



Definition?

Future-proofing is the process of anticipating the future and developing methods of minimizing the effects of shocks and stresses of future events.

Future-proofing is used in industries such as electronics, medical industry, industrial design, and, more recently, in design for climate change. The principles of future-proofing are extracted from other industries and codified as a system for approaching an intervention in an historic building.

https://en.wikipedia.org/wiki/Future_proof

What is future proofing?

Future proofing is a broad term that can encompass not only buildings and infrastructure but also communities, cities, countries or the whole planet.

It has adopted different meanings within these different contexts, ranging from resilience to climate change to demographic change and resource security.

For an holistic approach it could include sustainability issues, life-cycle costing and even wellbeing.

In relation to buildings, future proofing is an assessment process aimed at maximising whole-life value in the face of unpredictable, ongoing change.

Future proofing is not a new phenomena. The anthropologist Gregory Bateson is credited with telling the following story about planning for the future.

New College, Oxford, founded in 1379 has a large dining hall like other Oxford colleges. This is constructed using large oak beams. In 1859 it became clear that the beams needed to be replaced – a difficult and expensive undertaking given the size of the timbers required. It was discovered however that replacement oaks had been planted in the college estates, and these were cut for use in the hall. It has been suggested that these trees were expressly planted for the hall – in effect, the hall had been future proofed against the possibility that the resources necessary to repair it would become (or remain) difficult to obtain.

Design

Future proofing a building requires careful consideration of likely future scenarios:

What changes are might happen in the life of the building?
How likely are those changes?

How serious would the impact of such a change be?

What is the cost of future proofing against that change?

This assessment process should be a continuous exercise that involves the client, designers, suppliers contractors, end users, and is similar to the way that risk assessments are carried out.

Design

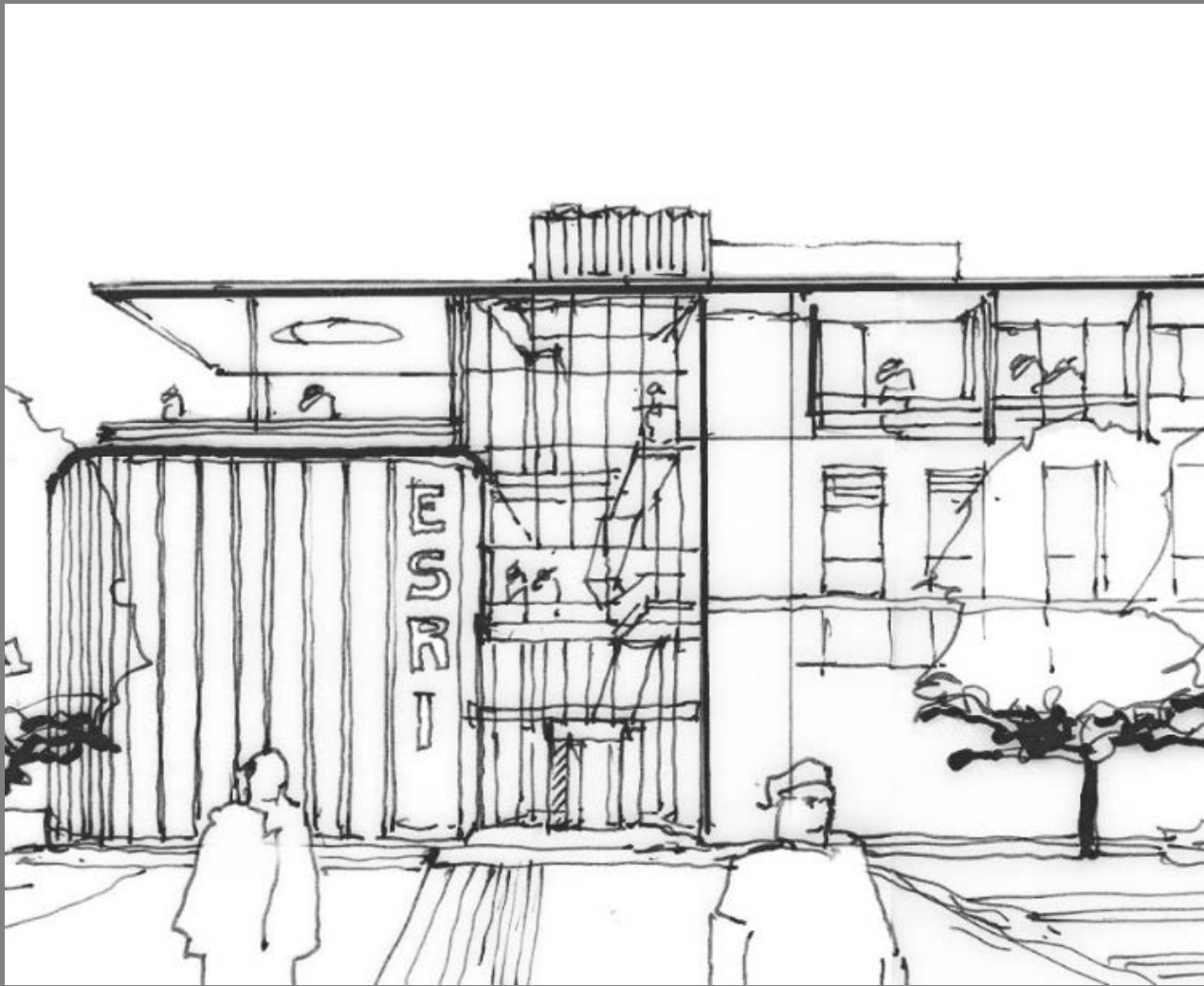
Assessment is a complex process, and there is a danger that a building will adopt future-proofing solutions that might fail:

The scenario might not happen.

The solution adopted to cope with the scenario might fail or might not be implemented.

An unforeseen scenario might render the solution ineffective.

This means that whilst literature often suggests that future-proofing a building is always beneficial, and is inherently 'environmental', in fact, future proofing against the wrong scenarios could be a significant waste of resources.



ESRI

ENERGY SAFETY RESEARCH INSTITUTE

Innovation by design

presented by **Ian Standen**

 Stride Treglown



ESRI

ENERGY SAFETY RESEARCH INSTITUTE

This BREEAM 'Outstanding' building is the centrepiece of Swansea University's research into renewable and alternative energy production. It is also the new home of SPECIFIC, a renewable energy joint venture with Indian steel manufacturer, TATA.

