Design, Build and Operation of a Passive House for the Purpose of Environmental Education and Nature Observation


R41
Algemeen Stedelijk Ziekenhuis
Molendreef
Posthoornstraat
Marktweg
N9
Sluisken
Siesegemlaan
Zurendries
Sint Jobstraat
Leo de Bethunelaan
Kwalestraat
Kwalestraat
Kwalestraat
Zurendries
Siesegemlaan
R41
Kerkhof

Campus Dirk Martens … http://Aalst.KaHoSL.be

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Aimed purposes

- Spreading the knowledge of sustainable building:
  - own students
  - teachers and pupils
  - in-service training for different groups
- Open to the audience to disseminate of results of our research groups
- Integrating different techniques (soft and hard) in a edicational center
- Coöperation between diffent groups of students
  - Three international building camps
  - Secondary technical school for the realisation
  - Dissertations : master in Industrial Engineering, Erasmusstudents
  - Building similar observation cabins at other locations

ELECTRABELHUT

Electrabel fund for environmental safety 2005

King Baudouin Foundation

Project definition

Build and start a small documentation and educational centre realized with the passive house standard and with ecological and renewable materials

Objectives

- building “Electrabelhut”: dimensions 8m x 8m
- integration research and education
- accessible for public

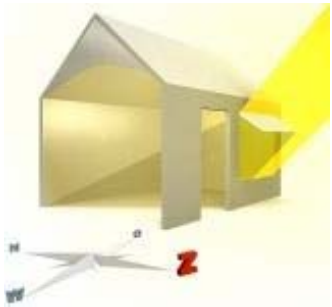

Tyvek
Guest Jeans
DYA
NAVARRA

Theoretical background

Four parameters to obtain a passive concept:

insulation

air-tightness



orientation

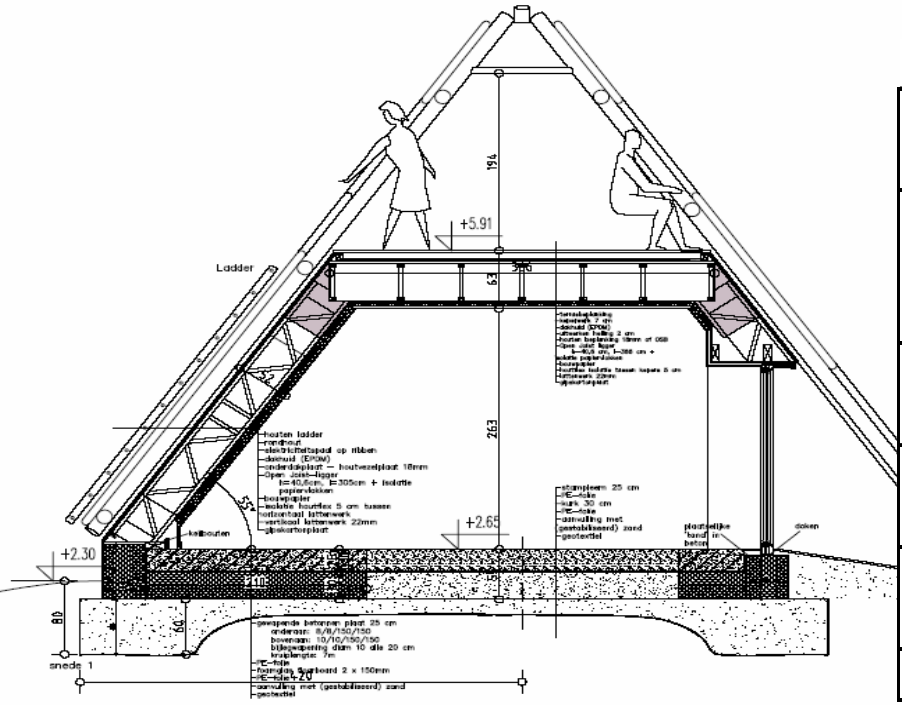
ventilation

Three certificate criteria for a passive house:

- the net energy demand for heating ≤ 15 kWh/m² year
- air-tightness n_{50} ≤ 0,6 h-1 (tested by the blowerdoor test)
- temperature exceeding frequency above 25°C ≤ 5%

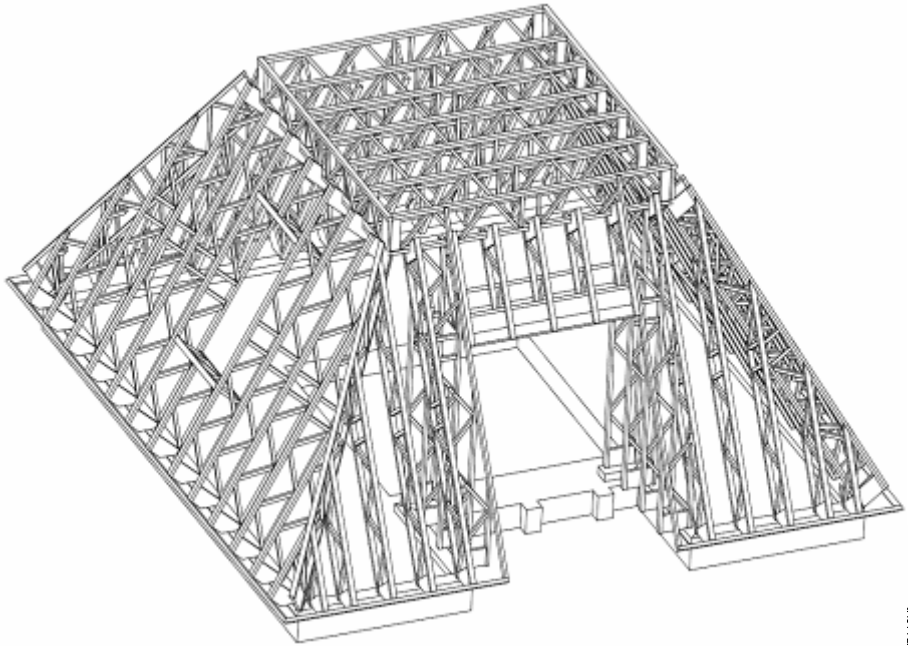
Importance of developing and designing phase

