Changes to Approved Document L 2021 (England)

In support of the Government's commitment to bring all greenhouse gas emissions to net zero by 2050, it is intended to halve energy use in all new builds by 2030. The introduction of a Future Homes Standard (FHS) for new build homes by 2025 is intended to produce homes which are future proofed with high levels of energy efficiency and low carbon heating.

As a steppingstone on the path towards the FHS, and the 75% reduction in CO_2 emissions which it will deliver (over the 2013 regulations), an interim change to Part L has been introduced. Published in December 2021, the latest amended Approved Document comes into effect on 15 June 2022 and will require the delivery of

- a 31% reduction in CO_2 for dwellings
- a 27% reduction for buildings other than dwellings

Published at the same time were an amended Approved Document F (Ventilation) and a new Approved Document O (Overheating), both of which have interacting consequences with Part L.

Summary of changes

A major difference between AD L 2021 and previous versions is that transitional arrangements will now only apply to individual buildings as opposed to a whole site.

For transitional arrangements to apply, developers will need to both:

a) submit a building / initial notice or have deposited plans by 15 June 2022; and
b) commence work on each individual building by 15 June 2023.

Where notices or plans are submitted after 15 June 2022, all homes must be built in line with the new AD L standards.

Where notices or plans are submitted before 15 June 2022 but work on any individual building does not commence by 15 June 2023, the relevant buildings must build in line with the new AD L standards.

For the purposes of transition, commencement is not changed from the previous 2013 definitions being:

- Excavation for strip, trench or pad footings.
- Digging out and preparation of ground for raft foundations.
- Vibrofloatation (stone columns) piling, boring for piles or pile driving.
- Drainage work specific to the building(s) concerned.

Although gas boilers will still be permitted under the interim changes, heating systems will be required to be future proofed for heat pumps with wet heating systems designed for flow temperatures of 55°C. In addition, with targets based on the use of photovoltaics (PV) it is likely that some degree of PV will be required in design solutions.

The design versus as built gap is also being addressed with requirements for provision of photographic evidence and air pressure testing for every plot. Site checklists will be required to be completed and submitted to ensure work is in accordance with specifications and critical junctions satisfy thermal bridging values.

In anticipation of the new requirements and to aid user of H+H products, H+H UK Limited have drawn junction details in CAD or PDF format, compatible calculated thermal bridging values and site checklists, which are available for free download from our website. Use of H+H aircrete will continue to provide cost effective wall solutions by enabling the thinnest possible masonry constructions to be used.

Laid out as two documents, Approved Document L 2021 is split into dwellings (AD L1) and buildings other than dwellings (AD L2), with each part covering requirements for new constructions as well as work within existing buildings.

Approved Document L1: Work in new dwellings

AD L1 covers work in a dwelling (defined as a self-contained unit designed to accommodate a single household). Other residential buildings which include rooms for residential purposes such as hotels, hostels or student accommodation, are covered by AD L2.

Below is a summary of the AD L1 requirements relevant to masonry walls in dwellings, for further guidance and specific information, reference should be made to the Approved Documents.

A new dwelling must be built to a minimum standard of energy performance. As with previous regulations, compliance will need to be shown by comparing the performance of the actual dwelling against a theoretical 'notional dwelling' of the same size and shape.

Compliance with the new regulations will need to be shown by considering four metrics:

1. CO_2 emissions ($kgCO_{2e}/m^2/year$), influenced by fabric and fuel choice.
2. Primary Energy ($kWh_{PE}/m^2/year$), also influenced by fabric and fuel choice.
3. Fabric Energy Efficiency Standards (FEES) ($kWh/m^2/year$), influenced by fabric only
4. Minimum Fabric and Building Services Standards

CO_2 emissions have been used as the main metric for compliance with building regulations for a number of years, however, this will become less effective as a measure of energy performance as the electricity grid becomes de-carbonised. If not addressed, this could result in a dwelling with low CO_2 emissions complying with regulations, despite having excessively high energy consumption. Consequently, the Primary Energy metric has been introduced to ensure that energy efficiency is directly measured rather than assuming it is linked to CO_2 emissions.

