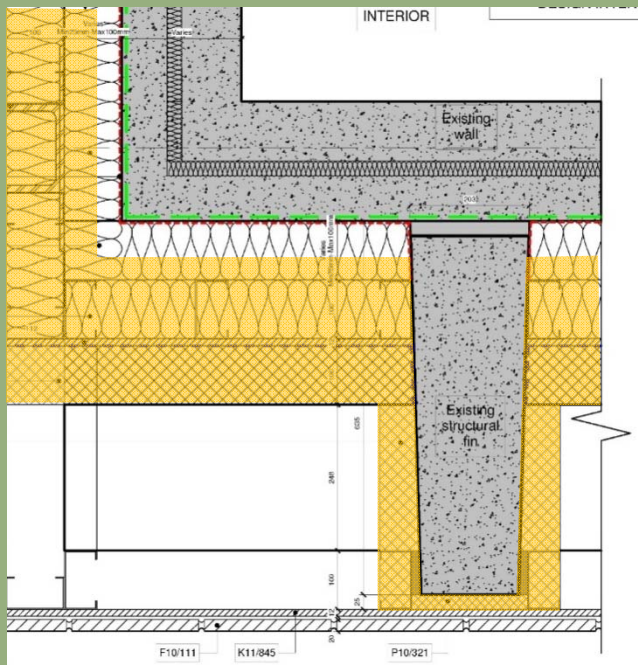


# Passivhaus Conference

## *Refurbishing Housing to meet C21st needs*

Tuesday 22<sup>nd</sup> October 2015

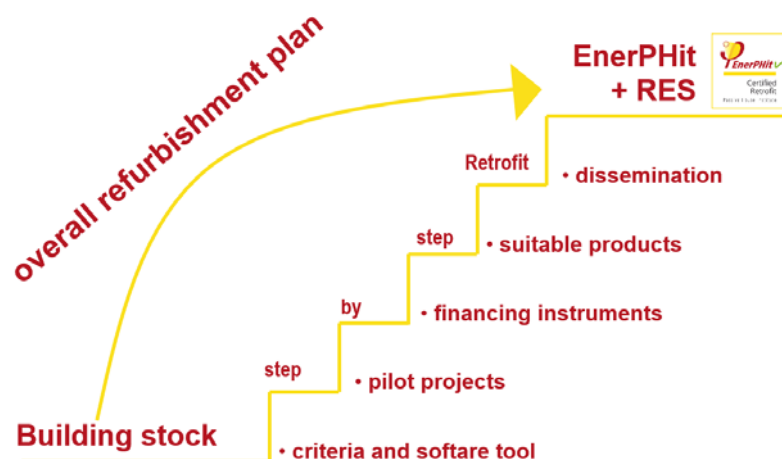
James Traynor &  
Loreana Padron



# Doing retrofit properly...achieving EnerPHit at scale. What are challenges?

# Doing retrofit properly...achieving EnerPHit at scale. What are challenges?

## 1. Technical – *EuroPHit study (BRE/ PHI)*



- CS01 ● Home for the Elderly, County Dublin
- CS02 ● Secondary School, Galway
- CS03 ● Hotel, Valcanover
- CS05 ● Social Housing, Courcelles
- CS06 ● Social Housing, Liévin
- CS15 ● Family Home, Toumon-sur-Rhone
- CS08 ● Therapy Centre, Asturias
- CS16 ● Single Family Home, Santander
- CS10,CS11 ● Two Schools, Gabrovo
- CS12 ● Family Home, Svartbäcksvägen
- CS13 ● Rehab Workshop, Naestved
- CS14 ● Council Apart. Block, Portsmouth

# Doing retrofit properly...achieving EnerPHit at scale. What are challenges?

1. Technical
2. Human – *LSE Report*





# Doing retrofit properly...achieving EnerPHit at scale. What are challenges?

1. Technical
2. Human
3. **Financial** – *ECD Study*

## WILMCOTE HOUSE, PORTSMOUTH : WHOLE LIFE COST

A study to calculate the whole life cost implications of retrofitting a social housing tower block to the Enerphit standard.



- 1. Introduction**
- 2. Capital Cost Differential models**
- 3. Lifecycle cost analysis**
- 4. Other reasons...**

# 1. Introduction



Wilmcote House  
Portsmouth









Report from Portsmouth  
City Council Nov 2012



Report from Portsmouth  
City Council Nov 2012

- One third of residents suffer from condensation problems



## Report from Portsmouth City Council Nov 2012

- One third of residents suffer from condensation problems
- Windows are at the end of their servicable life





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## Report from Portsmouth City Council Nov 2012

- One third of residents suffer from condensation problems
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- Increased maintenance responses for the past two years
- Roof needs replacing





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- Water ingress problems in staircores

## Report from Portsmouth City Council Nov 2012

- One third of residents suffer from **condensation problems**
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- Roof needs **replacing**
- Water ingress problems in staircores
- No gas allowed, only **costly electric**





## Report from Portsmouth City Council Nov 2012

- One third of residents suffer from **condensation problems**
- Windows are at the **end of** their servicable **life**
- Increased **maintenance** responses for the past two years
- Roof needs **replacing**
- Water ingress problems in staircores
- No gas allowed, only **costly electric**
- Concrete repairs are required to future-proof the building

Demolition option considered





Demolition option considered





Demolition option considered



Demolition option considered



Demolition option considered but rejected by the client ...





Demolition option considered but rejected by the client ...

It would take at least **18-24 months** to decant the block.



Demolition option considered but rejected by the client ...

- It would take at least **18-24 months** to decant the block.
- Over **a hundred families** would have to be relocated.





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- It would take at least **18-24 months** to decant the block.
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- Three bedroom properties are in **high demand** locally.



## Demolition option considered but rejected by the client ...

- It would take at least **18-24 months** to decant the block.
- Over **a hundred families** would have to be relocated.
- Three bedroom properties are in **high demand** locally.
- Rebuild costs would be **prohibitive**.





## Demolition option considered but rejected by the client ...

- It would take at least **18-24 months** to decant the block.
- Over **a hundred families** would have to be relocated.
- Three bedroom properties are in **high demand** locally.





Demolition option considered but rejected by the client ...

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Demolition option considered but rejected by the client ...

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Demolition option considered but rejected by the client ...





Demolition option considered but rejected by the client ...



# Wilmcote House





# Wilmcote House



External walkways



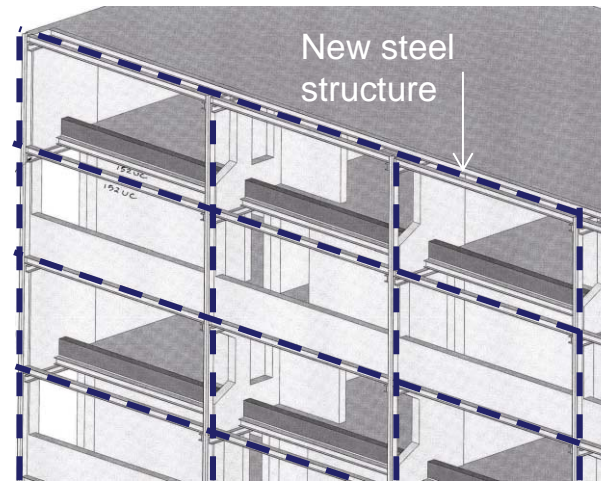
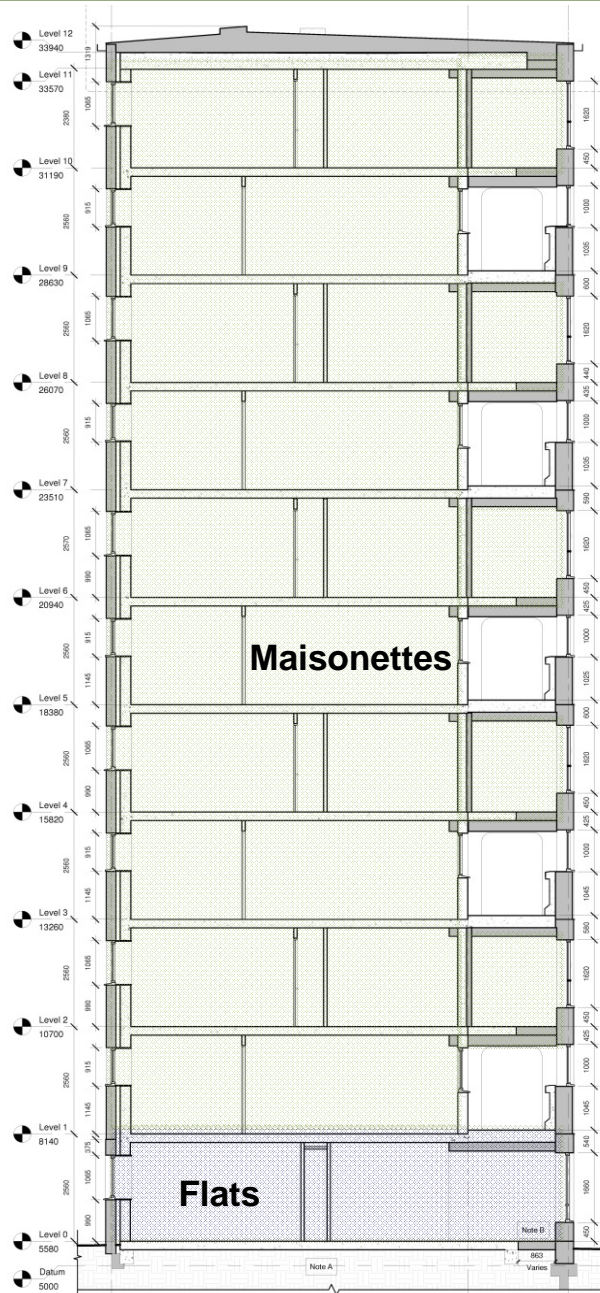
Living room and door to balcony



Open balcony

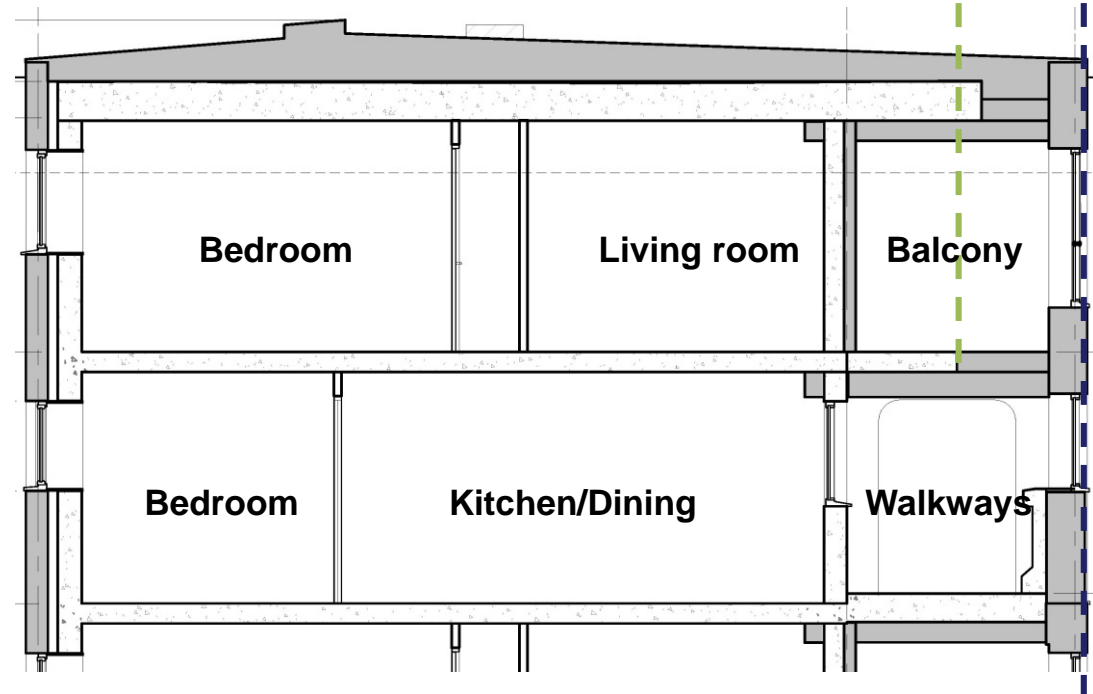


# Works: Envelope

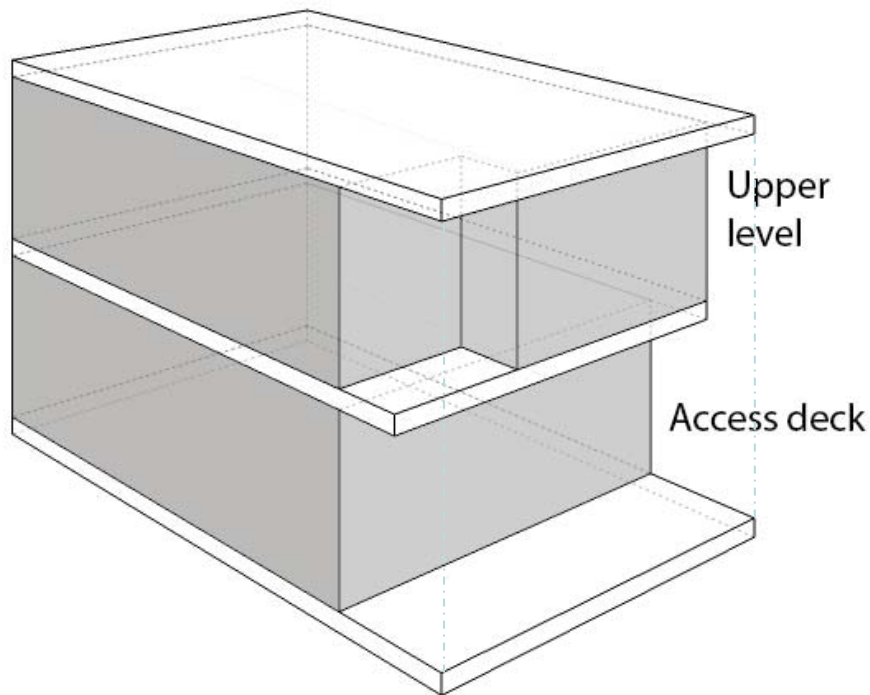


Proposed new external wall

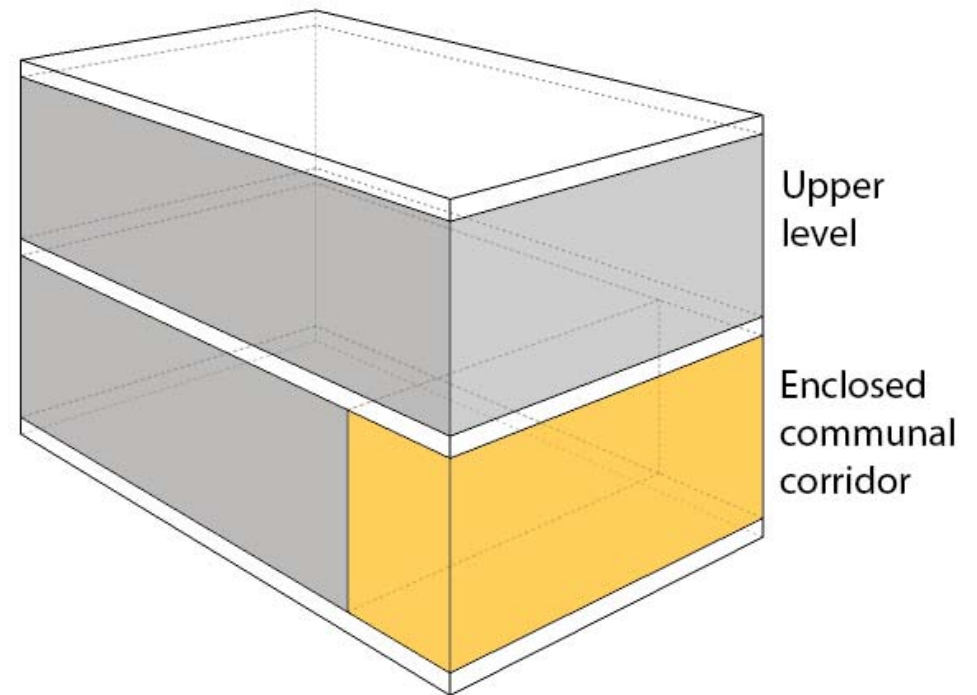
Existing wall of living room and open balcony



Existing envelope:



Proposed envelope (preferred option):



Schematic of the maisonette form pre and post-retrofit (Access deck on the South-East elevation)

Teli, D. et al., *Impact of current occupant behaviour on potential carbon savings in a council owned tower block undergoing retrofit*. University of Southampton, 2014



# Works: Existing envelope







**Enclosed walkways**

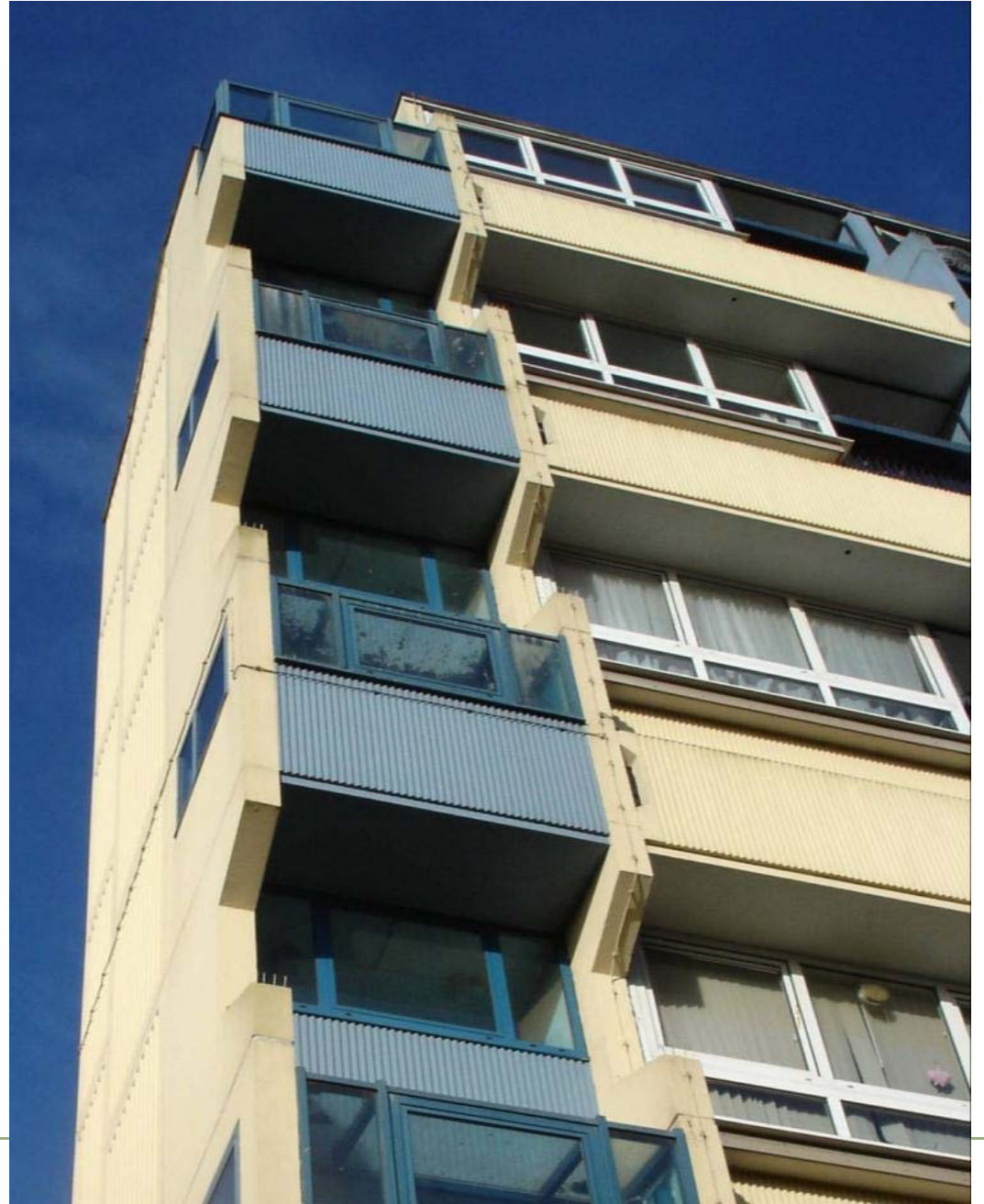


**Enlarged enclosed sun-space**



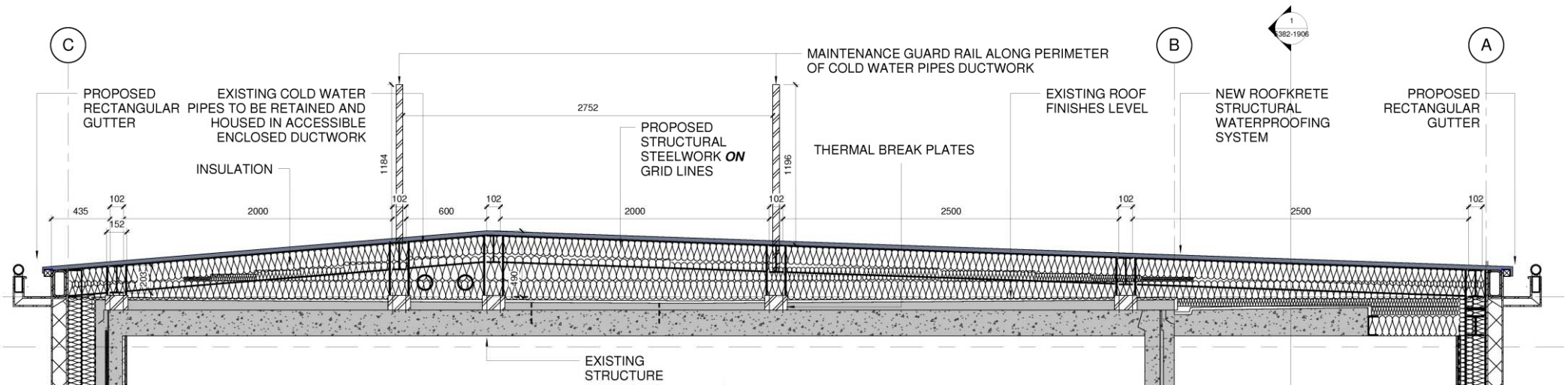
**Enlarged living room**

# Works: Windows



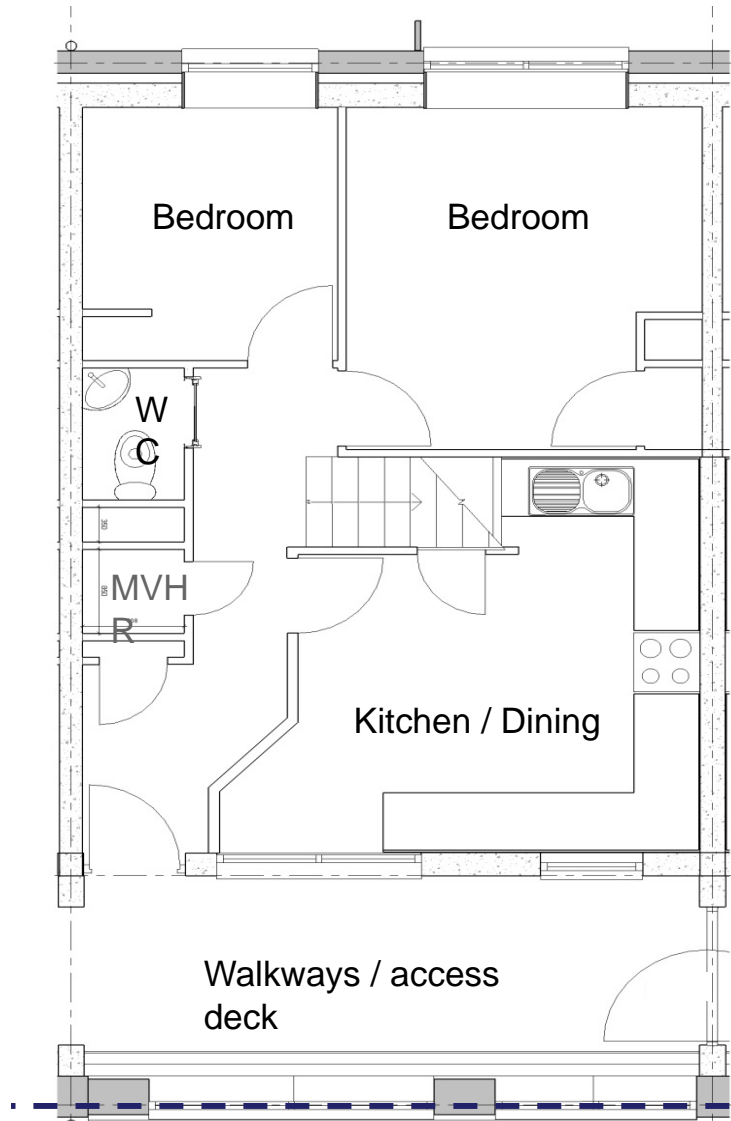


# Works: Roof

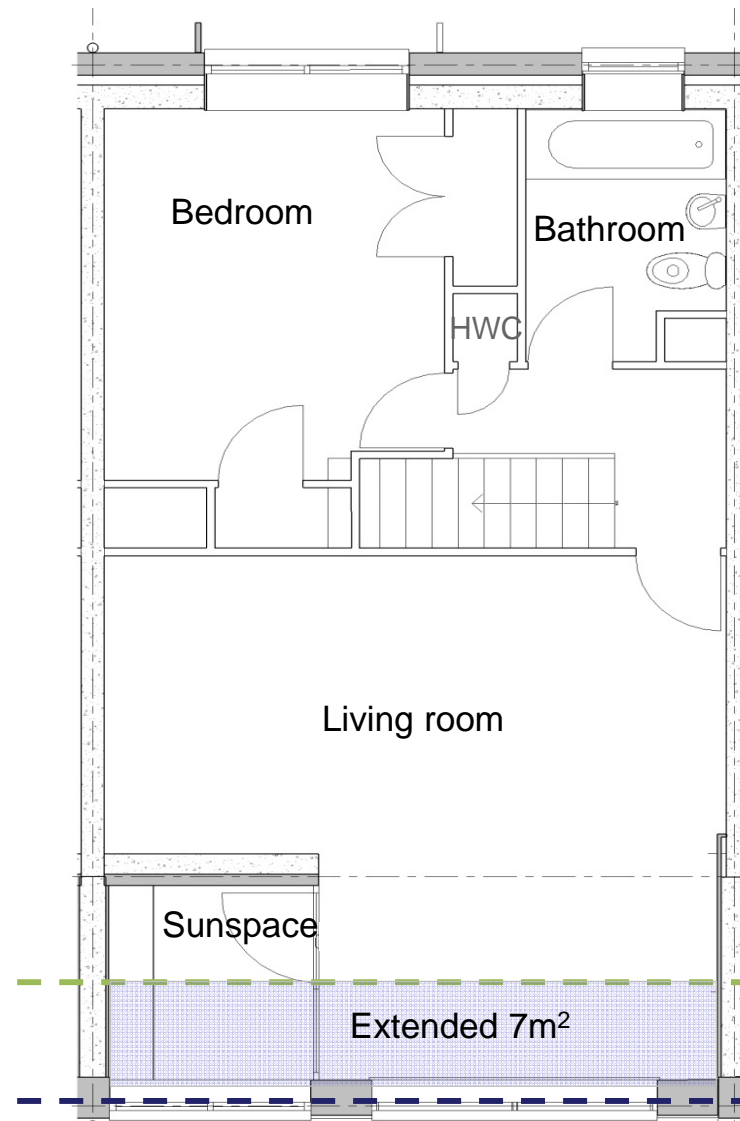




# Works: Maisonettes



Lower level



Upper level

Existing wall of living room and open balcony

Proposed new external wall

# Pilot maisonette: MVHR in existing cupboard



Existing cupboard in entrance hall



Paul Focus 200 installed and running

# Pilot maisonette: MVHR system



Supply valve in bedroom and ducts in existing riser



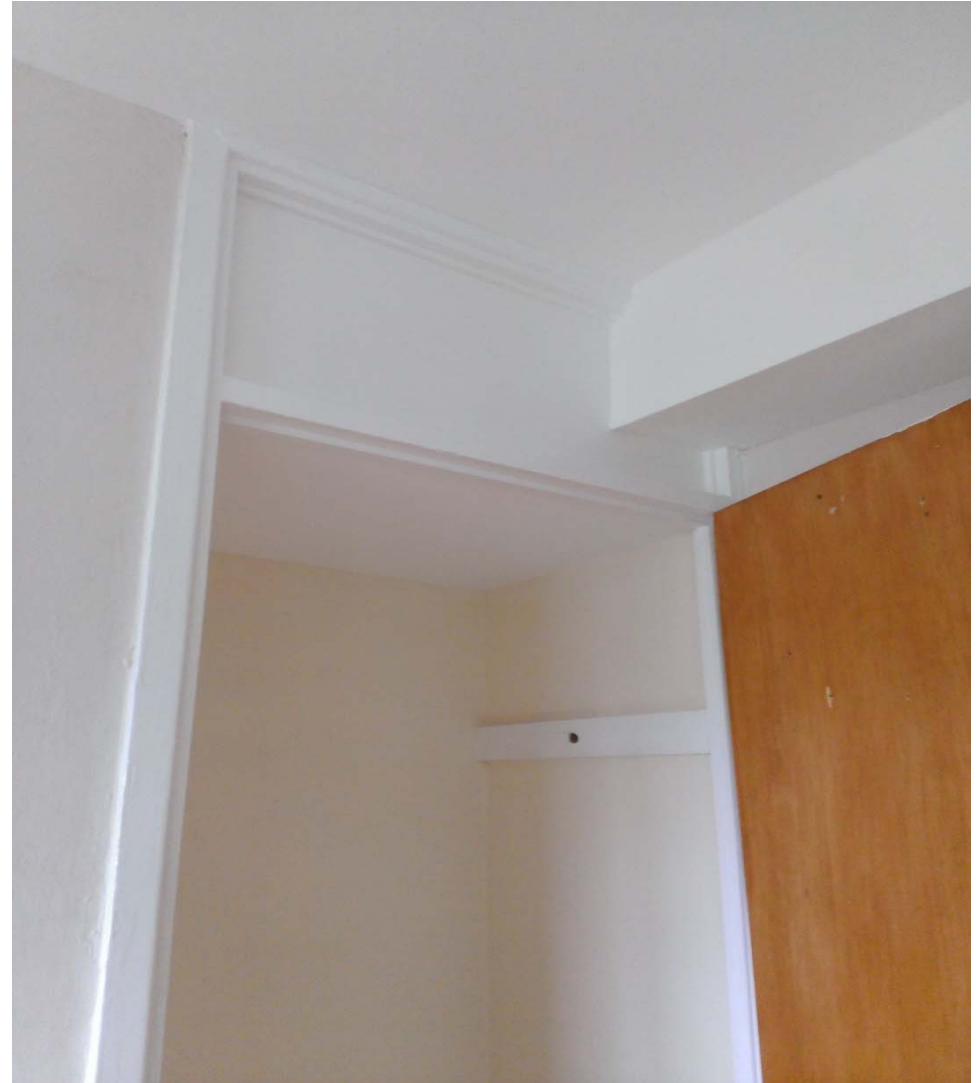
Temporary exhaust and intake valves to corridor.  
After enclosing the walkways these will be extended to the external wall