Setting the scene

Setting the scene





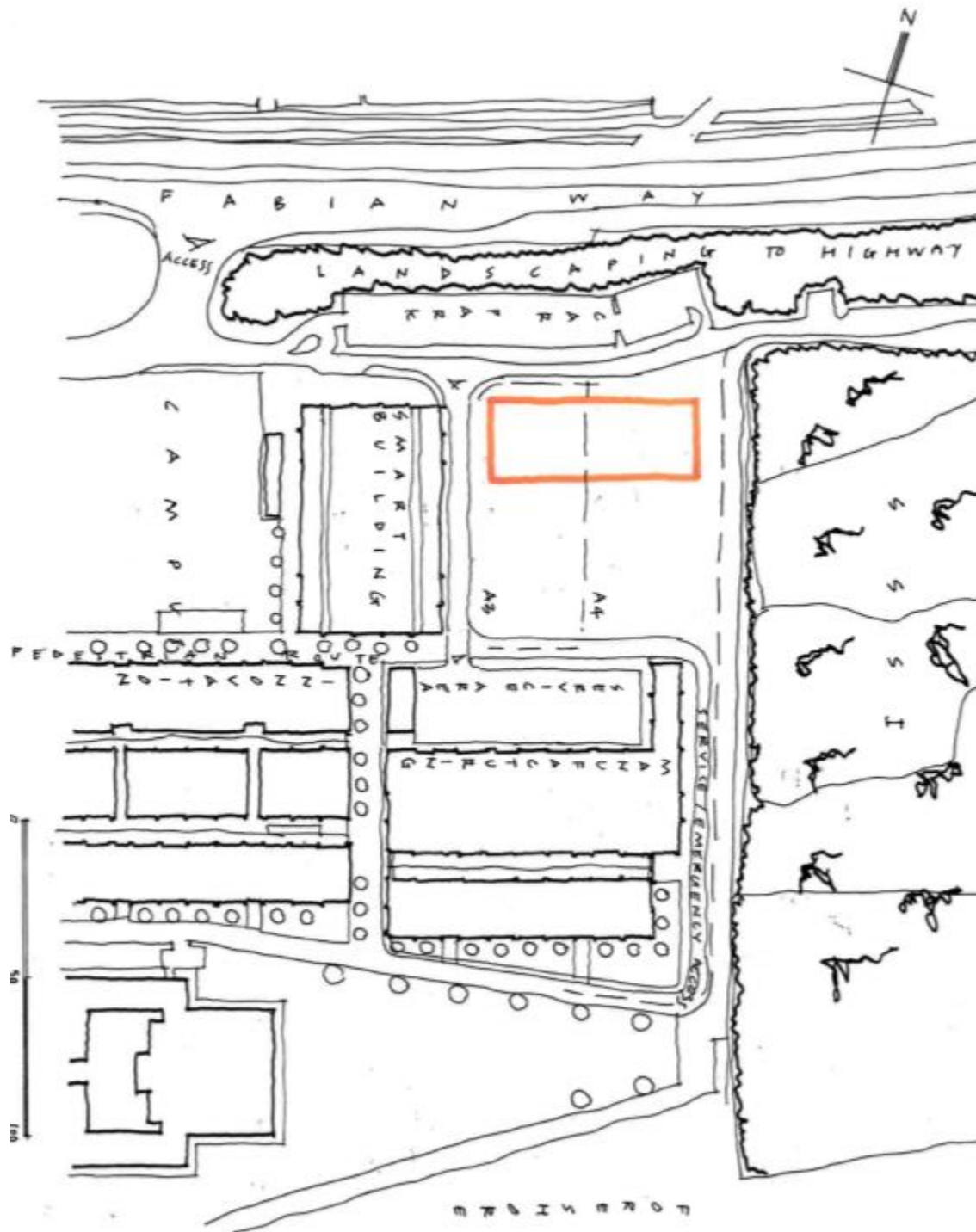
70076 ESRI
Aerial View

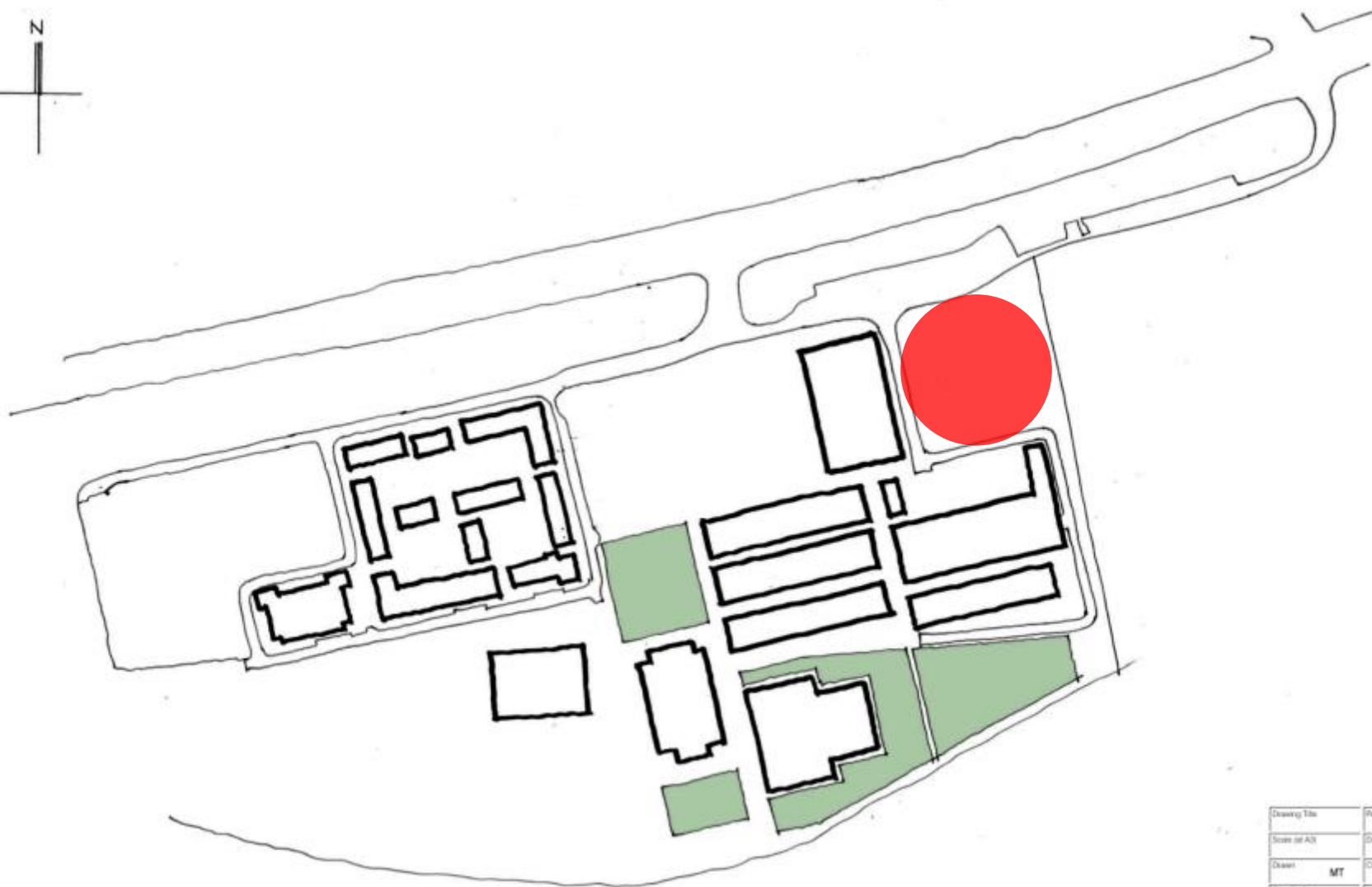
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Drawing No.	Rev
Regrowth Court, Dunsboro Road, Dunsboro Park, Cardiff CF24 5LQ	
T: 019 2043 0990 F: 019 2047 0422 E: enquiries@stride-treglown.com www.stride-treglown.com	



Setting the scene

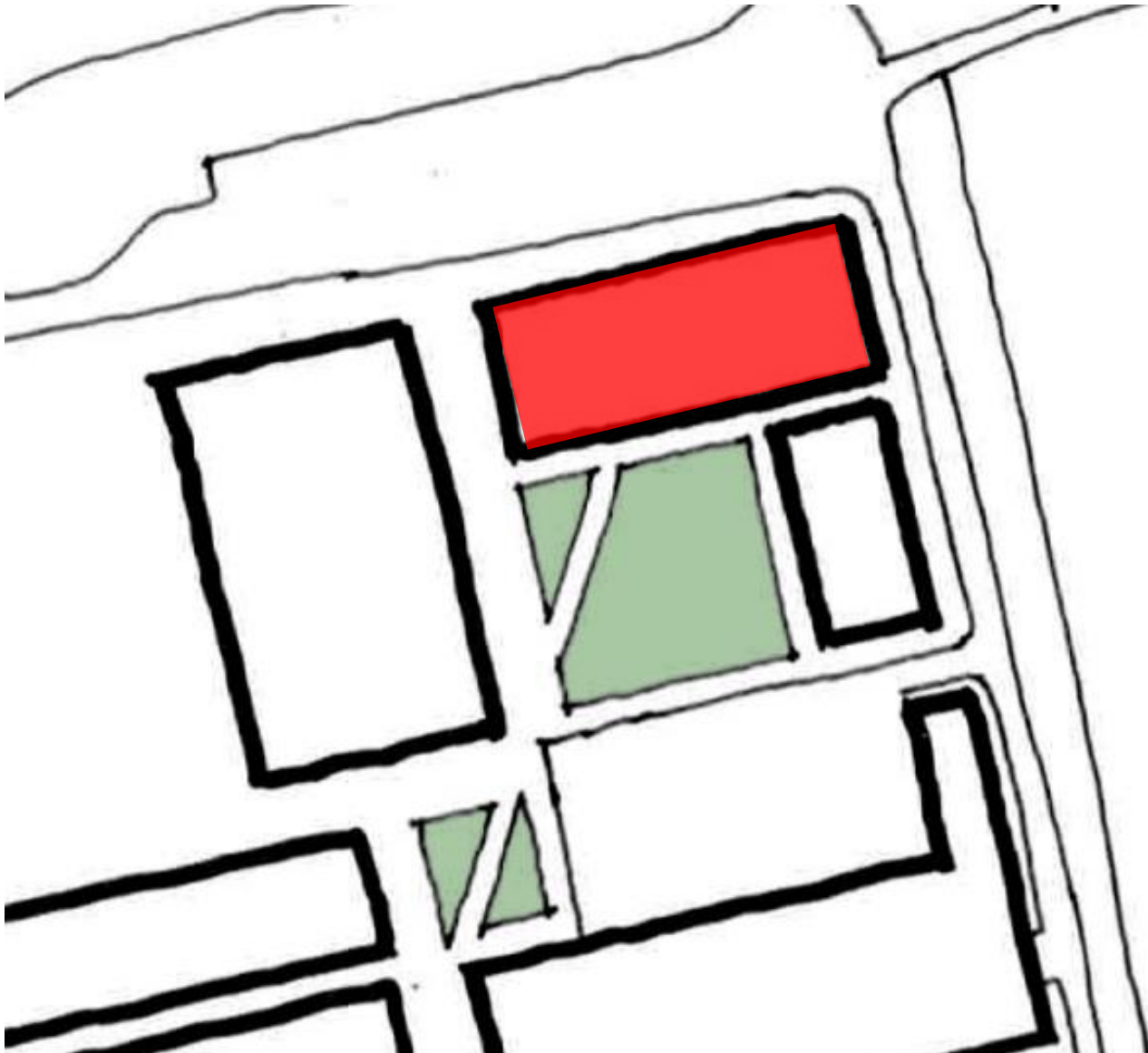






70076_ESRI
Masterplan - Existing

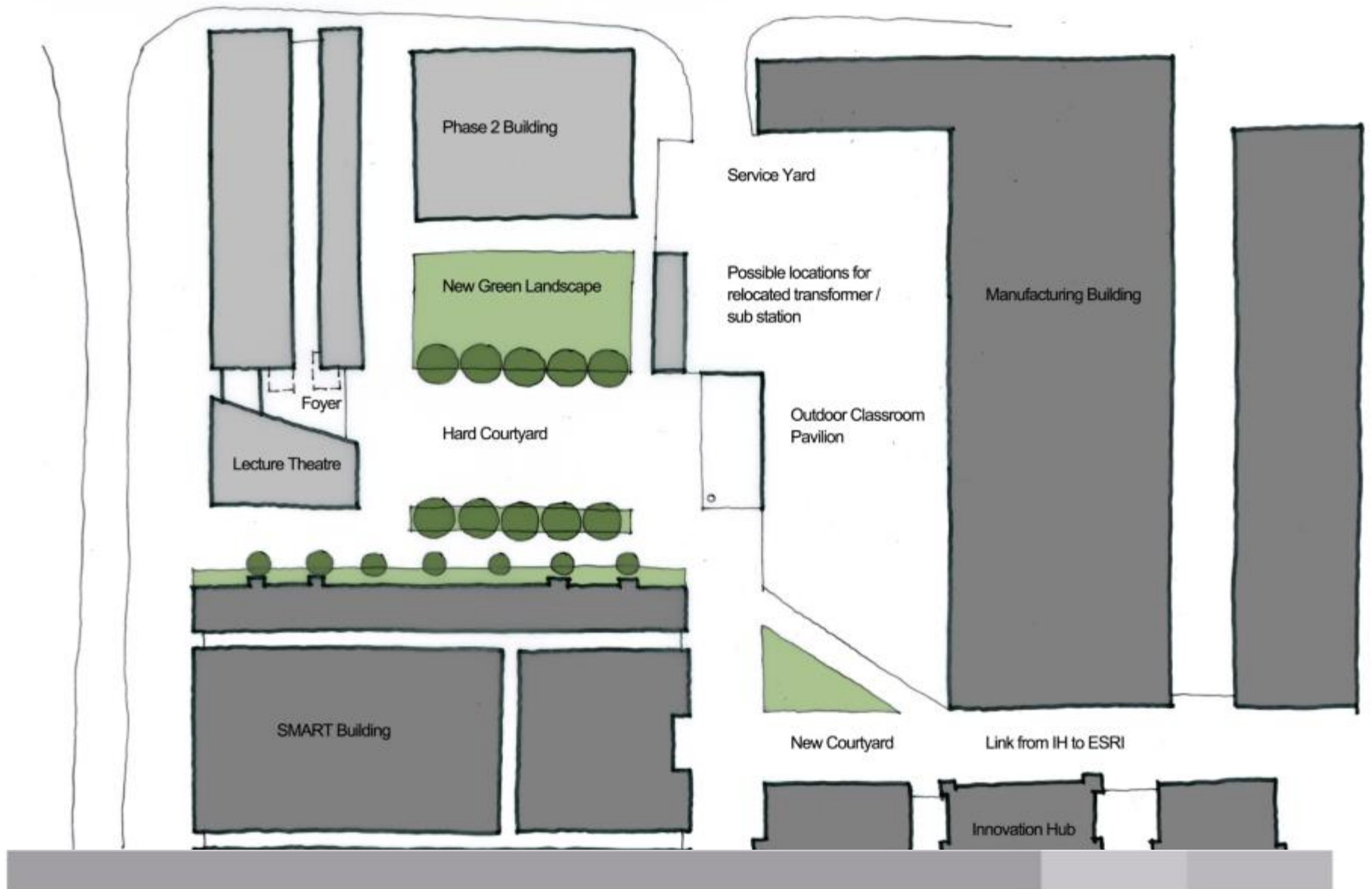
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Client	City
Drawing No.	Rev
Englewood Coast Overlook Road, Ocean Park Cardiff CF24 1LQ	
T 019 2043 0800 F 019 2047 0422 E greg@stride.com W www.stride.com	