Similarly, the FEES and Minimum Fabric and Building Services Standards help to ensure that a design has good levels of fabric insulation that is a long lasting and permanent solution, with future proofed services, rather than one which relies on bolt-on low carbon technology as the main route to compliance.

The Target Emission Rate (TER), Target Primary Energy Rate (TPER) and Target FEE (TFEE) are calculated based on a notional dwelling of the same size and shape as the actual dwelling with specific performance criteria set to the reference values (as summarised in Table A1 in Appendix A). This is similar to the 2013 approach except that the notional dwelling is now based on reference values which have been set at a level which will provide the targeted 31% reduction in CO_2 (when adopted in their entirety).

As such, one means of achieving compliance would be to adopt the parameters in the notional dwelling for the actual dwelling. However, the guidance is not prescriptive, and the actual dwelling specifications can be based on any other solution, as long as the TER, TPER and TFEE is not exceeded and the guidance from the other parts of the Approved Document are followed.

Multiple occupancy buildings

Where a building contains more than one dwelling (such as in a terrace of houses or in a block of flats), compliance can be achieved if either

a) every individual dwelling has a DER, DPER and DFEE that is no greater than its corresponding TER, TPER and TFEE, or
b) the average DER, DPER and DFEE is no greater than the average TER, TPER and TFEE.
   The average values are the floor-area-weighted averages of all the individual dwelling values. When adopting the average approach, it will still be necessary to provide information for each individual dwelling.

Limiting Standards for new dwellings

There are certain limits on design flexibility such as the maximum average U-value (see Table 1 below) to ensure that each construction element plays a significant part in meeting the requirements. In practice, in order to satisfy the TFEE rate, the U-values of some elements would need to be significantly better than the limiting backstop values.

Table 1: Summary of reference values for notional dwelling and backstop values

Element	Reference Values	Limiting Backstop Values
External Walls	0.18 W/m²K	0.26 W/m²K
Party Walls	0.00 W/m²K	0.20 W/m²K
Floor	0.13 W/m²K	0.18 W/m²K
Roof	0.11 W/m²K	0.16 W/m²K
Windows, roof windows, rooflights and glazed doors	1.20 W/m²K	1.60 W/m²K 2.20 W/m²K (rooflights)
Opaque doors and semi-glazed doors	1.0 W/m²K	1.60 W/m²K
Air tightness	5.0 $m^3/(h.m^2)$ @ 50Pa	8.0 $m^3/(h.m^2)$ @ 50Pa 1.57 $m^3/(h.m^2)$ @ 4Pa

Table 1 gives a summary of the fabric requirements only, the full set of reference values in Appendix A also shows the reference requirements for ventilation, space and water heating systems, low energy lighting and PVs. Although the reference U-values appear fairly similar to AD L 2013, a major change is the inclusion of photovoltaic (PV) cells for the notional dwelling. This accounts for a substantial part of the 31% reduction making it difficult to eliminate the need for some PV.

Thermal Bridging

The building fabric has to be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements, at the joints between elements and at the edges of elements such as those around window and door openings. The Approved Document specifically mentions that blockwork with higher thermal performance, such as H+H aircrete, should be used in the inner leaf of a cavity wall or both leaves of a party wall to help reduce thermal bridging.

To limit thermal bridging and to help tackle the design versus as-built performance gap, the Approved Document requires that drawings should be provided for junctions, an on-site audit should be undertaken to confirm the designed details have been constructed prior to elements being concealed over and that photographs of the details should be taken.

H+H Calculated Ψ-values

Additional heat losses due to thermal bridging (H_{TB}) at junctions are considered within the SAP calculations and are obtained by multiplying the linear thermal transmittance (ψ-value) of a junction by the total length.

Where thermal bridge details are not known, a y-value of 0.05W/m²K is applied to the total exposed area of the notional dwelling to obtain the targets, however, for the actual dwelling the y-value is fixed at 0.20W/m²K. This is a very onerous value which makes it impractical to ignore thermal bridging as the dwelling will invariably fail to meet the TFEE. It is important, therefore that, H_{TB} is determined using calculated Ψ-values.