Concept & design: building enveloppe

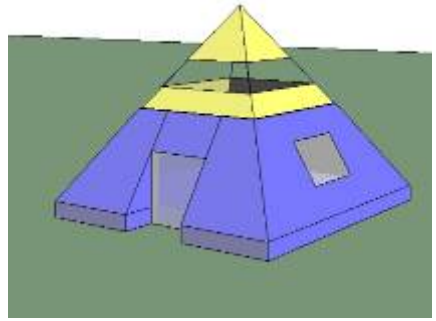


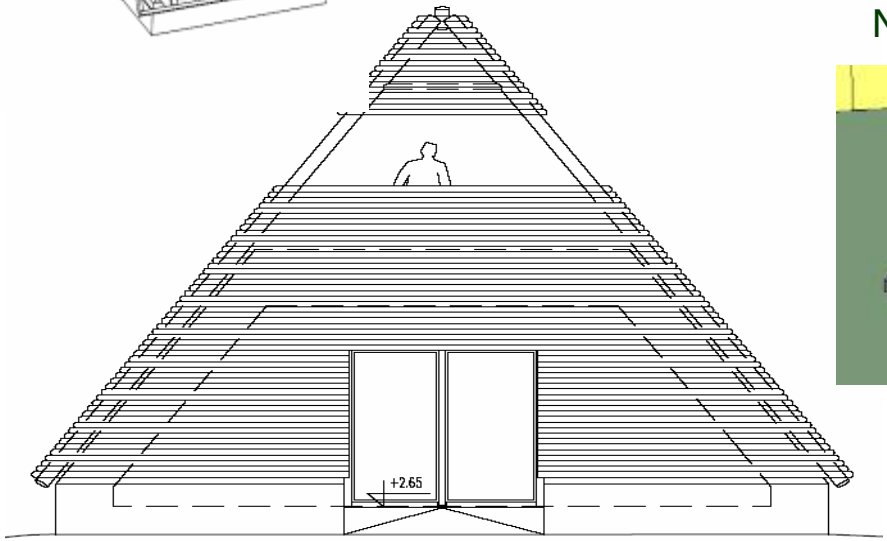
	Components	U [W/m².K]
Groundfloor	30 cm foamglas 20 cm concrete or rammed earth	0,13
Walls ad the bottom	10 cm foamglas 14 cm brick 20 cm foamglas	0,14
Walls	44 cm cellulose 2 cm earth	0,10
Roof	30 cm cellulose 2 cm earth	0,14
Double window with woor frames	Double pane (1.1) Single pane (4.2)	0,8 (g=0.6)
Entrance door	Triple pane (g=0.6)	0,8