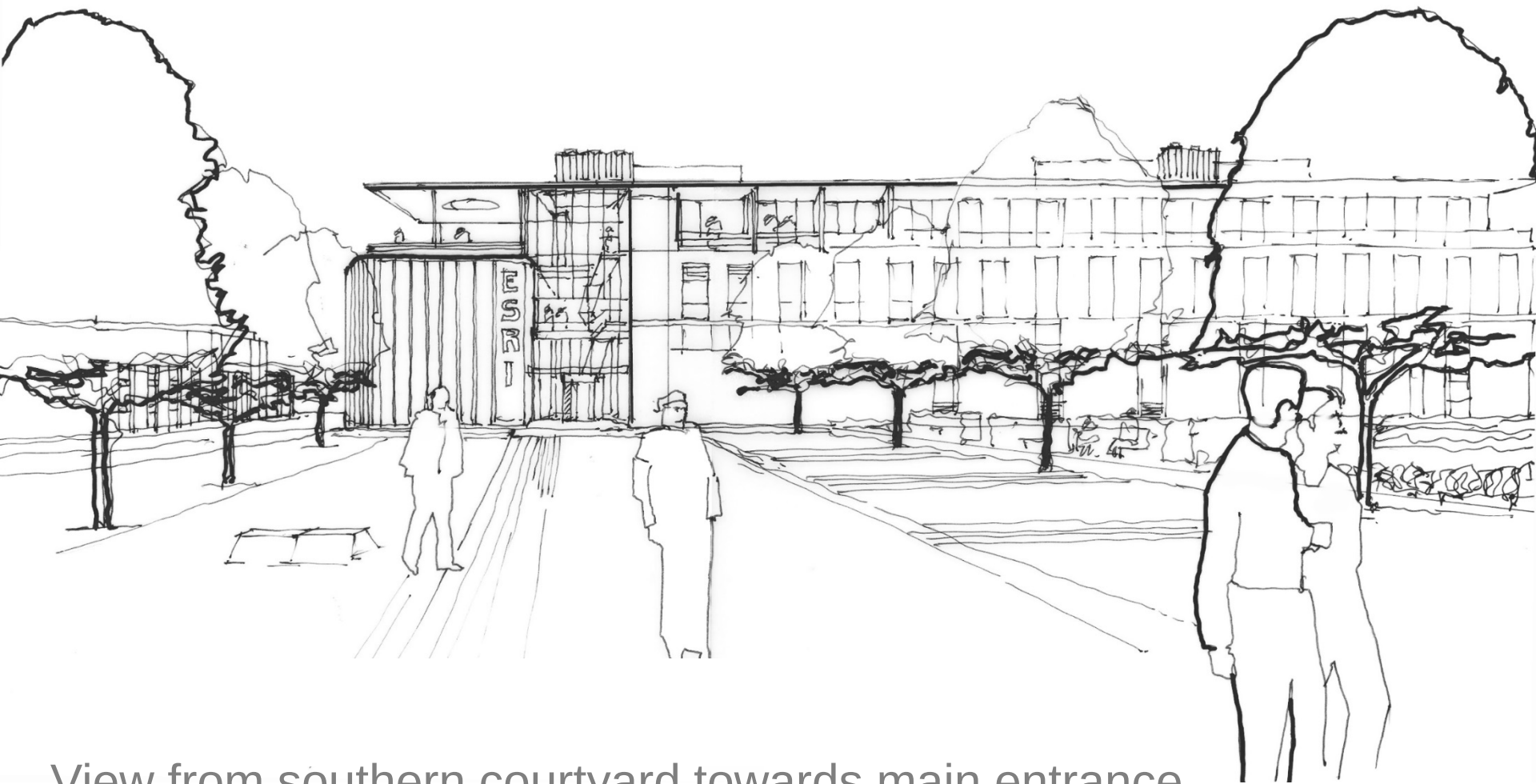
70076_ESRI
Masterplan - Proposed

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MT	04/03/13
Drawing No.	City
SK 077	IS
Region: Coast	Rev
Drawn: Road, Green Park	
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	T: 020 2543 0660
	M: 020 2547 0420
	E: green@stride.com
	stridetreglown.com

