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Vision Built
3D-Volumetric Building System

NSAI Agrément (Irish Agrément Board) is designated by Government to issue European Technical Assessments.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with TGD Part D of the second schedule of the **Building Regulations 1997 to 2024.**

SYSTEM SCOPE

This Certificate relates to the Vision Built 3D-Volumetric Building System, for the design, manufacture and installation of volumetric, modular buildings on a site-specific basis. The Vision Built Volumetric Building System is a 3D Volumetric building system (MMC Category 1).

The Vision Built 3D-Volumetric Building System is a factory-built structural a Hot Rolled Steel (HRS) frame and Light Gauge Steel (LGS) infill building system consisting of pre-assembled modules. These modules are delivered to the site with internal finishes, insulation, external sheathing board, membranes, suitable internal boarding, as well as mechanical, electrical, waste, plumbing and sprinkler systems, where applicable. External finishes and windows may be factory or site installed, depending on the cladding system and site-specific design. Bathrooms and kitchens are completed upon the modules' installation on site. The steel module frames are manufactured and fitted out with internal fixtures, fittings and finishes (outside the scope of this Certificate) relevant to their function.

Site installation is conducted by approved installers employed by Vision Built or specialist sub-contractors under the supervision of Vision Built Structures Limited.

USE

The Vision Built 3D-Volumetric Building System, a MMC Category 1 building system, is certified to be used in the following purpose groups 1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a), 5(b), and 7(a) as defined in Technical Guidance Documents (TGDs[2][3]) Part B of the Building Regulations [2] and the categorisation of consequence classes up to 2B as per I.S. EN 1991-1-7+NA[48].

The Vision Built 3D-Volumetric Building System may be used to construct buildings where the height to the upper floor surface of the top floor

does not exceed 20m from ground level or as an additional storey(s) on an existing building where the resultant top floor is not greater than 20m in height from ground level, except where otherwise limited by the requirements of current Technical Guidance Documents to the Second Schedule of the Building Regulations.

DESIGN

The Vision Built 3D-Volumetric Building System is a modular system based on a Hot Rolled Steel (HRS) frame with Light Gauge Steel (LGS) infill and is intended for use where architects' finalised construction and fire strategy drawings are available and satisfy the Building Regulations. The Building Owner[79]/Client[78] and their appointed Architect and Engineering Design Team are responsible for the architectural drawings and compliance of the building design with the applicable Building Regulations and this Certificate.

The Vision Built Structures Limited nominated Chartered Structural Engineer is responsible for the final structural design of the Vision Built 3D-Volumetric Building System. Coordination between Vision Built Structures Limited and the Building Owner/Client and their Engineering Design Team is required to successfully complete the project. The Building Owner/Client is responsible for the coordination of their Engineering Design Teams.

The Vision Built 3D-Volumetric Building System is designed for use in permanent buildings. The system has been assessed for use with traditional brick and/or block outer leaf, and a number of specific rainscreen claddings, as detailed in Section 2.1.5.

The system may also be used with NSAI Agrément certified external wall cladding systems for LGS framed structures as per Section 2.1.5 of this Certificate. The compatibility of an NSAI Agrément approved cladding system with this volumetric, modular building system shall be agreed and confirmed by Vision Built Structures Limited at design stage to ensure compatibility between both systems and written approval shall be sought from the appointed Vision Built Chartered Structural Engineer on the use of such claddings.

The Vision Built 3D-Volumetric Building System is also designed for use with a wide range of traditional roofing finishes or NSAI Agrément certified roofing systems compatible with HRS and LGS framed structures. The Vision Built 3D-Volumetric Building System is typically designed with a flat roof, but pitched roof construction may also be used with the interface with the modules included as part of the System.

The LGS building system may also be designed to incorporate other cladding and roofing systems for which fitness for use as a cladding or roofing system has been determined through the recognised standardisation procedures referred to in paragraphs (a), (b) or (c) of Requirement D3 of the Building Regulations or those in Section 1.1 of TGD D. However, written approval shall be sought from the appointed Vision Built Chartered Structural Engineers for the use of such roofing or cladding systems. Other such cladding and roofing systems may be suitable but have not been considered as part of this certification.

Staircases, windows, door sets, fittings, raised access floors, adequacy of mechanical/electrical services, plumbing and ventilation of bathrooms and rooms containing sanitary conveniences are outside the scope of this Certificate.

RESPONSIBILITIES

Prior to the commencement of the contract, the responsibilities are determined and agreed between Vision Built Structures Limited and the Building Owner/Client, including but not limited to substructure design and construction, fire stopping, cavity barriers, roof completion, coordination of design and works. Responsibilities of all parties shall be clearly identified and documented.

MANUFACTURE, MARKETING, DESIGN & INSTALLATION

The product is manufactured, marketed and designed by the Certificate Holder:

Vision Built Structures Limited

Head Office & Manufacturing Facility location:

Ballina Road,
Rathscanlan,
Tubbercurry,
Co. Sligo,
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1.1 ASSESSMENT
In the opinion of the NSAI (National Standards Authority of Ireland) Agrément, the Vision Built 3D-Volumetric Building System, if used in accordance with this Certificate, shall meet the requirements of the Irish Building Regulations 1997 to 2024, as indicated in Section 1.2 of this Agrément Certificate.

1.2 BUILDING REGULATIONS
Buildings incorporating the Vision Built 3D-Volumetric Building System may be designed to meet the requirements of the following clauses of the Second Schedule of Irish Building Regulations 1997 to 2024.

REQUIREMENTS:

Part D – Materials and Workmanship
D1 – Materials and Workmanship
The Vision Built Steel Frame 3D-Volumetric Building System, as certified in, and when used in accordance with, this Certificate, can meet the requirements of the Building Regulations for workmanship.

D3 – Proper Materials
The Vision Built 3D-Volumetric Building System is comprised of 'proper materials' i.e. materials which are fit for their intended use and for the conditions in which they are to be used.

Note: Nothing in this Certificate is intended to prevent the use of materials of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those described in this Certificate.

Part A - Structure
A1 – Loading
The Vision Built 3D-Volumetric Building System, once appropriately designed, detailed, and constructed, has adequate strength and stability to meet the requirements of this Regulation (see Part 3 of this Certificate).

A2 – Ground Movement
The structure shall be designed and constructed, with due regard to the theory and practice of structural engineering, to ensure that movements of the subsoil caused by subsidence, swelling, shrinkage or freezing will not impair the stability of any part of the building structure.

An appropriately designed foundation structure shall safely sustain the combined dead, imposed and wind loads of the system into the foundation structure without causing undue deflection to any part of the building.

A3 – Disproportionate Collapse
The Vision Built 3D-Volumetric Building System shall be designed, detailed and constructed with sufficient structural robustness to avoid disproportionate collapse in accordance with Eurocode Design.

Part B – Fire Safety
For purpose group 1(a), 1(b) and 1(d), the fire safety requirements are laid out in TGD B-Fire Safety, Volume 2[3], Dwelling Houses, to Part B of the Building Regulations. For purpose groups 1(c), 2(a), 2(b), 3, 4(a), 5(a), 5(b) and 7(a) the fire safety requirements are laid out in Volume 1[2] of TGD or Part B of the Building Regulations. Refer to maximum building height stated on cover page of this Certificate. Distance to relevant boundary to be reviewed by competent Fire Engineer.

For Dwelling Houses, TGD to Part B Volume 2[3] Part B6 – B12 are required to be adhered to, while for purpose group 1(c), 2(a), 2(b), 3, 4(a), 5(a) and 5(b), Parts B1 – B5 and B12 are required to be adhered to, as stated in TGD B Volume 1[2].

B1 & B6 – Means of Escape in Case of Fire
Buildings shall be designed and constructed for adequate means of escape in compliance with Technical Guidance Documents B with the Vision Built 3D-Volumetric Building System.

B2 & B7 – Internal Fire Spread (Linings)
The plasterboard lining of walls and ceilings is designated Class B-s1, d0, or higher. It may therefore be used on the internal surfaces of buildings of every purpose group.

B3 & B8 – Internal Fire Spread (Structure)
The Vision Built 3D-Volumetric Building System shall be designed and constructed so that its stability will be maintained for a reasonable period in the event of fire in compliance with Sections B3 and B8 of Technical Guidance Documents[2][3] to Part B of the Building Regulations.

B4 & B9 – External Fire Spread
External masonry walls (masonry units containing a mass or volume fraction of <1% of homogeneously distributed organic materials) have a Class A1 Reaction to fire rating as per I.S. EN 771-3[15] and when installed and used in the context of this Certificate will provide adequate resistance to the spread of flame over the external walls and roofs and can satisfy the relevant requirements of this Regulation as indicated in Section 4.1 of this Certificate.

The Insulated metal skin sandwich wall panels assessed for use with the system have a Class B-s1,d0 Reaction to fire rating in accordance with I.S. EN 13501-1[16].

The rainscreen cladding options provide a range of fire classifications from Euroclass B-s2, d0 to A2-s1, d0, to suit project-specific requirements.

Note: In a building with a topmost floor >15m high, insulation material used in drained and/or ventilated cavities in the external wall construction shall have a reaction to fire classification of Class A2-s3, d2 or better as in accordance with TGDs[2][3] Part B of the Building Regulations. Where the topmost floor >15m, the reaction to fire classification of the whole external wall build-up shall meet the requirements of the TGDs[2][3] Part B of the Building Regulations. The requirements depend on the purpose group of the building, building height and distance to the relevant boundary.

The system shall be designed to comply with the project-specific Fire Safety Design Certificate (FSDC), where applicable.

B5 & B10 – Access and Facilities for the Fire Service

Buildings shall be designed and constructed with the Vision Built 3D-Volumetric Building System for adequate access and facilities for the Fire Service in compliance with the Technical Guidance Documents[2][3] to TGD Part B of the Building Regulations.

B12 Provision of Information

Vision Built Structures Limited can provide adequate information on elements of their system, as installed, for the purpose of fire safety, to the Building Owner[79] /Operator so that the building may be operated in order to protect the health and safety of the building occupants. This is compiled on a project-specific basis.

Part C – Site Preparation and Resistance to Moisture

Groundworks, site preparation and drainage are outside the scope of this certificate. The works must be designed and executed in accordance with Technical Guidance Document to Part C, ensuring appropriate site preparation and drainage. Site assessment for possible ground contamination, groundwater management, ground conditions assessment must be carried out by suitably qualified professionals.

C3 – Dangerous Substances

The ground floor must include sufficient radon sumps and provide the facility for radon extraction. Where it is shown that protection from dangerous substances (e.g. radon), is required, an approved gas resistant membrane and gas handling system shall be provided under the ground floor for all building types. The Vision Built 3D-Volumetric Building System permits the incorporation of the appropriate underfloor ventilation, membrane, sump and gas handling system, as per project-specific requirements.

Radon protection must follow Section 2 of TGD[4] to Part C of the Building Regulations, referencing EPA Radon Map and radon mitigation requirements for Radon risk rating. Where ventilation is used as part of radon protection, it must satisfy the ventilation criteria of Table 3 of TGD[4] to Part C.

C4 – Resistance to Weather and Ground Moisture

The Vision Built 3D-Volumetric Building System has adequate damp-proof courses and membranes to resist the passage of moisture from the substructure and the external ground to the building. The ground floor of the Vision Built 3D-Volumetric Building System is positioned over a ventilated sub-floor void, which must also be drained where required for determined site hydrology and therefore will not be subject to moisture ingress from the ground. An adequate site drainage system is required to be installed around and, where required, under the buildings to prevent the presence of water in the sub-floor void.

Roof and external walls above site Damp Proof Course (DPC) level will have adequate weather resistance in all exposures to prevent the passage of moisture from the external atmosphere into the building as specified in section 4.6 of this Certificate. The external cladding selected shall be suitable for the site specific exposure and orientation.

Part E – Sound

E1 – Airborne Sound (Walls)

Walls shall be appropriately detailed and constructed to meet the airborne sound level performance outlined in Table 1 of TGD[6] to Part E of the Building Regulations, provided good workmanship is adhered to onsite.

Airborne and Impact Sound (Floors)

Separating floors shall be constructed to meet the airborne and impact sound level performance outlined in Table 1 of TGD[6] to Part E, provided good workmanship is adhered to onsite.

Part F – Ventilation

F1 (a) – Means of Ventilation

Adequate ventilation openings shall be provided in internal and external walls and in roofs to meet ventilation requirements. Walls and roofs used in the system shall be designed and constructed to prevent any harmful effect from interstitial or

inner surface condensation, to comply with the requirements of BS 5250[17] Code of practice for the control of condensation in buildings.

