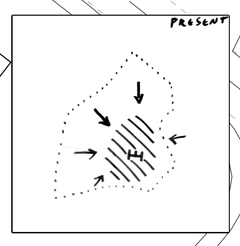
BRØSET CLIMATE CENTRE

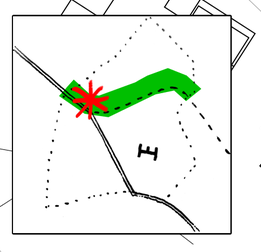
AAR 4546 ZEB DESIGN

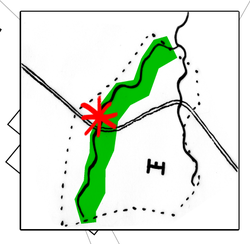
Kristof Lijnen, Vegard Heide, Michael Gruner

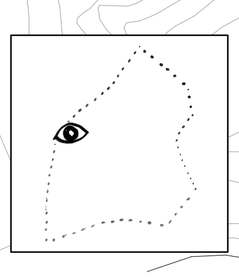
"Connected isolation"



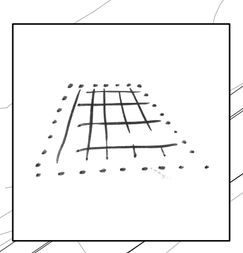
Focal point and attractor

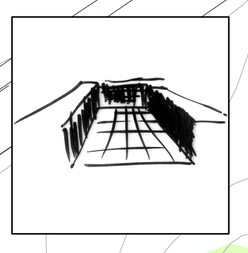


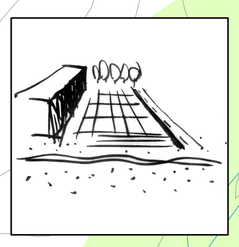


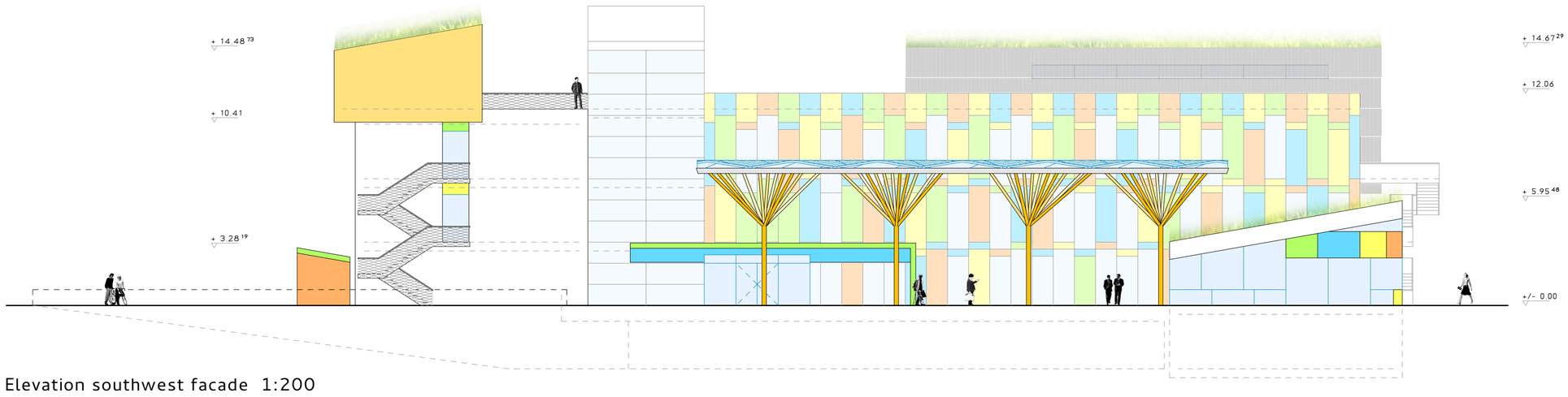


Square

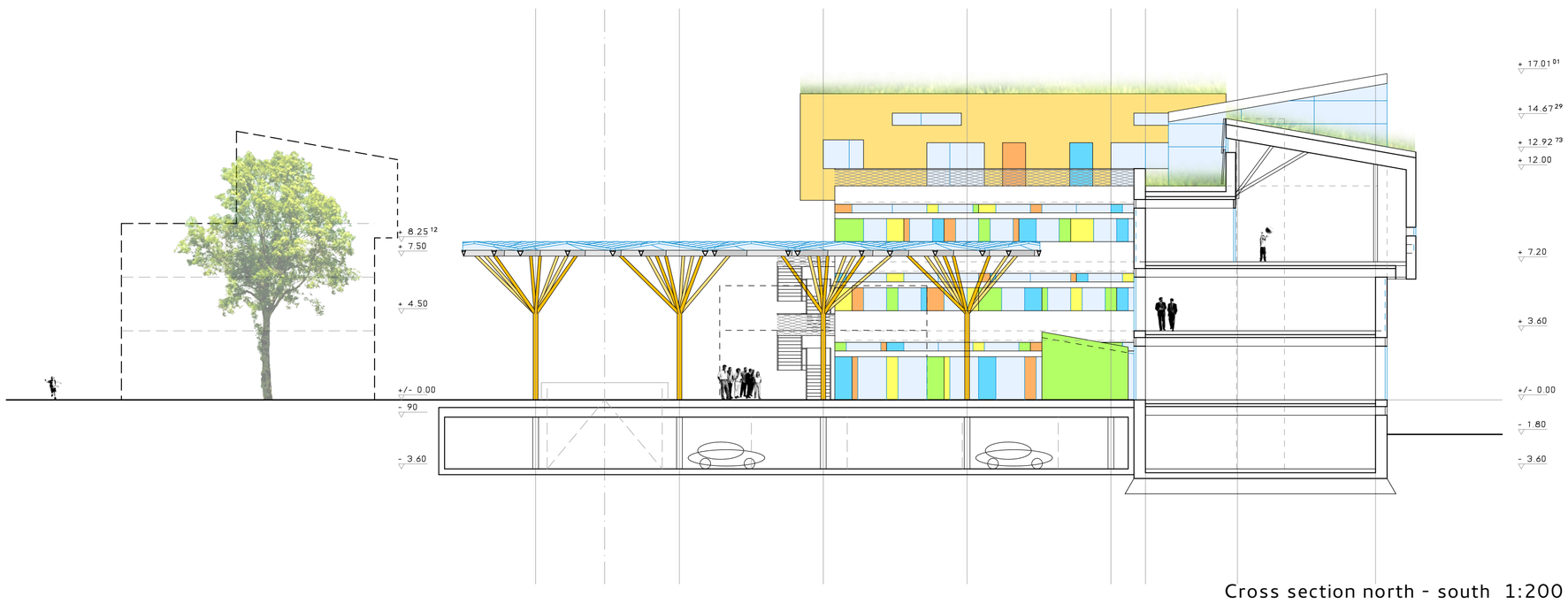








Elevation southwest facade 1:200

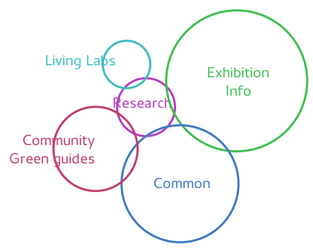


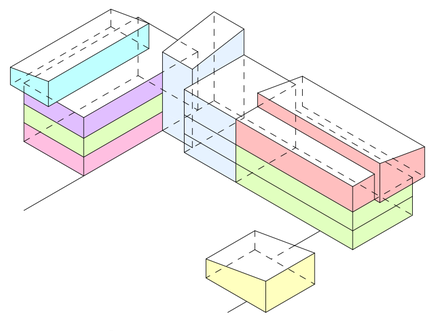
Cross section north - south 1:200

Concepts

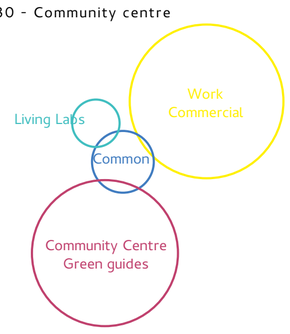
Change over lifetime

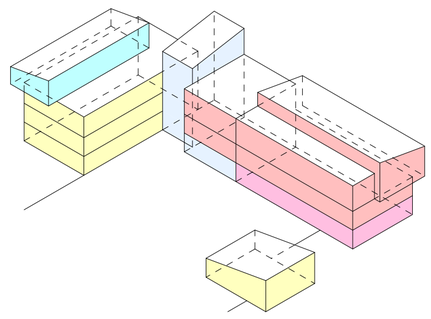