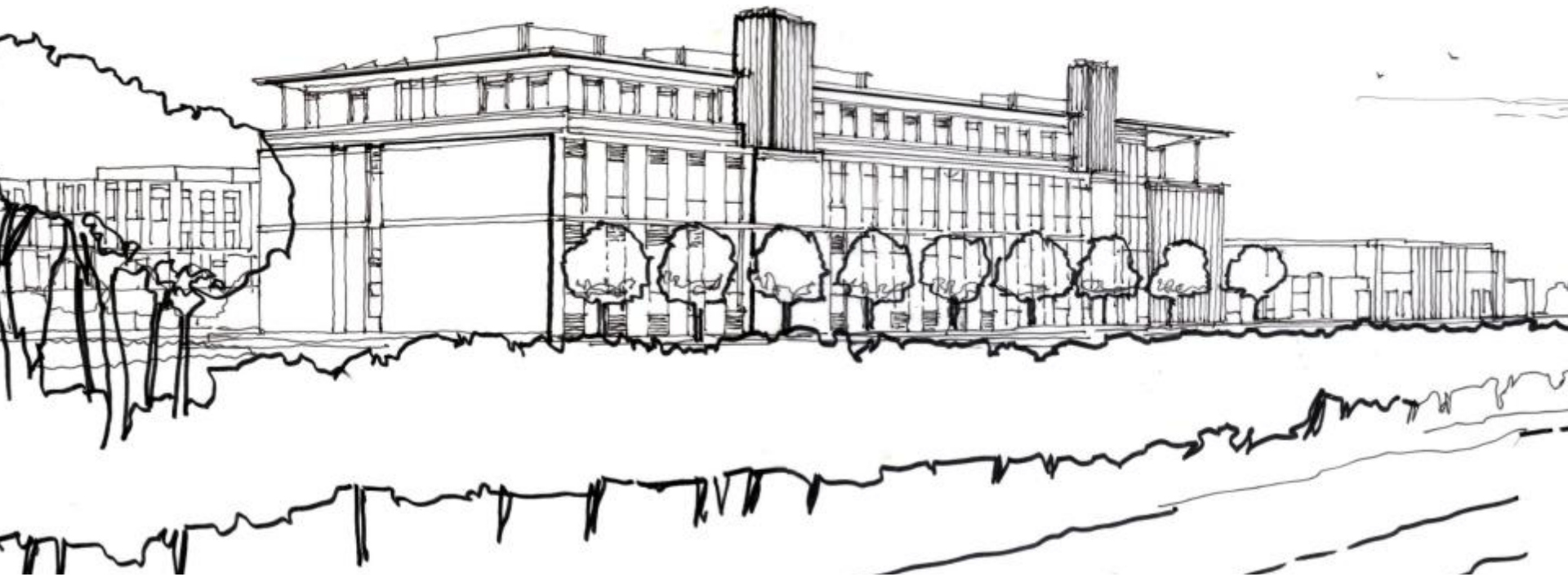
SSSI site



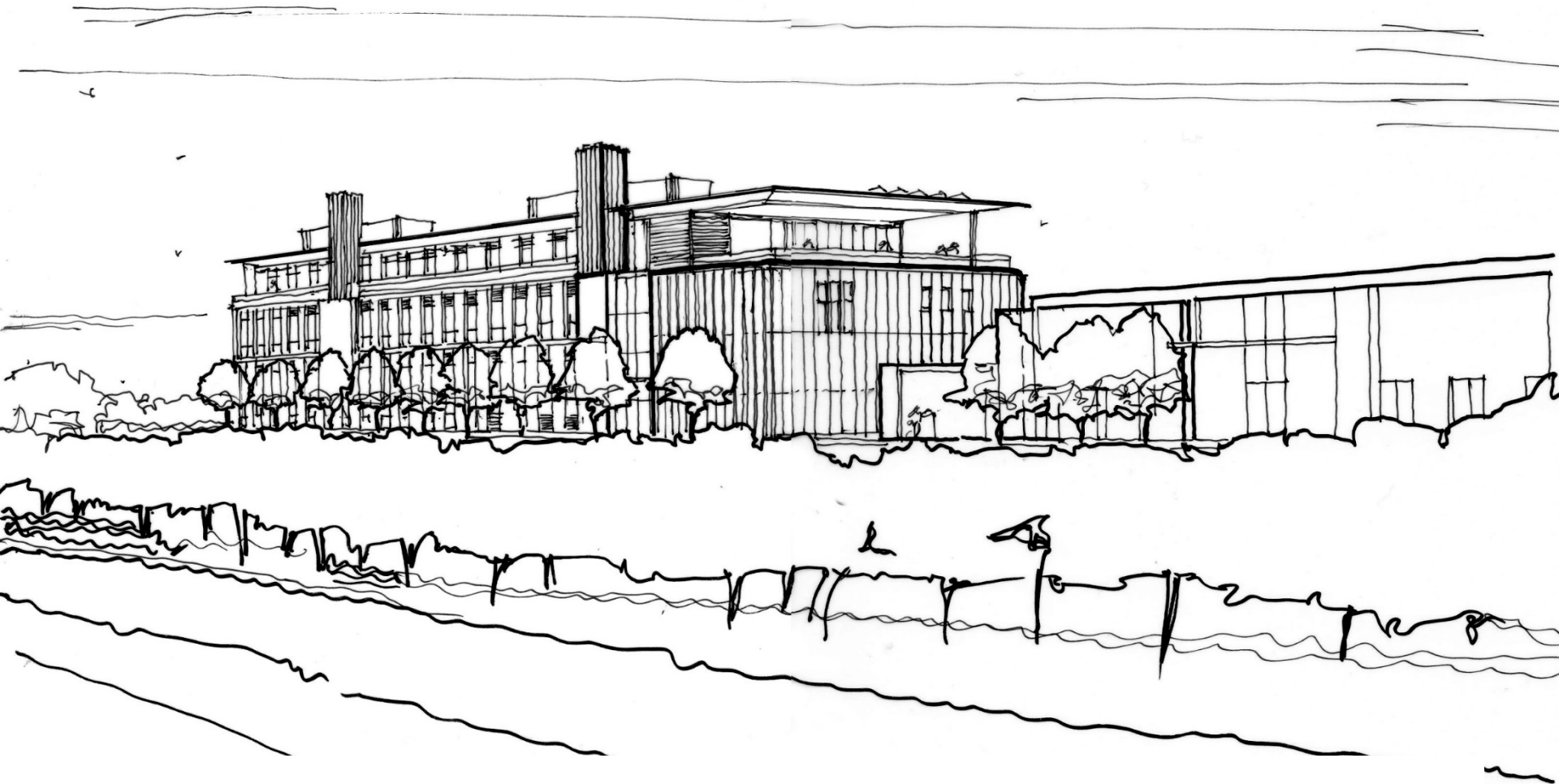
Design evolution



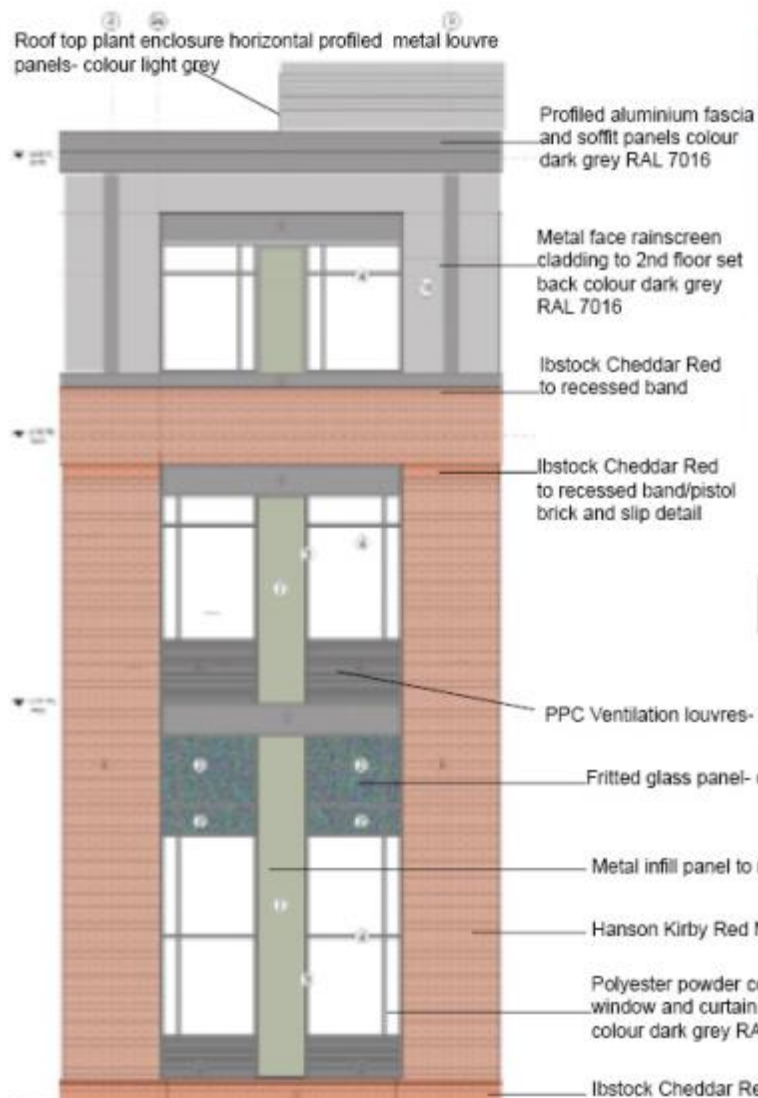
View from southern courtyard towards main entrance



View from Fabian Way



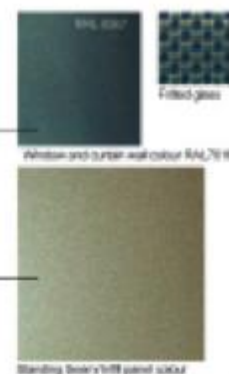
View from Fabian Way



TYPICAL BAY EXTRACT



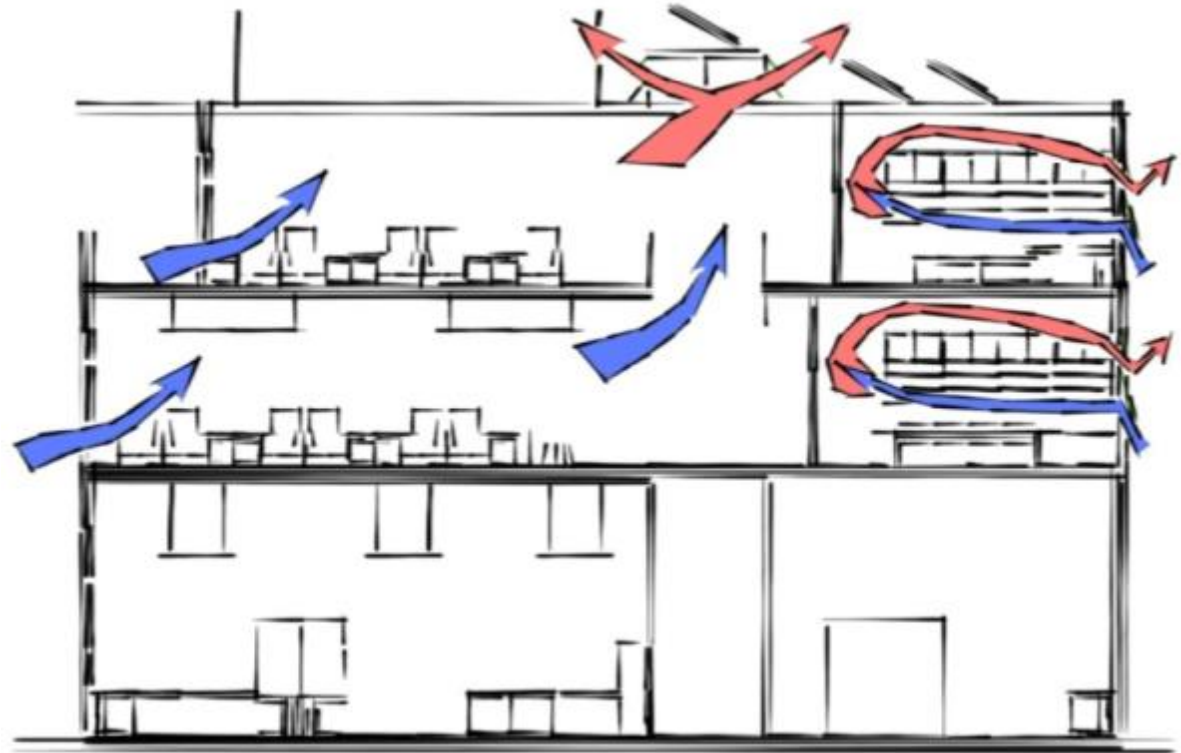
PART ELEVATION EXTRACT



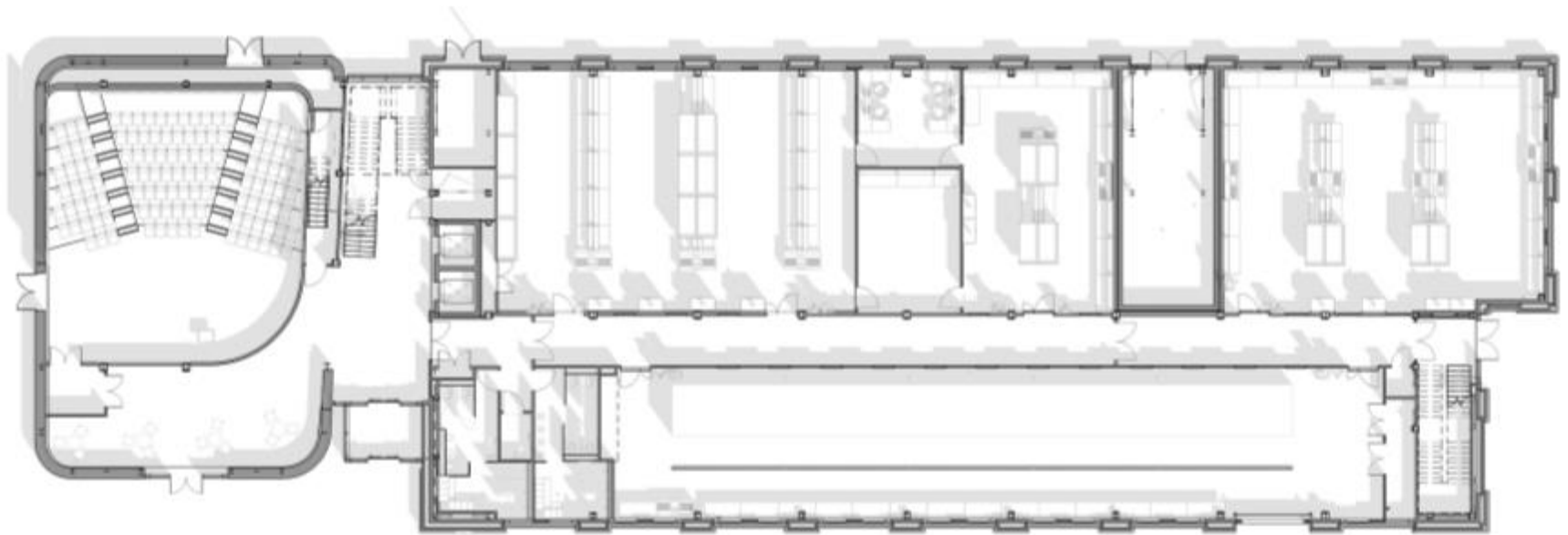
Example of facing brickwork with dark coloured mortar joint

