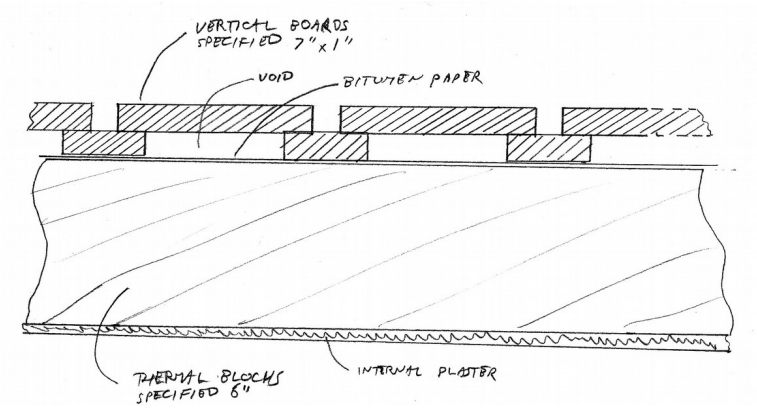
Thermal Performance of Proposed Replacement Weatherboards

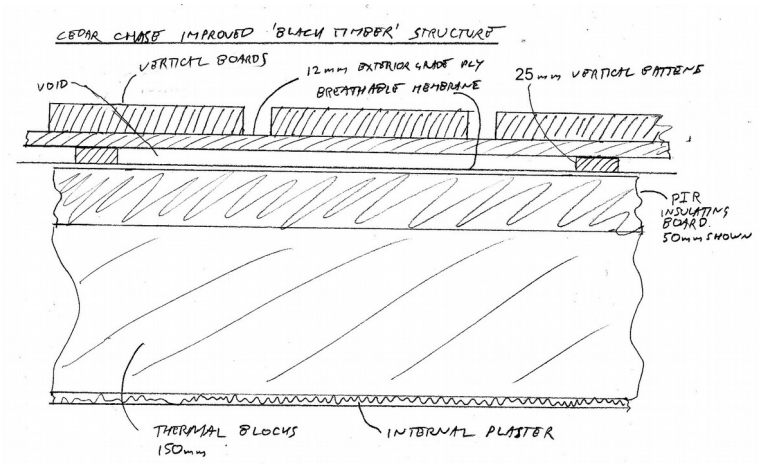
Existing structure



Element	**Assumed thermal resistance m^2K/W**	**Notes**
Outer surface	0.04	Taken from Celotex calculator
Outer weatherboards 24mm	0.1	Pine: approx 0.14W/mK across the grain, so 24mm board gives 0.17m^2K/W at best.
Inner weatherboards 24mm	0	These cover areas missed by outer boards
Bitumen paper	0	
Lightweight blocks 150mm	0.44	Assuming λ=0.34W/mK. This is probably pessimistic: Thermalite Shield gives 0.15W/mK so resistance could be as much as 1m^2K/W
Plaster skim	0.05	Taken from Celotex calculator
Inside surface	0.13	Taken from Celotex calculator
TOTAL	**0.76**	
TOTAL assuming block resistance is 1m^2K/W	**1.32**	

Taking the reciprocal of the total resistance gives a U-value between 0.75W/m^2K and 1.3 W/m^2K. For comparison, the Buildings Research Establishment found that as-built 9" solid brick walls have a mean U-value of 1.75W/m^2K (*Solid wall heat losses and the potential for energy saving*, BRE, Nov 2016). We would expect to do better than that as we know the blockwork is a lightweight (aerated) type. 1W/m^2K might be a reasonable estimate for the Cedar Chase walls.

Proposed Structure



The inner layer of boards is replaced with 12mm ply on 25mm battens. Behind that is a breather membrane (Tyvek, Nilvent, etc) and a layer of solid insulation board (Celotex GA4000 or similar).

The overall structure is thicker than the existing one by the thickness of the insulation board plus 12mm. The plywood and PIR board layers will greatly improve the air-tightness of this area.

Element	**Assumed thermal resistance m^2K/W**	**Notes**
Outer surface	0.04	Taken from Celotex calculator
Outer weatherboards 24mm	0.05	Not a continuous layer
Ply 12mm	0.05	
25mm void	0.2	Guess based on 1/3 of the resistance of a cavity seen in other calculations.
Membrane	0	
Insulation 50mm	2.25	Celotex XR4000 or similar
Lightweight blocks 150mm	0.44	Assuming λ=0.34W/mK. This is probably pessimistic: Thermalite Shield gives 0.15W/mK so resistance could be as much as $1m^2K/W$
Plaster skim	0.05	Taken from Celotex calculator
Inside surface	0.13	Taken from Celotex calculator
TOTAL	**3.21**	
TOTAL assuming block resistance is $1m^2K/W$	**3.77**	

That gives U values between **$0.31W/m^2K$** (assuming less-good blocks) and **$0.27W/m^2K$** (assuming blocks like Thermalite Shield). Part L of the Building Regulations require $0.28W/m^2K$ or better, and we should be fairly close to that.

Effect on heat loss

Applying the calculated U-values to the 2 Cedar Chase heat-loss spreadsheet shows that we currently lose 30W/K through black timber areas, and this would reduce to about 8W/K if the whole area was re-worked with 50mm of insulation board, saving us about £45/year on gas.

In practice we are more likely to only use this system above kitchen, dining, and living room windows: roughly half the total area.

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