Preservation through Adaptation

Revitalising St Barbara church with a focus on preservation and choice of materials

P5

Adriaan Bon | 5231426 | 30-10-2023

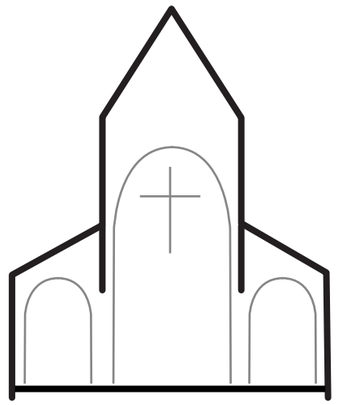
PREMIUM

▲ De St. Barbarakerk staat in de steigers.

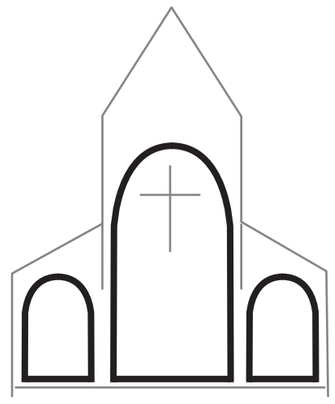
Binnen twee jaar is deze kerk in Culemborg (mét achterstallig onderhoud) te koop

CULEMBORG - Het is onvermijdelijk: binnen twee jaar komt de rooms-katholieke, Culemborgse Barbarakerk in de verkoop bij de makelaar. Al jaren drukken de onderhoudskosten van het laat negentiende-eeuwse gebouw loodzwaar op de sterk geslonken kerkgemeenschap.

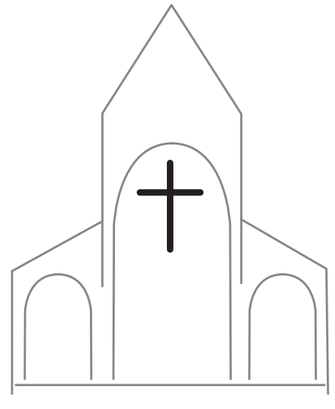
Bram van Schaik 27-07-20, 14:27



Materials



Space



Values

My Aim

How can a vacant church be redesigned in a way that it can accommodate different demands for use now and in the future through a Minimal Waste approach?

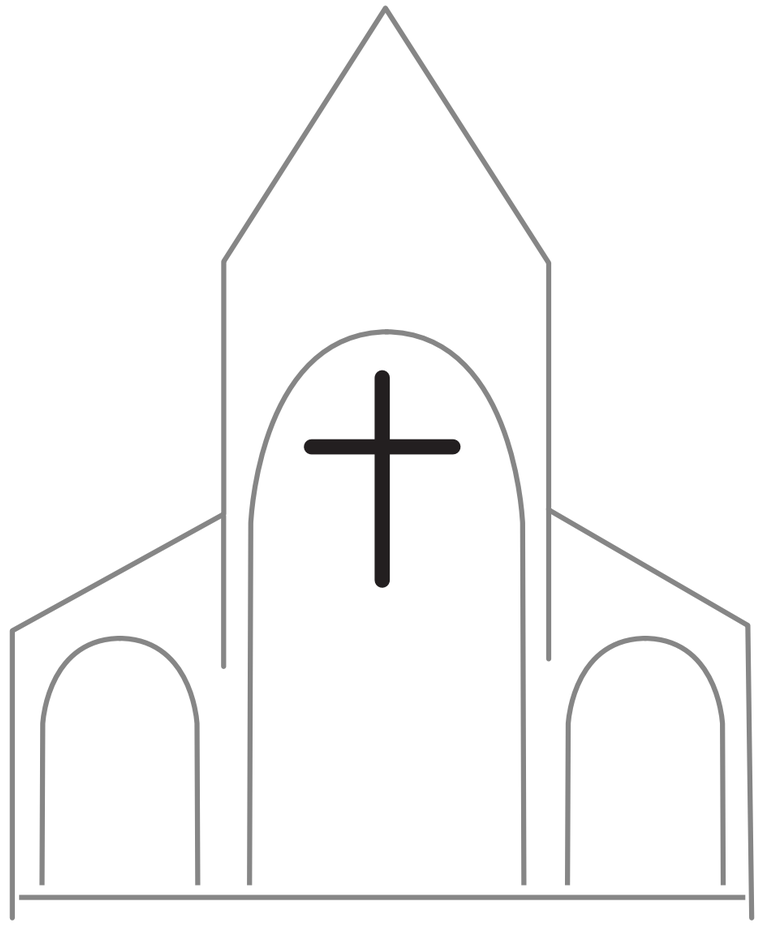
SQ1: What does a Minimal Waste future mean within the building sector?

SQ 2: How is circularity implemented in selected new buildings?

SQ 3: How is circularity implemented in selected repurposed churches?

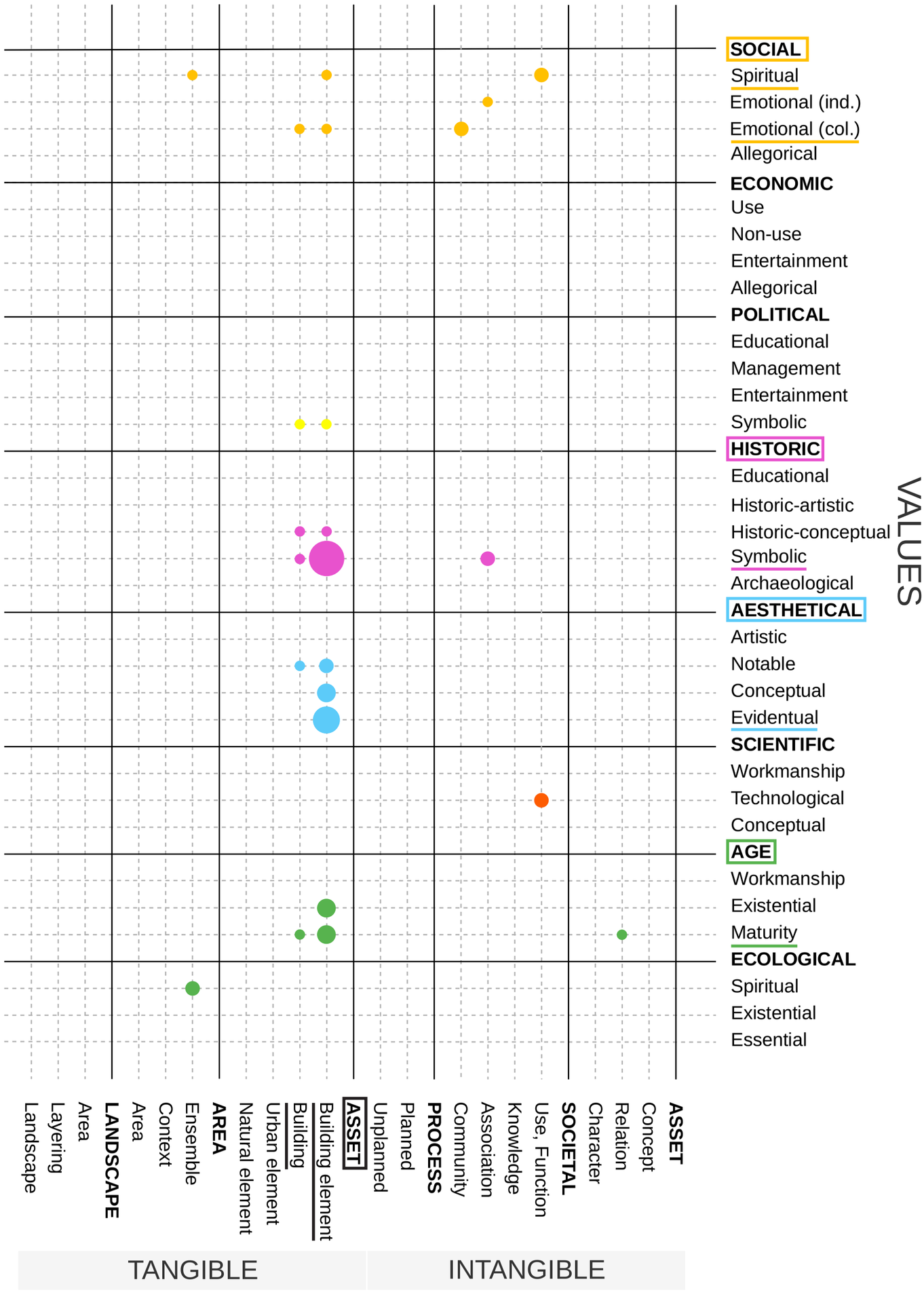
SQ 4: How can the stake of Minimal Waste within a church redesign for adaptive use be maximized?

Research Questions



Values

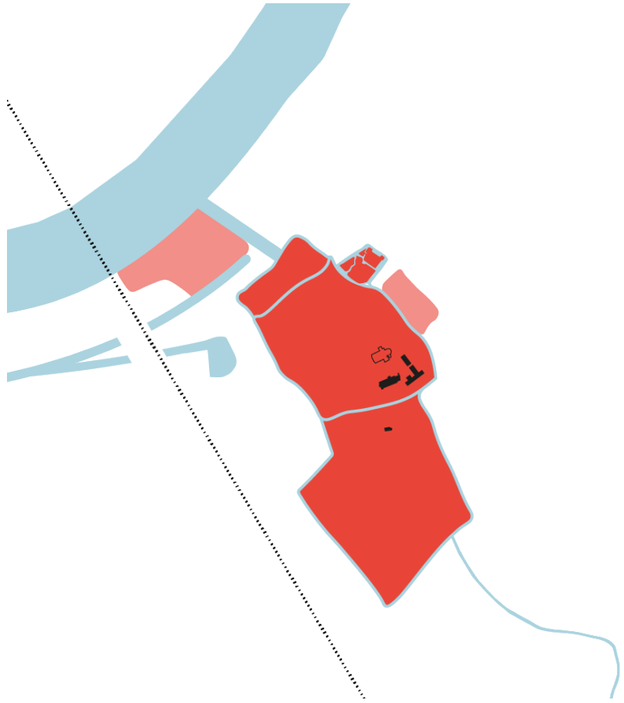
Value Assesment



Important in the urban context

Detailed facade towards the market square

Made possible by gifts



New start for the Roman Catholics

Noteworthy Values

CVLENBVRGVM,

Illustrissimo Comiti

HENRICO WOLRADO

COMITI IN WALDECK, PYRMONT et CVLENBVRG;
Baroni in Tonna, Palant, Wittem, et Werth, etc. Domino in Leede, Linlen, Wildenborgh, Kinzweiller, Engelsdorp, Bachum, Frechem, Dalem, etc.

Tabulam hanc D. D. Ioannes Blaeu.

De Haven

Cleyne Leck

Leck

Graeft uyter weyden

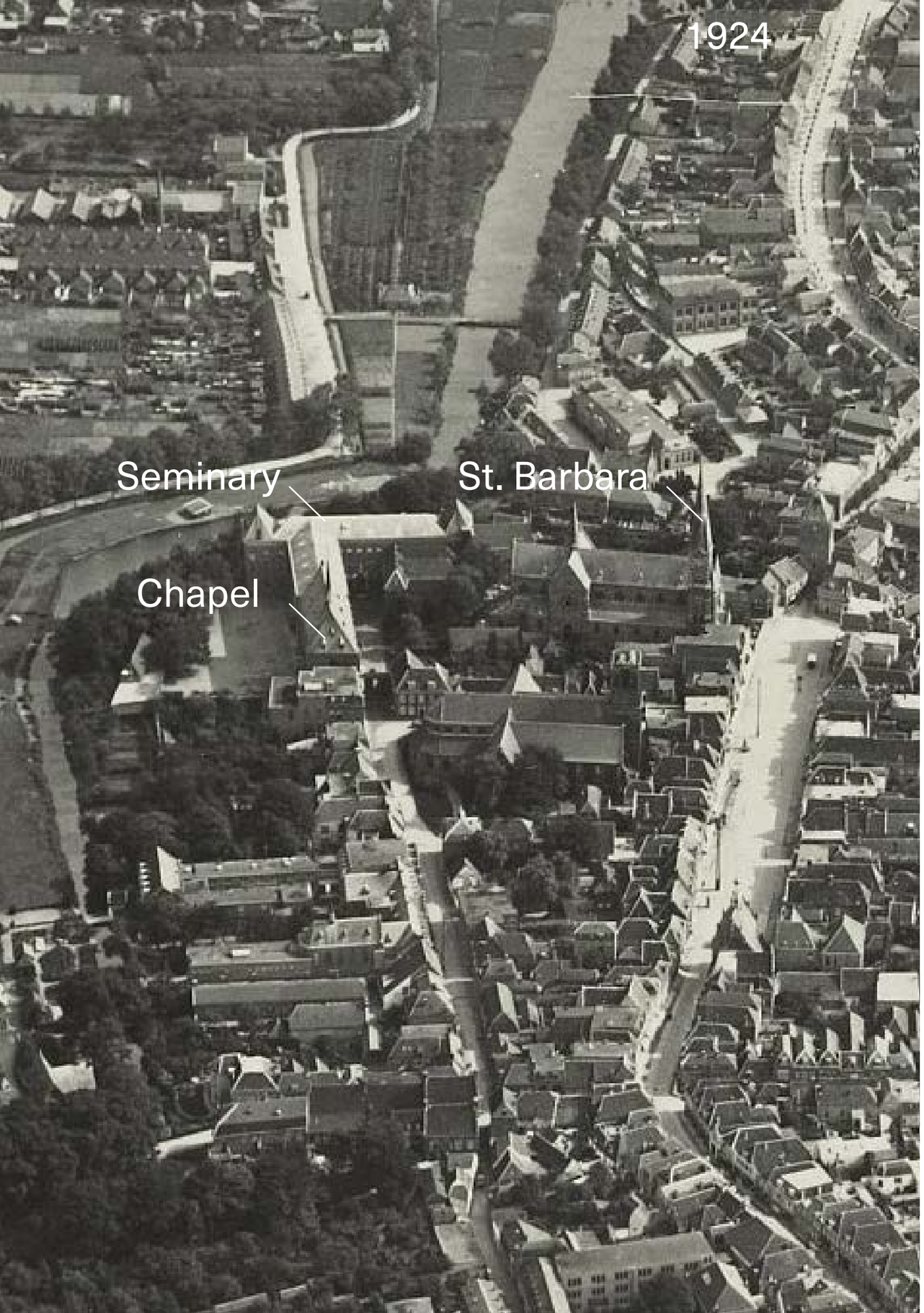
Graeft uyter weyden

Graeft uter weide

Voor Hoff

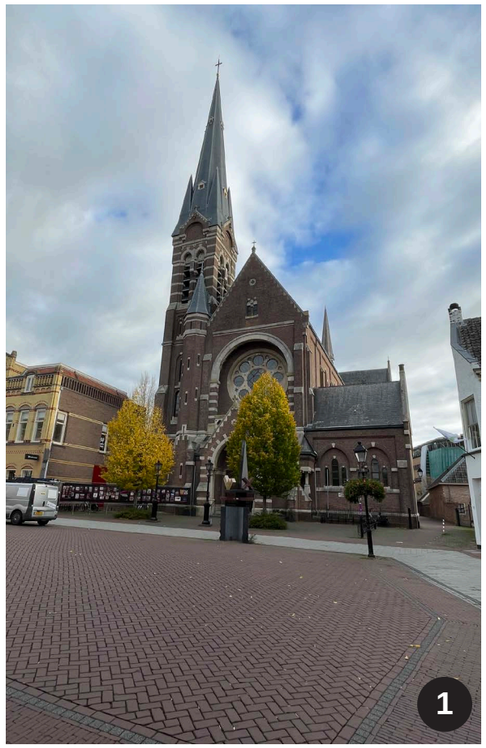
Voole Camp

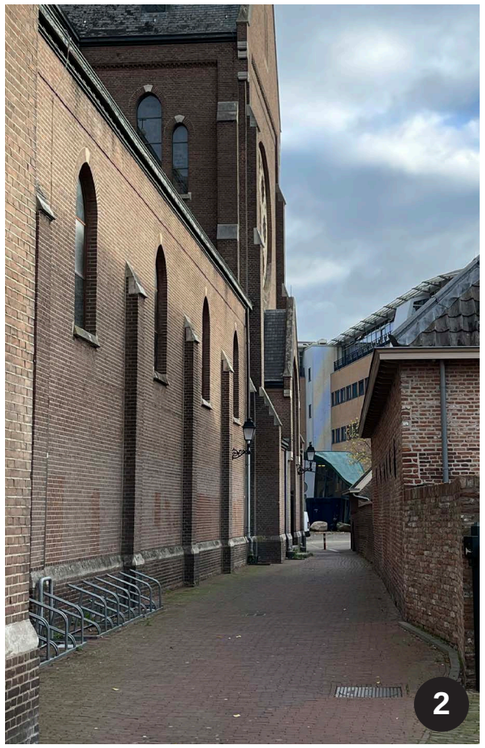
1 . t Graffelijck Slot
2 . t Voorhoch
3 . De Stallagh
4 . Picuer huys
5 . Cruyt en Blom hoff
6 . t Luft huys
7 . Boomgaerden
8 . Caets-haen
9 . De Droeff poort
10 . Oude en nieuwe Droef