Concept & design: oriëntation



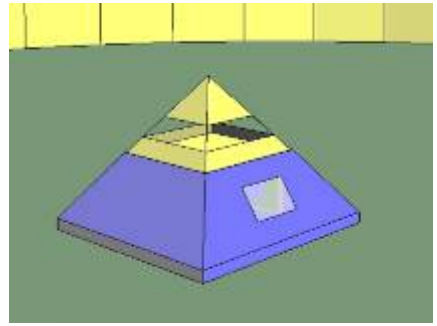
Zuid-Oost zicht





Zuidgevel

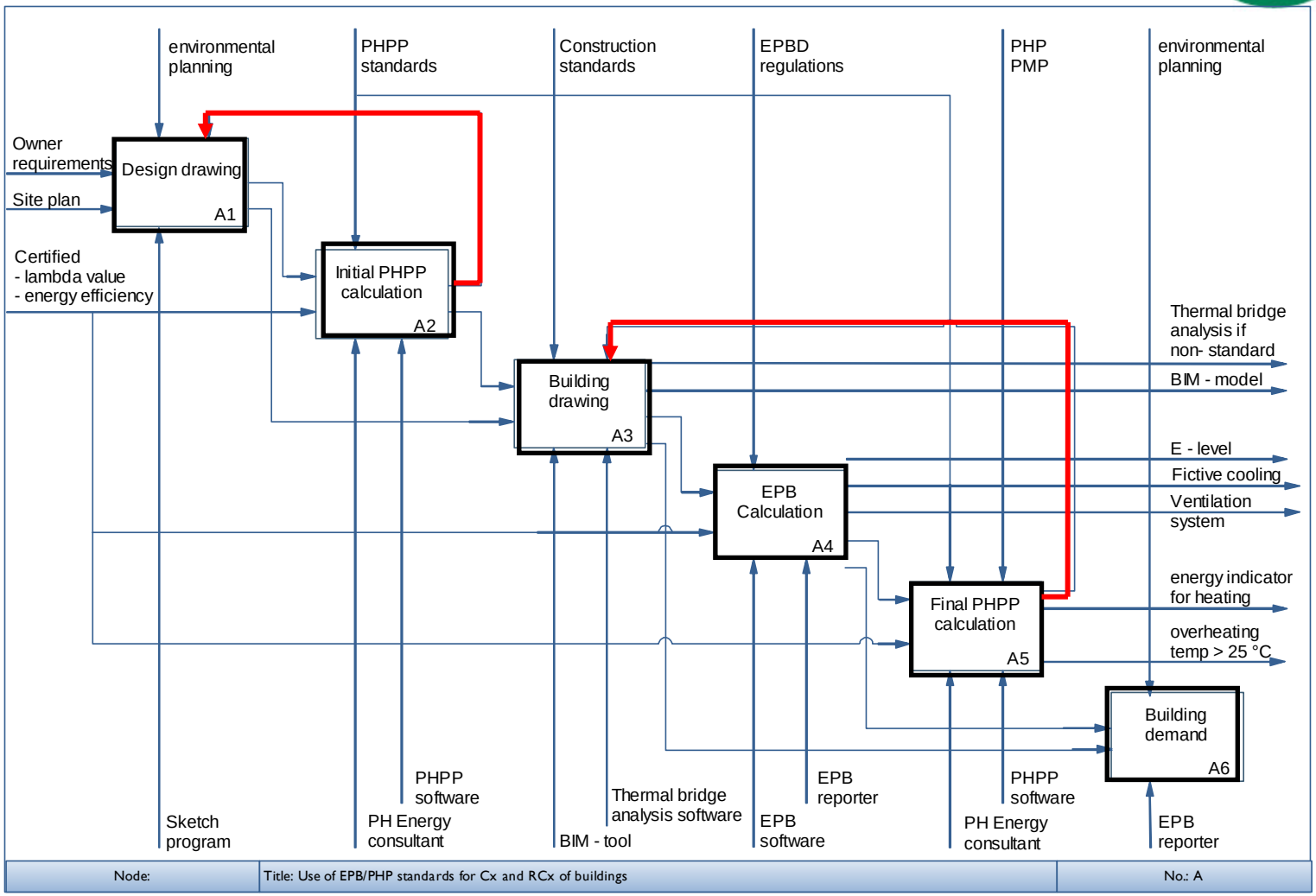
Noord-west zicht



Commissioning team

- Contractors, Engineers, Architect, Supplier, Security manager, …
- Students

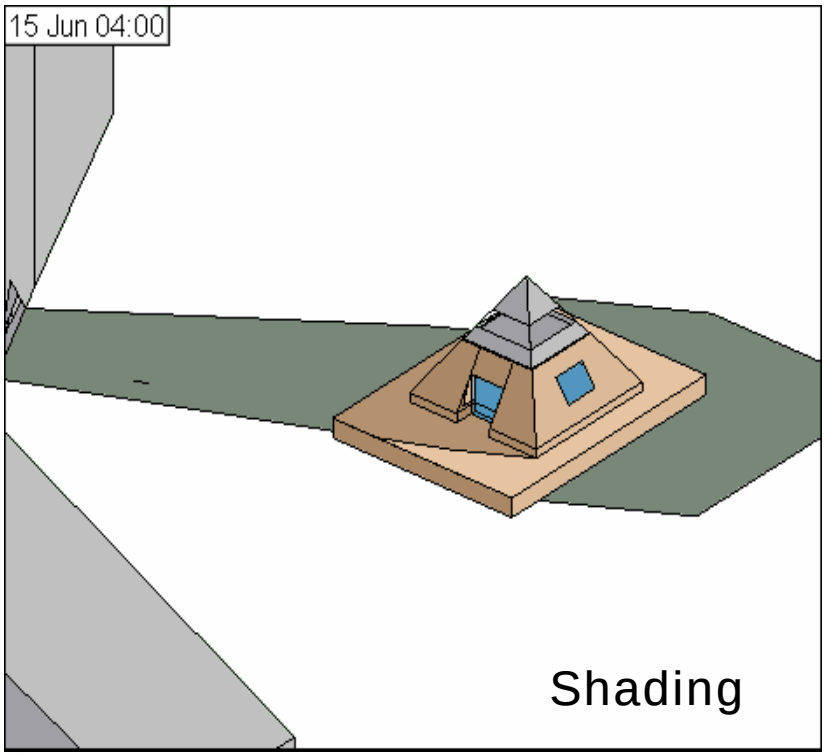
Flowcharts and Data Models

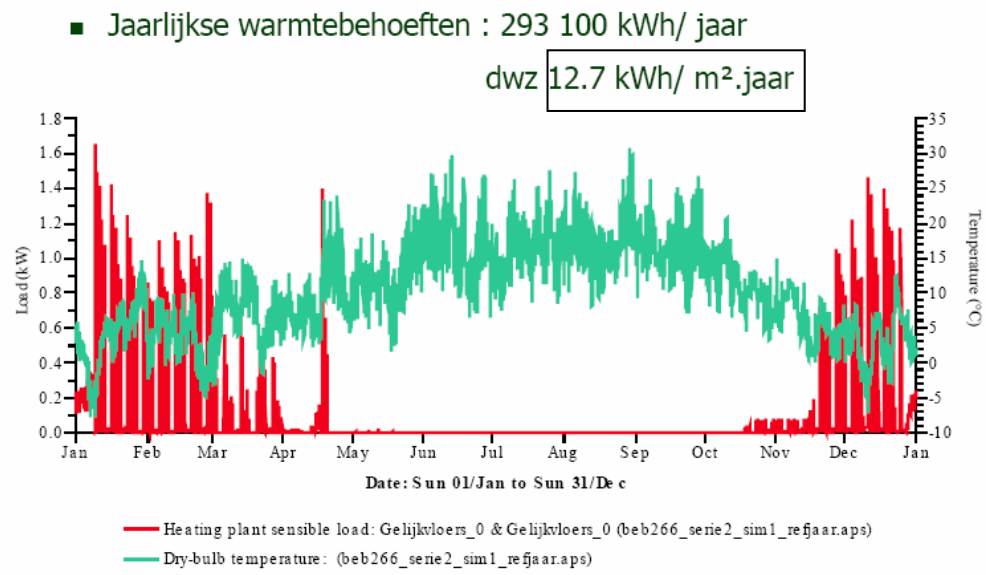


Dynamic simulations of energy performance

-TRNSYS: simulation of the physical and technical characteristics of the building and its equipment using one unique dynamic model

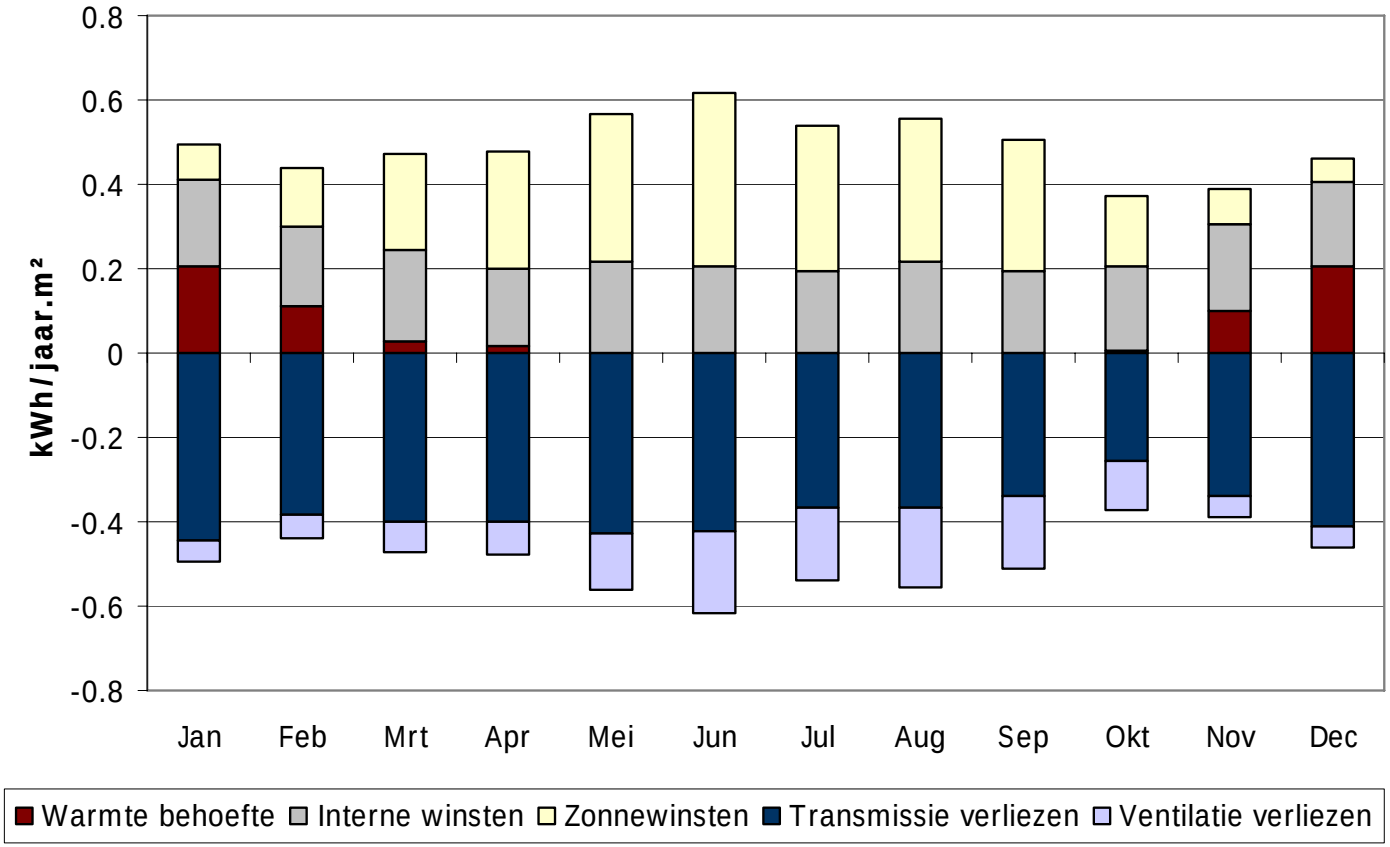
- SOLARIN (Ecofys): to optimise the implantation of different buildings on site-level with respect to the application of active and passive solar energy