Natural Ventilation Strategy

- High level pop ups with BMS controlled windows
- Innovative Acoustic louvre system
- Night purge system
- System provides fresh air and utilises stack effect

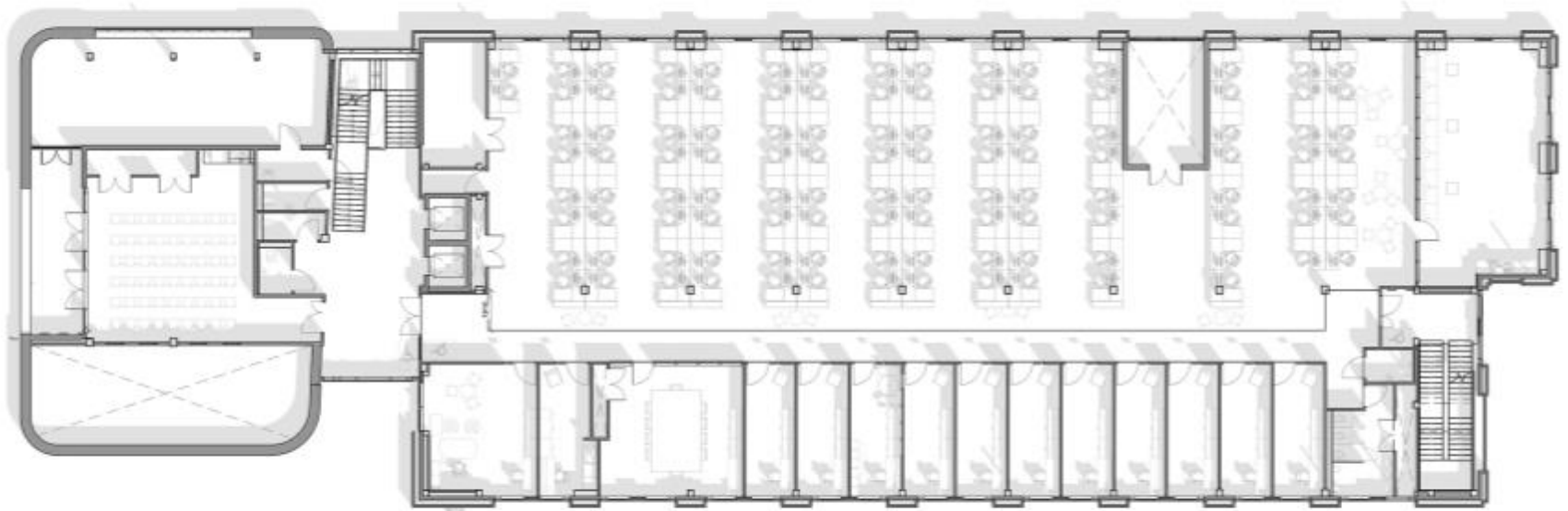


Airflow Through ESRI Building

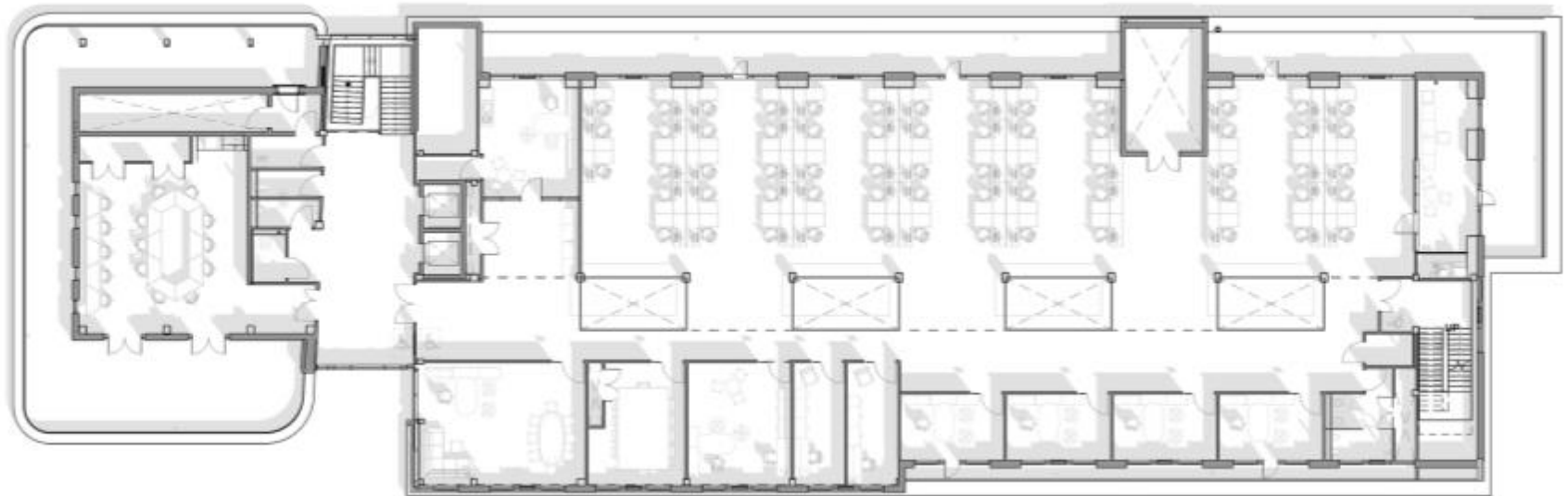


GROUND FLOOR PLAN

ESRI Plans



FIRST FLOOR PLAN



SECOND FLOOR PLAN

ESRI Plans





Laboratories

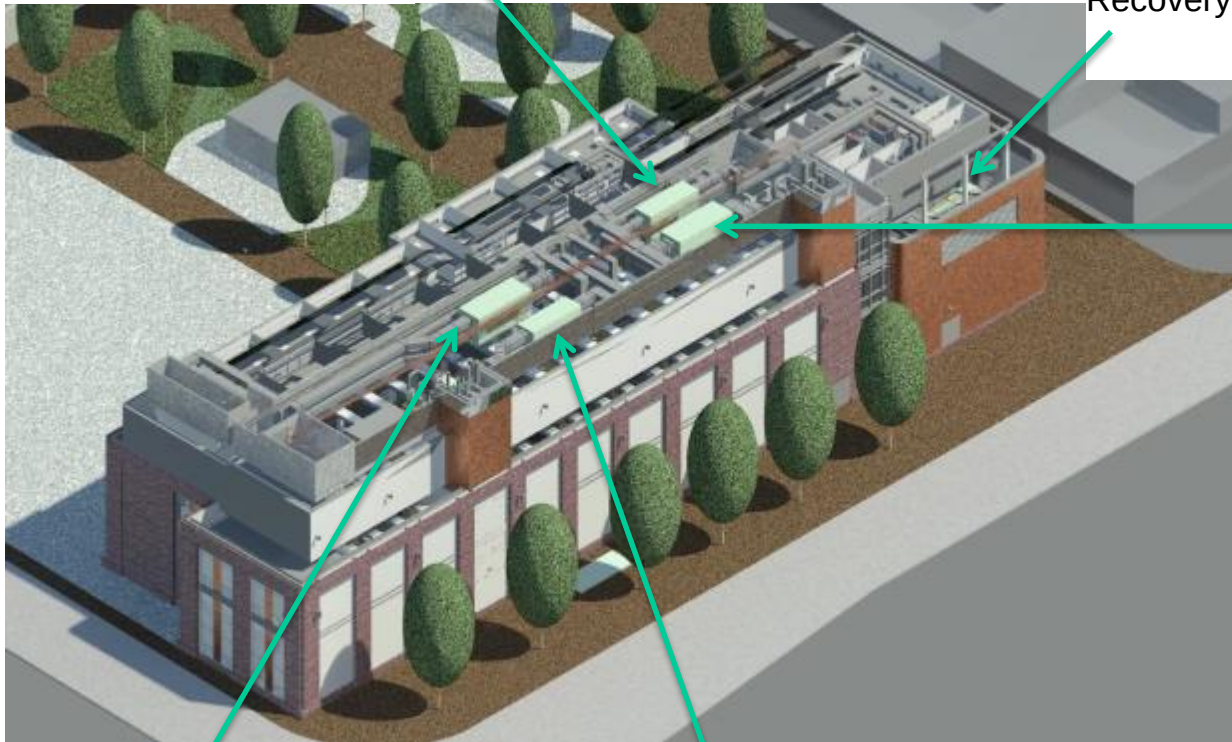


Lecture Theatre

AHU locations purposes

AHU-04 : General, Supply & Extract
with Heat Recovery

AHU-03 : Lecture Theatre,
Displacement Low Level Supply &
High Level Extract with Heat
Recovery



