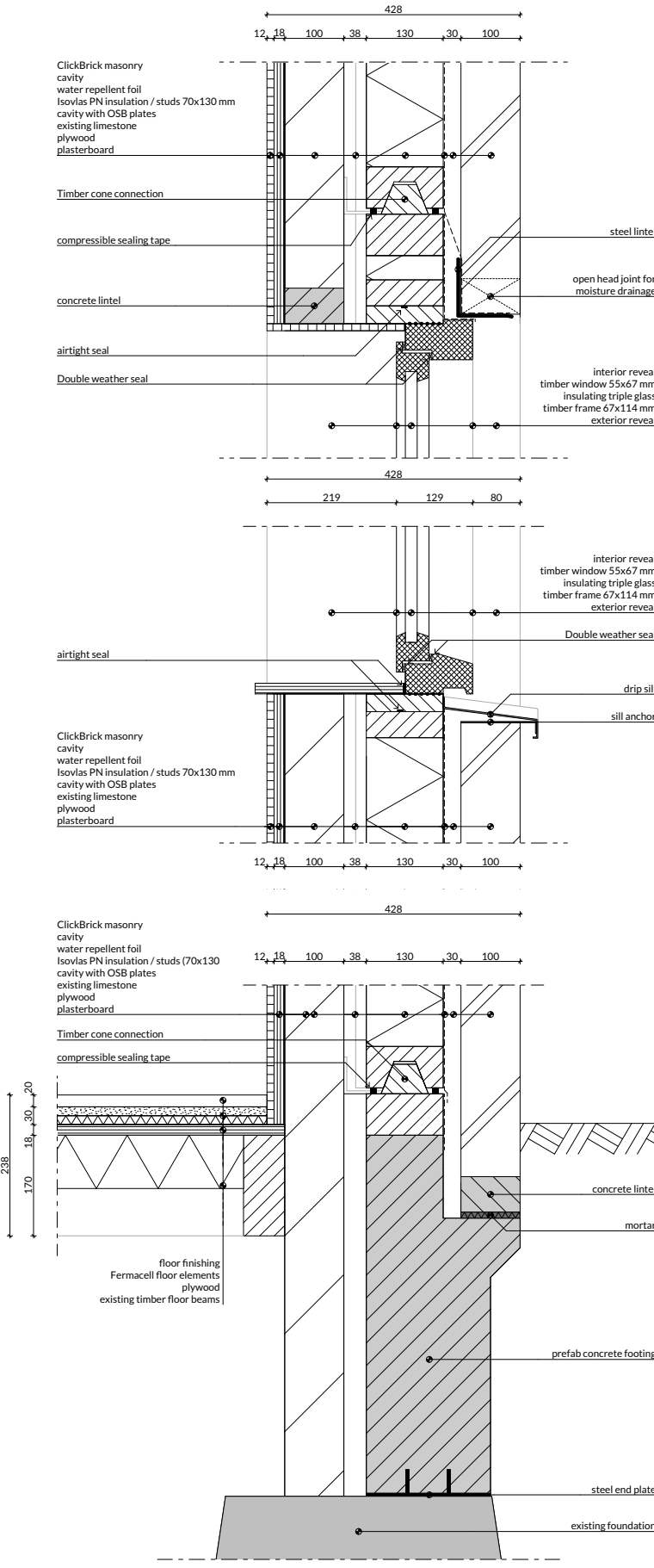
8. The ClickBrick cladding is placed on the concrete lintels.