# Pilot maisonette: bulkheads for ducts



New entrance door and lowered ceiling for exhaust and intake ducting

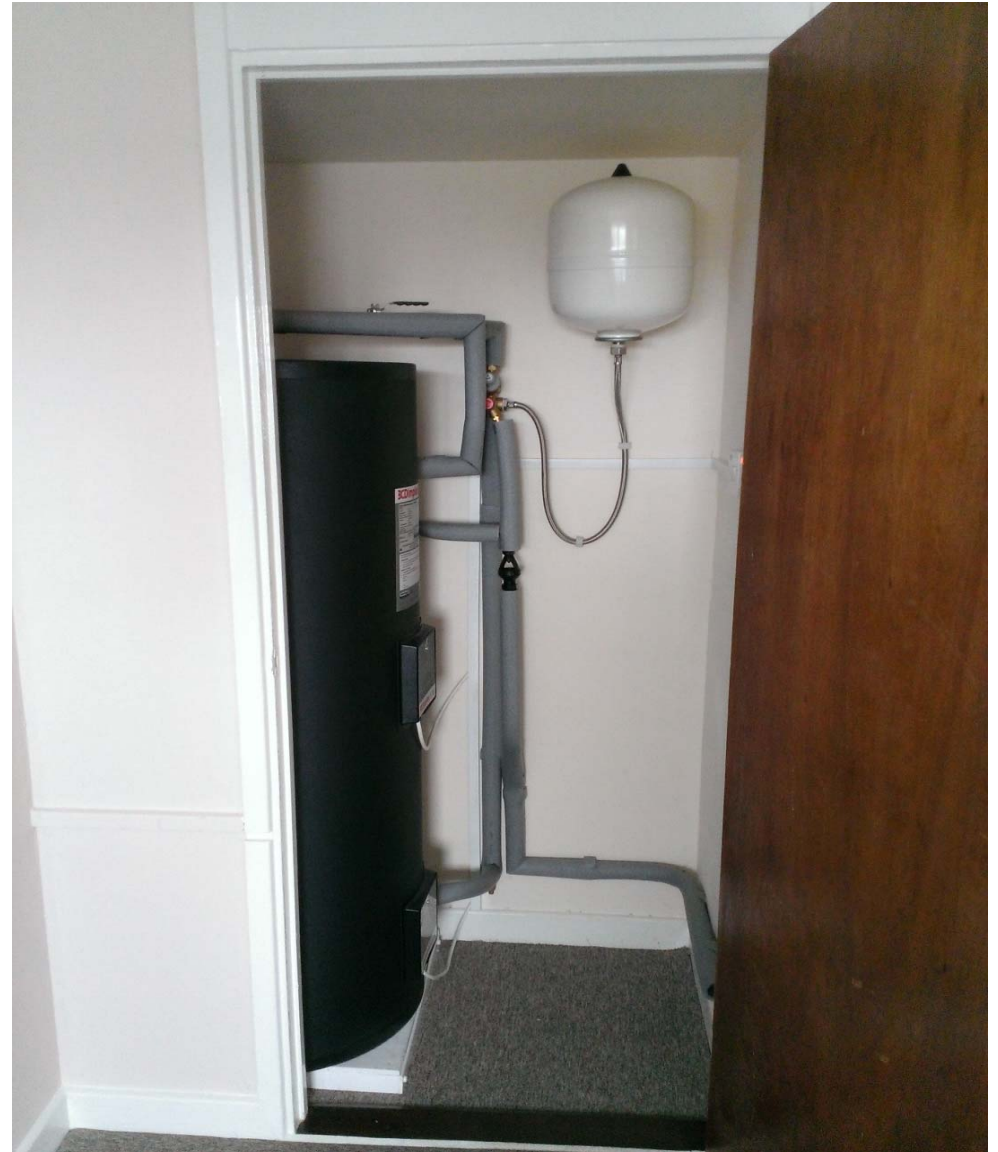


Ducts boxed-out in a bedroom to connect them to the riser

# Pilot maisonette: M&E



New storage heater in bedroom



New insulated hot water cylinder















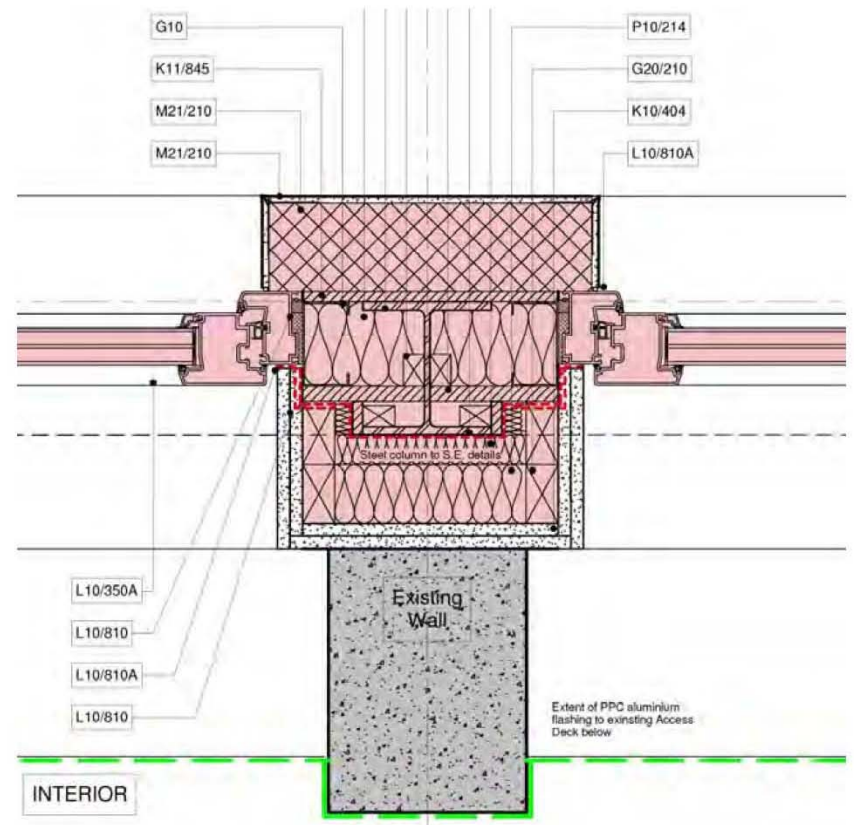


## **2. Capital Cost Differential Models**

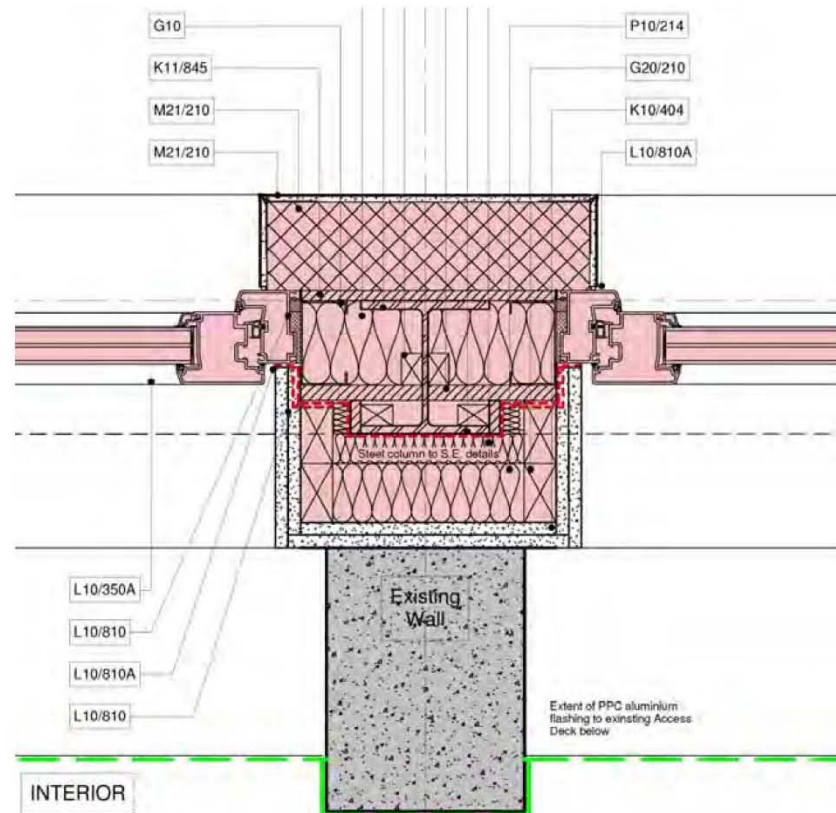
- **Passivhaus specification (as tendered)**
- **Building regulations equivalent (Part L 2010)**



# Overcladding strategy

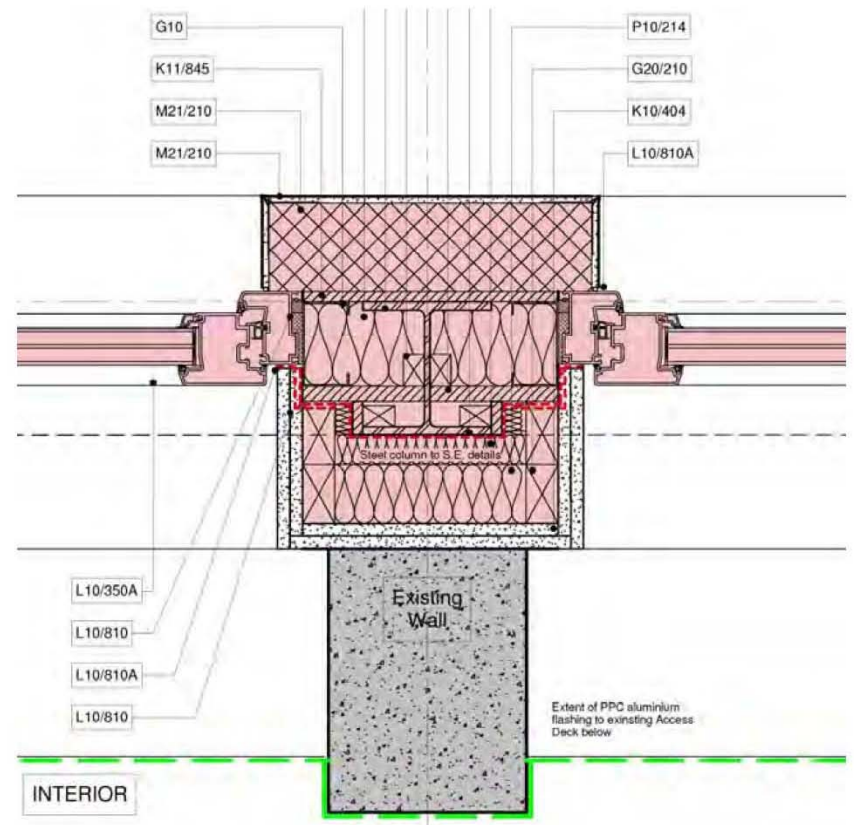
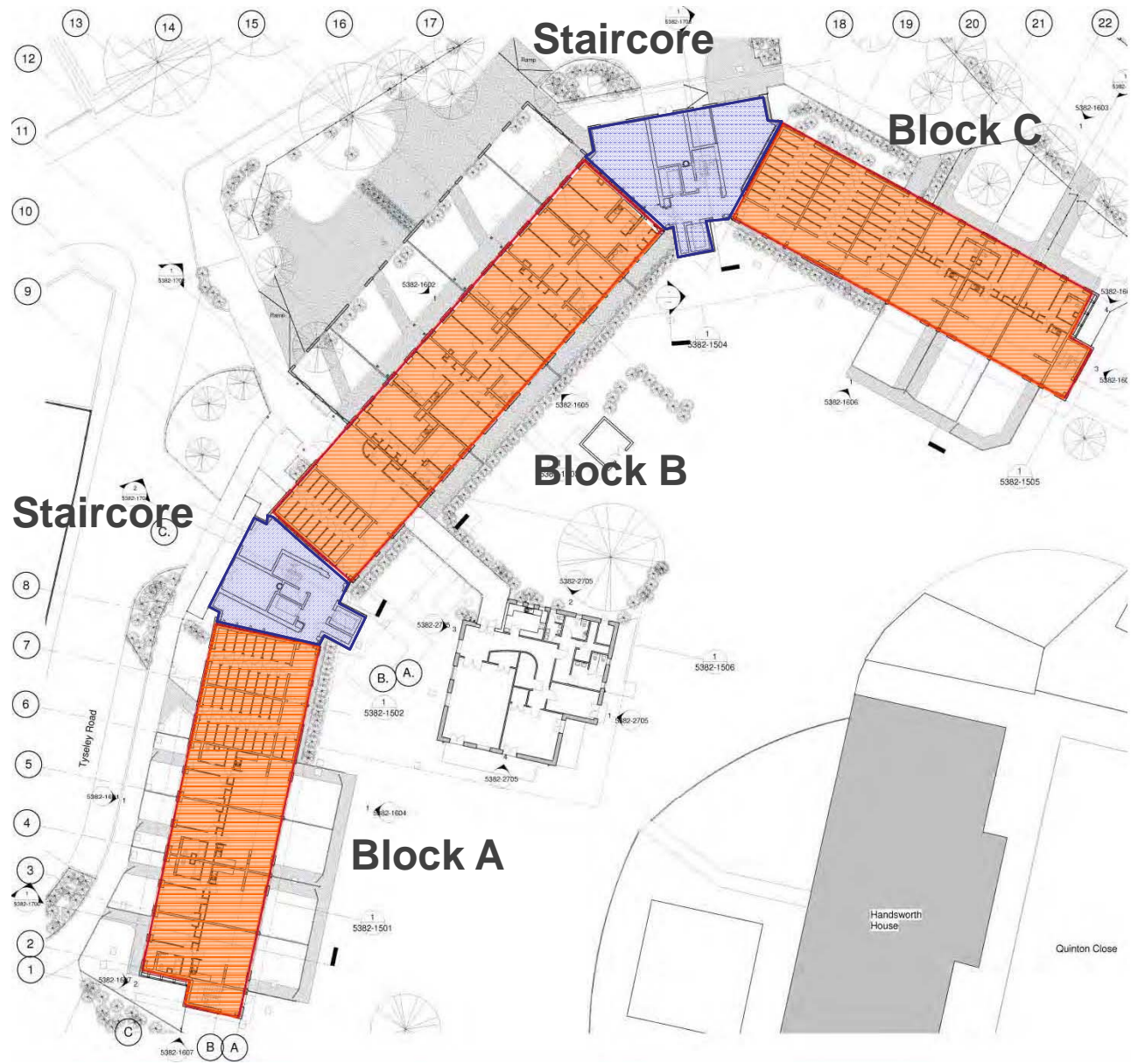


# Overcladding strategy



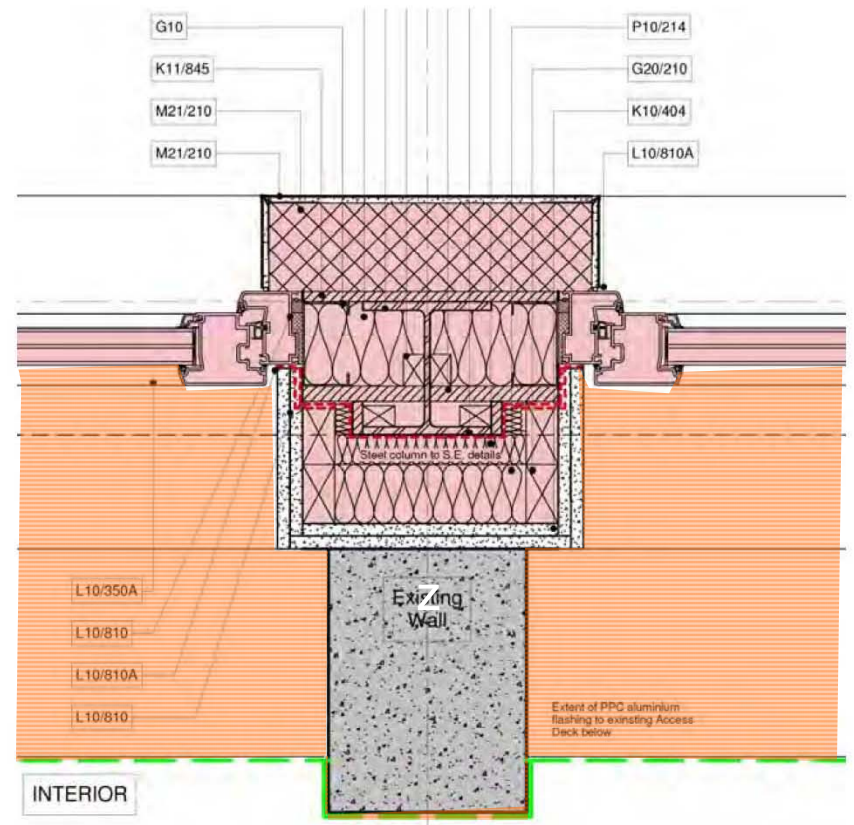


# Overcladding strategy





# Overcladding strategy



Overcladding detail – External wall

# Capital Cost Breakdown

- **Foundations**
- **Below DPC**
- **Internal Wall Insulation**
- **External Wall Insulation**
- **Roof Insulation**
- **Thermal break pads**
- **Windows**
- **MVHR/Extract**
- **Strip out existing ducts**
- **Strip out asbestos**
- **Airtightness and quality control**
- **Prelims, design fees & risk,  
bond, contingency**



# Capital Cost Breakdown

- Foundations
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## Bill of quantities – relevant items