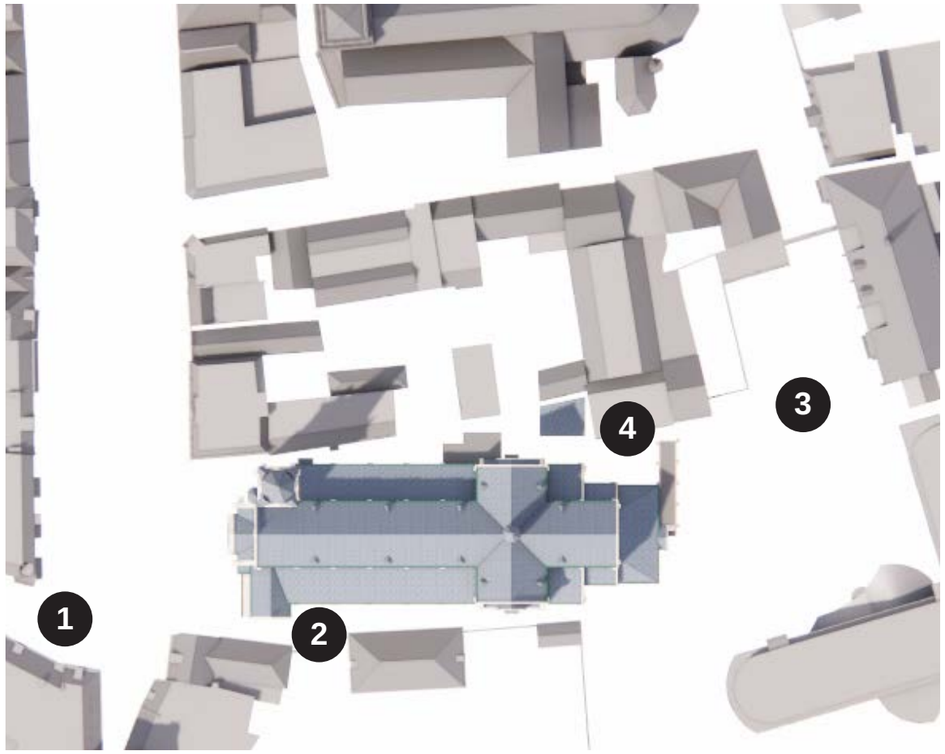

1924
Seminary
St. Barbara
Chapel

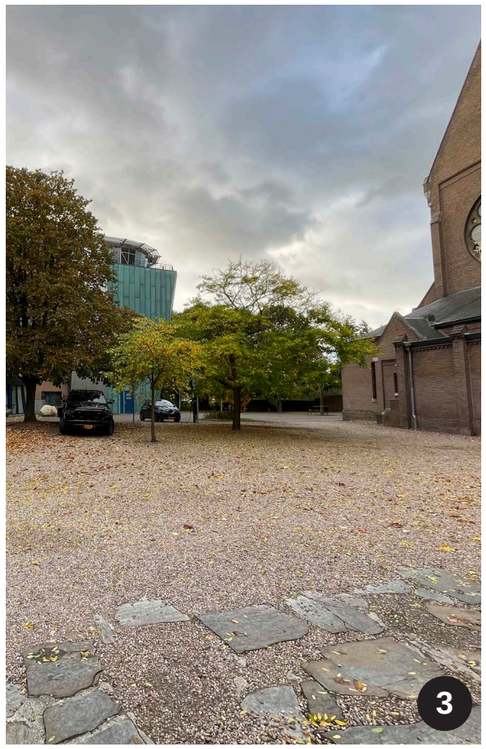

1910
Culemborg
Aarts Bisschoppelijk Seminarie
Binnenplaats
Aankomst van den Aartsbisschop

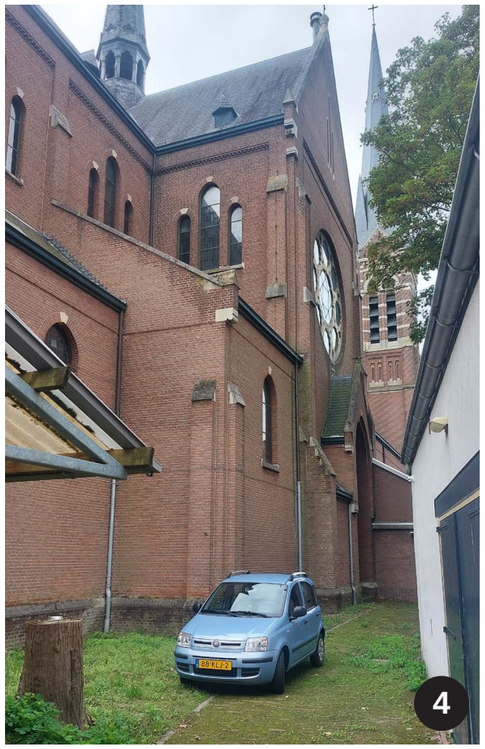

2021

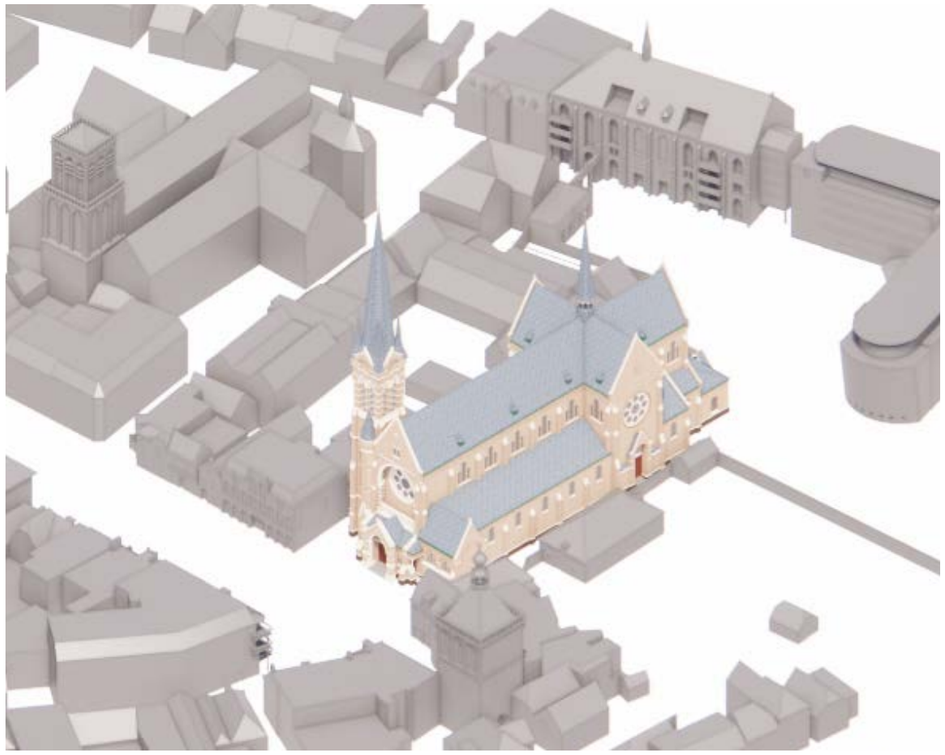












Site & Surroundings

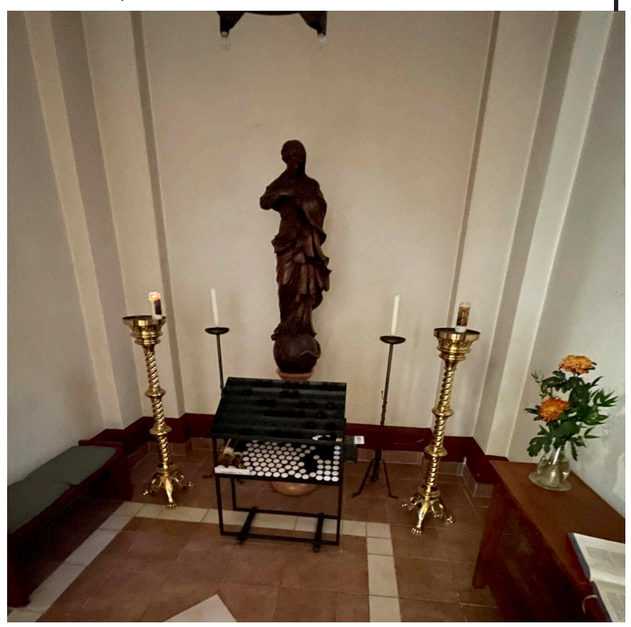
polychromy and beige interior

interior is painted over

ground floor is replaced

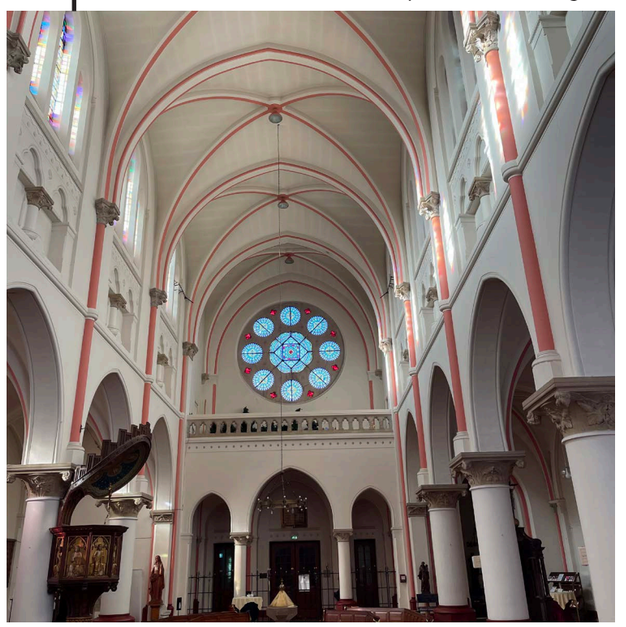
1886 1889 1936 peak 1948 1950 1962 1991 1992 2023

Maria chapel is added



high altar is replaced

interior is painted over again



Preservation of function & space

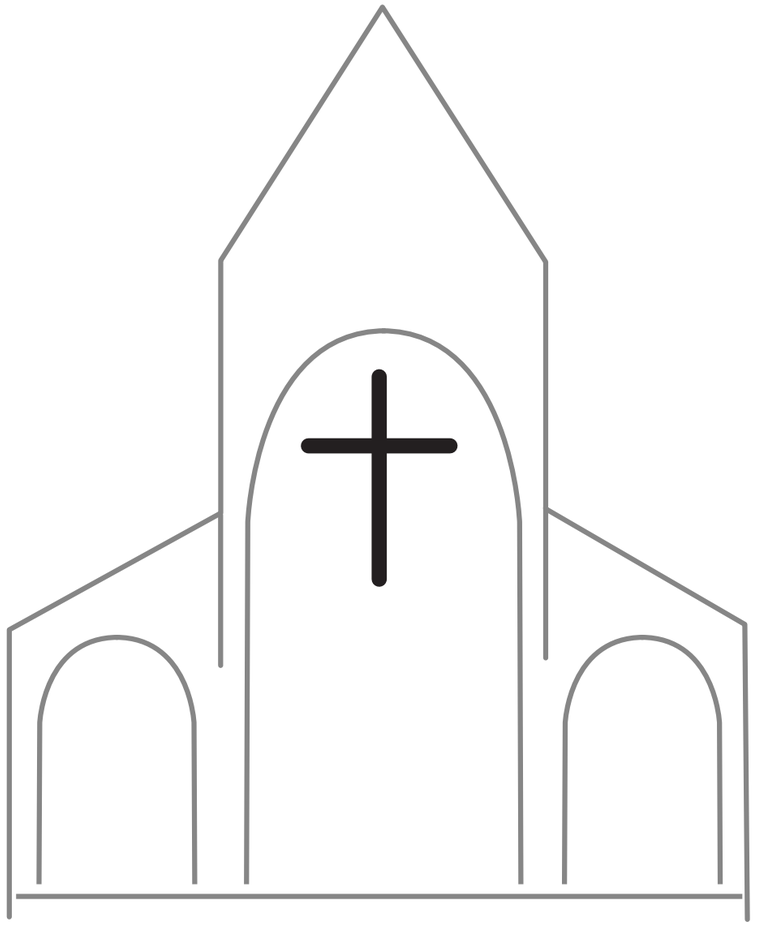
▲ Bernard Schoenmakers, Bernard Joosten en Werner Dovens (van links naar rechts) hebben een verrijdbaar altaar gemaakt zodat in De Rips ook op kleinere locaties missen kunnen worden gevierd. © Hein van Bakel/DCI media

Kerk in beweging wordt voor De Rips letterlijk waar met verplaatsbaar altaar

DE RIPS – Een koude kerk (door minder stoken) hoeft in De Rips geen probleem te zijn. De inwoners kunnen binnenkort toch verwarmd een mis bijwonen in de parochiezaal van de kerk, dankzij een verrijdbaar altaar.

Jeanne van Ansem 29-09-22. 16:56 **Bron:** ED

Historical, Social &
Symbolic significance
for Culemborg and its
inhabitants

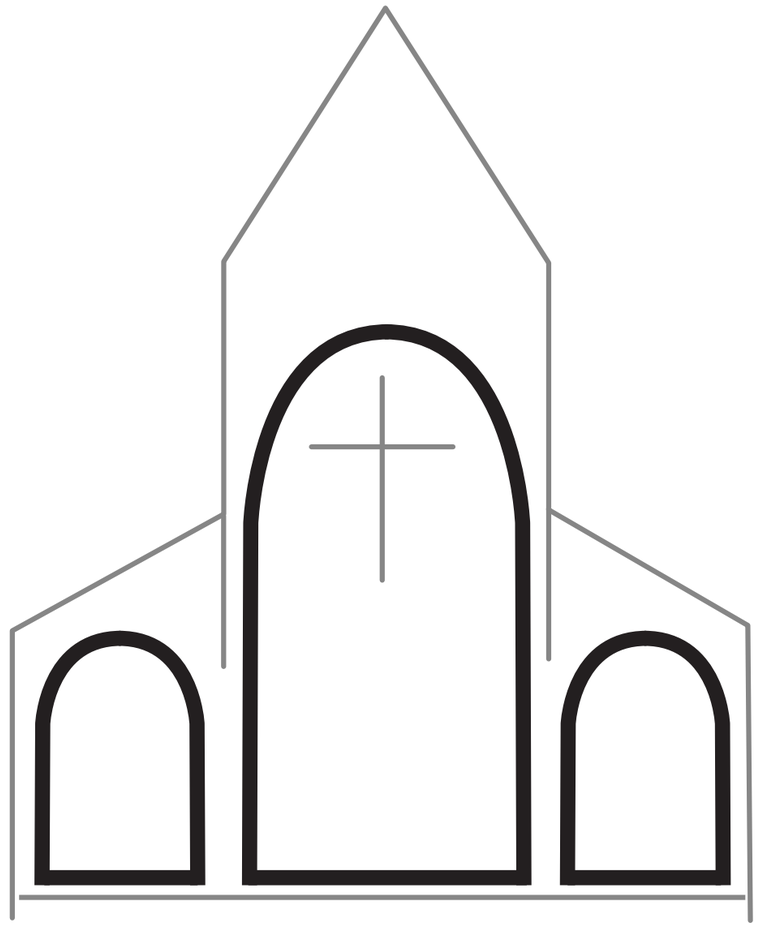


surroundings has
changed drastically

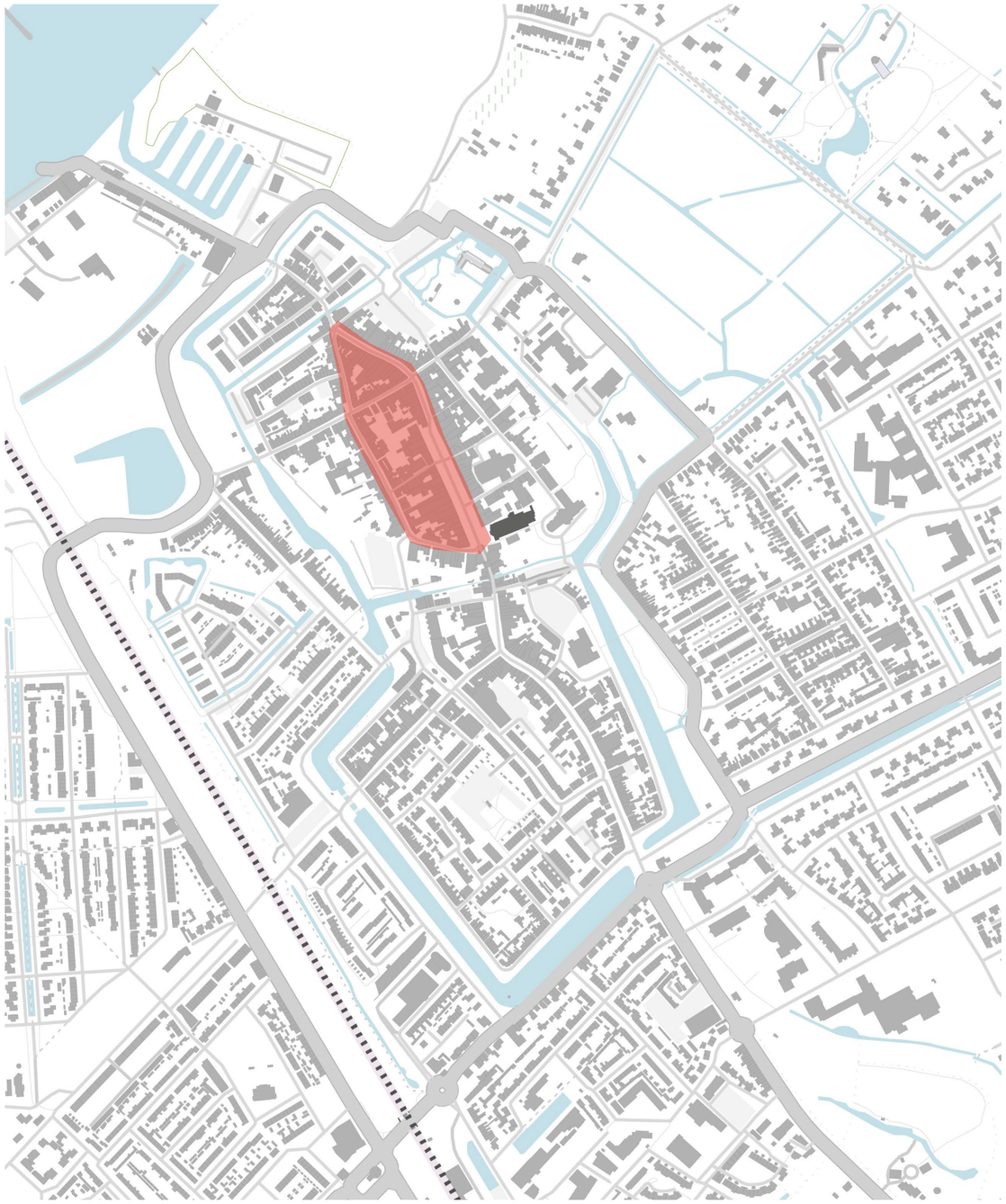
church is the only
remaining function left of
the cluster

retaining the church's
function & nave are
essential

Findings



Space



Increase tourism
Encouraging circular initiatives

Intensify the city centre with:
- Retail
- Restaurants & cafés
- Hotel accommodation

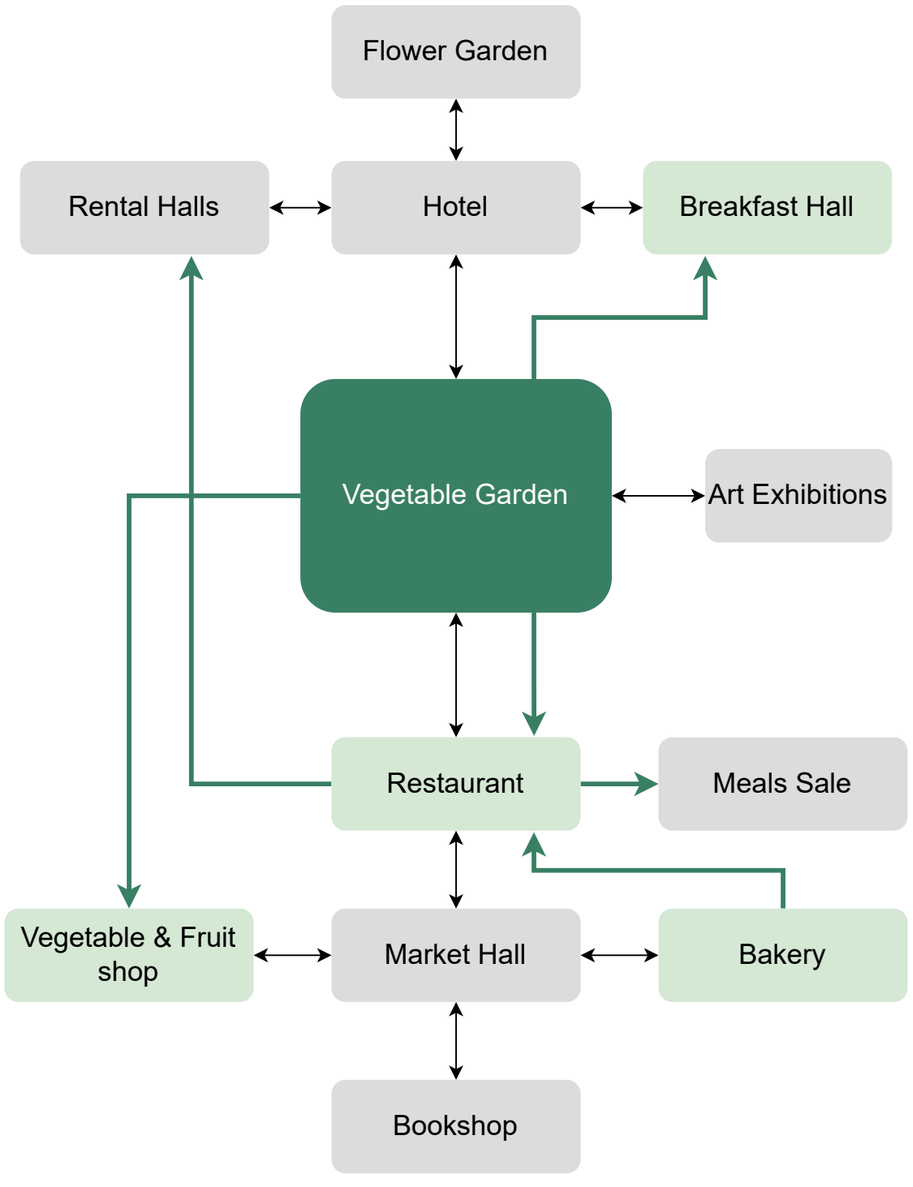
Plans of the Municipality

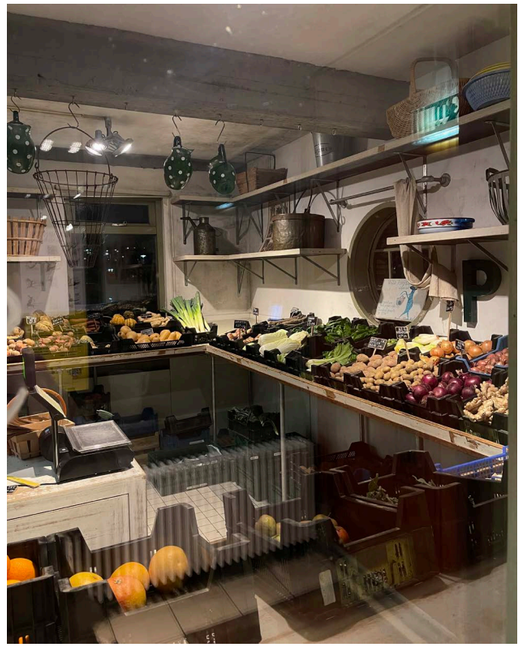
100%(Y)ourCityHotel Culemborg

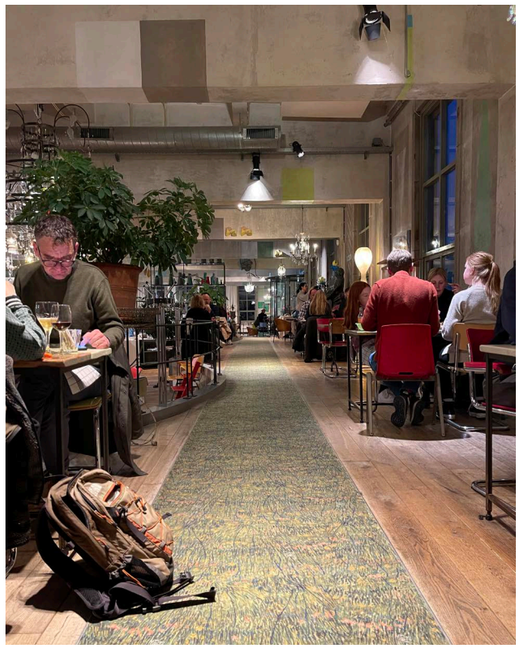
- Demand for sustainable tourism
- Increase aware-minded tourists
- Quality > Quantity
- Local connections & initiatives
- Circular building & program