F1 (b) – Limiting the concentration of harmful pollutants in the air within the building

The ventilation rate is required to be designed to meet the level of air pollutants present in the building. This will be based on the project-specific design.

F2 – Condensation in Roofs

Adequate ventilation shall be provided in roofs to meet this requirement (see Section 3.9.2 of this Certificate).

Part J – Heat Producing Appliances

Design for compliance with TGD J, MEP (Mechanical, Electrical & Plumbing) systems design and regulatory compliance of design and installation of same is outside the scope of this certification. It is the responsibility of the Building Owner/Client to appoint suitably competent qualified persons to design the building in compliance with TGD J.

J1- Air Supply

It is the responsibility of the Building Owner/Client appointed specialist designer's to ensure the design provides for adequate permanent ventilation for all heat-producing appliances, that combustion air supply meets appliance manufacturer requirements and minimum free area- values to TGD to Part J are achieved. This building system can accommodate ducts to provide for an adequate supply of permanent combustion air to a heat producing appliance or in a room in which a fireplace is located, as per Building Owner/Client appointed specialist designer's Building Regulation compliant design.

J2- Discharge of combustion products

It is the responsibility of the Building Owner/Client appointed specialist designers to ensure a suitable flue or chimney system is designed to safely remove carbon monoxide & other combustion gases in accordance with TGD to Part J. This building system can facilitate ducts for the adequate discharge of combustion products by means of cast-in extract ducts, as per Building Owner/Client appointed specialist designer's Building Regulation compliant design.

J3- Protection of Building

Buildings built with this system shall be designed to meet specified separation distances and wall lining insulation requirements of TGD[10] to Part J3 of the Building Regulations. Project-specific design to ensure required separation distances are maintained from combustible materials and suitable fire-stopping where flues pass through the building system walls.

Part L – Conservation of Fuel and Energy

L1, L5, L6 – Conservation of Fuel and Energy

All building elements of the Vision Built 3D-Volumetric Building System may be designed to incorporate the required thickness of insulation to meet a wide range of required elemental U-values. The elemental U-values are calculated using the elemental heat loss method for walls as per TGDs[11][12] to Part L of the Building Regulations.

Any building incorporating this building system shall be designed in tandem with this certificate and constructed in accordance with TGD to Part L, ensuring compliance with the energy performance requirements for conservation of fuel and energy. The design must achieve limits on primary energy use, carbon emissions and incorporate the necessary renewable energy provision, along with meeting prescribed building fabric standards, thermal performance, and building services efficiency. These measures collectively ensure compliance with the energy efficiency requirements set out under Part L.

Thermally bridged junctions have been assessed for both their linear thermal transmittance (i.e. Psi-value (ψ-value) and their temperature factors (f_{Rsi}) in accordance with the procedures outlined in BRE IP 1/06[18] "Assessing the effects of thermal bridging at junctions and around openings" and BRE report BR 497[19] "Conventions for calculating linear thermal transmittance and temperature factors" and I.S. EN ISO 10211[20] Thermal Bridges in Building Construction - Heat Flows and Surface Temperatures – Detailed Calculations. As a result, best practice has been observed to limit heat loss due to thermal bridging and to minimise risk of mould growth due to surface condensation.

Part M – Access for People with Disabilities

Design for compliance with Part M on a project-specific basis is outside the scope of this certification. It is the responsibility of the Building Owner/Client to appoint suitably competent, qualified persons to design the building in compliance with TGD M. The system shall be designed to comply with project-specific Access and Use Certificate (AUC).

M1 – Access and Use

Buildings built using this building system shall be designed and constructed using the Vision Built 3D-Volumetric Building System to meet the access, circulation and facilities requirements of this Regulation.

M2 – Sanitary Conveniences

Buildings built using this building system shall be designed and constructed using the Vision Built 3D-Volumetric Building System to meet the requirements for use of the sanitary conveniences by people with a range of abilities who may require assistance.

2.1 PRODUCT DESCRIPTION

This Certificate relates to the design, manufacture and installation of the Vision Built 3D-Volumetric Building System, as a MMC Category 1, 3D Volumetric Modular building system. The Vision Built 3D-Volumetric Building System components are manufactured off-site by Vision Built, transported as three-dimensional volumetric modules and assembled in sequence on a prepared sub-structure to construct the designed building. Two-dimensional sub-assemblies may also form part of the system, where required.

Module structure is created from a steel frame structure formed with steel columns with cold rolled LGS floor and ceiling joists and infill wall panels. The Vision Built 3D-Volumetric Building System can accommodate a wide range of custom module designs, sizes, and configurations. Modules with both floors and roof/ceilings, open-bottom and open-top designs. Open-top and open-bottom may be combined to form double height spaces in buildings. Module dimensions vary, typically ranging from 2.4m to 15m in length, 2.4m to 4.5m in width, and up to 4.5m in height. These are typical sizes and exceptional modules can be outside these ranges, subject to project-specific structural design by Vision Built Structures Limited's Chartered Structural Engineer and being logistically feasible to deliver and install on site.

All elements of the system are assembled in the Vision Built factory to create volumetric units that are then transported to designated sites for installation. The modules may be delivered to site finished internally. This includes windows (outside the scope of this Certificate); insulation, plasterboard, electrical, plumbing, ventilation and air conditioning systems (services are outside the scope of this Certificate) where applicable.

This Certificate contains illustrations to explain the various elements of the Vision Built 3D-Volumetric Building System – these illustrations are not intended to be used as construction drawings. Project Engineer or Architect, as referenced in this Certificate, defines the competent person responsible for co-ordinating individuals or companies providing specific expertise. Vision Built, in conjunction with the design team on a project, will produce a set of project-specific details on a project-by-project basis. All drawings shall be compliant with the relevant codes of practice and relevant standards, along with the current Irish Building Regulations.

This Certificate does not contain a full set of installation instructions, but an overview of the procedures involved. For a full list of these instructions, refer to the Certificate holder's System Manual[73] and Installation Manual[74]. Should a conflict arise between this Certificate and the Certificate holder's manuals, this Certificate shall take precedence. The full structure will be designed, assembled, and erected by Vision Built and / or Vision Built approved installers / specialist sub-contractors under the full supervision of Vision Built Structures Limited.

2.1.1 Foundations

The construction of the foundations and substructure is outside the scope of this Certificate. The construction of the foundations is the responsibility of the Main Contractor and shall be constructed in accordance with the Building Owner/Client's appointed Engineering design and specification. Any structure supporting the Vision Built 3D-Volumetric Building System shall be designed by the Building Owner/Client's appointed Engineer for structural load criteria specified by the Vision Built Chartered Structural Engineer. The Building Owner/Client's appointed Engineer will be a suitably qualified Chartered Engineer and the design will be in accordance with the relevant codes and standards, i.e. Foundation's shall be designed in accordance with TGD[1] to Part A of the Building Regulations and I.S. EN 1997-1[21] Eurocode 7 Geotechnical Design – Part 1: General Rules.

Foundations, site drainage concrete/hardcore subfloor oversite, subfloor ventilation requirements, radon membrane and sump system are to the Building Owner/Client's appointed engineer's site-specific design and specification. Site Drainage must consider site-specific hydrogeology and hydrology, including areas under the building. It is the main contractor's responsibility to ensure that the oversite is installed at a level that will maintain a minimum 150mm clear void between the level of the oversite and the soffit of the ground floor modules, see Figure 2. Tolerances for the system installation on foundations are defined by the Vision Built Chartered Structural Engineer. Where drainage to the sub-floor void is required, this is designed by the Building Owner/Client appointed specialist designer for the site specific requirements including adequate access for rodding and installed by the main contractor.

A radon-resistant membrane, approved by NSAI Agrément or an equivalent authority, shall be

installed beneath the oversite in accordance with the TGD[4] to Part C of the Building Regulations, where required, to ensure a full and continuous barrier to the infiltration of radon to the sub-floor void where required by the site-specific location and specification. This membrane must be fully sealed across the entire footprint of the building. Where the membrane is penetrated by anchor bolts connecting the modular units to the rising walls/foundations, it shall be adequately repaired to maintain its integrity. Radon membranes shall be NSAI Agrément certified and installed per the respective Agrément certificate, manufacturer instructions and TGD[4] to Part C Construction Details.

The hardcore bed beneath the radon/DPM membrane shall be constructed in accordance with the TGD[4] to Part C of the Building Regulations and to the project-specific design by the Building Owner/Client's appointed engineer and design team.

All buildings shall be provided with a potential means of extracting Radon from the substructure should that prove necessary after construction, in accordance with TDG[4] to Part C of the Building Regulations. Radon mitigation measures are outside the scope of the Vision Built 3D-Volumetric Building System.

2.1.2 Ground Floor

The ground floor forms part of the three-dimensional modular unit of the Vision Built 3D-Volumetric Building System.

The floor sub-assembly is formed by LGS C-joists supported on the structural steel parallel flange channel (PFC) perimeter beams, as per the Vision Built Structures Limited Chartered Engineer's design and specification. Foil-faced PIR insulation is factory fitted to the underside of the floor joists with treated timber cross battens; with all joints in insulation taped with foil tape. A metal mesh is fitted at the soffit for protection of the insulation from damage. The PFC edge beam is filled with stone mineral wool packing.

The PIR insulation is provided at ground floor to meet the requirement of TGDs[11][12] to Part L of the Building Regulations including the avoidance of thermal bridging. Stone mineral wool can also be provided between the LGS joists to reduce the U-value where required for compliance with TGDs to Part L and/or project-specific requirements. An airtight vapour permeable membrane layer (AVPM) is fitted below the floor deck and sealed to the wall AVPM. All ground floor steel is kept within a warm environment above a ventilated subfloor cavity.

The ground floor structure is supported on hot-dip galvanised support stubs. The connection between the ground floor and the rising wall/foundation is achieved using galvanised anchor bolts, in accordance with the Vision Built Structural Engineer's specification. A DPC/DPM layer or, where applicable, a radon membrane is provided between the support stub and plinth connection. The DPC/DPM membrane shall be adequately repaired where it is punctured by anchor bolts connecting the modular units to the rising wall/foundations. All steelwork outside of the insulated plane is galvanised as per Section 2.4.2.

Vision Built 3D-Volumetric Building System provides four options for the deck of the ground floor of the lowest module (Ground floor module):

1. 22mm OSB3.
2. 28mm Gypsum fibre board with levelling compound.
3. 22mm Cement-bonded particle Board.
4. Composite concrete Lewis deck of reinforced concrete screed on low profile metal deck.

A minimum 150mm clear void between the underside of the ground floor construction and the oversite is required. The sub-floor void is cross ventilated using periscopic vents built within the external walls, which are linked to 'air bricks' or similar in the façade. The size and number of periscope vents required to ventilate the subfloor void are determined on a project-specific basis by the Building Owner/Client-appointed design team and in line with the relevant national standards and regulations.

2.1.3 Loadbearing Walls

The walls are manufactured from cold or hot rolled structural steel (CR/HR) elements -square hollow section posts (SHS), rectangular hollow sections (RHS) and perimeter PFC beams and LGS infill panels and floor sub-assemblies. The primary load-bearing elements are SHS/PFC sections which are located at module corners, and intermittently along the length of the module as required. Stacked and adjacent modules are connected by means of bespoke intermodular connections to Vision Built Chartered Engineer's project-specific design. The LGS infill studs typically do not transfer any vertical loads, however, they are utilised to transfer lateral forces on to the primary structure of the modules. The infill panels are formed using 89x45mm LGS C-stud sections at approximately 400-600mm centres. LGS sections are also provided to trim window and door openings where required. HRS bracing is provided in walls as specified by the Vision Built Chartered Structural Engineer. Typically, all perimeter walls within a module are load-bearing walls.

Mild steel sections used in the module chassis are either welded together directly or welded to angle or flange plates to form bolted

connections. Modules are connected at site using either bolted or welded fin plate or flange plate connections as per the structural design. Any SHS/RHS structural members used as part of the Vision Built Building System shall be fabricated, welded (as applicable) and certified in accordance with I.S. EN 1090-1[22] and in accordance with execution class EXC2.

The LGS stud wall panel systems are filled with stone mineral wool between the studs to meet the fire resistance requirements and for additional thermal insulation and acoustic properties, refer to Table 3 below for fire performance specification. Glass wool may be used between studs for thermal and/or acoustic requirements where the wall is not required to have a fire resistance performance. The stud wall panels are boarded with the required thickness and grade of board as per Table 3 of this Certificate, depending on their location within the module and the building, to meet fire, acoustic, thermal and/or weathering requirements.