Item cost £££

Total Cost to summary £££

Running total £££

# Foundations



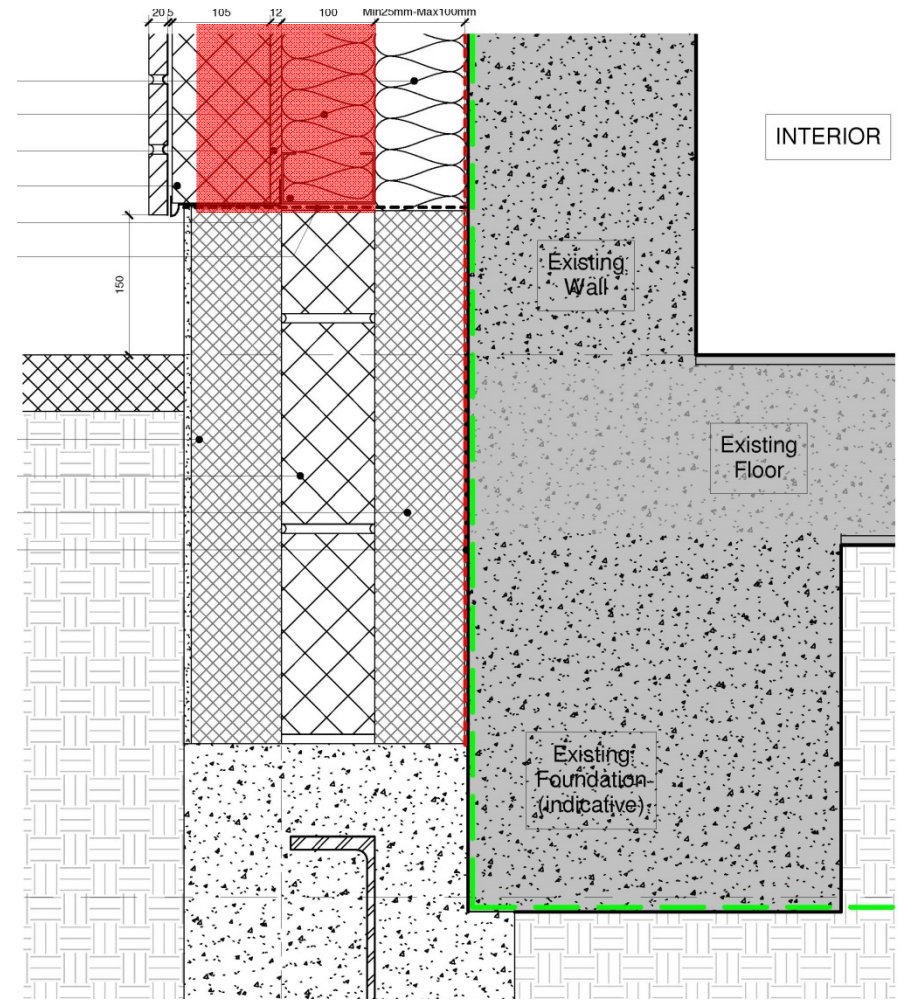
 **Passivhaus requirements**



# Foundations

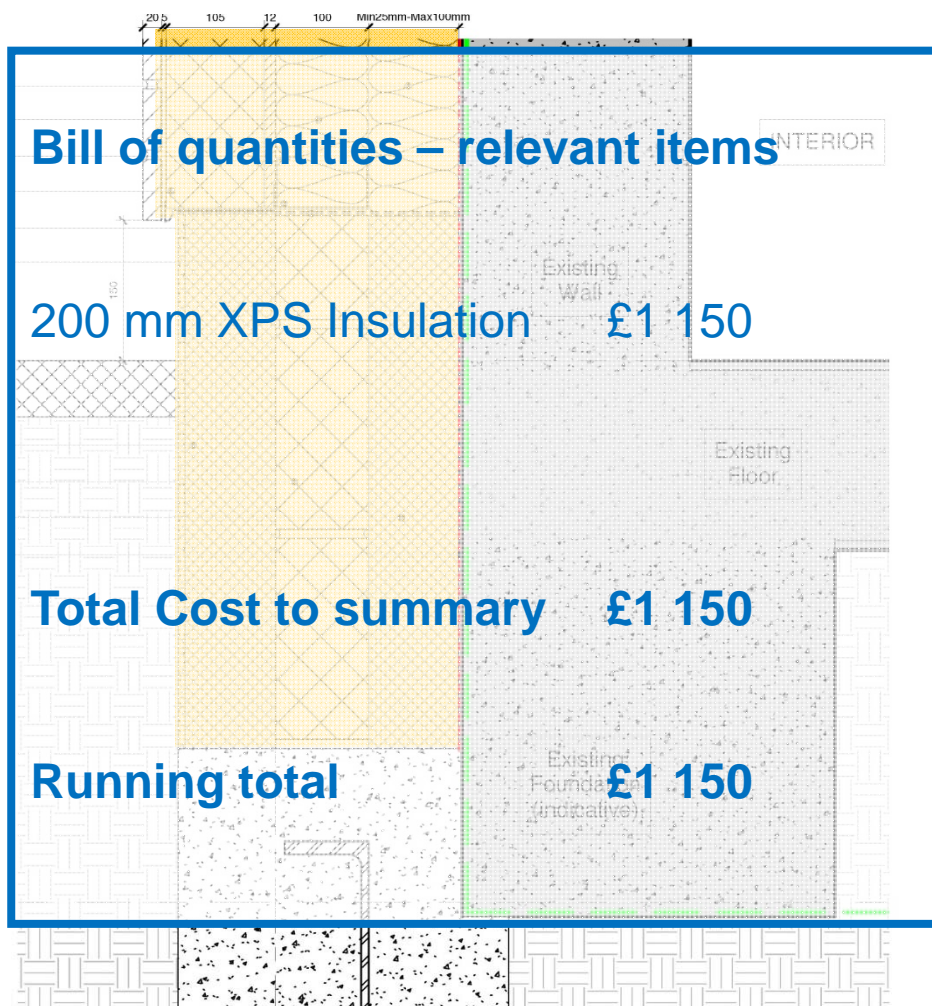


 **Passivhaus requirements**

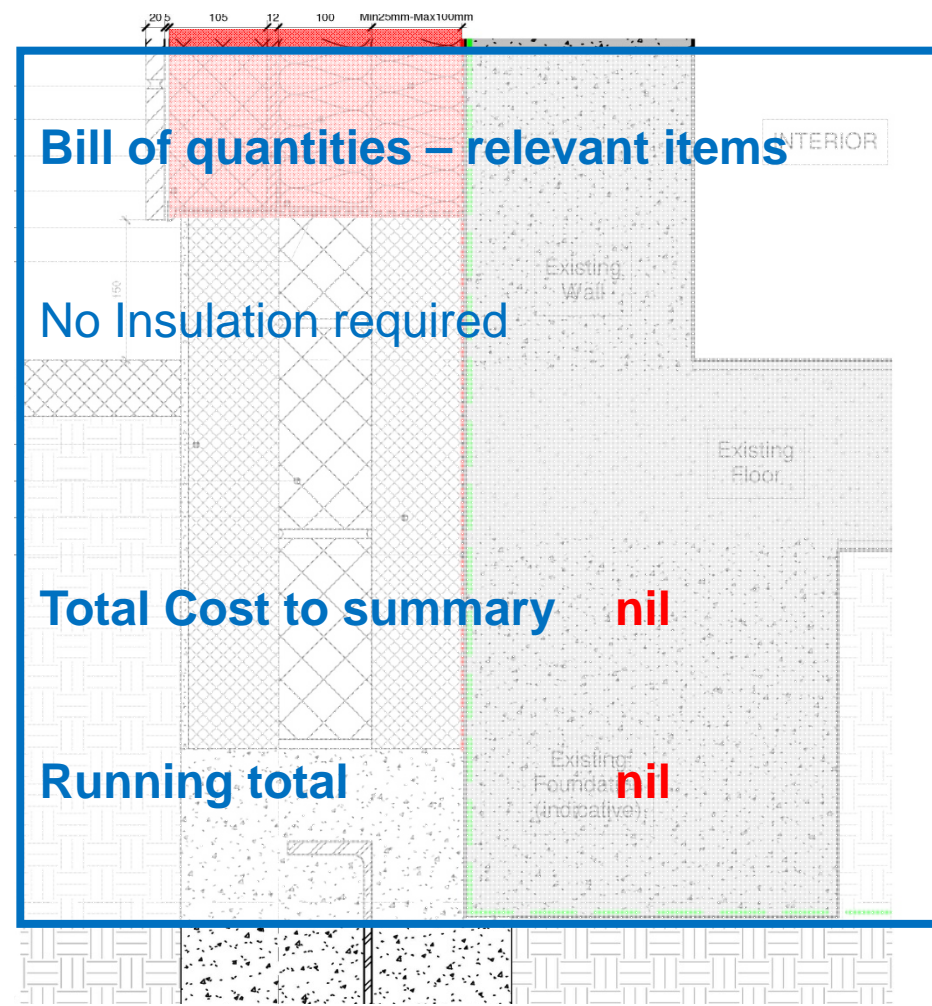


 **Part L 2010 equivalent**

# Foundations



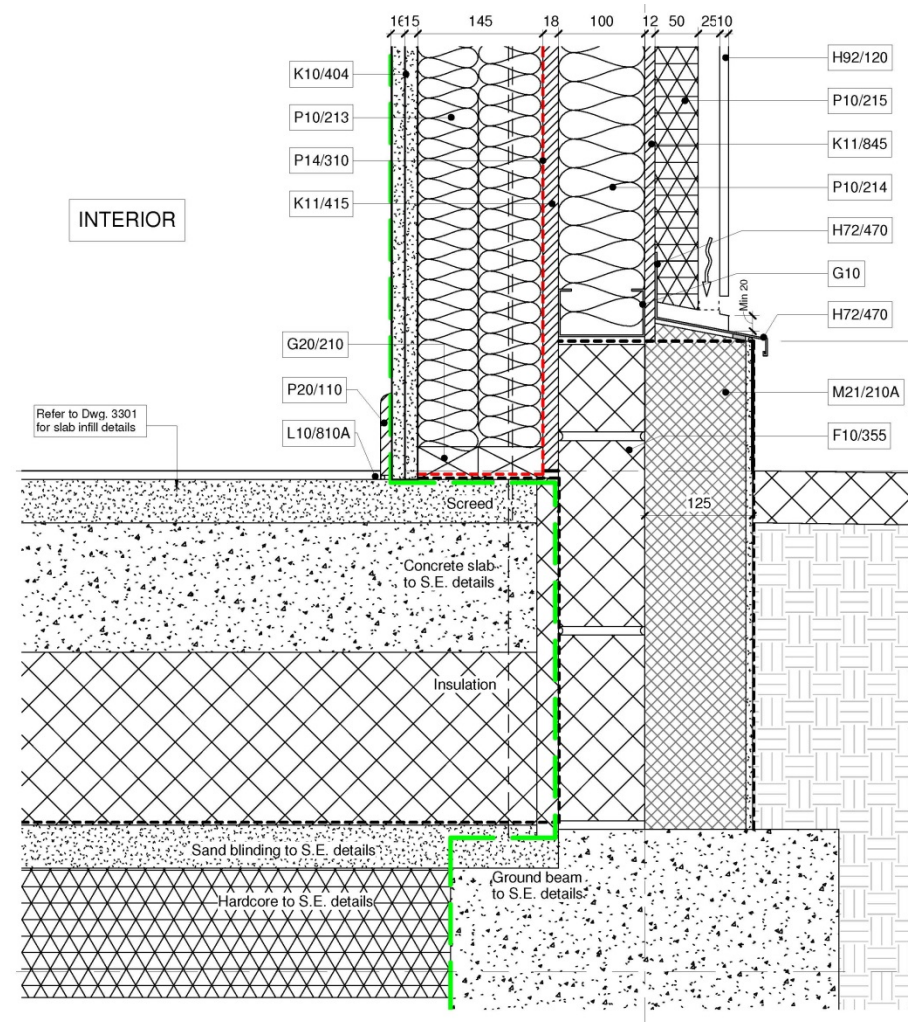
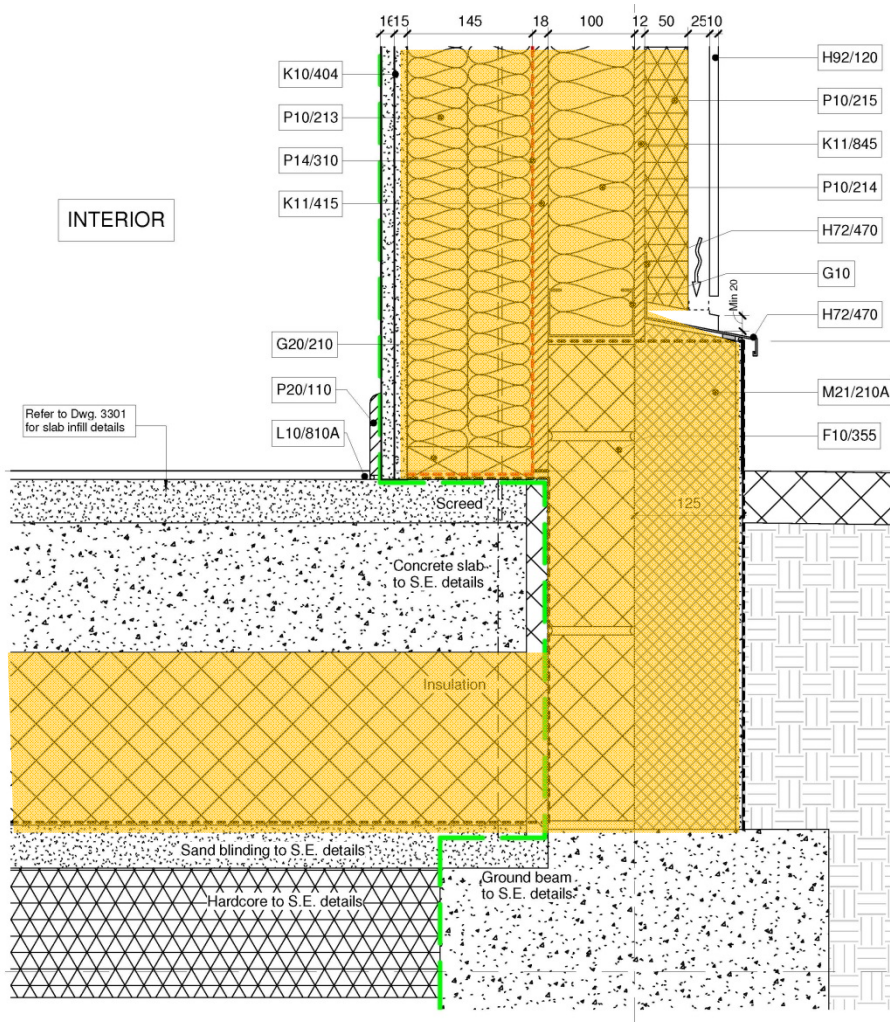
 **Passivhaus requirements**



 **Part L 2010 equivalent**



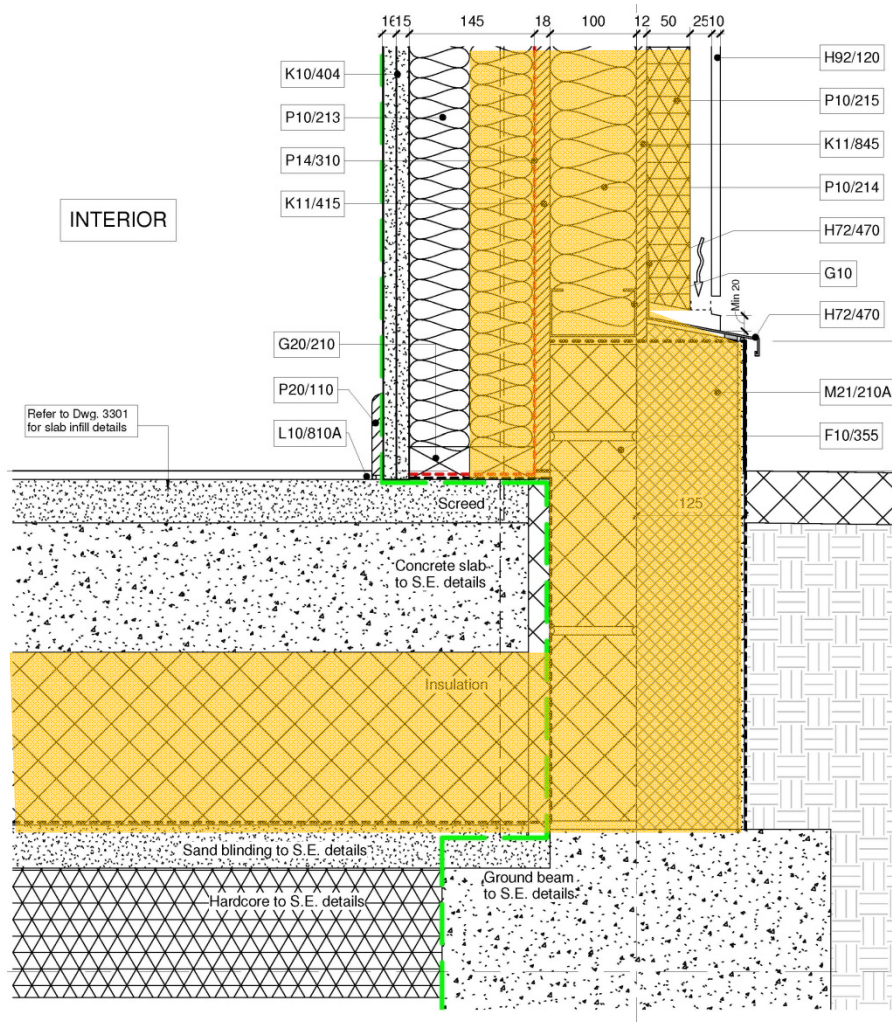
# Below DPC



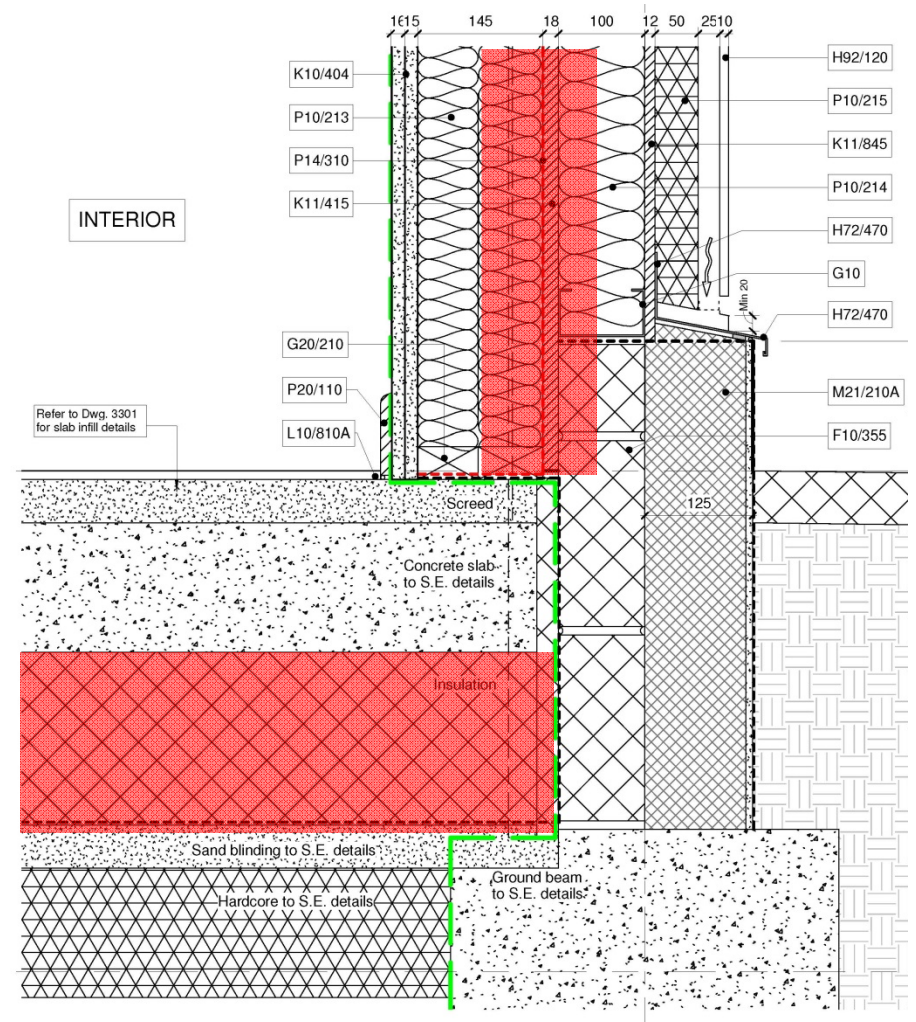
 **Passivhaus requirements**



# Below DPC



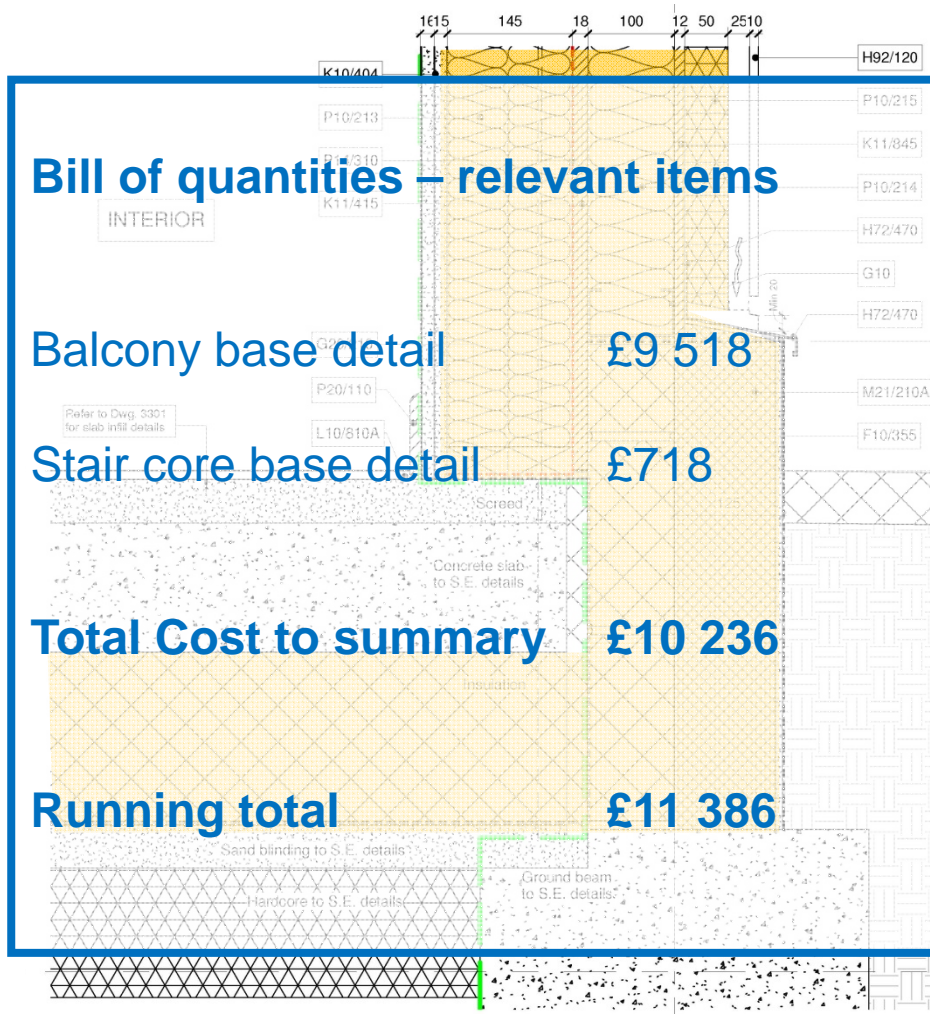
**Passivhaus requirements**



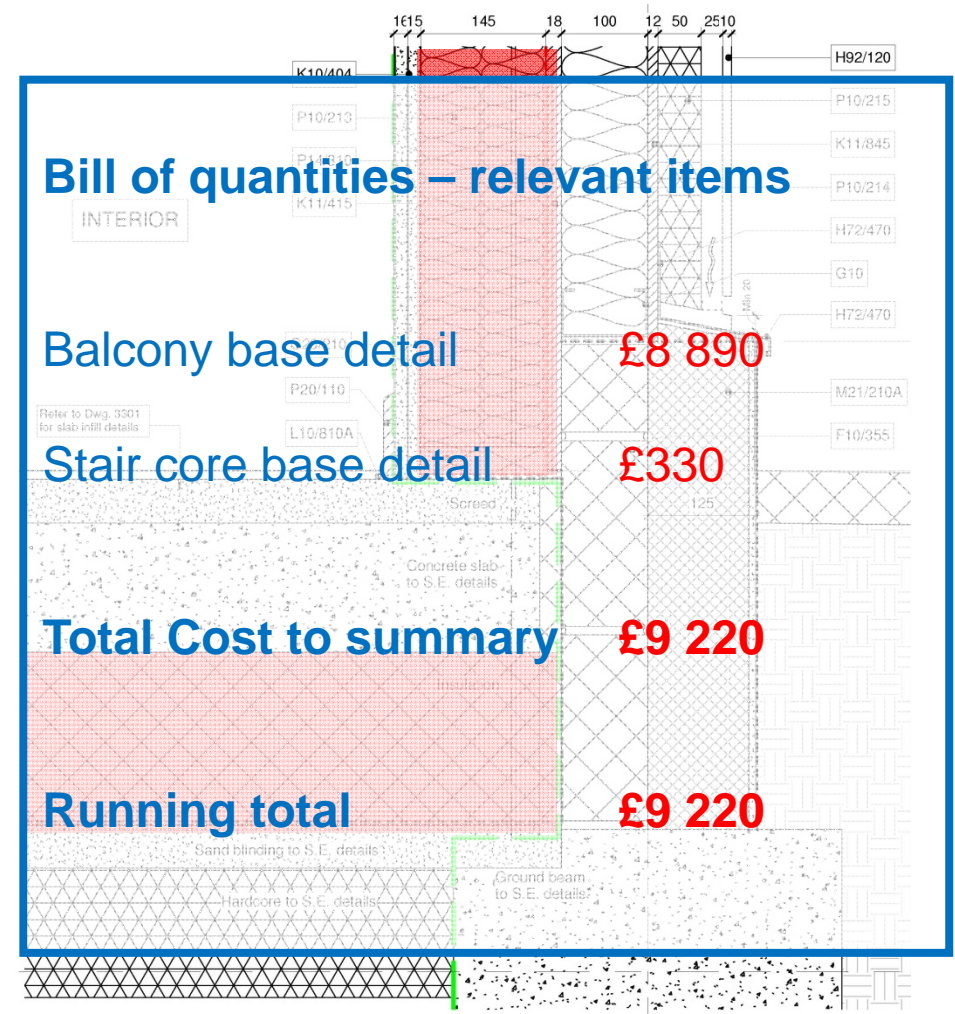
**Part L 2010 equivalent**



# Below DPC



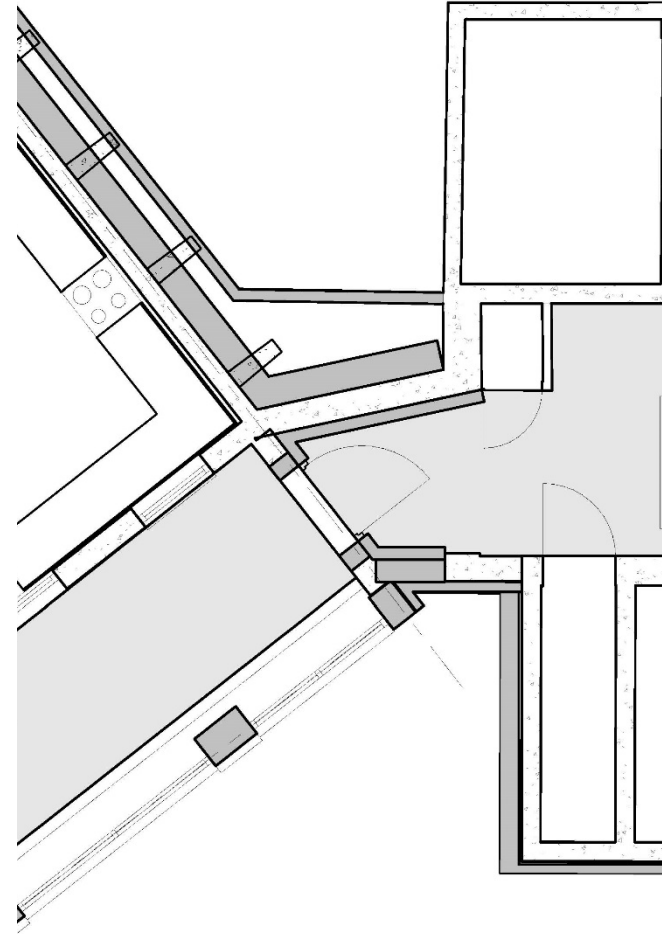
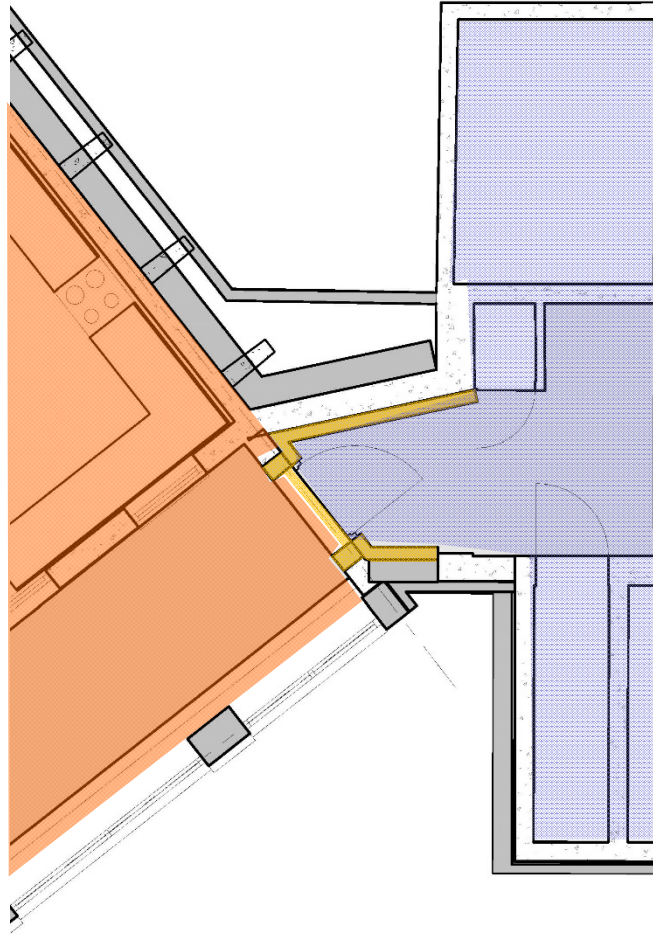
 **Passivhaus requirements**