In order to provide the most up to date and accurate data where our blocks are being used, H+H have developed a comprehensive set of around 2,700 individual Ψ-values specifically covering our Solar (2.9N/mm²), Standard (3.6N/mm²), High Strength (7.3 N/mm²) and Super Strength (8.7N/mm²) blocks. Variations cover their use in partial or full fill in cavity walls, in beam and block floors, separating walls or as Foundation blocks below DPC.

The calculations, which are free to download from our website hhcelcon.co.uk/psi-values, conform to both BR497 (2016) and IP 1/06 and may be used by energy assessors in their SAP calculations to take full advantage of the inherent benefits of H+H aircrete blocks for all parts of the building fabric. To provide maximum flexibility, whilst covering the most common forms of constructions, varying levels of insulation in the form of combinations of three different thicknesses and three different conductivities are considered. These represent typical wall U-values ranging from around 0.13 - 0.30W/m²K.

Using H+H Calculated Ψ-values will result in a typical y-value of around 0.03W/m²K compared to a figure of around 0.05W/m²K derived from the reference values used when setting the targets. Both of these figures rely on a high performance at the lintels, which will typically require independent inner and outer leaf cavity lintels or a lintel incorporating a thermal break.

Standard Detail Drawings
As mentioned previously, the Approved Document also states that drawings should be provided for junctions. To allow proper coordination from initial Design, through SAP assessment to Construction phase, all junctions covered by the H+H Calculated Ψ-values document are consistent with, and referenced to, drawn H+H Construction Details which are available to download free of charge, in CAD or PDF format, from our website. When adopted at design stage, the designer can have confidence that the details used conform to best thermal practice.

Site Checklists
In addition, to aid the on-site audit requirement of the Approved Document, Site Checklists are also provided for each wall type to enable feedback to the energy assessor to help ensure that the final EPC reflects the as built conditions. These have been developed for ease of use by Site in order to encourage their use and improve quality control procedures. Each form is dedicated to the variations applicable to the specific wall type and may be completed electronically or as hard copies and returned to the energy assessor. The PDF format forms have been designed such that they can be filled in electronically by typing directly into the relevant boxes or selecting predetermined options, either on a PC or a handheld smart device.

Air permeability and pressure testing

Unlike previous versions of the AD L where testing of a sample number of dwellings was sufficient, AD L 2021 requires that an air pressure test should be carried out on every new dwelling and reported to the building control body (including any failures which are subsequently remedied).

Air pressure testing should be carried out following the methodology given in CIBSE TM23 (2021) which now includes the low-pressure pulse method. Previous versions of AD L only permitted the blower door method to measure air tightness, which involves pressurising the whole dwelling to a pressure differential of 50 Pa.

The pulse method involves applying a pressure pulse to the building envelope and measuring the building volume's pressure response. It uses a considerably lower pressure differential of 4 Pa, which not only more closely mirrors real-world conditions but is also quicker and less disruptive to site.

Compliance with the requirements will be demonstrated if:

a) the measured air permeability is not worse than the limit value given in Table 1 above; and
b) the DPER, DER and DFEE calculated using the measured air permeability must not be worse than the TPER, TER and TFEE respectively.

BREL Reporting

All of the above will need to be reported by means of a standardised BREL (Building Regulations England Part L) report, which will be produced by approved SAP software. As with 2013 requirements, two versions will be required,

a) the first, design stage BREL report, is required to be submitted before commencement of works and will include
    i. The Target and Dwelling Primary Energy Rate
    ii. The Target and Dwelling Emission Rate
    iii. A supporting list of specifications

b) The second, as built BREL report, will include
    i. The Target and as-built Dwelling Primary Energy Rate
    ii. The Target and as-built Dwelling Emission Rate
    iii. A supporting list of specifications and any changes to the list of specifications provided at the design stage

The as-built BREL will need to be signed by the energy assessor to confirm that the as-built calculations are accurate and that supporting documentary and photographic evidence have been reviewed, and in addition, signed by the developer to confirm that the dwelling has been built according to the specifications given in the report.