Technical drawings

Vertical details



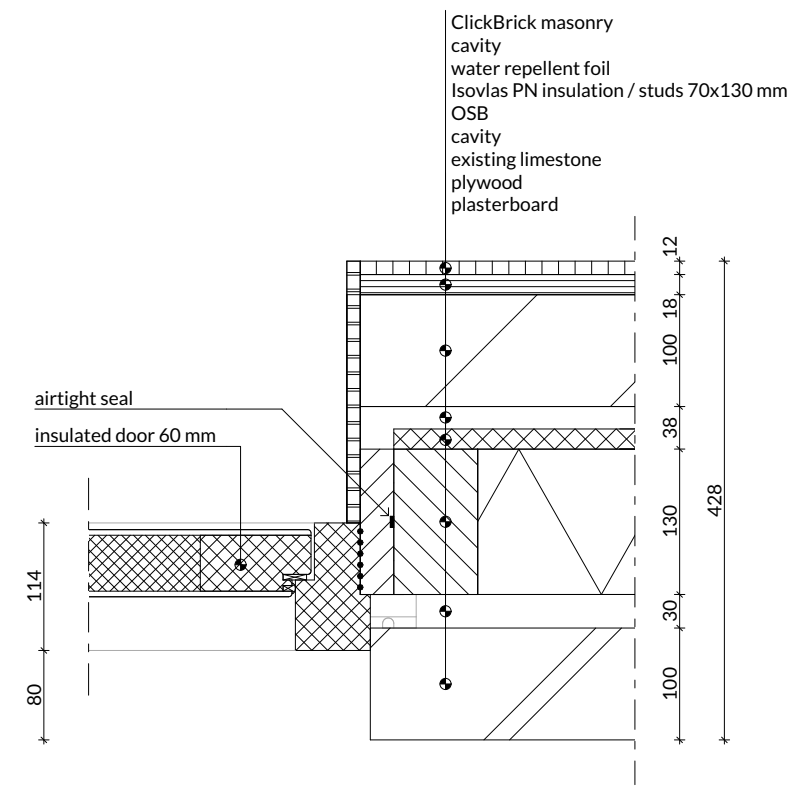
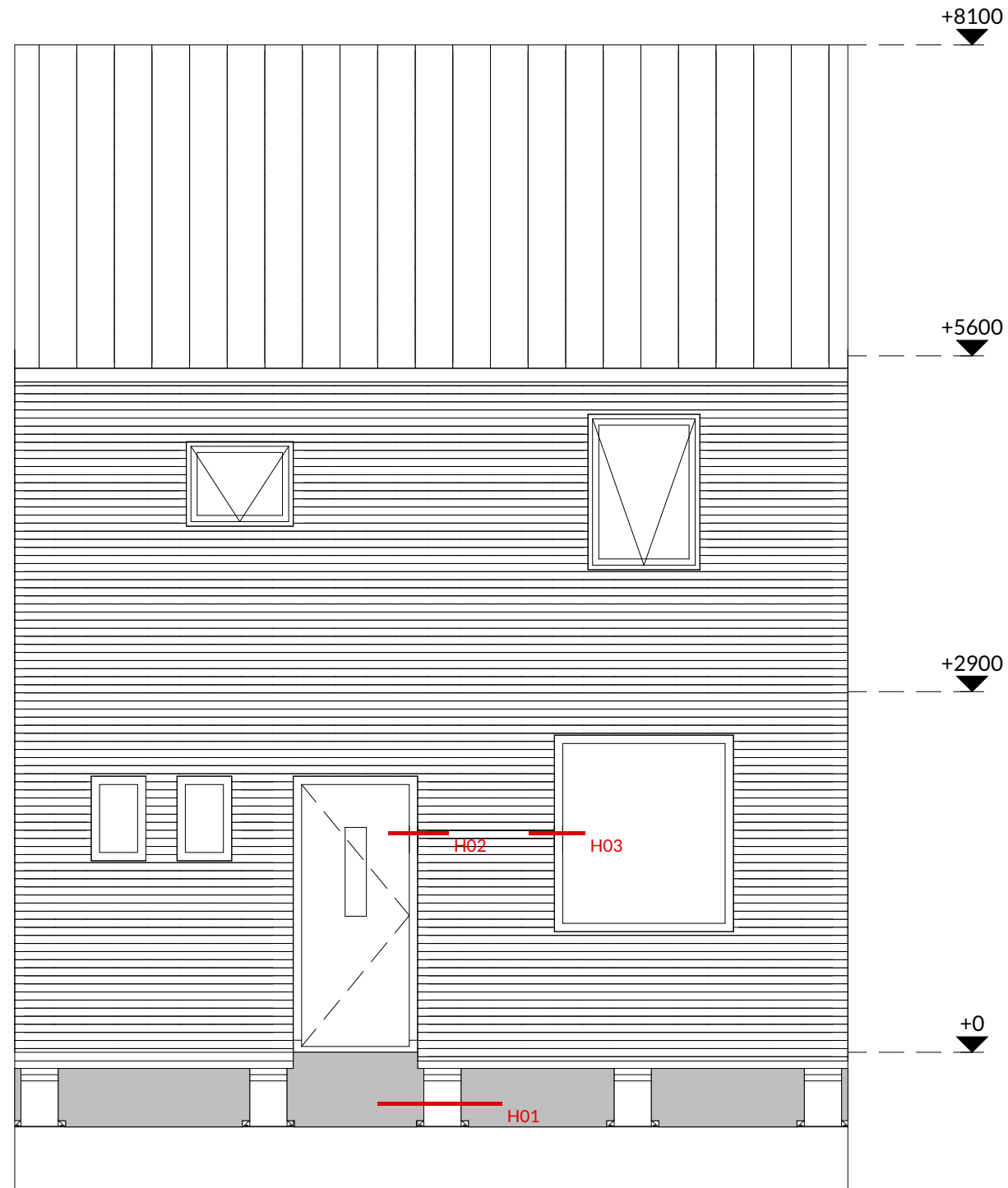
Foundation & door (V01)



