"LIPA MILJØPROSJEKT" LINESØYA

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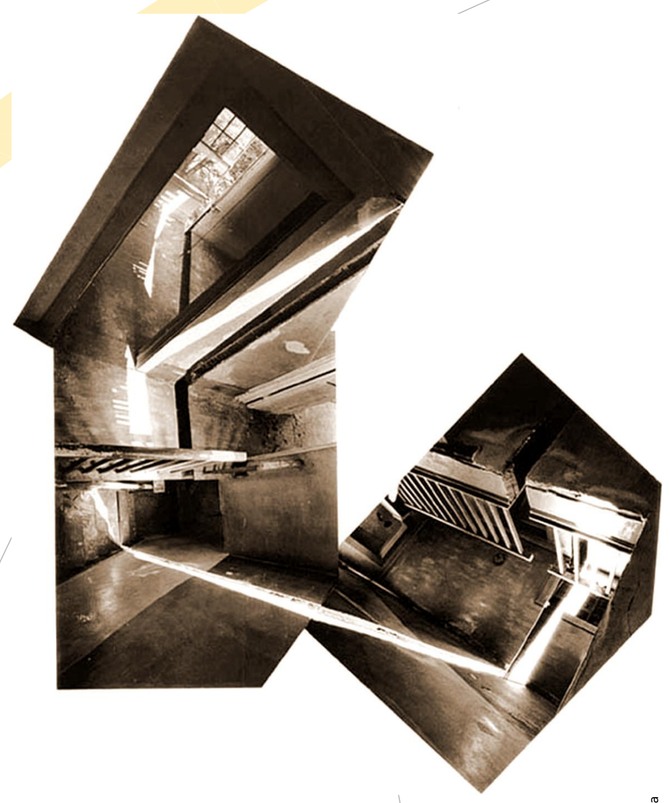
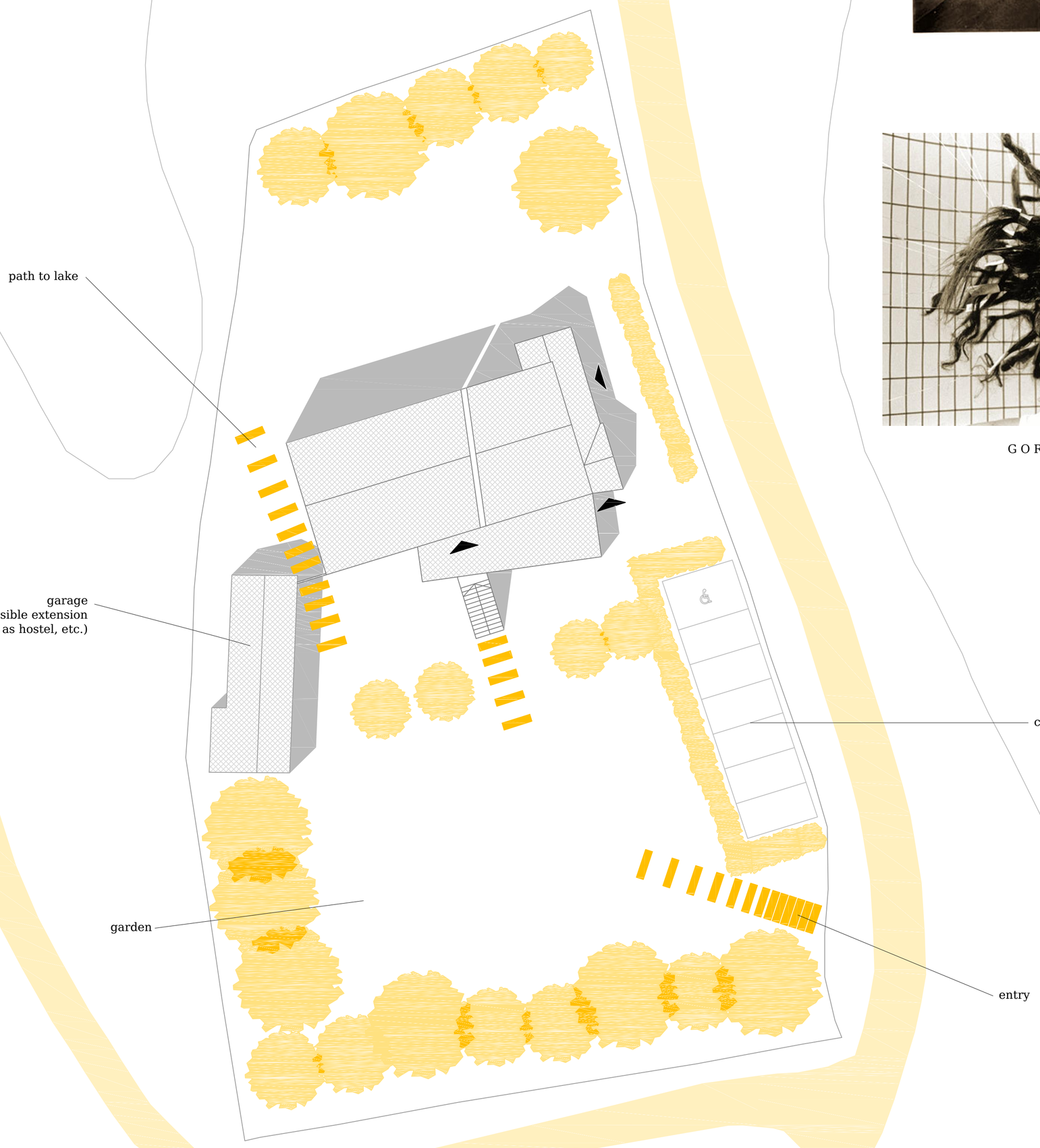
10 PRINCIPLES

1. Refurbishment - a case study for retro-fitting
2. Respecting The Existing - sensitive fitting in local and historical context
3. Salvageability - re-use of no longer used building parts (e.g. roof girders)
4. Tangibility - revealing the ´inner life´ of the building (inspired by Gordon Matta Clark)
5. An Informative Walkthrough - experiencing, learning the building on a tour
6. Passive House Standard - fulfilling requirements as “passivhus” and “Passivhaus”
7. Compactness - maximizing usable space within volume; no extensions
8. Neglectable Thermal Bridges - a continuous insulating envelope
9. Air-Tightness - careful detailing regarding infiltration; yet diffusion open construction
10. Material Choice - environmental friendly materials; a no-mineral-wool-policy



http://secretforts.blogspot.com/2011/01/anarchitect-gordon-matta

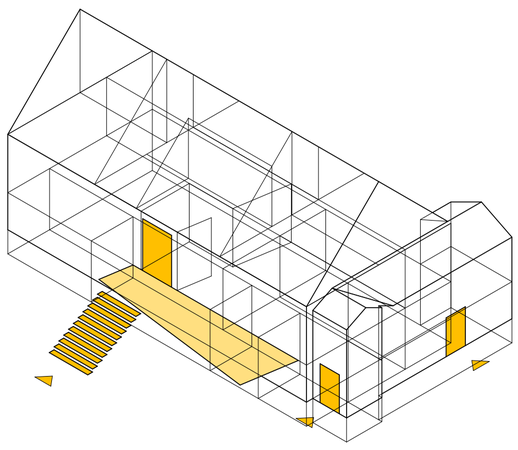
GORDON MATTA-CLARK (1943-78)