2012 - Exhibition and research





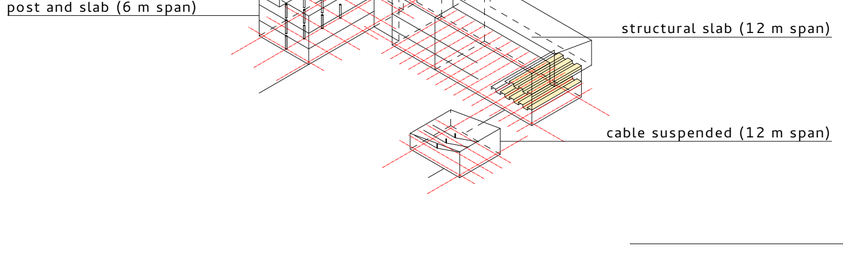
2030 - Community centre



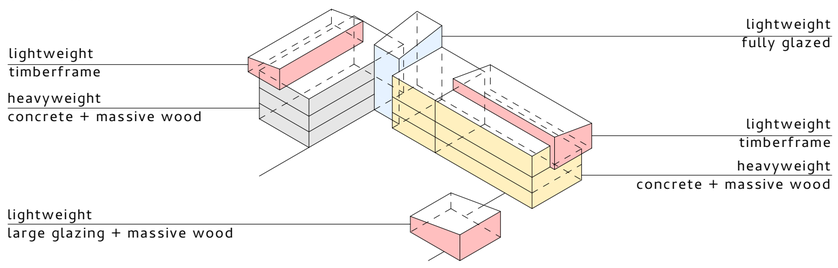


Differentiation of buildings

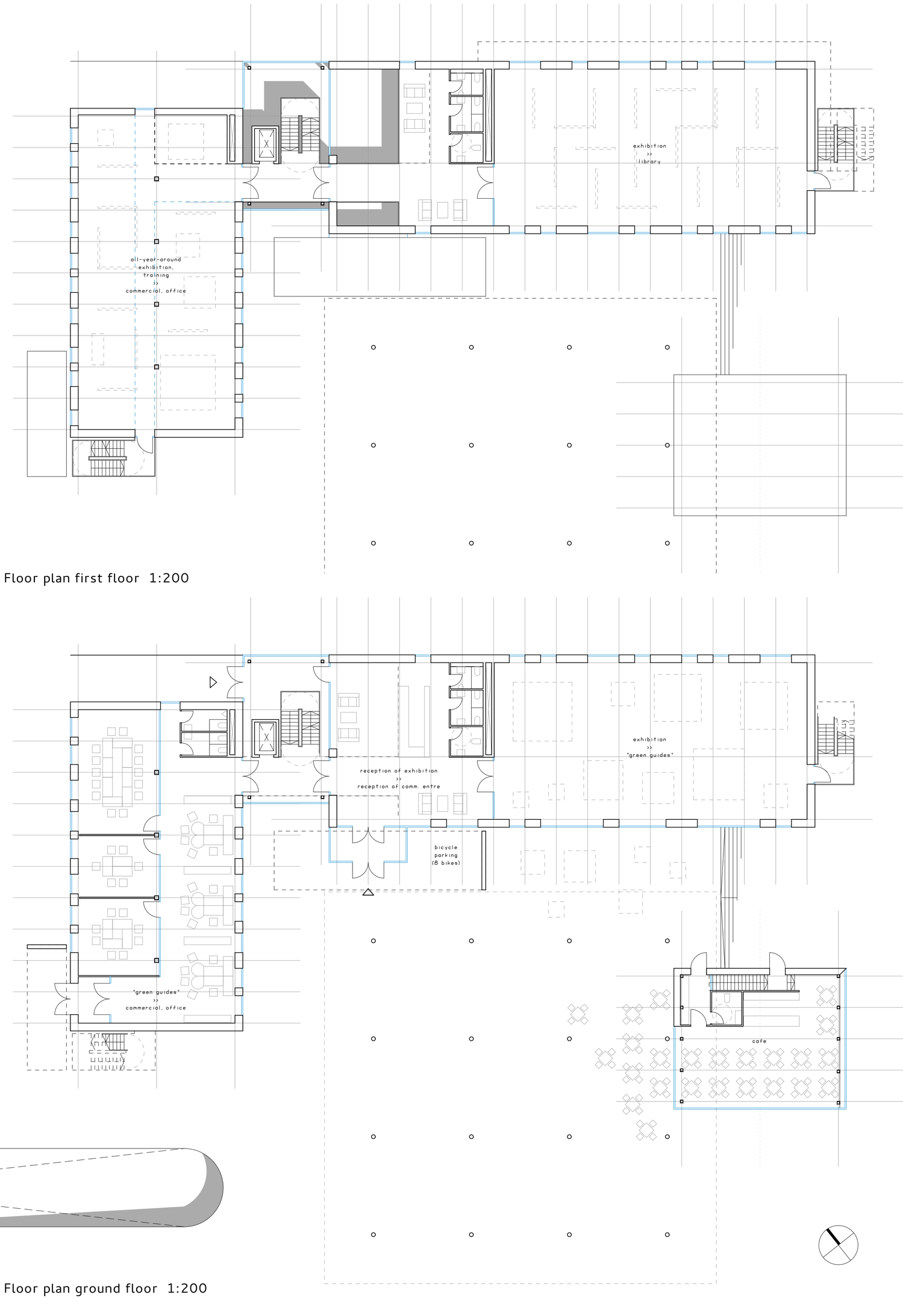
Zoning



Construction

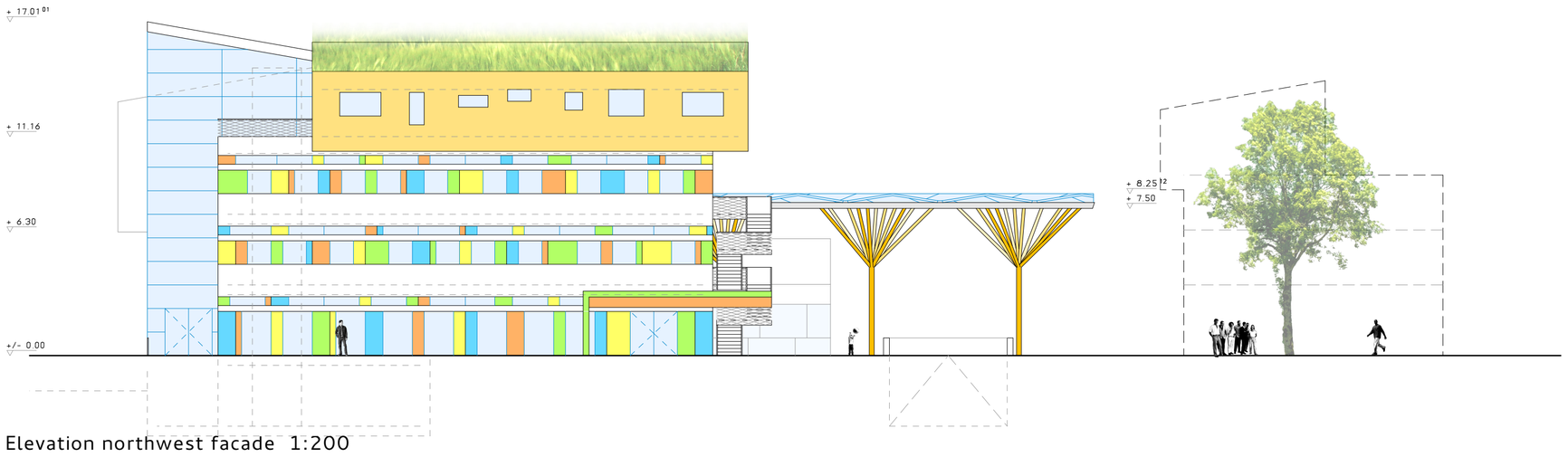


Structural systems



Floor plan first floor 1:200

Floor plan ground floor 1:200

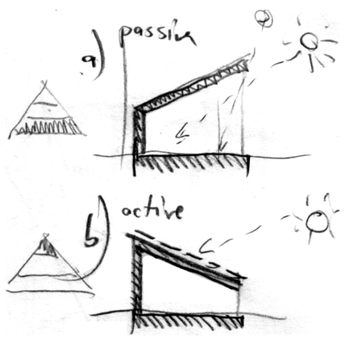


Elevation northwest facade 1:200

Cross section east - west 1:200

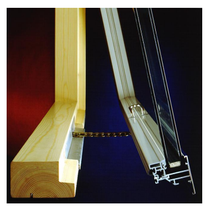
Strategies

Passive solar vs. active solar



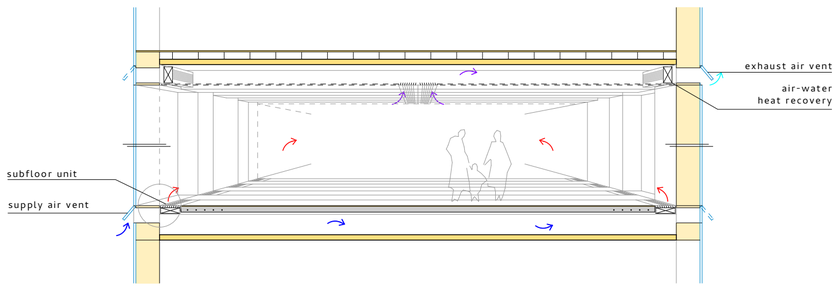
Cross ventilation

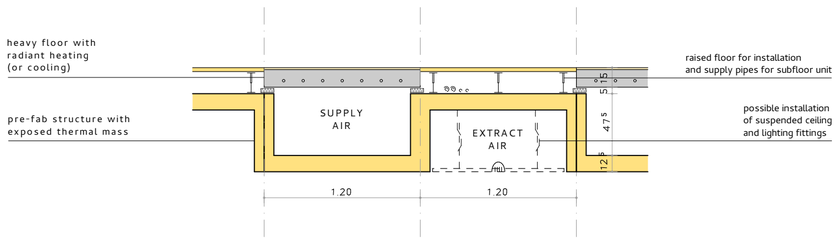
Reference: BRE Reseach Centre



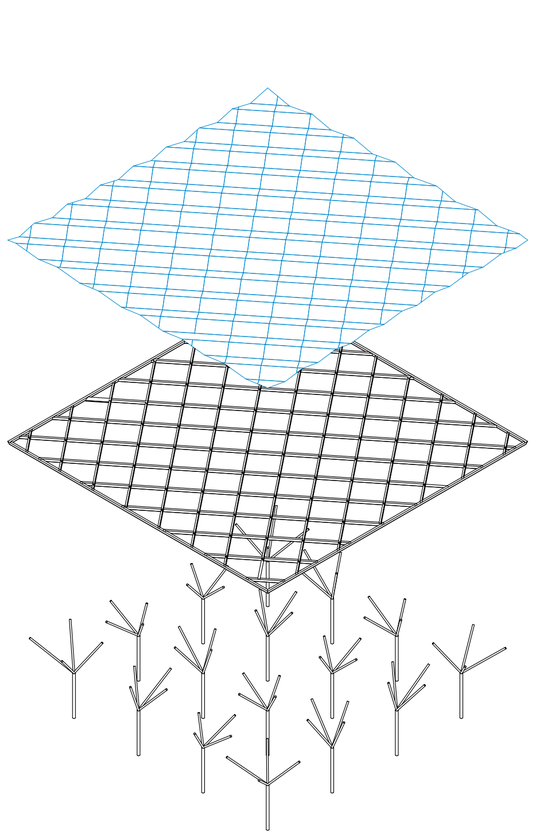
"WindowMaster"

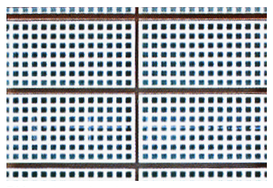
"Inventer"