Energy demand for heating

Energy Balance



Bestand Help

Projectgegevens | Bibliotheken

selecteer deelproject/subdossier: project1 - electrabelschuilhut

- electrabelschuilhut
  - Ventilatiezone
    - Energiesector
      - oostelijke gevel
      - westelijke gevel
      - zuidelijke gevel
      - noordelijke geve
      - dak
      - vloer

Installaties

- electrabelschuilhut
  - Verwarming en koeling
    - Energiesector
  - Bevochtigingstoestellen
  - Verlichting
    - Energiesector
  - Ventilatie
    - Ventilatiezone
  - Hulpenergie pompen en
  - Hulpenergie ventilatoren
  - Thermische zonne-energ
  - Fotovoltaïsche zonne-en

Hygiënische ventilatie

- electrabelschuilhut
  - Ventilatiezone
    - Energiesector
      - Ruimte 1

Resultaten

- electrabelschuilhut
  - Algemeen
  - Verwarming
    - Energiesector
  - Koeling

E32 K17 Calc

Energiebehoefte voor ruimteverwarming

	jan	feb	mar	apr	mei	jun	jul	aug	sep	okt	nov	dec	totaal	
Transmissieverliezen	778	672	645	467	281	133	69	69	181	384	605	763	5047	[MJ]
Ventilatieverliezen	539	466	447	324	195	93	48	48	126	266	420	529	3499	[MJ]
Interne winsten	466	421	466	451	466	451	466	466	451	466	451	466	5489	[MJ]
Zonnewinsten	207	339	591	818	1056	1070	1052	974	767	509	260	163	7805	[MJ]
Benuttingsfactor	0,9324	0,8792	0,7653	0,5581	0,3122	0,1485	0,0769	0,0811	0,2517	0,5869	0,8697	0,9396		[-]
Netto energiebehoefte	690	469	284	83	0	0	0	0	0	78	406	702	2711	[MJ]
Systeemrendement	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00		[-]
Bruto energiebehoefte	690	469	284	83	0	0	0	0	0	78	406	702	2711	[MJ]
Opwekkingsrendement	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00		[-]
Eindenergieverbruik	690	469	284	83	0	0	0	0	0	78	406	702	2711	[MJ]

Onvolledige invoer voor volgende gegevens:

EPB-software

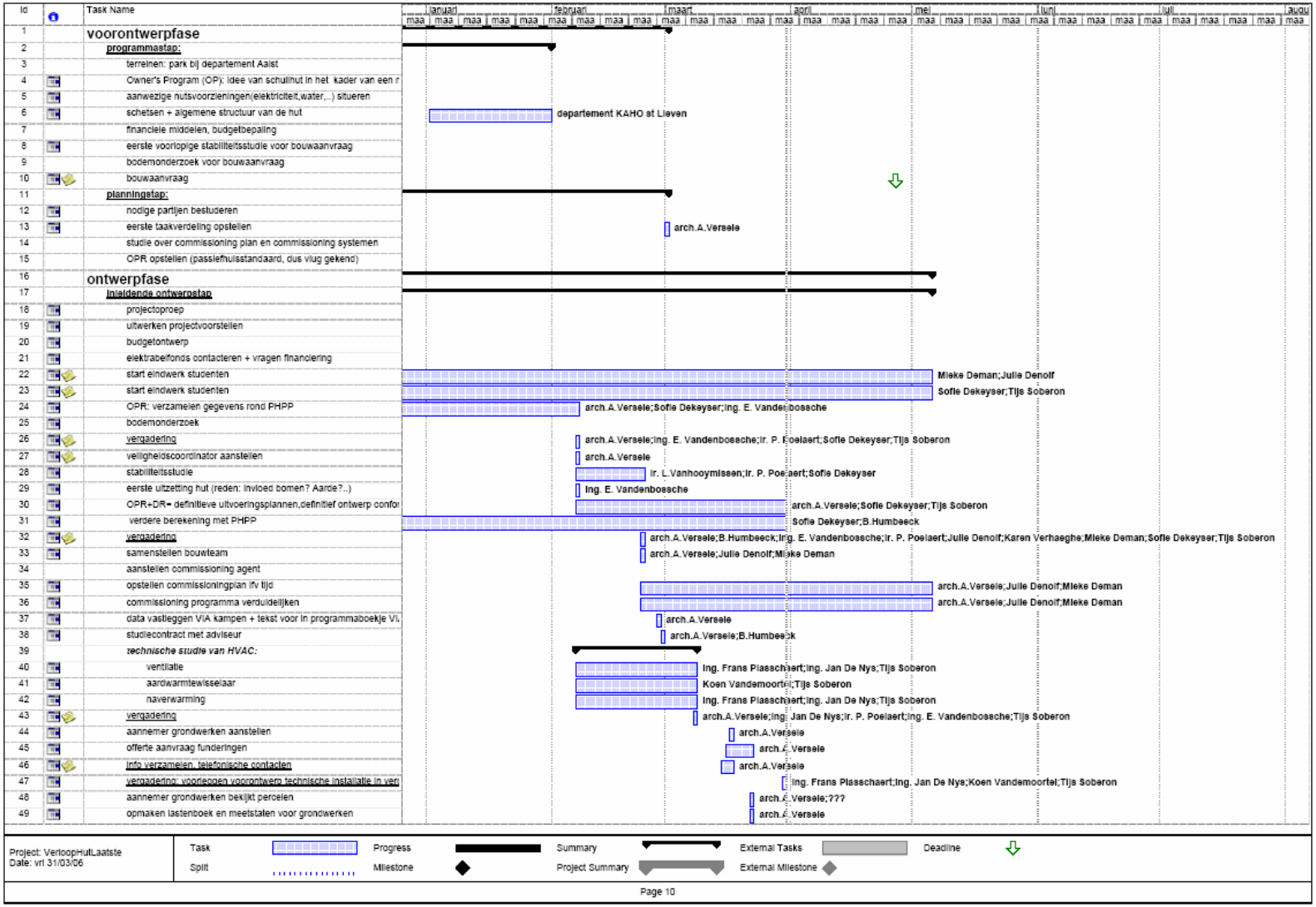
Werking software

Handleiding bij versie 1.0

Decysis, februari 2006

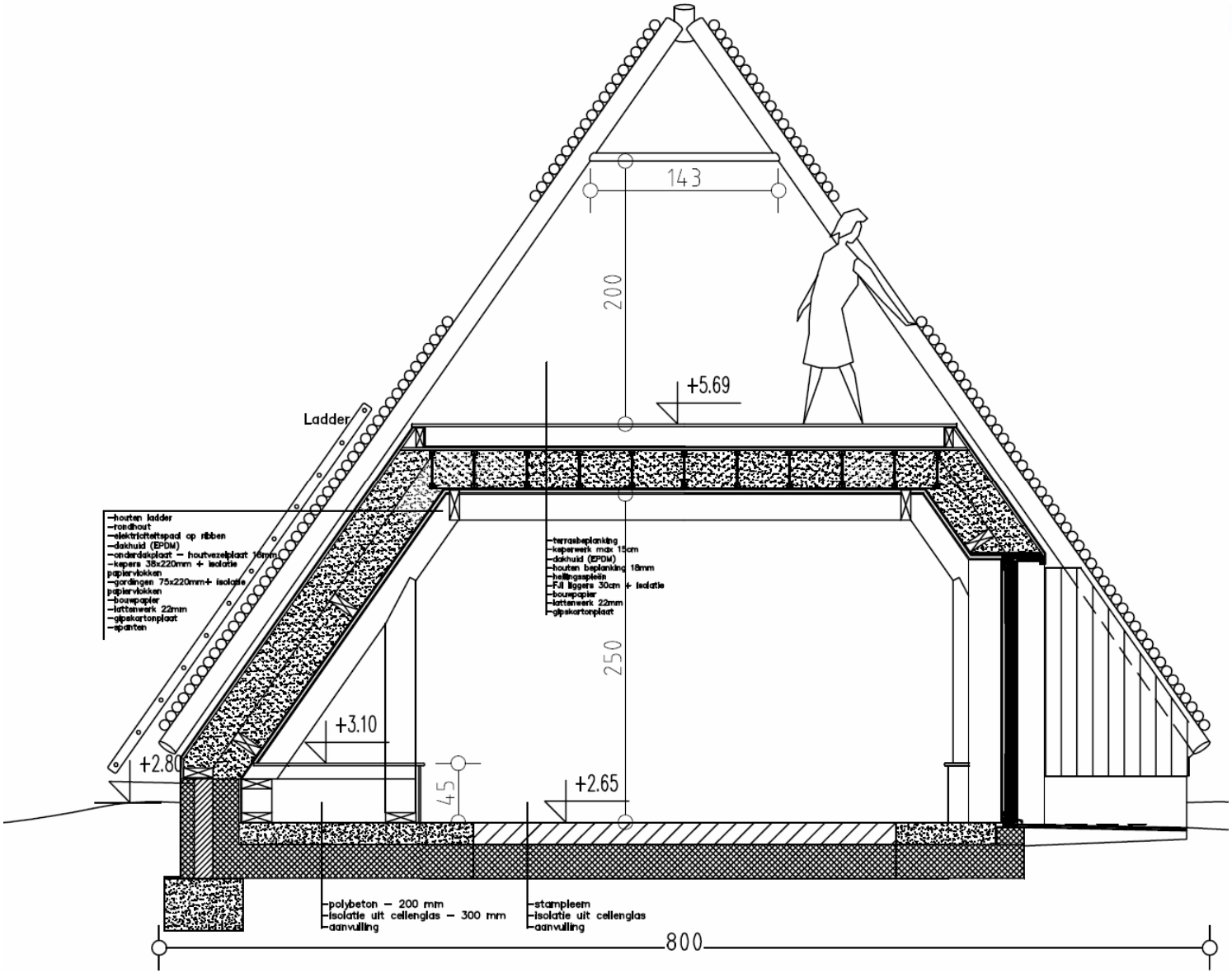
epb

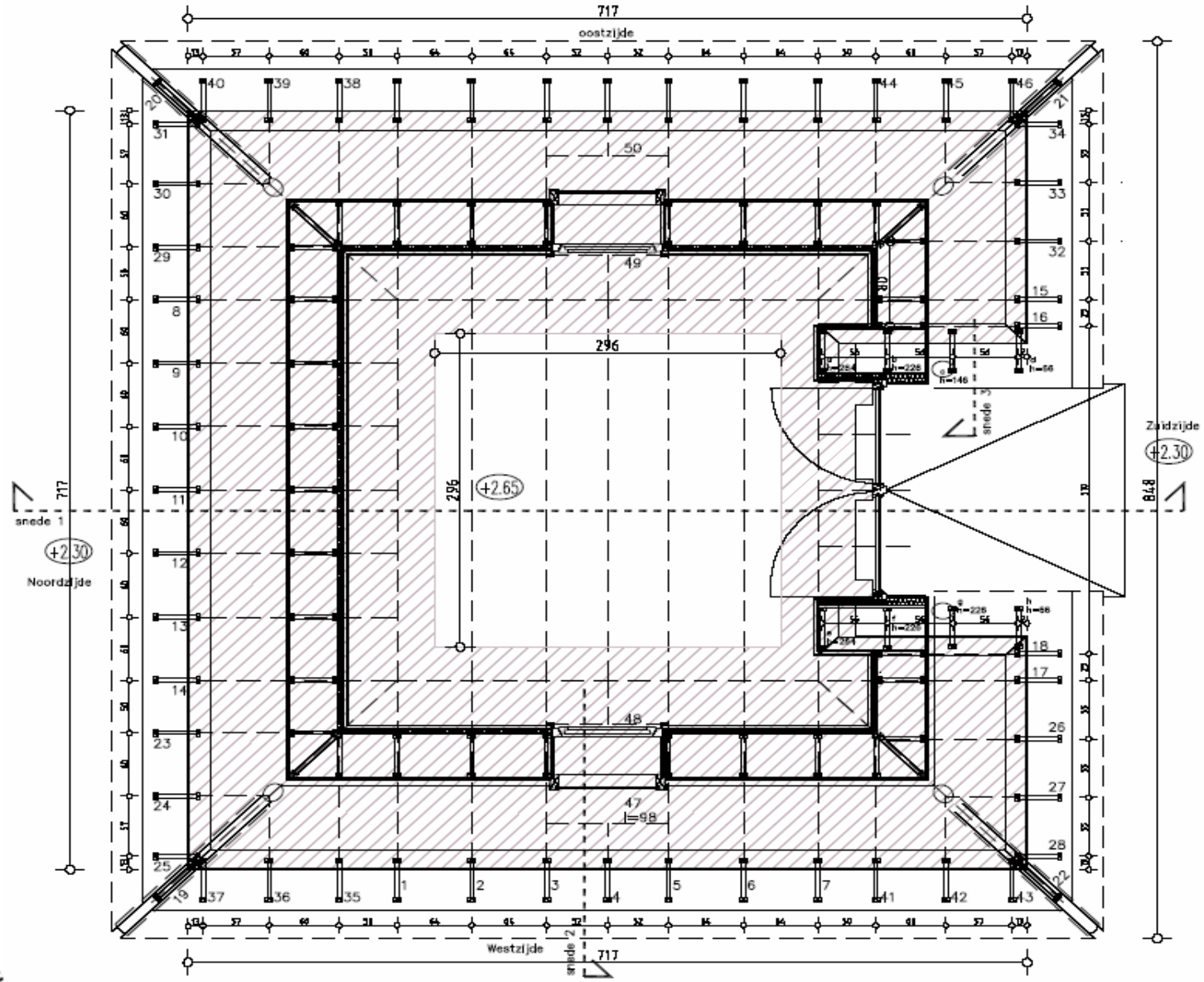
Project planning



Building procedure and details

Ground works


143
200
+5.69
Ladder
-houten ladder
-rondhout
-elektricitetsspoel op ribben
-dakhuid (EPDM)
-onderdakplaat – houtvezelplaat 18mm
-kepers 38x220mm + isolatie
papiervlokken
-gordingen 75x220mm+ isolatie
papiervlokken
-bouwpapier
-lattenwerk 22mm
-gipskartonplaat
-spanten
-terrasbeplanking
-keperwerk max 15cm
-dakhuid (EPDM)
-houten beplanking 18mm
-hellingsspleïen
-FJI liggers 30cm + isolatie
-bouwpapier
-lattenwerk 22mm
-gipskartonplaat
250
+3.10
+2.80
45
+2.65
-polybeton – 200 mm
-isolatie uit cellenglas – 300 mm
-aanvulling
-stampleem
-isolatie uit cellenglas
-aanvulling
800


717
oostzijde
296
+2.65
snede 1
+2.30
Noordzijde
Zuidzijde
+2.30
848
Westzijde
snede 2
717

Layer of stabilized sand – PE-foil

Central gap 2,5 m by 2,5 m – later stage cork layer with above a loam floor

Uneveness of concrete slab – wooden base plate combined with a High Pressure Laminate

Prefabricated trusses are placed


Tyvek

Visually closing the pyramid

Water proofness: epdm rubber
Joints were closed by welding, using warm air of 600°C