PARTNERS IN WALL BUILDING

Approved Document L1: Work in existing dwellings

Extensions

Table 2 gives the maximum U-values applicable to new thermal elements installed in an existing dwelling and to thermal elements constructed as a replacement for existing thermal elements.

Table 2: Limiting U-values for new fabric elements in existing dwellings

Element	Maximum U-value [1]
External Walls	0.18 W/m²K
Floor [2]	0.18 W/m²K
Roof	0.15 W/m²K
Swimming pool basin	0.25 W/m²K
Windows and doors [3]	1.40 W/m²K
Rooflights	2.20 W/m²K

1) Area weighted average U-values
2) The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged dwelling
3) The total area of windows, roof windows and doors in extensions should not exceed the sum of:
    i) 25 percent of the floor area of the extension; plus
    ii) the total area of any windows and doors which no longer exist or exposed due to the extension.

Alternative approaches are available for extensions in order to give some flexibility to the designer where, for example, larger window areas than those permitted in the table are desired. In this case additional heat loss through some parts of the fabric would need to be compensated by reduced heat loss elsewhere.

Under the area weighted U-value approach, it should be shown that the area weighted U-value of all the elements in an extension is no greater than that of an extension of the same size and shape which complies with the Table. In this case the area weighted U-value would be given by the expression:

$$\frac{U_1 \times A_1 + U_2 \times A_2 + U_3 \times A_3 + \ldots}{A_1 + A_2 + A_3 + \ldots}$$

Where:
U_1 = the U-value of element type 1, etc
A_1 = the area of element type 1, etc

An additional alternative approach for extensions is to use SAP to demonstrate that the DPER, DER and DFEE of the combined dwelling and proposed extension is not greater than the dwelling plus notional extension (as defined by Table 2 limits).

Conservatories and porches

A conservatory or porch will be exempt from energy efficiency requirements if there is thermal separation from the existing dwelling. If thermal separation is removed or the existing dwelling's heating system is extended into the new conservatory or porch, then it should be treated as an extension and Table 2 limitations will apply (with the exception of limits on areas of glazing),

Renovating existing thermal elements

Existing thermal elements (includes thermal elements being renovated and elements being retained in existing dwellings e.g. through a loft or garage conversion) should meet the maximum U-values given in Table 3.

Retained elements whose existing U-value is worse than the threshold value in column (a), should be upgraded to achieve the U-values in column (b).

Table 3: Limiting U-values for retained fabric elements in existing dwellings

Element	(a) Threshold U-value [1]	(b) Improved U-value [1]
Wall – cavity insulation [2]	0.70 W/m²K	0.55 W/m²K
Wall – internal or external insulation [3]	0.70 W/m²K	0.30 W/m²K
Floor [4, 5]	0.70 W/m²K	0.25 W/m²K
Roof	0.35 W/m²K	0.16 W/m²K

1. Area weighted average U-values.
2. This applies only to a wall that is suitable for cavity insulation. Where this is not the case, it should be treated as 'wall - external or internal insulation'.
3. If meeting such a standard would reduce by more than 5% the internal floor area of the room bounded by the wall, a lesser provision may be appropriate.
4. If meeting such a standard would create significant problems in relation to adjoining floor levels, a lesser provision may be appropriate.
5. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged dwelling.

Generally, an existing thermal element, once upgraded should not be worse than column (b), however, it may be possible retain a lesser standard if it can be shown that upgrading is not technically or functionally feasible or that it would not achieve a simple payback of 15 years or less.

Renovation of a thermal element is defined as one of the following:

a) Providing a new layer through cladding or rendering the external surface
b) Providing a new layer through dry lining the internal surface
c) Replacing an existing layer through stripping down the element to expose basic structural components (e.g. bricks, blocks, rafters, joists, frame etc.) and then rebuilding
d) Providing cavity wall insulation

The whole of the thermal element would require to be upgraded where more than 50% of the surface area of the individual thermal element is to be renovated, or the work constitutes a major renovation (ie more than 25% of the external envelope of the building).

Approved Document L2: Buildings other than dwellings

Buildings other than dwellings will include buildings with rooms for residential purposes such as hotels, hostels or student accommodation. Some building types such as portable modular, swimming pools, shell and core developments, industrial buildings or those with low energy demand will require special considerations, which we will not go into detail here but are covered in sections 2.10 – 2.32 of AD L2.