Canopy



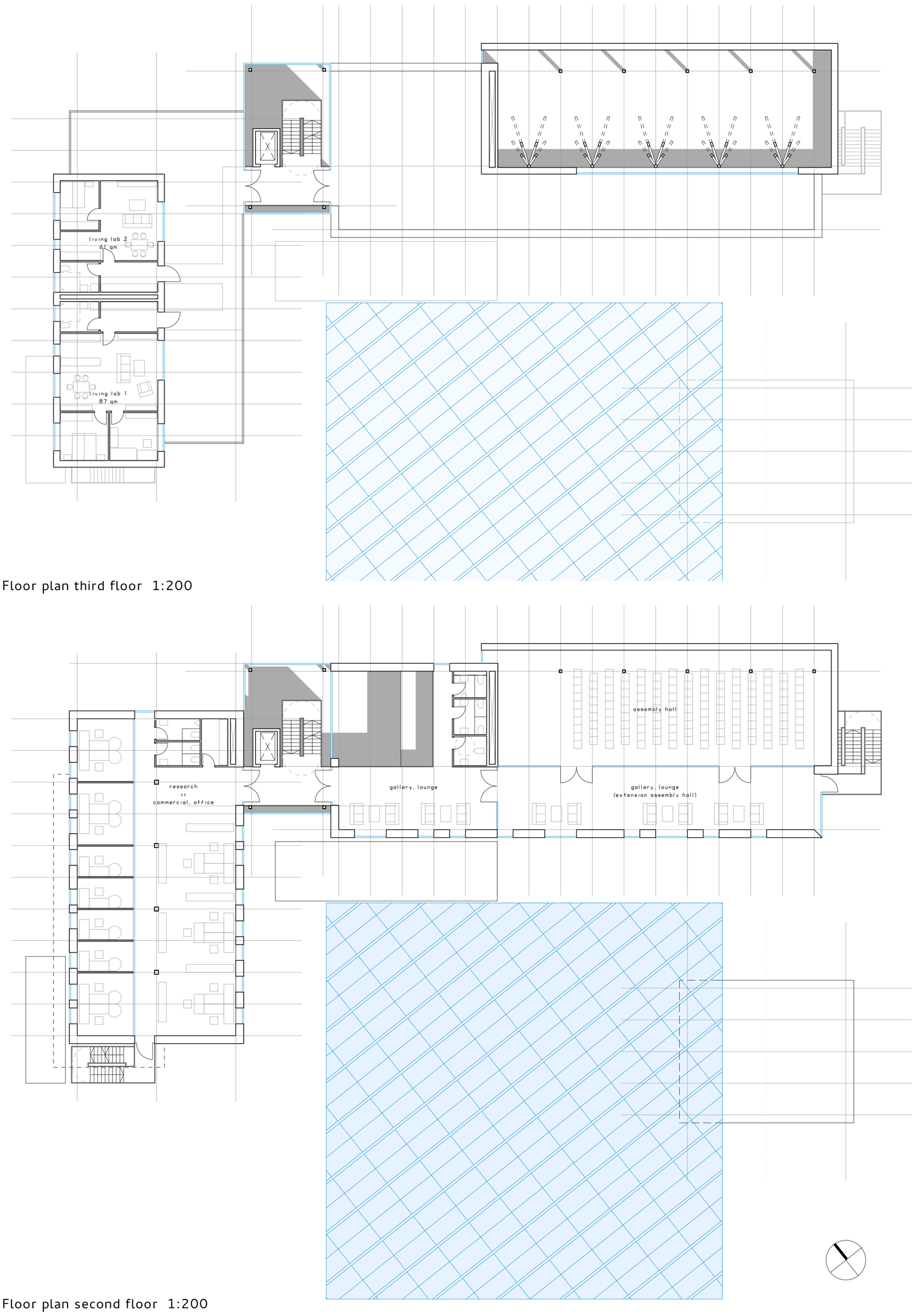


PV - glass laminate

cable suspended glazing

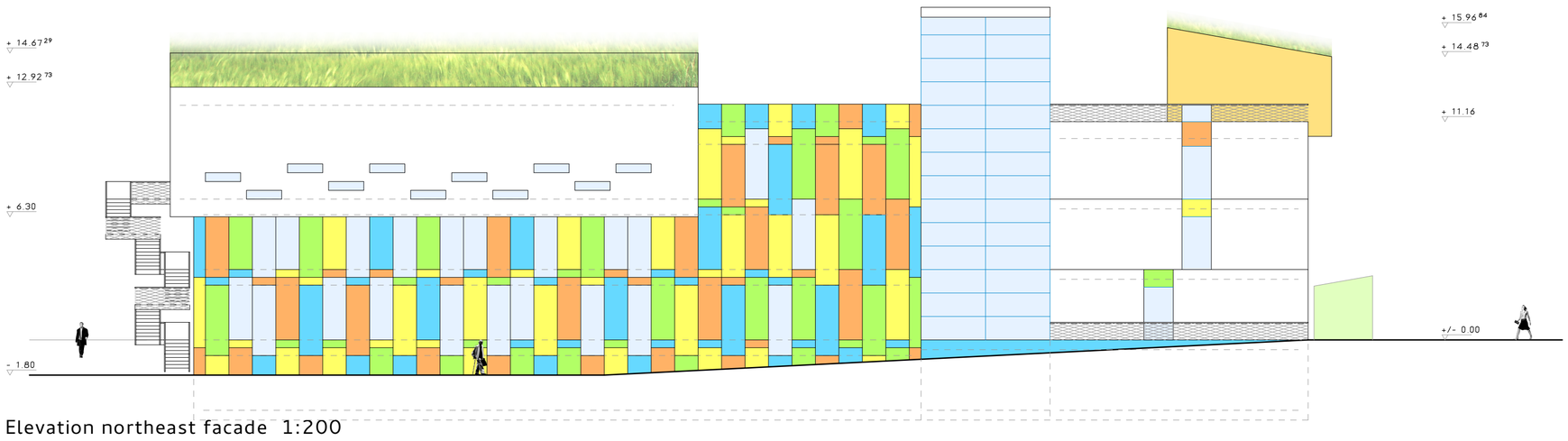
wooden joints

columns of "formed timber"



Floor plan third floor 1:200

Floor plan second floor 1:200

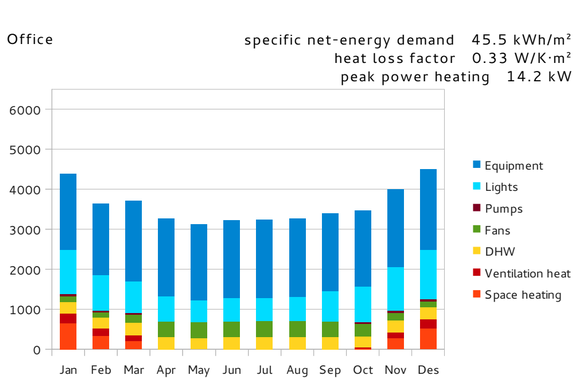


Elevation northeast facade 1:200

Energy demand

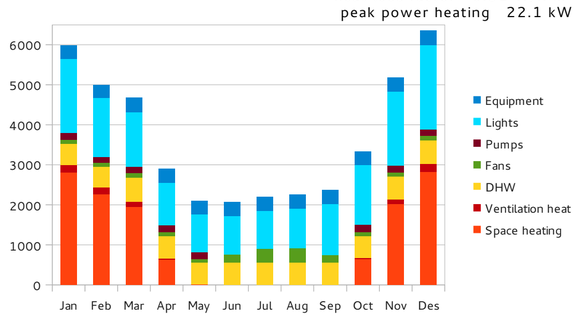
Office

specific net-energy demand 45.5 kWh/m²
heat loss factor 0.33 W/K·m²
peak power heating 14.2 kW



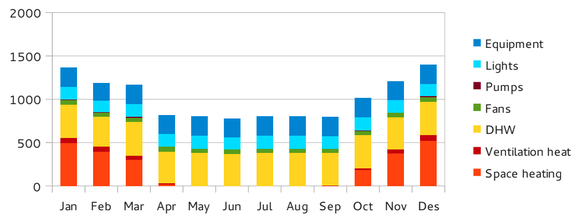
Community centre

specific net-energy demand 33.4 kWh/m²
heat loss factor 0.32 W/K·m²
peak power heating 22.1 kW



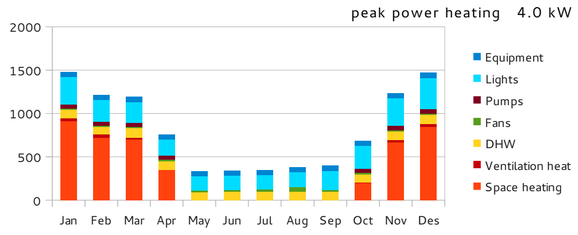
Apartments

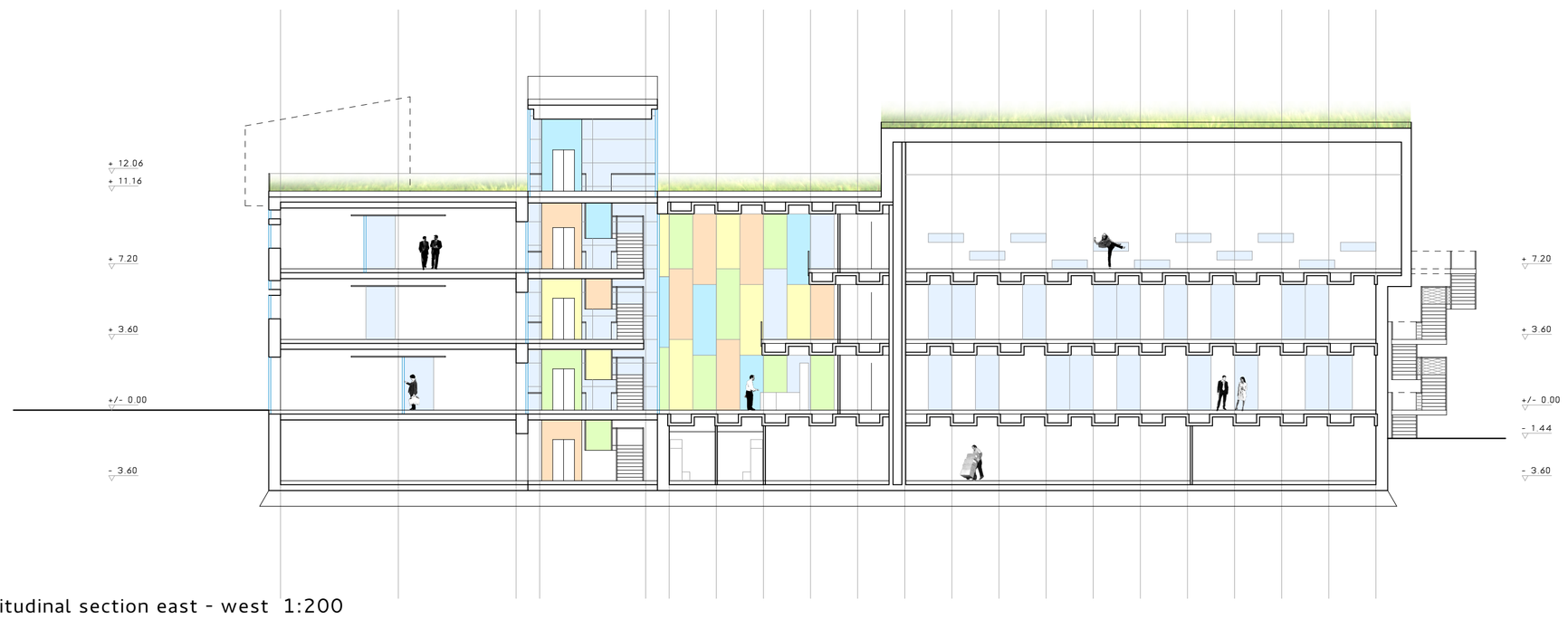
specific net-energy demand 80.5 kWh/m²
heat loss factor 0.43 W/K·m²
peak power heating 2.7 kW