- No nearby competition
- 35 Hotel rooms buisnessmodel
- Co-operative ownership

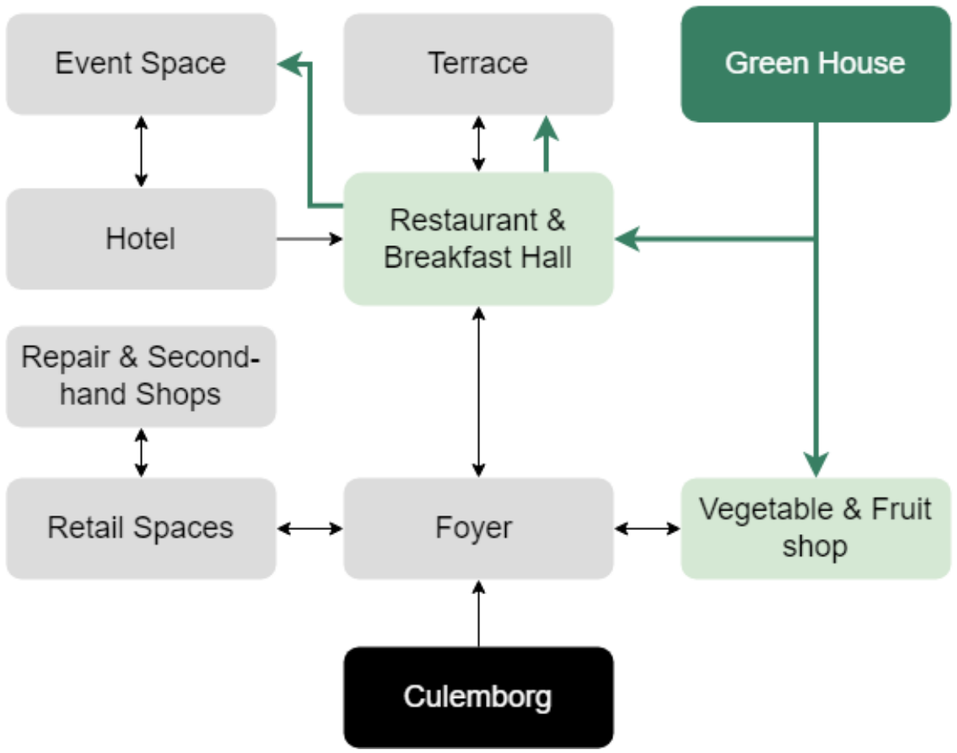
100%(Y)ourCityHotel Culemborg



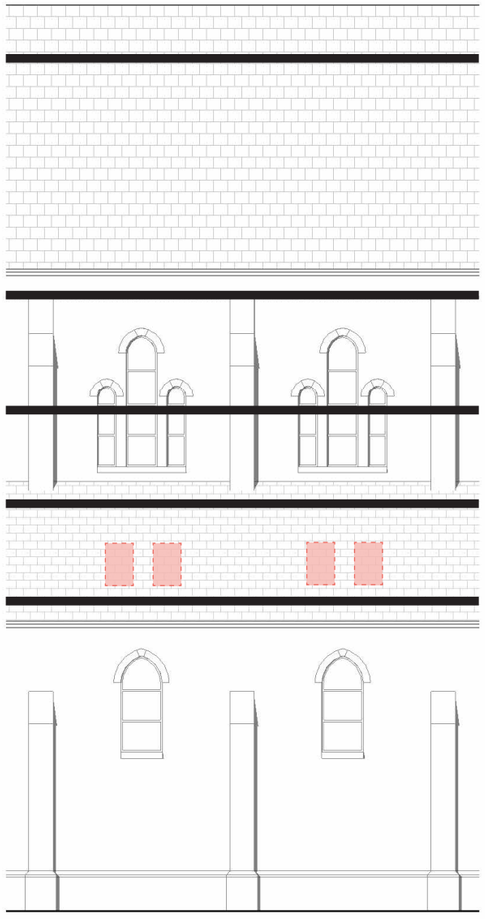


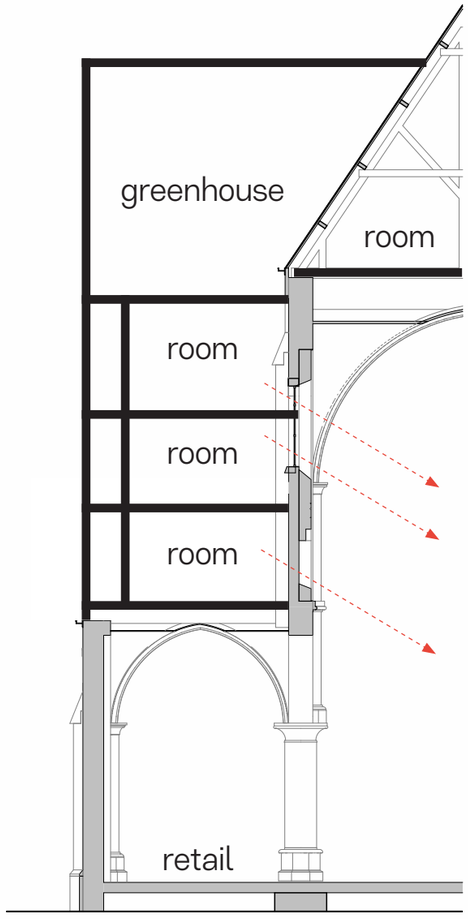


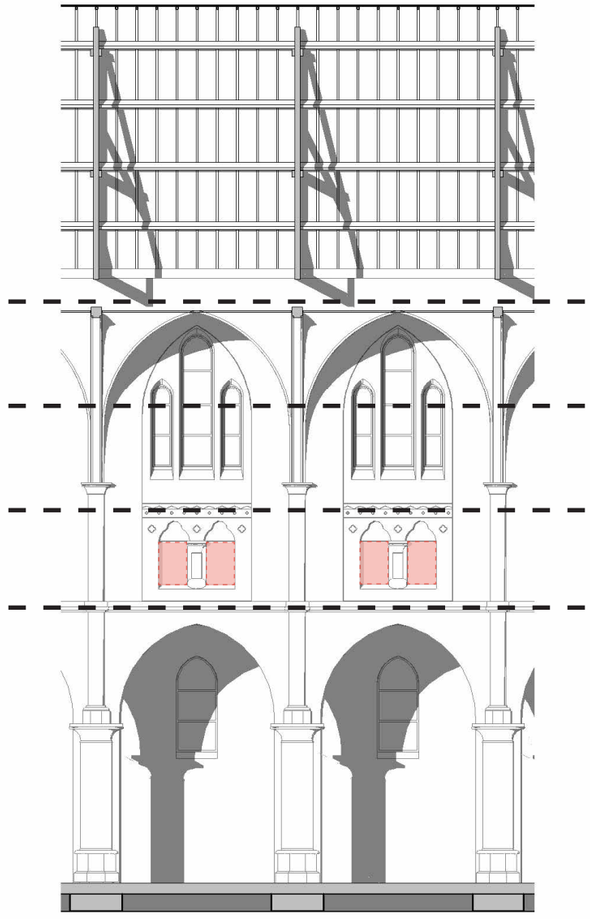
Villa Augustus analyses


Event Space
Terrace
Green House
Hotel
Restaurant &
Breakfast Hall
Repair & Second-
hand Shops
Retail Spaces
Foyer
Vegetable & Fruit
shop
Culemborg

New Program







Concept

Two Sided Concept

South West Side
preserve & small interventions

North East Side
space for expansions

Two Sided Concept

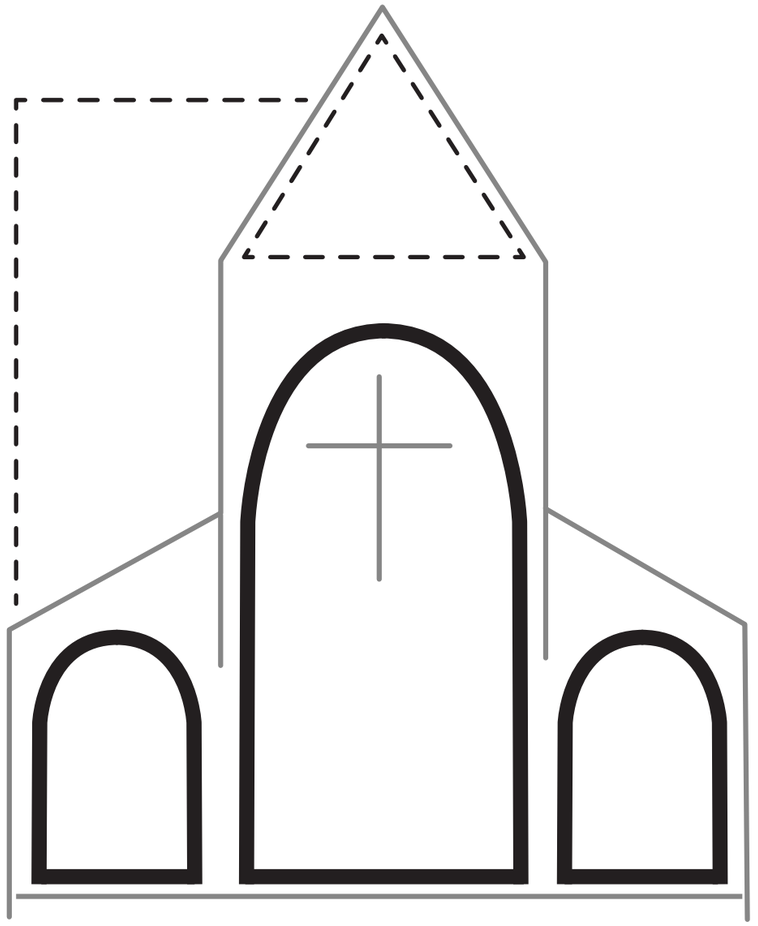
South West Side
preserve & small interventions

North East Side
space for expansions

Two Sided Concept

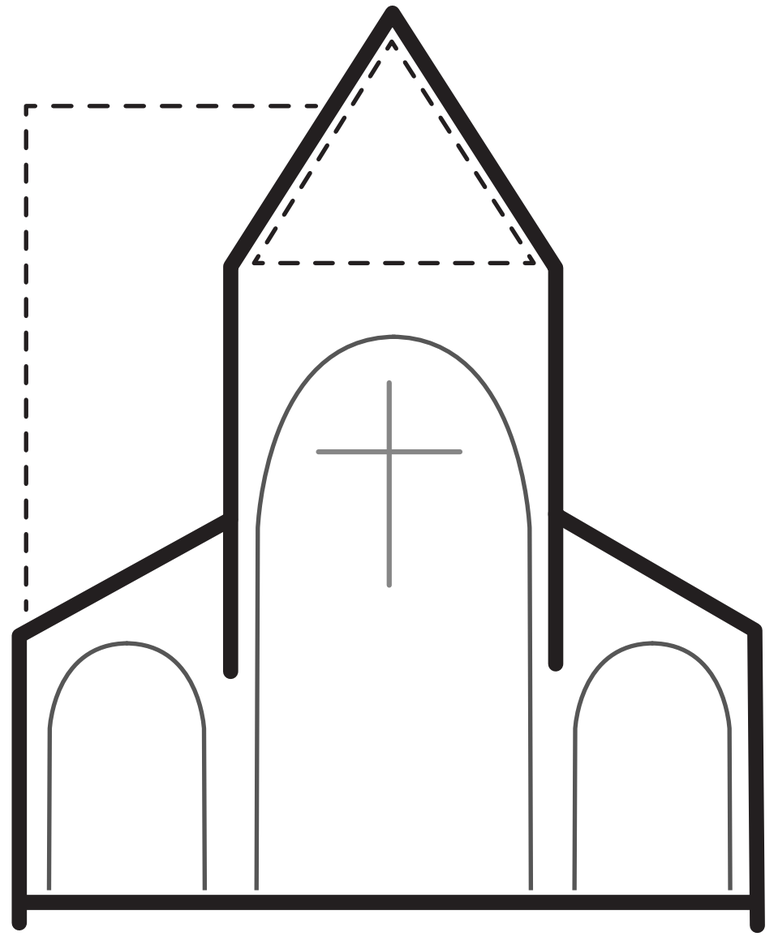
attic contains a large floor area & height

north side aisle's roof must be replaced

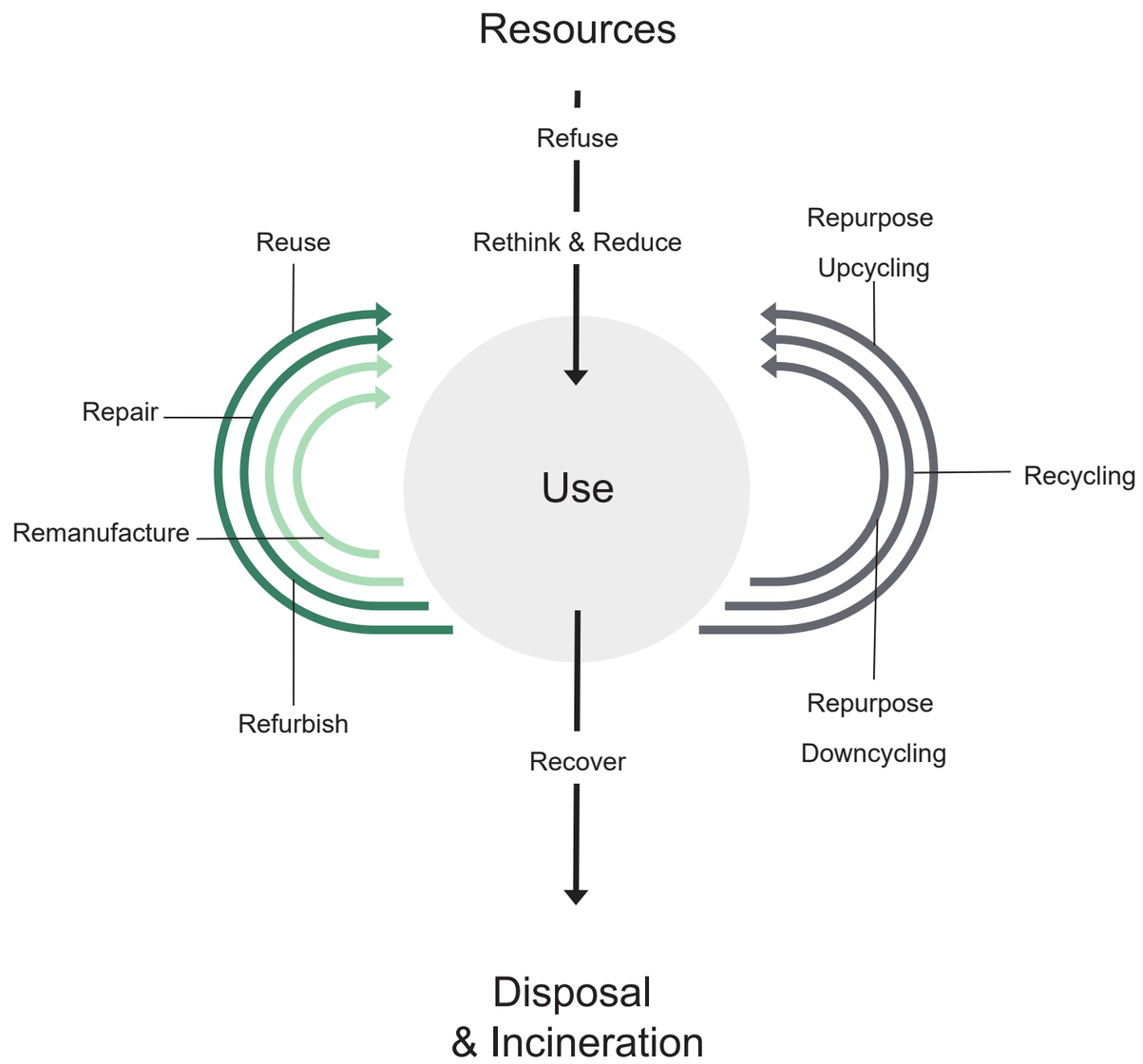


demand for retail, cafés & hotel accomodation in Culemborg

Findings



Materials



Role of the Architect

Case Study: **FOR, Roterdam**
Architect: Powerhouse Company
Area: 3564 m²
Program: Offices & restaurant
Finished: 2021
Usage period: 50 years (assumption)
Assembly: largely dry & mechanical connections

Renewable resource
Fossil resource
Harvested / Existing resource
Low maintenance
High Maintenance
Replacement needed
P= Periodically recurring

Layer	Element	Material / Product (mm)	Amount	MPG	Lifespan in years	Remaining lifespan after 50 years of use	Maintenance	Remountable	Adaptive	Recover	Recycle	Repurpose	Remanufacture	Refurbish	Repair	Reuse	Performance Explanation
SKIN	Ground floor	Ins. ribbed concrete floor-280	2086 m²	0,052	≥75	≥25										■	Still has a long lifespan, reusable (part of floating foundation).
		XPS insulation-190	1188 m²	0,022	≥75	≥25		■								■	Still has a long lifespan, can be reused.
		Concrete substrate layer-70	1188 m²	0,011	≥75	≥25					■						Cast in situ, can be pulverised and recycled.
	Facades	Aluminium curtain wall	972 m²	0,024	≤75	≤25		■							■		Still has a long lifespan, used outside, will need maintenance.
		HR+++ safety glazing	972 m²	0,090	≤30	**-20**	■	■			■						Needs to be replaced, can be recycled.
		Prefab ins. timber wall-200	181 m²	0,002	≥75	≥25		■	■			■	■	■		■	Still has a long lifespan, can be reused and adapted.
		Spruce wall cladding-40	181 m²	0,002	≥50	0	■	■		■						■	Will reach end of life, needs to be recovered.
		CLT balconies-220	773 m²	0,002	≥75	≥25	**P**	■							■		Still has a long lifespan, used outside, will need maintenance.
		Steel barred balustrade	369 m	0,004	≥60	≥10		■							■		Still has a long lifespan, used outside, will need maintenance.
	Roof	CLT roof plate-120	1842 m²	0,004	≥75	≥25		■								■	Still has a long lifespan, can be reused.
		XPS insulation-200	1842 m²	0,040	≥75	≥25		■								■	Still has a long lifespan, can be reused.
		EPDM Roofing (glued)	1842 m²	0,013	≥70	≥20	**P**			■	■					■	last longer due to greenery, can be recycled or recoverd.
		Green roof drainage system	1842 m²	0,012	25-	**-25**	■	■			■						Needs to be replaced, can be recycled.
STRUCTURE	Foundation	Concrete floating foundation	4512 m²	**0,227**	≥75	≥25									■	■	Still has a long lifespan, reusable, will need maintenance.
	Support structure	Timber laminated structure	2967 m	0,002	≥75	≥25		■								■	Still has a long lifespan, can be reused.
	Core	CLT walls-220	339 m²	0,001	≥75	≥25		■								■	Still has a long lifespan, can be reused.
	Floors	CLT floors-190	2376 m²	0,012	≥75	≥25		■								■	Still has a long lifespan, can be reused.
SERVICES	Heating & Cooling	Floor H&C	3564 m²	0,017	≤50	≤0	**P**			■							Will reach end of life, is inside the situ floor finish.
	Heating & Cooling	H&C Climate ceiling	3564 m²	**0,078**	≤20	**-30**	■	■	■		■						Needs to be replaced, can be recycled.
	Heat generation	Water heat exchange	3564 m²	N/A	≤15	**-35**	■				■				■		Needs to be partly repaired, partly replaced & recycled.
	Ventilation	Mechanical ventilation	3564 m²	**0,180**	≥15	**-35**	■	■	■		■				■		Needs to be partly repaired, partly replaced & recycled.
	Electricity	PV-panels	870 m²	**0,438**	≤25	**-25**	■			■	■						Will reach end of life, needs to be recovered & recycled.
SPACE PLAN	Interior walls	Steel frame glass walls & doors	502 m²	0,024	≤50	≤0	**P**	■			■				■		Will reach end of life, needs to be repaired & recycled.
	Interior walls	Timber system walls-100	697 m²	0,019	≥25	**-25**	■	■	■			■	■	■	■		Lifespan can be improved by maintenance, adaptable.
	Interior doors	Timber doors	52 p.	0,001	≥25	**-25**	■	■			■				■		Will reach end of life, needs to recovered & recycled.
	Stairs	Steel & timber staircase	9 p.	0,002	≥100	≥50		■								■	Still has a long lifespan, can be reused.
	Balustrade	Steel sheet balustrade	33 m	0,001	≥60	≥10		■								■	Still has a long lifespan, can be reused.