 **Part L 2010 equivalent**

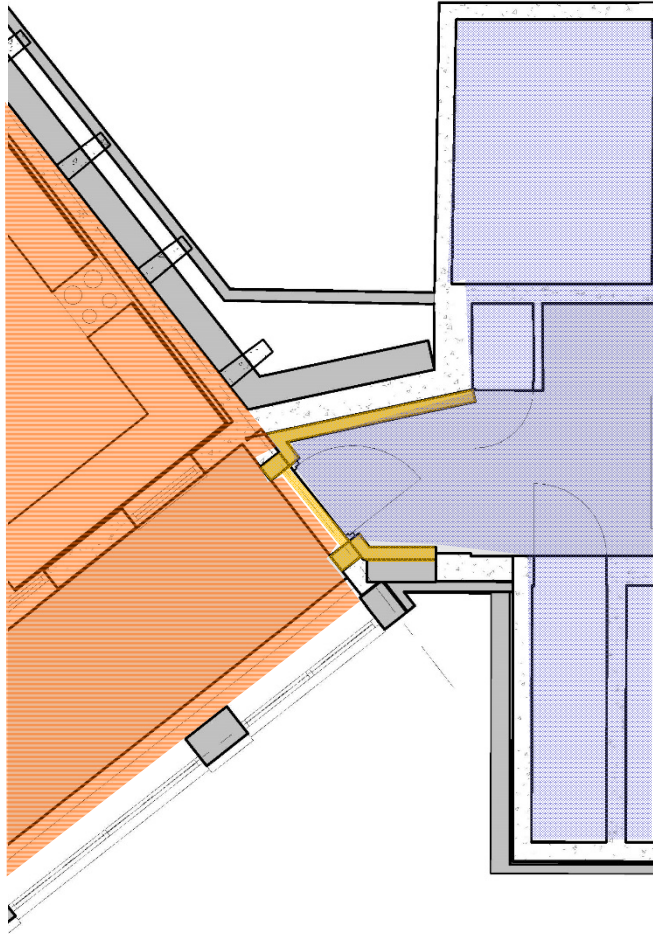


# Internal Wall Insulation

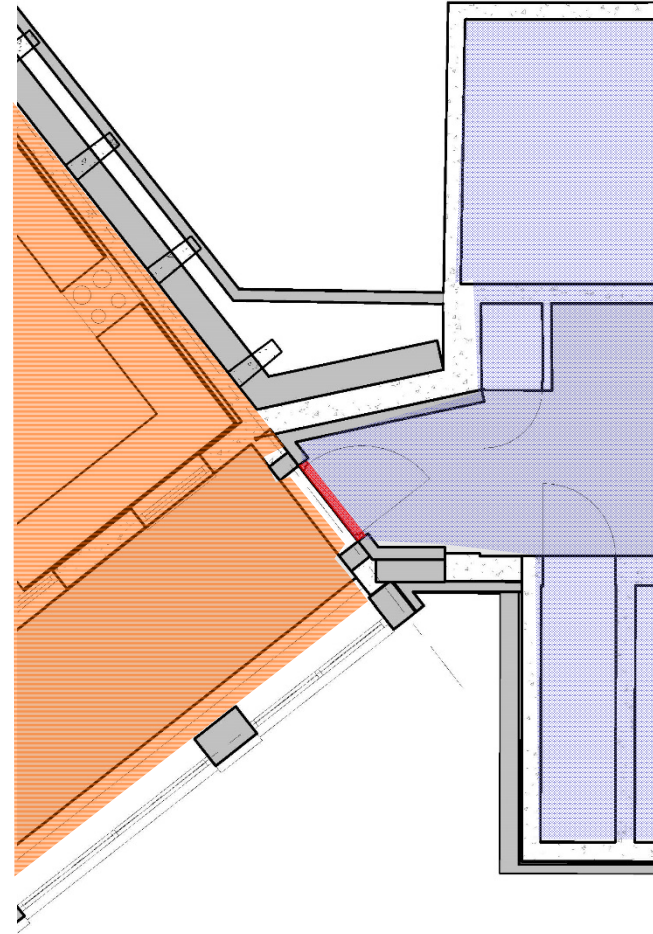


 **Passivhaus requirements**

# Internal Wall Insulation



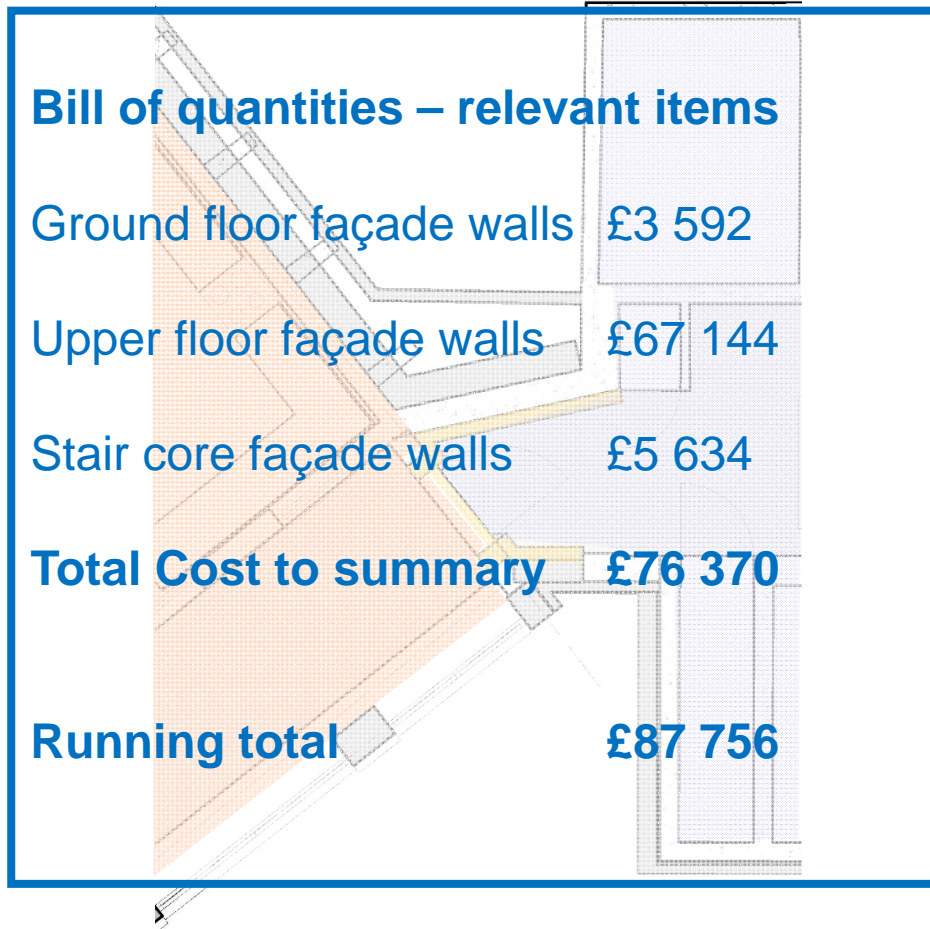
 **Passivhaus requirements**



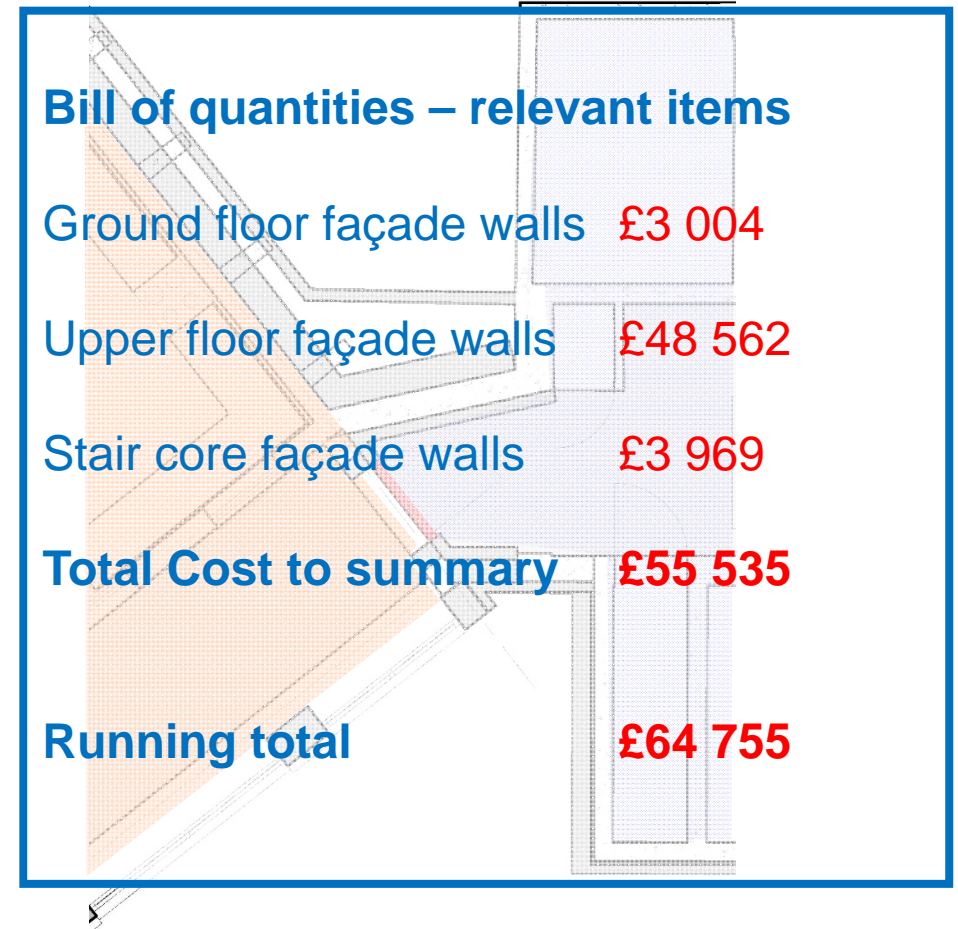
 **Part L 2010 equivalent**



# Internal Wall Insulation



 **Passivhaus requirements**

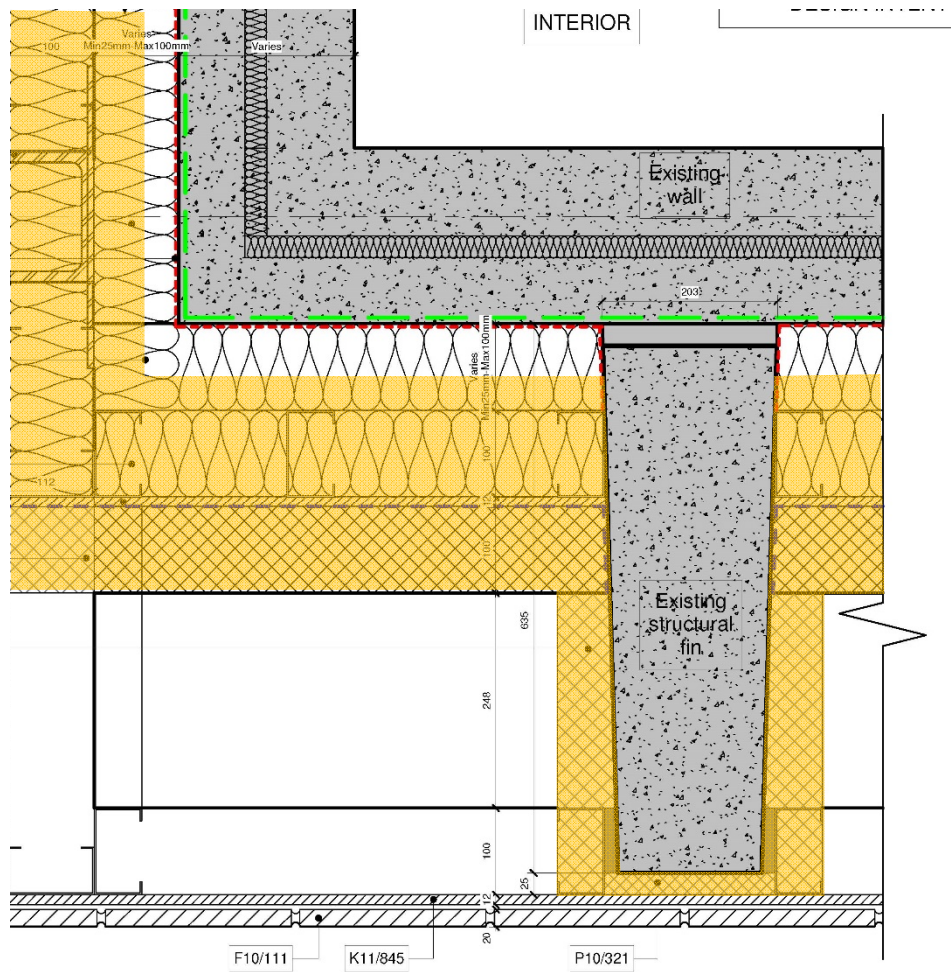


 **Part L 2010 equivalent**

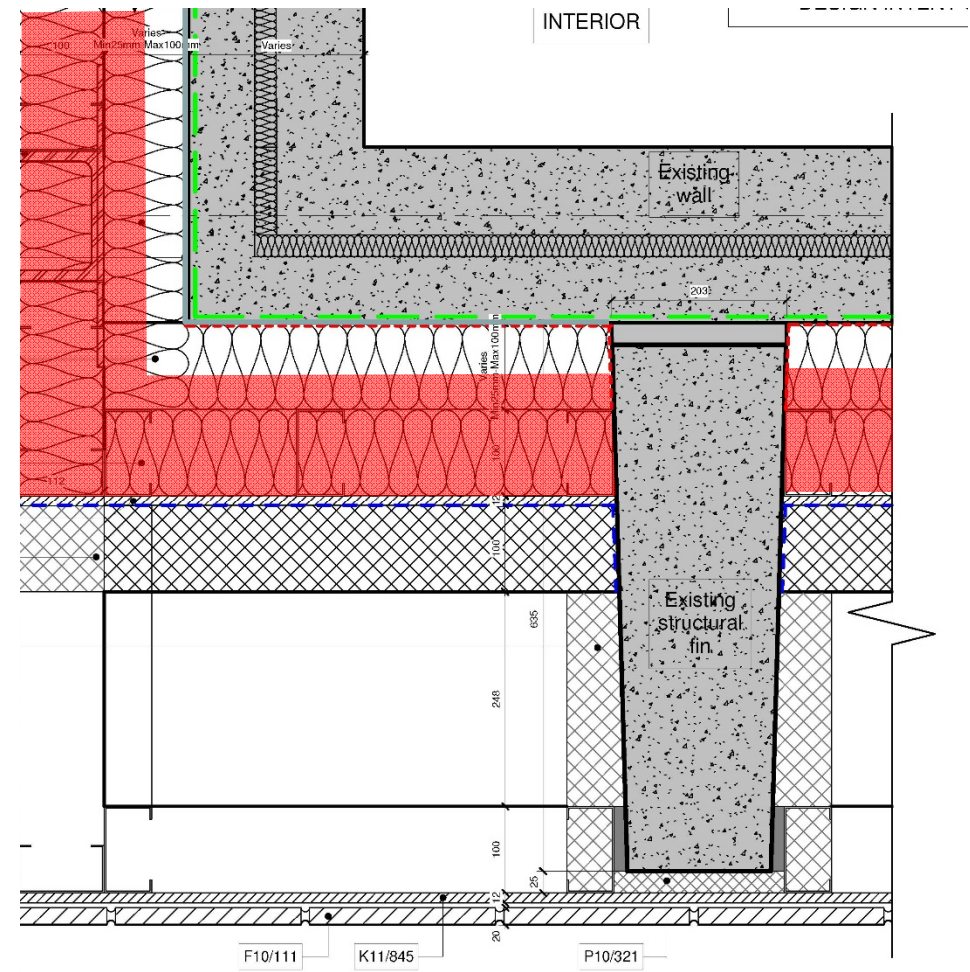




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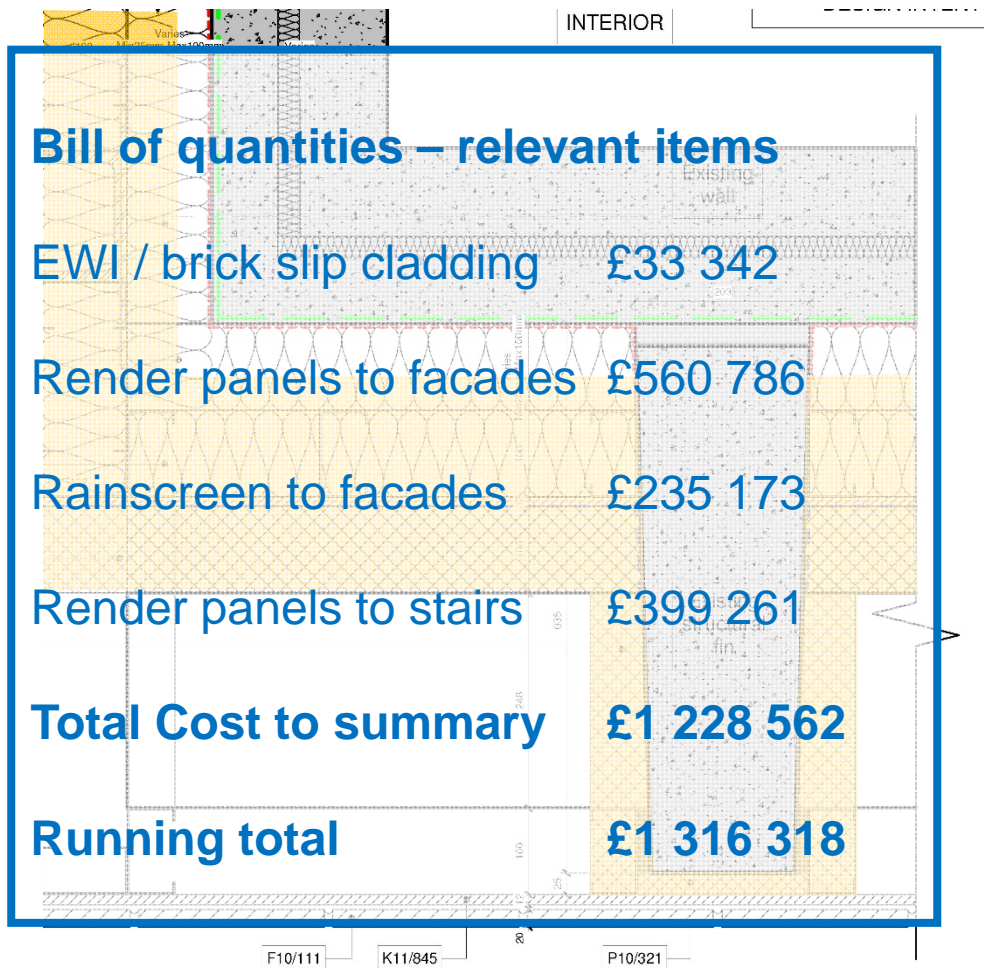


**Passivhaus requirements**

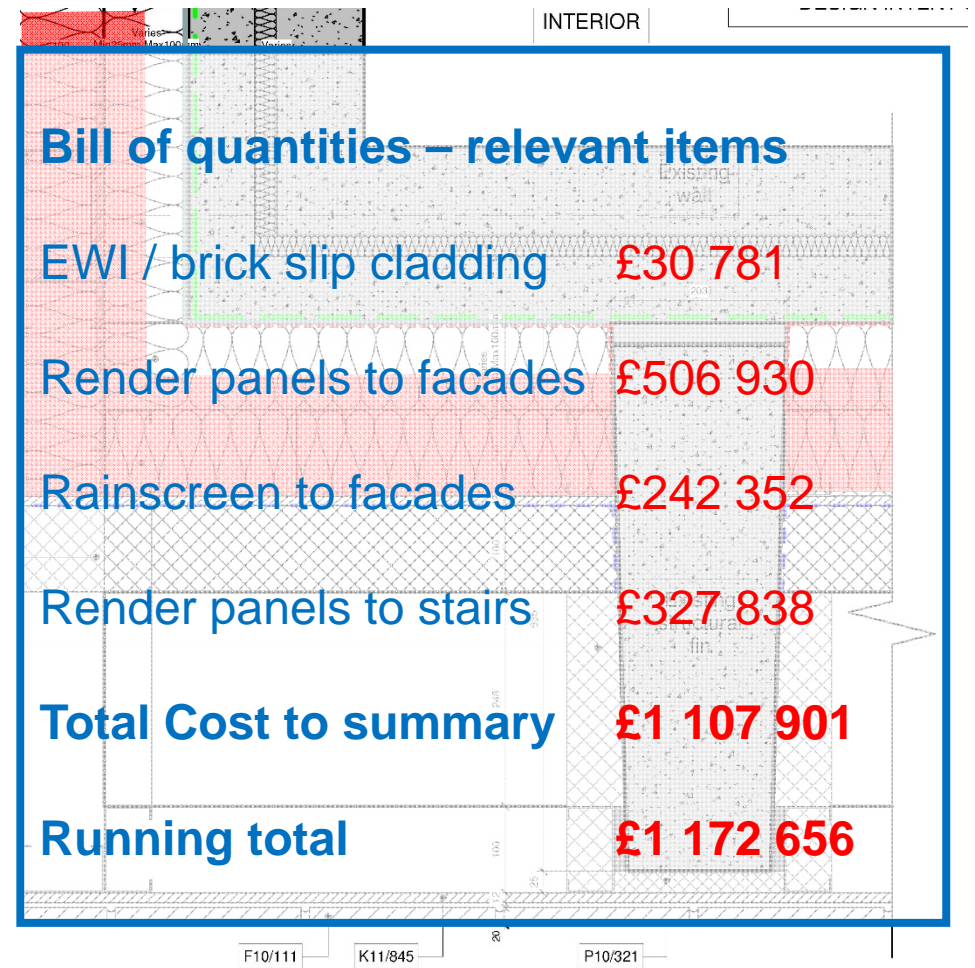


**Part L 2010 equivalent**

# External Wall Insulation



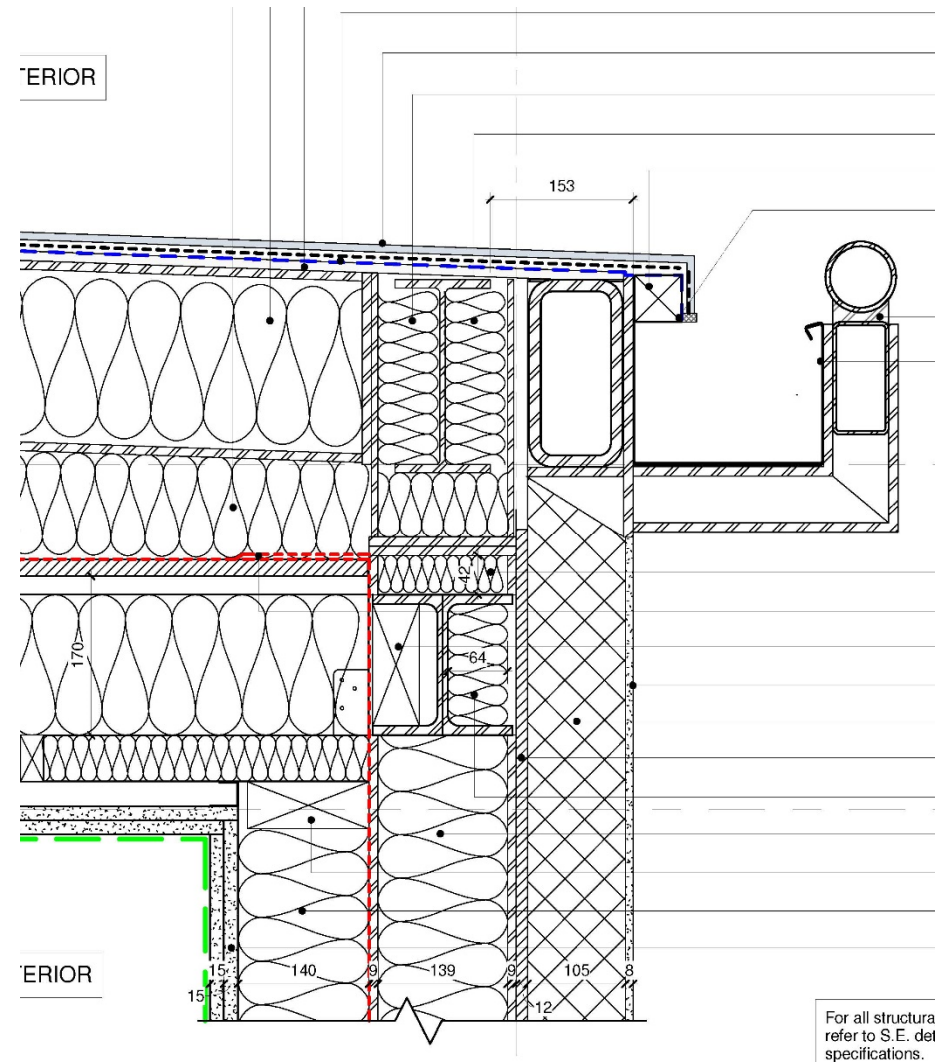
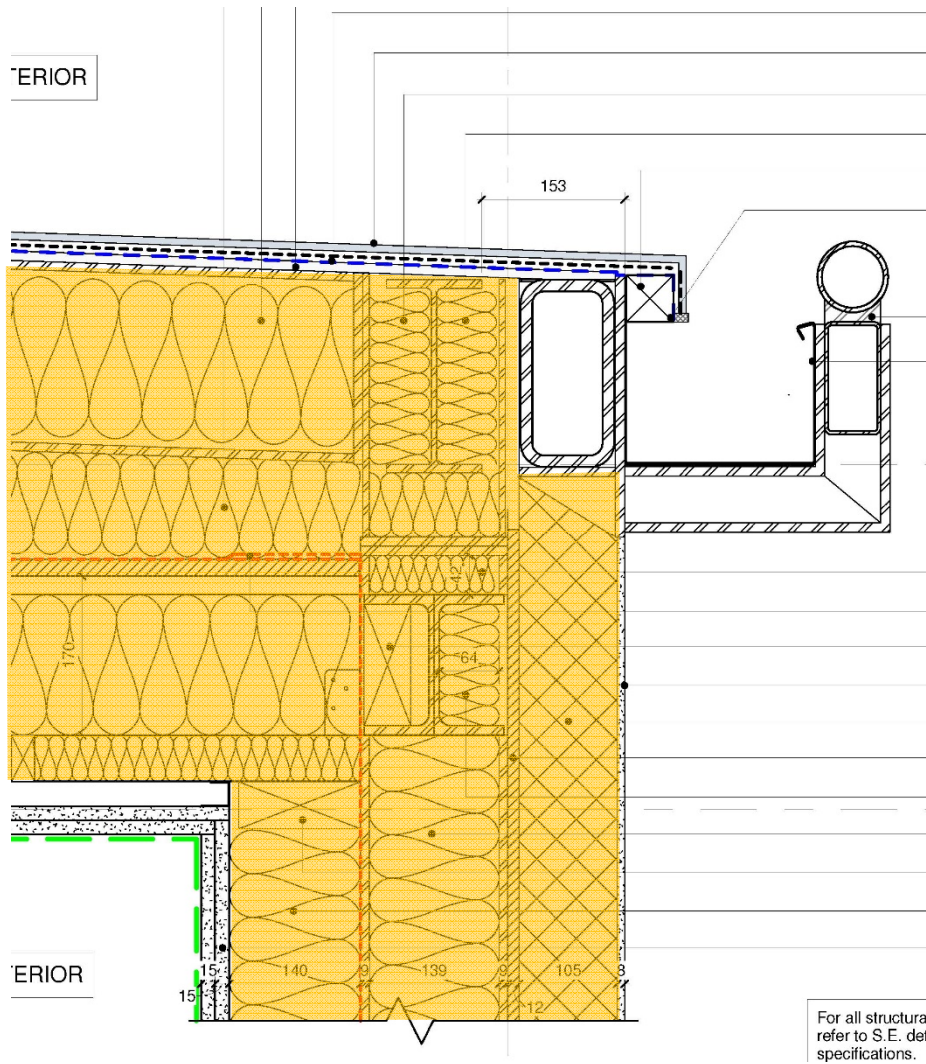
 **Passivhaus requirements**