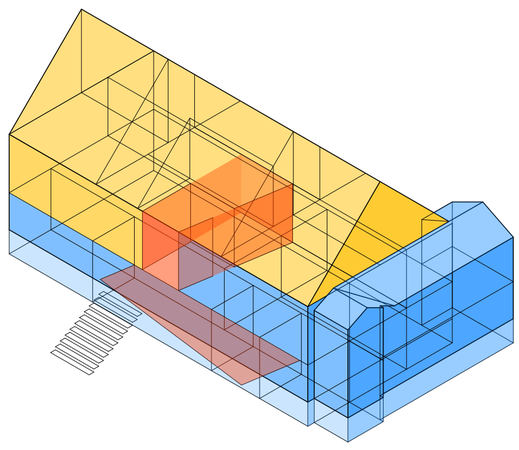
SITE PLAN 1 : 200

ELEVATION SOUTH FACADE 1:100

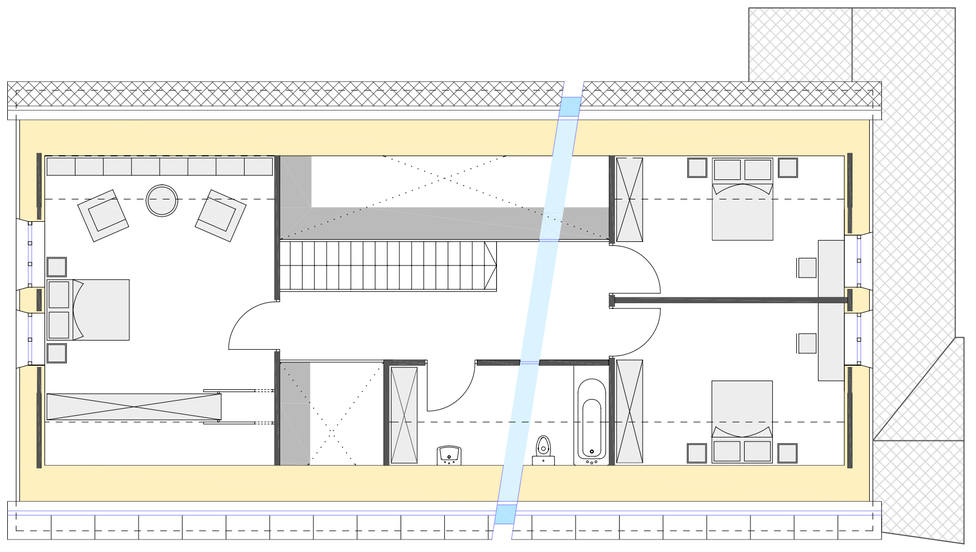
ELEVATION WEST FACADE 1:100



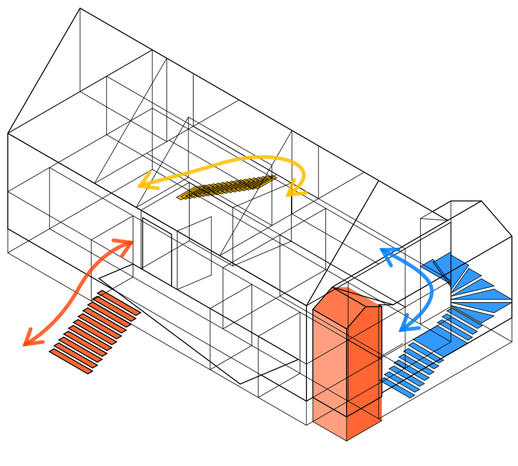
ACCESS



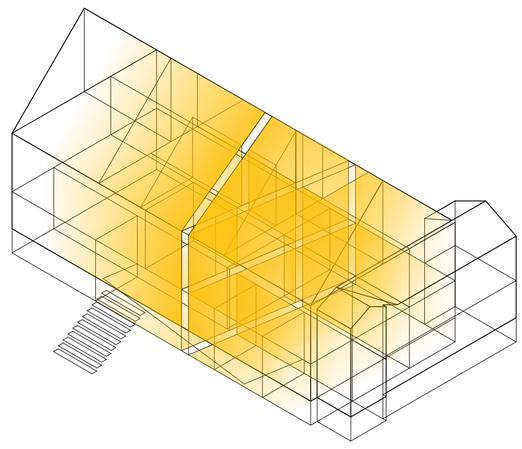
PUBLIC - PRIVATE



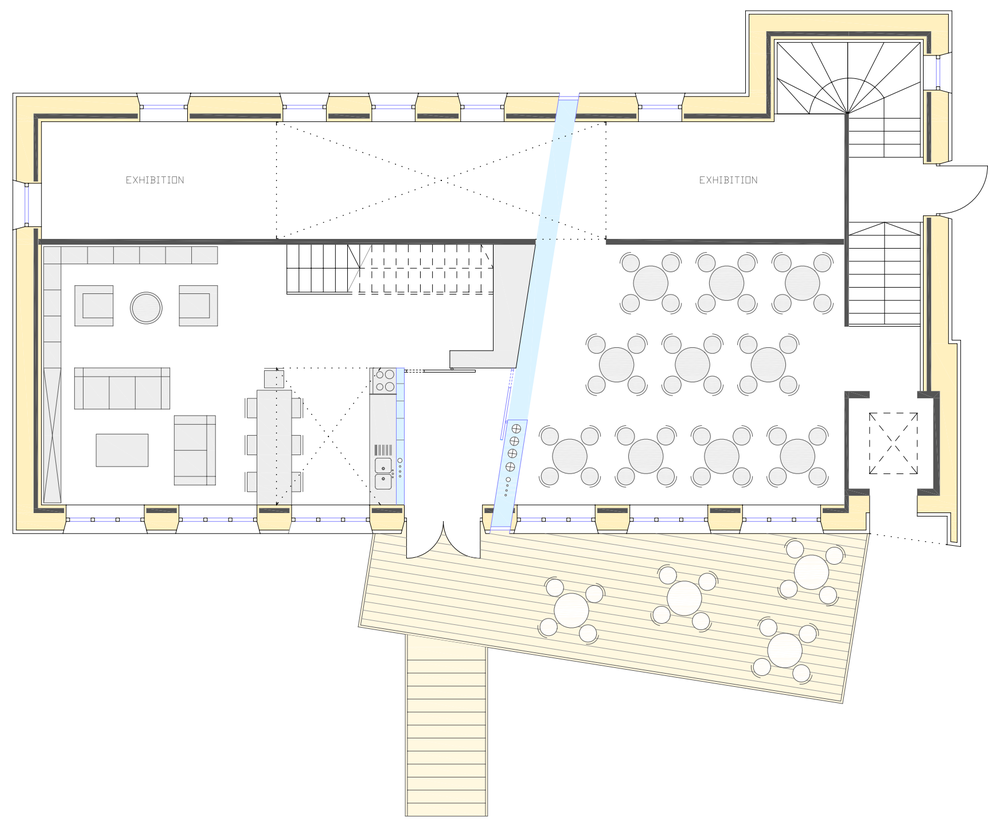
FLOOR PLAN SECOND FLOOR 1:100



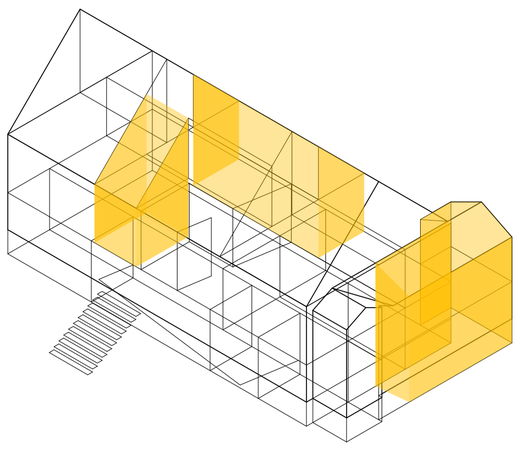
CIRCULATION



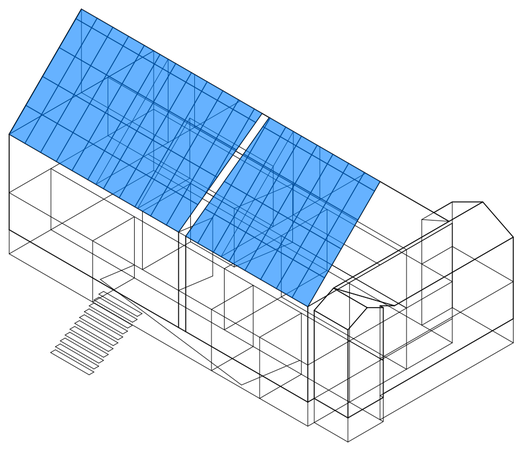
CREVICE



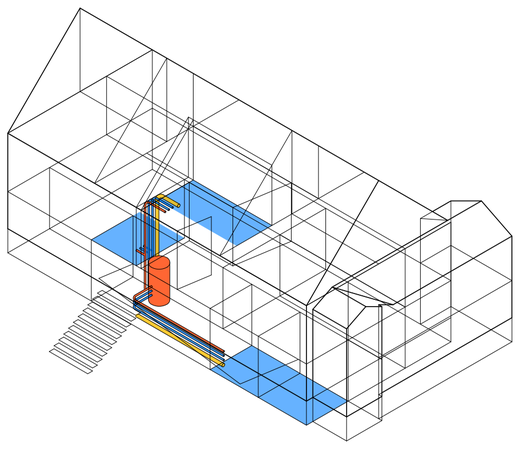
FLOOR PLAN FIRST FLOOR 1:100



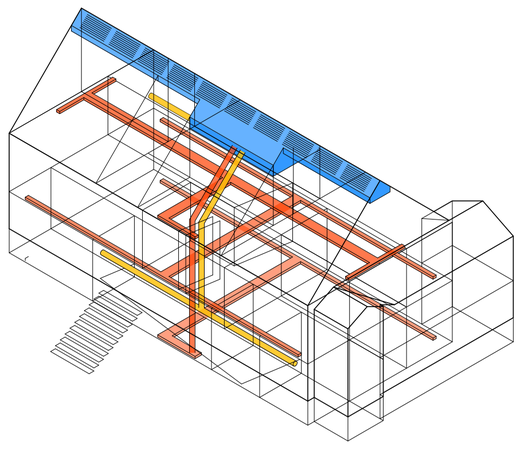
DOUBLE-HEIGHT SPACE



PHOTOVOLTAICS

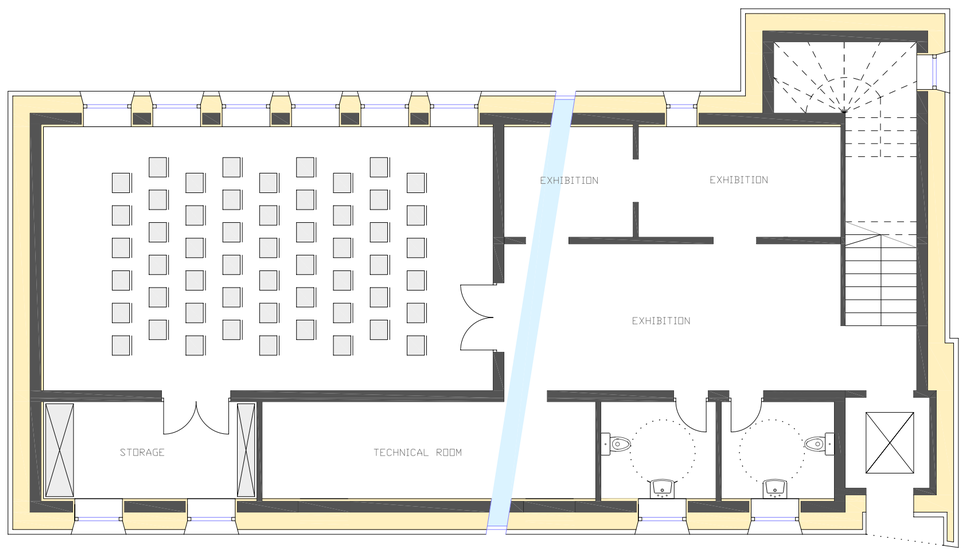


DOMESTIC HOT WATER



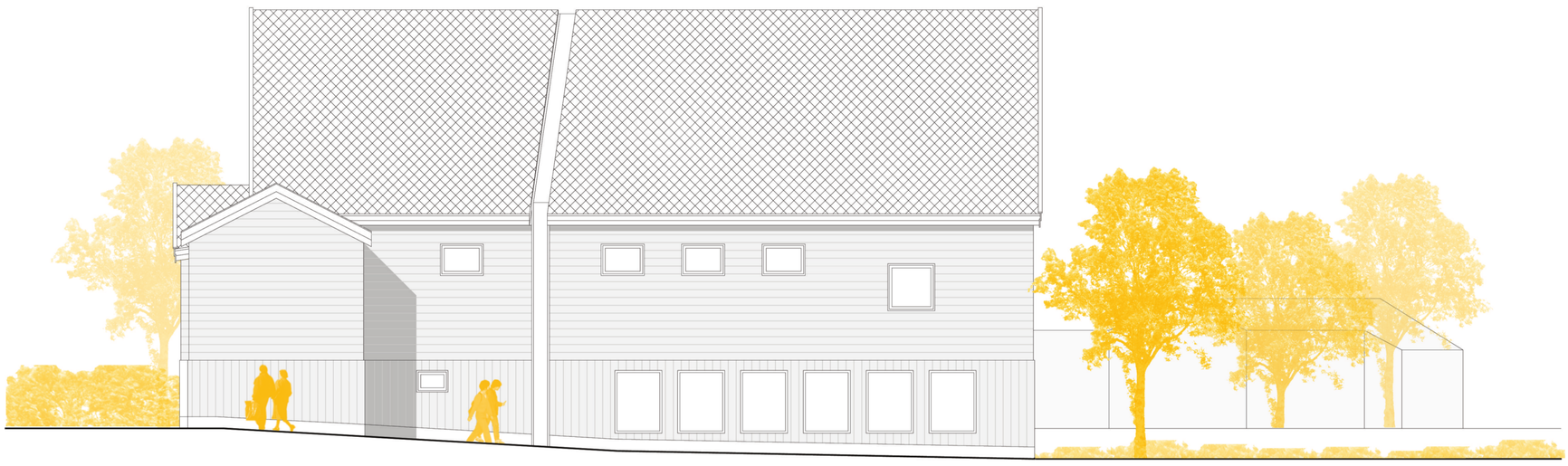
VENTILATION / HEATING

CONCEPTUAL DIAGRAMS

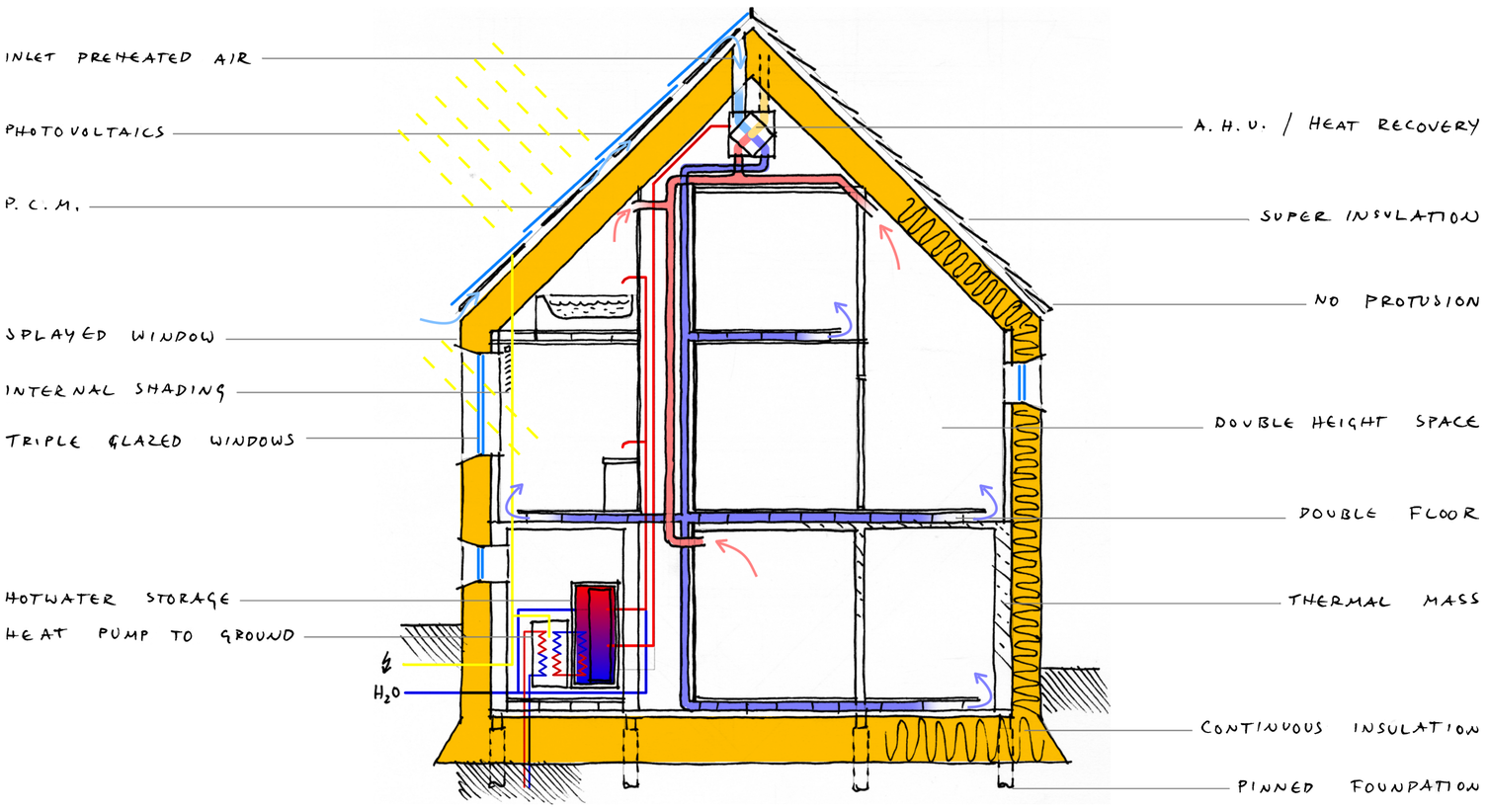


FLOOR PLAN GROUND FLOOR 1:100

ELEVATION SOUTH FACADE 1:100



ELEVATION WEST FACADE 1:100



PASSIVE AND ACTIVE STRATEGIES

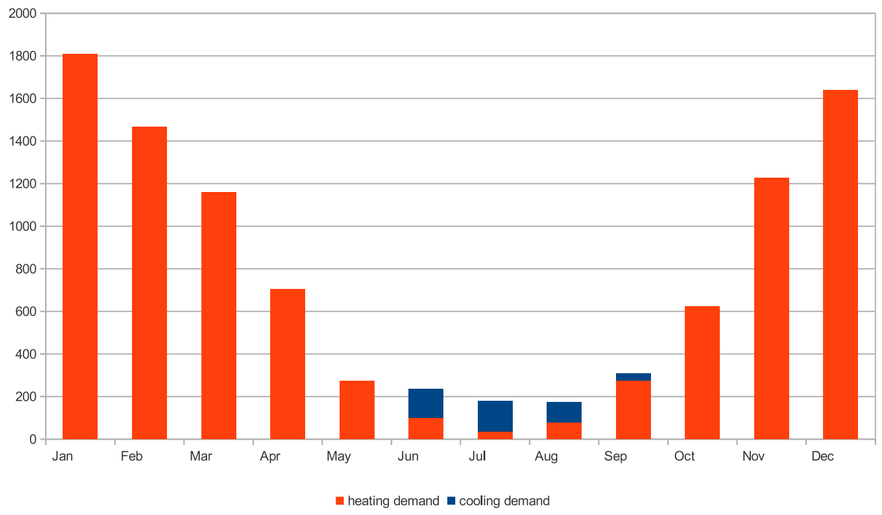
energy budget

prNS3700	power	operation time	energy demand	
	(in W/m²)	(in h/a)	(in kWh/(m²a)	(in kWh/a)
heating (supplementary)			2.5	1260.0
ventilation heating	1.72	8736	15.0	7500.0
fans & pumps	0.90	8736	7.9	3931.2
domestic hot water	3.40	5824	19.8	9900.8
equipment	2.00	5824	11.6	5824.0
lighting	1.30	5824	7.6	3785.6
cooling	-	8736	0	0.0
total energy demand			**64.4**	**32201.6**

net energy demand

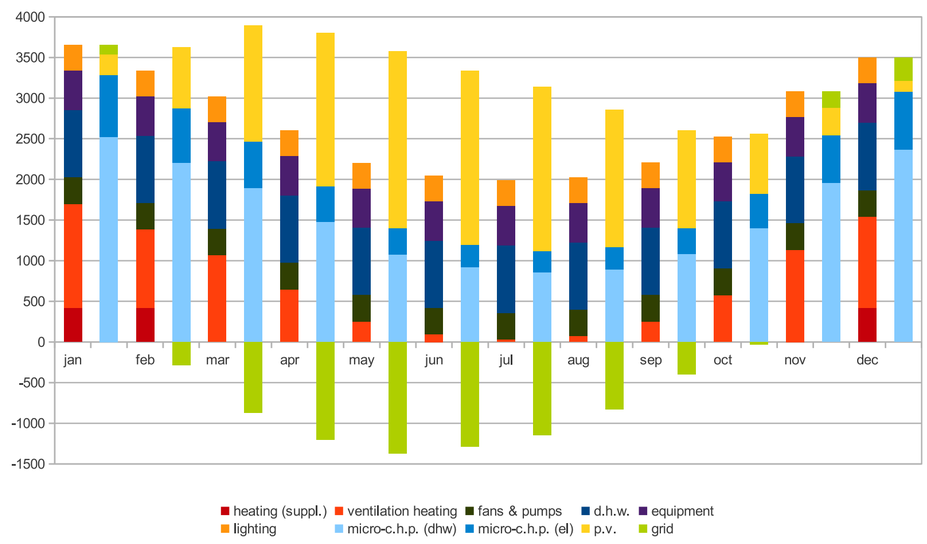
	electricity (in kWh/a)	heating (in kWh/a)	other (in kWh/a)	
heating		1260.0		
ventilation heating		7500.0		
fans & pumps	3931.2			
domestic hot water		9900.8		
equipment	5824.0			
lighting	3785.6			
cooling	0.0			
total energy demand	**13540.8**	**18660.8**	**0.0**	**32201.6**

HEATING DEMAND ACCORDING TO "ECOTECT"



delivered energy **photovoltaics + bio-fuel micro-CHP (power ~3 kW) + electricity grid connection**

	energy supply (in kWh/a)	fraction (in %)	efficiency	delivered energy (in kWh/a)	delivered energy (in kWh/m²a)	fraction (in %)	CO_2 factor (in g/kWh)	CO_2 emissions (in kg)	CO_2 emissions (in kg/m²)