2.1.4 Non-Load-Bearing Walls

Non-load bearing stud wall panels are made from cold-formed LGS sections. Non-load bearing walls shall be adequately fixed to modules using fixings and a deflection head design if required as per the Vision Built Chartered Structural Engineer's specification. All walls shall be designed to resist lateral loads and to provide for required sound and/or fire resistance, where required for compliance with Building Regulations. Non-loadbearing partitions, including proprietary partition systems, may be used for non-loadbearing non-fire rated partitions, where the partition system has been approved for use by the Vision Built Chartered Structural Engineer and is constructed strictly in accordance with the partition manufacturer's instructions.

2.1.5 External Walls

External walls in the context of this Certificate refer to an outer wall of a building (which is not a separating wall), taken from the innermost surface to the outermost external surface, including all building components integral to the construction of the wall. External walls form part of the three-dimensional unit of the Vision Built 3D-Volumetric Building System. The external wall is constructed similarly to the load-bearing wall described in Section 2.1.3.

The following description applies to elements common to all external walls, regardless of cladding options: The stud wall panels are filled with stone mineral wool between the studs for acoustic, thermal, and fire performance. The wall panels are clad internally with the required thickness and grade of board, as per Table 3 to achieve the appropriate fire rating required for the building. The stud wall panels are clad externally with a gypsum-based external sheathing board and an airtight vapour permeable membrane layer (AVPM).

The Building Owner/Client must ensure the durability for the selected external cladding system is suitable for the building use, height, site-specific location and exposure.

2.1.5.1 External Cladding: Masonry

Where an external masonry leaf is to be used with the system, stone mineral wool or foil-faced PIR is fitted externally to the sheathing board, as per the wall build-up described in Section 2.1.5. The thickness and type of insulation is project-specific to achieve required compliance with TGDs[11][12] to Part L and Part B of the Building regulations.

Traditional brick or block masonry may form the external leaf of the Vision Built 3D-Volumetric Building System where the masonry units contain a mass or volume fraction of <1% of homogeneously distributed organic materials as per I.S. EN 771-3[26] with design and construction to I.S. EN 1996-1-1[23] Eurocode 6 *(including Irish National Annex)* and S.R. 325[24] respectively. The masonry outer leaf is tied to the Vision Built Volumetric Building System with a stainless-steel slot and channel cavity wall tie system in accordance with I.S. EN 845-1[25].

The wall tie system comprises two parts; the channel, which is secured back to the LGS studs, and the tie which can move in the channel. The tie is therefore intended to be used in masonry to studded applications, with a design cavity width in accordance with I.S. EN 845-1[25]. The cavity width is defined as the distance between the outer surface of the rigid board insulation and the inner surface of the masonry leaf. The channel incorporates may be factory or site fitted through the insulation with the required depth of stainless-steel Tec screws directly into the flange of the studs. The tie channels are fitted to the steel studs at a frequency which will satisfy the requirements for wall tie spacing as outlined in I.S. EN 1996-1-1[23] Eurocode 6. Wall ties are available as standard flat ties and are also available with a twist for installation over window and door openings.

The wall ties have been assessed and meet the performance requirements given I.S. EN 845-1[25] for a Type 6 wall tie and designed in accordance with I.S. EN 1996-1-1[23]. Where masonry cladding is being used over 4 storeys (12m) in height, a Type 1 wall tie in accordance with I.S. EN 845-1[25] shall be used. The wall tie and channel are made from minimum Grade 304 austenitic stainless steel.

Vision Built Structures Limited Chartered Structural Engineer determines the design and specification for stainless steel masonry support

brackets on a project-specific basis. Weep holes, thermal breaks, and DPC shall be installed at bracket locations. Vision Built Chartered Structural Engineer shall provide specification for movement joints, if required, on a project-specific basis. Design and spacing of movement joint shall be in accordance with I.S. EN 1996-2[27].

Precast concrete or aluminium window sills with DPC are installed in accordance with the Certificate holder's instructions. The sills shall have stop ends, be designed to prevent water ingress, and incorporate drip details to shed water clear of the system.

Proprietary cavity barriers/fire stops are installed in accordance with the Certificate holder's instructions as defined in Section 2.1.13 of this Certificate, at locations defined in the project-specific design and in accordance with the manufacturer's instructions.

The cavity in the external wall must be maintained at a minimum of 40mm and kept clear of construction debris. Masonry claddings must have adequate weep holes along their bases and over openings to allow moisture to exit the cavity. Stepped DPC/DPM shall be installed at ground floor level. Refer to Figure 2 for typical detail.

2.1.5.2 External Cladding: Rainscreen

The Vision Built 3D-Volumetric Building System external wall build up as described above in Section 2.1.5 may be clad externally in the factory or on site with an approved rainscreen cladding.

The Vision Built 3D-Volumetric Building System external wall build up as described above in Section 2.1.5 may be fitted in the factory with cladding brackets and a dual-density stone mineral wool with a rainscreen cladding applied on site. The cladding support brackets are to be designed, specified, detailed, and approved for use with the rainscreen cladding and site-specific requirements by the Vision Built Chartered Structural Engineer.

The drained and ventilated cavity in the external wall must be maintained at a minimum of 40mm where a masonry or an open-jointed rainscreen cladding is used. The cavity stone mineral wool insulation shall be suitable for use in a drained cavity with a rainscreen external cladding and the cavity kept clear of construction debris. The rainscreen cladding shall be detailed and installed in accordance with the rainscreen manufacturer's recommended details.

The Vision Built 3D-Volumetric Building System external wall build up as described above in Section 2.1.5 may be clad externally in the factory or on site with an insulated exterior sandwich panel as a rainscreen. Where an insulated metal-skin sandwich panel is to be used as an external rainscreen with the system, foil-faced PIR is to be fitted externally to the sheathing board, as per the wall build-up described in Section 2.1.5. The thickness of insulation and installation height is project-specific to achieve required compliance with TGDs[11][12] to Part L and Part B of the Building regulations, respectively. A 20mm minimum drained and ventilated cavity is provided between the impermeable external sandwich panel and the sheathing insulation, as per project specific design. The sandwich panel detailing and installation are in accordance with the panel manufacturer's recommended details.

The system has been assessed for use with a specific fibre cement panel rainscreen cladding system to I.S. EN 12467[28] with Euroclass A2-s1, d0 and a specific high-pressure laminate to I.S. EN 438-6[29], Type EDF with Euroclass B-s2, d0. The system has also been assessed for use with a specific metal skin, insulated exterior sandwich panel with a 45mm polyisocyanurate core to I.S. EN 14509[30] with an interior and exterior reaction to fire of B-s1,d0. Other rainscreen cladding systems may be suitable for use with the 3D-Volumetric building system but have not been considered in the assessment of this certification. Details of the rainscreen claddings included in this assessment are available from Vision Built Structures Limited.

Open-state cavity barriers/fire stops are installed horizontally, while closed-state barriers are used in vertical orientation; Installation shall be in accordance with both the Certificate holder's instructions as defined in Section 2.1.13 of this Certificate and cavity barrier manufacturer instructions. Cavity barriers must be determined by test data as suitable for use with the substrates and the approved cladding system. All cavity barriers and their positioning are to be in accordance with project specific design, Section 3.6 of TGDs[2][3] to Part B of the Building Regulations and the project's Fire Safety Design Certificate (FSDC), where applicable.

2.1.5.3 External Cladding: Other

The system may also be designed to incorporate NSAI Agrément approved cladding systems where fitness for use with this LGS / 3D-Volumetric Modular structure has been determined.

Other cladding systems may be suitable where fitness for use with LGS structures has been determined through the recognised standardisation procedures referred to in paragraphs (a), (b) or (c) of Requirement D3 of the Building Regulations or those in Section 1.1 of TGD D[5]. However, written approval is required from the appointed Vision Built Chartered Structural Engineers to confirm compatibility of the use of such cladding systems with the Vision

Built 3D-Volumetric Building system, as certified. Where such cladding systems are used, it is important that the maximum storey height in their NSAI Agrément or other certification is complied with. The maximum building height shall not exceed 20m. The external wall must contain a drained cavity at a minimum of 40mm; however, this can be reduced to 20mm where the external cladding is impervious to moisture vapour and has sealed joints. The construction at the warm side of the cavity must be breathable. Refer to Section 2.1.10 for further details on roof cladding.

2.1.6 Internal Walls

Internal walls within the modules vary in design, depending on the project-specific design of the overall building and on the service requirements that each wall is required to meet. Therefore, designs for load-bearing walls, non-load bearing walls and walls designed for lateral wind load resistance exist in the system.

Non-load bearing internal walls are those which serve no structural function during the service life of the building. The non-load bearing partitions are generally fitted within modules to divide the internal area of a particular module. However, these walls can also be required to serve a structural purpose during the transportation, lifting and installation of the modules. Non-load bearing walls may be required to provide fire resistance to comply with the fire strategy for the building.

Where an internal wall is loadbearing, it may be fully constructed of SHS/RHS, or it may be comprised of corner posts with infill LGS non-load bearing studs and plasterboard for finishing. All internal load bearing panels shall be sufficiently supported directly under the panels. Plasterboard specifications on the steel panels shall be in accordance with Table 3 of this certificate, which shows the plasterboard fire resistance requirements for wall, floor and ceiling elements with a fire resistance performance requirement. In areas prone to high levels of humidity, moisture resistant plasterboard shall be used.

2.1.7 Separating & Compartment Walls

2.1.7.1 Twin-frame Separating and Compartment Walls

A separating / compartment stud wall build up is typically achieved with two adjacent modules resulting in a twin wall. The full compartment wall build up is constructed from the following:

- Plasterboard, in accordance with this Certificate (refer to Table 3)
- HRS/CRS primary steelwork and LGS infill from module 1 with stone mineral wool insulation between the steelwork (forming part of volumetric modular unit 1 by Vision Built)
- Gypsum-based sheathing board (refer to Table 3)
- 50mm cavity
- Gypsum-based sheathing board (refer to Table 3)
- HRS/CRS primary steelwork and LGS infill from module 2 with stone mineral wool insulation between the steelwork (forming part of volumetric modular unit 2 by Vision Built)
- Plasterboard, in accordance with this Certificate (refer to Table 3)

Refer to

Figure 8 for a typical compartment/ separating wall detail.

The plasterboard finish is provided for acoustic and fire properties, as per Table 3. The space between LGS studs and HRS steelwork is filled with stone mineral wool insulation from ground floor to the underside of the roof structure to provide the required fire and acoustic properties. Where a compartment wall has two separate leaves, a minimum of 50mm clear distance shall be maintained throughout the wall cavity.

Where a twin separating/compartment wall abuts an external wall, compressed stone mineral wool insulation within the cavity of the twin separating wall extends through the inner leaf of the external wall and abuts the external leaf of the system and to form the fire stop in the wall. This detail seals air gaps and minimises flanking sound transmission. Refer to

Figure 8 for the external wall to compartment/separating wall detail.

At the junction of the ground floor and the compartment/separating wall, a cavity barrier is provided under the floor perimeter PFC and compressed stone mineral wool in the cavity extends to the substructure to minimize flanking and direct sound transmission and provide protection against the spread of fire. A DPC and DPM/Radon membrane is fitted between the cavity barrier/stone mineral wool and the substructure to prevent any rising damp. Refer to Figure 12 for a typical drawing detail.

At the junction of a separating/ compartment wall with a separating/compartment floor, the floor and ceiling perimeter beams are packed with stone mineral wool and the cavity-side gypsum-based sheathing board extends through the junction with compressed stone mineral wool in the cavity from below ceiling level of the lower module to above finished floor level of the upper module to minimize flanking and direct sound transmission and provide protection against the spread of fire.

The head of the separating/compartment wall must also be fire stopped and the cavity closed as specified on the Vision Built Structures Limited drawing detail and in accordance with TGDs[2][3] to Part B of the Building Regulations. A typical detail of the interface between a twin separating wall and a flat roof is shown in Figure 7.

2.1.7.2 Single Frame Compartment Wall

A compartment wall within the Vision Built 3D-Volumetric Building System may be constructed as a single frame wall and shall be designed and specified to meet the acoustic, fire and structural requirements of the Building Regulations.

This compartment wall must not be used where a wall is common to two or more buildings (separating wall) or where a compartment wall is used to separate dwellings from each other within a building.

2.1.7.3 Services in Compartment Walls

Services passing through compartment walls should be kept to a minimum and avoided where possible. Services can pass through a compartment wall when they are appropriately protected with reference to Section 3 of TGDs[2][3] to Part B of the Building Regulations for all purpose groups to which this Certificate applies. A service void may be created on the un-breached linings of the fire-resistant compartment and separating walls to allow for services.