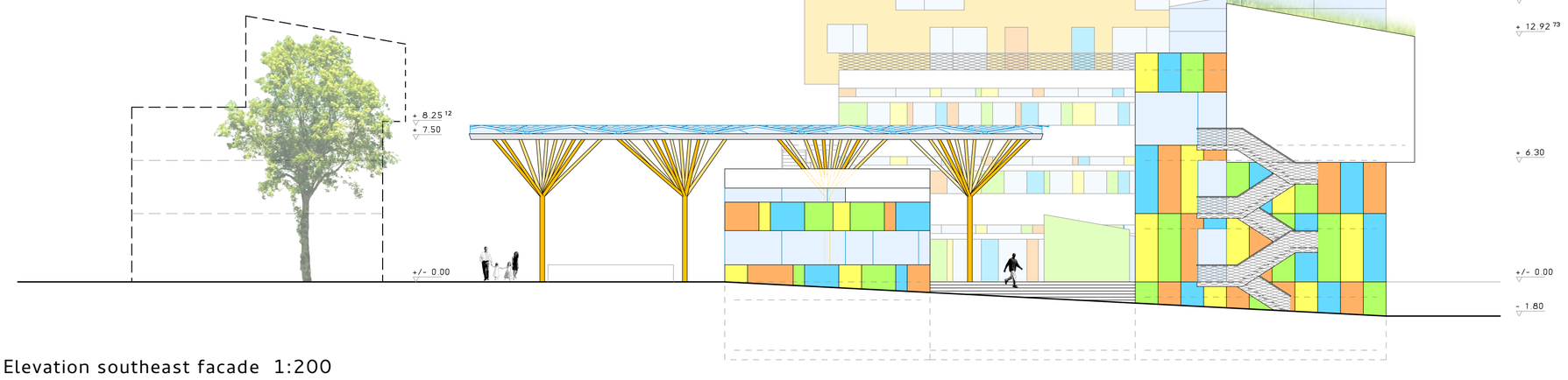
Cafe

specific net-energy demand 42.7 kWh/m²
heat loss factor 0.42 W/K·m²
peak power heating 4.0 kW



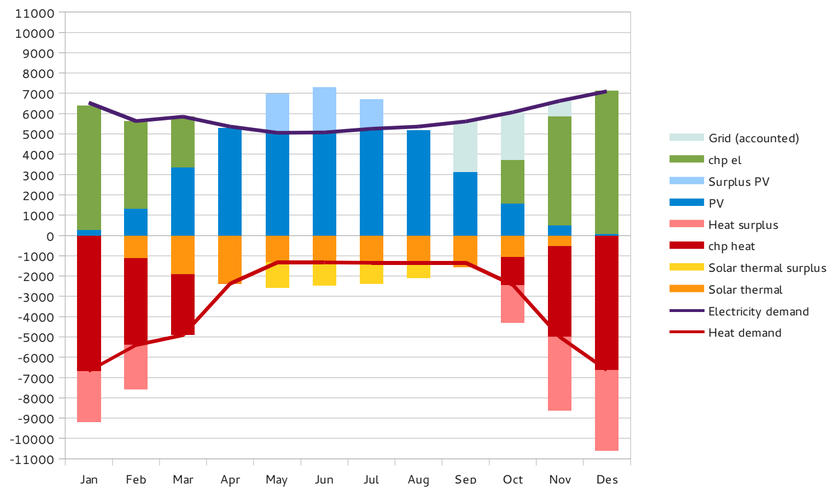


Longitudinal section east - west 1:200



Elevation southeast facade 1:200

Energy supply

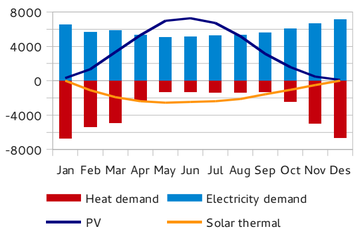


bio-fuel micro-combined heat hower plant(s)
total power: 43 kW heat + 26 kW electricity

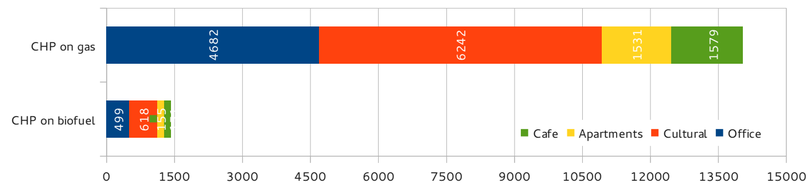
Photovoltaics
420 m² mono-cristalline in glass - PV laminate
integrated in glazed roofs (canopy and staircase)

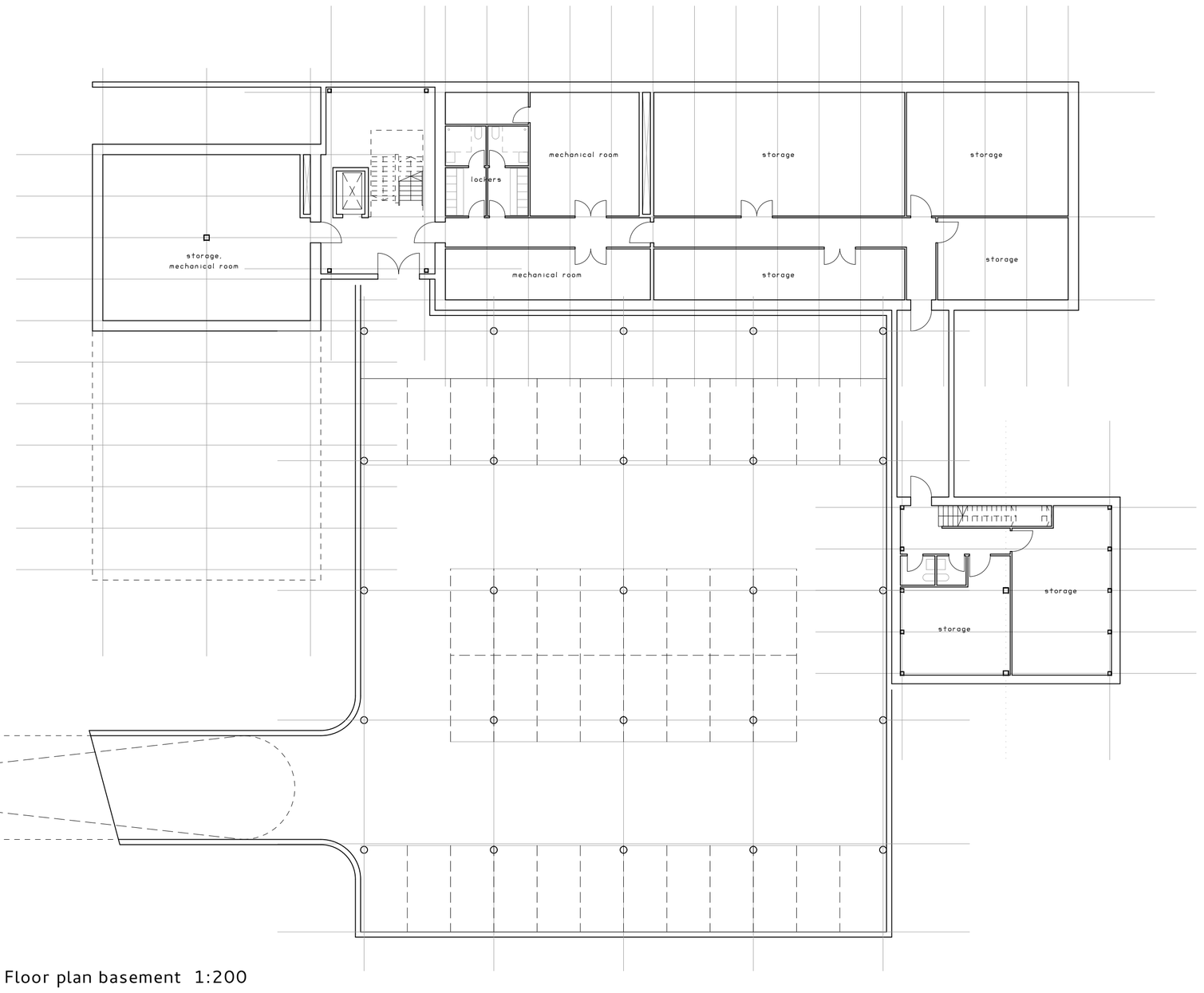
Solar thermal collector
45 m² vacuum tube collectors
on assembly hall facade as "plumage" ("fjærdrakt")

> annual energy output mCHP: ~70000 kWh
> wood chip consumption: 32 tons
> annual harvest: 0.3 ha forest or 1.5 km roadside cuts