Renewable resource
Fossil resource
Harvested / Existing resource

Total MPG score for 15 years of use: 2,452
Total MPG score for 50 years of use: 1,040
Total MPG score for 75 years of use: 0,908

Conclusion

Embodied CO2 - 50 years: 279 kg eg/m2

The MPG at an assumed lifespan of 50 years is 1,040 which is higher than the currently permitted score of 1,0, a longer lifespan would be appropriate. Partly due to the amount of concrete and all the PV panels, ventilation units and air conditioning units that need to be replaced during use, the score is so high. Perhaps replacing the air-conditioning ceilings with air heating and cooling, since mechanical ventilation is used anyway, will ensure less replacement of components. Noteworthy are the very low scores of the applied materials in timber, this is due to its renewable raw material and long lifespan. Much of the material is remountable and has a long lifespan, leading to many possibilities for reuse. Without the concrete floating foundation and the PV-panels is the MPG score 0f 0,375, which clearly shows the potential of building with a lot of

Circularity Overview

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		Prefab ins. timber wall-200	181 m²	0,002	≥75	≥25		■	■			■	■	■			Still has a long lifespan, can be reused and adapted.
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Harvested / Existing resource

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Total MPG score for 50 years of use: 1,040
Total MPG score for 75 years of use: 0,908

Conclusion

Embodied CO2 - 50 years: 279 kg eg/m2

The MPG at an assumed lifespan of 50 years is 1,040 which is higher than the currently permitted score of 1,0, a longer lifespan would be appropriate. Partly due to the amount of concrete and all the PV panels, ventilation units and air conditioning units that need to be replaced during use, the score is so high. Perhaps replacing the air-conditioning ceilings with air heating and cooling, since mechanical ventilation is used anyway, will ensure less replacement of components. Noteworthy are the very low scores of the applied materials in timber, this is due to its renewable raw material and long lifespan. Much of the material is remountable and has a long lifespan, leading to many possibilities for reuse. Without the concrete floating foundation and the PV-panels is the MPG score 0f 0,375, which clearly shows the potential of building with a lot of

Measurable & Verifiable

Assembly

Case Study:	**FOR, Roterdam**
Architect:	Powerhouse Company
Area:	3564 m²
Program:	Offices & restaurant
Finished:	2021
Usage period:	50 years (assumption)
Assembly:	largely dry & mechanical connections

Renewable resource
Fossil resource
Harvested / Existing resource
Low maintenance
High Maintenance
Replacement needed
P= Periodically recurring

Layer	Element	Material / Product (mm)	Amount	MPG	Lifespan in years	Remaining lifespan after 50 years of use	Maintenance	Remountable	Adaptive	Recover	Recycle	Repurpose	Remanufacture	Refurbish	Repair	Reuse	Explanation
		Ins. ribbed concrete floor-280	2086 m²	0,052	≥75	≥25										■	Still has a long lifespan, reusable (part of floating foundation).
	Ground floor	XPS insulation-190	1188 m²	0,022	≥75	≥25										■	Still has a long lifespan, can be reused.
											■						Cast in situ, can be pulverised and recycled.
															■		Still has a long lifespan, used outside, will need maintenance.
											■						Needs to be replaced, can be recycled.
												■	■	■		■	Still has a long lifespan, can be reused and adapted.
										■						■	Will reach end of life, needs to be recovered.
							P								■		Still has a long lifespan, used outside, will need maintenance.
															■		Still has a long lifespan, used outside, will need maintenance.
																■	Still has a long lifespan, can be reused.
																■	Still has a long lifespan, can be reused.
							P			■	■					■	last longer due to greenery, can be recycled or recoverd.
		Green roof drainage system	1842 m²	0,012	25-	-25					■						Needs to be replaced, can be recycled.
STRUCTURE	Foundation	Concrete floating foundation	4512 m²	0,227	≥75	≥25									■	■	Still has a long lifespan, reusable, will need maintenance.
	Support structure	Timber laminated structure	2967 m	0,002	≥75	≥25										■	Still has a long lifespan, can be reused.
	Core	CLT walls-220	339 m²	0,001	≥75	≥25										■	Still has a long lifespan, can be reused.
	Floors	CLT floors-190	2376 m²	0,012	≥75	≥25										■	Still has a long lifespan, can be reused.
SERVICES	Heating & Cooling	Floor H&C	3564 m²	0,017	≤50	≤0	P			■							Will reach end of life, is inside the situ floor finish.
	Heating & Cooling	H&C Climate ceiling	3564 m²	0,078	≤20	-30					■						Needs to be replaced, can be recycled.
	Heat generation	Water heat exchange	3564 m²	N/A	≤15	-35					■				■		Needs to be partly repaired, partly replaced & recycled.
	Ventilation	Mechanical ventilation	3564 m²	0,180	≥15	-35					■				■		Needs to be partly repaired, partly replaced & recycled.
	Electricity	PV-panels	870 m²	0,438	≤25	-25				■	■						Will reach end of life, needs to be recovered & recycled.
SPACE PLAN	Interior walls	Steel frame glass walls & doors	502 m²	0,024	≤50	≤0	P				■				■		Will reach end of life, needs to be repaired & recycled.
	Interior walls	Timber system walls-100	697 m²	0,019	≥25	-25						■	■	■	■		Lifespan can be improved by maintenance, adaptable.
	Interior doors	Timber doors	52 p.	0,001	≥25	-25					■				■		Will reach end of life, needs to recovered & recycled.
	Stairs	Steel & timber staircase	9 p.	0,002	≥100	≥50										■	Still has a long lifespan, can be reused.
	Balustrade	Steel sheet balustrade	33 m	0,001	≥60	≥10										■	Still has a long lifespan, can be reused.

Reuse	When your washing machine is not working and you fix it, then you...
Repair	When you take an electrical engine for a sun-shading device and exchange all parts that show "wear and tear" and you restore it to "as a new" condition, then you...
Refurbish	When you decide to not build a suspended ceiling to cover HVAC and that still matches your architectural concept, then you...
emanufacture	When you are harvesting washbasins, for example, and re-sell them as such, then you...
Repurpose	When you burn waste to feed power plants, then you...
Recycle	When you use discarded window glass to make bottles, then you...

Renewable resource
Fossil resource
Harvested / Existing resource

Total MPG score for 15 years of use:	2,452
Total MPG score for 50 years of use:	**1,040**
Total MPG score for 75 years of use:	0,908

Conclusion

Embodied CO2 - 50 years: 279 kg eg/m2

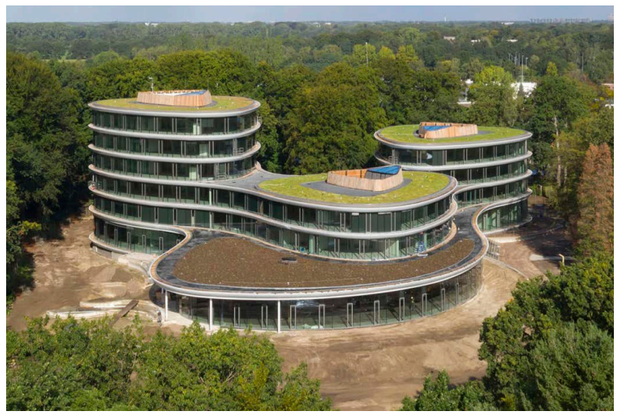
The MPG at an assumed lifespan of 50 years is 1,040 which is higher than the currently permitted score of 1,0, a longer lifespan would be appropriate. Partly due to the amount of concrete and all the PV panels, ventilation units and air conditioning units that need to be replaced during use, the score is so high. Perhaps replacing the air-conditioning ceilings with air heating and cooling, since mechanical ventilation is used anyway, will ensure less replacement of components. Noteworthy are the very low scores of the applied materials in timber, this is due to its renewable raw material and long lifespan. Much of the material is remountable and has a long lifespan, leading to many possibilities for reuse. Without the concrete floating foundation and the PV-panels is the MPG score 0f 0,375, which clearly shows the potential of building with a lot of

R-Strategies

The Green House | 2018

MPG 15 years: **1,110**
Reusable elements: **22**/26
Embodied CO_2: **237** kg eq/m^2

Triodos Bank | 2019



MPG 50 years: **0,567**
Reusable elements: **18**/32
Embodied CO_2: **175** kg eq/m^2

FOR | 2021

MPG 50 years: **1,040**
Reusable elements: **21**/27
Embodied CO_2: **279** kg eq/m^2

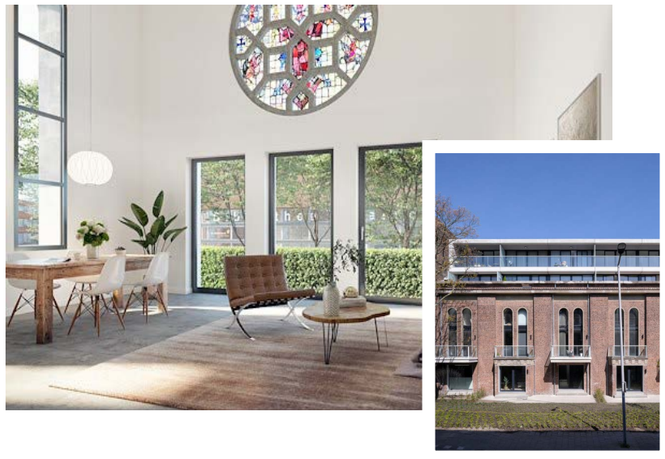
Grote Kerk Hoorn | 2020

MPG 50 years: **0,221**
Reusable elements: **21**/28
Embodied CO_2: **77** kg eq/m^2

Laurentiuskerk | 2020

MPG 50 years: **0,409**
Reusable elements: **17**/26
Embodied CO_2: **167** kg eq/m^2

Baumannkerk | 2020



MPG 50 years: **0,422**
Circular elements: **18**/28
Embodied CO_2: **175** kg eq/m^2

Case Study Results

Case Study: **Baumannkerk, Rotterdam**
Architect: HOYT
Area: 4205 m² (+ 492 annex)
Program: Appartments & retail
Finished: 2020
Usage period: 50 years (assumption)
Assembly: largely wet & mechanical connections

Was built in 1953,

Renewable resource
Fossil resource
Harvested / Existing resource
Low maintenance
High Maintenance
Replacement needed
P= Periodically recurring

Layer	Element	Material / Product (mm)	Amount	MPG	Lifespan in years	Remaining lifespan after 50 years of use		Remountable	Adaptive	Recover	Recycle	Repurpose	Remanufacture	Refurbish	Repair	Reuse	Performance Explanation
		Refurbishment PUR ins.-200	1305 m²	0,024	≥75	≥25				■							Will last longer then 75y, cannot be recycled.
	Ground floor	Existing concrete floor-160	1305 m²	0,000	≥75	≥25					■						Will last longer then 67y, can be pulverised and recycled.
		Concrete substrate layer-110	1305 m²	0,024	≥75	≥25					■					■	Will last longer then 75y, cannot be recycled.
		Existing brick facade-500	631 m³	0,000	≥75	**-58**			■					■	■		Is already 67y old, will continue to last with maintenance.
		Existing windows & doors	58 m²	0,000	≥40	**-177**	P	■						■	■		Is already 67y old, will continue to last with maintenance.
		Refurbishment insulation-160	1262m²	0,017	≥25	**-25**		■	■		■						Will last longer then 25y, can be pulverised and recycled.
SKIN	Facades	Prefab ins. timber wall-200	194 m²	0,002	≥75	≥25		■	■			■	■	■		■	Still has a long lifespan, can be reused and adapted.
		Micro concrete cladding-15	188 m²	0,001	≥75	≥25		■	■			■	■	■		■	Will last longer then 75y, can be reused or recycled.
		Aluminium window & door frames	447 m²	0,012	≥100	≥50		■							■		Still has a long lifespan, used outside, will need maintenance.
		HR++ glazing	447 m²	0,026	≤30	**-20**		■			■						Will reach end of life, needs to be recycled and replaced.
		Monument add-on glazing	7 m²	0,000	≤30	**-20**		■			■						Will reach end of life, needs to be recycled and replaced.
		Existing roof tiles-12	325 m²	0,000	≥75	**-58**	P	■	■						■		Is already 67y old, will continue to last with maintenance.
	Roof	Existing timberboard-22	325 m²	0,000	≥75	**-58**	P	■	■						■		Is already 67y old, will continue to last with maintenance.
		PUR roof insulation-180	861 m²	0,016	≥75	≥25				■							Will last longer then 75y, cannot be recycled.
		EPDM Roofing (glued)	425 m²	0,003	≤50	0				■	■					■	Will reach end of life, needs to be recycled and replaced.
	Foundation	Ex. brick structure & foundation	N/A	0,000	≥75	**-58**			■					■	■		Is already 67y old, will continue to last with maintenance.
	Support structure	Sand lime bricks-214	1225 m²	0,022	≥75	≥25					■						Wet fixed, can be pulverised and recycled.
STRUCTURE	Walkway	Steel walkway structure-200	47 m²	0,001	≥50	**0**		■							■		Will last significantly longer than 50y, maintenance.
	Floors	Concrete in situ floor-250	2900 m²	**0,117**	≥50	**0**					■				■		lasts longer than 50y, maintenance, can be recycled.
	Floors	Concrete substrate layer-70	2900 m²	0,025	≥75	≥25					■						Cast in situ, can be pulverised and recycled.
	Heating & Cooling	Floor H&C	3562 m²	0,004	≤50	0				■							Will reach end of life, is inside the situ floor finish.
SERVICES	Heat generation	Water heat pump	38 p.	0,057	≥20	**-30**		■	■		■				■		Needs to be partly repaired, partly replaced & recycled.
	Ventilation, H&C	Mechanical ventilation	3562 m²	0,015	≥15	**-35**		■	■						■		Lifespan can be improved by maintenance.
	Interior walls	Gypsum drywall-100	1021 m²	0,010	≥25	**-25**		■			■				■		Lifespan can be improved by maintenance, can be recycled.
	Interior walls	Sand lime bricks-100	167 m²	0,001	≥75	≥25					■						Wet fixed, can be pulverised and recycled.
	Interior doors	Timber doors	223 p.	0,002	≥25	**-25**		■			■				■		Will reach end of life, needs to recovered & recycled.
	Stairs	Steel & timber staircase	9 p.	0,002	≥100	≥50		■								■	Still has a long lifespan, can be reused.
	Balustrade	Steel & glass balustrade	84 m	0,002	≥60	≥10		■								■	Still has a long lifespan, can be reused.

Renewable resource
Fossil resource
Harvested / Existing resource

Total MPG score for 15 years of use: 1,268
Total MPG score for 50 years of use: 0,422
Total MPG score for 75 years of use: 0,331

Conclusion

The MPG at an assumed lifespan of 50 years is 0,422, which is a high score compared to the Grote Kerk but similar to the Laurentiuskerk. The use of a large amount of concrete mainly contributes to this score. Although concrete has a very long lifespan, which can be extended with inspections and maintenance what is sustainable if it remains as it is, the structure cannot be changed or taken apart without demolition. Using long-lasting natural materials could have made the MPG even lower. The structure could have easily be made out of timber to replace the concrete and sand lime stone.

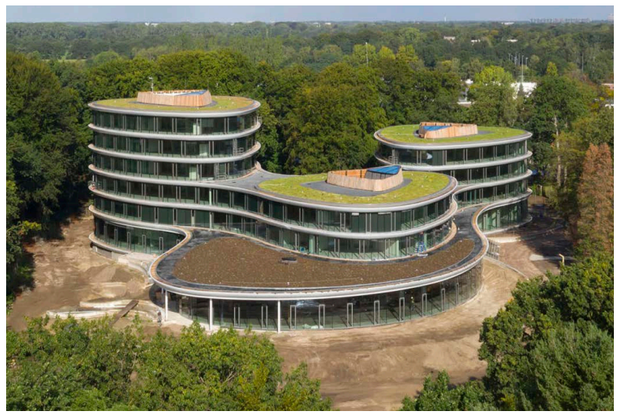
Example

The Green House | 2018

short lifespan

> reused greenhouse facade

Triodos Bank | 2019



extreme amount of concrete, glass & steel is used

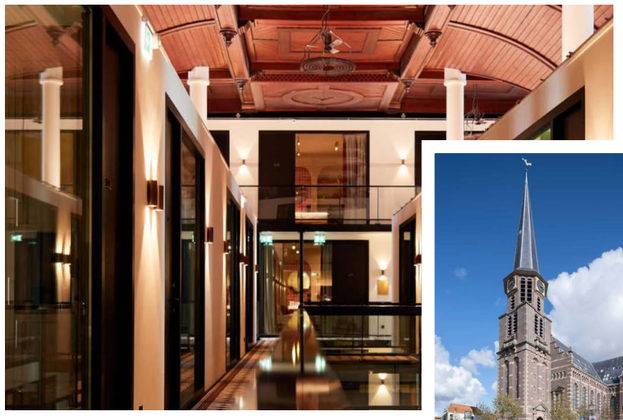
> self-sufficient, flexible layout

FOR | 2021

extreme amount of concrete and glass is used

> Timber structure & facade

Grote Kerk Hoorn | 2020

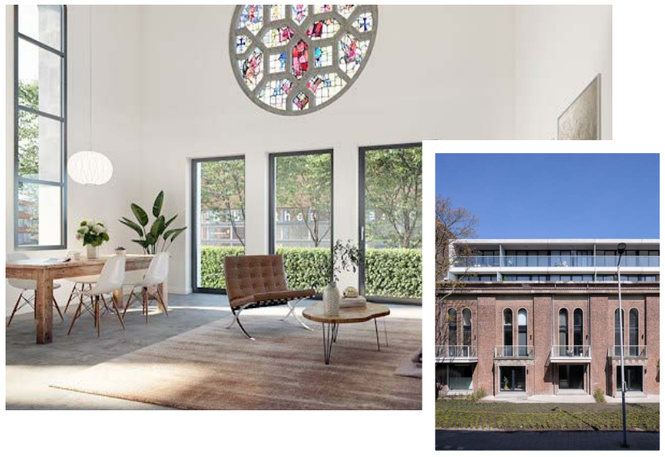


hardly any biobased materials have been used

Laurentiuskerk | 2020

hardly any biobased materials have been used

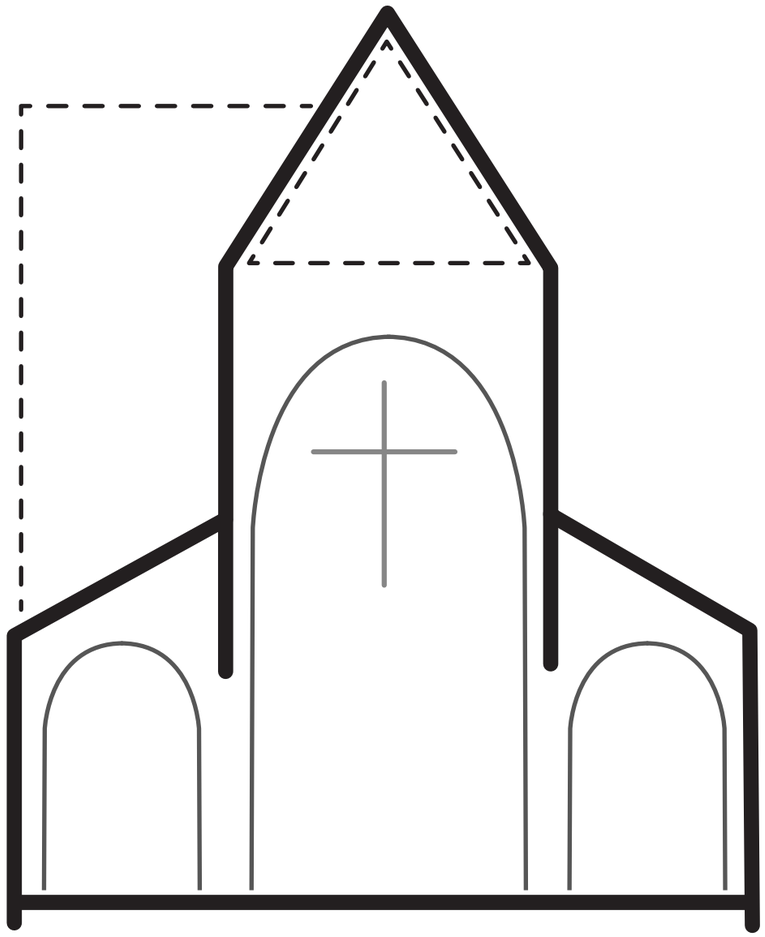
Baumannkerk | 2020



hardly any biobased materials have been used

Case Study Findings

combination of preserving existing materials & adding biobased materials will result in favourable circularity scores



applying materials with dry connections will make it flexible and adaptive for future needs

Materials

Was built in 1886,

Renewable resource
Fossil resource
Harvested / Existing resource
Low maintenance
High Maintenance
Replacement needed
P= Periodically recurring

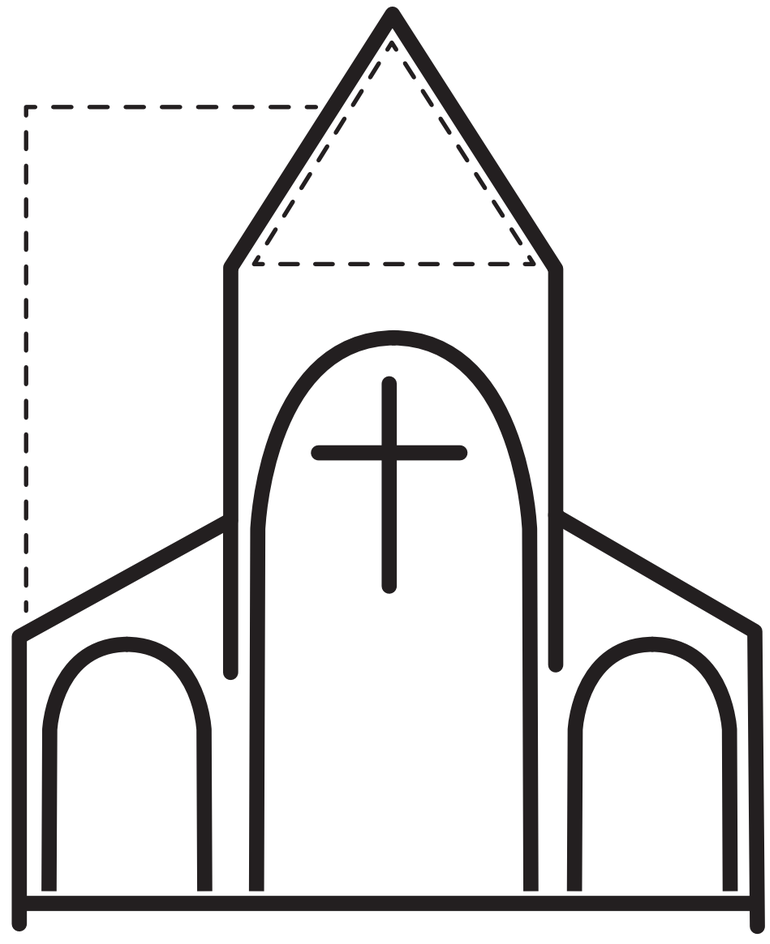
Layer	Element	Material / Product (mm)	Amount	MPG	Lifespan in years	Remaining lifespan after 50 years of use	Maintenance	Remountable	Adaptive	Recover	Recycle	Repurpose	Remanufacture	Refurbish	Repair	Reuse	Performance Explanation
SKIN	Ground floor	Terrazzo with reused mat.	1179 m²	0,031	≥75	≥25									■		Will last longer then 75y, can be repaired.
		Existing concrete floor-200	1179 m²	0,000	≥75	**-36**					■				■		Will be replaced, can be pulverised and recycled.
	Facades	Existing brick facade-600	1408 m³	0,000	≥75	**-112**	**P**		■					■	■		Is already 137y old, will continue to last with maintenance.
		Existing windows & doors	96 m²	0,000	≥40	**-177**	**P**	■						■	■		Is already 137y old, will continue to last with maintenance.
		Reused Azobé cladding	628 m²	0,000	≥25	**-25**		■	■			■	■	■		■	Will last longer then 25y, can be reused or recycled.
		Prefab ins. timber wall-200	306 m²	0,001	≥75	≥25		■	■			■	■	■	■	■	Still has a long lifespan, can be reused and adapted.
		Larch timber curtainwall	225 m²	0,003	≥40	**-10**	**P**	■	■					■	■		Will reach end of life, needs to be recycled and replaced.
		Steel window frames	32 m²	0,000	≥100	≥50	**P**	■					■		■	■	Still has a long lifespan, can be reused or changed.
		Timber window & door frames	163 m²	0,002	≥75	≥25	**P**	■	■			■	■	■	■		Will last longer then 75y, can be repaired.
		HR++ glazing	147 m²	0,009	≤30	**-20**		■			■						Will reach end of life, needs to be recycled and replaced.
		Safety glazing	78 m²	0,026	≤30	**-20**		■			■						Will reach end of life, needs to be recycled and replaced.
	Roof	Existing roof tiles-12	2197 m²	0,000	≥75	**-58**	**P**	■	■				■		■	■	Is already 137y old, will continue to last with maintenance.
		Existing timberboard-22	2197 m²	0,000	≥75	**-58**	**P**	■	■				■		■	■	Is already 137y old, will continue to last with maintenance.
		Vlas roof elements	2296 m²	0,003	≥75	≥25		■		■		■			■	■	Will last longer then 75y, biobased.
		Biosbased roof seal, mech.	98 m²	0,003	≤50	0	**P**	■				■			■	■	Will reach end of life, biobased.
STRUCTURE	Foundation	Ex. brick structure & foundation	N/A	0,000	≥75	**-112**			■					■	■		Is already 137y old, will continue to last with maintenance.
	Floors	Timber casette floor-440	1225 m²	0,022	≥75	≥25	**P**	■	■			■		■	■	■	Still has a long lifespan, can be reused.
	Support structure	Larch laminated timber	54,9 m³	0,012	≥75	≥25	**P**	■	■			■		■	■	■	Still has a long lifespan, can be reused.
SERVICES	Heating & Cooling	Floor H&C	1225 m²	0,004	≤50	0	**P**			■							Will reach end of life, is inside the situ floor finish.
	Heat generation	Water heat pump	5x.	0,012	≥20	**-30**		■	■		■				■		Needs to be partly repaired, partly replaced & recycled.
	Ventilation, H&C	Mechanical ventilation	3562 m²	0,001	≥15	**-35**	**P**	■	■						■		Lifespan can be improved by maintenance.
SPACE PLAN	Interior walls	Timber frames	533 m²	0,000	≥25	**-25**		■	■			■	■	■	■	■	Lifespan can be improved by maintenance, biobased.
	wall & floor finish	Gypsumboard	3576 m²	0,019	≥25	**-25**		■			■			■	■	■	Lifespan can be improved by maintenance, can be recycled.
	Interior doors	Timber (sliding) doors	41x	0,001	≥25	**-25**		■			■				■		Will reach end of life, needs to recovered & recycled.
	Stairs	Steel & timber staircase	9 p.	0,000	≥100	≥50		■								■	Still has a long lifespan, can be reused.
	Balustrade	glass balustrade	158 m	0,006	≥60	≥10		■								■	Still has a long lifespan, can be reused.