Services shall not be placed in the cavity or penetrate the wall linings of separating walls. Where services are required, an additional service cavity shall be provided with timber battens or metal top hat sections and plasterboard, so that the integrity of the fire lining is maintained. The integrity of the linings of compartment walls should not be breached to allow for the installation of services, except where necessary to allow services pass through these compartment walls . All battens used with the Vision Built Volumetric Building System are treated in accordance with BS 8417[31]. The design must comply with the requirements of Section 3 of TGDs[2][3] to Part B of the Building Regulations for all purpose groups to which this Certificate applies.

Where services are required to penetrate a compartment wall, all such penetrations shall be kept to a minimum and shall be fire stopped. Where services (e.g. light switches and sockets) are placed on a compartment wall, a service cavity shall be provided so that the integrity of the fire lining is maintained. Where a compartment wall has two separate leaves, a minimum of 50mm clear distance shall be maintained throughout the wall cavity.

Service penetrations in external walls shall be suitably sealed for moisture exclusion, thermal, sound, and fire performance, as appropriate

2.1.8 Separating & Compartment Floor

The Vision Built 3D-Volumetric Building system compartment floor is designed to provide 60-minute fire resistance from the underside. The compartment floor can provide a non-combustible build up for use with residential care facilities and all buildings where the height of the top storey is 11m or more by using a floor deck option with a reaction-to-fire classification of Class A2-s3, D2 or better. When creating separating floors, the ceiling of the lower module and the floor of the upper module are combined when determining the performance of the floor. The following is the structure/configuration of this floor:

<u>Floor of upper module(top to bottom):</u>

- 5mm leveling compound
- Floor deck options:
  - 18mm OSB3
  - 28mm Gypsum fibre board (RtF: A1)
  - 22mmCement-bonded particle Board (A2fl-s1)
  - Composite concrete Lewis deck of 60mm concrete screed on low profile metal deck
- 150-300mm deep LGS C joist fixed into module floor perimeter PFC section
- Optional stone mineral or glass wool insulation between floor joists held in place with metal furring channels at soffit for acoustic performance.

Cavity between ceiling and floor sub-assemblies, as per Table 3. The cavity between ceiling and floor sub-assemblies is fire stopped as required for compartmentation and compliance with TGDs[2][3] to Part B of the Building Regulations.

<u>Ceiling of lower module (top to bottom):</u>

- 0.7mm gauge trapezoidal roof sheet/ 12mm Cement particle board, as per Table 3
- 150-300mm deep LGS C joist fixed into module ceiling perimeter PFC section
- Stone mineral wool insulation between floor joists held in place with metal furring channels at soffit, as per Table 3
- 2no. layers of 12.5 or 15mm Type F plasterboard, as per Table 3 of this certificate

An additional layer of resilient material is added to the top of the composite Lewis deck where required to meet the requirements outlined in Section 4.4 of TGD[6] to Part E of the Building Regulations (see Section 4.4.2.1 of TGD[6] to Part E for definition of resilient material).

2.1.8.1 Services in Compartment Floors

The mechanical, electrical and plumbing (MEP) services shall not be installed within the compartment floor build up, as described in

Section 2.1.8. Horizontal distribution of services may be accommodated within a service cavity created external to the un-breached linings of the fire-resistant compartment floor on the underside of the ceiling below. The integrity of the linings of separating floors should not be breached to allow for the installation of MEP services, except where necessary to allow services pass through these compartment walls or floors, in accordance with Section 3.5.7 of TGD B, Vol. 1[2]. All electrical installations shall be accommodated by creating a separate service void under the compartment floor.

Vertically distributed services, such as waste pipes, ventilation ducts and electrical cabling may pass through compartment floors. Service penetrations through a compartment floor need to be adequately protected in fire resistant risers or with fire-stopping so that the fire resistance is not impaired in accordance with TGDs[2][3] to Part B of the Building Regulations and section 2.1.11 below.

All services are installed with reference to Section 3.5.7 and 3.4 of TGD B[2] Volume 1 for all purpose groups to which this certificate applies. Penetrations through compartment floors should be minimised.

Service penetrations in ground floors shall be suitably sealed for moisture exclusion, thermal, sound, and fire performance, as appropriate.

2.1.9 Intermediate Floor

An intermediate floor may be constructed from the compartment floor build-ups described in Section 2.1.8 above. The Vision Built 3D-Volumetric Building System also provides an intermediate floor/ceiling sub-assembly which provides 30-minute fire resistance from the underside. This option is used with a floorless module above. The intermediate floor is constructed of LGS floor joists with OSB3 (Oriented Strand Board) decking at the top of the lower module. Fire protection is provided by plasterboard to the underside of the lower module ceiling in accordance with Table 3.

Typical system intermediate floor consists of:

- 5mm leveling compound
- 18mm OSB3 boarding
- 300mm deep LGS C joist fixed into module floor perimeter PFC section
- 100mm stone mineral wool insulation between floor joists, as per Table 3
- 15mm Type F plasterboard ceiling, as per Table 3of this certificate

A service zone may be achieved below the ceiling joists of the lower module where a service cavity is provided in addition to the above described build up. The plasterboard lining to the ceiling sub-assembly above must remain un-breached.

2.1.10 Roof Structure

Roof trusses may be either a traditional timber prefabricated roof truss made from timber or prefabricated LGS proof trusses or a modular LGS flat roof structure manufactured offsite by Vision Built Structures Limited. A modular steel roof structure may be constructed similarly to intermediate floor or as described in Section 2.1.9.

The System has been assessed only with traditional roofing finishes and NSAI Agrément certified flat roofing finishes. Where a flat roof membrane system is used it may be factory applied. Detailing of such membrane must comply with the manufacturers recommended detailing and their Agrément certificate. A parapet may be provided on the roof by installing LGS framed walls to the top module roof PFC (parallel flanged channels). For taller parapets, where the Vision Built Structural Engineer deems them necessary, the parapet structure may be formed with SHS at designated centres with an infill LGS framed wall between them.

The roofing solution chosen for a particular building is both Building Owner/Client and project-specific and shall be assessed and signed off by Vision Built's Chartered Structural Engineer on a project-by-project basis.

Other roofing systems whose fitness for use with the LGS 3D-Volumetric modular building system that has been determined through the recognised standardisation procedures referred to in paragraphs (a), (b) or (c) of Requirement D3 of the Building Regulations or those in Section 1.1 of TGD D[5], may be suitable for use with the Vision Built 3D-Volumetric building system but have not been considered as part of this certification. Additional loads from roof-mounted elements such as PV arrays or roof constructions such as green roofs are outside the scope of this certification and must be designed on a project-specific basis.

Refer to TGDs[2][3] to Part B of the Building regulations on roof finish over compartment/separating wall. B_{ROOF}(t4) roof covering and non-combustible insulation shall be provided extending 1.5m to each side of the compartment/separating wall as per TGDs[2][3] to Part B of the Building Regulations.

2.1.11 Internal Linings and Finishes

Surface linings of walls and ceilings must comply with Section 2 of Technical Guidance Documents[2][3] to Part B. The plasterboard slabs used on the internal wall finishes must meet or exceed Class B-s3,d2 rating in accordance with I.S. EN 13501-1[16].

Linings to walls and ceilings are of plasterboard of Type F, as specified in Table 3, manufactured to

I.S. EN 520[32]. They are attached by means of self-drill/self-tap screws into steel members. In areas prone to high levels of humidity, moisture resistant plasterboard shall be used. Joints in plasterboard may be taped and filled in accordance with the plasterboard manufacturer's instructions. Alternatively skim coat plaster may be applied.

Reaction to fire classification of surface linings of walls and ceilings shall meet the fire classification as per TGDs to Part B of the Building Regulations.

Any wall mounted fitting to the wall other than lightweight items, e.g. framed pictures, shall be fixed into a vertical stud behind plasterboard using appropriately sized proprietary fixings. The fixings shall be appropriate for fixing to 1-2.5mm gauge LGS. To accommodate larger wall mounted fittings such as kitchen units, grounds may be included in the LGS frame design and factory installed between LGS studs.

Internal finishes are outside of the scope of this Certificate.

2.1.12 Compartment Junctions

Compartment junctions shall be designed in accordance with Section 3 of the TGDs[2][3] to Part B of the Building Regulations.

Where a compartment wall or compartment floor meets another compartment wall or compartment floor, or an external wall, the junction shall maintain the fire resistance of the compartmentation.

Where a compartment wall or floor meets an external wall, the compartmentation shall be maintained to the inside surface of the outermost element, including external rendering and cladding systems.

2.1.13 Cavity Barriers and Fire stops

If an element is intended to provide fire separation (i.e. it has a requirement for fire resistance in terms of insulation and integrity), then every joint or opening to allow services to pass through the element shall be adequately protected by sealing of fire-stopping so that the fire resistance of the element is not impaired.

Cavity barriers and fire stopping shall be in accordance with sections 3.6 and 3.7 of TGD B Volume 1[2], and Section 3.6 and 3.7 of TGD B Volume 2[3] of the Building Regulations. The fixing of the fire stopping and cavity barriers shall be carried out as per manufacturer's specification.

To meet the requirements of TGDs[2][3] to Part B of the Building Regulations, the correct specification and placement of cavity barriers and fire stops shall be detailed and shown on a schedule for the project. Typically, cavity barriers and fire stops shall be provided as follows:

- At the top of an external cavity wall and at the junction of any such wall with a separating wall.
- At the junction between an external cavity wall and every compartment floor and compartment wall.
- At the junction between an internal cavity wall and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier.
- At the junction between any internal cavity compartment wall or cavity compartment floor and any other internal cavity compartment wall or cavity compartment floor.
- At top of separating/compartment wall and roof junction.
- In a protected escape route, above or below any fire-resisting construction which is not carried full storey height, or (in the case of a top storey) to the underside of the roof covering.
- Cavity barriers are required around all openings in external walls (with cavity) such as doors, windows, vents, extractor fans, meter cupboards, services, etc.
- At openings and service penetrations in fire resisting construction.

For special provision for cavity barriers for Purpose groups 2(a), 2(b), 3, 4(a), 5(a) and 5(b) refer to TGD[2] to Part B of the Building Regulations, Volume 1.

Figure 8, Figure 9, Figure 11, Figure 12, Figure 13, Figure 15, Figure 17 and Figure 18 show typical details of the proper installation of cavity barriers and fire stops in the Vision Built 3D-Volumetric Building System. Proprietary open-state cavity barriers/fire stops are installed horizontally and closed-state barriers are used in vertical orientation in accordance with the Certificate holder's instructions and with the manufacturer's instructions.

The Vision Built Site Installation Manager will inspect all cavity barriers and fire stops prior to the closing up of the cavities and ceilings and this is recorded in the site inspection application. Where Vision Built Structures Limited employ a Specialist for cavity barrier and fire stopping installation, then all fire stopping must be installed correctly before Vision Built Structures Limited will issue the final certificate(s) for the building.

2.1.14 Stairs and Lifts

Stair core enclosures may be formed with fire-rated stud wall construction. Lift shafts are generally formed as part of a module which may also include the stairs.

Walls forming a lift shaft are constructed as fire rated if required by the project-specific Fire Safety Design Certificate (FSDC) and in line with the twin/double fire rated loadbearing wall principles. Loads from the lift are transferred to the pit structure at the base of the shaft, with lateral restraint provided to the lift car frame through a secondary steel structure connected to the primary structure of the module to provide lateral restraint to the guide rails for the lift car, as required. Walls are lined with either plasterboard or cement particle boards to meet the required fire performance.

Lift shafts can also be constructed as a pre-cast concrete element. These shafts may be designed to support all loading from the lift equipment and support lateral loads from the main structure as per the Vision Built Chartered structural engineer's project-specific design.

The planning, layout, design and specification of separating construction around firefighting shafts is the responsibility of the Building Owner/Client's appointed design engineer and shall be in accordance with Section 5.5 of TGD Volume 1[2] to Part B of the Building Regulations.

2.1.15 Services

Services are outside the scope of this Certificate. Electrical installation shall be designed, installed, inspected and tested in accordance with I.S. 10101[33]. Heating and plumbing services shall be designed and installed by competent professional engineers in accordance with TGDs to Part J[10] and Part H[9] of the Building Regulations.

Refer to Section 2.1.7 of this Certificate for information on services penetrations through compartment floors and Section 2.1.8 through compartment walls. No openings are permitted in the separating wall construction.