 **Part L 2010 equivalent**

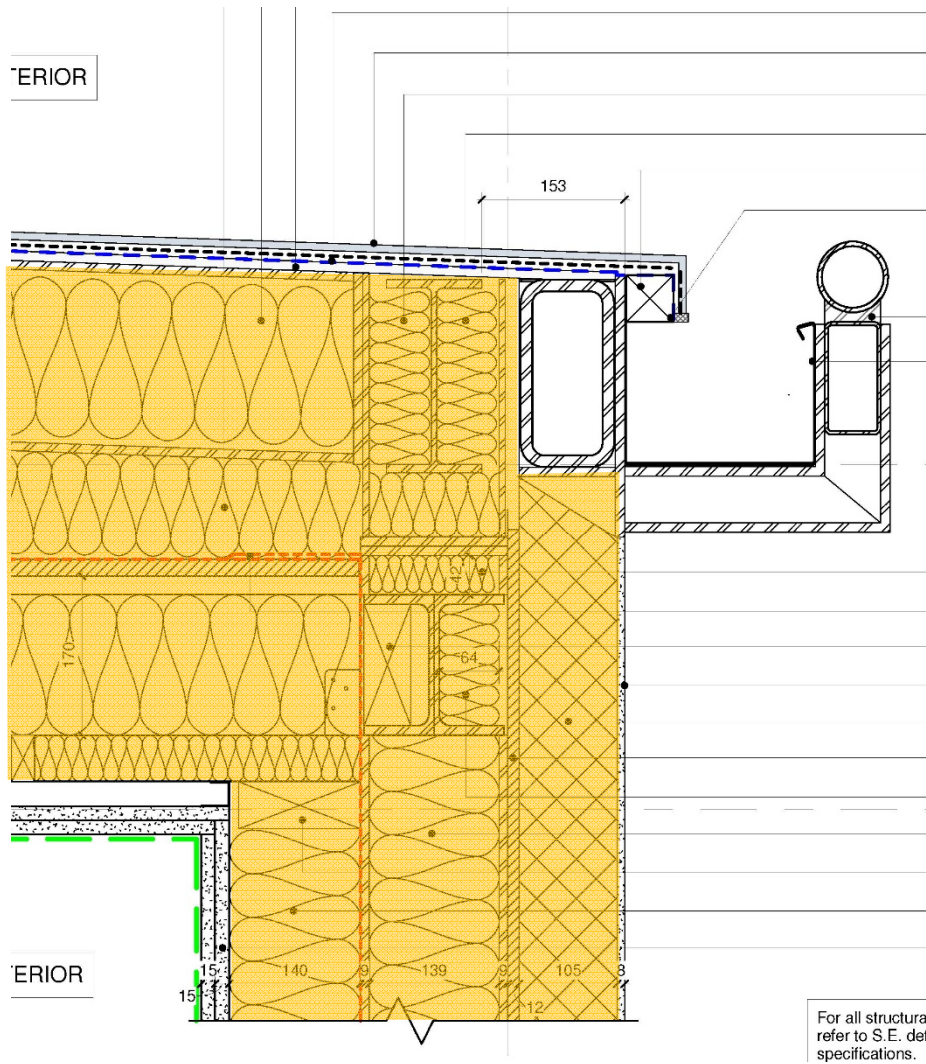


# Roof Insulation

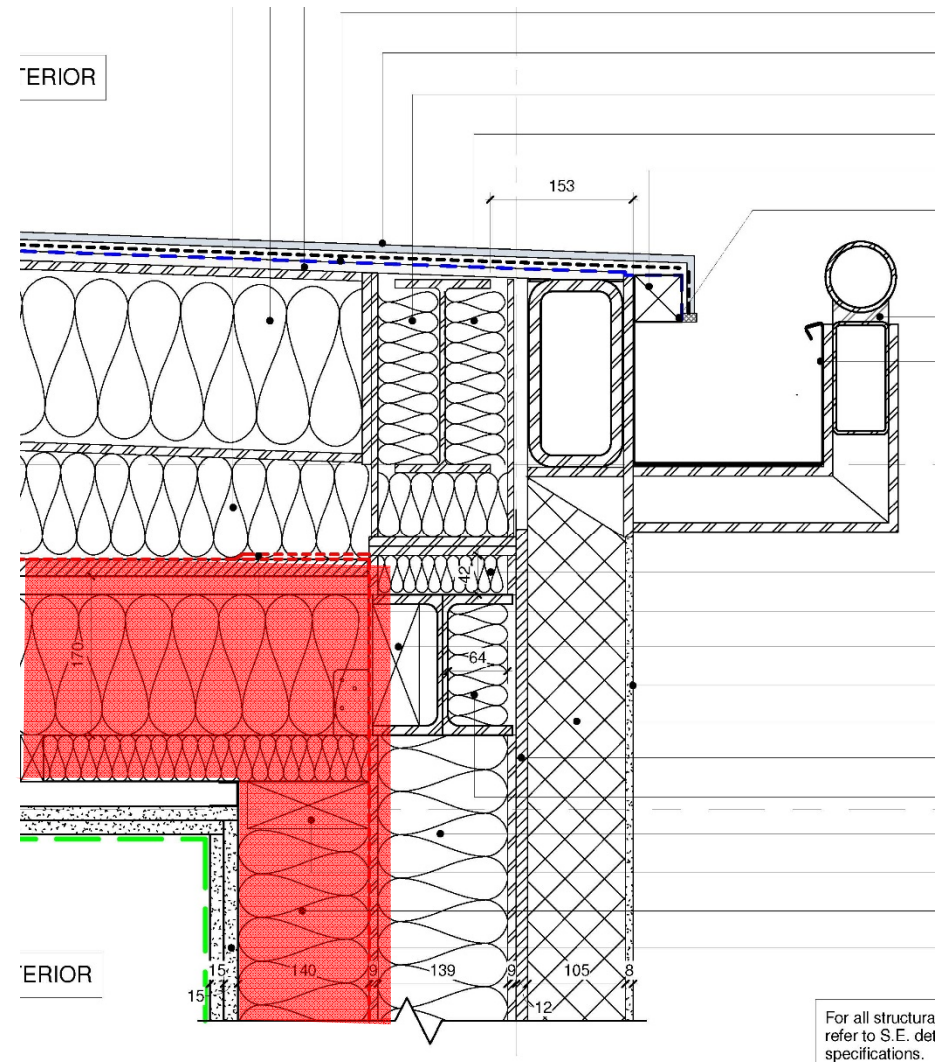


 **Passivhaus requirements**

# Roof Insulation



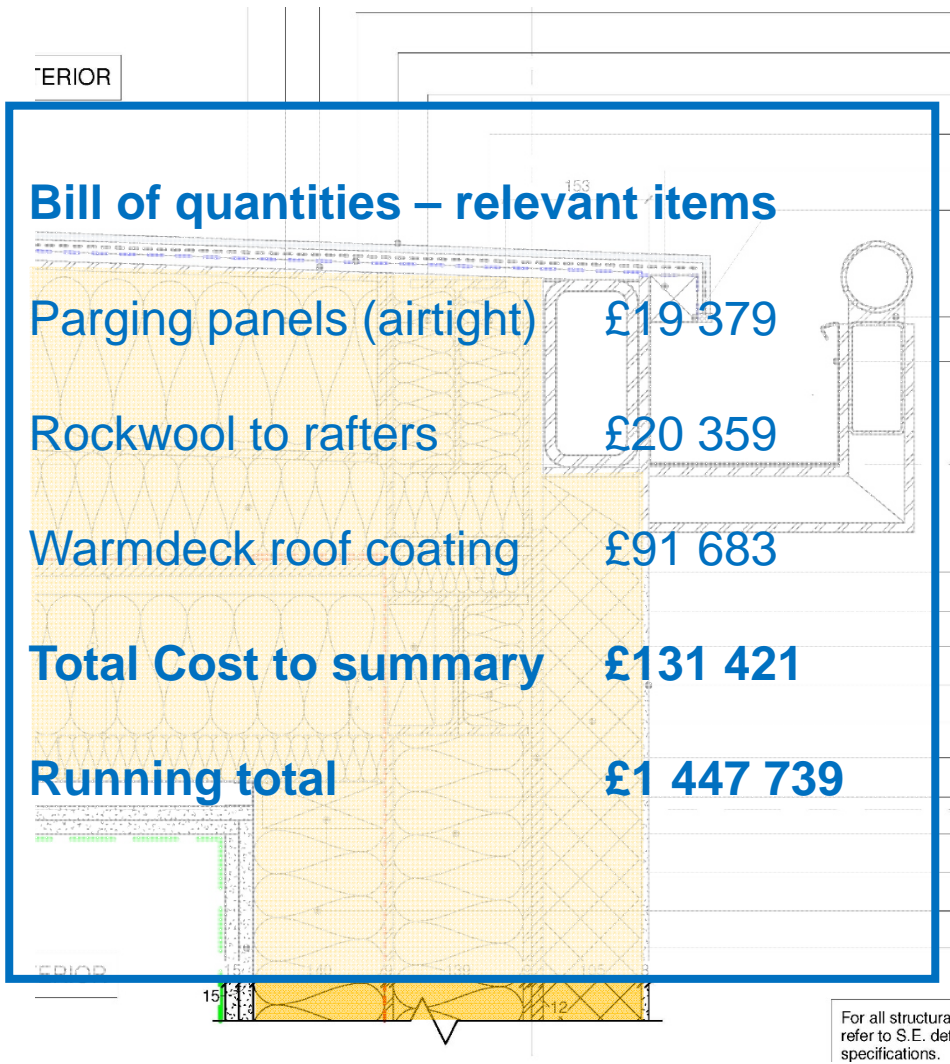
 **Passivhaus requirements**



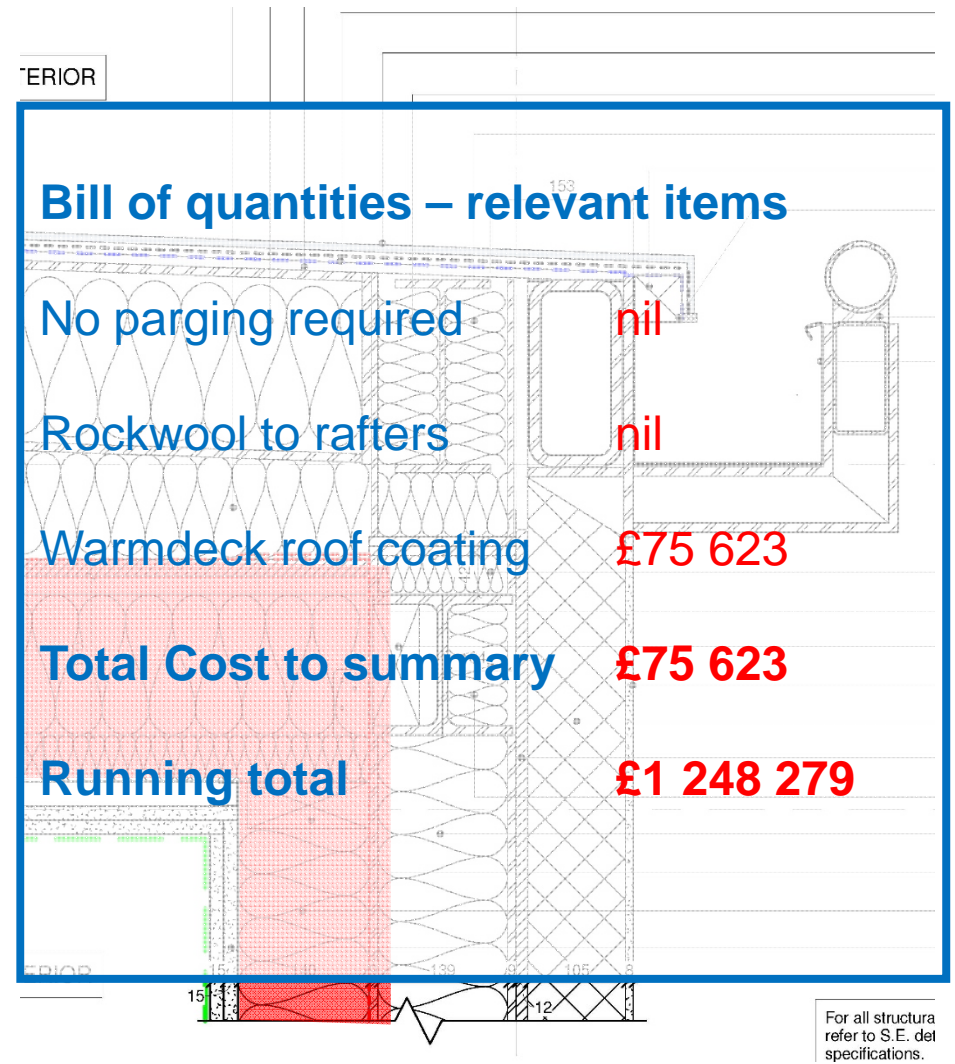
 **Part L 2010 equivalent**



# Roof Insulation

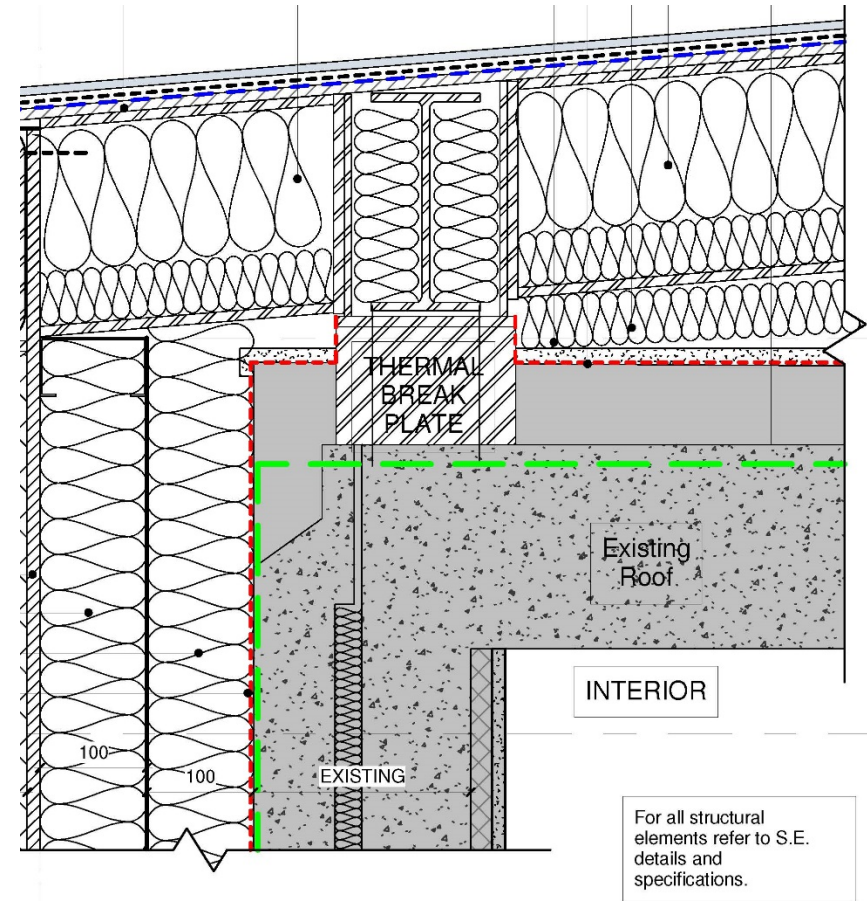
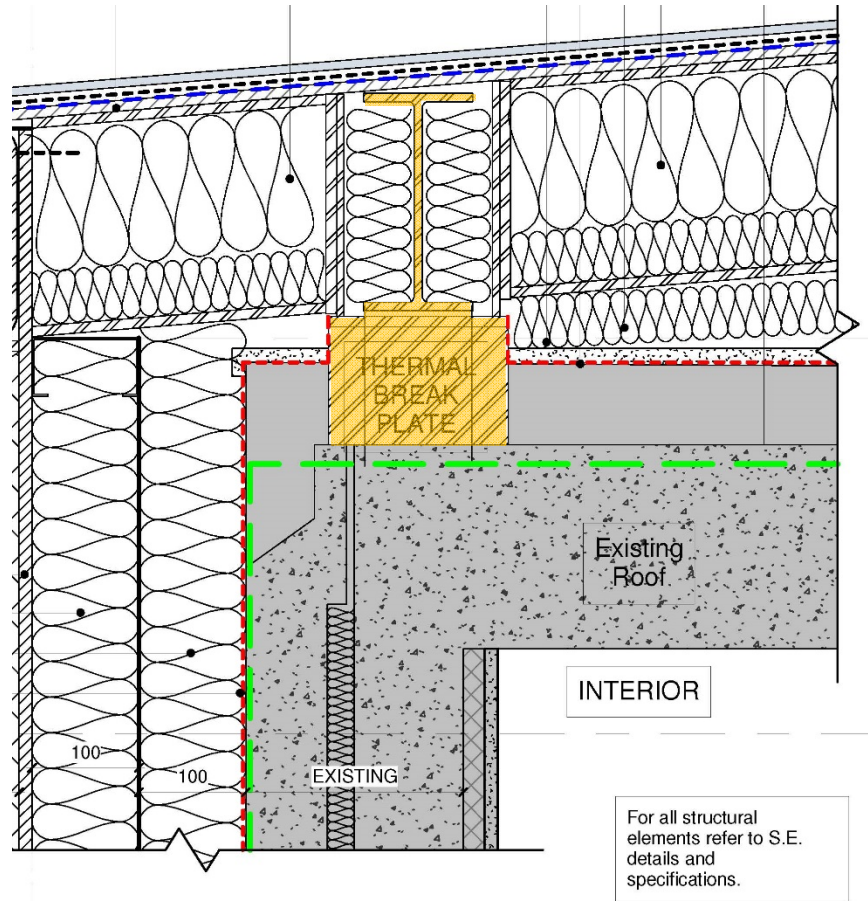


 **Passivhaus requirements**



 **Part L 2010 equivalent**

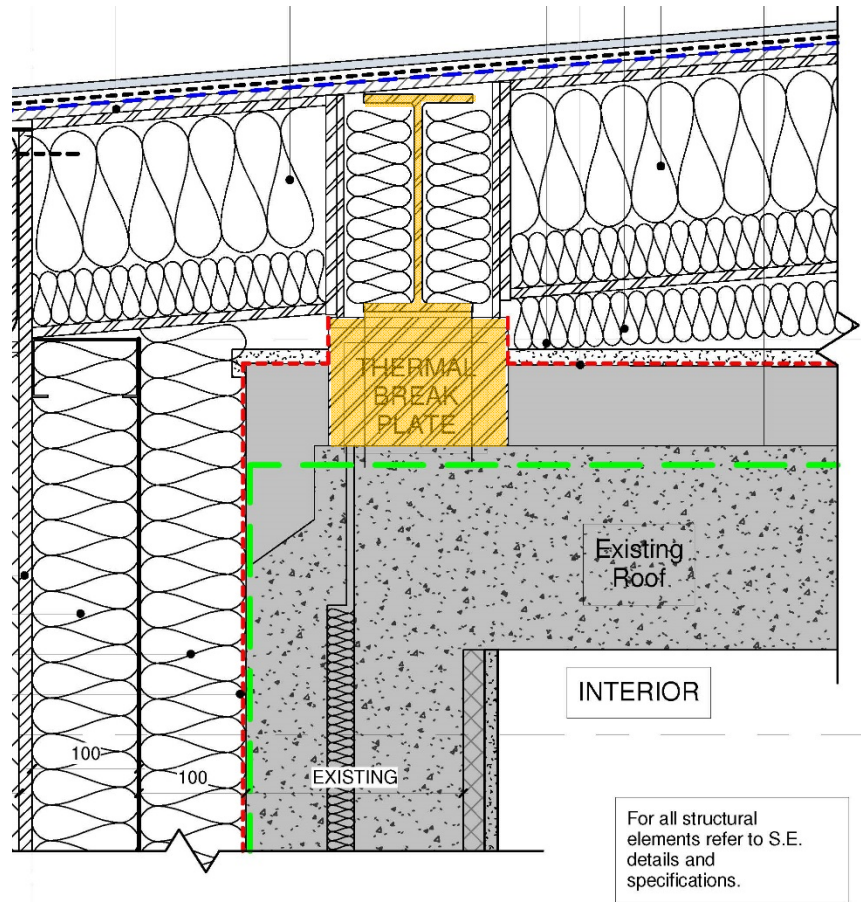
# Thermal break pads



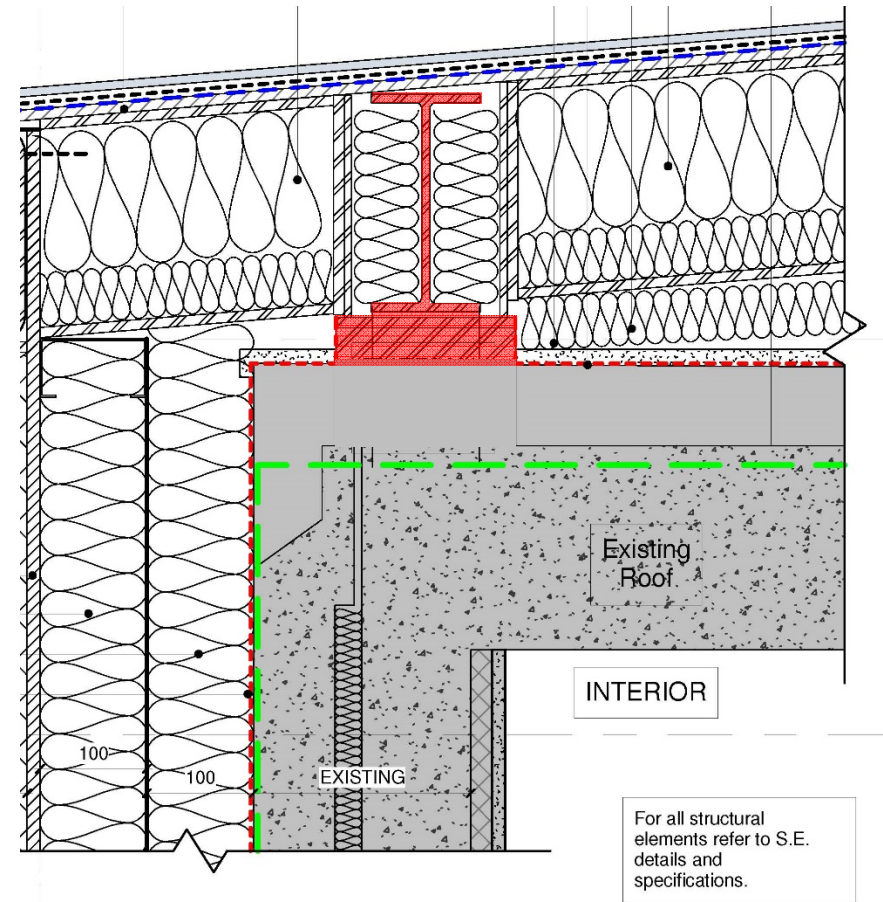
 **Passivhaus requirements**



# Thermal break pads

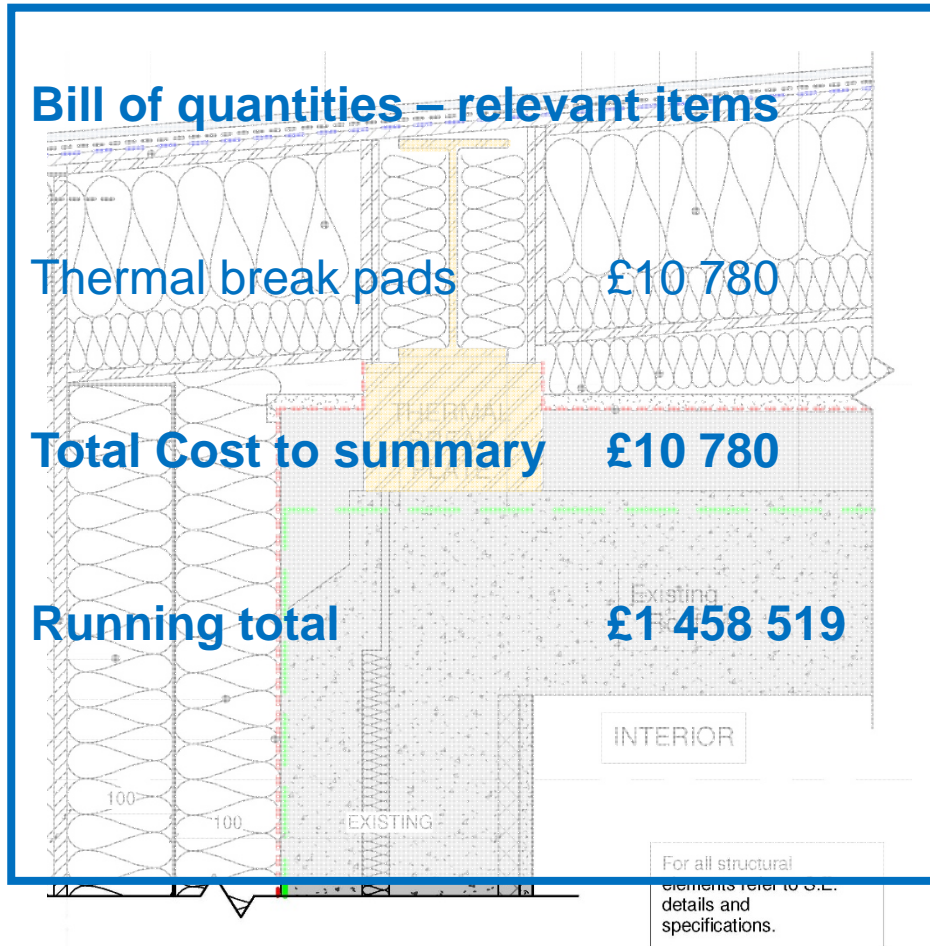


 **Passivhaus requirements**

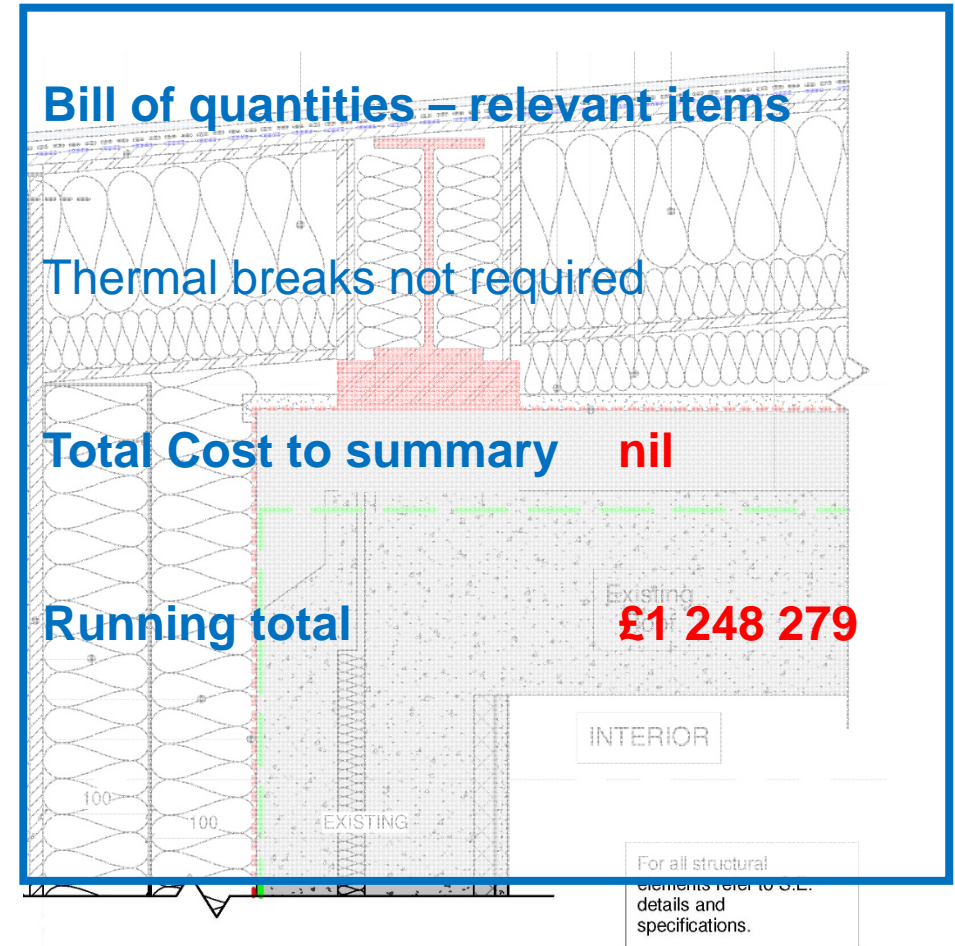


 **Part L 2010 equivalent**

# Thermal break pads



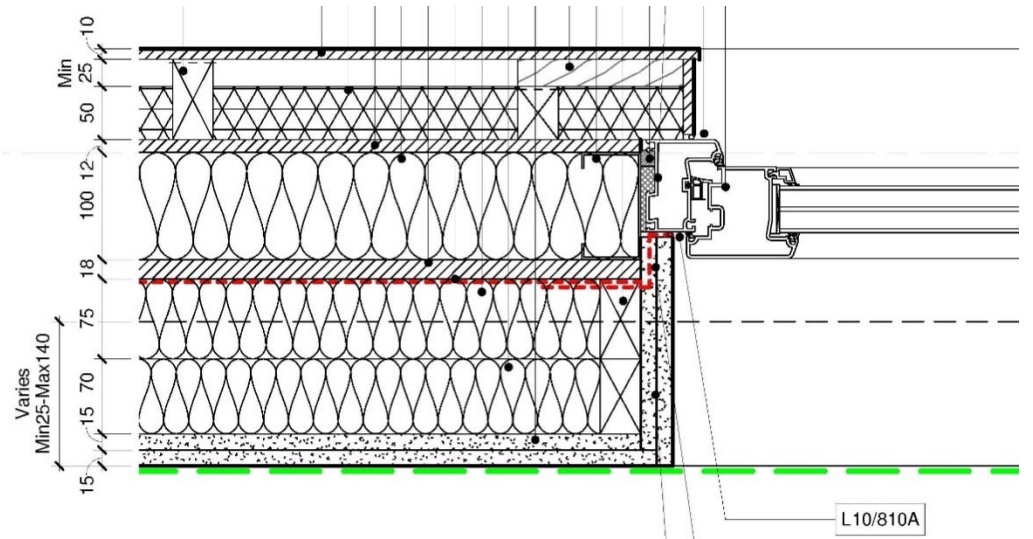
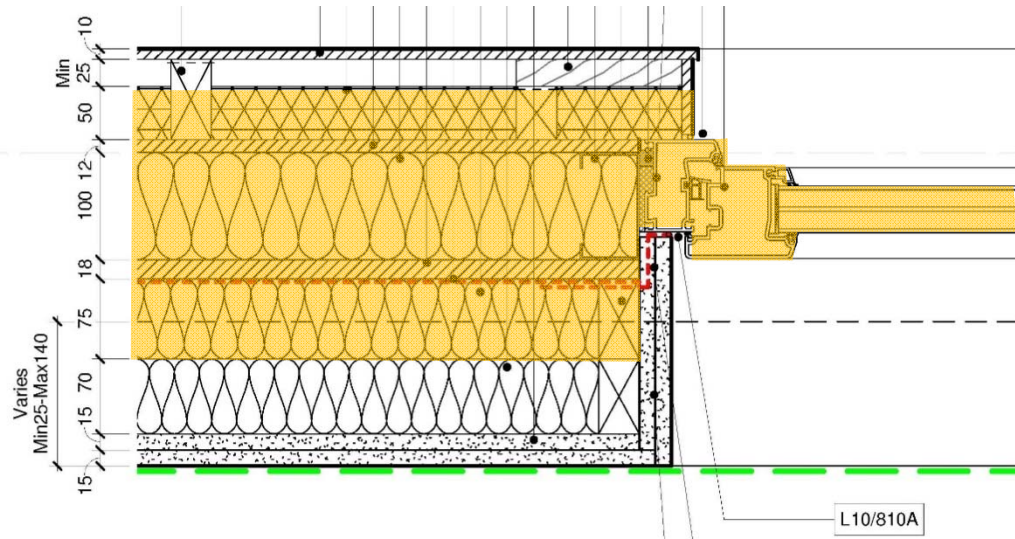
 **Passivhaus requirements**