electricity									
monocristalline PV	13986.0	103.3%	100.0	139.9	0.3	13.4%	130.0	18.2	0.0
biofuel micro-CHP (30 %)	7997.5	59.1%	0.8	9520.8	19.0	910.5%	14.0	133.3	0.3
grid	-8442.7	-62.3%	1.0	-8615.0	-17.2	-823.9%	617.0	-5315.4	-10.6
total electricity	*13540.8*	*100.0%*		*1045.7*	*2.1*	*100.0%*	*-4938.3*	*-5164.0*	*-10.3*
heating									
biofuel micro-CHP (70 %)	18660.8	100.0%	0.8	22215.2	44.4	100.0%	14.0	311.0	0.6
total heating	*18660.8*	*100.0%*		*22215.2*	*44.4*	*100.0%*	*14.0*	*311.0*	*0.6*
total	**32201.6**			**23260.9**	**46.5**			**-4853.0**	**-9.7**

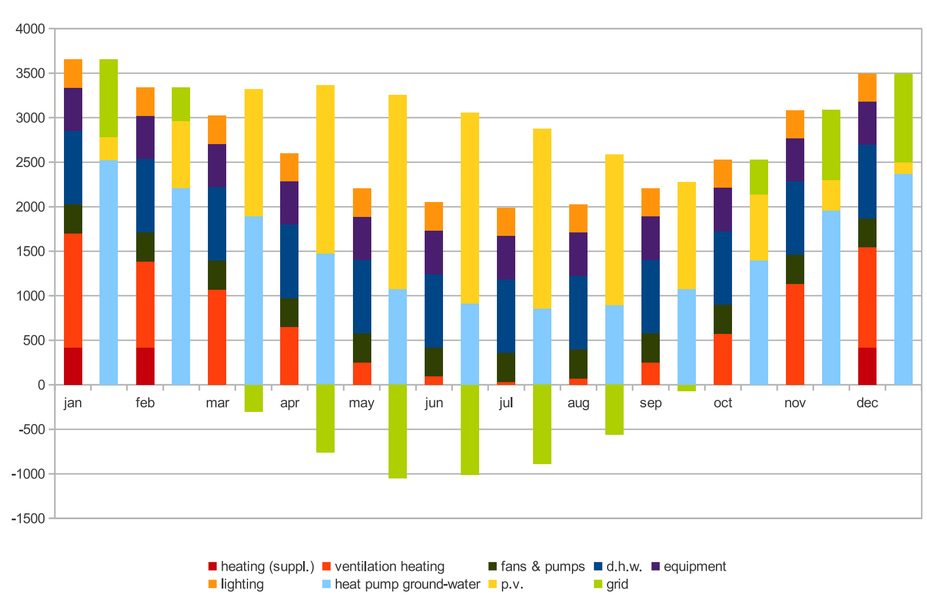


ENERGY SUPPLY OPTION 1

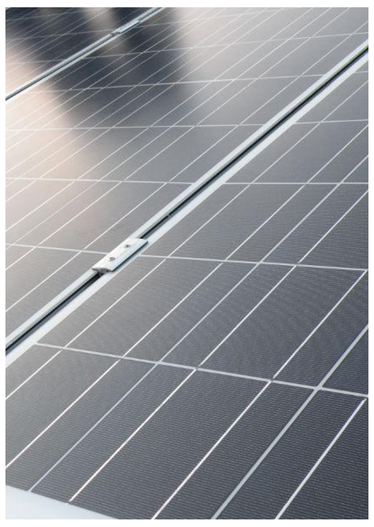
ENERGY DEMAND

delivered energy **photovoltaics + ground-water heat pump (power ~2.2 kW) + electricity grid connection**

	energy supply (in kWh/a)	fraction (in %)	efficiency	delivered energy (in kWh/a)	delivered energy (in kWh/m²a)	fraction (in %)	CO_2 factor (in g/kWh)	CO_2 emissions (in kg)	CO_2 emissions (in kg/m²)
electricity									
monocristalline PV	13986.0	103.3%	100.0	139.9	0.3	-44.5%	130.0	18.2	0.0
grid	-445.2	-3.3%	1.0	-454.3	-0.9	144.5%	617.0	-280.3	-0.6
total electricity	*13540.8*	*100.0%*		*-314.4*	*-0.6*	*100.0%*	*833.6*	*-262.1*	*-0.5*
heating									
heat pump ground-water	18660.8	100.0%	2.3	8113.4	16.2	100.0%	617.0	5006.0	10.0
total heating	*18660.8*	*100.0%*		*8113.4*	*16.2*	*100.0%*	*617.0*	*5006.0*	*10.0*
total	**32201.6**			**7799.0**	**15.6**			**4743.8**	**9.5**



ENERGY SUPPLY OPTION 2 -> CHOSEN

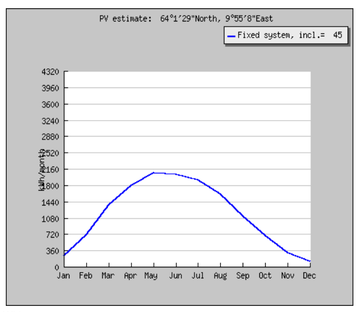


PVGIS estimates of solar electricity generation

Location: 64°1'29" North, 9°55'8" East, Elevation: 65 m a.s.l.,
Nominal power of the PV system: 18.0 kW (crystalline silicon)
Estimated losses due to temperature: 7.5% (using local ambient temperature)
Estimated loss due to angular reflectance effects: 2.9%
Other losses (cables, inverter etc.): 14.0%
Combined PV system losses: 22.8%