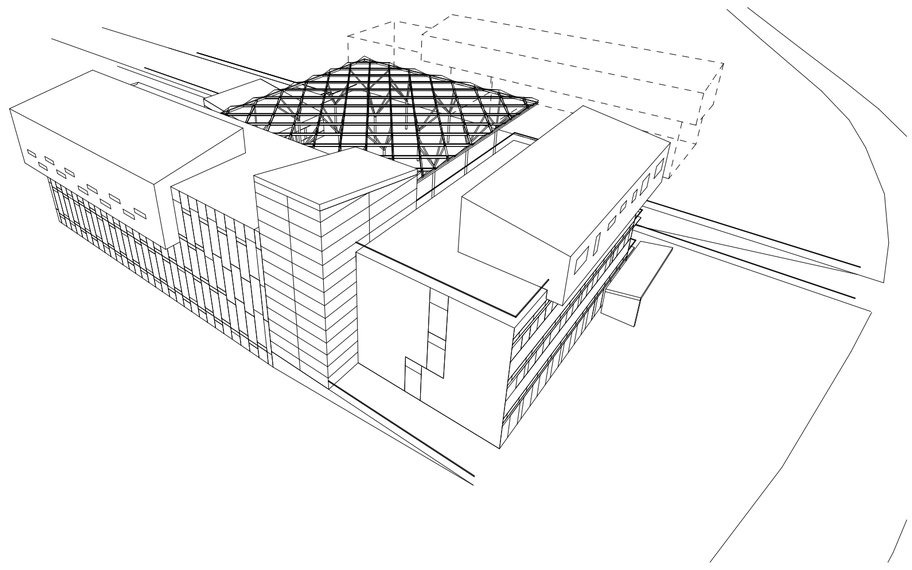
> 14000 kWh surplus heating for local district heating of neighbours