Embodied CO2 - 50 years: 57 kg eg/m2

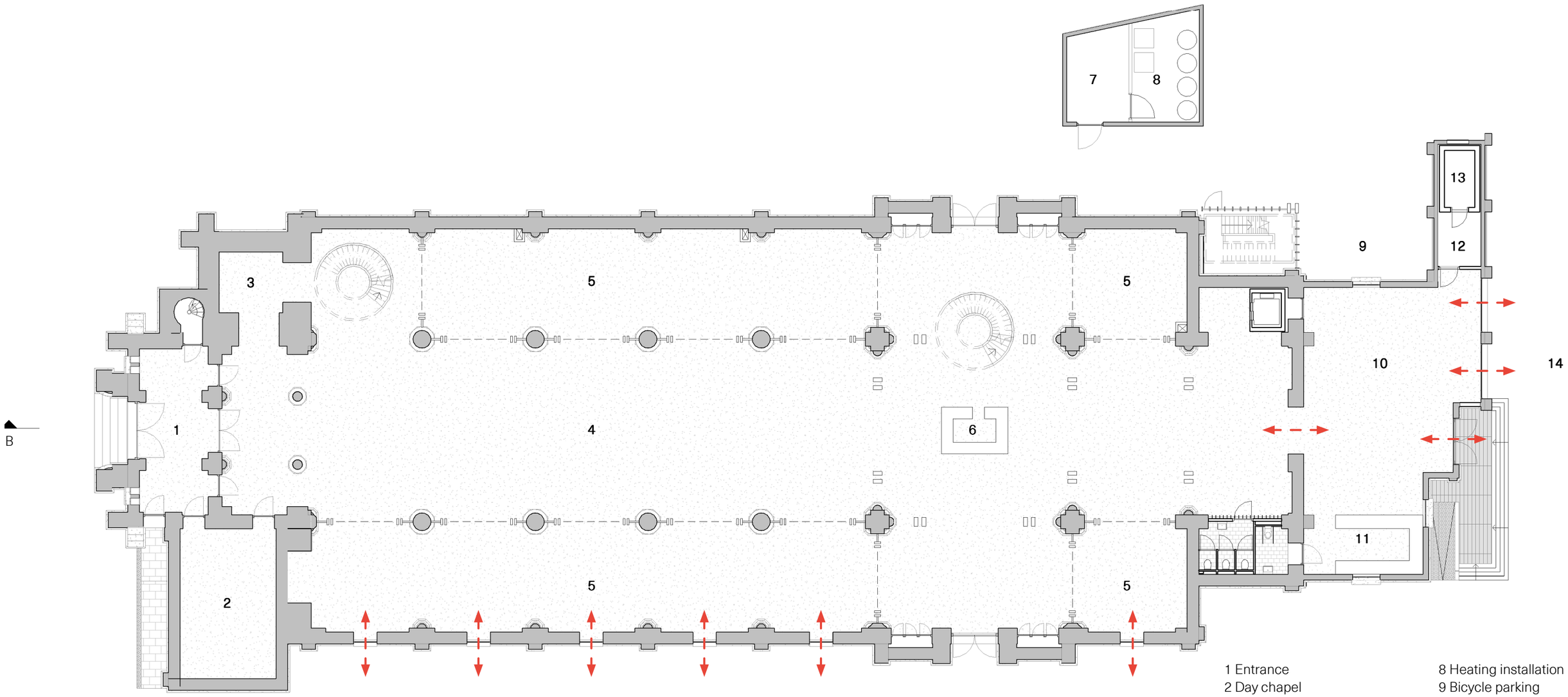
Renewable resource
Fossil resource
Harvested / Existing resource

Total MPG score for 15 years of use: 0,425
Total MPG score for 50 years of use: 0,147
Total MPG score for 75 years of use: 0,121

Design Overview



Design



00 Ground level

1 Entrance
2 Day chapel
3 Maria chapel
4 Market foyer
5 Retail
6 Lobby, Reception
7 Luggage storage
8 Heating installation
9 Bicycle parking
10 Restaurant
11 Kitchen
12 Storage
13 Freezer
14 Terrace