AHU-01 : Marine Lab, Supply &
Extract with Heat Recovery

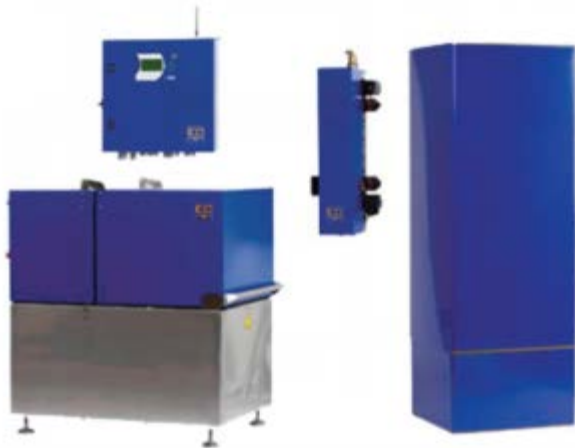
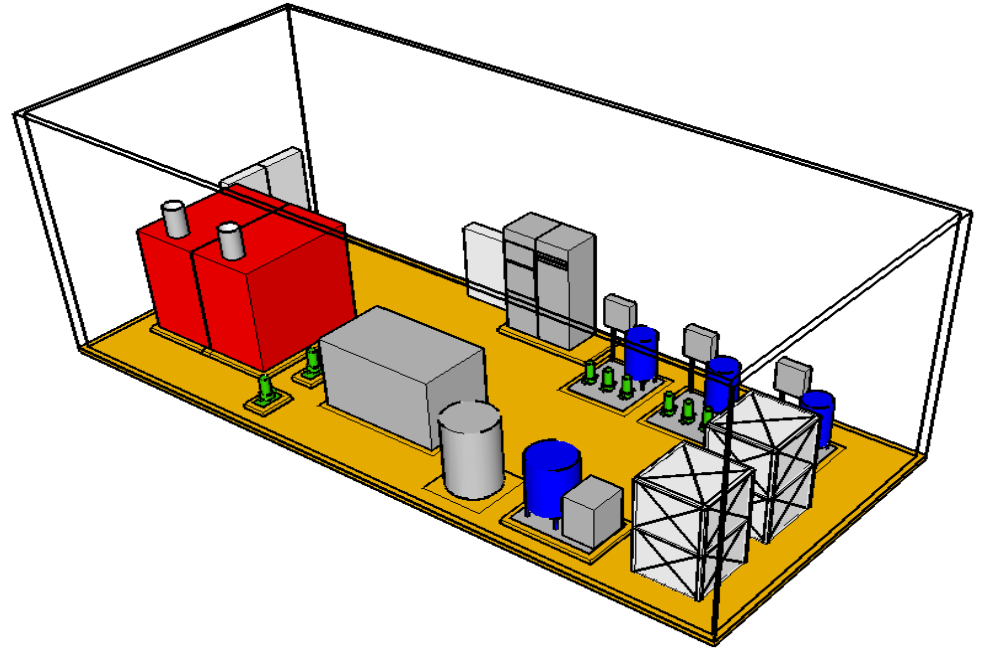
AHU-05 : Chemical & PV Lab, Supply
& Extract with Heat Recovery

AHU-02 :
Chemical Lab 1,
Supply & Extract
with Heat
Recovery

CHP & Boilers

Combined Heat & Power - SAV
Load Tracker

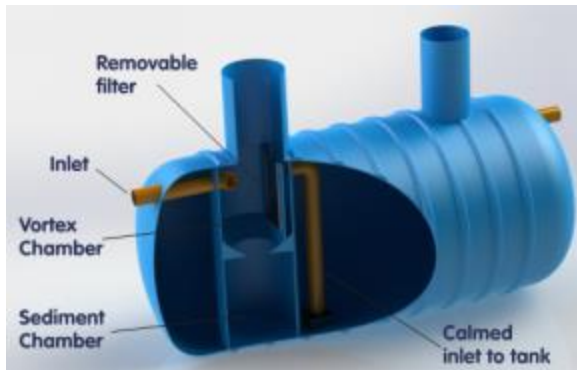
- 6 – 15kW Power Output
(Modulating)
- 17 – 30kW Thermal Output



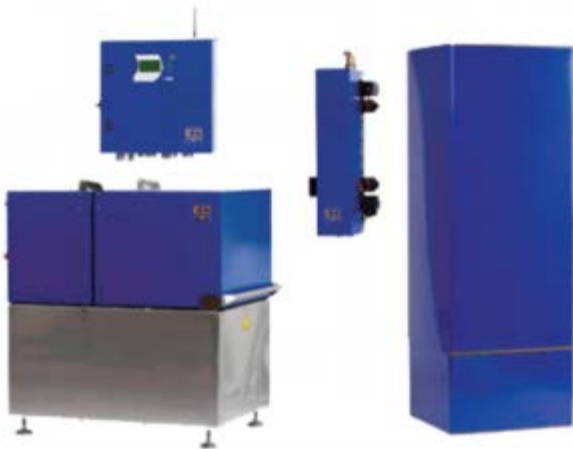
Condensing Boiler – 2 No. Hoval
UltraGas

- 460kW Rating per Boiler
- High Relative Efficiency

Renewable Technologies

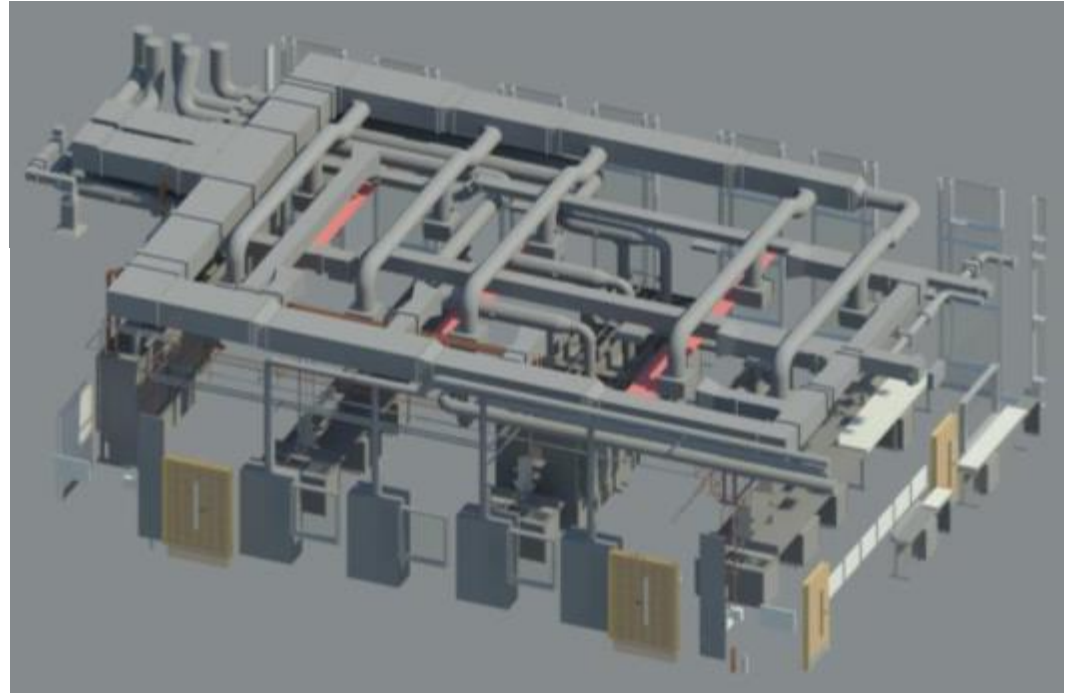
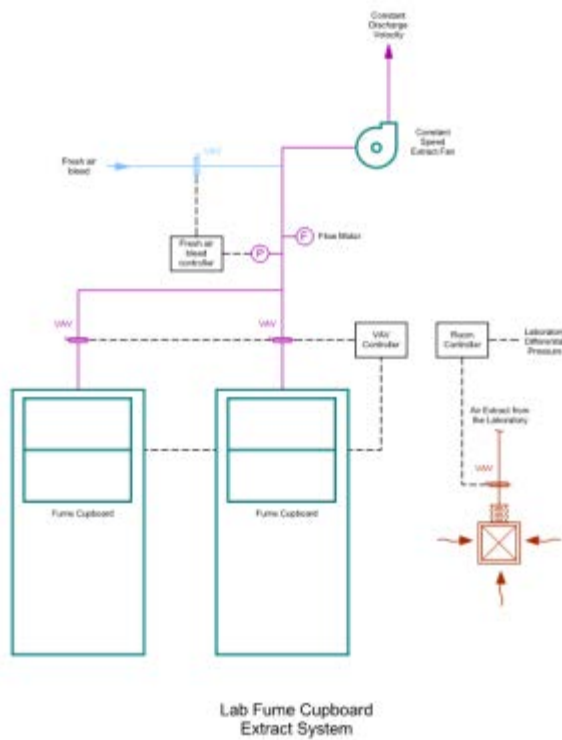


- Rainwater Harvesting – Reducing Flushing water consumption
- Photo Voltaic – Reduction in electricity required from grid, can even be sold back to grid.
- Combined Heat and Power Reduction in electricity required from grid.



Chemical Lab One and Fume Cupboards

- Fully modulated fume cupboard sash



- Radiant panels provides thermal comfort not affecting air temperature
- Cooling provided by air system from dedicated lab AHU

Energy Performance Certificate

Non-Domestic Building



ESRI
Swansea University
Second Campus
Swansea
SA

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient



Net zero CO₂ emissions

A 0-25

19

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel: Natural Gas
Building environment: Heating and Natural Ventilation
Total useful floor area (m²): 3653.614
Building complexity (NOS level): 5
Building emission rate (kgCO₂/m²): 13.78

Benchmarks

Buildings similar to this one could have ratings as follows:

39 If newly built

105 If typical of the existing stock

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{Typ}	U _{Min}	Surface where the minimum value occurs*
Wall	0.23	0.21	1CHN0001:Surf[1]
Floor	0.2	0.15	1CHN0001:Surf[0]
Roof	0.15	0.15	1LCT0001:Surf[1]
Windows, roof windows, and rooflights	1.5	1.3	1CRC0000:Surf[1]
Personnel doors	1.5	1.1	1LAB0001:Surf[6]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{Typ} = Typical individual element U-values [W/(m ² K)]			U _{Min} = Minimum individual element U-values [W/(m ² K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	4

3.1 Thermal Mass

In addition to the automated ventilation strategy, exposed thermal mass in the building assists in moderating internal temperatures. Materials with high thermal mass that are exposed to the spaces will absorb heat during the day and release it at night when the external temperature drops. As shown in Figure 3 below, the internal temperature of a lightweight building with little thermal mass closely follows the external temperature. With a high thermal mass and secure night time ventilation to purge heat, the mass absorbs a proportion of the heat and therefore the internal temperature remains more moderate over time.