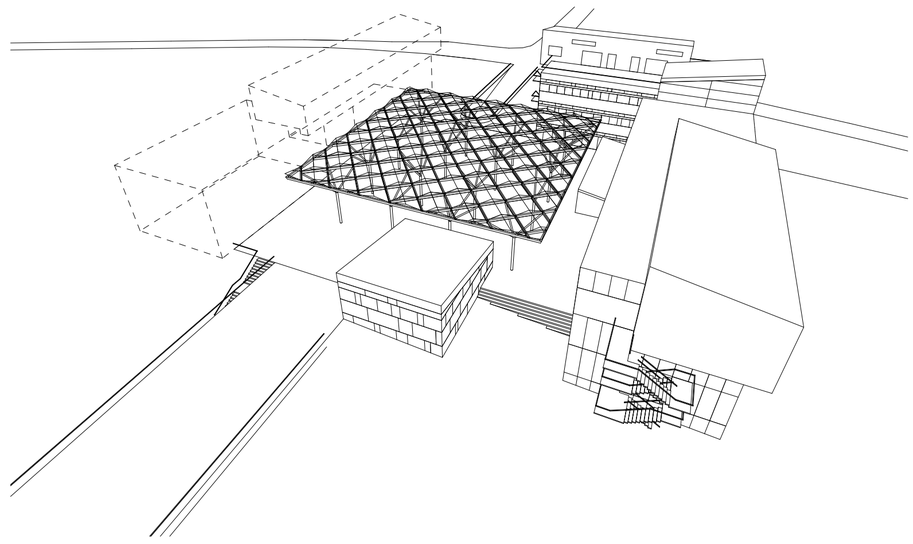


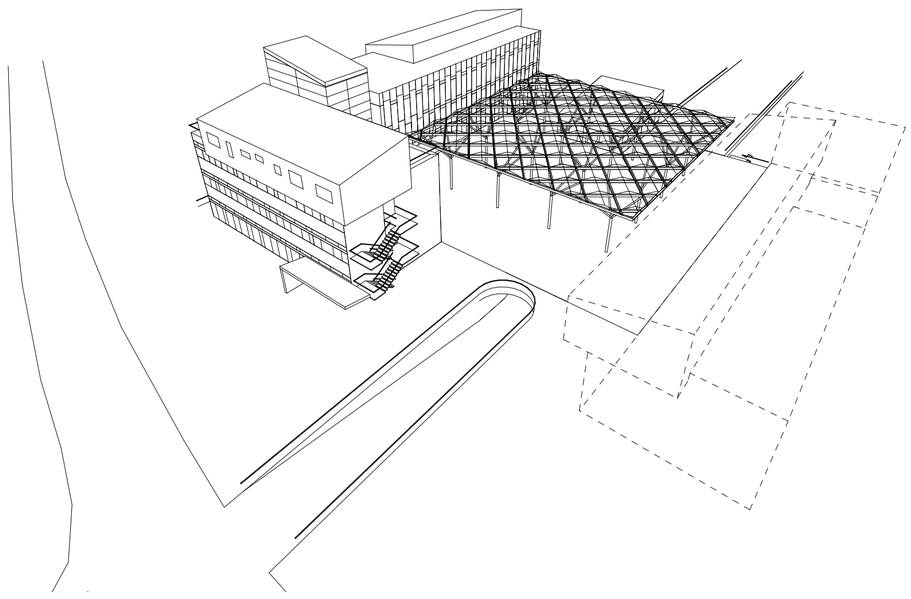


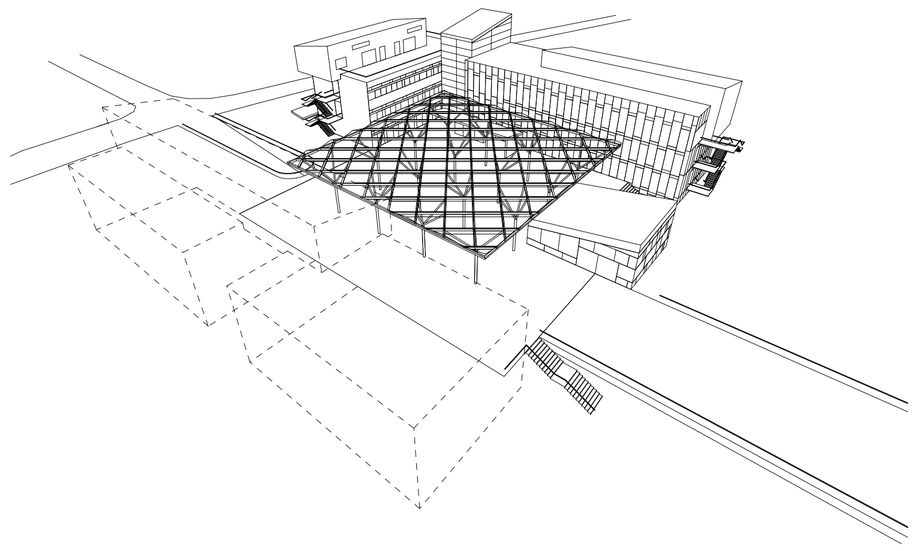
Floor plan basement 1:200

Bird's perspectives

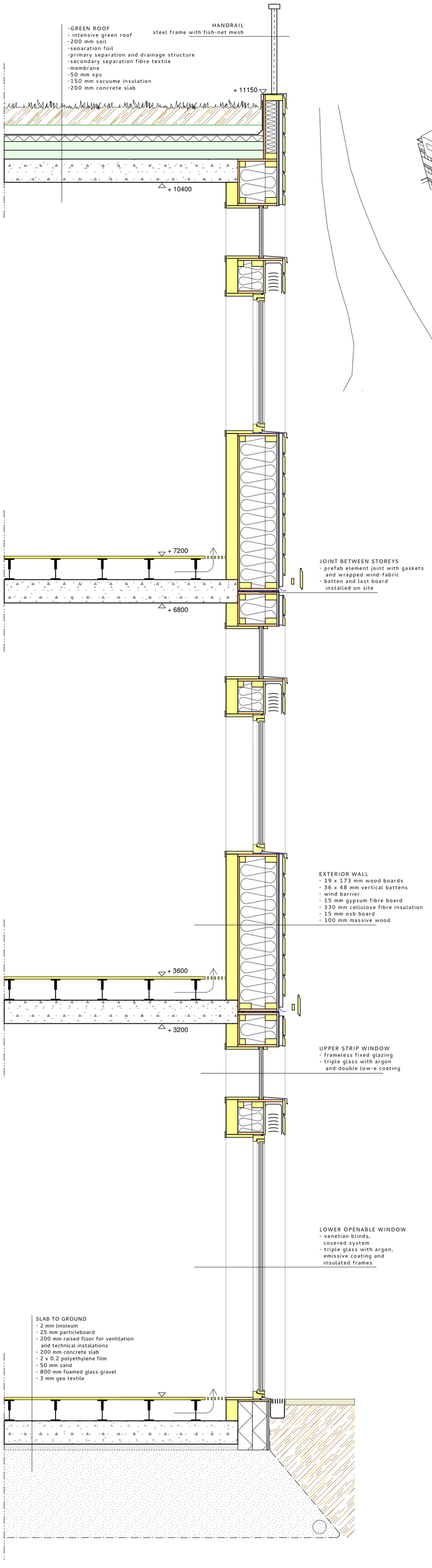








Detail section office wing 1:20



BREEAM Pre-assessment

MANAGEMENT — BREEAM ENVIRONMENTAL WEIGHTING - 12%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
MAN1	COMMISIONING	2	1					M1	Identify Project Personnel to monitor commisioning
			1					M2	Seasonal commissioning for one year, post construction
MAN2	CONSIDERATE	2	1					M3	Contractor to comply with best practice site management principles eg
	CONSTRUCTORS		1					M4	As above but with score between 32 and 35.5
MAN3	CONSTRUCTION	4	1					M5	Comply with 2 of 7 Breeam requirements
	SITE IMPACTS		1					M6	Comply with 4 of 7 Breeam Requirements
			1					M7	Comply with 6 of 7 Breeam Requirements
			1					M8	80% site timber responsibly sourced and 100% legally sourced
MAN4	BUILDING USER GUIDE	4	1					M9	Commission a simple Building User Guide (AS build plan)
MAN5	SITE INVESTIGATION	1	1					M10	Carry out detailed site investigations of the selected site including
MAN 12	LIFE CYCLE COSTING	2	1					M19	Life Cycle Cost analysis based on Feasibilty Study at a strategic and system level
			1					M20	Demontrate that results of the above study have been implemented in th project
	TOTALS	15	15	0	0	0	0		

HEALTH & WELBEING — BREEAM ENVIRONMENTAL WEIGHTING - 15%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
HEA1	DAYLIGHTING	1	1					H1	Demonstrate at least 80% floor area in each occupied space is adequately daylit
HEA2	VIEW OUT	1	1					H2	Demonstrate all relevant building areas have an adequate view out
HEA3	GLARE CONTROL	1	1					H3	Demonstrate an occupant controlled shading system is fitted in relevant building areas
HEA4	HIGH FREQUENCY LIGHTING	1	1					H4	Demonstrate high frequency ballasts are installed on all flouerescent lights
HEA5	INT. & EXT. LIGHTING LEVELS	1	1					H5	External and internal lighting illuminance levels to the current CIBSE Guidance
HEA6	LIGHTING ZONES & CONTROLS	1	1					H6	Design for lighting to be appropriately zoned and crontrollable by occupants
HEA7	POTENTIAL FOR NATURAL VENT.	1	1					H7	Demon. fresh air is capable of being del. to occup. Spaces via a nat. Vent. strategy
HEA 8	INDOOR AIR QUALITY	1	1					H8	Air intakes to avoid major sources of external pollution
HEA 9	VOLATILE ORG.COMPOUNDS	1	1					H9	Demonstrate emiss. of VOC's from key internal surfaces to comply with best pract. lev.
HEA 10	THERMAL COMFORT	1	1					H10	Demonstrate therm. Comf. in occupied spaces assessed at design stage ensuring comfort in use
HEA 11	THERMAL ZONING	1	1					H11	Demonstrate local occupant control of temperature adjustment in occupied spaces
HEA 12	MICROBIAL CONTAMINATION	1	1					H12	Design demonstrates the risk of waterborne and airborne legionella contamination min.
HEA 13	ACOUSTIC PERFORMANCE	3	1					H15	Increased indoor ambient noise level during heavy rain does
HEA 14	OFFICE SPACE		1					H16	Good working environment in smaller office areas
HEA 16	DRINKING WATER	1	1					H17	Demonstrate mains fed point of use water coolers provided
	TOTALS	15	15	0	0	0	0		

ENERGY — BREEAM ENVIRONMENTAL WEIGHTING - 19%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
ENE 1	REDUCT. IN CO2 EMMISS	15	6					E1-6	Demonstrate an improvement in energy efficiency of the building fabric.
									6 Credits is the min. requirement for EXCELLENT Rating
			9					E7-15	Strategy for capt. additional credits to be incl. in RIBA Stage C submission to DE
ENE 2	SUB-METERING OF ENERGY USES	1	1					E-16	Demonstrate provision of direct sub-metering of energy uses within the building
ENE 4	EXTERNAL LIGHTING	1	1					E17	Design incl. energy-eff. ext. light and all light fittings controll for the pres. of daylight
ENE 5	LOW CARBON	3	1					E18	Demonstrate that a feasibility study considering local low or zero carbon