Care shall be taken to avoid dissimilar metals coming into contact to reduce the risk of galvanic corrosion. Local earth connection to the steel frame shall be avoided. The structural frame shall be earthed in accordance with the current regulations I.S. 10101[33].

2.1.16 Ancillary elements

Non-exhaustive list of ancillary elements is provided below. All ancillary elements are outside the scope of this Certificate.

- Foundation/substructure
- Internal finishes (ceiling/wall/floor final finishes which do not contribute to Building Regulations compliance)
- Mechanical and Electrical installations and services
- Windows and doors
- Fittings, fixtures and furniture

2.2 GENERAL BUILDING STRUCTURE

2.2.1 Foundations

Foundations are outside the scope of this Certificate. The construction of the foundations is the responsibility of the Main Contractor and shall be constructed in accordance with the Building Owner/Client's site-specific Engineering specification and design. Structure supporting the Vision Built 3D-Volumetric Building System shall be checked by the Building Owner/Client's appointed Engineer for structural load criteria specified by Vision Built Chartered Structural Engineer. Tolerances for the system installation on foundations are defined by Vision Built's Chartered Structural Engineer.

Based on finalised layouts, the Vision Built Chartered Structural Engineer performs a load take down calculation and provides the Building Owner/Client's appointed structural engineer with accurate line and/or point loads which they account for in their foundation design.

A site investigation shall be carried out by an appropriately qualified and experienced engineer to determine the maximum bearing pressure the soil can carry. Once this is established a suitable foundation type shall be determined. A foundation tolerance of ±5mm in 10-meter lengths is specified in the Vision Built 3D-Volumetric Building System Installation Manual[74].

Note: The construction of the foundations is the responsibility of the main contractor and shall be constructed in accordance with the Building Owner/Client's engineering specifications and design and in accordance with required standards. Due to the low tolerances of the steel frame manufacture, the foundation must be constructed accurately, i.e. correct dimensions, square and level so that the module steel frame may be assembled and erected properly within the specified tolerances.

2.3 DESIGN AND MANUFACTURE

2.3.1 Design Process

The Vision Built 3D-Volumetric Building System shall be designed in accordance with I.S. EN 1993-1-1[34] by Vision Built Structures Limited's Chartered Structural Engineer.

Structural design is reviewed and checked by Vision Built's Chartered Structural Engineer independent of the original designer. All connections including intermodular connections shall be checked for project-specific loading.

Each module is analysed for key structural stages throughout the manufacture-to-installation process during the design process:

- Assembly in the factory
- Transport
- Lifting into place on-site
- Permanent State

2.3.2 Manufacture Process

The Vision Built 3D-Volumetric Building structure is manufactured in accordance with I.S. EN 1090-1[22], to minimum execution class EXC2. The manufacture is the responsibility of Vision Built Structures Limited.

The structural elements of the primary structural carcass of the Vision Built 3D-Volumetric Building System are composed of cold or hot rolled structural steel elements. The structural steel columns used in each module are typically cold rolled SHS sections (minimum 80x80x5mm) which are welded/bolted to the horizontal beam and floor PFC section. The perimeter header and floor beams are a minimum of 150x75mm PFC. Module floor and ceiling sub-assemblies are typically constructed using 150 to 300mm deep LGS C-sections, refer to Table 3. LGS infill panels are typically manufactured from 89x45mm C-sections. Stud gauge ranges from 1.0mm to 2.5mm. Table 1 provides typical sizes of steel sections used in the module structure.

The modules are manufactured off-site at the Vision Built manufacturing facility in a quality-controlled factory environment. The module assembly at the factory can include all internal finishes required for acoustic, fire and structural requirements, 1st and 2nd fix plumbing and electrical works, carpentry, tiling and painting. Some elements including cavity barriers and firestopping, external wall façade, and certain external and internal finishes must be installed on the construction site. The level of finishes that may be installed in the factory varies and is project dependant. Internal fixtures and finishes have not been assessed as part of the assessment and are therefore outside the scope of this Certificate.

The Vision Built 3D-Volumetric Building System can accommodate a wide range of custom module designs, sizes, and configurations. Module dimensions vary, typically ranging from 2.4m to 15m in length, 2.4m to 4.5m in width, and up to 4.5m in height. Several factors may influence the allowable sizes of a module. These factors include transportation, site accessibility, weight and preferred module dimensional limitations.

2.3.3 Plasterboard Installation

The proper application of plasterboard to the steel frame members (LGS, HRS, CRS) is critical for both fire and sound performance. Attention shall be given to proper and practical detailing on the part of the designer and a high standard of workmanship in installation on behalf of Vision Built Structures Limited. Plasterboard, in addition to all cavity barriers and fire stops on all structural walls and floors and separating walls, shall be fully checked on site and signed off in accordance with project-specific details by the appropriate personnel, as detailed in Section 2.6 of this certificate. All boarding that provides fire resistance must conform to the specification given in Table 3.

If alternative boarding is proposed, then the build-up of the element shall be verified by fire testing to relevant EN standard or by technical assessment by an Accredited Laboratory and a suitably qualified, competent professional in accordance with I.S. EN 15725[35] and I.S. CEN/TS 15117[36].

2.4 STRUCTURAL PRINCIPLES

2.4.1 Steel Frame Structure

The structural design basis of the Vision Built 3D-Volumetric Building System is a cold or hot rolled steel structure with LGS infill. The perimeter/intermediate columns and beams form the primary structural elements of the system. The LGS infill panels transfer lateral loads to the primary structure.

The vertical loading is transferred through the roof structure and floor units to wall elements and then to substructure/foundations. The horizontal loading is transferred through the wall elements down to substructure/foundation through shear elements.

The primary load bearing elements of the volumetric, modular system consist of mild steel SHS/RHS corner and intermediate columns, where required, fixed to top and bottom parallel flanged channels (PFC). LGS is then utilised as infill panels between the mild steel carcass as described in Section 2.1.3 of this certificate. Table 1 shows the typical section sizes used in the Vision Built 3D-Volumetric building system.

2.4.2 Protective Coatings

LGS Components: The LGS members are manufactured from galvanized coil steel to I.S. EN 10346[37] (min. yield stress 350 N/mm^2) with a minimum of 275g/m^2 zinc protection to I.S. EN 10143[43]. All cold-formed section properties are calculated using the core design thickness of steel (excluding coatings) in accordance with I.S. EN 1993-1-1+NA[34] and I.S. EN 1993-1-5+NA[38].

LGS components within the ground floor construction thermal envelope and moisture barrier layer are considered to be, typically, within a C2 corrosivity category in accordance with I.S. EN ISO 14713-1[40] and are manufactured from galvanized coil steel to I.S. EN 10346[37] (min.

yield stress 350 N/mm^2) with 275g/m^2 zinc protection to achieve a design life to first maintenance of 60 years in accordance with I.S. EN ISO 9223[41] and I.S. EN ISO 9224[42]. Zinc protection up to 600g/m^2 can be provided, as required to achieve the required design life, if the project-specific corrosion classification zone is deemed to exceed a C2 category. Other coatings may be suitable for use in high corrosivity categories but have not been assessed as part of this assessment.

Primary Steel Structure: A paint system in accordance with I.S. EN ISO 12944-5[39] is used on the hot or cold rolled primary structure elements. The paint system for the primary structure is designed to achieve high durability for a C2 corrosivity category according to I.S. EN ISO 14713-1[40] for all elements except the ground floor support stubs.

Structural steel elements below 150mm above ground level but within the ground floor construction (i.e. within the thermal envelope and moisture barrier layer and above the ventilated floor void) use a zinc-rich paint system (minimum 100µm). The paint system is in accordance with I.S. EN ISO 12944-5[39] and is designed to achieve the appropriate level of durability as per the conditions of I.S. EN ISO 14713-1[40]. In the Vision Built 3D-Volumetric Building System a C2 corrosivity category is typically considered for all elements above the ventilated floor void which are within the thermal envelope and moisture barrier layer, however, depending on site specific atmospheric conditions and location this category could be higher and the paint specification project-specific durability design.

The ground floor support stubs are structural steel elements that are positioned outside the 'warm frame' insulation envelope and/or the moisture barrier and are, therefore, characterised as being in a C3 corrosivity category according to I.S. EN ISO 12944-5[39] . The ground floor support stubs are hot dip galvanised to I.S. EN ISO 1461[44] and I.S. EN ISO 14713-2[45]. Minimum coating thickness (nominal dry film thickness)/ weight equal to 85g/m^2.

In addition to the steel members in the system being protected as described above, further protection against corrosion and therefore longer design life is given to the steel by providing the following:

- A minimum 150mm subfloor ventilated void is provided below ground floor of modules. Drainage provided to sub-floor void if required for site-specific hydrogeology and hydrology.
- The ground floor structure is fully wrapped with a combination of AVCLs and airtight vapour permeable membranes (AVPM).
- A DPC is provided at the ground floor support stub to foundation connection. Where the anchors bolts go through DPC, any puncture(s) shall be repaired on site. This may be provided by the radon barrier system where one is required. Where no Radon membrane system is installed, the galvanised stubs will be painted with bitumen paint or tops of the plinths will be treated with a liquid damp proofing system.
- Galvanised anchor bolts are used between the foundation and ground floor galvanised steel footing/plate
- Stepped DPC and weepholes are provided at ground floor level and at masonry support system locations.
- The external insulation keeps the steel in a "warm frame" environment, which in conjunction with an airtight vapour permeable membrane prevents the formation of condensation within the wall and ground floor elements.
- All steel outside the "warm frame" environment is suitably galvanised or made from stainless steel.
- All fasteners have been assessed for use with the system, do not pose a risk of bi-metallic corrosion, and meet the minimum design life requirements of the system

Where the protective coating on steelwork is damaged during the installation works, it shall be adequately repaired to meet the protective coatings requirements stated in this Section.

Note: Where the Vision Built 3D-Volumetric Steel Building System is to be used for buildings within 50km of the coast or industrial areas with processes that may lead to SO_2 rates exceeding 30µg/m^3 locally, the structural steel elements outside the 'warm frame' insulation envelope and/or the moisture barrier layer shall require engineer-designed, site-specific corrosion protection.

2.4.3 Fasteners and Connection Joints

All primary steel sections are fully welded all-round or connected through a bolted angle or flange plate. Any SHS/RHS structural members used as part of the Vision Built 3D-Volumetric Building System shall be fabricated in accordance with I.S. EN 1090-1[22] to achieve minimum Execution Class 2 (EXC 2). Weld records to be maintained in accordance with the I.S. EN 1090-1[22] certification requirements. There is no welding of joints within the LGS elements of the system. Where LGS elements connect to primary structural steel screw fasteners are used. Similarly screw fasteners are used for LGS-to-LGS connections.

Vision Built Structures Limited to provide a full specification of all fasteners, where they are to be used and how they are to be installed during the

assembly and construction of the system. Only system fasteners approved or supplied by Vision Built may be used with the system.

All fasteners used in the Vision Built 3D-Volumetric Building System are adequately protected against corrosion and made from a suitable metal to ensure the design life of the system is maintained. It is important to ensure that protective coatings on fasteners are not removed, i.e. to assist the fitting of a connection, as this would severely compromise the corrosion performance of the fastener. Vision Built Structures Limited specify corrosion protection of fasteners with consideration to the environment in which they are to be used, with additional coatings applied on site, where required.

Holding down connections are installed to provide adequate loading transfer to foundations. Galvanised anchor bolts are provided and designed by Vision Built Chartered Structural Engineer to I.S. EN 1992-4[46]. The installation is in accordance with the HSA: Code of Practice for the Design and Installation of Anchors[47] *Anchors in accordance with section 60 of the Safety, Health and Welfare at Work Act*[77] and is carried out by competent personnel in accordance with Vision Built 3D-Volumetric Building System Installation Manual[74].

2.4.4 Lateral load resistance

The composite action of the steel studs, bracing and horizontal diaphragm action of the floor and roof elements combine, as per the design, to provide the required stiffness and racking to meet the stability requirements of the building system.

The horizontal load transfer in the intermediate floor is provided by floor sub-assembly. Similarly, compartment floors rely on sub-assembly in conjunction with floor decking for additional load transfer. The horizontal load transfer in the wall elements is provided by LGS infill and bracing of the primary structural elements.

While the Vision Built 3D-Volumetric Building System shall be designed to provide overall structural stability to the system, structural stability can also be provided by means of a traditional reinforced concrete core and/or a separate braced structure using hot-rolled steel members located in the lifts and stair area or in the end gables. However, foundations and lateral stability systems such as concrete cores are outside of the scope of this certificate and responsibility for construction, tolerances and structural details of such a braced structure shall be clearly defined before construction begins. All structural criteria and load transfer to lateral stability system shall be determined by Vision Built's Chartered Structural Engineer and communicated to Building Owner/Client's appointed Structural Engineer.