Cabinet-making: four windows, one door

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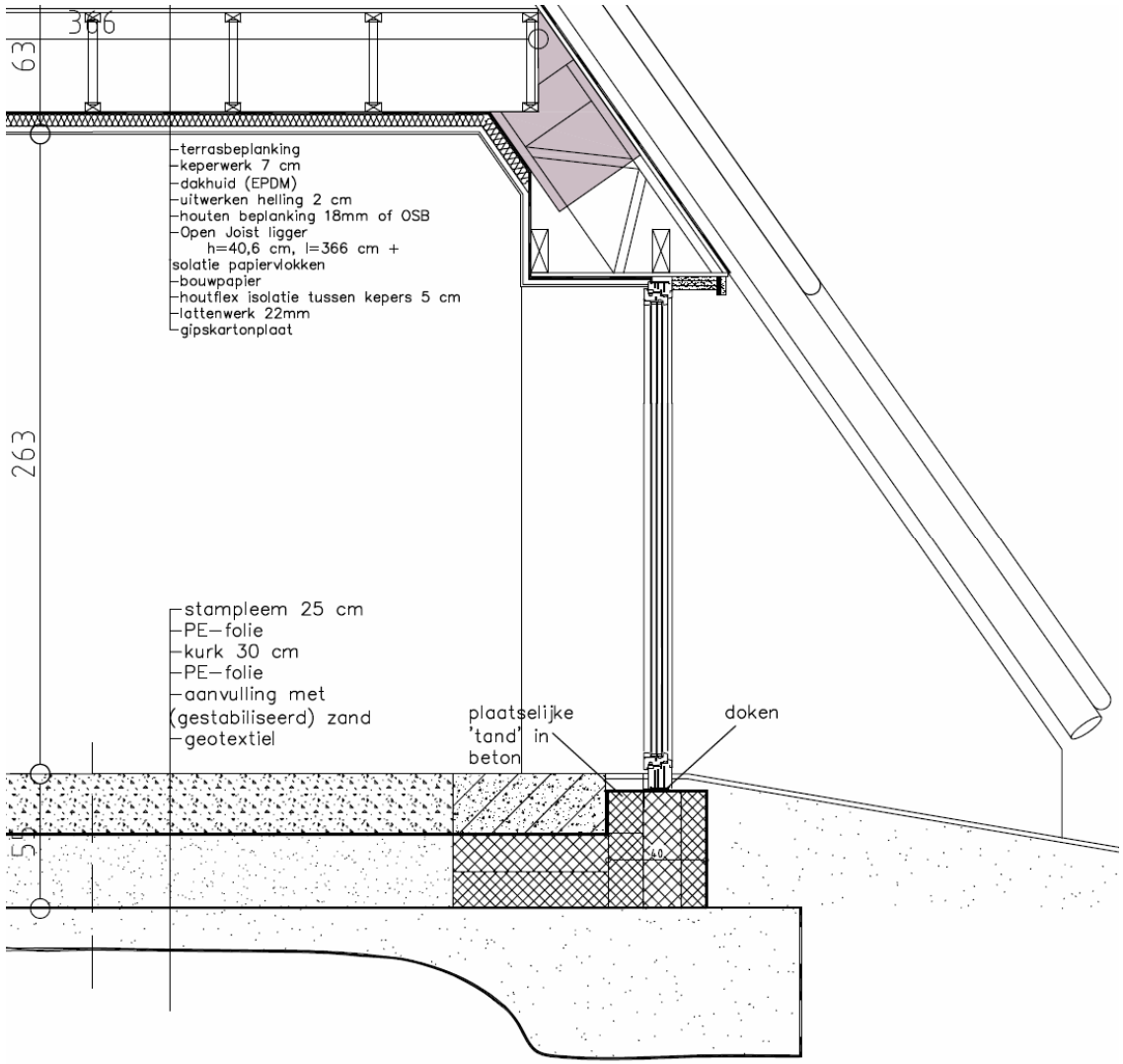
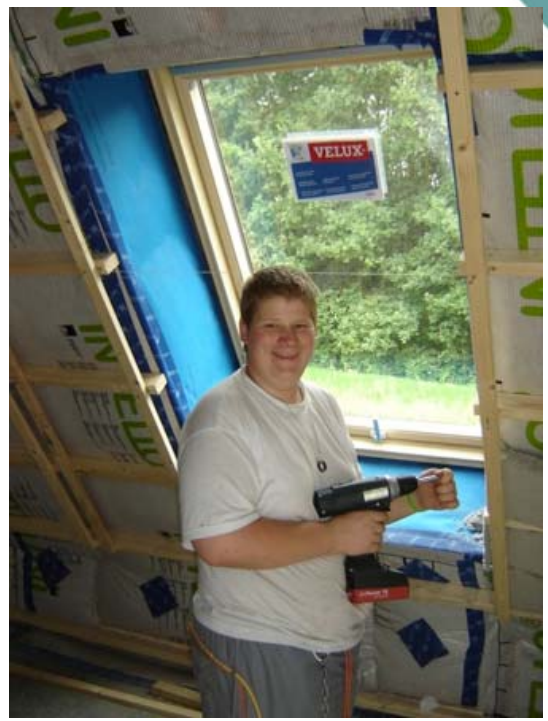
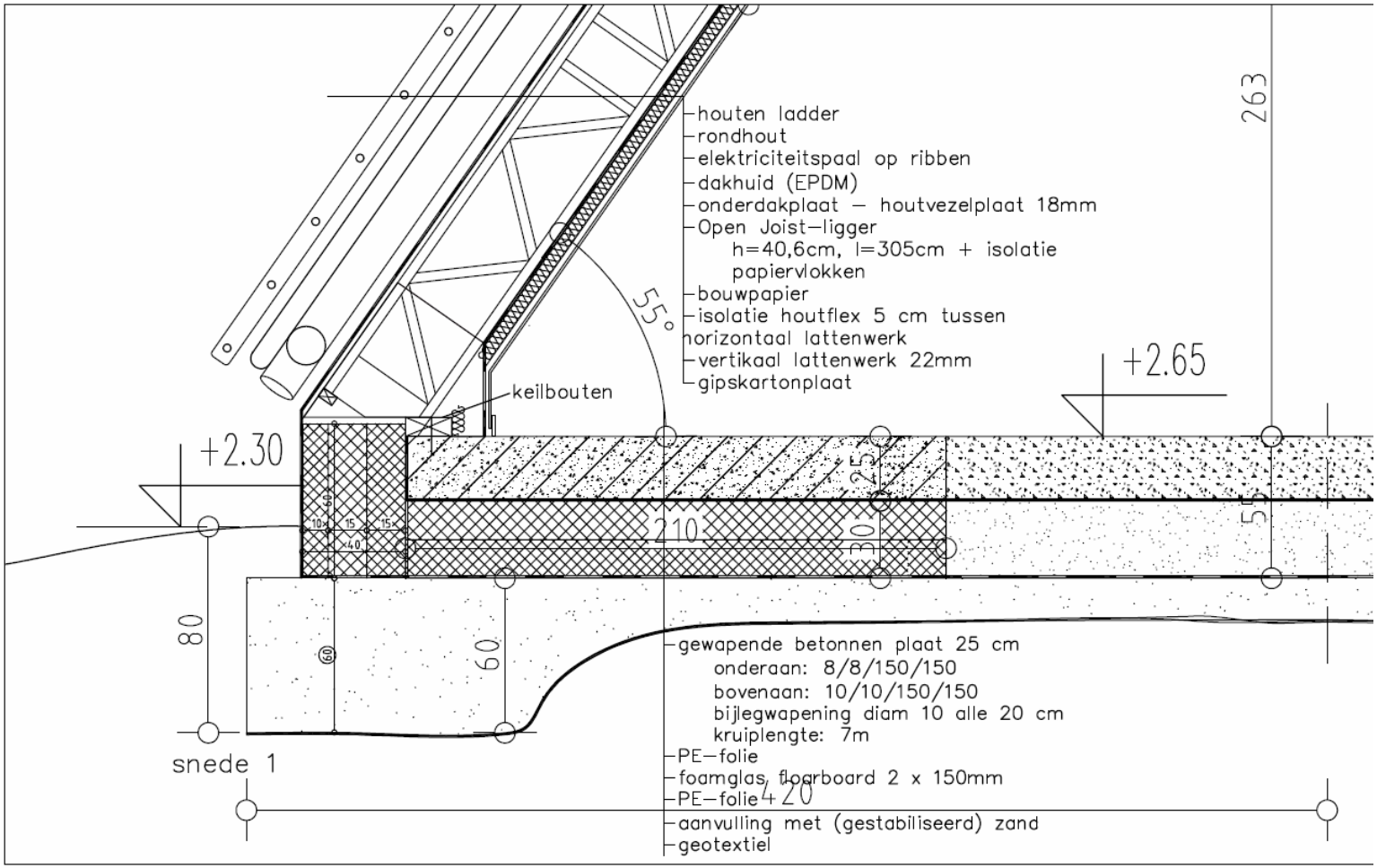


Cabinet-making: four windows, one door



Intello vapour retarder – isofloc cellulose insulation

Detail insulation: foamglass – isofloc insulation



September 2007: Passive cabin was set on fire

September 2007: Passive cabin was set on fire

September 2007: Passive cabin was set on fire

Cooperation with VTI, 7th year cabinet-making

November 2007: Rebuilding of the passive cabin

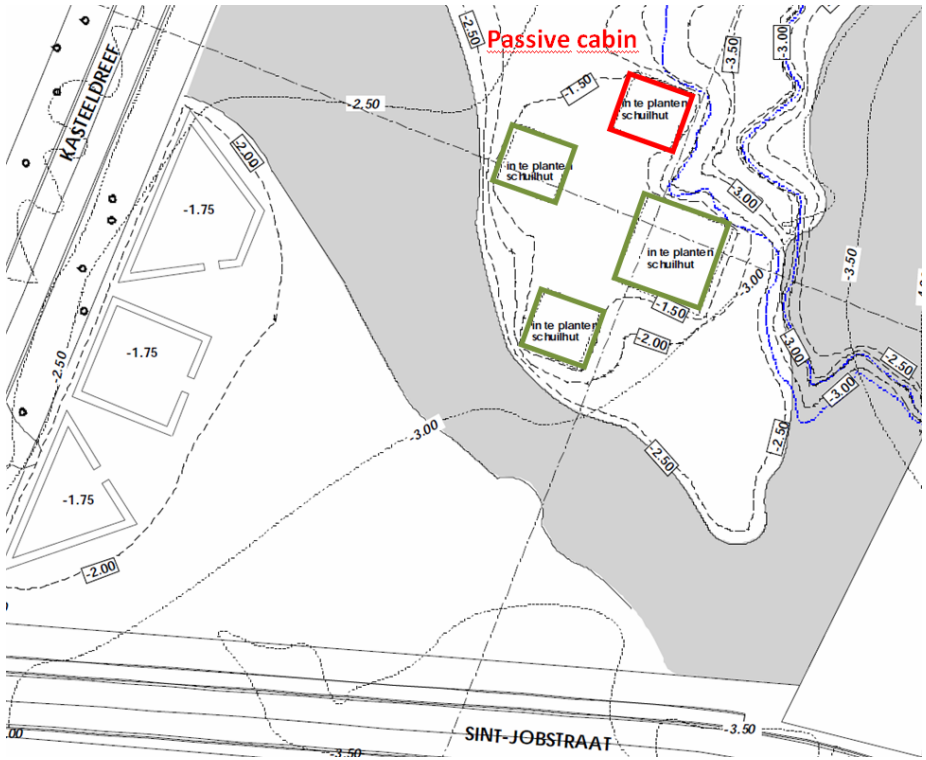
Whole procedure of 2007 was repeated
Added: four tree trunks – wooden pillars – cellulose inside – Fermacell plates