The compliance approach is similar with AD L1, as it will need to be shown by comparing the performance of the actual building against a theoretical 'notional building' of the same size and shape, by considering three metrics:

1. CO_2 emissions ($kgCO_{2e}/m^2/year$),
2. Primary Energy ($kWh_{PE}/m^2/year$)
3. Minimum Fabric and Building Services Standards

The Target Emission Rate (TER) and Target Primary Energy Rate (TPER) are calculated based on specific performance criteria set to the reference values set at a level which will provide the targeted 27% reduction in CO_2 (when adopted in their entirety).

As such, one means of achieving compliance would be to adopt the parameters in the notional building for the actual building. The full properties of the notional building are set out in the National Calculation Methodology Modelling Guide (www.uk-ncm.org.uk), as summarised in Table 4 below. However, the guidance is not prescriptive, and the actual building specifications can be based on any other solution, as long as the TER and TPER is not exceeded and the guidance from the other parts of the Approved Document are followed.

Table 4: Summary of reference values for notional dwelling and backstop values

Element	Reference Values		Limiting Backstop Values
	Side-lit or unlit activities	Top-lit activities	
External Walls	0.18 W/m²K	0.26 W/m²K	0.26 W/m²K
Floor	0.15 W/m²K	0.22 W/m²K	0.18 W/m²K
Roof	0.15 W/m²K	0.18 W/m²K	0.16 W/m²K (pitched) 0.18 W/m²K (flat)
Windows, roof windows and glazed doors	1.40 W/m²K	-	1.60 W/m²K 2.20 W/m²K (rooflights)
Rooflights	-	2.1 W/m²K	2.20 W/m²K
Vehicle access and similar large doors	1.30 W/m²K		1.30 W/m²K
Pedestrian doors and high usage entrance doors	1.90 W/m²K		1.60 W/m²K (pedestrian) 3.00 W/m²K (high use entrance)
Air tightness	3.0 $m^3/(h.m^2)$ @ 50Pa	5.0 $m^3/(h.m^2)$ @ 50Pa	8.0 $m^3/(h.m^2)$ @ 50Pa 1.57 $m^3/(h.m^2)$ @ 4Pa

1) Area weighted average U-values
2) The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of either the whole enlarged building or the extension alone.

Renovating existing thermal elements in buildings other than dwellings

Existing thermal elements (includes thermal elements being renovated and elements being retained in existing buildings) should meet the maximum U-values given in Table 5.

Table 5: Limiting U-values for retained fabric elements in existing dwellings

Element	(a) Threshold U-value	(b) Improved U-value
Wall – cavity insulation	0.70 W/m²K	0.55 W/m²K
Wall – internal or external insulation	0.70 W/m²K	0.30 W/m²K
Floor	0.70 W/m²K	0.25 W/m²K
Roof	0.35 W/m²K	0.16 W/m²K (pitched roof, insulation at ceiling level) 0.18 W/m²K (other roof types)

Generally, an existing thermal element, once upgraded should not be worse than column (b), however, it may be possible retain a lesser standard if it can be shown that upgrading is not technically or functionally feasible or that it would not achieve a simple payback of 15 years or less.

Thermal Bridging

As with AD L1, the use of calculated Ψ-values are encouraged with heavy penalties for calculating the BPER and BER where thermal bridging has not been considered.

Appendix A
Approved Document L1 Solutions

As mentioned, one means of achieving compliance would be to adopt the parameters in the notional dwelling for the actual dwelling, these are summarised in Table A1 below. However, the guidance is not prescriptive, and the actual dwelling specifications can be based on any other solution, as long as the TER, TPER and TFEE are not exceeded and the guidance from the other parts of the Approved Document are followed.