JRC EUROPEAN COMMISSION

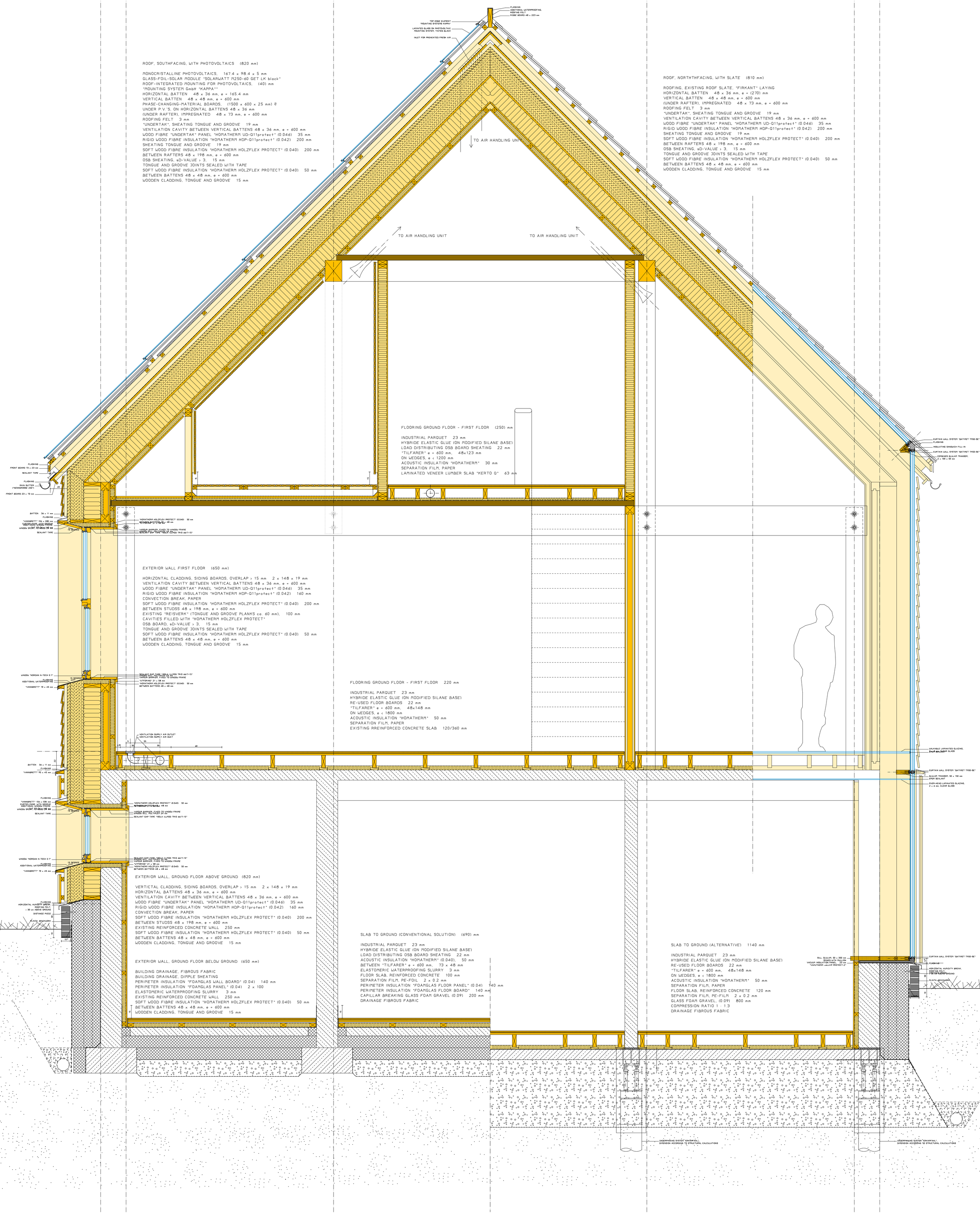
	Fixed system: inclination=45 deg., orientation=-17 deg.			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	7.60	236	0.49	15.1
Feb	25.30	708	1.66	46.3
Mar	43.80	1360	2.97	92.0
Apr	59.90	1800	4.25	128
May	66.80	2070	4.92	152
Jun	67.80	2030	5.12	154
Jul	61.80	1910	4.69	145
Aug	51.90	1610	3.89	121
Sep	37.70	1130	2.69	80.7
Oct	22.40	695	1.53	47.5
Nov	10.50	316	0.69	20.8
Dec	3.92	121	0.25	7.87
Year	38.30	1170	2.77	84.1
Total for year		14000		1010



Ed: Average daily electricity production from the given system (kWh)
Em: Average monthly electricity production from the given system (kWh)
Hd: Average daily sum of global irradiation per square meter received by the modules of the given system (kWh/m2)
Hm: Average sum of global irradiation per square meter received by the modules of the given system (kWh/m2)

PHOTOVOLTAICS

30 | 2.45 | 3.70 | 2.45 | 30



ROOF, SOUTHFACING, WITH PHOTOVOLTAICS (820 mm)

MONOCRISTALLINE PHOTOVOLTAICS, 167.4 x 98.4 x 5 mm
GLASS-FOIL-SOLAR MODULE "SOLARWATT M250-60 GET LK black"
ROOF-INTEGRATED MOUNTING FOR PHOTOVOLTAICS, (40) mm
"MOUNTING SYSTEM GmbH "KAPPA""
HORIZONTAL BATTEN 48 x 36 mm, e = 165.4 mm
VERTICAL BATTEN 48 x 48 mm, e = 600 mm
PHASE-CHANGING-MATERIAL BOARDS, (1500 x 600 x 25 mm) 2
UNDER P.V.'S, ON HORIZONTAL BATTENS 48 x 36 mm
(UNDER RAFTER), IMPREGNATED 48 x 73 mm, e = 600 mm
ROOFING FELT 3 mm
"UNDERTAK", SHEATING TONGUE AND GROOVE 19 mm
VENTILATION CAVITY BETWEEN VERTICAL BATTENS 48 x 36 mm, e = 600 mm
WOOD FIBRE "UNDERTAK" PANEL "HOMATHERM UD-Q11protect" (0.046) 35 mm
RIGID WOOD FIBRE INSULATION "HOMATHERM HDP-Q11protect" (0.042) 200 mm
SHEATING TONGUE AND GROOVE 19 mm
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 200 mm
BETWEEN RAFTERS 48 x 198 mm, e = 600 mm
OSB SHEATING, sD-VALUE > 3, 15 mm
TONGUE AND GROOVE JOINTS SEALED WITH TAPE
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 50 mm
BETWEEN BATTENS 48 x 48 mm, e = 600 mm
WOODEN CLADDING, TONGUE AND GROOVE 15 mm

ROOF, NORTHTHFACING, WITH SLATE (810 mm)

ROOFING, EXISTING ROOF SLATE, "FIRKANT" LAYING
HORIZONTAL BATTEN 48 x 36 mm, e = (270) mm
VERTICAL BATTEN 48 x 48 mm, e = 600 mm
(UNDER RAFTER), IMPREGNATED 48 x 73 mm, e = 600 mm
ROOFING FELT 3 mm
"UNDERTAK", SHEATING TONGUE AND GROOVE 19 mm
VENTILATION CAVITY BETWEEN VERTICAL BATTENS 48 x 36 mm, e = 600 mm
WOOD FIBRE "UNDERTAK" PANEL "HOMATHERM UD-Q11protect" (0.046) 35 mm
RIGID WOOD FIBRE INSULATION "HOMATHERM HDP-Q11protect" (0.042) 200 mm
SHEATING TONGUE AND GROOVE 19 mm
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 200 mm
BETWEEN RAFTERS 48 x 198 mm, e = 600 mm
OSB SHEATING, sD-VALUE > 3, 15 mm
TONGUE AND GROOVE JOINTS SEALED WITH TAPE
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 50 mm
BETWEEN BATTENS 48 x 48 mm, e = 600 mm
WOODEN CLADDING, TONGUE AND GROOVE 15 mm

FLOORING GROUND FLOOR - FIRST FLOOR (250) mm

INDUSTRIAL PARQUET 23 mm
HYBRIDE ELASTIC GLUE (ON MODIFIED SILANE BASE)
LOAD DISTRIBUTING OSB BOARD SHEATING 22 mm
"TILFARER" e = 600 mm, 48x123 mm
ON WEDGES, e < 1200 mm
ACOUSTIC INSULATION "HOMATHERM" 30 mm
SEPARATION FILM, PAPER
LAMINATED VENEER LUMBER SLAB "KERTO Q" 63 mm

EXTERIOR WALL FIRST FLOOR (650 mm)

HORIZONTAL CLADDING, SIDING BOARDS, OVERLAP > 15 mm 2 x 148 x 19 mm
VENTILATION CAVITY BETWEEN VERTICAL BATTENS 48 x 36 mm, e = 600 mm
WOOD FIBRE "UNDERTAK" PANEL "HOMATHERM UD-Q11protect" (0.046) 35 mm
RIGID WOOD FIBRE INSULATION "HOMATHERM HDP-Q11protect" (0.042) 160 mm
CONVECTION BREAK, PAPER
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 200 mm
BETWEEN STUDSS 48 x 198 mm, e = 600 mm
EXISTING "REISVERK" (TONGUE AND GROOVE PLANKS ca. 60 mm), 100 mm
CAVITIES FILLED WITH "HOMATHERM HOLZFLEX PROTECT"
OSB BOARD, sD-VALUE > 3, 15 mm
TONGUE AND GROOVE JOINTS SEALED WITH TAPE
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 50 mm
BETWEEN BATTENS 48 x 48 mm, e = 600 mm
WOODEN CLADDING, TONGUE AND GROOVE 15 mm

FLOORING GROUND FLOOR - FIRST FLOOR 220 mm

INDUSTRIAL PARQUET 23 mm
HYBRIDE ELASTIC GLUE (ON MODIFIED SILANE BASE)
RE-USED FLOOR BOARDS 22 mm
"TILFARER" e = 600 mm, 48x148 mm
ON WEDGES, e < 1800 mm
ACOUSTIC INSULATION "HOMATHERM" 50 mm
SEPARATION FILM, PAPER
EXISTING RREINFORCED CONCRETE SLAB 120/360 mm

EXTERIOR WALL, GROUND FLOOR ABOVE GROUND (820 mm)

VERTICTAL CLADDING, SIDING BOARDS, OVERLAP > 15 mm 2 x 148 x 19 mm
HORIZONTAL BATTENS 48 x 36 mm, e = 600 mm
VENTILATION CAVITY BETWEEN VERTICAL BATTENS 48 x 36 mm, e = 600 mm
WOOD FIBRE "UNDERTAK" PANEL "HOMATHERM UD-Q11protect" (0.046) 35 mm
RIGID WOOD FIBRE INSULATION "HOMATHERM HDP-Q11protect" (0.042) 160 mm
CONVECTION BREAK, PAPER
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 200 mm
BETWEEN STUDSS 48 x 198 mm, e = 600 mm
EXISTING REINFORCED CONCRETE WALL 250 mm
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 50 mm
BETWEEN BATTENS 48 x 48 mm, e = 600 mm
WOODEN CLADDING, TONGUE AND GROOVE 15 mm

EXTERIOR WALL, GROUND FLOOR BELOW GROUND (650 mm)

BUILDING DRAINAGE, FIBROUS FABRIC
BUILDING DRAINAGE, DIMPLE SHEATING
PERIMETER INSULATION "FOAMGLAS WALL BOARD" (0.04) 140 mm
PERIMETER INSULATION "FOAMGLAS PANEL" (0.04) 2 x 100
ELASTOMERIC WATERPROOFING SLURRY 3 mm
EXISTING REINFORCED CONCRETE WALL 250 mm
SOFT WOOD FIBRE INSULATION "HOMATHERM HOLZFLEX PROTECT" (0.040) 50 mm
BETWEEN BATTENS 48 x 48 mm, e = 600 mm
WOODEN CLADDING, TONGUE AND GROOVE 15 mm