Future plans

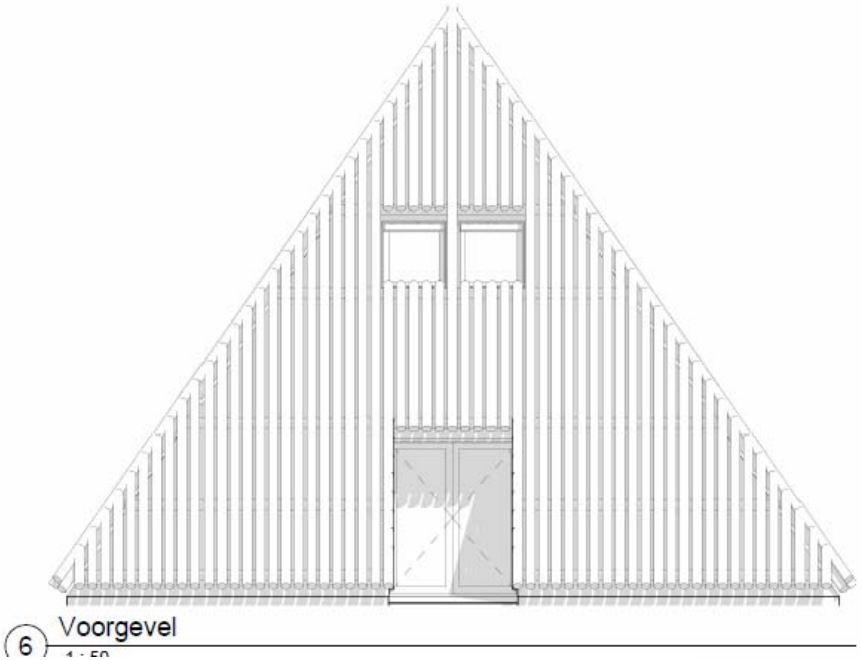
Placing ventilation unit (mechanical in – mechanical out)

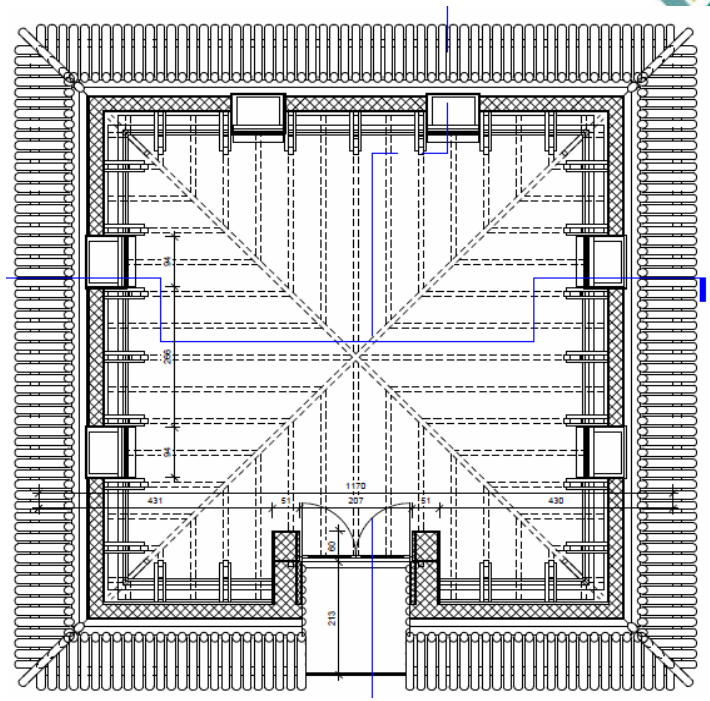
Placing sensors (temperature, lighting, occupation, …)

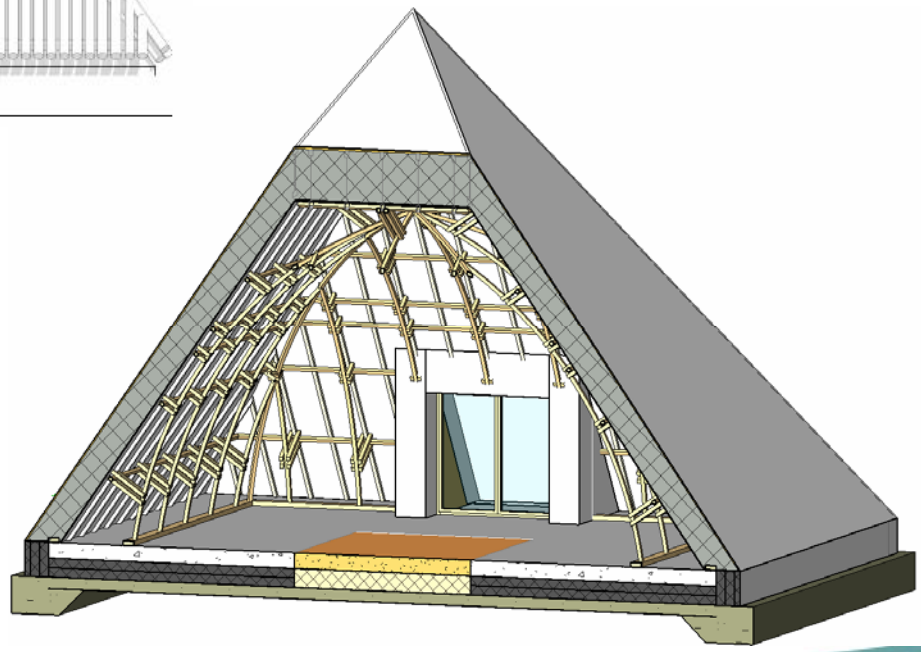
Constructing three other pyramids



Low energy cabin







Inside height of 6m

Square 12m - 12m

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