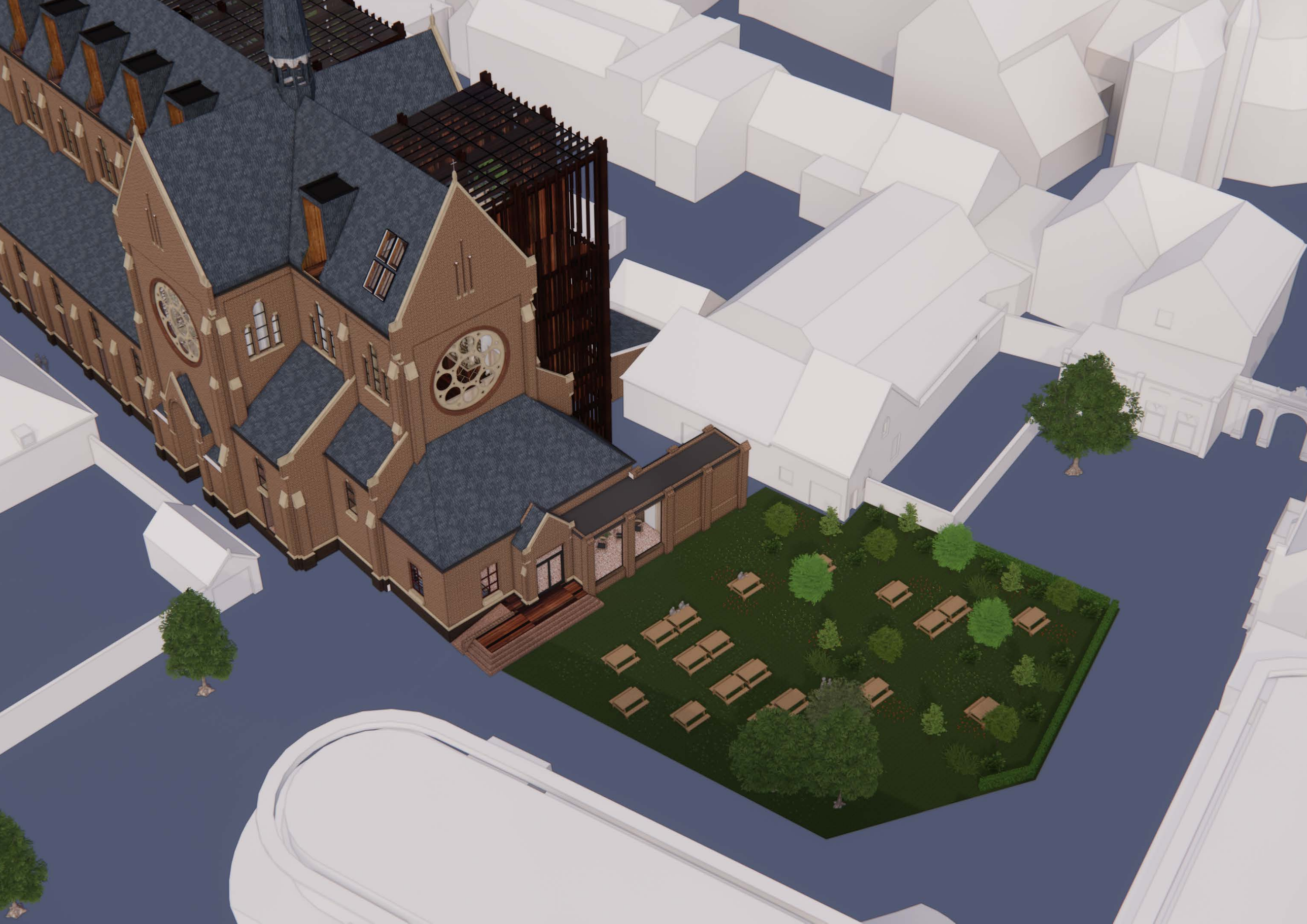
Ground Floor

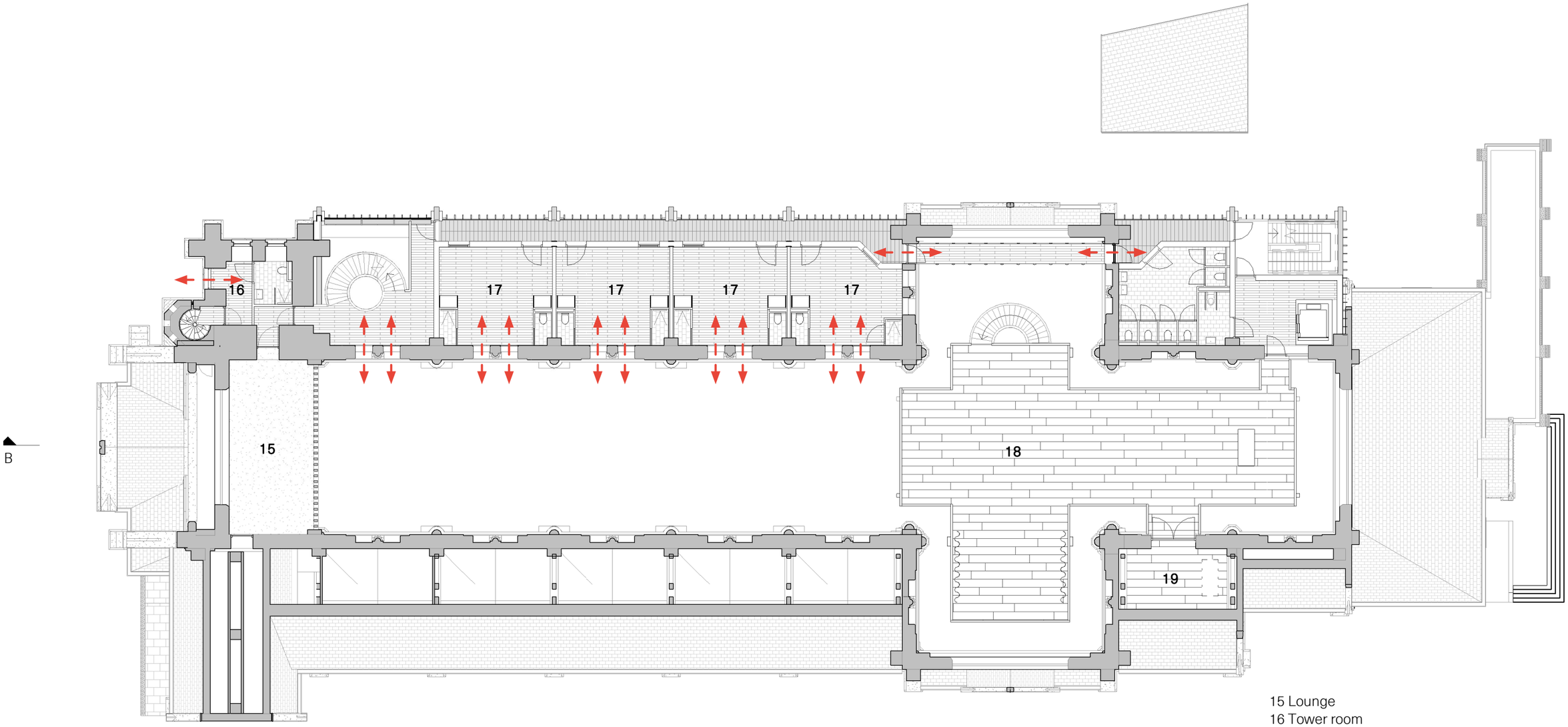
Ground Floor

Ground Floor


ruiden
reparatie
zeep


groente

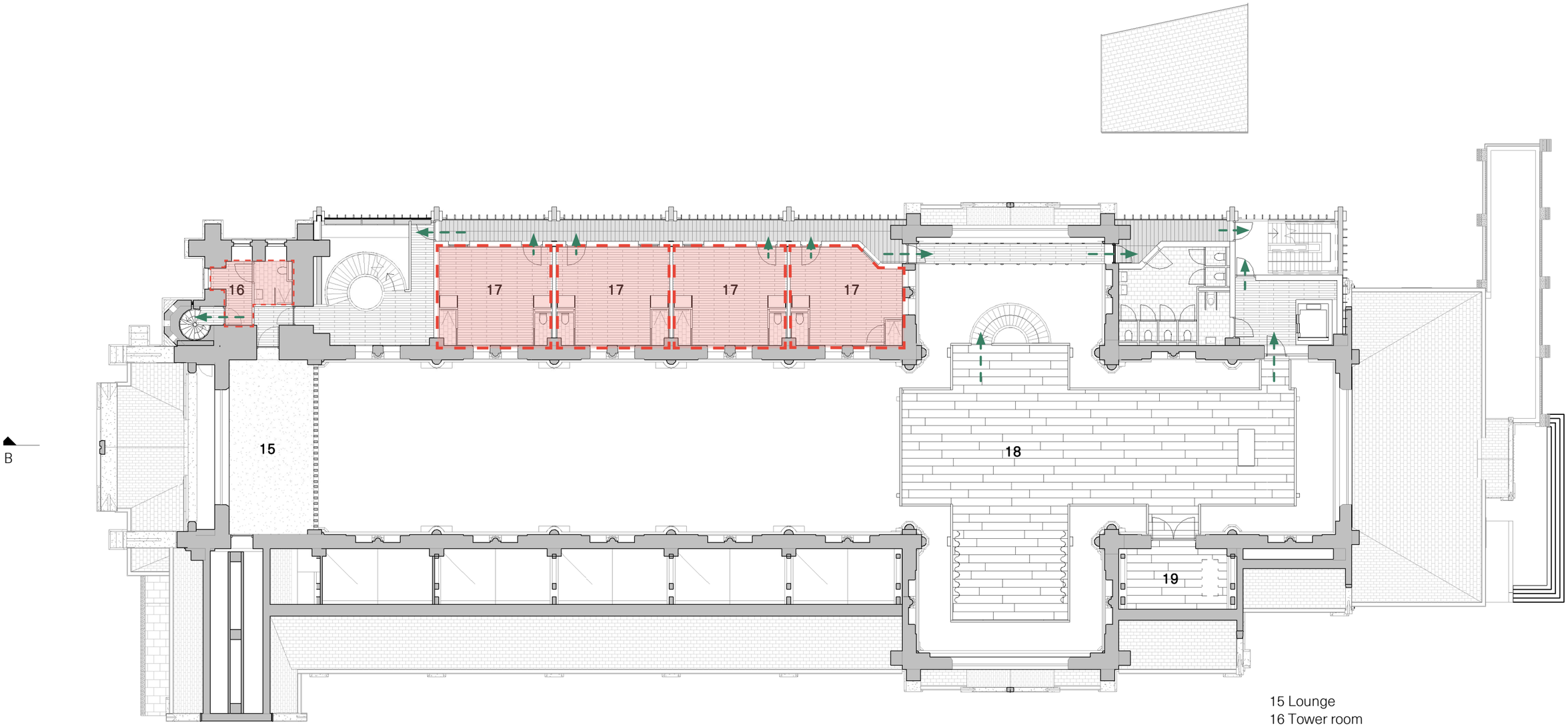




01 First floor

15 Lounge
16 Tower room
17 Nave room
18 Event space, Church hall
19 Church storage

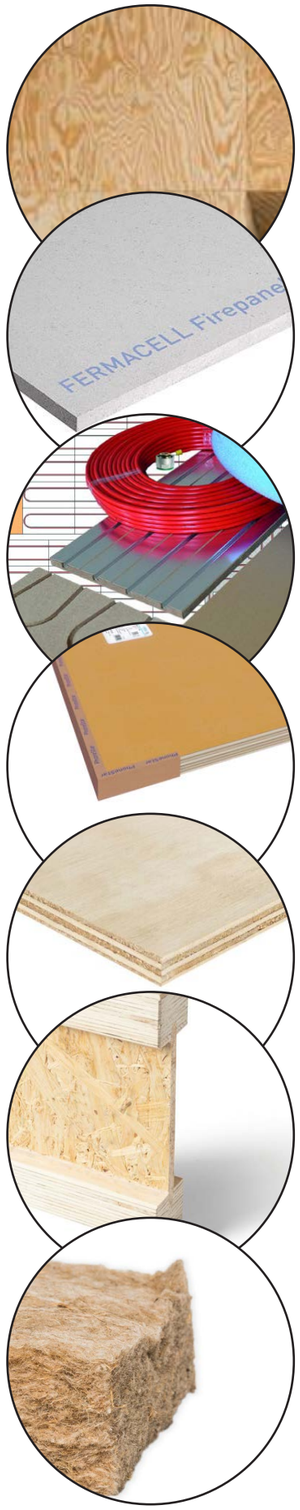
1st, 2nd & 3rd Floor

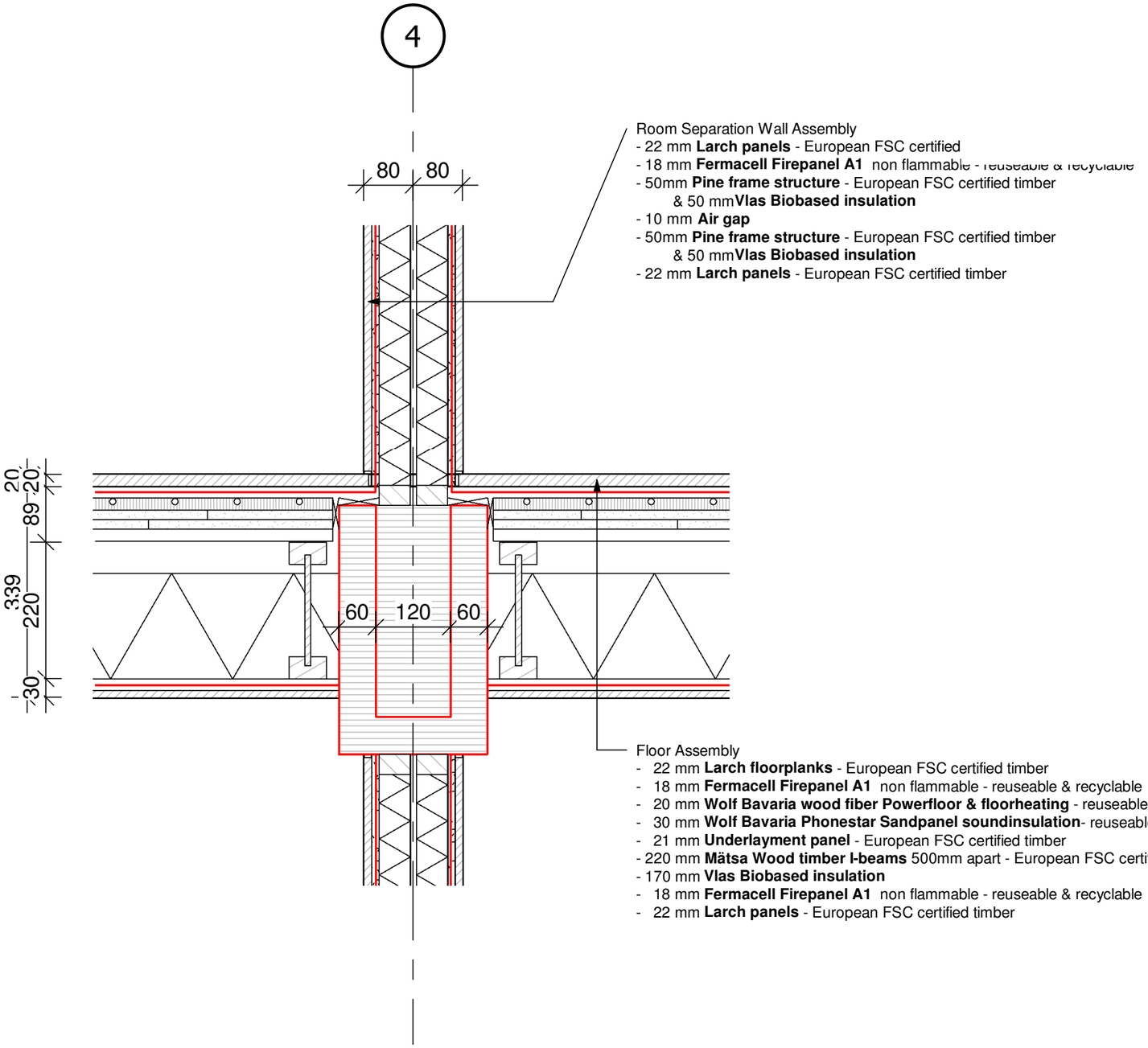


01 First floor

15 Lounge
16 Tower room
17 Nave room
18 Event space, Church hall
19 Church storage

1st, 2nd & 3rd Floor fire safety

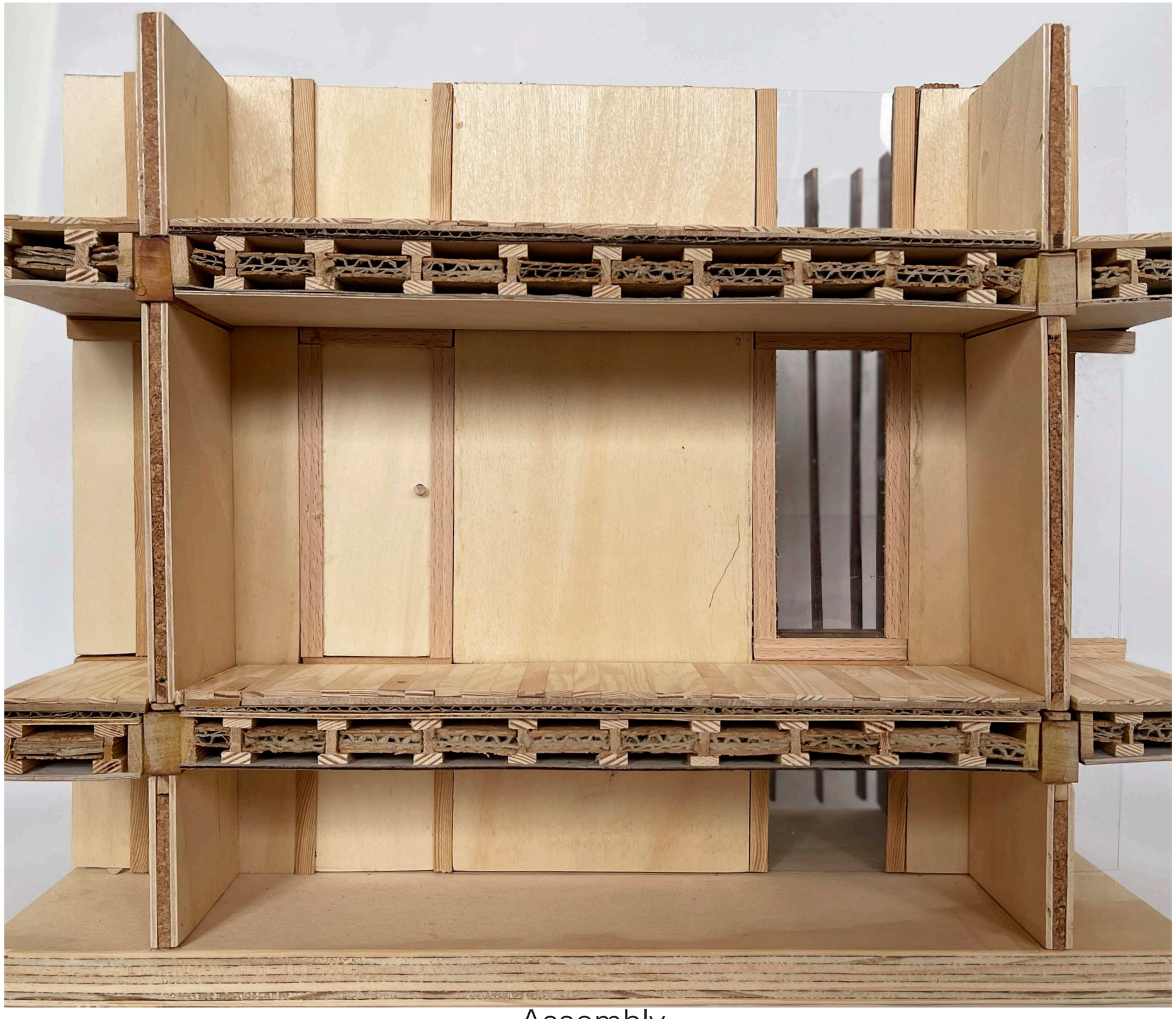




Room Separation Wall Assembly
- 22 mm **Larch panels** - European FSC certified
- 18 mm **Fermacell Firepanel A1** non flammable - reuseable & recyclable
- 50mm **Pine frame structure** - European FSC certified timber
  & 50 mm**Vlas Biobased insulation**
- 10 mm **Air gap**
- 50mm **Pine frame structure** - European FSC certified timber
  & 50 mm**Vlas Biobased insulation**
- 22 mm **Larch panels** - European FSC certified timber

Floor Assembly
- 22 mm **Larch floorplanks** - European FSC certified timber
- 18 mm **Fermacell Firepanel A1** non flammable - reuseable & recyclable
- 20 mm **Wolf Bavaria wood fiber Powerfloor & floorheating** - reuseable & recyclable
- 30 mm **Wolf Bavaria Phonestar Sandpanel soundinsulation**- reuseable & recyclable
- 21 mm **Underlayment panel** - European FSC certified timber
- 220 mm **Mätsa Wood timber I-beams** 500mm apart - European FSC certified timber
- 170 mm **Vlas Biobased insulation**
- 18 mm **Fermacell Firepanel A1** non flammable - reuseable & recyclable
- 22 mm **Larch panels** - European FSC certified timber