Table A1: Summary of reference values for notional dwelling

Element or System	Reference Values
Opening areas (windows, doors and roof lights)	Same as actual dwelling, up to a maximum of 25% of total floor area
External Walls	0.18 W/m²K
Party Walls	0.00 W/m²K
Floor	0.13 W/m²K
Roof	0.11 W/m²K
Windows, roof windows, rooflights and glazed doors	1.20 W/m²K
Opaque doors and semi-glazed doors	1.0 W/m²K
Air tightness	5.0 m³/hr/m²
Linear thermal transmittance	Determined from lengths of junctions in the actual dwelling and standardised ψ-values given in SAP Appendix R. Alternatively, y taken as 0.05
Main heating (space and water)	Mains gas
Heating system	Boiler and radiators, design flow temperature = 55°C
Boiler	SEDBUK efficiency = 89.5%
Heating system controls	Boiler interlock Either: single storey dwelling in which the living area > 70% of total floor area - programmer and room thermostat; or any other dwelling - time and temperature zone control + TRVs
Hot water system	From main system Separate time and temperature control
Wastewater heat recovery	All showers connected to WWHR
Hot water cylinder	If cylinder, declared loss factor = 0.85 x (0.2 + 0.051 V2/3) kWh/day, where V is the volume of the cylinder in litres
Lighting	Fixed lighting capacity (lm) = 185 x TFA Efficacy of all fixed lighting = 80 lm/W
Air conditioning	None
PV System	kWp = 40% of floor area of lowest storey / 6.5 (x number of storeys for flats) System facing SE/SW, 45° pitch

There will be a range of wall U-values that can be used to achieve compliance, depending on other parameters. Examples of typical wall constructions giving U-values ranging from 0.22 to 0.15W/m²K are given in Table A2 below**.** Please contact our Technical Services Department where other specific U-values are required or where the construction is not shown.

Table A2: Typical wall constructions to achieve specific U-values

Brick outer leaf, partially filled cavity			
0.22 W/m²K	**0.20 W/m²K**	**0.18 W/m²K**	**0.15 W/m²K**
Brick outer leaf Clear cavity 50mm Phenolic insulation 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf Clear cavity 75mm PIR insulation 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf Clear cavity 85mm PIR insulation 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf Clear cavity 100mm Phenolic insulation 100mm Celcon Standard Plasterboard on dabs
Brick outer leaf, fully filled cavity			
0.22 W/m²K	**0.20 W/m²K**	**0.18 W/m²K**	**0.15 W/m²K**
Brick outer leaf 125mm Full fill 34 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf 125mm Full fill 32 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf 150mm Full fill 34, OR 100mm PIR full fill 100mm Celcon Standard Plasterboard on dabs	Brick outer leaf 125mm PIR full fill 100mm Celcon Standard Plasterboard on dabs
Solid wall, internally insulated			
0.22 W/m²K	**0.20 W/m²K**	**0.18 W/m²K**	**0.15 W/m²K**
Render 215mm Celcon Standard 70mm Thermaline Super thermal laminate board	Render 215mm Celcon Standard 80mm Thermaline Super thermal laminate board	Render 215mm Celcon Standard 90mm Thermaline Super thermal laminate board	Render 215mm Celcon Standard 102.5mm Kingspan K118 thermal laminate board
Solid wall, externally insulated			
0.22 W/m²K	**0.20 W/m²K**	**0.18 W/m²K**	**0.15 W/m²K**
Render 65mm PIR insulation 215mm Celcon Standard Plasterboard on dabs	Render 75mm PIR insulation 215mm Celcon Standard Plasterboard on dabs	Render 85mm PIR insulation 215mm Celcon Standard Plasterboard on dabs	Render 110mm PIR insulation 215mm Celcon Standard Plasterboard on dabs
Notes Ancon Staifix RT2 cavity wall ties assumed Celcon Standard Grade blocks assumed as being laid in 10mm traditional mortar joints. PIR insulation = insulation with thermal conductivity of 0.022W/mK (foil faced for partial fill use) Phenolic insulation = insulation with thermal conductivity of 0.018W/mK (foil faced for partial fill use) Full fill 34 / 32 = full fill insulation with a thermal conductivity of 0.034 / 0.032W/mK respectively			

Whilst there are a number of solutions to achieve the reference wall value of 0.18W/m²K, with cavity widths ranging from 100mm to 150mm depending on the insulation used, it is worth noting that, as mentioned previously in the thermal bridging section, once the use of H+H aircrete is adopted, additional benefits to heat loss can be realised.