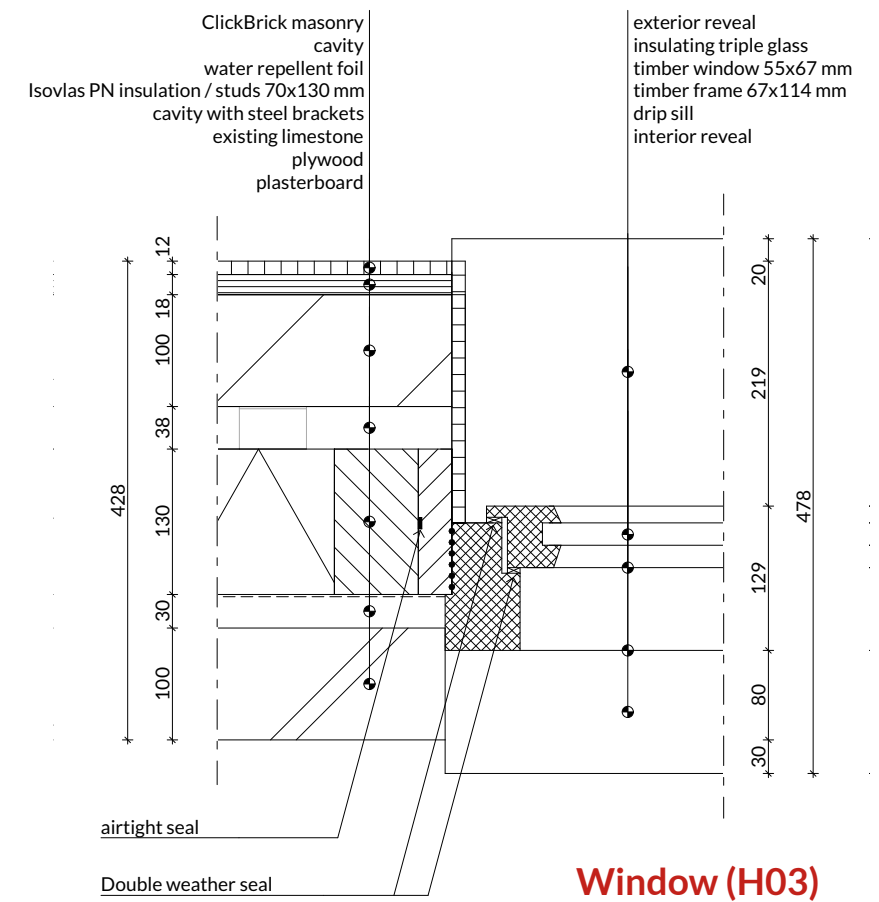
Foundation & window (V02 - V03 - V04)