2.4.5 Intermodular Connections

Connections between the modules are installed on site. Connections on site include the following:

- Holding down bolts to foundations/substructure
- Vertical connections between the modules
- Horizontal connections between modules

The intermodular connection provides lateral and vertical connection between the adjacent modules. Requirements for vertical and horizontal connections depends on consequence class in accordance with EN 1991-1-7[48]. The consequence class determination considers building type/occupancy and building height.

Holding down connections are installed (where necessary) to provide adequate loading transfer to foundations.

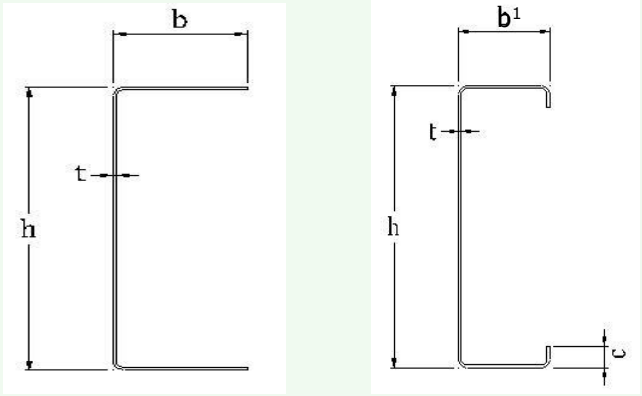
The type of fixing used to hold down the modules of the system will be dependent on what substrate the anchor is being fixed to. Typically, cast in reinforcement or chemical anchors are used. Anchors design and installation shall be in accordance with HSA: Code of Practice for the Design and Installation of Anchors[47].

Vertical connections between the modules are installed (where necessary) using a mild steel joint plate connection with specified bolt and plate washers as required for the project. Horizontal connections are provided (where necessary) are made through factory fitted connection plates which are bolted to adjacent module on installation on site. Where more robust horizontal and vertical connection between modules is required for higher consequence classes in accordance with I.S. EN 1991-1-7[48], a bespoke fin plate connection has been developed that provides an on-site connection plate installed between factory-fitted fin plates at module primary structural columns. All on-site connections such as intermodular connections are bolted.

All connections shall be designed by Vision Built Chartered Structural Engineer to I.S. EN 1992-4[44 and I.S. EN 1993-1-8[49] and installed by competent personnel in accordance with Vision Built Volumetric Building System Installation Manual[74]. The positions of the fixings are project-specific and are determined by the Vision Built Chartered Structural Engineer. The Vision Built Site Manager/Engineer inspects structural connections prior to closing up cavities and junctions and records evidence of inspection(s)

including photographs in the site inspection software application used.

Component Type		Grade of Steel	Typical Section Dimensions (mm)				
			Depth (h)	Width (b)	Width (b^1)	Lip I	Thickness[1] (t)
Wall Stud	LGS C Stud	S390 S450	89	52.5	45	10 –12	1.0-2.5
Wall Track/Noggin[2]	LGS C Stud	S390 S450	92	52.5	45	-	1.0-2.5
Floor/Ceiling Joist	LGS C Section	S390 S450	150 300	54.5	45-85	10 –15	1.5-2.8
Column	RHS/ SHS	S275 S355	80-160	80-160	-	-	5-12
Floor Perimeter Beam	PFC	S275 S355	150-300	75-90	-	-	variable
Roof Perimeter Beam	PFC	S275 S355	150-300	75-90	-	-	variable



[1] The range of thicknesses of cold-formed sections available is 1.0, 1.2, 1.5, 2.0, 2.5, and 2.8 mm
[2] Range of Depth (h) and Width (b) available to allow for a uniform cross-section of structural zone.
[3] These profiles are standard; alternative profiles are available on request, as all steel sizes are project-specific.

Table 1: Typical Steel Section Sizes

2.5 DELIVERY, STORAGE AND SITE HANDLING

2.5.1 Site Preparation

Site conditions shall be fully verified and deemed suitable prior to the commencement of any lifting activities on-site. All required information is to be provided in advance to both the installation team and the cranage company. Before the lift begins, the Lift Supervisor and crane operator will jointly review all on-site conditions to confirm that they meet the necessary safety requirements, including acceptable wind speeds and environmental factors such as snow or other adverse weather conditions. Lifting operations will proceed only when all parties determine that it is safe to do so.

Prior to the installation of modules, a DPC shall be installed in accordance with the layout drawing ensuring that a DPC is in place at the galvanised steel structure to foundation connection.

2.5.2 Delivery of Modules

Each module is shrink-wrapped in a plastic weather wrapping on completion. The wrapping includes a zipped access hatch for inspection during storage or on delivery. The wrapping also includes ventilation grilles to reduce the risk of condensation accumulation and conditions that would support mould growth during storage. The relative humidity is remotely monitored in modules while wrapped in storage and upon notification of levels exceeding the set humidity threshold, the Vision Built Structures Limited Quality Assurance team assesses the module condition and agrees remedial actions, if required.

The modules leave the factory as weather-proofed sealed units with a label that shows the module unique identifier/identification number, project, external dimensions of the module, factory and site lifting plan, and unit weight. A crane with adjustable modular spreader bars or a lifting frame lifts the modules into place directly from the delivery transport where possible; in some cases, the use of a temporary staging area will be required depending on site conditions and installation schedule. All lifting shall be carried out by competent personnel in accordance with the Vision Built 3D-Volumetric Installation Manual[74] and the site-specific safety statement along with the site-specific lifting plan.

Modules are transported on low-loader or flat-bed trailers to site, depending on module height. Lifting operation is carried out using a crane with adequate capacity to lift the modules. Lifting points are located, designed and certified by the Vision Built Chartered Structural Engineer, taking into account the unit weight, dimensions and size. Transport and lifting shall be carried out by competent personnel in accordance with the Vision Built 3D-Volumetric Building System Installation Manual[74] and the site-specific lift plan and safety statement. Special care must be taken to avoid any damage to the modular units during transport and lifting operations.

The module temporary weather protection membrane is inspected upon arrival on site to ensure there are no tears or damage to the membrane or module during transport. Any damage to the module found shall be reported to the Site Manager, and a determination shall be made as to whether it may be repaired on site or needs to be sent back to the factory. The plastic wrapping stays largely in place until the external module joints are ready to be completed between modules on site. Additional temporary covering may also be required depending on weather conditions and the module installation sequence.

In cases where modules are not lifted directly into their permanent position, all modules shall be stored on level ground on timber bearers, blocks or other approved supports to elevate the modules off the ground. The modules shall be stored with adequate space between them for natural ventilation and personnel circulation, and with the identification labels clearly visible.

2.5.3 Traceability

The Vision Built 3D-Volumetric Building System uses a specifically designed QR code system which ensures full traceability between design, production and site assembly is achieved. Each module is assigned a unique reference number in a BIM design model, and all drawing outputs include a QR code that links to the module design model and factory and site checklists. This QR code is scanned at each stage of the production, and a hold-point checklist is completed before progressing to the next stage of assembly. Each time the QR code is scanned, information is automatically updated on a traceability program designed by the company. All production and design information for each individual module may be accessed using this system if required. Site assembly drawings also use this QR code reference to ensure modules are delivered to site in the correct order and subsequently placed in the correct sequence.

2.5.4 Safe Handling

A site and project-specific risk assessment shall be created for every site in order to assess the risks involved with the handling and installation of the volumetric modular units.

Modules shall be lifted by crane using a lifting frame or spreader bar with vertical connections between the lifting frame or spreader bars and the module. Chains / slings shall be connected to each lifting point directly above the point. Module lifting type (bottom or top) and lifting points are designed on a module-specific basis by Vision Built's chartered structural engineer.

2.5.5 Typical Material List Supplied to Site

With each customised delivery to site, a comprehensive bill of materials is supplied. This bill of materials provides a detailed list of all components, including a fixing schedule, delivered to site to complete the installation of the Vision Built 3D-Volumetric Building System on site.

2.5.6 Main Contractor Responsibilities

The main contractor is responsible for the proper construction of the over-site, radon mitigation measures, incoming services and foundations and substructures within the tolerances specified by Vision Built. Once the foundations are within the tolerance range, installation of the Vision Built 3D-Volumetric Building System can commence. If the foundations are outside the specified tolerances when the site is surveyed the remedial works (grinding etc.) will be the responsibility of the Main Contractor.

The Main Contractor may be responsible for the construction of on-site facade claddings, roof claddings and the installation of fire stopping and cavity barriers where it is impractical for Vision Built to install prior to these claddings being applied. All other fire stopping, and cavity barriers are the responsibility of Vision Built Structures Limited. All design responsibilities are defined in a project-specific design responsibility matrix and on-site responsibilities are agreed prior to contract award / prior to entering into contract.

2.6 INSTALLATION

2.6.1 General

Installation is carried out in accordance with the requirements of this Certificate and all relevant codes of building practice, regulatory Health & Safety requirements and the manufacturer's instructions contained in the Vision Built 3D-Volumetric Building System Installation Manual[74], a copy of which shall be available on each site. The Vision Built 3D-Volumetric Building System Installation Manual[74] was reviewed during the NSAI assessment; the Certificate Holder shall be contacted for information on the latest Installation Manual[74]. Vision Built is responsible for site inspections and sign-off in accordance with Building Regulations. Site installation must only be carried out by an approved specialist sub-contractor under the supervision of Vision Built Structures Limited and in accordance with the Vision Built 3D-Volumetric Building System Installation Manual[74].

Installers are approved once they have undergone on-site training, understand the fundamental structural principles of the system, fire stopping requirements, tolerances, the importance of weathering, storage and handling of the modules and all other relevant information. Installers shall have installed modules under the guidance of a qualified installer and have a signed record of this training. All off-loading and installation shall be in accordance with the Vision Built Structures Limited's 3D-Volumetric method statement and installation procedures and the site-specific lifting plan and Project Execution Plan. Care shall be taken to avoid any damage to the modules and connection brackets during lifting, transportation and installation.

A Vision Built Chartered Structural Engineer or Vision Built nominated Consulting Chartered Structural Engineer must assess the adequacy of the design of the proposed superstructure of the building system in accordance with the Vision Built Inspection Plan and the Code of Practice for Inspecting and Certifying Buildings and Works[79].

All structural connections to the foundation shall be installed in accordance with the structural design details, independently checked by qualified members of the installation team and formally recorded on the Vision Built Structures Limited site quality control records.

Verticality	**Tolerance**
Plumb of wall-maximum deviation	±5mm in storey height (Approx. 2.5m)
	±10mm in overall height of wall (2 storey)
	±15mm in overall height of wall (2 storey)
Line	**Tolerance**
Straightness on plan	±5mm deviation in any length of wall up to 10m
	±10mm deviation in any length of wall over 10m

Table 2: Module Tolerances on-site

This Certificate does not contain a complete set of installation instructions but provides an overview of the procedures involved. For a full list of these instructions, refer to the Certificate Holder's 3D-Volumetric Installation Manual[74]. Should a conflict arise between this Certificate and the Certificate Holder's manuals, this Certificate shall take precedence.

2.6.2 Site Supervision

All Vision Built 3D-Volumetric Building System installation works are supervised by Vision Built Structures Limited. Vision Built employs a Site Manager for each project who works closely with the Main Contractor and ensures a project-specific roadmap for inspections is met. Where a Vision Built approved specialist subcontractor is used for installation of the system, they are subject to supervision by the Vision Built Site Manager.

Vision Built employs a full-time Site Manager who works closely with the installation supervisors, and the main contractor responsible for providing the substructure, ground and enabling works. The Building Owner/Client and their appointed Main Contractor is always responsible for ensuring the substructure is within the Engineer's specified tolerances before modules are installed on site. The substructure shall be signed-off by the main contractor before installation of modular units The Vision Built Site Manager is responsible for checking all substructure components are within the engineer's specified tolerances before modules are delivered to site. No modules are delivered to site or installed until the Vision Built Site Manager approves the substructure, substrate and incoming service connection points. Foundations shall be installed with the required waterproofing membranes or coatings and ground gas protection system as detailed in the project-specific drawings, by the main contractor.

Typically, the Vision Built Site Manager will agree a schedule of inspections with the installation contractor. The supervisor of the installation contractor is responsible for the quality and productivity of work carried out by the installation crew. The installation supervisor reports directly to the Vision Built Site Manager to ensure all work follows the requirements of the design drawings and the requirements of Vision Built Structures Limited's Structural certification for the building.