 **Part L 2010 equivalent**

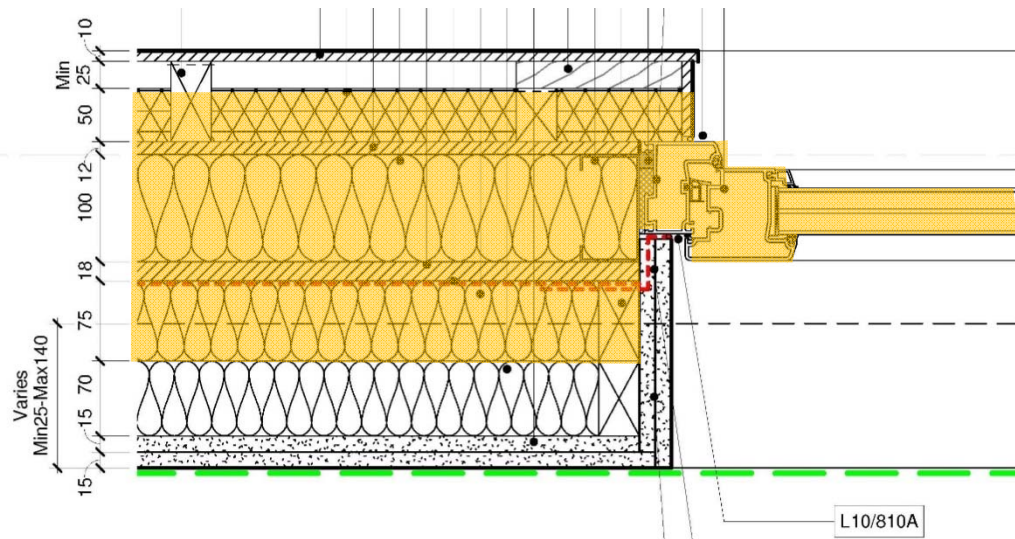


# Windows

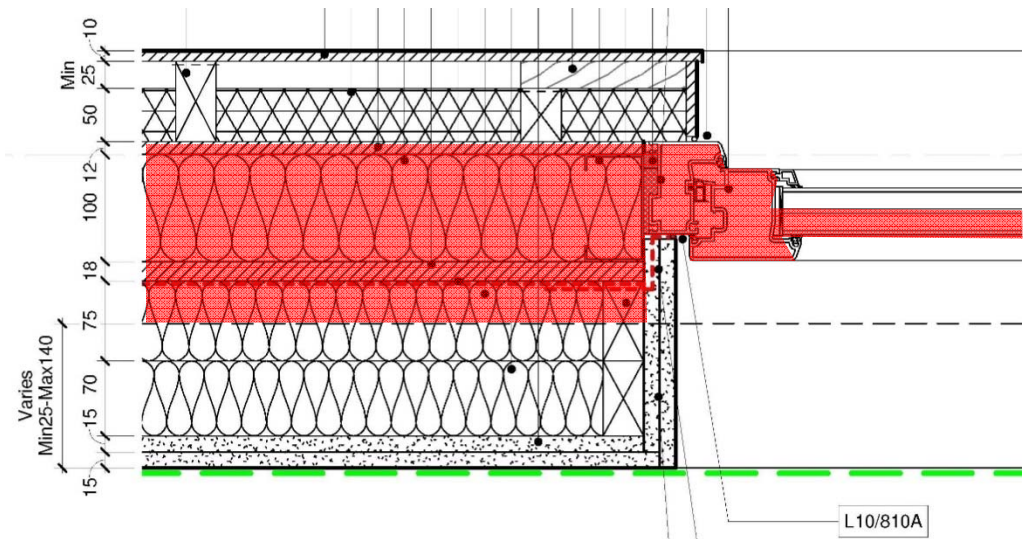


 **Passivhaus requirements**

# Windows



 **Passivhaus requirements**

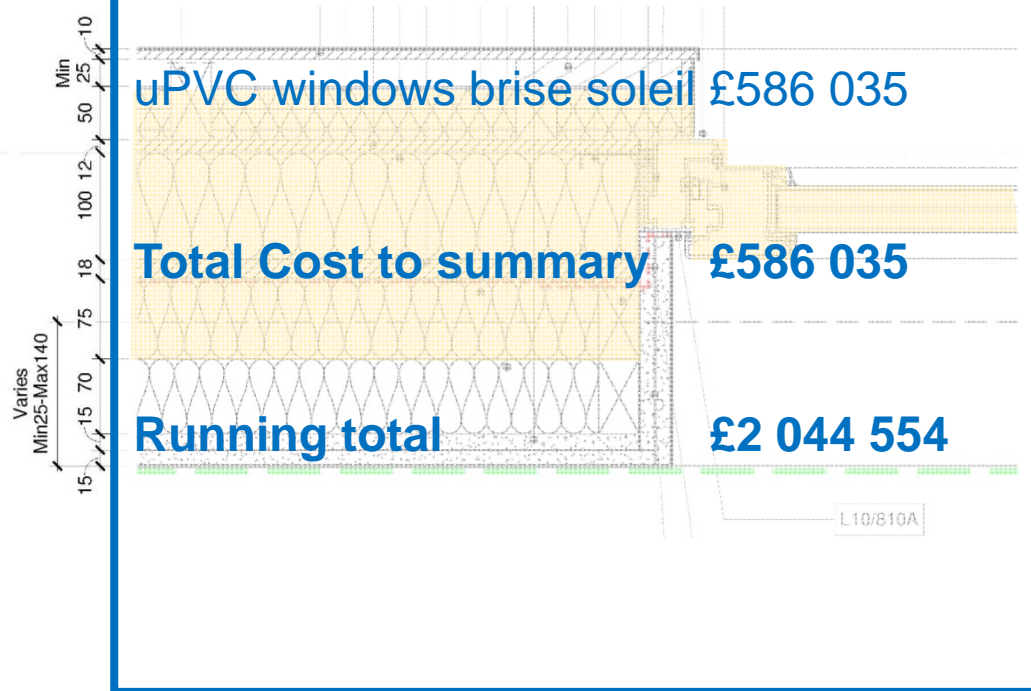


 **Part L 2010 equivalent**



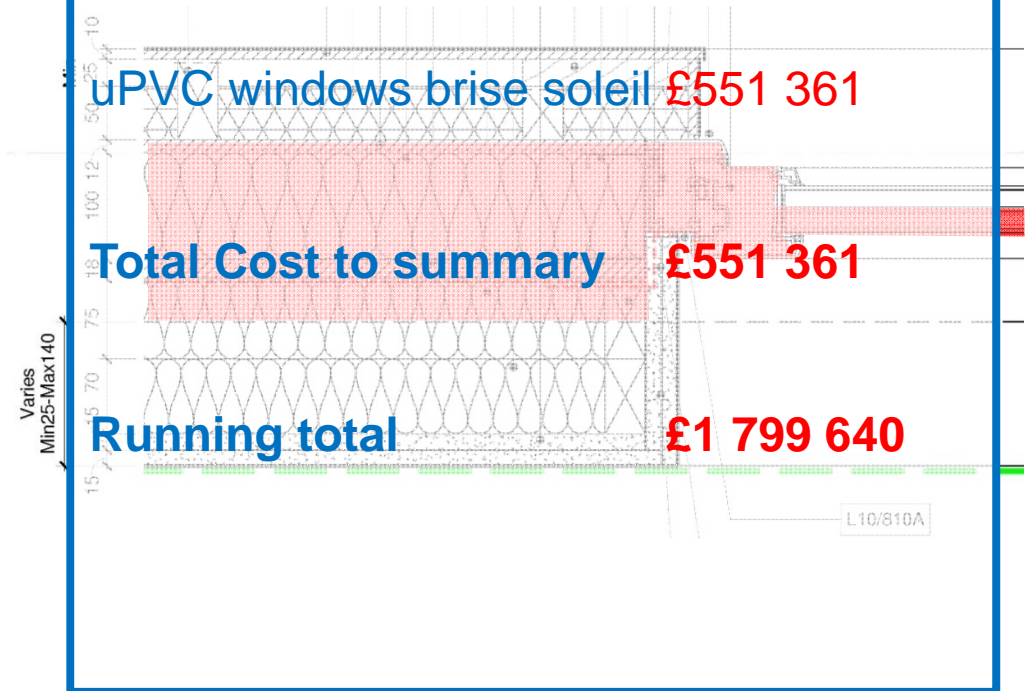
# Windows

## Bill of quantities – relevant items



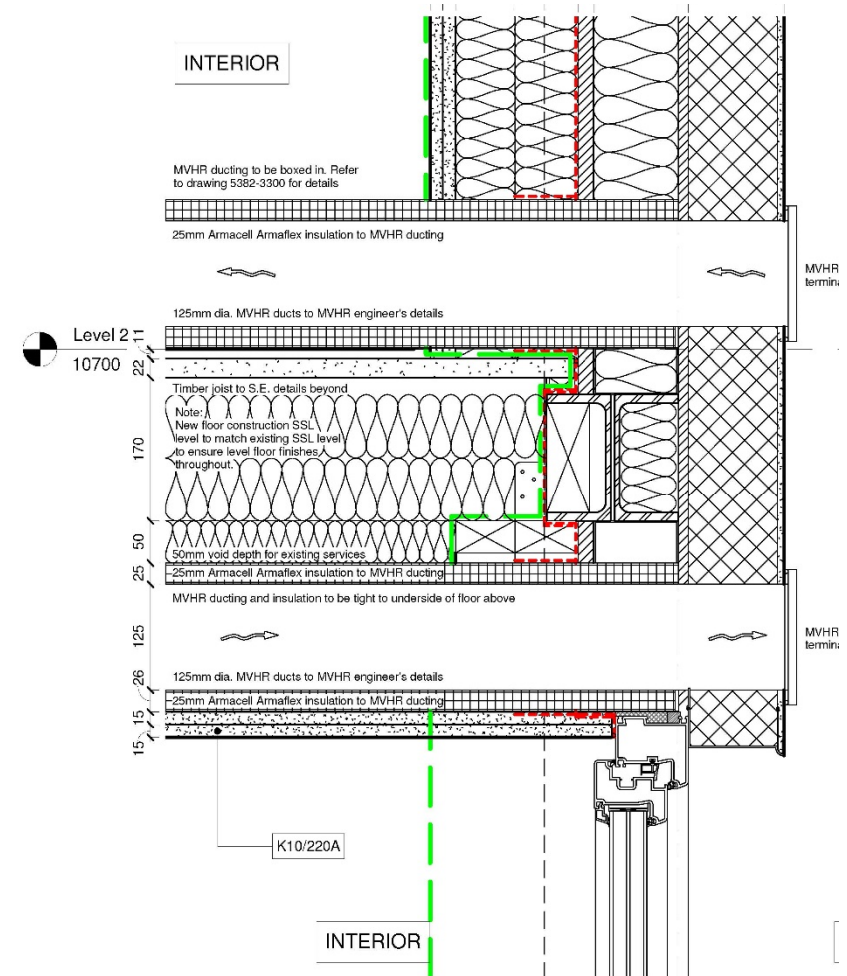
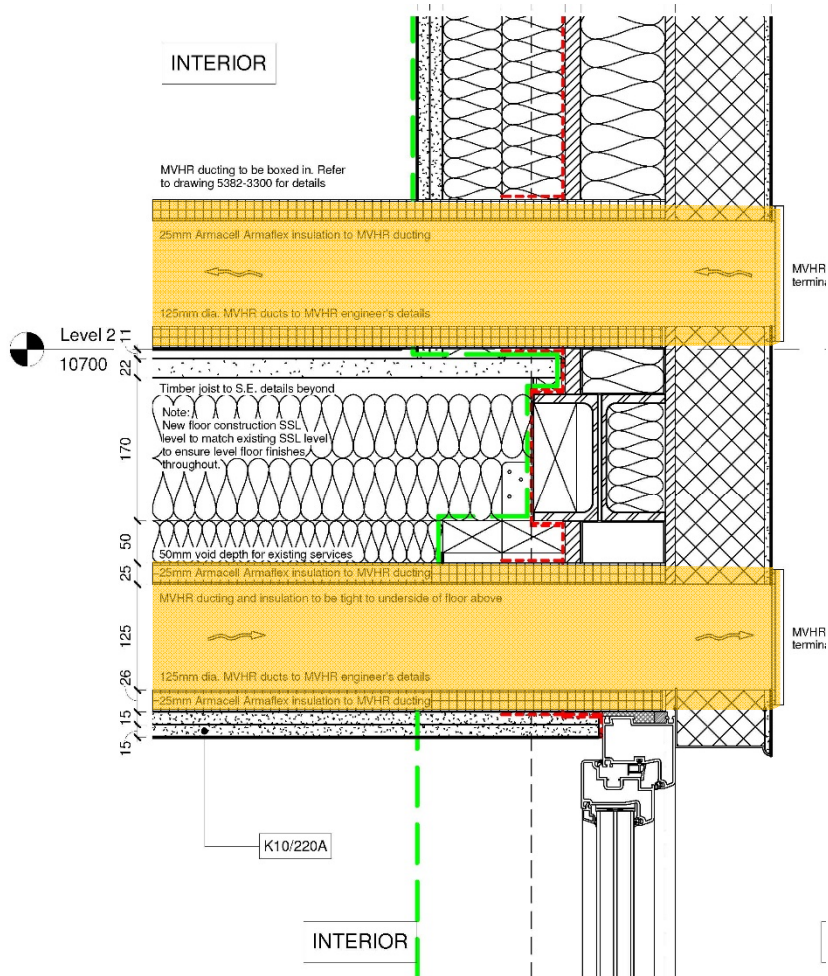
 Passivhaus requirements