The thermal model for ESRI includes a medium amount of exposed thermal mass to the ceiling and roof, specifically a 170mm concrete slab at each floor and at roof level.

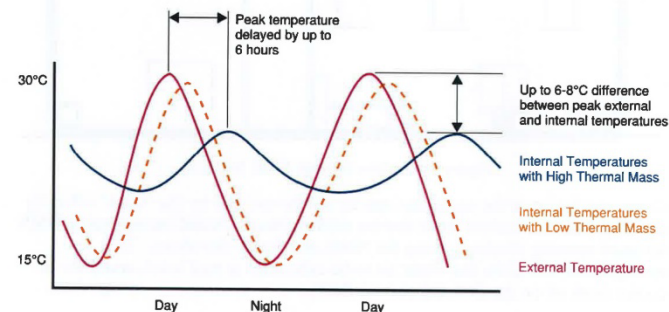


Figure 3 - Thermal Mass

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	3653.6	3653.6		A1/A2 Retail/Financial and Professional services
External area [m ²]	5820.2	5820.2		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	CAR	CAR		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	4	5		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	1988.58	2508.24		B8 Storage or Distribution
Average U-value [W/m ² K]	0.34	0.43		C1 Hotels
Alpha value* [%]	9.72	10		C2 Residential Inst.: Hospitals and Care Homes
			100	C2 Residential Inst.: Residential schools
				C2 Residential Inst.: Universities and colleges

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

C2A Secure Residential Inst.
Residential spaces
D1 Non-residential Inst.: Community/Day Centre
D1 Non-residential Inst.: Libraries, Museums, and Galleries
D1 Non-residential Inst.: Education
D1 Non-residential Inst.: Primary Health Care Building
D1 Non-residential Inst.: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Telephone exchanges
Others: Miscellaneous 24hr activities
Others: Car Parks 24 hrs
Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	35.12	39.34
Cooling	0.65	0.6
Auxiliary	8	7.67
Lighting	15.76	20.66
Hot water	38.44	25.67
Equipment*	42.18	42.18
TOTAL	81.89	93.94

* Energy used by equipment does not count towards the total for calculating emissions.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	8.91	0
Wind turbines	0	0
CHP generators	16.08	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	101.17	126.95
Total consumption [kWh/m ²]	81.89	93.94
Total emissions [kg/m ²]	14	27.9

4 Results

The table below illustrates the results from the Part L and EPC model:

Buildings Emissions Rate	BER	13.8 kgCO ₂ /m ²
Target Emissions Rate	TER	27.9 kgCO ₂ /m ²
Criterion 1 Result – BER < TER = PASS		

As illustrated in the table above the BER result is less than TER. This ensures that the regulation requirements of Criterion 1 of Part L are fulfilled.

Appendix A contains the Part L compliance output document which has been included for reference.

Furthermore an EPC assessment has been undertaken and the current grade is A-19. Appendix B contains the draft EPC assessment.

3.4.7 Low or Zero Carbon Technologies

- Photo Voltaic 250m²
- Micro CHP
 - Heat Output 30kW
 - Electrical Output 15.2kW
 - Thermal Efficiency 0.60
 - Turn down ratio 50%

The values in the table below have been implemented in the model to obtain regulation compliance.

Exposed Element	Actual Building	Notional Building	Part L (2010)
	U-value (W/m ² K)		
Roofs	0.15	0.18	0.25
External walls	0.21	0.26	0.35
Exposed floors and ground floors	0.15	0.22	0.25
Windows	1.3 (g=0.4)	1.8	2.2
Pedestrian doors	2.2	2.2	2.2
Natural ventilation louvers	1.1	N/A	N/A
Vehicle doors	1.5	1.5	1.5

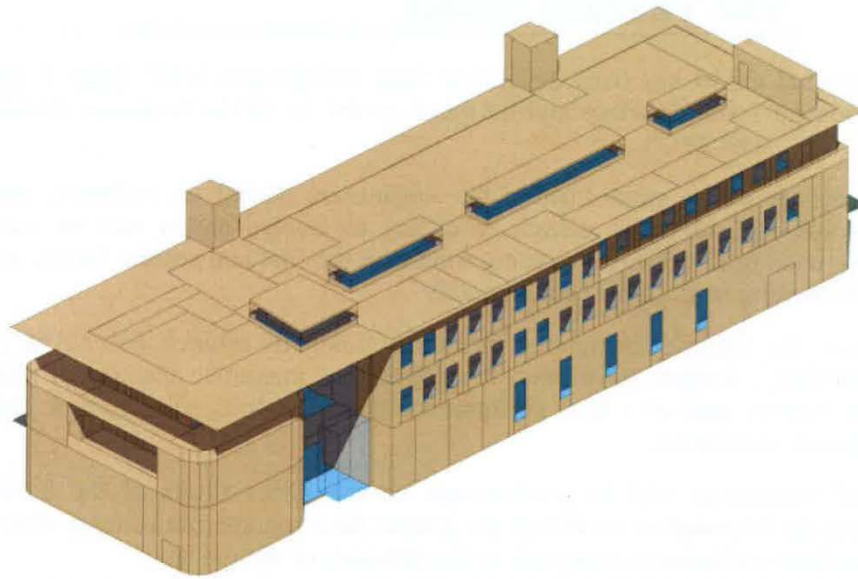


Figure 1 South - West View of IES Model

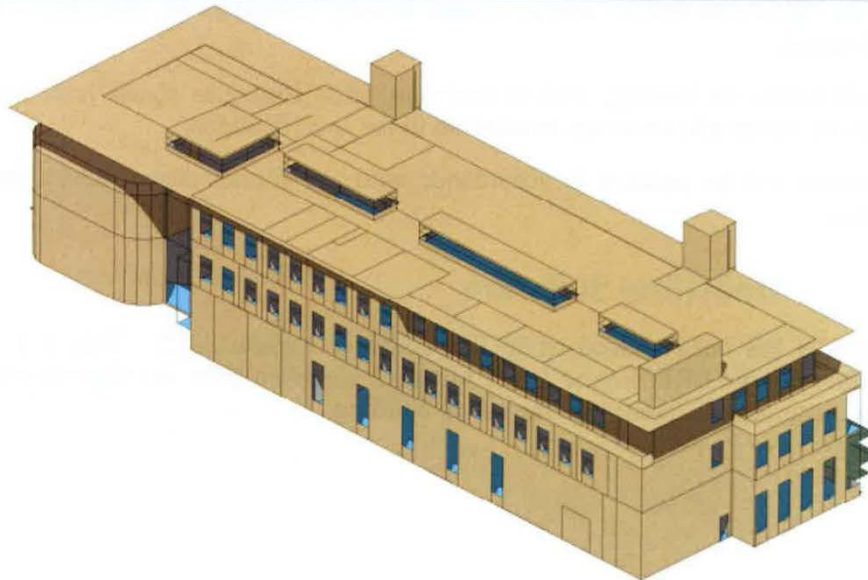
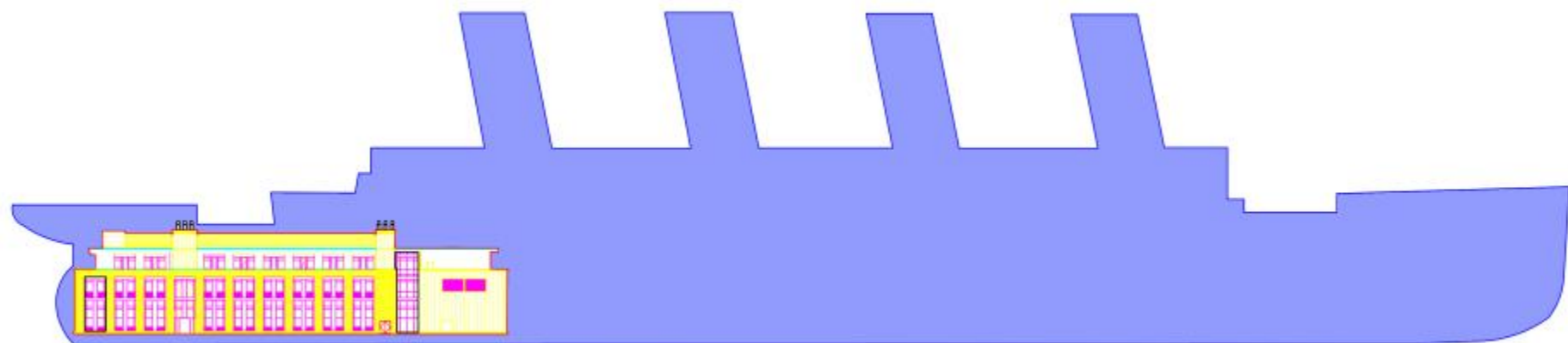
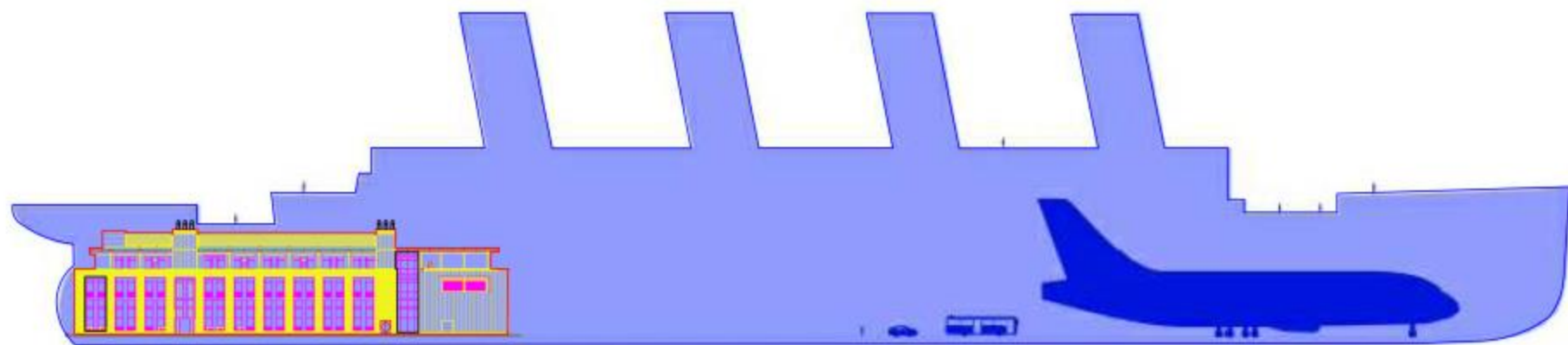