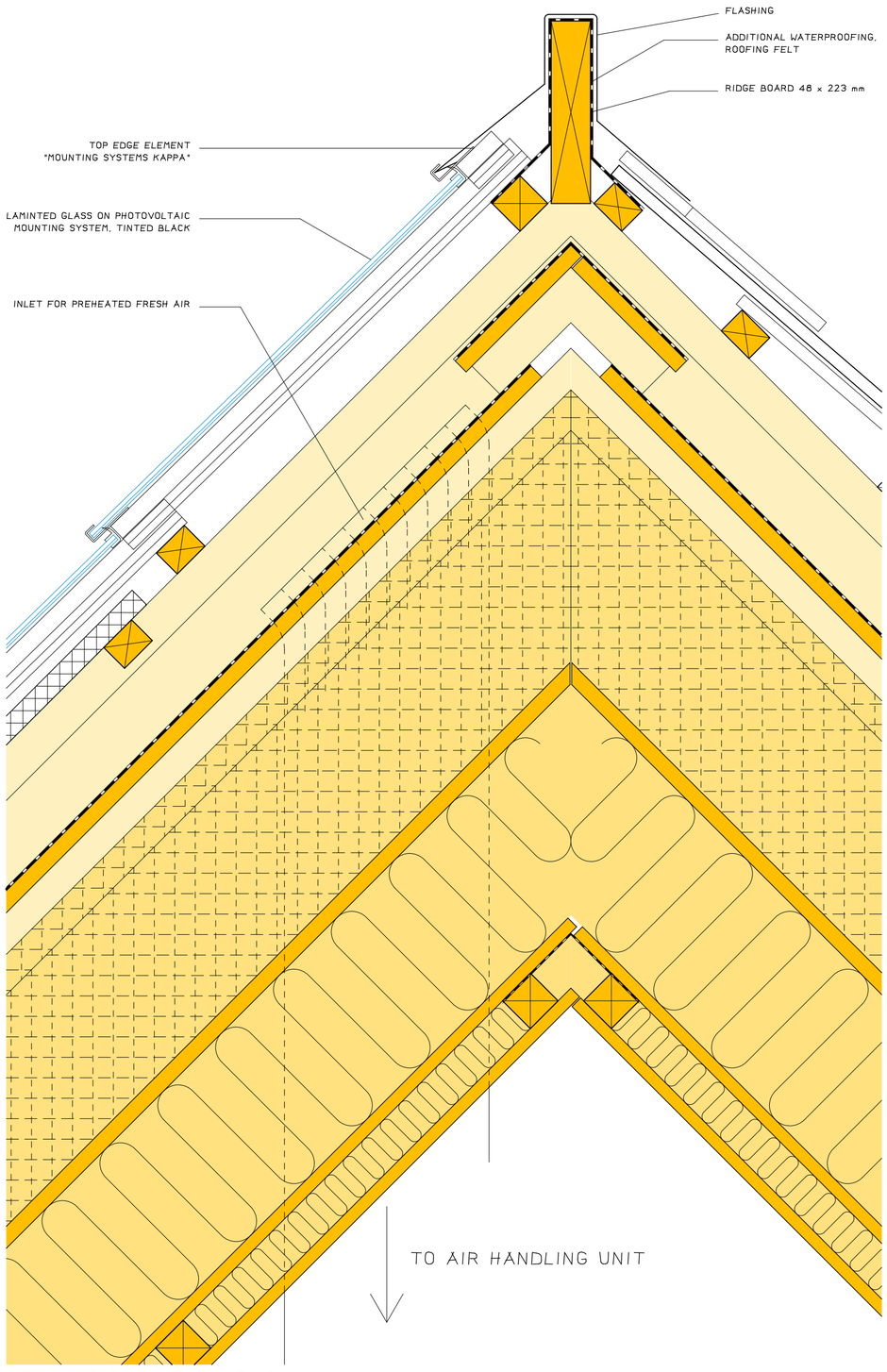
SLAB TO GROUND (CONVENTIONAL SOLUTION) (690) mm

INDUSTRIAL PARQUET 23 mm
HYBRIDE ELASTIC GLUE (ON MODIFIED SILANE BASE)
LOAD DISTRIBUTING OSB BOARD SHEATING 22 mm
ACOUSTIC INSULATION "HOMATHERM" (0.040), 50 mm
BETWEEN "TILFARER" e = 600 mm, 73 x 48 mm
ELASTOMERIC WATERPROOFING SLURRY 3 mm
FLOOR SLAB, REINFORCED CONCRETE 100 mm
SEPARATION FILM, PE-FOIL 2 x 0.2 mm
PERIMETER INSULATION "FOAMGLAS FLOOR PANEL" (0.04) 140 mm
PERIMETER INSULATION "FOAMGLAS FLOOR BOARD" 140 mm
CAPILLAR BREAKING GLASS FOAM GRAVEL (0.09) 200 mm
DRAINAGE FIBROUS FABRIC

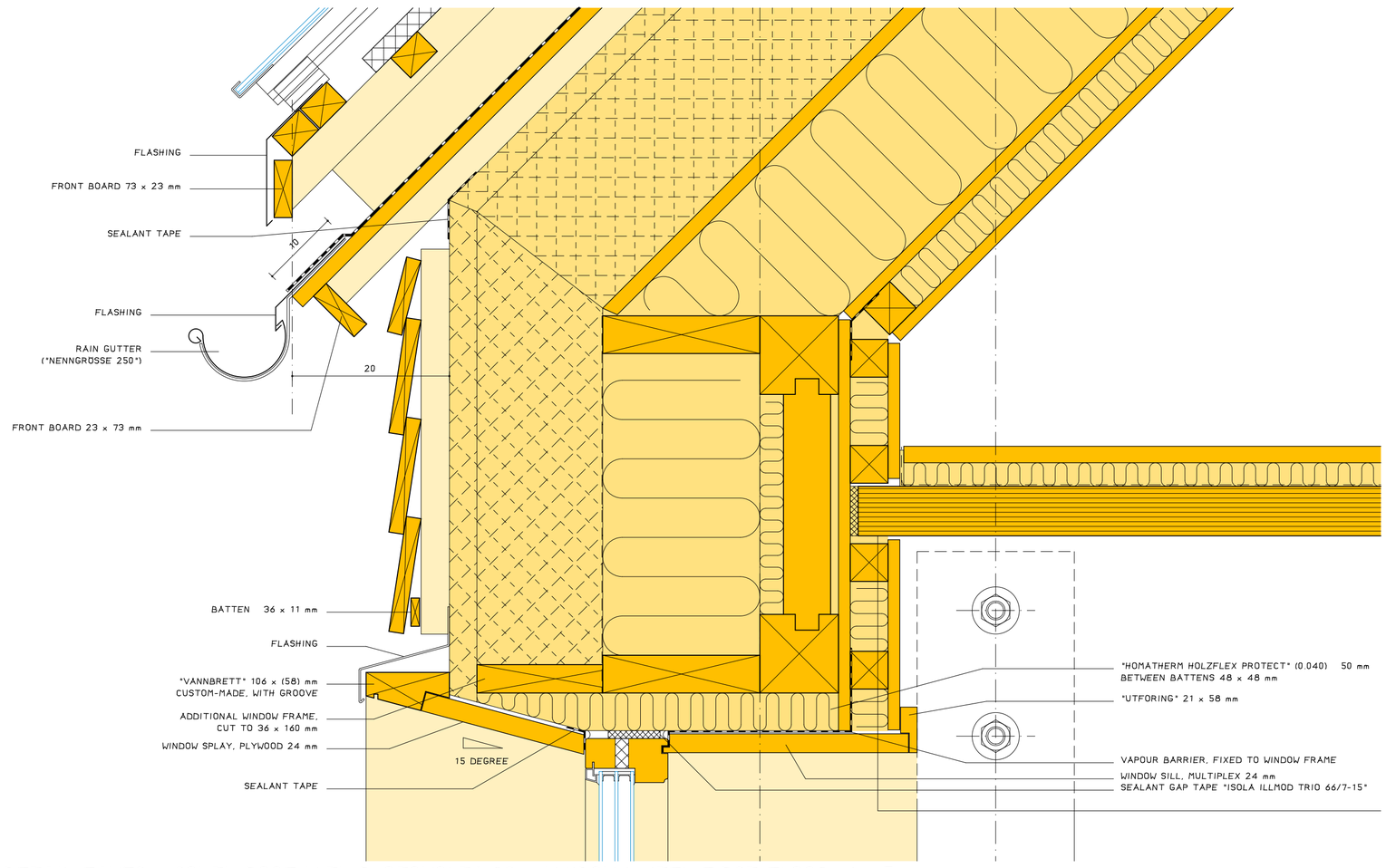
SLAB TO GROUND (ALTERNATIVE) 1140 mm

INDUSTRIAL PARQUET 23 mm
HYBRIDE ELASTIC GLUE (ON MODIFIED SILANE BASE)
RE-USED FLOOR BOARDS 22 mm
"TILFARER" e = 600 mm, 48x148 mm
ON WEDGES, e < 1800 mm
ACOUSTIC INSULATION "HOMATHERM" 50 mm
SEPARATION FILM, PAPER
FLOOR SLAB, REINFORCED CONCRETE 120 mm
SEPARATION FILM, PE-FILM 2 x 0.2 mm
GLASS FOAM GRAVEL, (0.09) 800 mm
COMPRESSION RATIO 1 : 1.3
DRAINAGE FIBROUS FABRIC