	TECHNOLOGIES								technologies has been carried out and results implemented
			1					E19	The Strategy identified contributes to 10% CO2 Reduction
			1					E20	Appoint a qual. ecol. to advise on site ecology and implement an action plan based on recom.
ENE 6	BUILDING FABRIC AVOID.	1	1					E20A	5 Measures for minimizing heat loss and air infiltration
E 7	FREE COOLING	1	1					E23	Free cooling strat. to replace mech. cooling. Must be gained in tandem with H11 Thermal Zoning
		1	1					E21	Analysis of transport demand and patterns to optimise lift design (not applicable to single storey constr.)
		1	1					E22	Lift design to include 3 of 4 energy saving features (not applicable to single storey constr.)
	TOTALS	24	24	0	0	0	0		

TRANSPORT — BREEAM ENVIRONMENTAL WEIGHTING - 8%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
TRA 1	PUBLIC TRANSPORT PROVISION	3	3					T1-3	Credits awarded on sliding scale based on accessibility to public transport
TRA 2	PROXIMITY TO AMENITIES	1	1					T4	Demonstrate accessibility to local amenities
TRA 3	CYCLIST PROVISION	2	1					T5	Covered secure and well-lit cycle storage facilities for all building users
			1					T6	Provide adequate changing and shower facilites for all users
TRA 4	PEDESTRIAN & CYCLE SAFETY	1	1					T7	Demon. site layout designed in accordance with best practice for safe pedestrian and cycle access
TRA 5	TRAVEL PLAN	1	1					T8	Demonstrate that a travel plan has been developed for specific needs
TRA 6	PARKING	2	1					T9	One parking space is provided for every three building users.
			1					T11	One parking space is provided for every four building users.
TRA 8	DELIVERIES&MANOEUVRING	1	1					T12	Demonstrate best practice design of vehicle manoeuvring areas
	TOTALS	11	11	0	0	0	0		

WATER — BREEAM ENVIRONMENTAL WEIGHTING - 6%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
WAT 1	WATER CONSUMPTION	3	1					W1	Potable water consumption, equivalent to 4.5 - 5.5m3 per person per year
			1					W2	Potable water consumption, equivalent to 1.5 - 4.4m3 per person per year
			1					W3	Potable water consumptionless, than 1.5m3 per person per year
WAT 2	WATER METER	1	1					W4	Water meter with a pulsed output will be installed on the mains supply
WAT 3	MAJOR LEAK DETECTION	1	1					W5	Leak detection system is installed on the buildings water supply
WAT 4	SANITARY SUPPLY SHUT-OFF	1	1					W6	Proximity detection shut-off is provided to the water supply of all toilet areas
WAT 5	WATER RECYCLING	1	1					W7	Installation of rainwater harvesting system/greywater for WC and urinal flushing purposes
WAT 6	IRRIGATION SYSTEMS	1	1					W8	Low-water irrigation strategy/system or planting is irrigated via rainwater or re-claimed water
	TOTALS	8	8	0	0	0	0		

MATERIALS — BREEAM ENVIRONMENTAL WEIGHTING - 12.5%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
MAT 1	MATERIALS SPECIFICATION	6	4					MT1-4	Design must demonstrate that specification includes BRE A
									rated materials for at least 2 major building elements
			1					MT5	rated materials for at least 3 major building elements
			1					MT6	rated materials for at least 4 major building elements
MAT 2	HARD LANDSCAPING	1					1	MT7	Demonstrate that 80% of the combined area of external hard landscaping and boundary protection
MAT 5	RESPONSIBLE SOURCING OF MAT.	3	1					MT10	Evidence provided that 80% of materials have been sourced responsibly
			1					MT11	Additional credits dependant on level of custody demonstrated by the Contractor
			1					MT12	Additional credits dependant on level of custody demonstrated by the Contractor
MAT 6	INSULATION	2	1					MT13	Insul. has low embodied impact relative to thermal propert. as determ. by the BRE Green Guide
			1					MT14	Demonstrate insulation products have been responsibly sourced
MAT 7	DESIGNING FOR ROBUSTINESS	1	1					MT15	Demonstrate that vulnerable parts of the building have adequate
	TOTALS	13	12	0	0	0	0		