Figure 2 South-East View of IES Model

3.2 Software

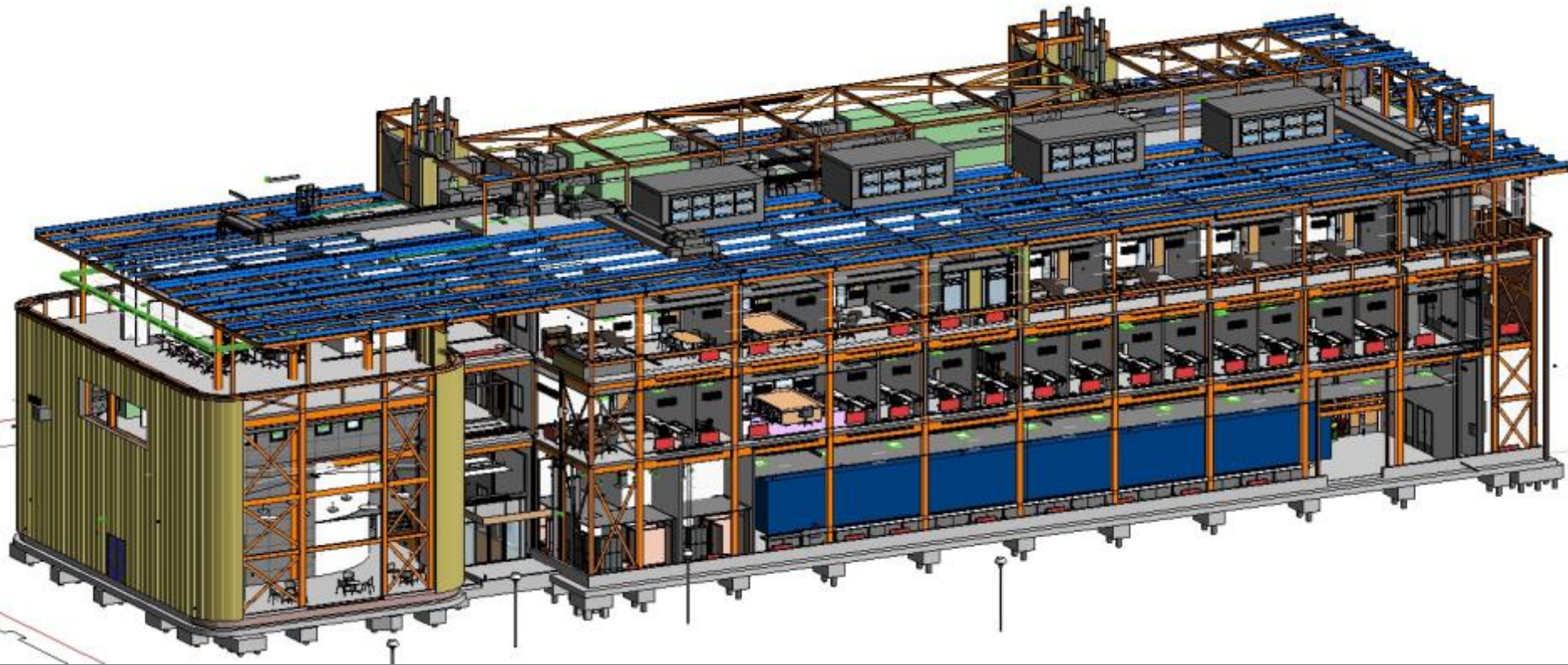
Modelling was completed using IES Virtual Environment version 2012.







BIM







Construction phase

ESRI - skeletal frame



ESRI - skeletal frame – lecture theatre





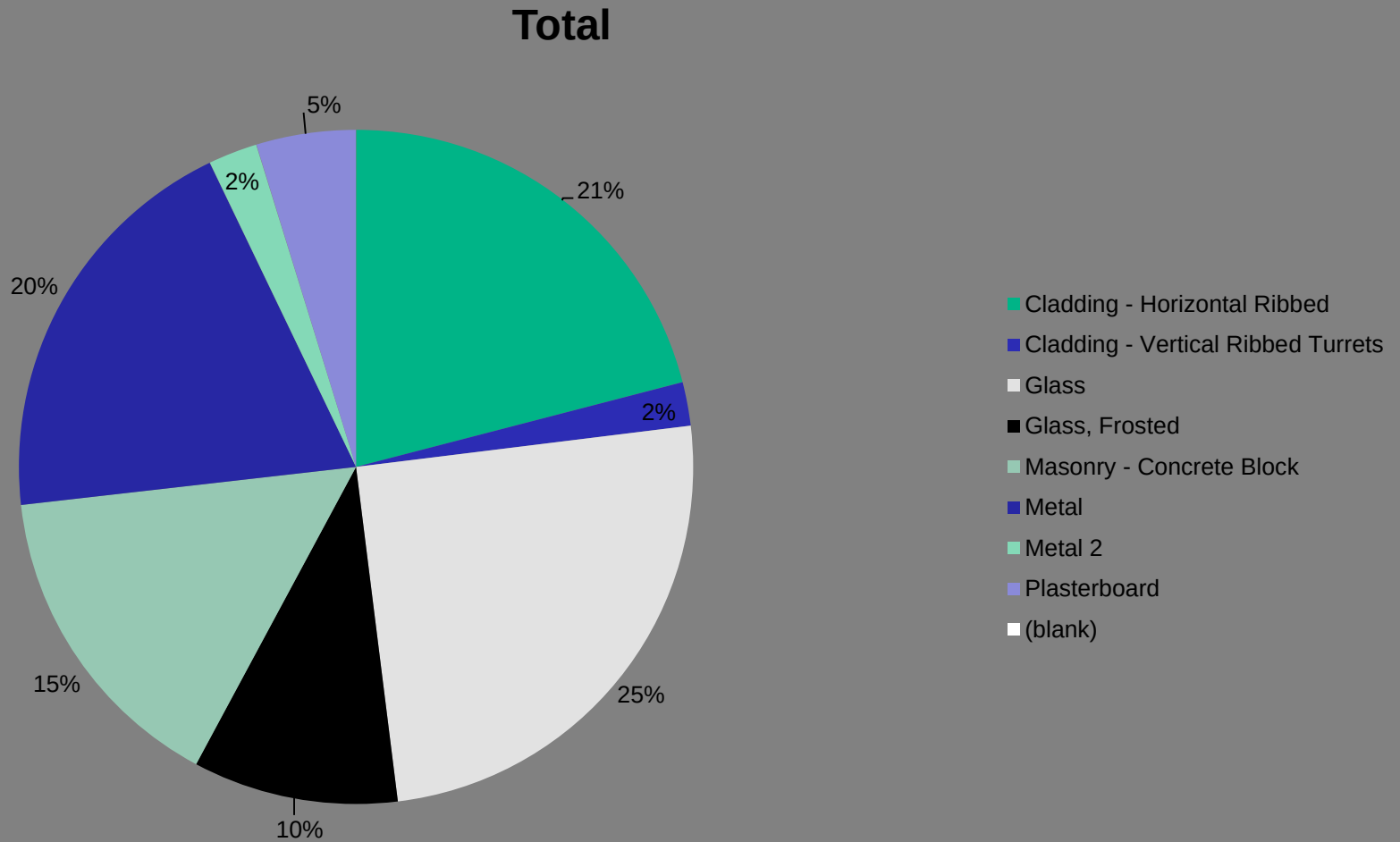


ESRI – structural information

The areas of main building materials are as follows;

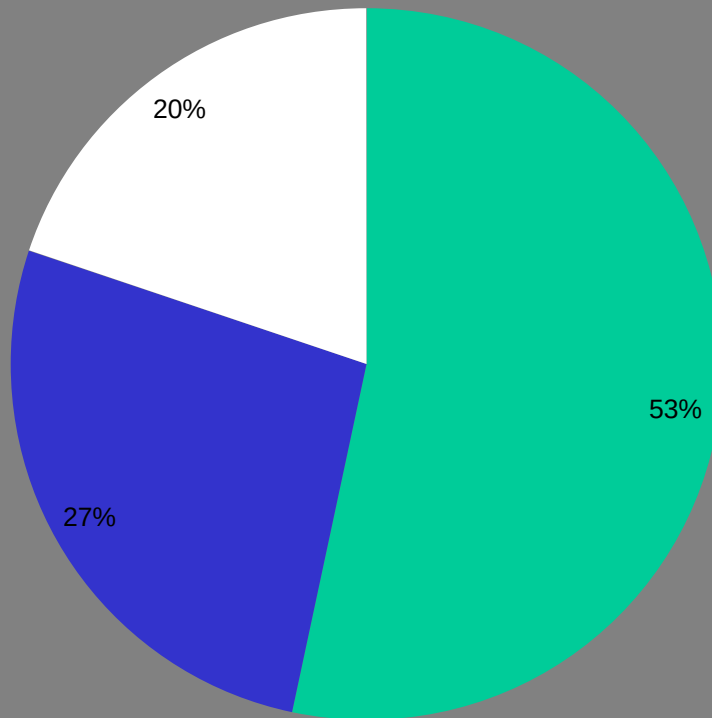
- Structural Frame – Steelwork S355 **365 tonnes**
- Cold rolled purlins **6.3 tonnes**
- Ground floor – 150mm thick reinforced concrete floor slab **1364m**
- Upper floors –170mm thick concrete on PMD, Level 01 & 02 **2680m²**
- 150mm thick concrete on PMD, Level 03 **413m²**
- Foundation/substructure – reinforced concrete ground beams **129m³**
- Pile caps **91m**
- Precast concrete piles **300mm Square piles**
- The upper floor slabs are constructed from 170mm thick concrete on Metfloor 55 profile metal deck

Façade material take off



Façade material windows

Total



- Glass
- Metal - Aluminium curtain wall
- Window Frame
- (blank)



Completion and occupation

Architecture