As an example, Table A3 below shows results for a typical 2 storey semi-detached house with a floor area of around 80m². It can be seen from Column B that using H+H aircrete with specifications to match the reference U-values will result in significant improvements over the targets due to the inherent benefits to linear thermal bridging. Column C shows that this could permit standard cavity lintels to be used as an alternative to independent or thermal break lintels, or, as in Column D, to reduce cavity widths.

It should be noted that the results in Table A3 are expressed with reference to the impact on external fabric only in order to demonstrate the magnitude of its significance in a simplistic manner, however, within limits, the benefits of reduction in heat loss can be applied to any aspect of the design to derive the most efficient solution.

Table A3: Summary for typical semi detached dwelling

	A	B	C	D
Element or System	**Reference Values**	**Using H+H aircrete blocks and associated ψ -values**		
		to match reference U-values	**to use standard cavity lintel**	**or to reduce cavity width**
External Walls	0.18 W/m²K	0.18 W/m²K **150mm Full fill 34 + 100mm Celcon Standard**	0.18 W/m²K 150mm Full fill 34 + 100mm Celcon Standard	**0.21 W/m²K** **125mm Full fill 34 + 100mm Celcon Standard**
Party Walls	0.00 W/m²K	0.00 W/m²K **2 x 100mm Celcon Standard + 100mm Full fill cavity**	0.00 W/m²K 2 x 100mm Celcon Standard + 100mm Full fill cavity	0.00 W/m²K 2 x 100mm Celcon Standard + 100mm Full fill cavity
Floor	0.13 W/m²K	0.13 W/m²K **Celcon Standard block & beam + 125mm PIR**	0.13 W/m²K Celcon Standard block & beam + 125mm PIR	0.13 W/m²K Celcon Standard block & beam + 125mm PIR
Roof	0.11 W/m²K	0.11 W/m²K	0.11 W/m²K	0.11 W/m²K
Windows	1.20 W/m²K	1.20 W/m²K	1.20 W/m²K	1.20 W/m²K
Doors	1.0 W/m²K	1.0 W/m²K	1.0 W/m²K	1.0 W/m²K
Linear thermal transmittance	y = 0.054 Determined from ψ-values given in SAP Appendix R[1]	**y = 0.035** **Determined from H+H Calculated ψ-values[2]**	**y = 0.048** **Determined from H+H Calculated ψ-values[3]**	y = 0.035 Determined from H+H Calculated ψ-values[4]
Wastewater heat recovery	1 shower connected to WWHR	1 shower connected to WWHR	1 shower connected to WWHR	1 shower connected to WWHR
PV System	2.375 kWp (8N° 300W panels)	2.375 kWp (8N° 300W panels)	2.375 kWp (8N° 300W panels)	2.375 kWp (8N° 300W panels)
Results	**TER = 11.54** **TFEE = 38.70** **TPER = 45.22**	**DER = 11.09 (- 3.9%)** **DFEE = 36.90 (- 4.6%)** **DPER = 42.71 (- 5.5%)**	**DER = 11.38 PASS** **DFEE = 38.20 PASS** **DPER = 44.27 PASS**	**DER = 11.39 PASS** **DFEE = 38.30 PASS** **DPER = 44.34 PASS**
Notes	[1] Lintel ψ-value given in SAP Appendix R is 0.05, which will typically require independent inner and outer leaf cavity lintels or a lintel incorporating a thermal break	[2] H+H Calculated lintel ψ-value based on independent inner and outer leaf cavity lintels, comfortable pass on all three metrics	[3] H+H Calculated lintel ψ-value based on standard insulated open back lintel (max 3mm steel)	[4] H+H Calculated lintel ψ-value based on independent inner and outer leaf cavity lintels. Cavity width reduced

The results above have been produced for illustrative purposes, using beta version software for SAP10.2 available at the time of issue, and are based on a typical semi-detached dwelling. The results and impacts of different aspects of the specification will vary for actual dwellings and should be assessed accordingly by a qualified energy assessor.