Detail

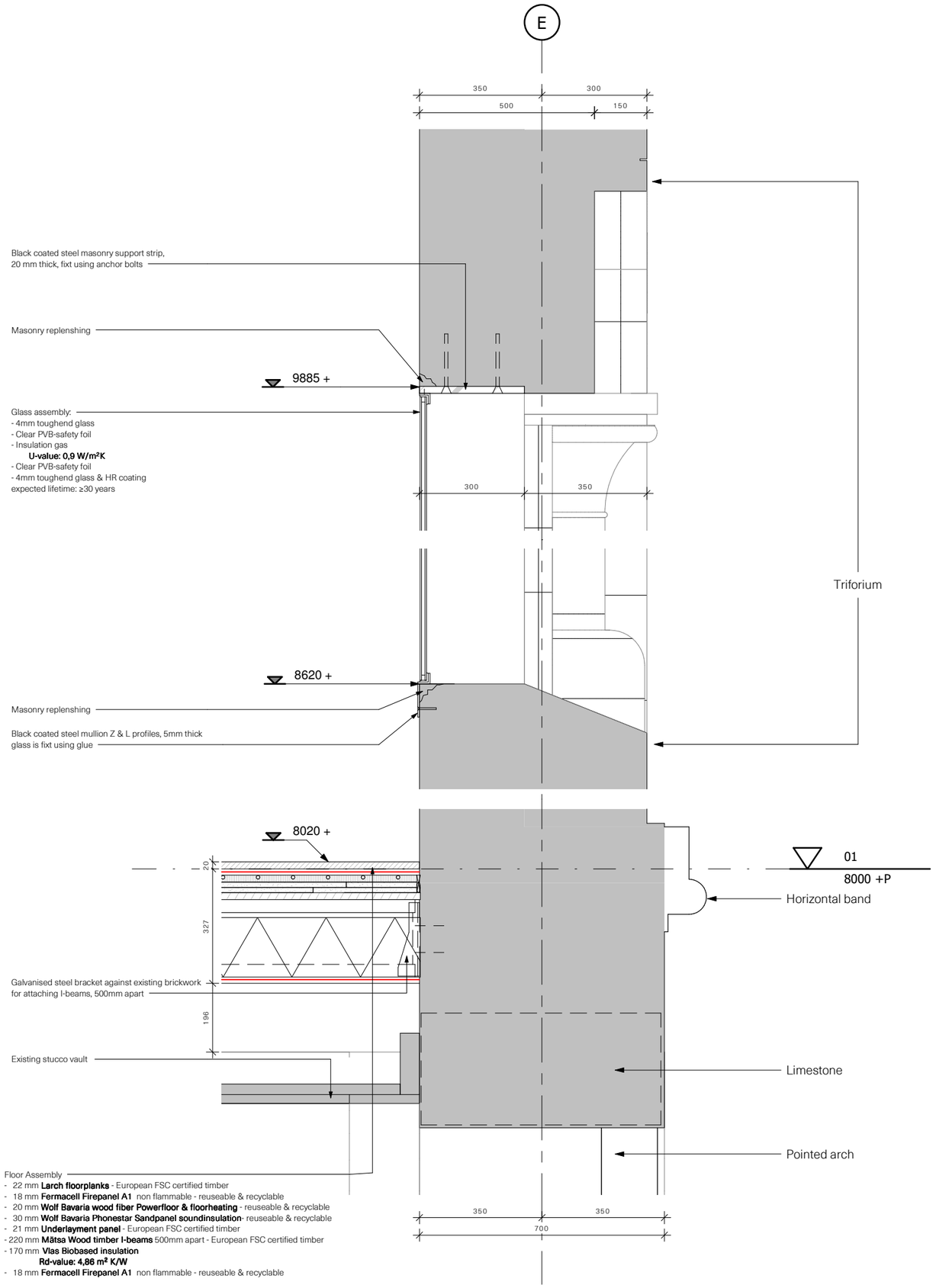


Assembly

Assembly

Section

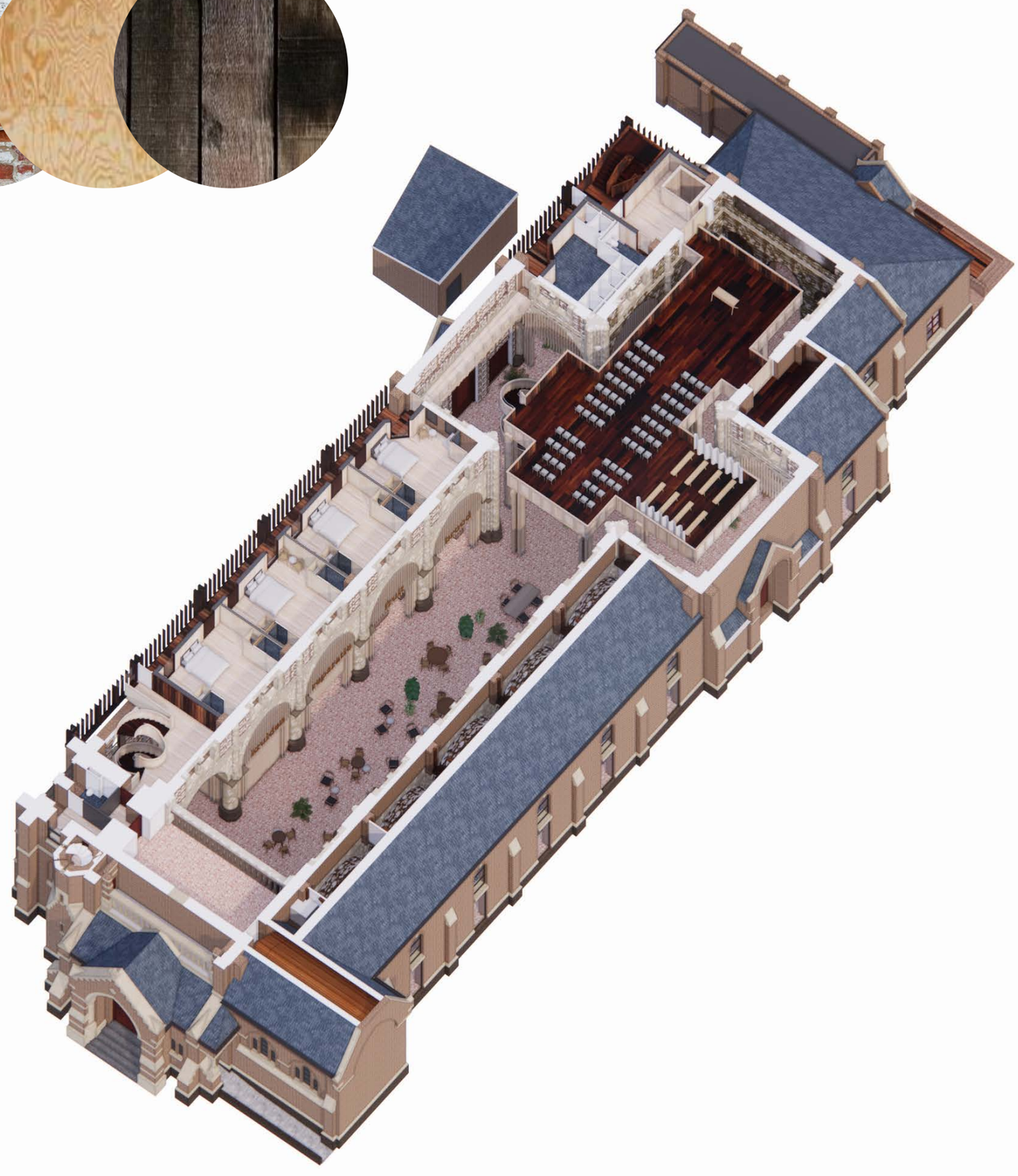
1st Floor



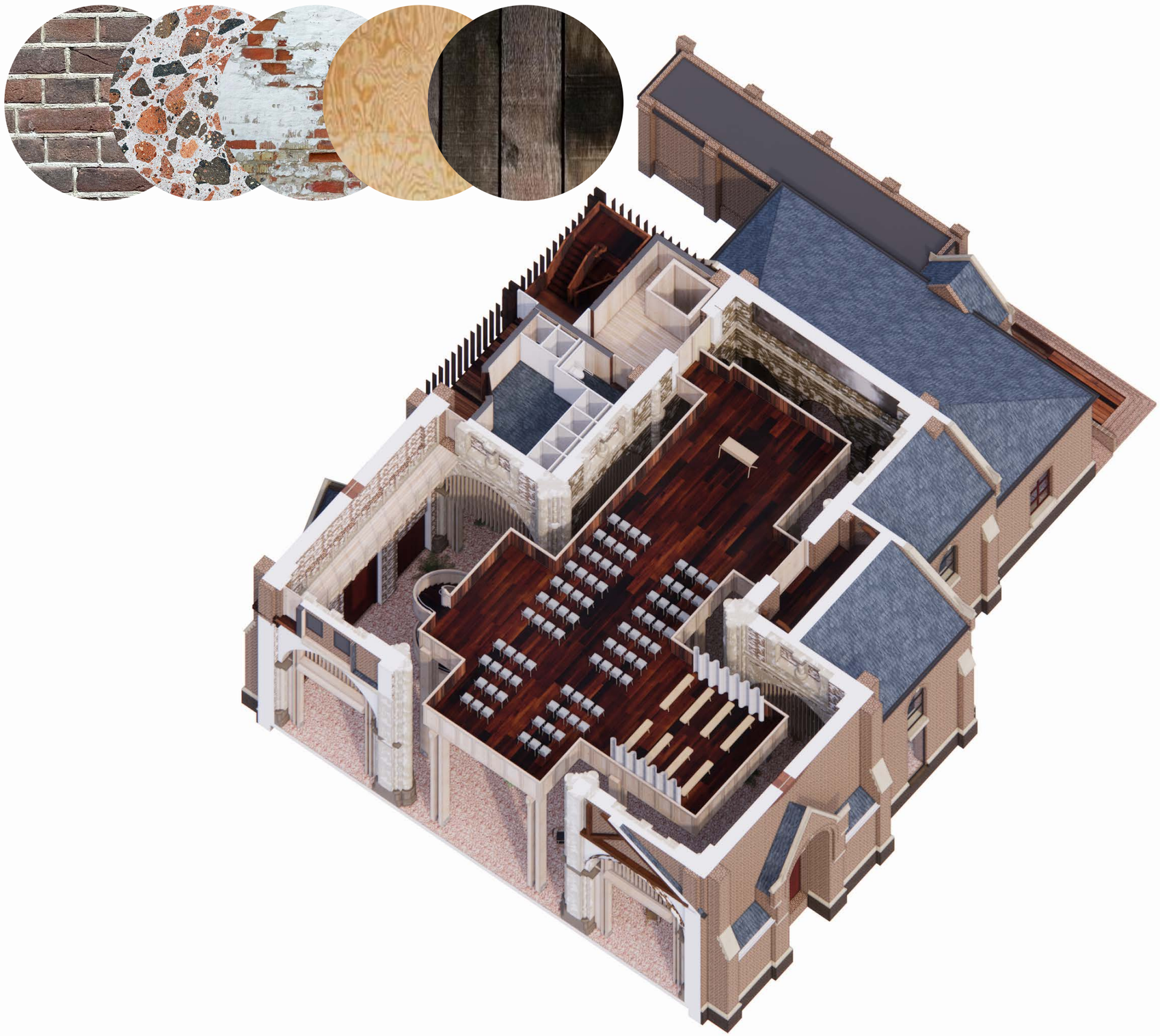
Detail V2 1:10

2nd Floor

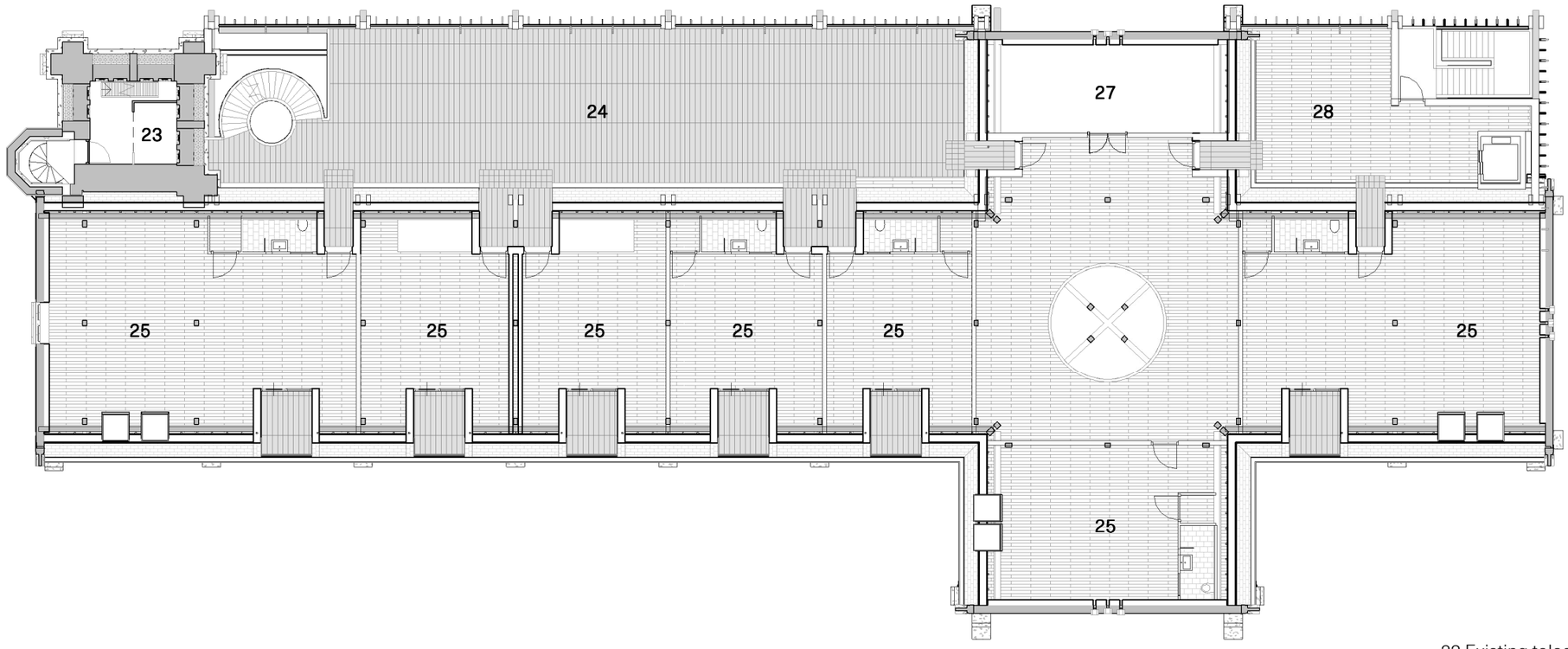
3rd Floor



1st Floor

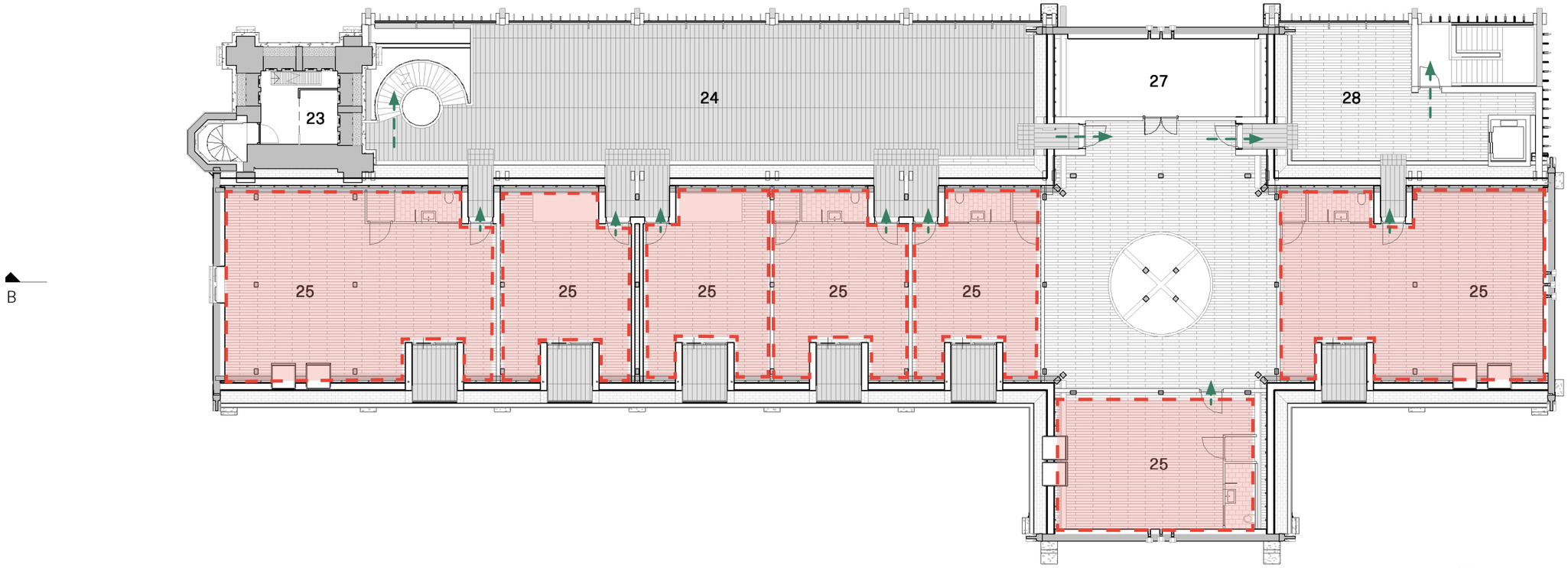


Event space



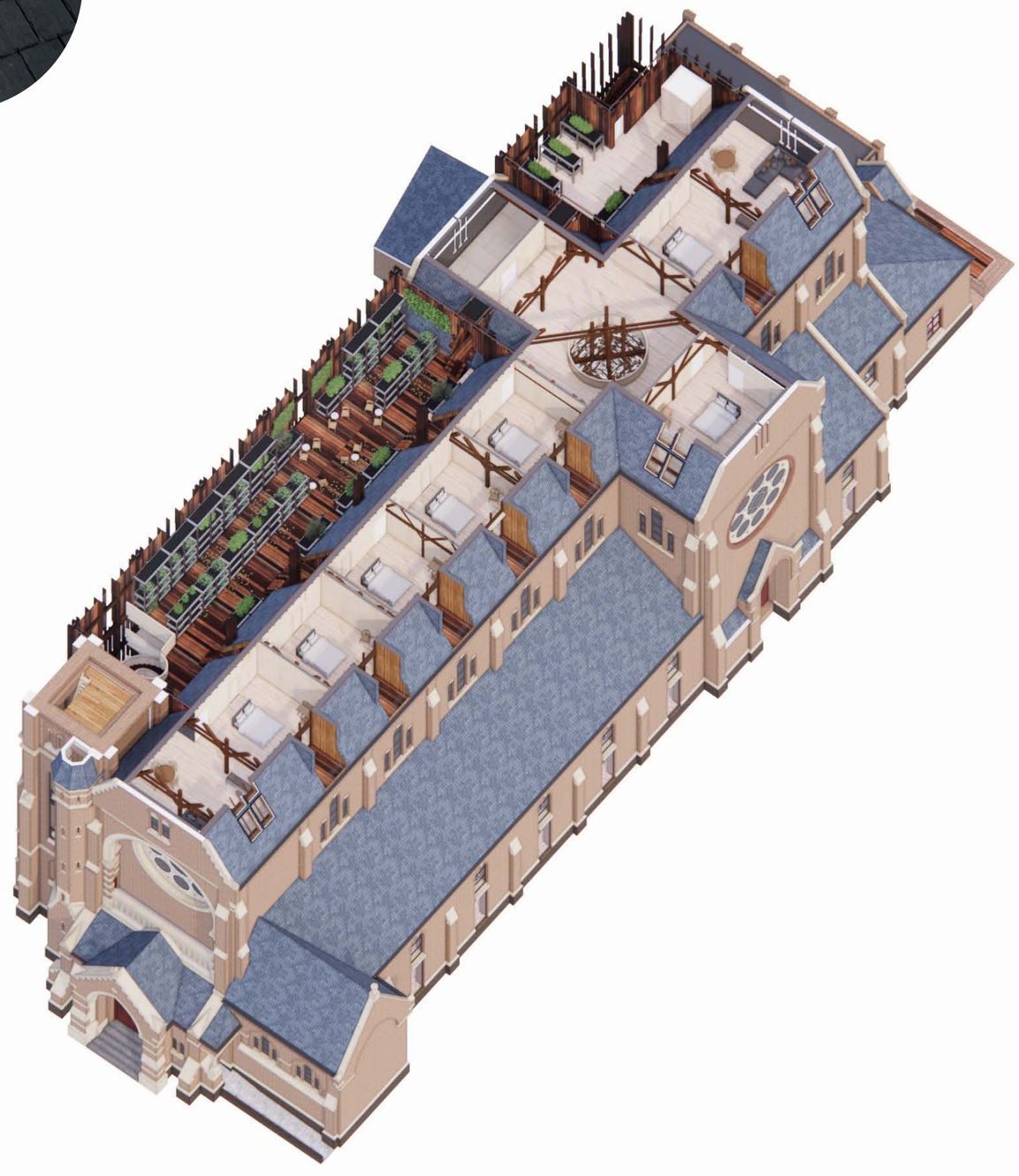
23 Existing telecom system
24 Greenhouse, Tea café
25 Large Attic room
26 Attic room
27 Air extraction system
28 Greenhouse, Lounge

4th Floor



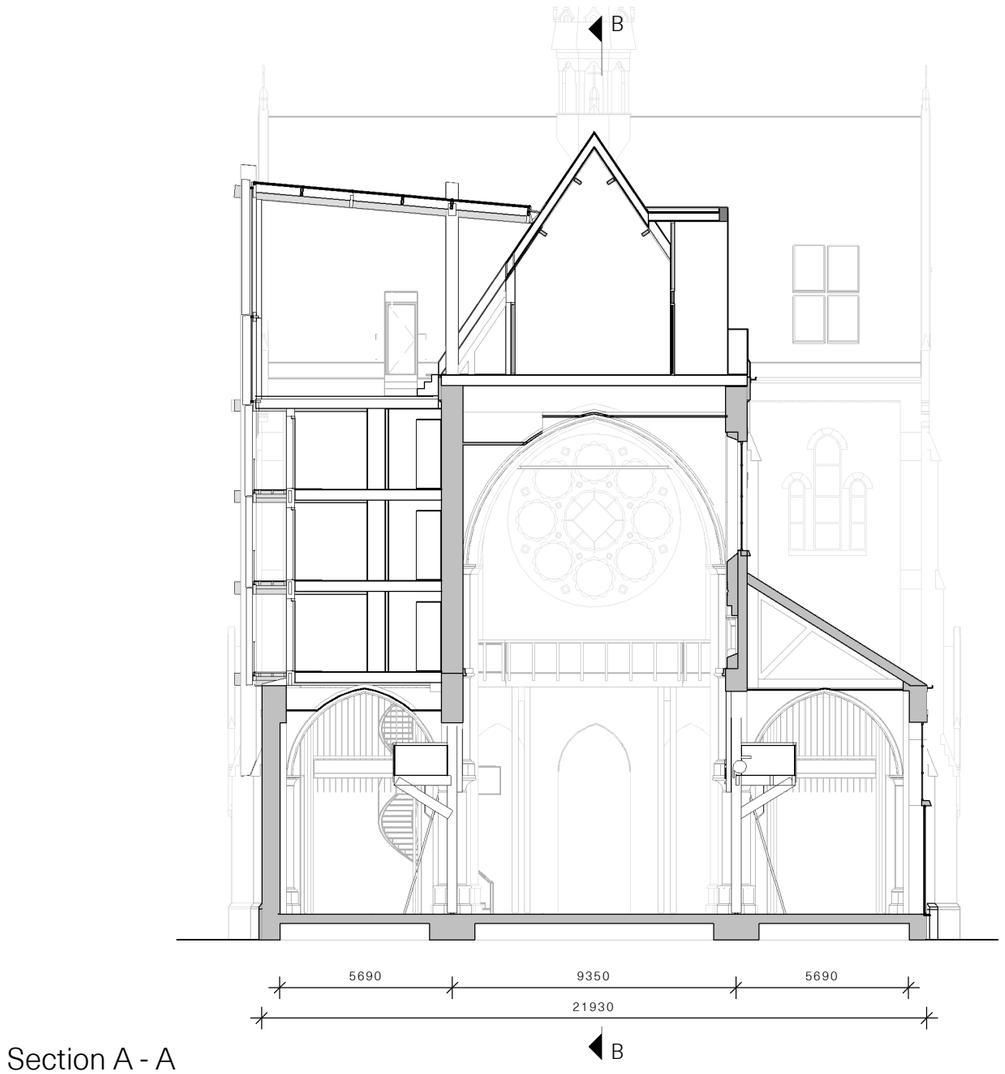
23 Existing telecom system
24 Greenhouse, Tea café
25 Large Attic room
26 Attic room
27 Air extraction system
28 Greenhouse, Lounge

Fourth Floor

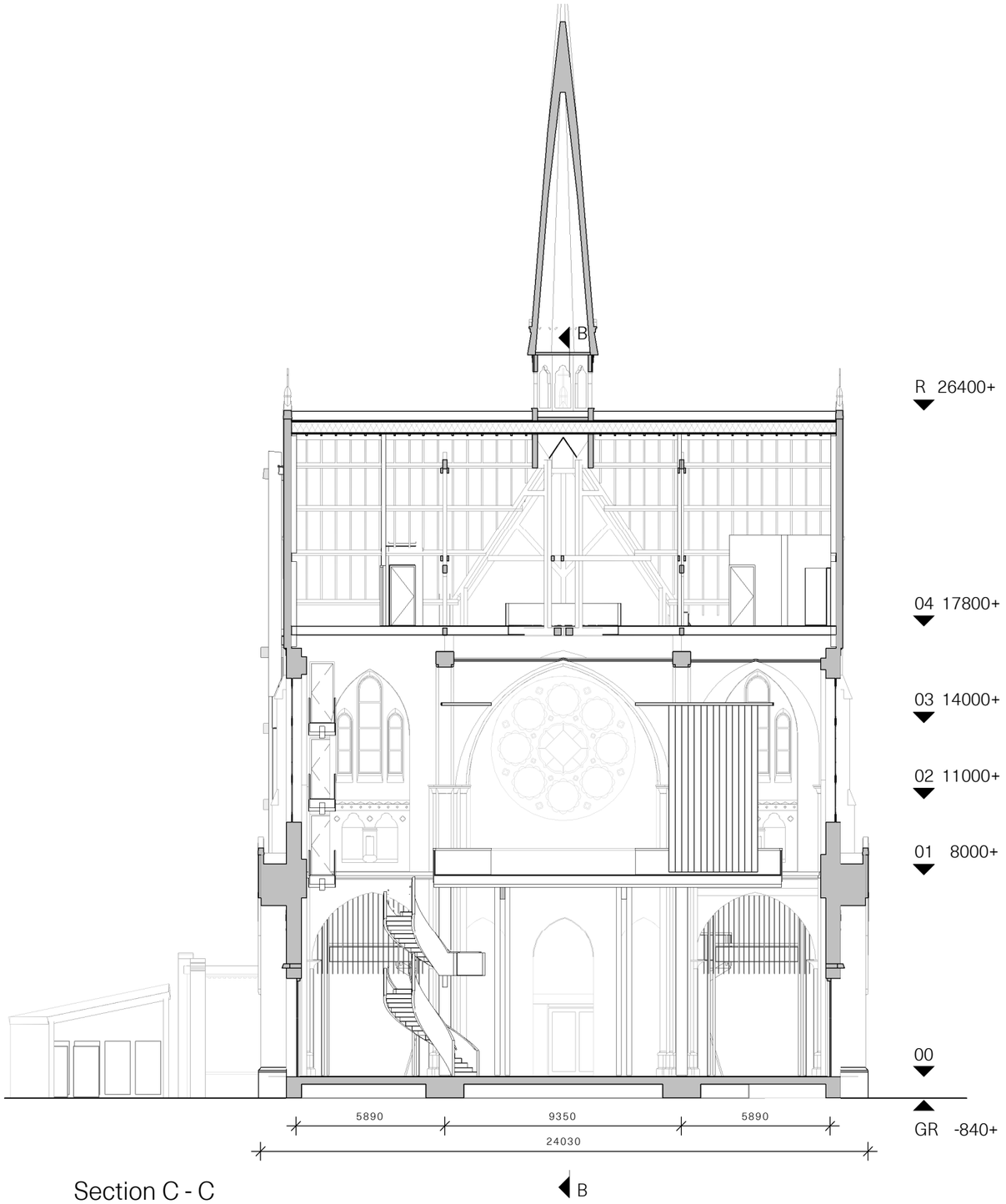


4th Floor

4th Floor

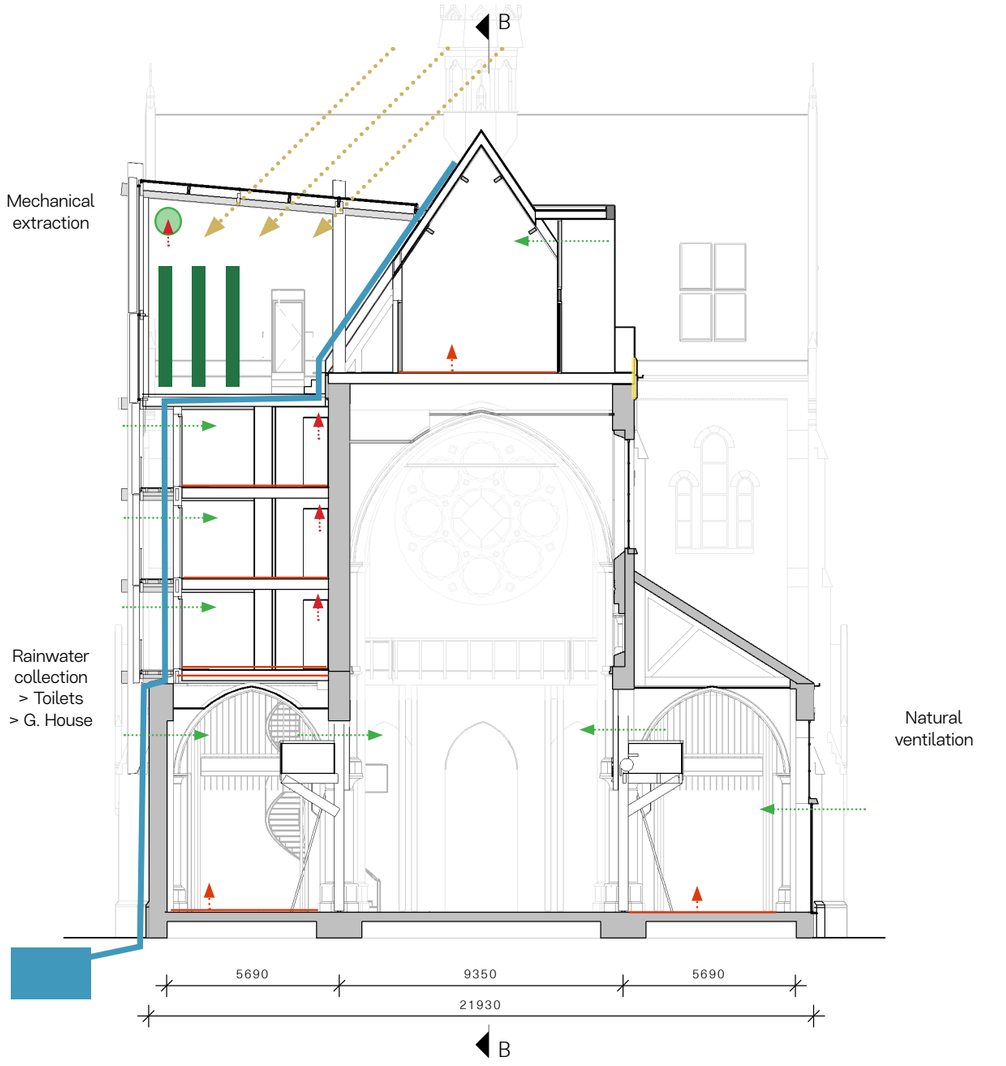


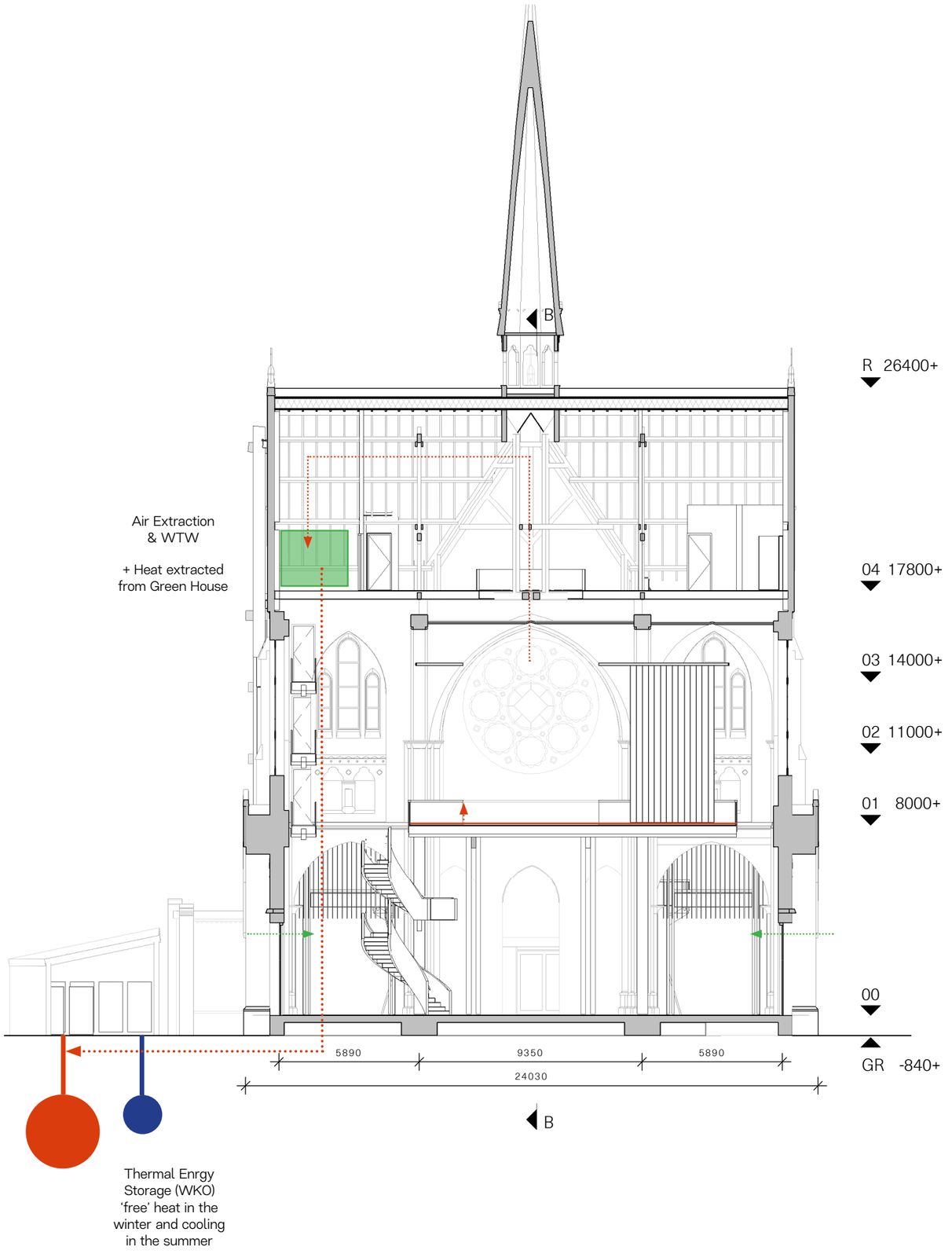
Section A - A



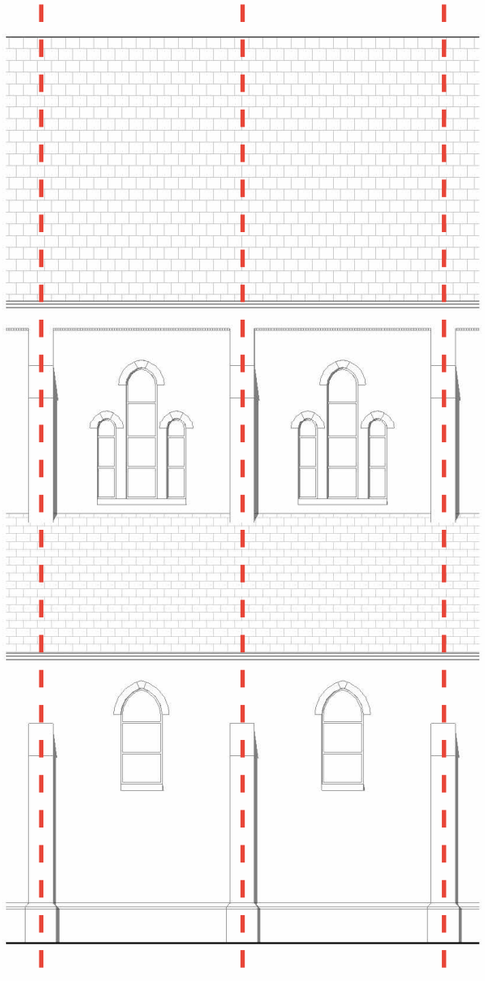
Section C - C

Sections

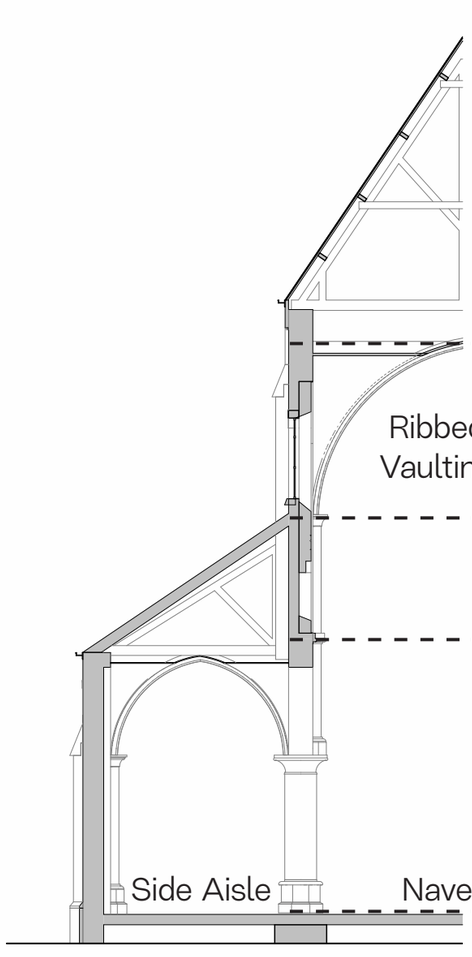

B
Mechanical extraction
Rainwater collection > Toilets > G. House
Natural ventilation
5690
9350
5690
21930
B