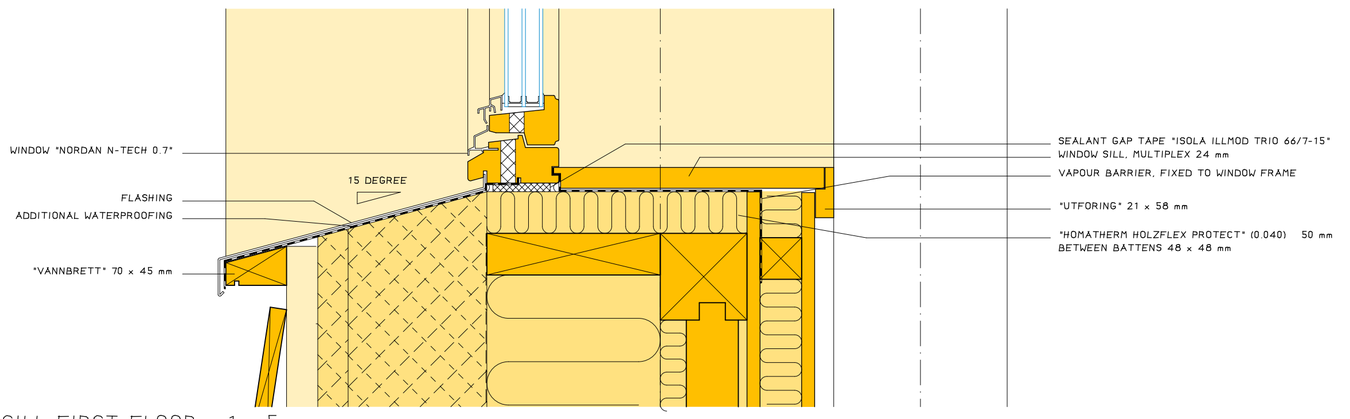
CROSS SECTION 1 : 20



DETAIL RIDGE OF ROOF 1 : 5



DETAIL EAVES - SOUTH ROOF WITH PHOTOVOLTAICS + WINDOW LINTEL FIRST FLOOR 1 : 5

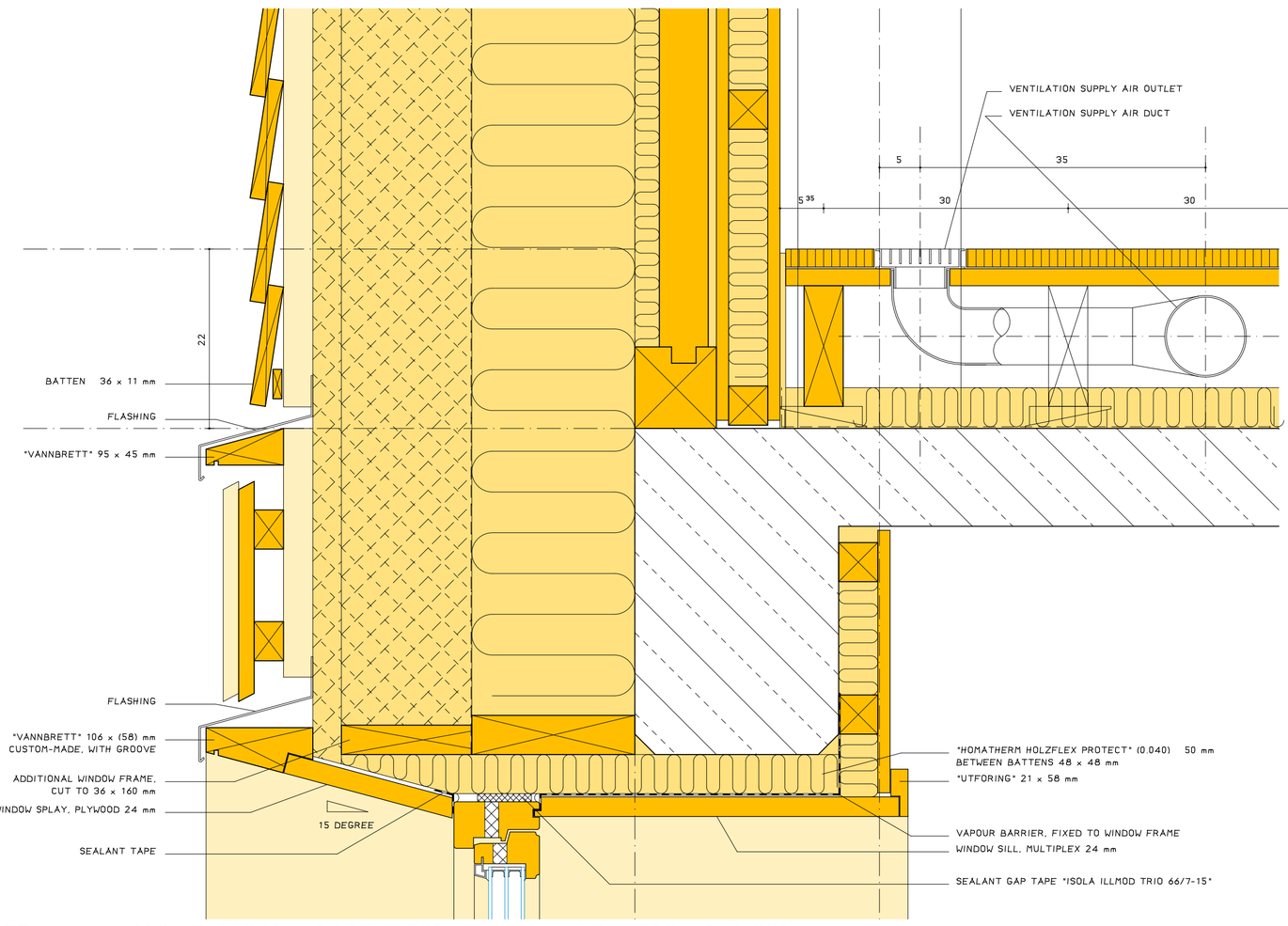


DETAIL WINDOW SILL FIRST FLOOR 1 : 5

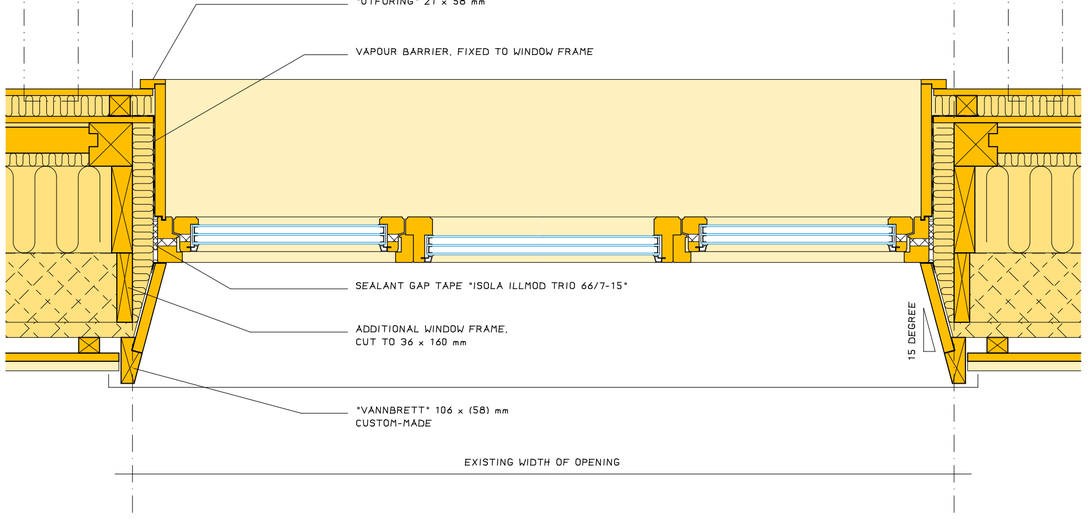
"homatherm holzflex"

"homatherm HDP-Q11 protect"

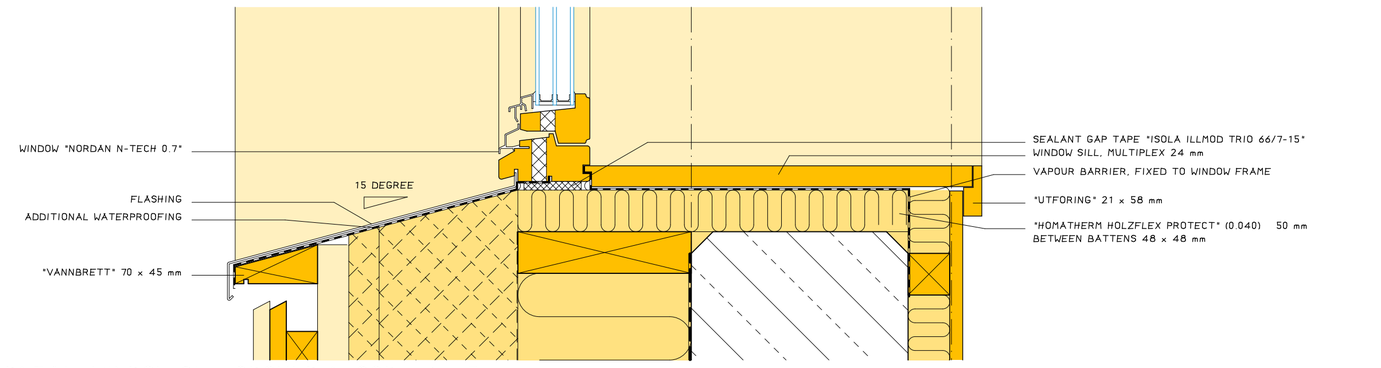
"homatherm UD-Q11 protect""