Technical drawings

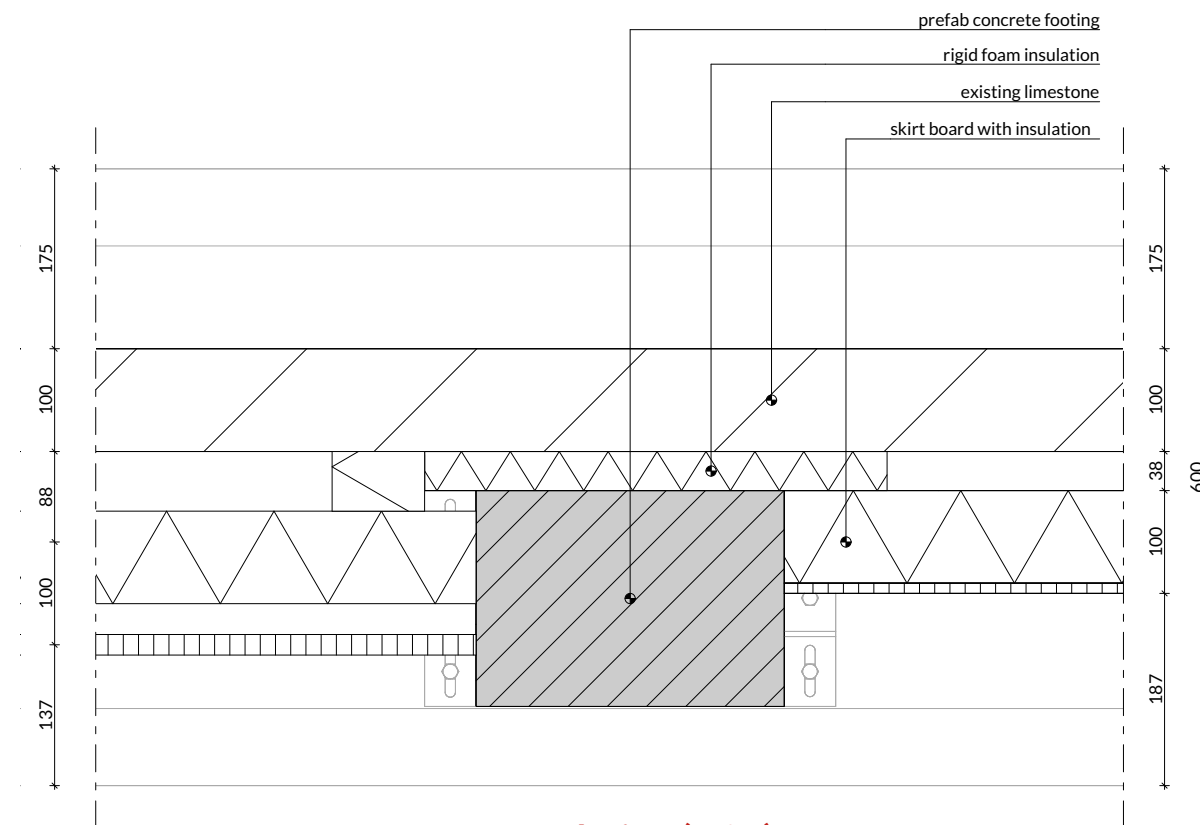
Horizontal details



Door (H02)



Window (H03)



Foundation (H01)

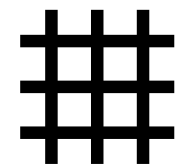
Conclusion

Research question

How can an industrialised façade renovation system incorporate future component reuse while being adaptable to different façade layouts?



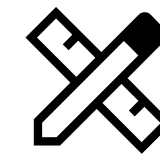
Layer facade



Standardised grid



Durable / bio-based materials



Design for disassembly

Thanks for listening