## Bill of quantities – relevant items



 Part L 2010 equivalent

# MVHR/Extract

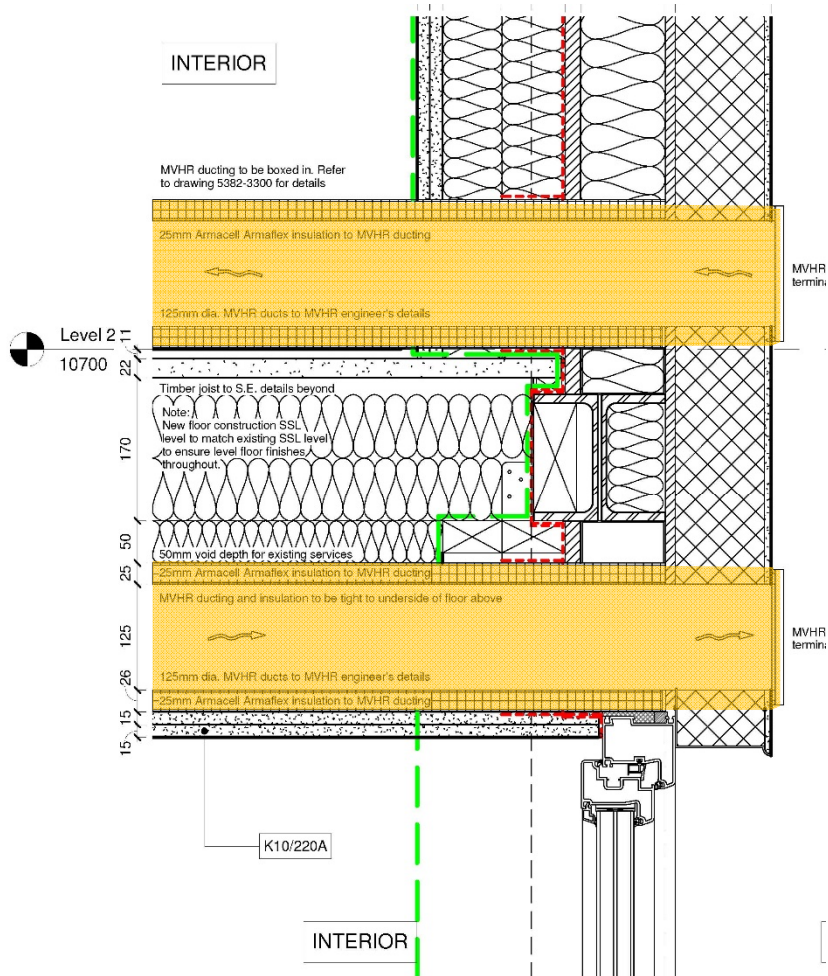


**Passivhaus requirements**

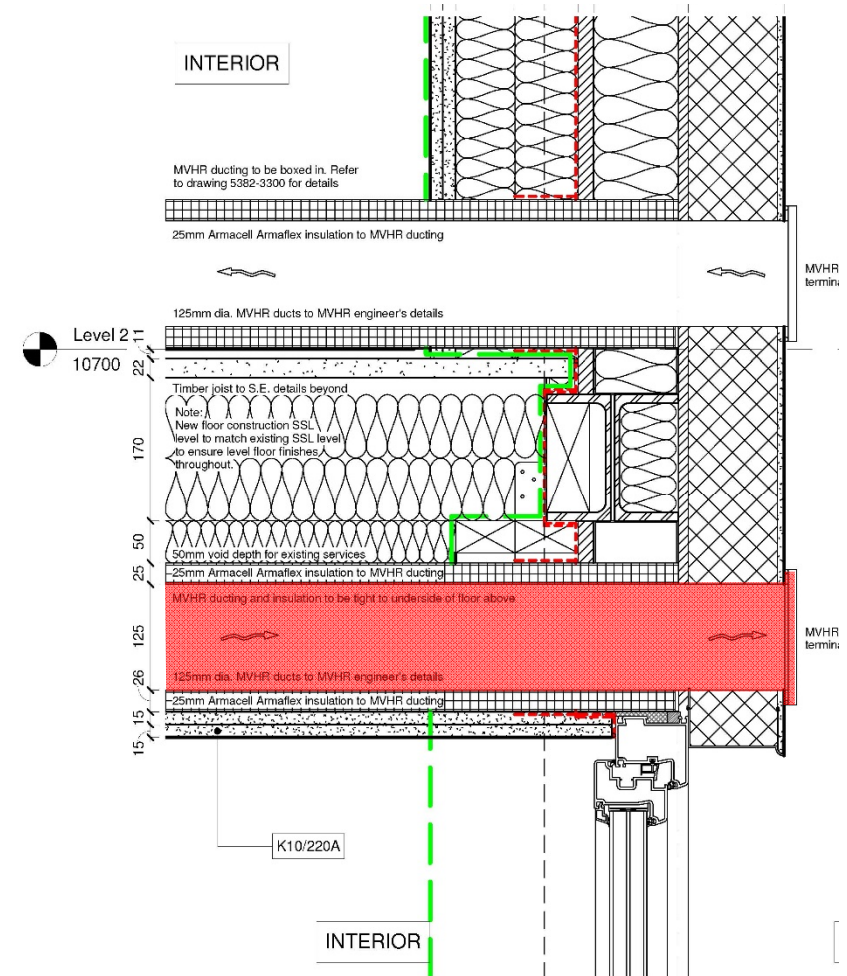
**Part L 2010 equivalent**



# MVHR/Extract

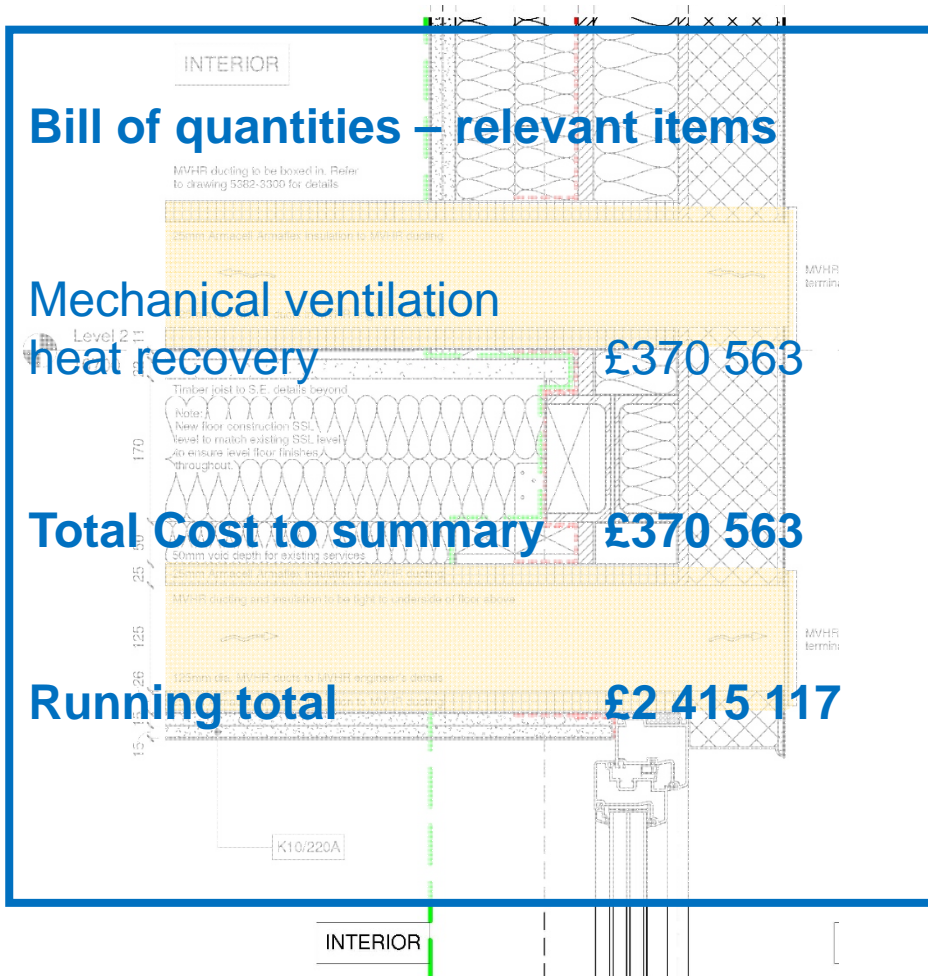


 **Passivhaus requirements**

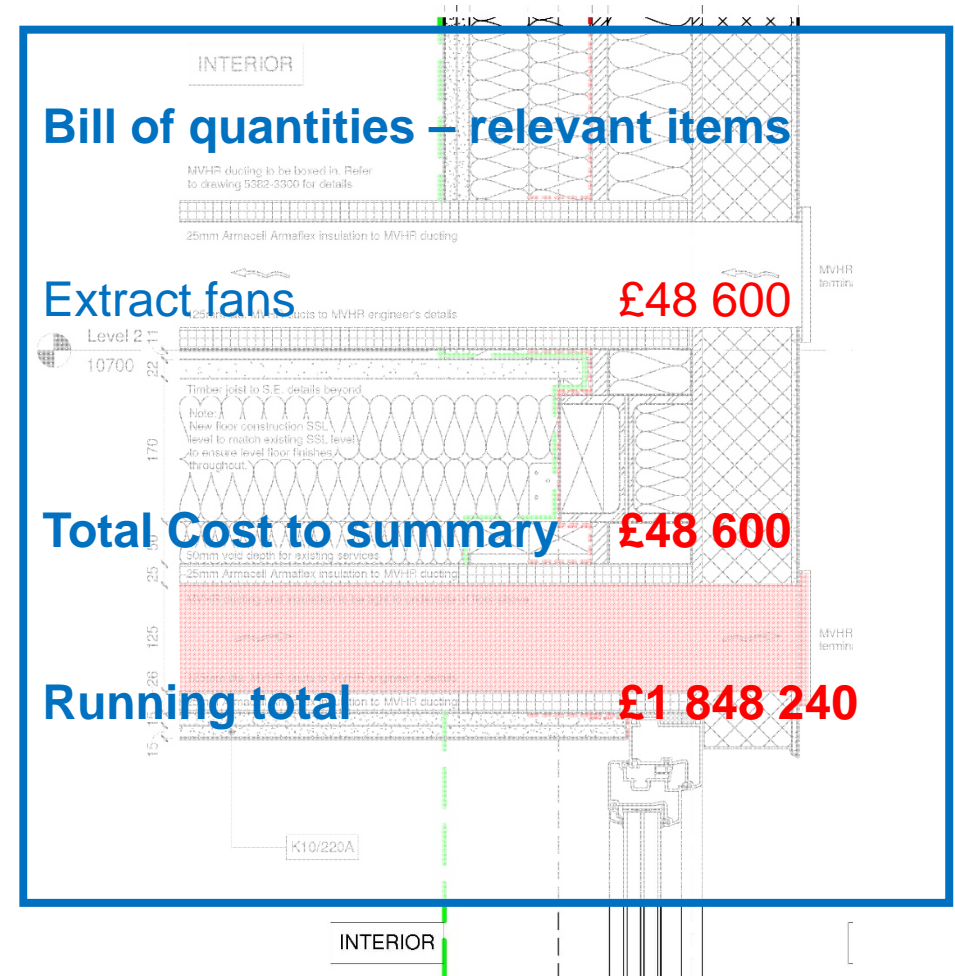


 **Part L 2010 equivalent**

# MVHR/Extract



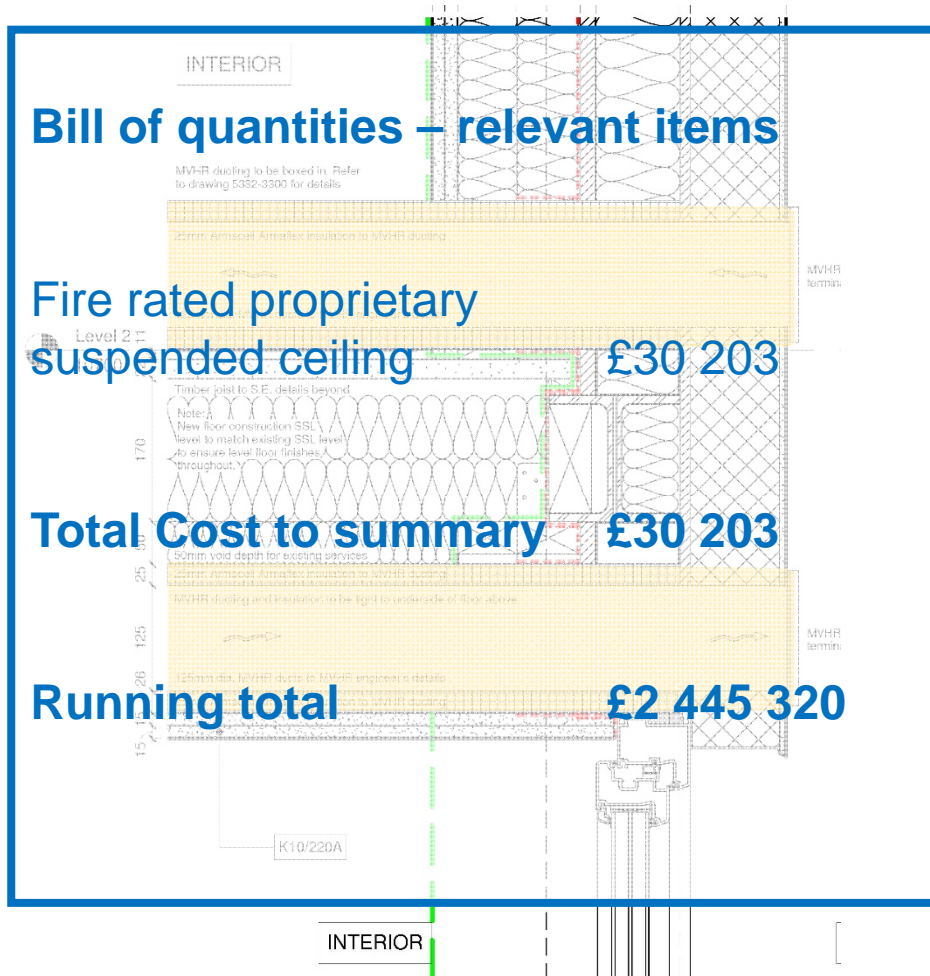
 **Passivhaus requirements**



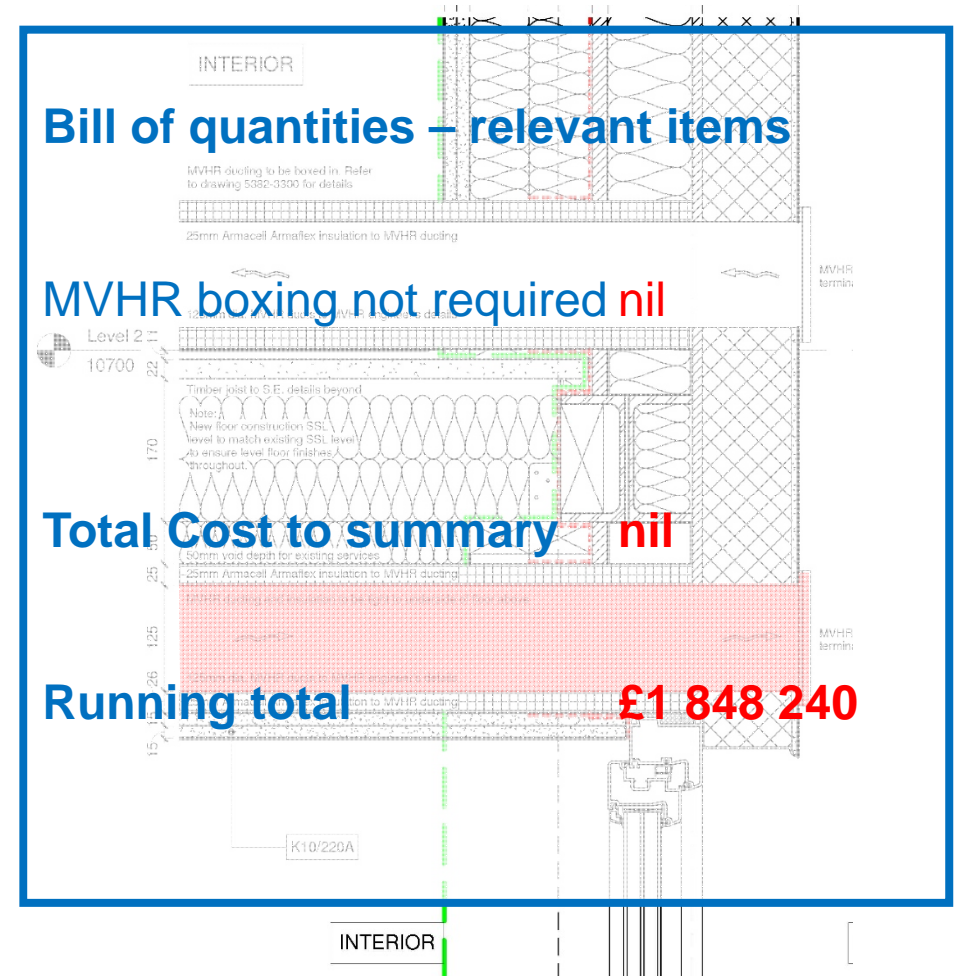
 **Part L 2010 equivalent**



# MVHR Boxing

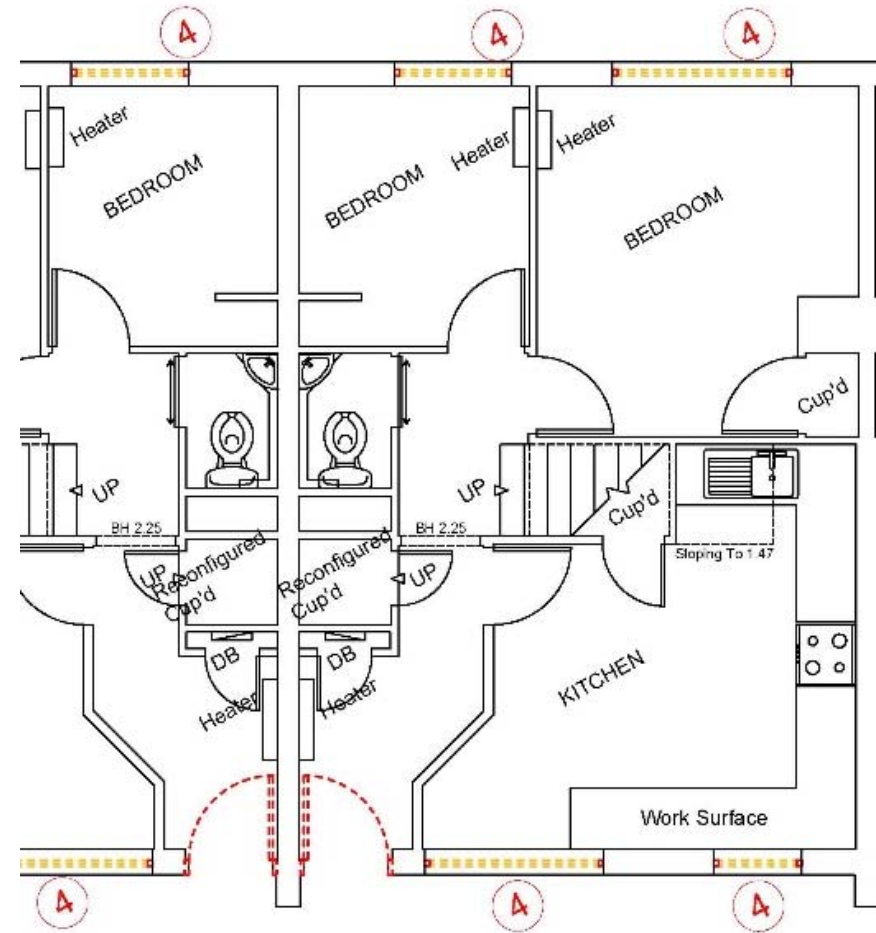
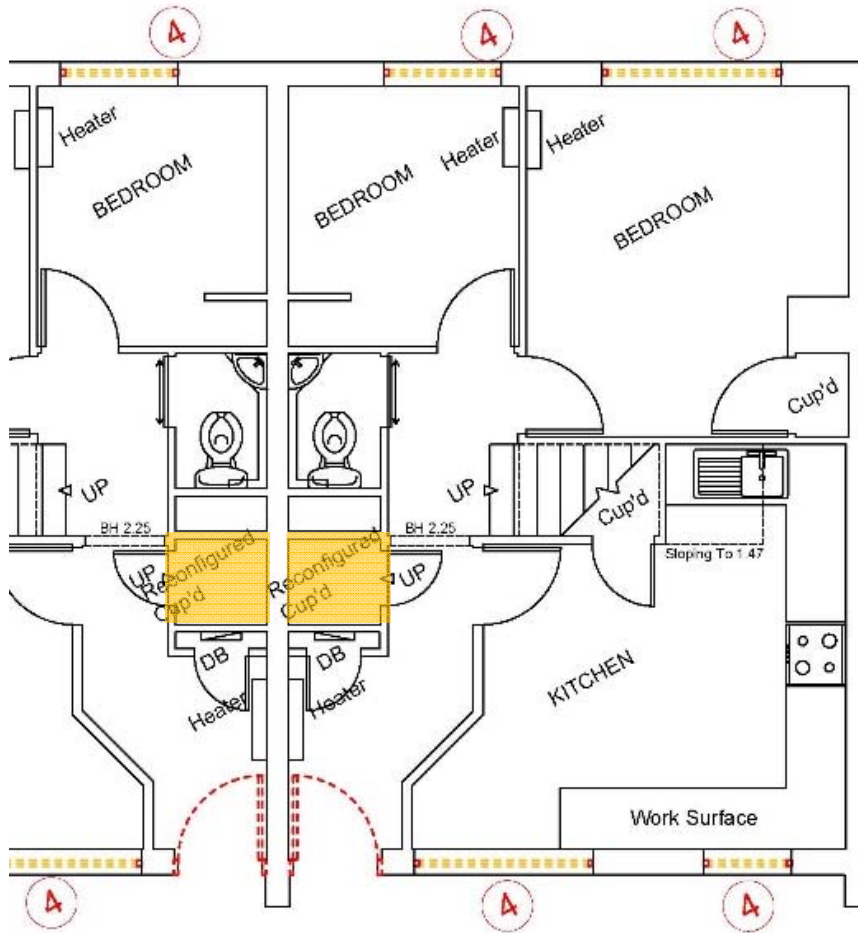


 **Passivhaus requirements**



 **Part L 2010 equivalent**

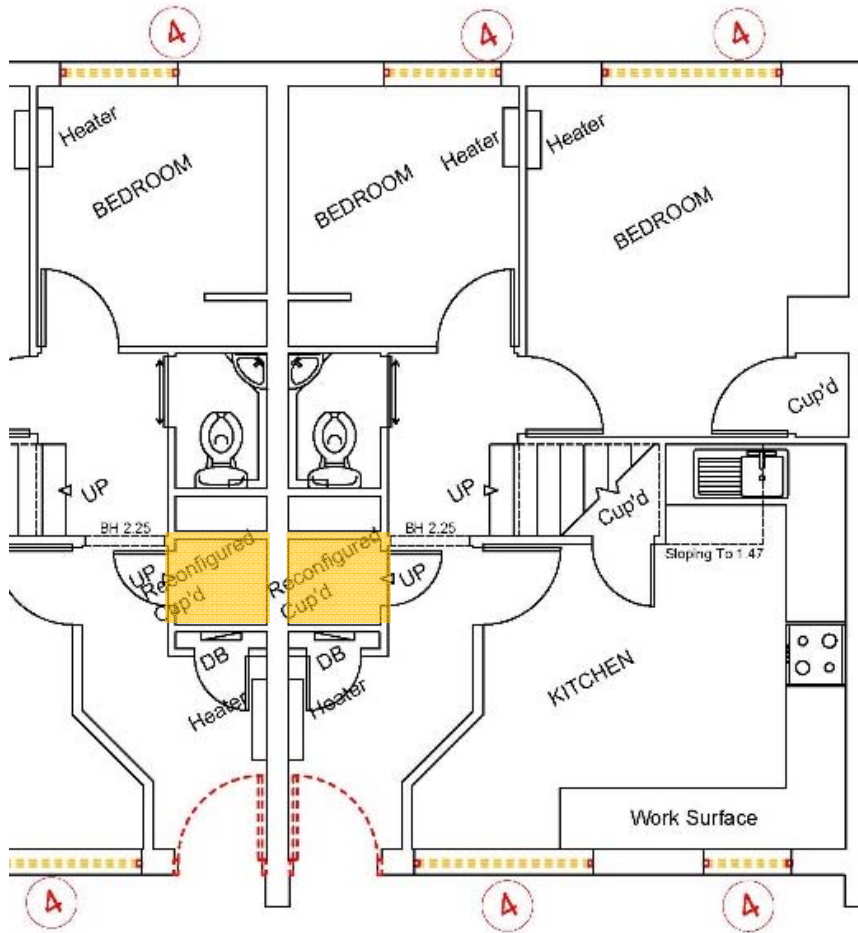
# Strip out existing ducts



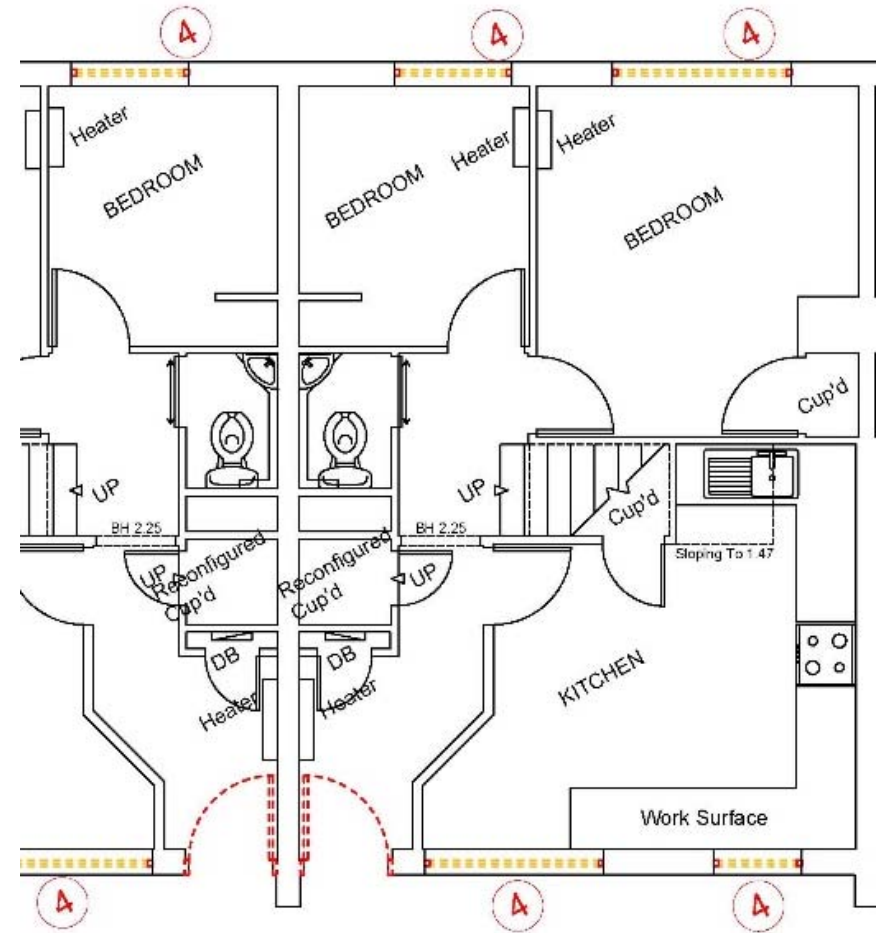
 **Passivhaus requirements**



# Strip out existing ducts

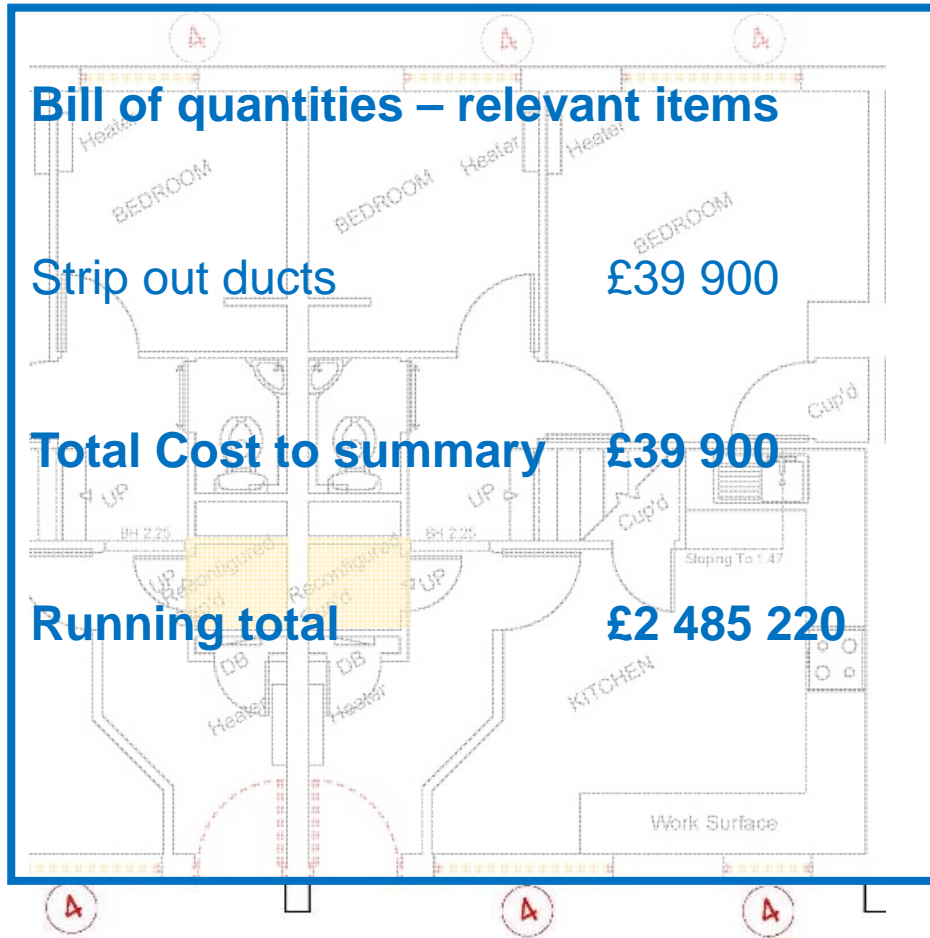


 **Passivhaus requirements**

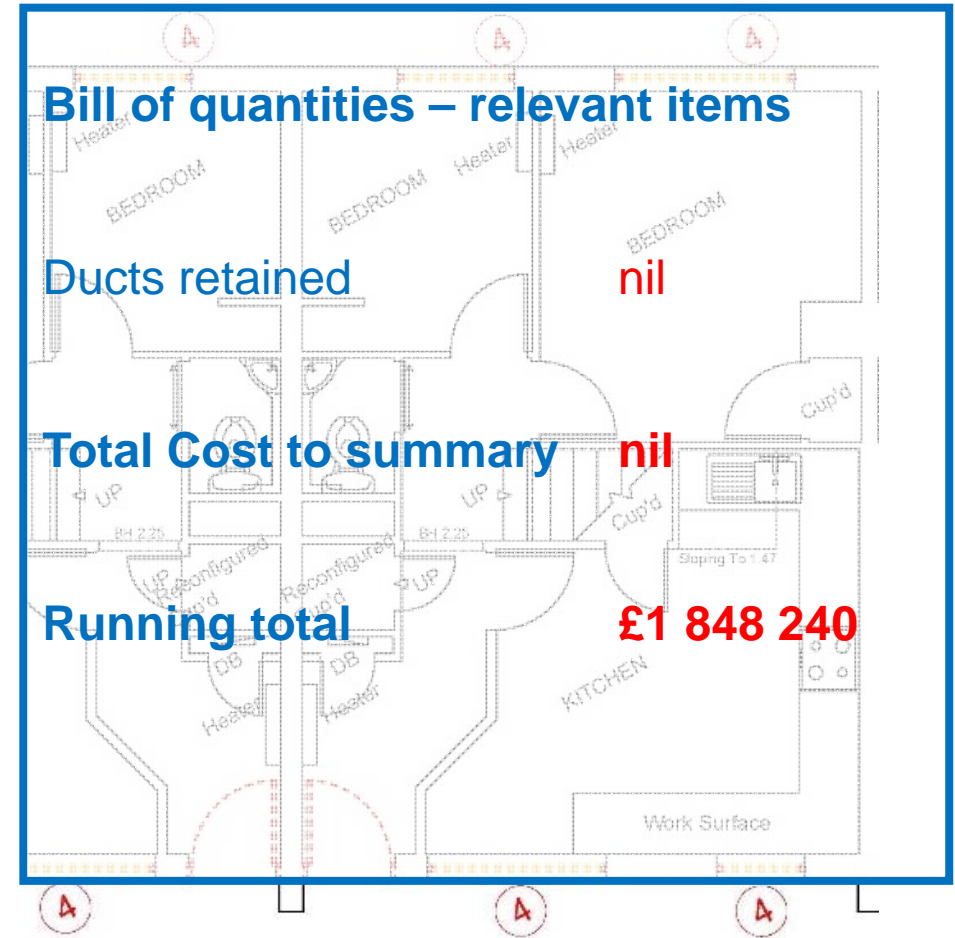


 **Part L 2010 equivalent**

# Strip out existing ducts



 Passivhaus requirements



 Part L 2010 equivalent



## Strip out asbestos



■ Passivhaus requirements

## Strip out asbestos



■ Passivhaus requirements



■ Part L 2010 equivalent



# Strip out asbestos

## Bill of quantities – relevant items

Asbestos removal (in connection duct removal)	£75 000
<b>Total Cost to summary</b>	<b>£75 000</b>
<b>Running total</b>	<b>£2 560 220</b>

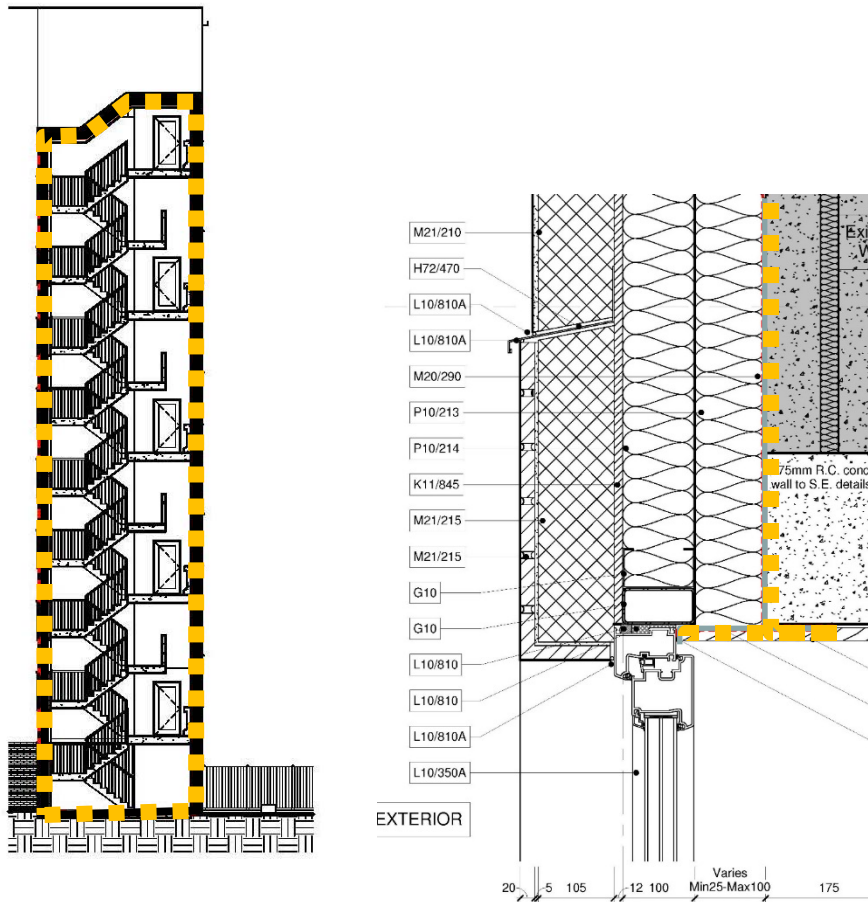
 Passivhaus requirements

## Bill of quantities – relevant items

Lesser scope of asbestos removal	£15 000
<b>Total Cost to summary</b>	<b>£15 000</b>
<b>Running total</b>	<b>£1 863 240</b>

 Part L 2010 equivalent

# Airtightness and quality control



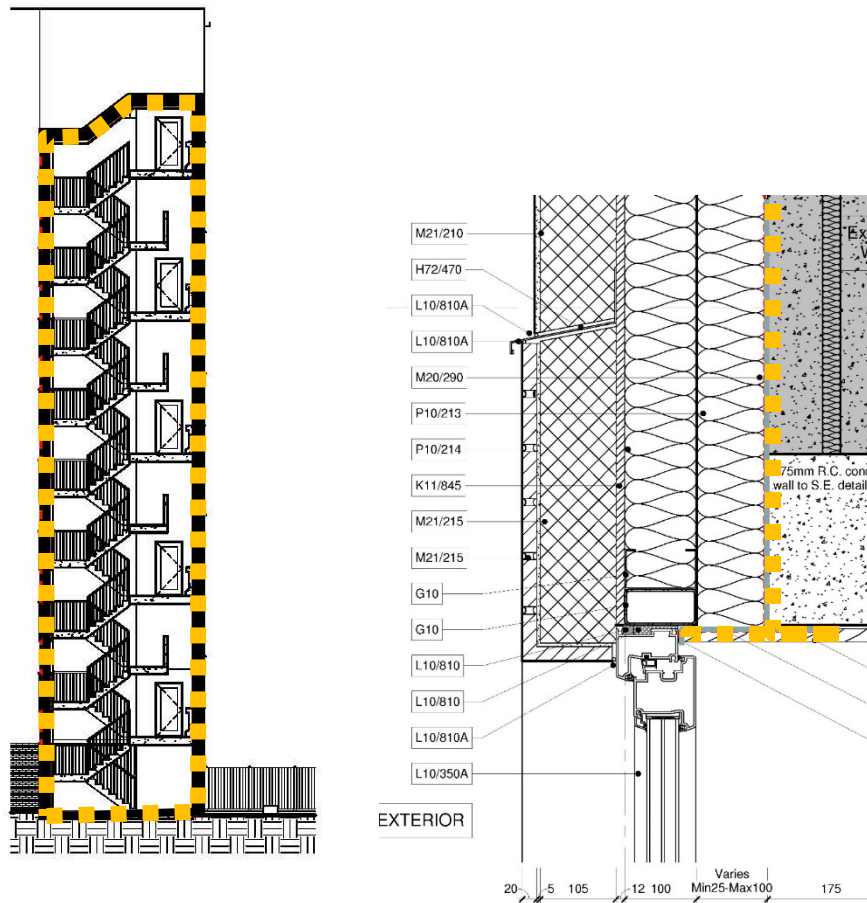
2 Typical End-Stair Core Section - Air-tightness strategy  
1:100