DETAIL WALL GROUND FLOOR - FIRST FLOOR + WINDOW LINTEL GROUND FLOOR 1 : 5

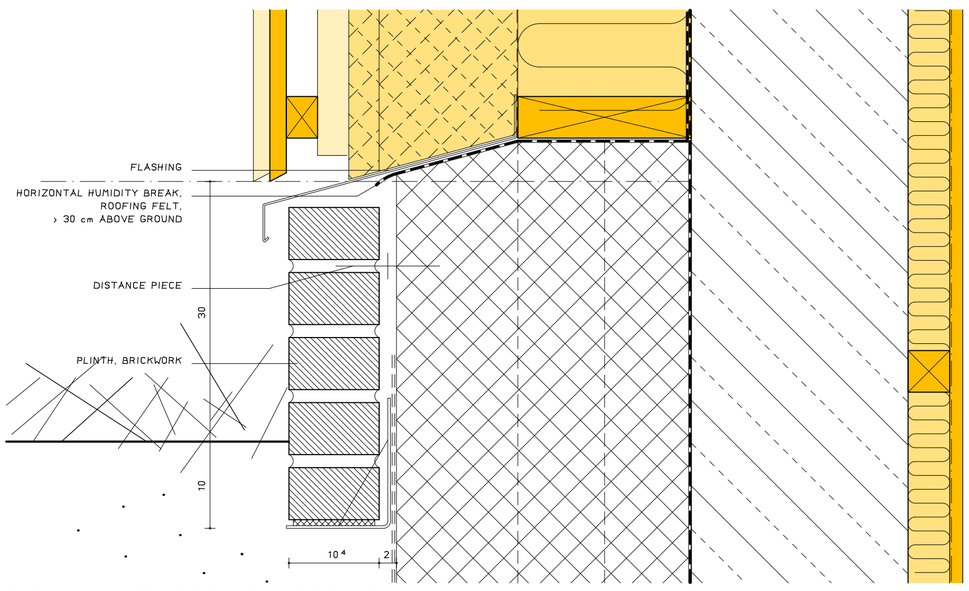


DETAIL WINDOW JAMB FIRST FLOOR 1 : 10

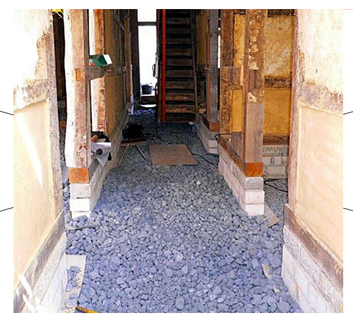


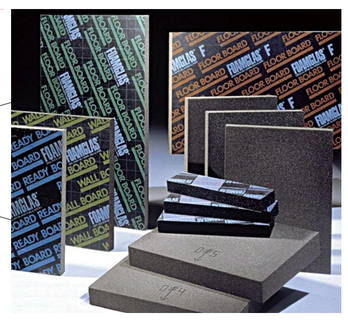
DETAIL WINDOW SILL GROUND FLOOR 1 : 5

DETAIL WINDOW JAMB GROUND FLOOR 1 : 10

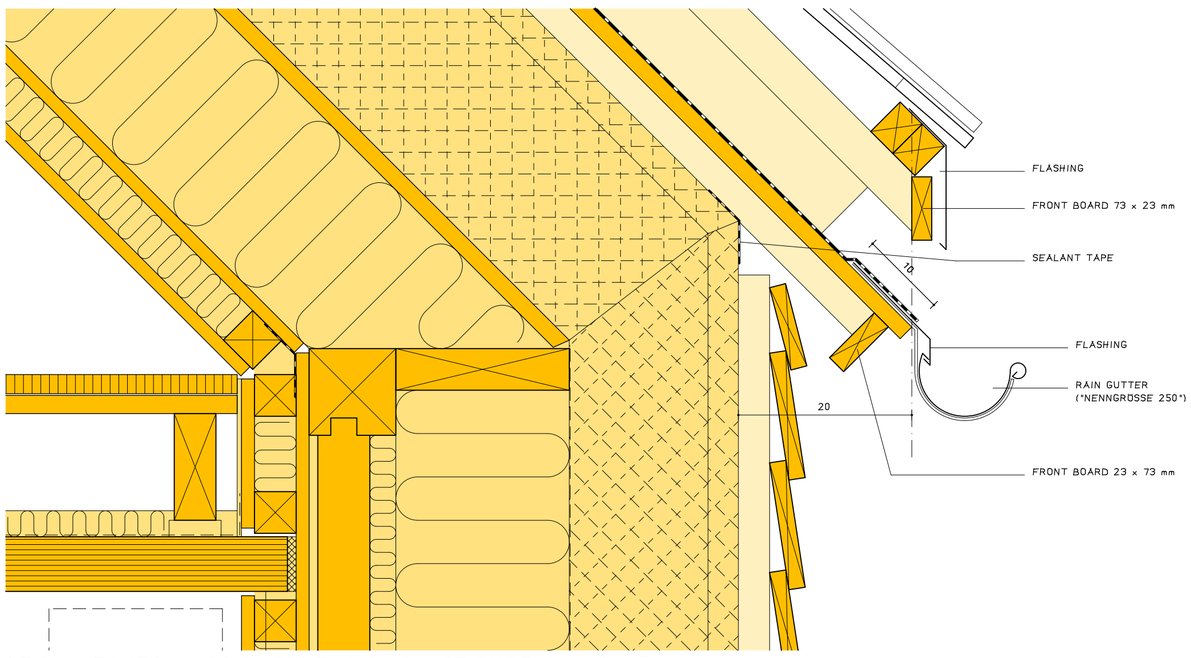


DETAIL PLINTH GROUND FLOOR 1 : 5

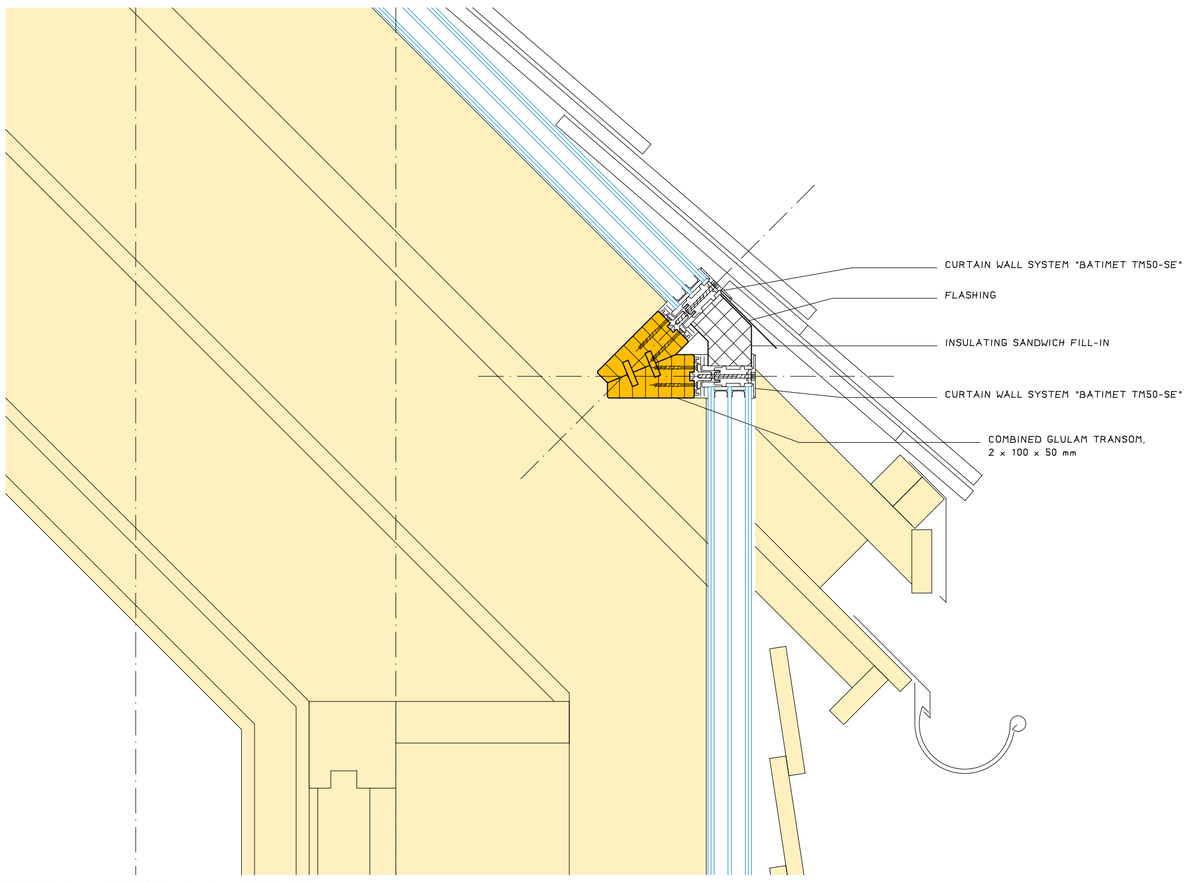




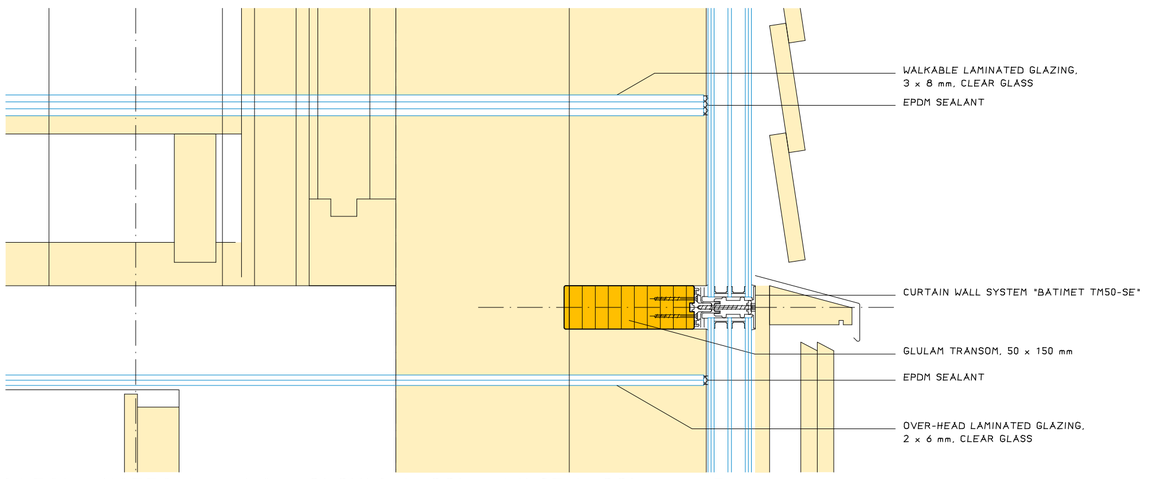
FOAM GLASS / FOAM GLASS GRAVEL



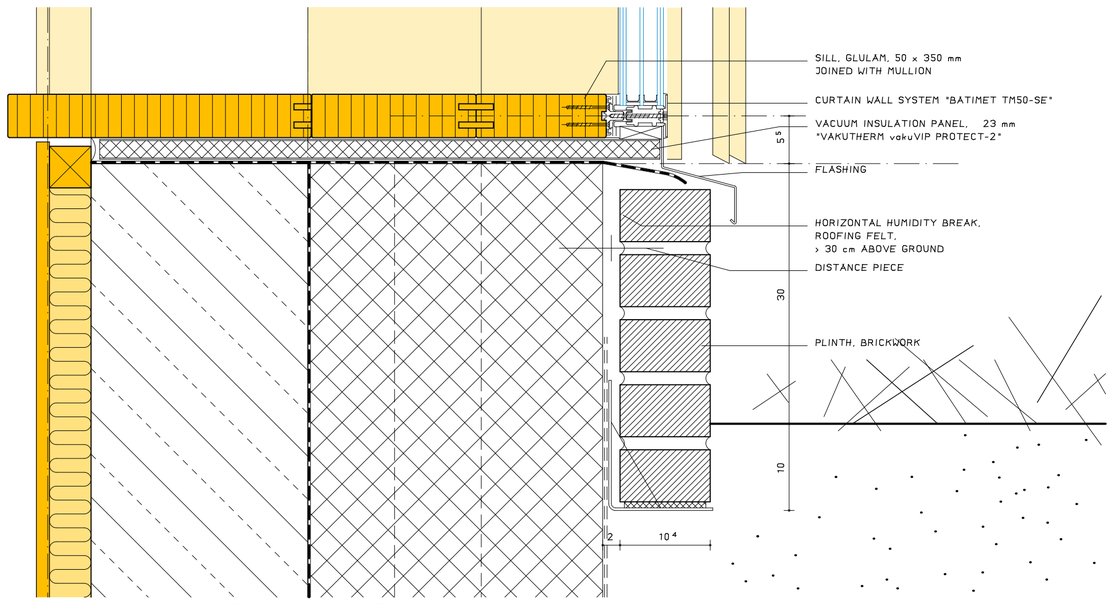
DETAIL EAVES - NORTH ROOF WITH SLATE ROOFING 1 : 5



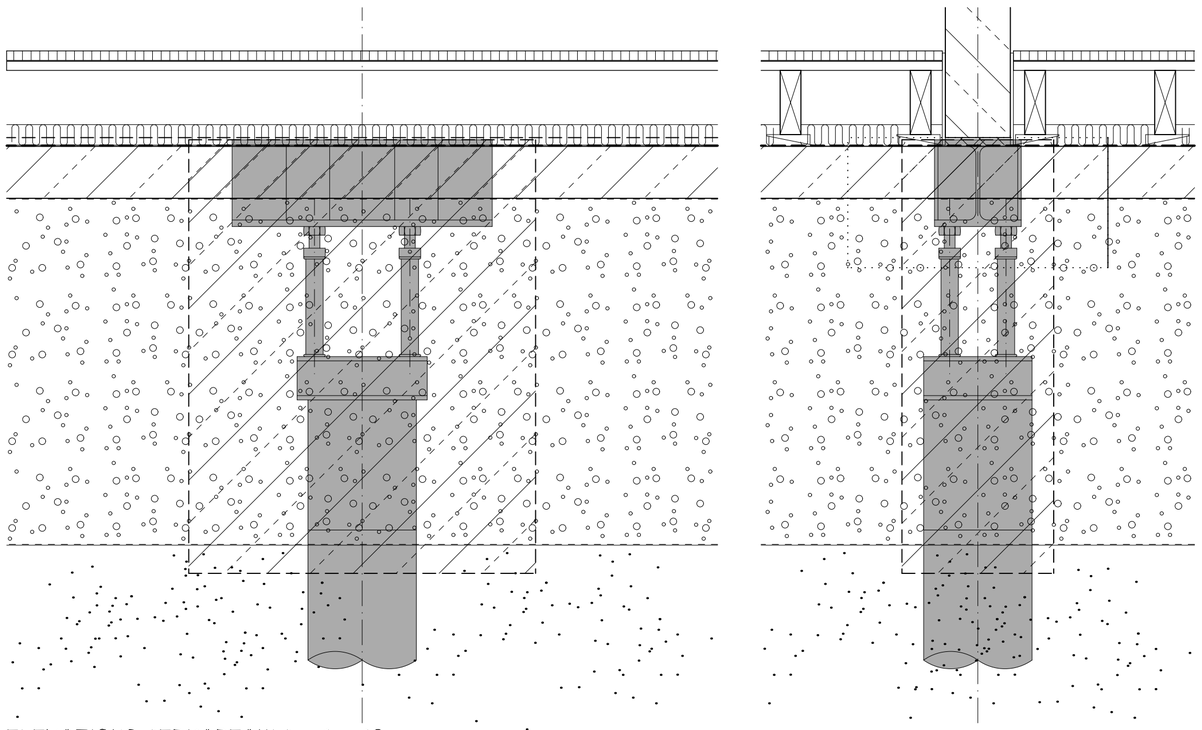