WASTE — BREEAM ENVIRONMENTAL WEIGHTING - 7.5%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
WST1	CONSTRUCTION WASTE MANAGEMENT	4	1					WS1	Demonstrate that the amount of non-Hazardous waste is the same as best practice
			1					WS2	Demonstrate that the amount of non-Hazardous waste is the same than best pactice
			2					WS3	Demonstrate that the amount of non-Hazardous waste is much better
WST2	RECYCLED AGGREGATES	1					1	WS5	Demonstrate that sign. use of recycled or sec. aggregates in high grade building aggregate uses
WST3	RECYCLABLE WASTE	2	1					WS6	Provide a central dedicated space for storage of building recyclable waste streams
			1					WS7	Project must include school endorsed policies on the collection and recycling of consumables
WST 5	COMPOSTING	1	1					WS8	reduction in vol. of compostable org. waste going directly to landfill during the building's operation.
	TOTALS	8	7	0	0	0	0		

LAND USE AND ECOLOGY — BREEAM ENVIRONMENTAL WEIGHTING - 10%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
LE 3	ECOL. VALUE OF THE SITE AND	1	1					L3	Demonstrate that ths site has been defined as contaminated and
	PROTECT OF FEAT.								undergone appropriate remedial action
LE 4	MITIGATING ECOLOGICAL IMPACT	2	1					L4	Demonstrate that the impact on the Ecology of the site is minimal
			1					L5	Demonstrate there is no negative change in ecological value of the site following development
LE 5	ENHANCING SITE ECOLOGY	3	1					L6	Appoint a qual. ecol. to advise on site ecology and implement an action plan based on recom.
			1					L7	Demonstrate a positive increase on ecological value of the site by up to 5 species
			1					L8	Demonstrate a positive increase on ecological value of the site by 6 or more species
LE 6	LONG TERM IMPACT ON BIODIVERSITY	2	1					L9	Client must commit to mandatory Breeam requirements and at least 2 regarding biodiversity
			1					L10	Client must commit to mandatory Breeam requirements and at least 4 regarding biodiversity
LE 7	CONSULTATION WITH STUDENT AND STAFF	1	1					L11	Record consultation workshops with the students and staff and inform them how their ideas shaped Breaset
LE 8	LOCAL WILD LIFE PARTNERSHIP	1		1				L12	Provide evidence that the design team set up a partnership with a local wildlife group
	TOTALS	10	9	0	0	0	0		

POLLUTION — BREEAM ENVIRONMENTAL WEIGHTING - 10%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
POL 1	REFRIGERANT GWP BUILDING SERVICES	1	1					P1	Demonstrate that the use of refrigerants with GWP of less than 5 or no refrigerants at all are used
POL 2	PREVENTING REFRIG. LEAKS	1	1					P2	Demonstrate that refrigerant leaks can be detected or no refrigerants used in the project
POL 3	REFRIGERANT GWP COLD STORAGE	1	1					P3	Demonstrates the use of refrigerants within cold storage systems with a GWP of less than 5
POL 4	Nox EMISS. FROM HEAT. SOURCE	3	1					P4	Demonstrate the dry NOx from space heating energy are 100mg/kWh(at 0% excess O2)
	These Credits are Fuel		1					P5	Demonstrate the dry NOx from space heating energy are 70mg/kWh(at 0% excess O2)
								P6	Demonstrate the dry NOx from space heating energy are 40mg/kWh(at 0% excess O2)
POL 5	FLOOD RISK	4	2					P7	Demonstrate the site is defined as a low risk of annual flooding
			1					P8	Demonstrate there is a medium to high flood risk but measures have been implemented to remediate risk
			1					P9	Demonstrate surface water run off measures taken to minimise localised flood risk
POL 6	MIN. WATER COURSE POLL.	1	1					P10	Demonstrate that effective on-site treatment such as SUDS or oil seperators have been spec to reduce poll. Risk
POL 7	REDUCT. IN NIGHT TIME LIGHT POLL.	1	1					P11	Demonstrate compliance of external lighting with Institution of Lighting Engin. guid. notes for reduct. in obtrusive light 2011
POL 8	NOISE ATTENUATION	1	1					P12	Demonstrate that the project does not increase the ambient noise levels on site
	TOTALS	13	12	0	0	1	0		

INNOVATION — BREEAM ENVIRONMENTAL WEIGHTING - 10%

BREEAM REF.	SECTIONS	AVAILABLE CREDITS	ACHIEVED CREDITS	CREDITS NOT ACHIEVED: SITE SPECIFIC CREDITS	DESIGN SPECIFIC CREDITS	TECHNICAL SPECIFIC CREDITS	CONSTRUCT SPECIFIC CREDITS	REF NR	ACTION REQUIRED
MAN 3	CONSTRUCTION SITE IMPACTS	1	1					M7	Comply with 6 of 7 Breeam Requirements
HEA1	DAYLIGHTING	1	1					H1	Demonstrate at least 80% floor area in each occupied space is adequately daylit
HEA 9	VOLATILE ORGANIC COMPOUNDS	1	1					H9	Demonstrate emission of VOC's from key internal surfaces to comply with best practice levels
HEA 14	OFFICE SPACE	1	1					H16	Good working environment in smaller office areas
ENE 1	REDUCTION IN CO2 EMMISSIONS	2	1					N3	Demonstrate scheme is Carbon neutral as defined by National Calculation Method
			1					N4	Demonstrate scheme is true carbon zero for building services and operations
ENE 5	LOW OR ZERO CARBON TECHN.	1	1					N5	Design must impl. CO2 Reduction strat. Ident. in the renew. energy feasibility study to reduce CO2 emissions by 20%
TRA 3	CYCLIST PROVISION	2	1					T5	Covered secure and well-lit cycle storage facilities for all building users
			1					T6	Provide adequate changing and shower facilites for all users
WAT 2	WATERMETER	1	1					N6	Add. sub-met. to allow ind. water cons. plant and/or areas monIT. ie Kitchens etc. Sub-meter must have pulsed output
MAT 1	MATERIAL SPECIFICATION	1	1					N7	Must score additional 2 points using BREEAM calculator above the best pract. set by BREEAM when ass. over 4 building elem.
MAT 5	RESPONSIBLE SOURCING OF MAT.	1	1					N8	95% of applicable materials must be responsibly sourced
POL 4	Nox EMISSIONS FROM HEATING SOURCE	3	1					P4	Demonstrate the dry NOx from space heating energy are 100mg/kWh (at 0% excess O2)
	These Credits are Fuel		1					P5	Demonstrate the dry NOx from space heating energy are 70mg/kWh (at 0% excess O2)
								P6	Demonstrate the dry NOx from space heating energy are 40mg/kWh (at 0% excess O2)
WST1	CONSTRUCTION	4	1					WS1	Demonstrate that the amount of non-Hazardous waste is the same as best practice
	WASTE MANAGEMENT		1					WS2	Demonstrate that the amount of non-Hazardous waste is the same than best practice
			1					WS3	Demonstrate that the amount of non-Hazardous waste is much better best practice
			1					WS4	Demonstrate that sign. amount of non-hazard. mat. will be diverted from landfill and re-used and/or recycl.
	TOTALS	19	18	0	0	0	0		

BREEAM SECTION	ACHIEVED	AVAILABLE	% ACHIEVED	WEIGHTING	SCORE
MANAGEMENT	15	15	100%	0.120	12.0%
HEALT & WELLBEING	15	15	100%	0.150	15.0%
ENERGY	24	24	100%	0.190	19.0%
TRANSPORT	11	11	100%	0.080	8.0%
WATER	8	8	100%	0.060	6.0%
MATERIALS	12	13	92%	0.125	11.5%
WASTE	7	8	88%	0.075	6.6%
LAND USE & ECOLOGY	9	10	90%	0.100	9.0%
POLLUTION	12	13	92%	0.100	9.2%
INNOVATION	18	19	95%	0.100	9.5%
FINAL BREEAM SCORE					105.81%
FINAL BREEAM RATING					OUTSTANDING