Line of Air-tightness

Passivhaus requirements



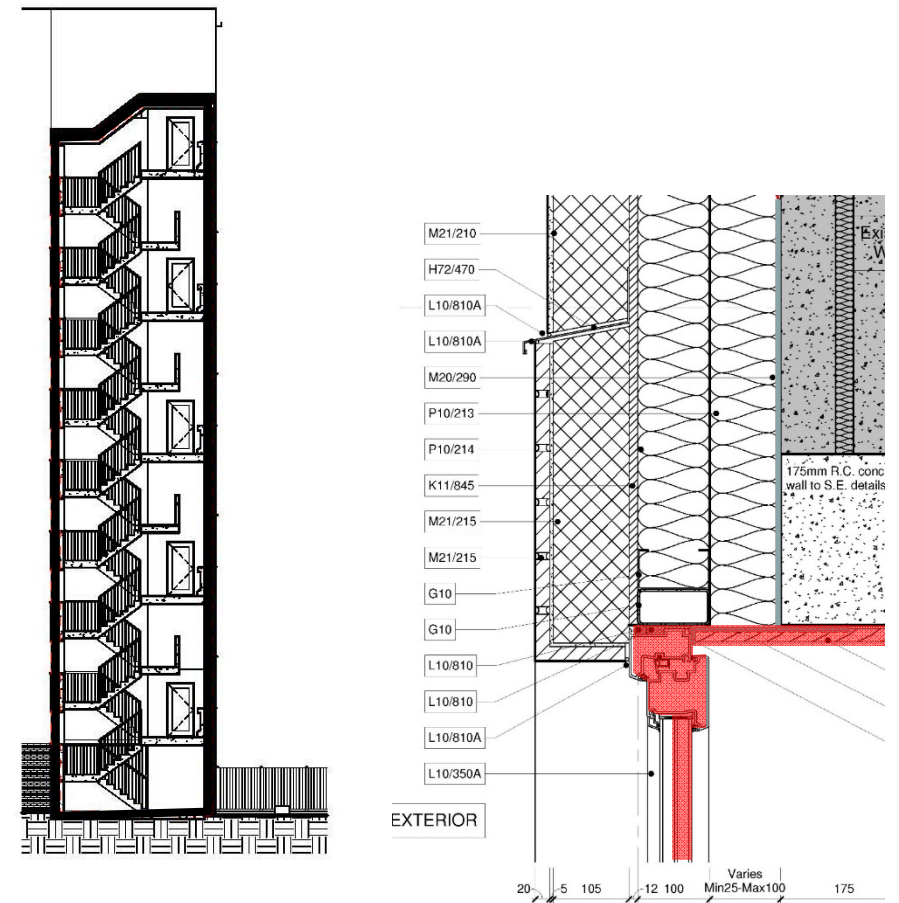
# Airtightness and quality control



② Typical End-Stair Core Section - Air-tightness strategy  
1:100

Line of Air-tightness

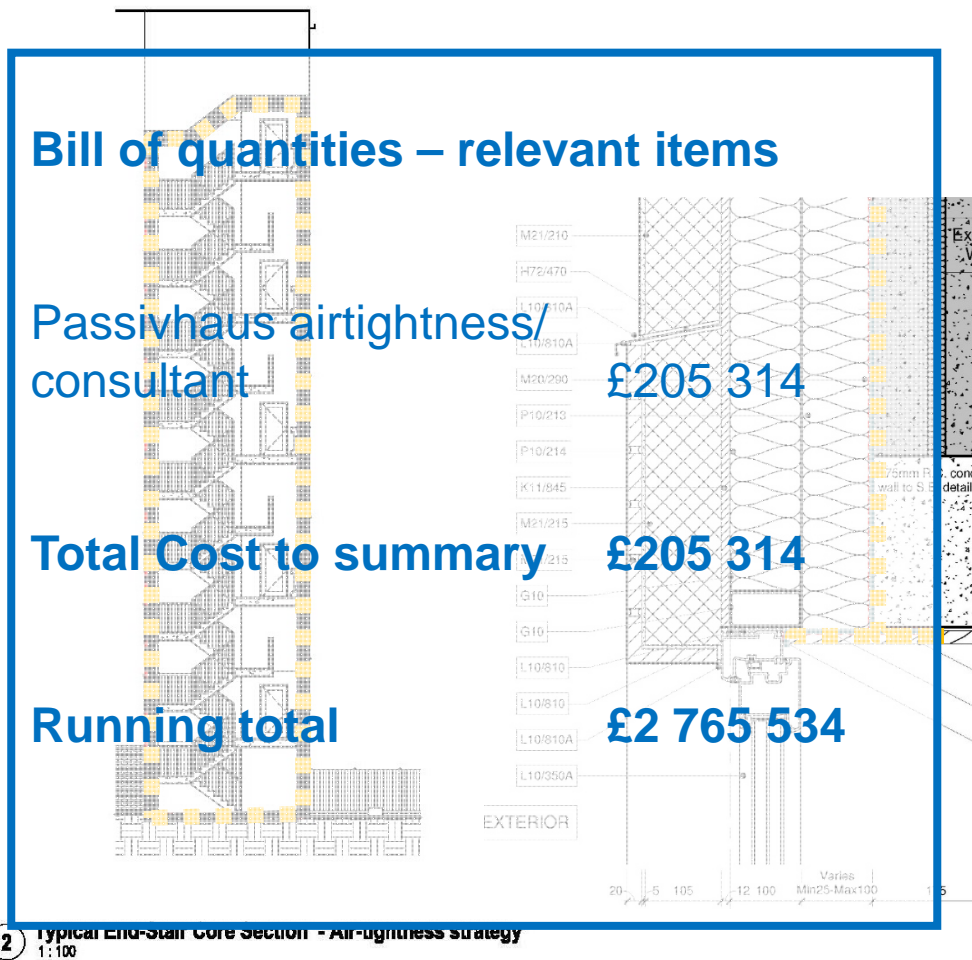
Passivhaus requirements



② Typical End-Stair Core Section - Air-tightness strategy  
1:100

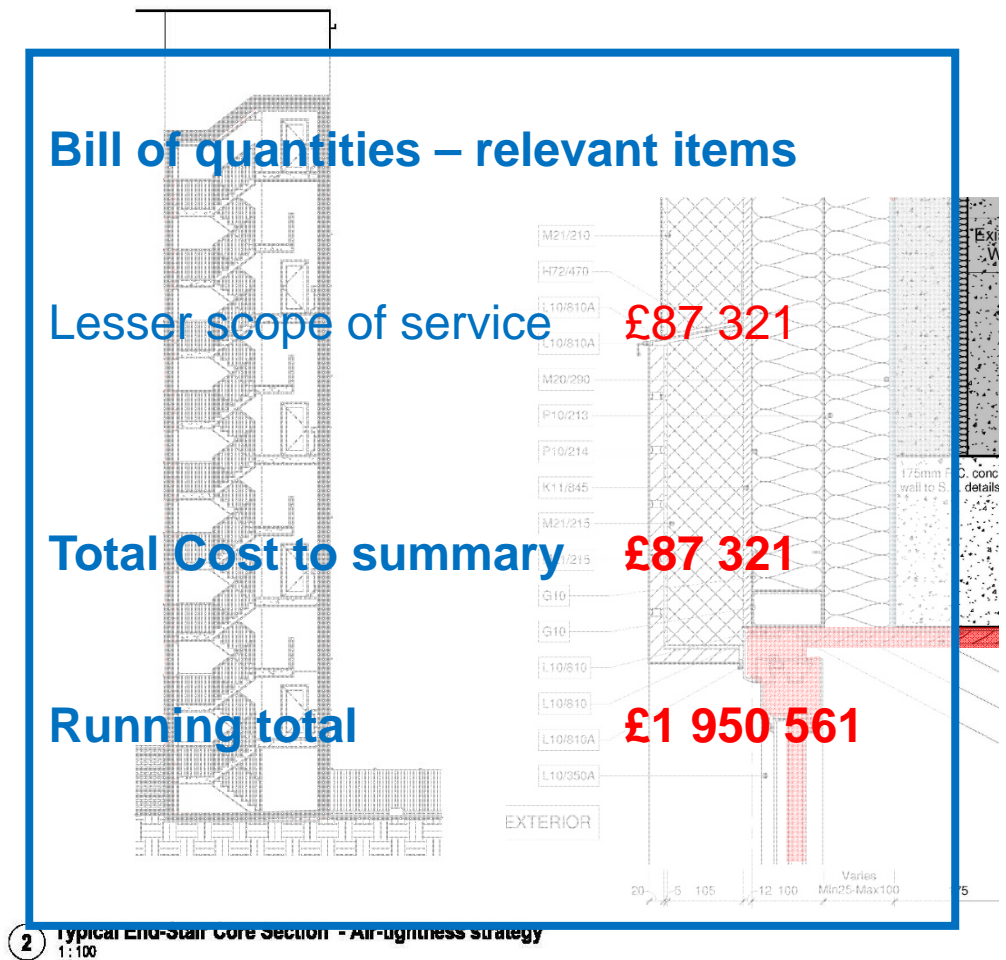
Part L 2010 equivalent

# Airtightness and quality control



Line of Air-tightness

Passivhaus requirements



Part L 2010 equivalent



# Total construction costs

## Summary

Adjusted works	£2 765 534
Non adjusted works	£5 909 907
	£8 675 441
Oncosts	£4 252 015
<b>Total</b>	<b>£12 927 456</b>
<b>Additional Cost</b>	<b>£1 090 536</b>

 **Passivhaus**

# Total construction costs

## Summary

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 **Passivhaus**

## Summary

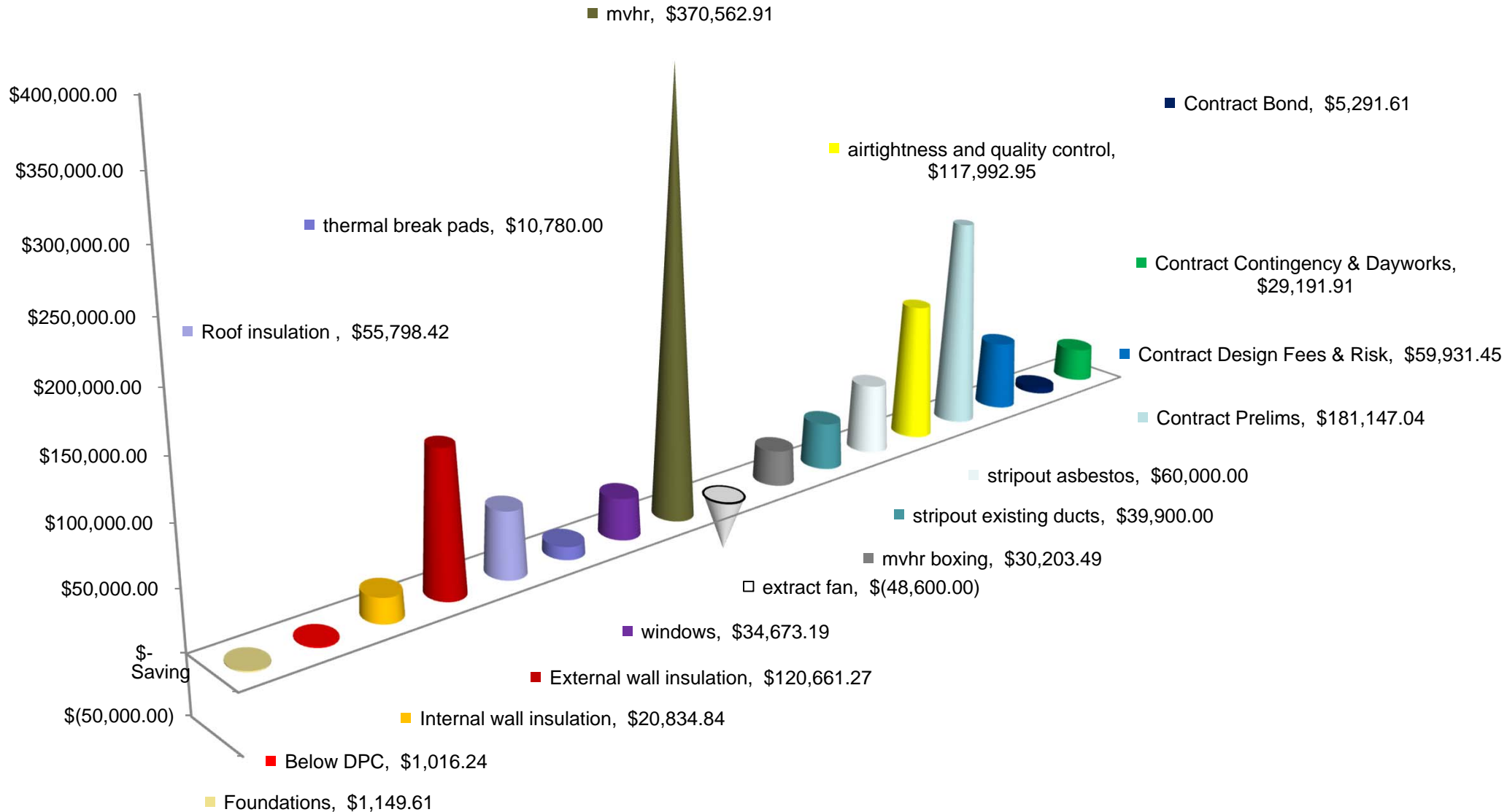
Adjusted works	£1 950 561
Non adjusted works	£5 909 907
	£7 860 468
Oncosts	£3 976 452
<b>Total</b>	<b>£11 836 920</b>
<b>Additional Cost 9%</b>	<b>£1 090 536</b>

 **Part L 2010 equivalent**



# Breakdown of capital cost differences

**Enerphit Contract Sum**    £12,927,456                    £889/m<sup>2</sup>  
**Building Regulations**    £11,836,920                   £814/m<sup>2</sup>  
**Difference**                    £1,090,536                    £75/m<sup>2</sup>



### **3. Lifecycle cost analysis**

- **Passivhaus specification (as tendered)**
- **Building regulations equivalent (Part L 2010)**

# Energy calculations

Treated floor area	4111.0	m <sup>2</sup>
Annual heating demand	23	kWh/(m <sup>2</sup> a)
Heating load	13	W/m <sup>2</sup>
Specific space cooling demand		kWh/(m <sup>2</sup> a)
Cooling load		W/m <sup>2</sup>
Frequency of overheating (> 25 °C)	0.4	%
Energy demand for space heating and auxiliary electricity		kWh/(m <sup>2</sup> a)
Energy demand for space cooling and auxiliary electricity		kWh/(m <sup>2</sup> a)
Pressurization test result n <sub>50</sub>	1.0	1/h

■ Passivhaus requirements



# Energy calculations

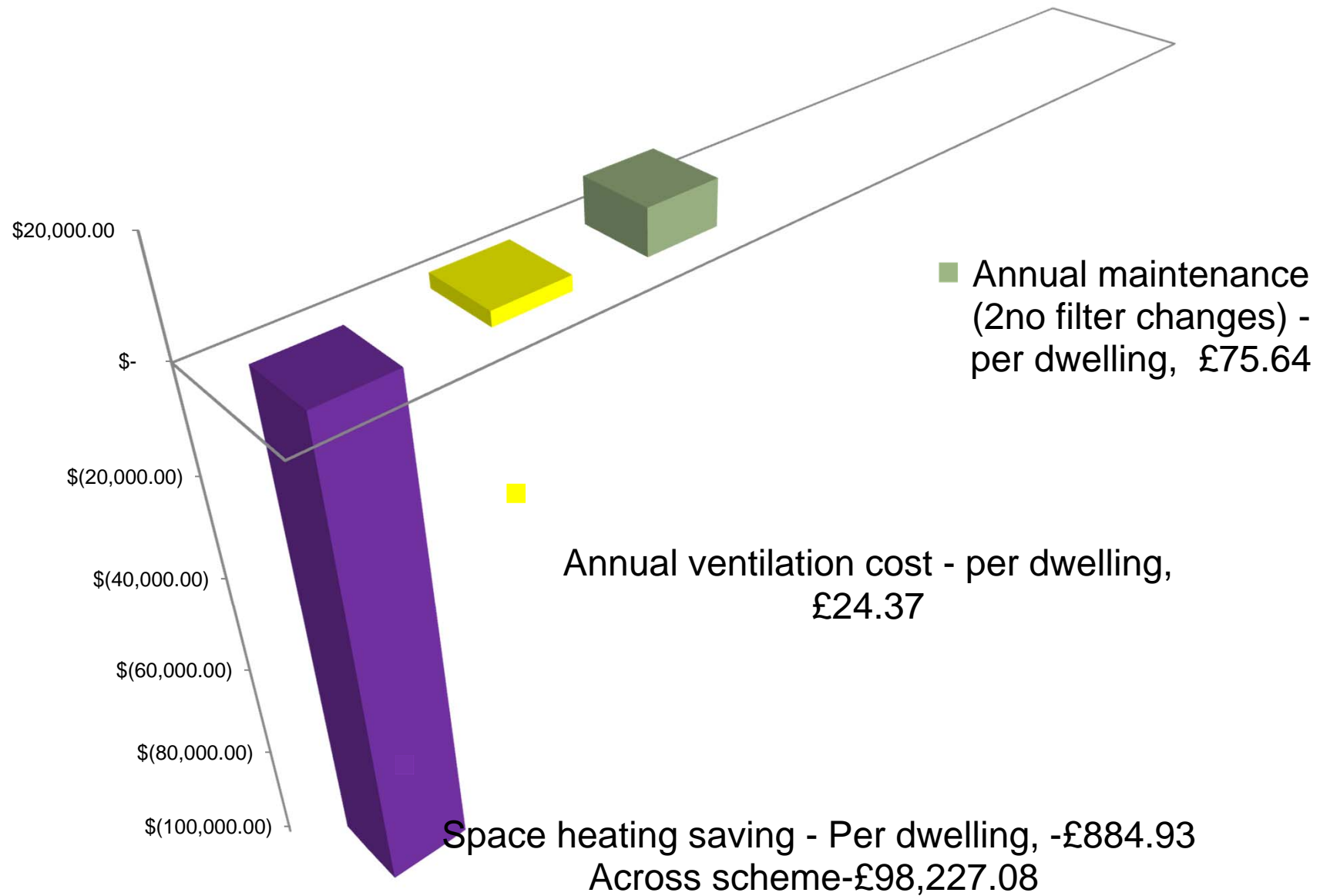
Treated floor area	4111.0	m <sup>2</sup>
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Specific space cooling demand		kWh/(m <sup>2</sup> a)
Cooling load		W/m <sup>2</sup>
Frequency of overheating (> 25 °C)	0.4	%
Energy demand for space heating, cooling, ventilation, household electricity.		kWh/(m <sup>2</sup> a)
Energy demand for space heating and auxiliary electricity		kWh/(m <sup>2</sup> a)
Energy demand for space heating and auxiliary electricity through solar electricity		kWh/(m <sup>2</sup> a)
Pressurization test result n <sub>50</sub>	1.0	1/h

 Passivhaus requirements

Treated floor area	4111.0	m <sup>2</sup>
Annual heating demand	93	kWh/(m <sup>2</sup> a)
Heating load	55	W/m <sup>2</sup>
Specific space cooling demand		kWh/(m <sup>2</sup> a)
Cooling load		W/m <sup>2</sup>
Frequency of overheating (> 25 °C)	0.0	%
Energy demand for space heating, cooling, ventilation, household electricity.		kWh/(m <sup>2</sup> a)
Energy demand for space heating and auxiliary electricity		kWh/(m <sup>2</sup> a)
Energy demand for space heating and auxiliary electricity through solar electricity		kWh/(m <sup>2</sup> a)
Pressurization test result n <sub>50</sub>	10.0	1/h

 Part L 2010 equivalent

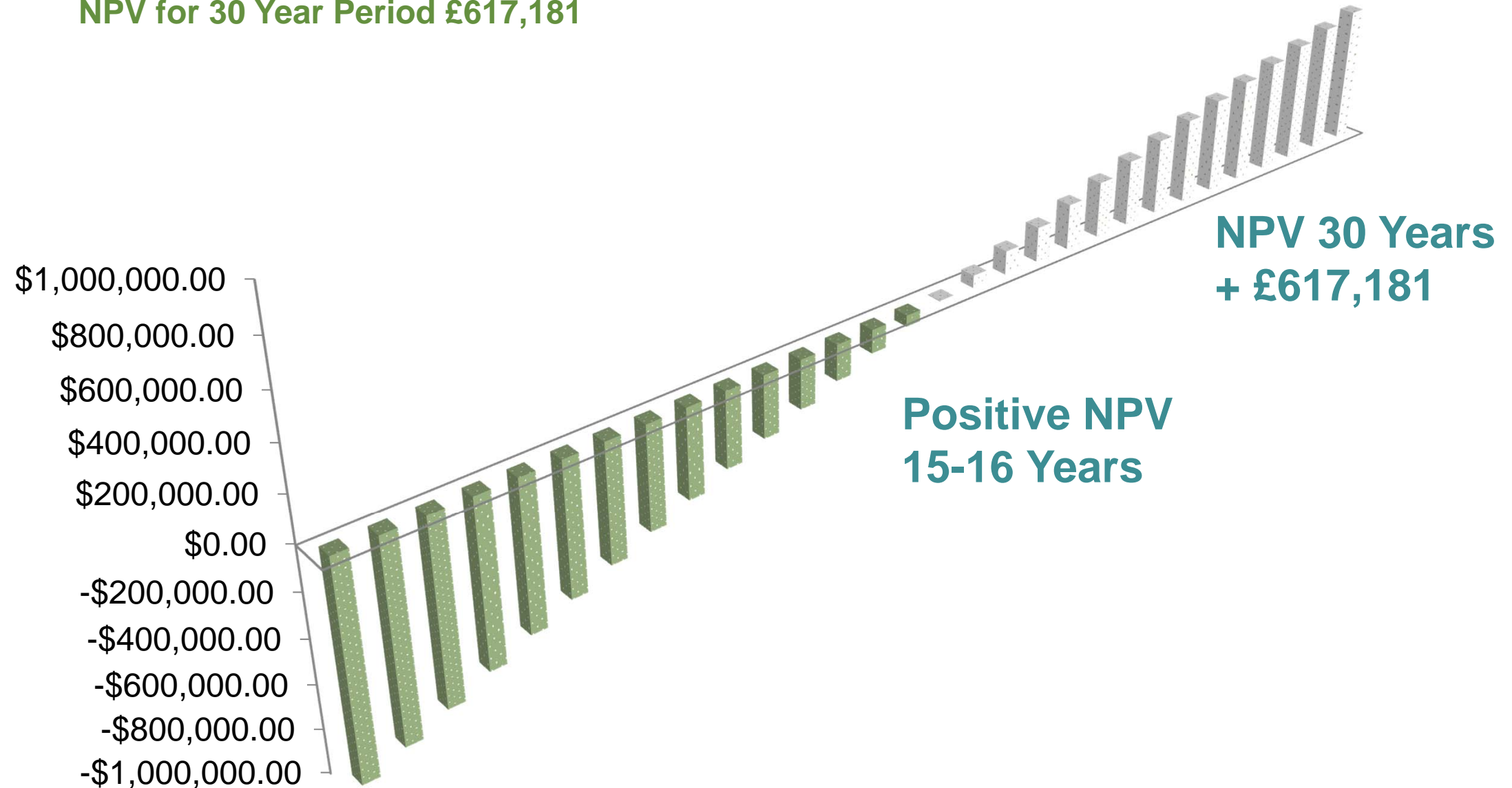
# Running costs for a passivhaus



# Life cycle cost – NPV 30 years

Positive NPV reached by close of 15<sup>th</sup> year

NPV for 30 Year Period £617,181









PCC Report to Cabinet Member for Housing  
Source: Portsmouth City Council Nov 2012

Comments from the Head of Finance:

- Wilmcote House is over 40 years old. Without refurbishment it will be **uninhabitable** in the medium term and **costly** to maintain in the short term.
- The [PCC] financial appraisal of the scheme demonstrates that the **high specification of work is cheaper** over the 30 year plan than demolition and replacement.
- The energy saving measures proposed will in addition **reduce the ongoing running costs** of the block.

## **4. Other Reasons...**



**A. Health & Wellbeing**

**B. Safety & Security**

**C. Employment & Economy**

**D. Changing perceptions**

# HEALTH & WELLBEING

- Marmot Review (2011)
- BRE Impact of DH works (2014)
- Oldham CCG report (2015)
- Coastline Housing study (2015)



## EDF to raise energy cost by 10.8%

EDF Energy customers will see a 10.8% rise in gas and electricity prices from 7 December, the company has announced.

The company becomes the fifth of the big six energy firms to announce price increases, although this was the biggest rise so far.

EDF accepted that the rise would be "unwelcome" but said it could no longer avoid a price rise for domestic customers.

It blamed the cost of wholesale energy and various government charges.

These included mandatory energy efficiency and social schemes, EDF said.




# SAFETY & SECURITY





The 'Secure Warm Modern' programme in Nottingham

Decent Homes impact study: Crime report




Nottingham City Homes  
Secure ♦ Warm ♦ Modern



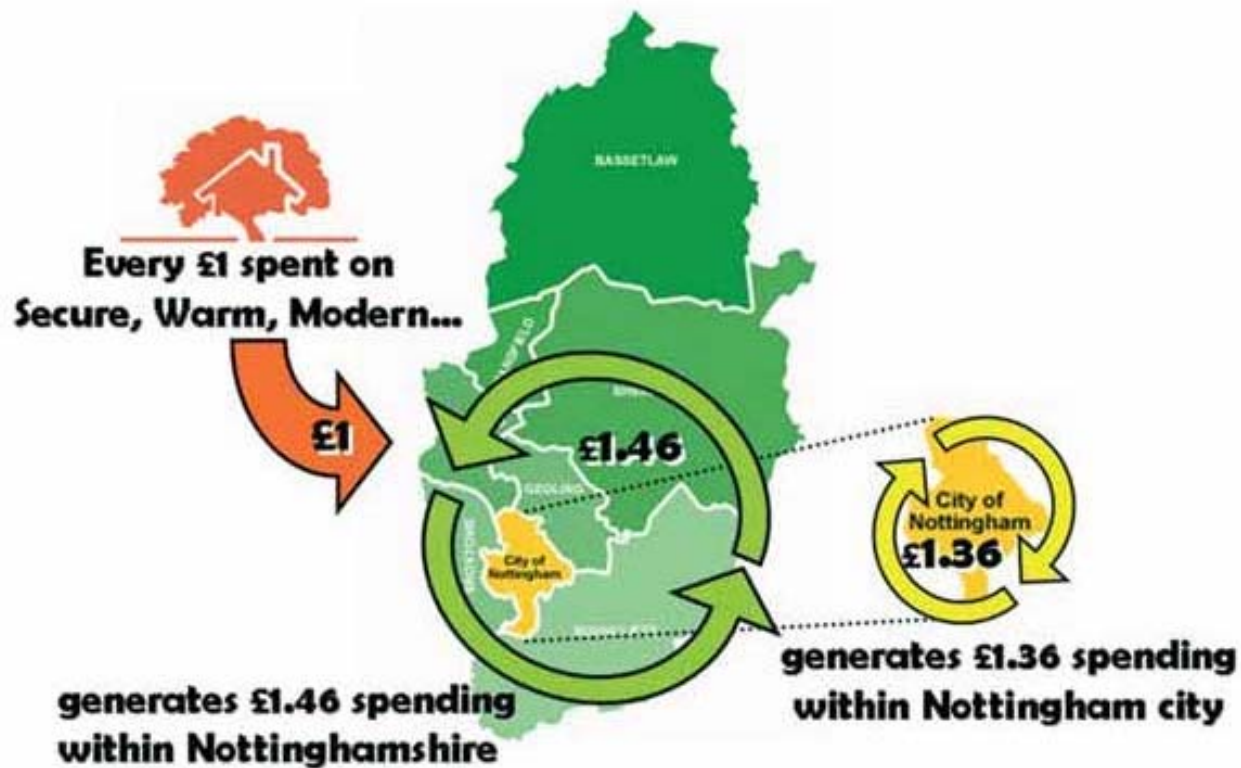
NOTTINGHAM TRENT UNIVERSITY

Knowledge Transfer Partnerships





# EMPLOYMENT & ECONOMY



## The 'Secure Warm Modern' programme in Nottingham

Decent Homes impact study:  
Employment and the local economy



**NOTTINGHAM TRENT UNIVERSITY**  
Knowledge Transfer Partnerships

# CHANGING PERCEPTIONS