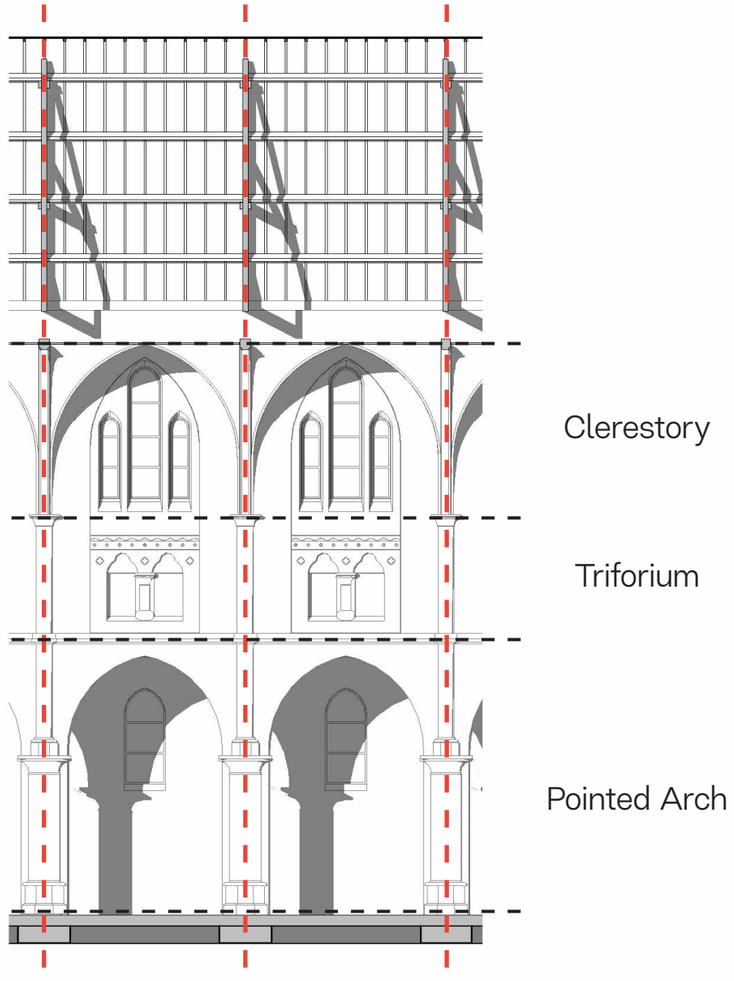

B
Air Extraction & WTW
+ Heat extracted from Green House
R 26400+
04 17800+
03 14000+
02 11000+
01 8000+
00
GR -840+
5890
9350
5890
24030
B
Thermal Enrgy Storage (WKO) 'free' heat in the winter and cooling in the summer

Climate



Visible Structure



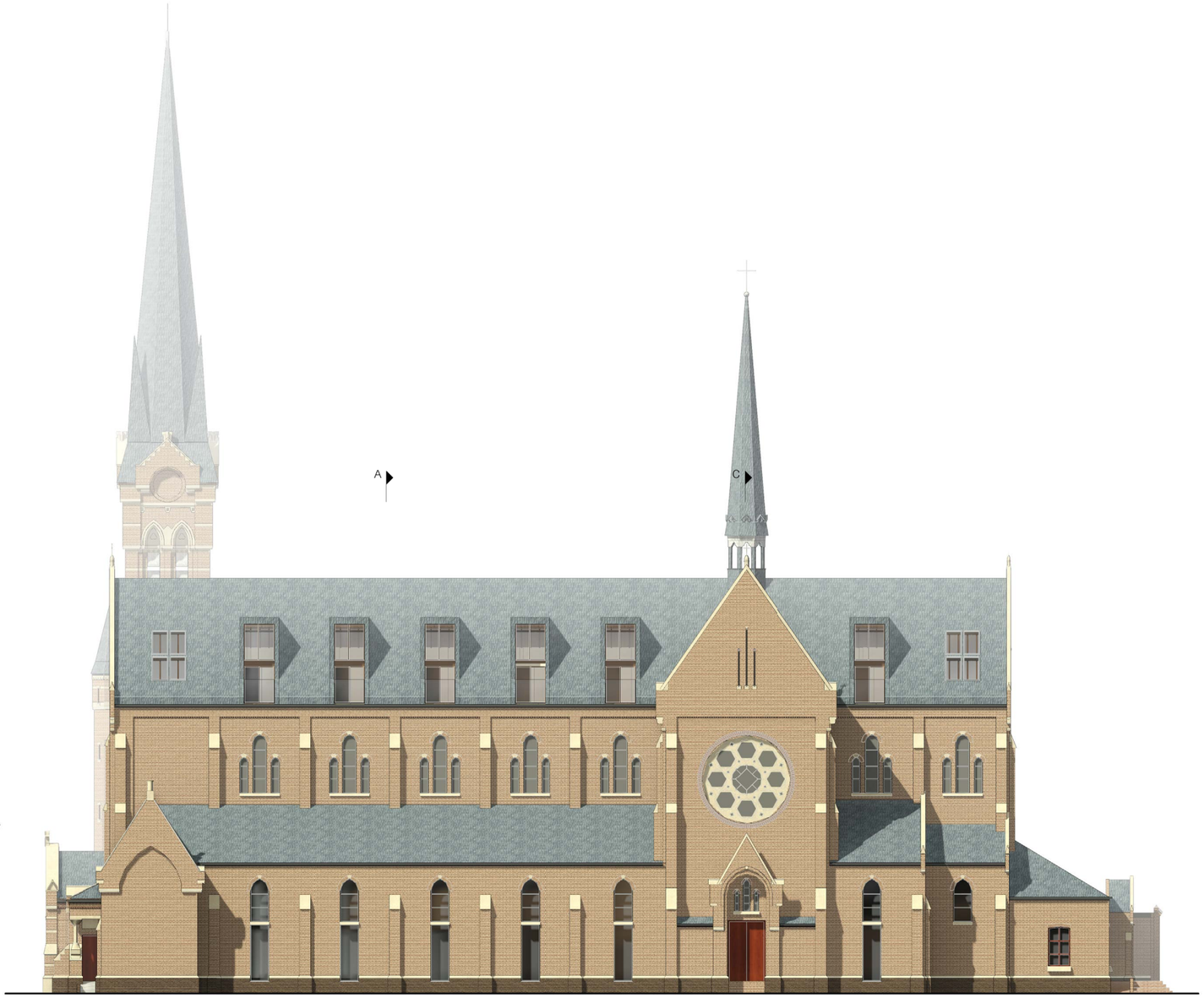


Three-part Composition

Rhythm & Symmetry

Front - East side

B

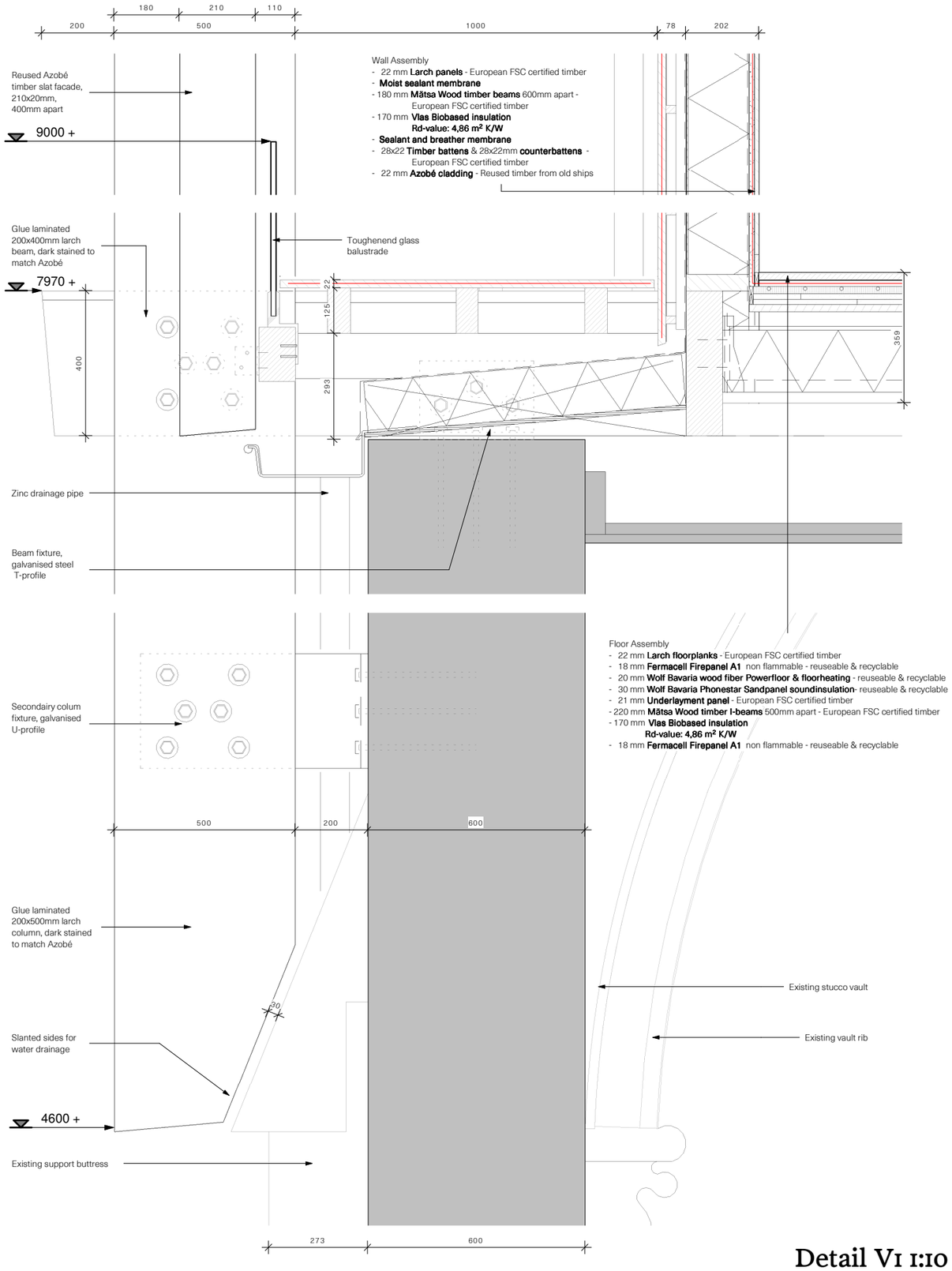


Right - South side

A C

Back - East side

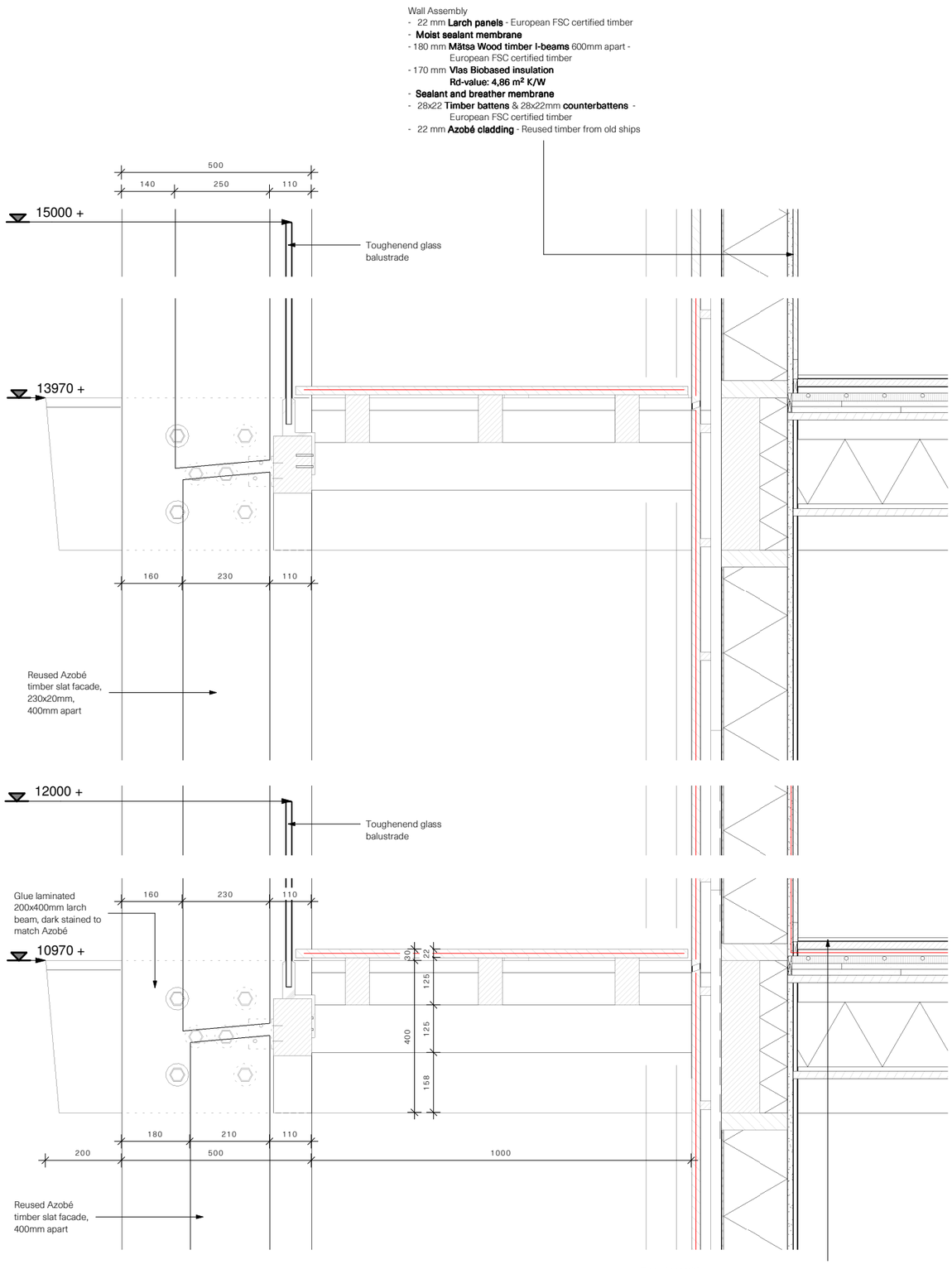
Left - North side



Detail V1 1:10


Preservation through Adaptation
Gevelfragment 2e verdieping noordgevel | schaal 1:20
Adriaan Bon | 5231428 | Heritage & Architecture - Zero Waste Church 2023
0 10cm 40cm 80cm

Facade

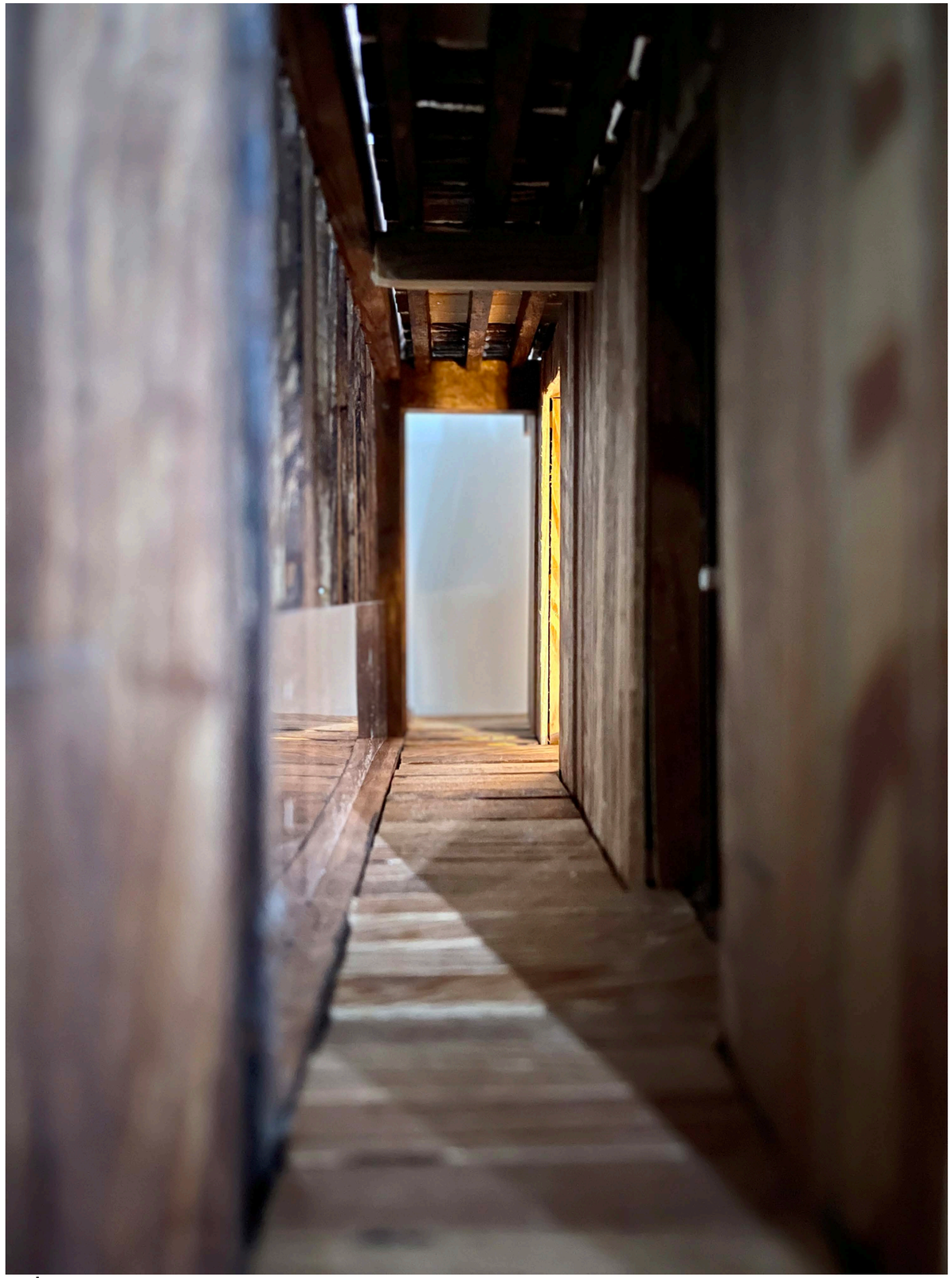


Wall Assembly
- 22 mm **Larch panels** - European FSC certified timber
- **Moist sealant membrane**
- 180 mm **Mätsa Wood timber I-beams** 600mm apart - European FSC certified timber
- 170 mm **Vlas Biobased insulation** **Rd-value: 4,86 m² K/W**
- **Sealant and breather membrane**
- 28x22 **Timber battens** & 28x22mm **counterbattens** - European FSC certified timber
- 22 mm **Azobé cladding** - Reused timber from old ships

Floor Assembly
- 22 mm **Larch floorplanks** - European FSC certified timber
- 18 mm **Fermacell Firepanel A1** non flammable - reuseable & recyclable
- 20 mm **Wolf Bavaria wood fiber Powerfloor & floorheating** - reuseable & recyclable
- 30 mm **Wolf Bavaria Phonestar Sandpanel soundinsulation**- reuseable & recyclable
- 21 mm **Underlayment panel** - European FSC certified timber
- 220 mm **Mätsa Wood timber I-beams** 500mm apart - European FSC certified timber
- 170 mm **Vlas Biobased insulation** **Rd-value: 4,86 m² K/W**
- 18 mm **Fermacell Firepanel A1** non flammable - reuseable & recyclable
- 22 mm **Larch panels** - European FSC certified timber

Detail V4 1:10

Facade



Facade

Thank you all for listening