DETAIL "MATTA C." - EAVES 1 : 5



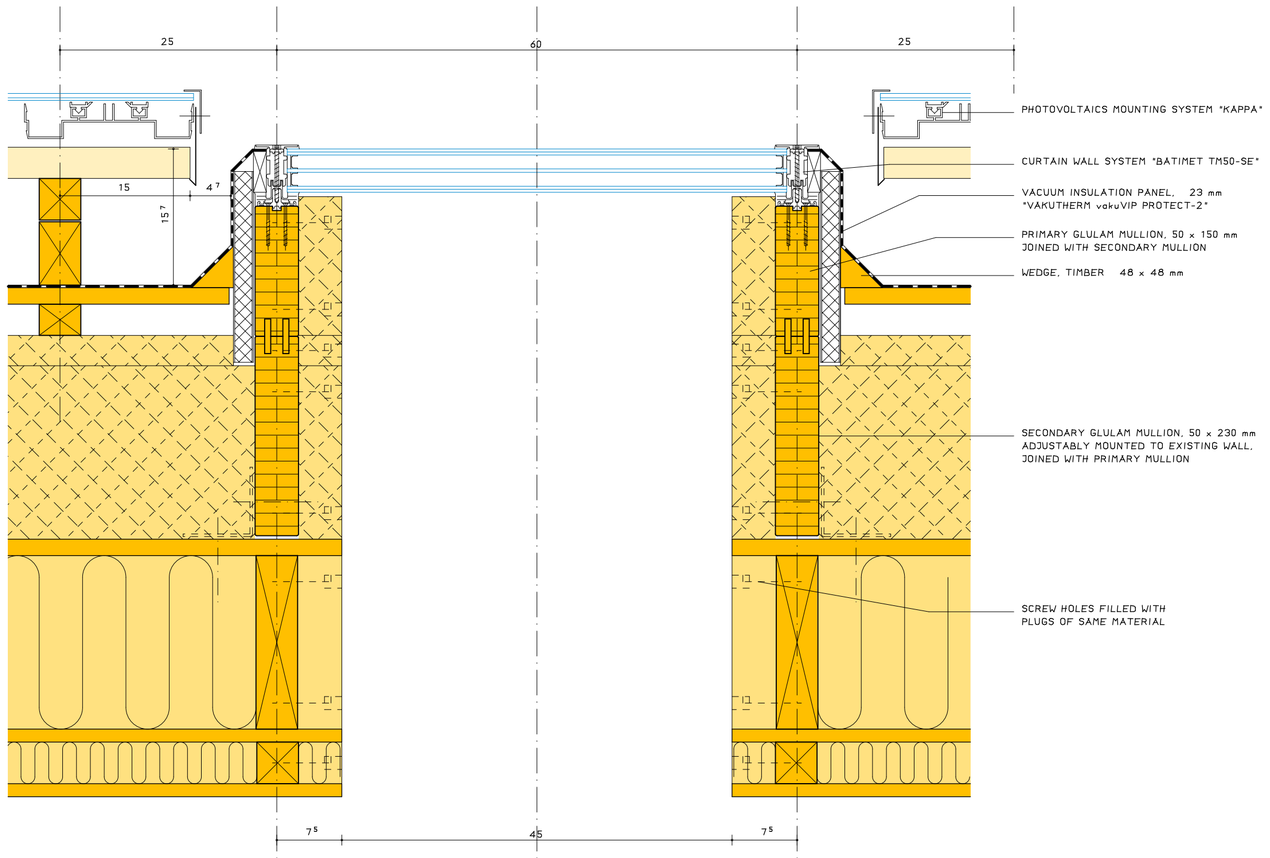
DETAIL "MATTA C." - WALL GROUND FLOOR - FIRST FLOOR 1 : 5



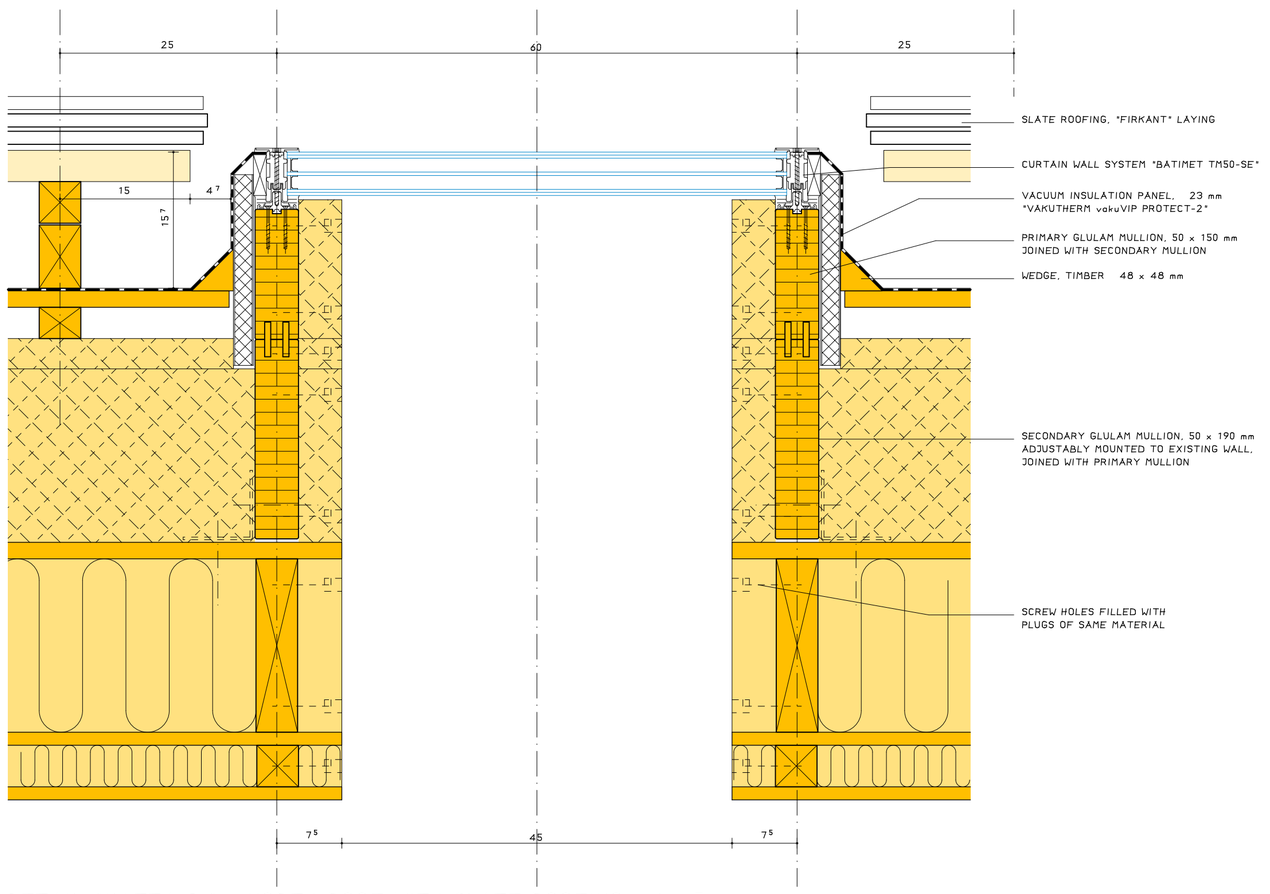
DETAIL "MATTA C." - WALL PLINTH 1 : 5



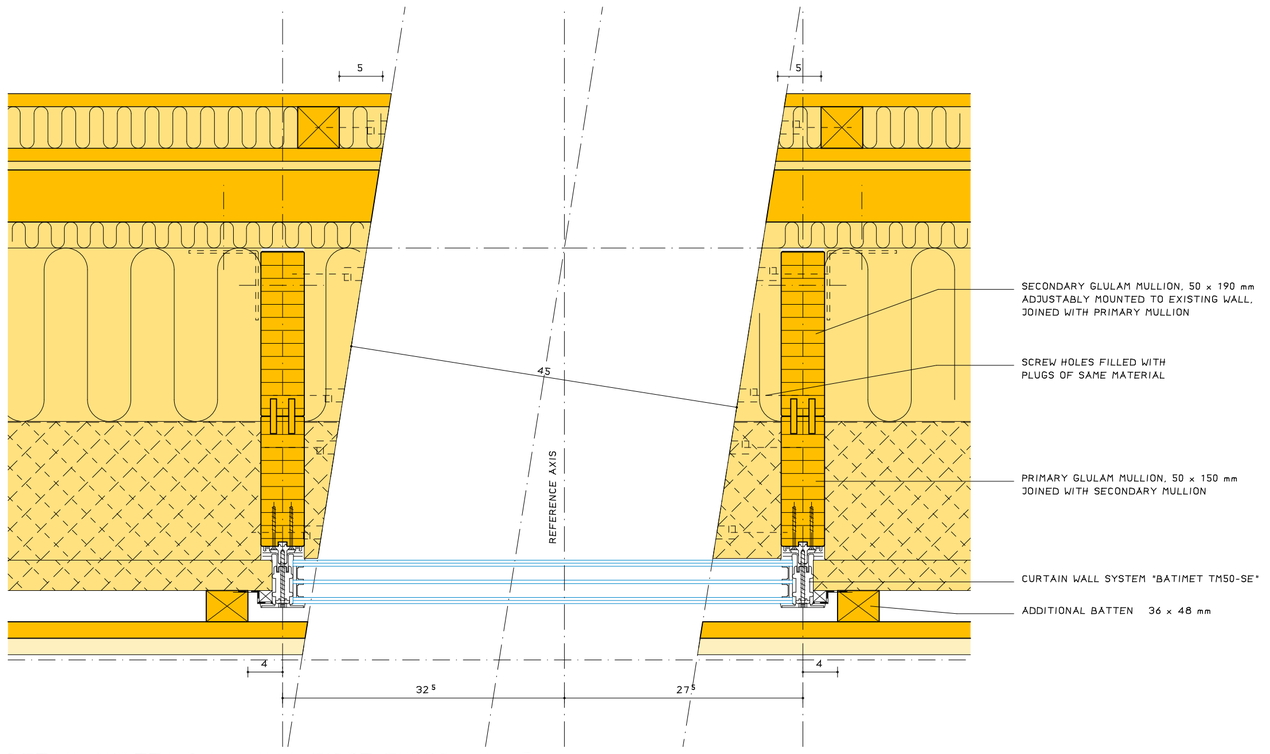
ELEVATIONS "ERKAPFAHL" 1 : 10



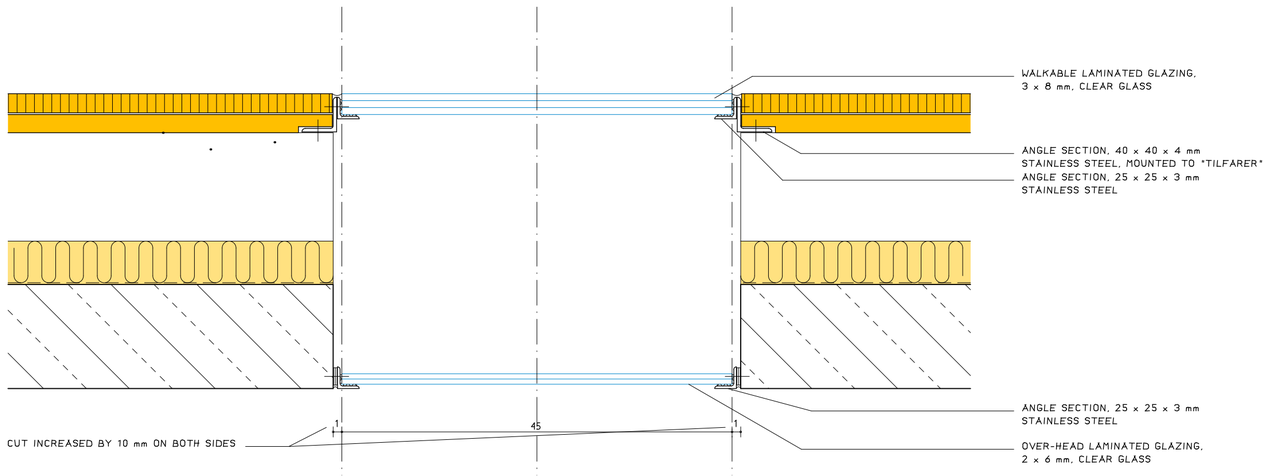
DETAIL "MATTA C." - SOUTH ROOF WITH PHOTOVOLTAICS 1 : 5



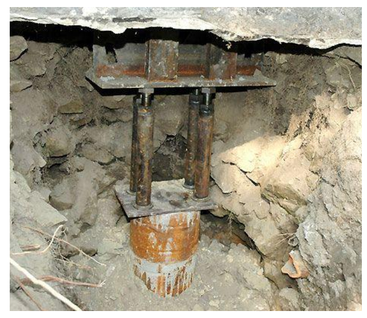
DETAIL "MATTA C." - NORTH ROOF WITH SLATE ROOFING 1 : 5



DETAIL "MATTA C." - WALL FIRST FLOOR 1 : 5



DETAIL "MATTA C." - SLAB GROUND FLOOR - FIRST FLOOR 1 : 5



UNDERPINNING SYSTEM *"ERKAPFAHL"*