All connections between modules and to the substructure are visually inspected, photographed and recorded on the install quality control sheet for structural connections on the site inspections

app in use by Vision Built Structures Limited. The Site Manager also inspects fire stopping and cavity closing of all cavities in the assembled building and then records this information on the fire stopping checklists within the Vision Built check sheets which are recorded on the site inspections app. Any defects noted are recorded, photographed where possible and notified to the installation supervisor via the software app for traceability of remedial actions. The Site Manager will inspect and approve the remediation before work can proceed.

The Vision Built Site Manager and installation subcontractor are responsible for the quality of work carried out by the installation crew for the volumetric modular units and connections between modules. The Vision Built Site Manager ensures all work follows the requirements of the design drawings, specifications and project-specific roadmap for inspections. Vision Built is always responsible for reviewing of inspection records and final sign-off of volumetric modular units. Each project will have a specific site inspection plan, where required, to comply with Building Control (Amendment) Regulations (BCAR)[80] requirements. Vision Built Site-Installation manager will take responsibility for carrying out inspections in accordance with the site inspection plan and maintaining appropriate records.

The approved module installation contractors are subject to continuous supervision by the Vision Built Site Manager. The following checklist is provided to offer guidance to Building Owners/Client(s) who intend to carry out their own additional site supervision. The items listed, are of a general nature which are in addition to all other building requirements.

- All components delivered to site comply with the bill of materials.
- Components and modules are not damaged and are properly pre-marked for installation.
- The substructure is set out accurately and level within the tolerance specified by Vision Built before the modules are positioned.
- The Substructure's Designer has signed-off foundations/substructure for the loading as defined by the Vision Built Structural Engineer.
- The modules are not erected until any inaccuracies in the substructure have been corrected and approved by the Structural Engineer.
- Radon membrane and sumps/DPC/DPM are correctly installed by the Main Contractor prior to placing the modules.
- The DPC course is laid between steel and concrete at all ground floor to foundation connections.
- Modules are in line and plumb in accordance with the Vision Built site-specific design drawings, installation manual and this Certificate.
- Ground floor modules are connected to the substructure/foundations as per Vision Built Chartered Structural Engineer's design and specification.
- Horizontal and vertical connections are installed between the modules as per Vision Built's Chartered Structural Engineer's design and specification (intermodular connections). Infill stone mineral wool is installed at these locations to provide continuity of insulation in the external wall and separating wall build up.
- Deflection gap is filled with stone mineral wool at all floor junctions with external wall/roof/compartment wall as per Vision Built Engineer's design and specification.
- Insulation at the walls is free from damage after the installation.
- All horizontal and vertical joints are correctly completed on site, as per design details, including lapping of membranes, infill insulation, etc.
- Where traditional block/brick outer leaf is installed, the channels are not damaged and correctly spaced and positioned.
- Cavity barriers and fire stops are installed as specified and in accordance with manufacturer's instructions and Irish Building regulations and signed off by Vision Built/Main Contractor as specified and in accordance with the Building Regulations.
- All fixings used are supplied or approved by Vision Built to Vision Built's Chartered Structural Engineers specification.
- Where roof structure is installed on site, the connection between the roof and modules is in accordance with Vision Built site-specific design drawings and specification.
- All service penetrations are adequately finished as per design details and specification.
- Modules are adequately protected from weather before and during install.
- Grommets are installed, where necessary, in-service holes as per Vision Built drawings.
- Roof bracing installed where required.
- Modules frames are correctly electrically earthed at one point, and all earth returns are connected back to that point.
- Where galvanised steel sections are cut, or where any damage occurs to the steel frame, a coat of zinc rich paint or galvanised spray is applied to exposed surfaces.
- No modification i.e. cutting of the steelwork is allowed without prior written permission by a Vision Built Chartered Structural Engineer.
- Radon membrane/DPC/DPM are correctly installed by Main Contractor prior to placing the modules.

Note: This Certificate contains illustrations to explain the various elements of the Vision Built

Volumetric Building System – these illustrations are not intended to be used as construction drawings. Vision Built, in conjunction with the Design Team on a project, will produce a set of project-specific details on a project-by-project basis. All drawings shall be compliant with the relevant codes of practice and standards, along with Irish Building Regulations.

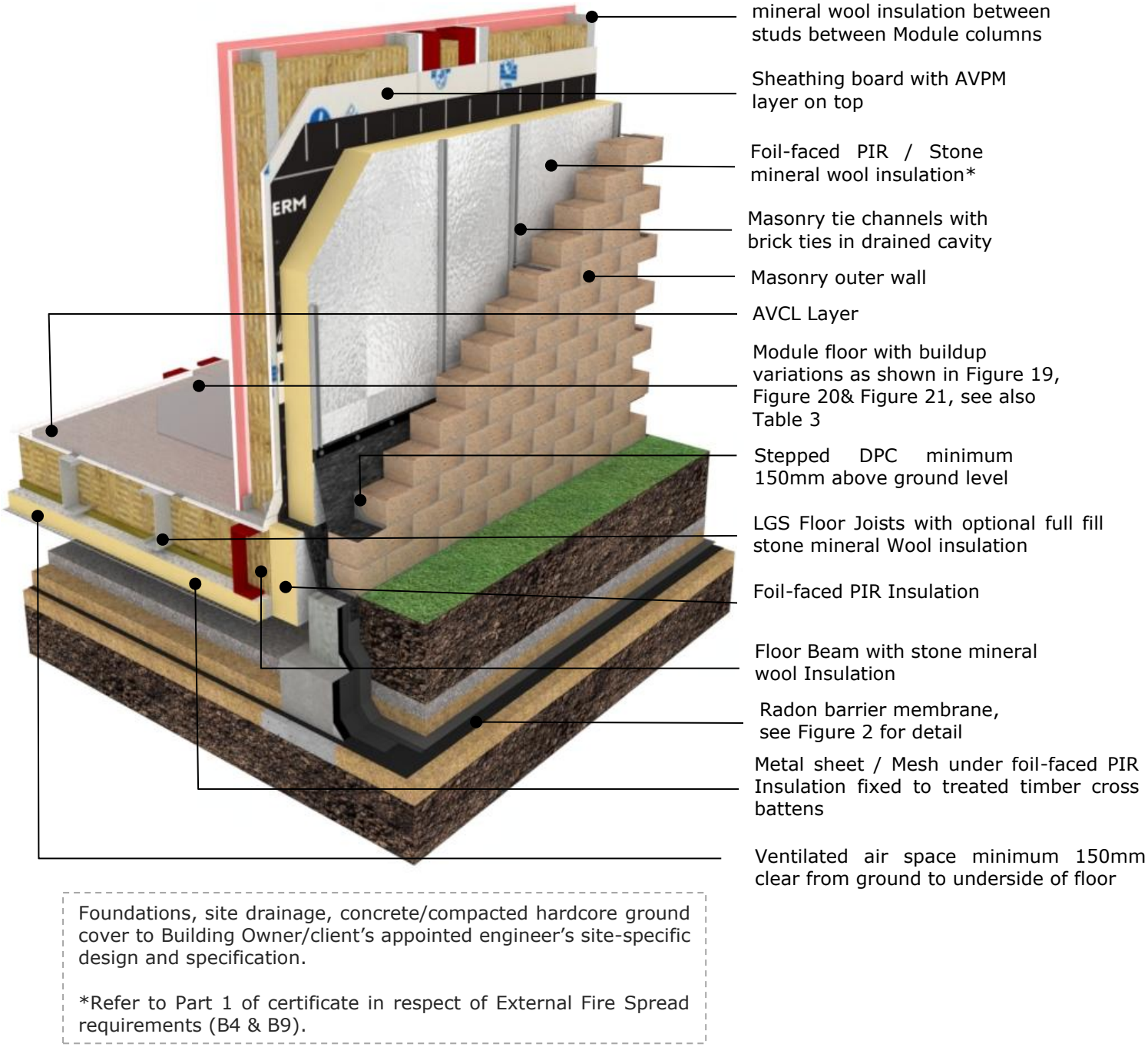


Figure 1: External Wall with Masonry Outer Leaf and Cavity to Ground Floor Detail

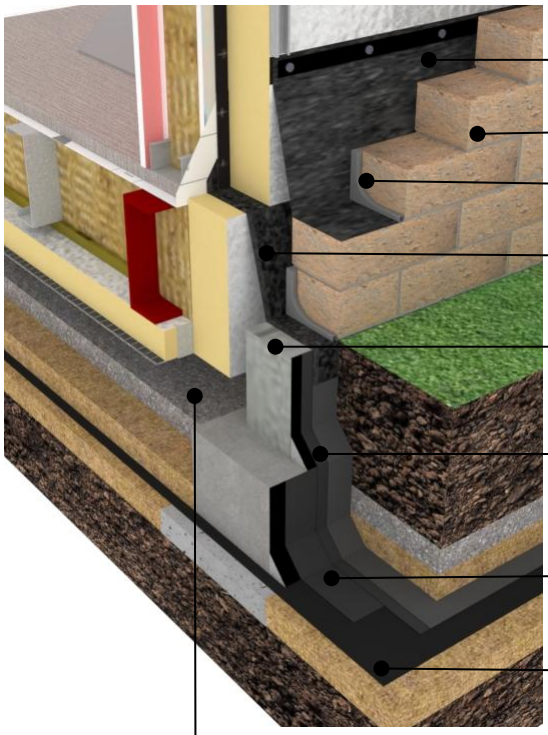


Figure 2: Detail at External masonry outer leaf and ground floor of module

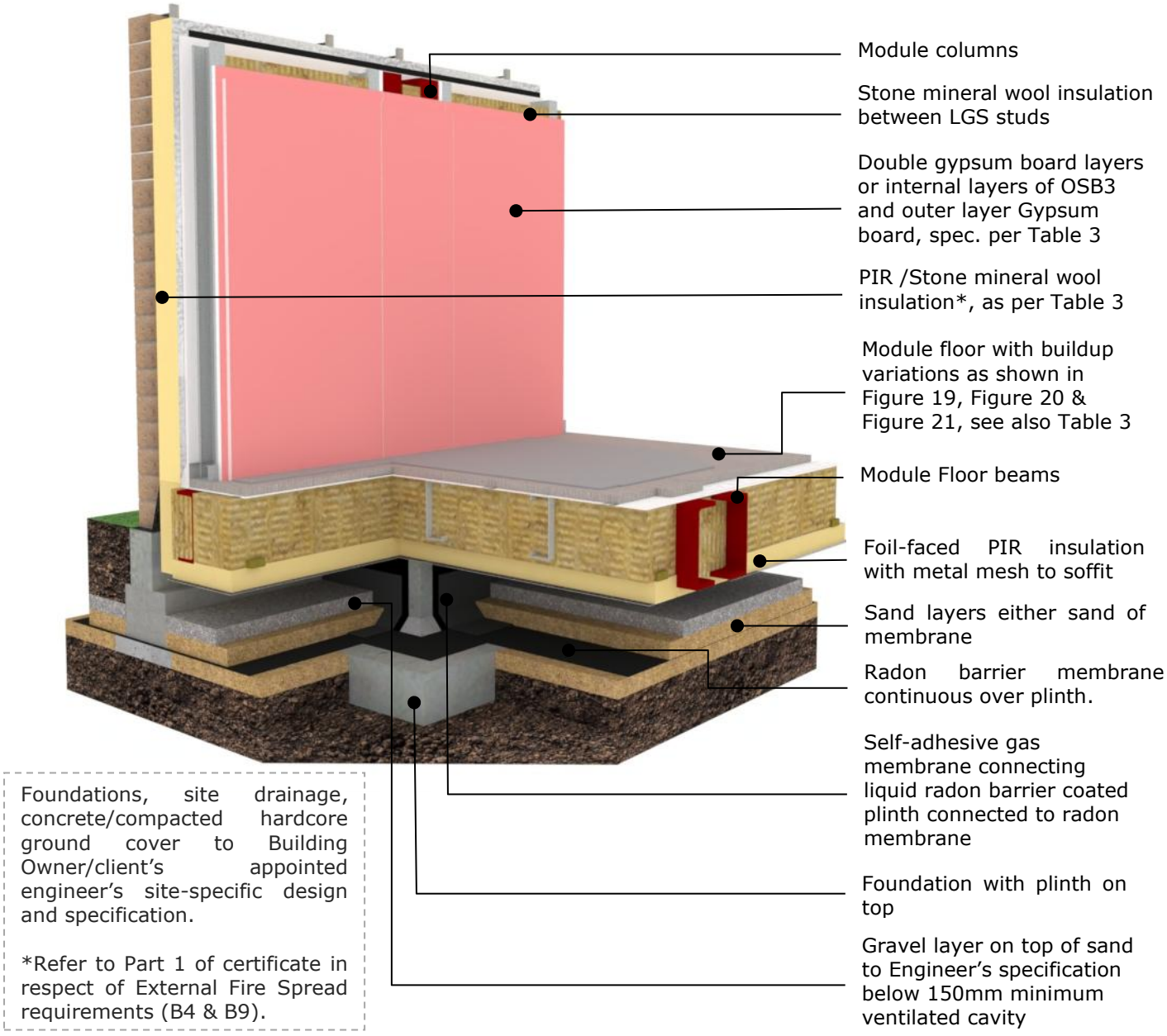


Figure 3a: External wall with masonry outer leaf at adjacent ground floor modules - Internal View

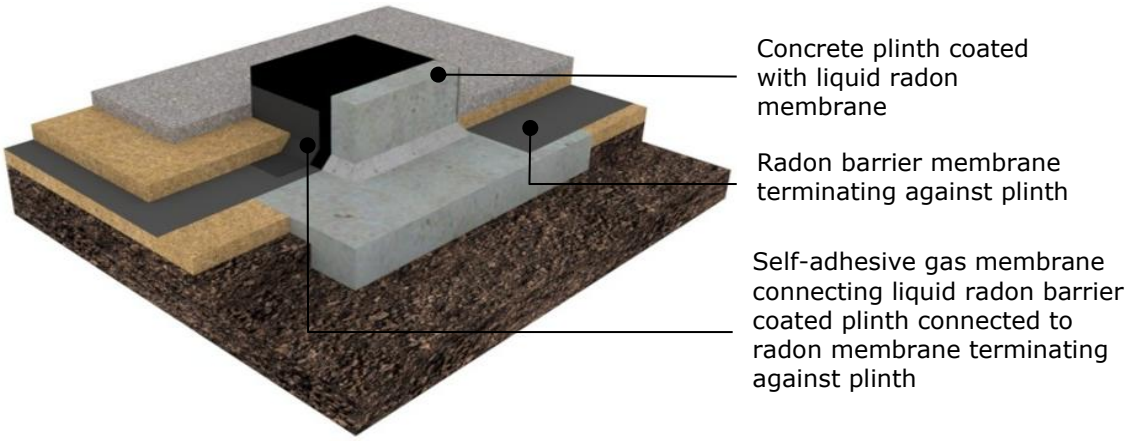


Figure 3b: Detail of Radon membrane termination against plinth

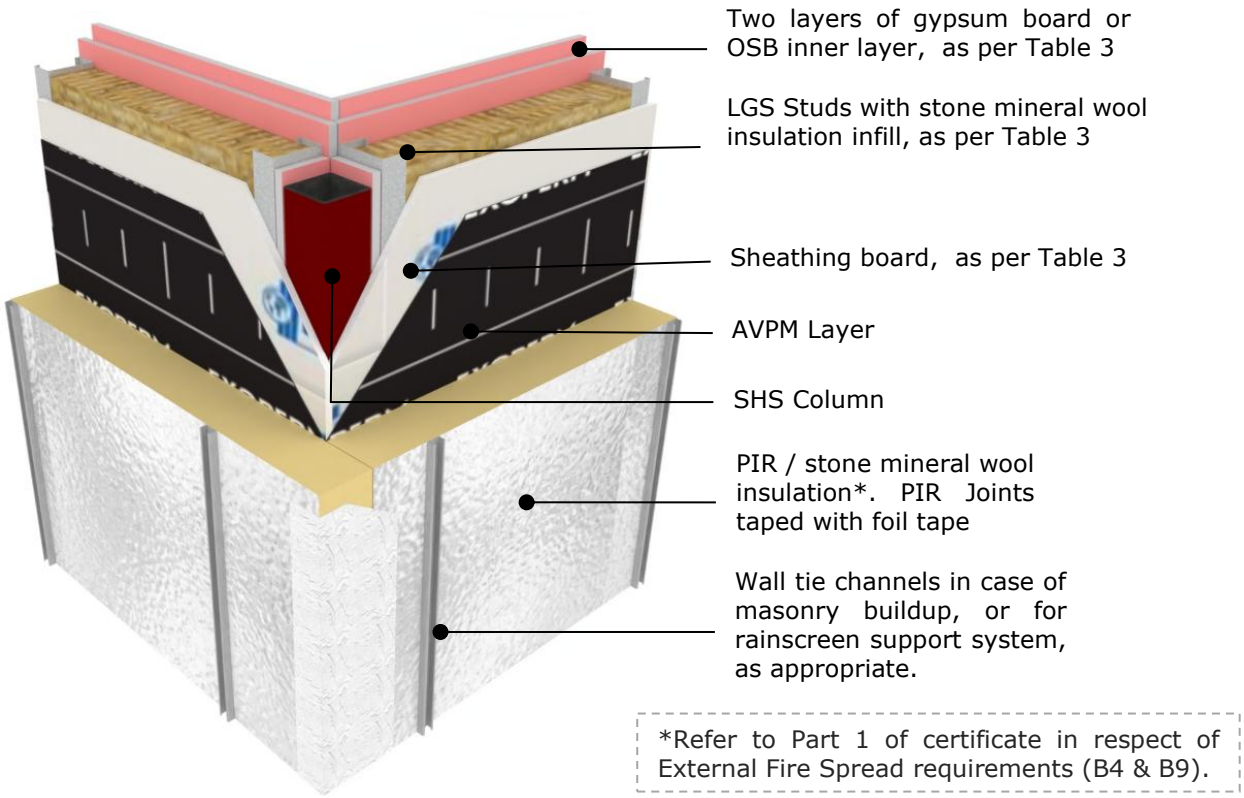


Figure 4: External module wall corner– External View (shown without masonry or rainscreen cladding)

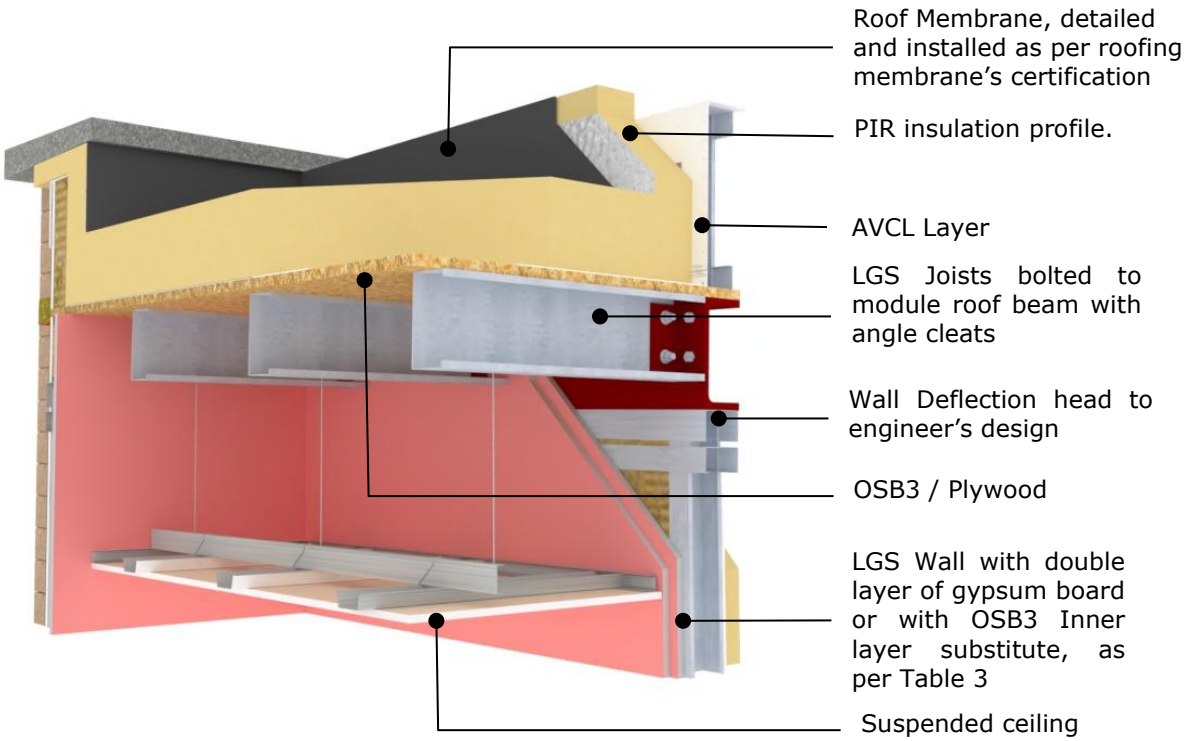


Figure 5: Flat Roof with parapet and brick external wall – Internal View

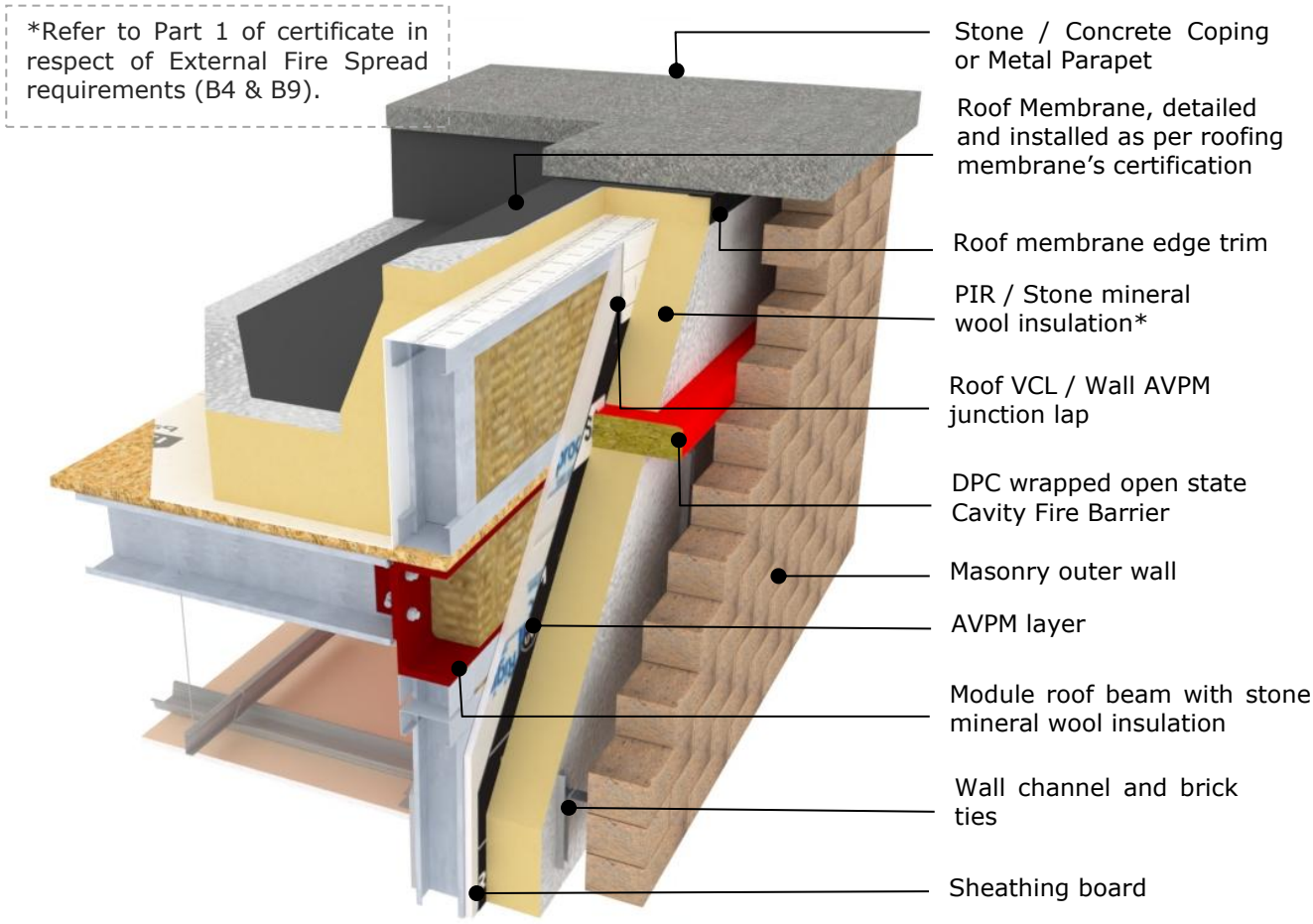


Figure 6: Flat Roof with parapet and brick external wall – External View

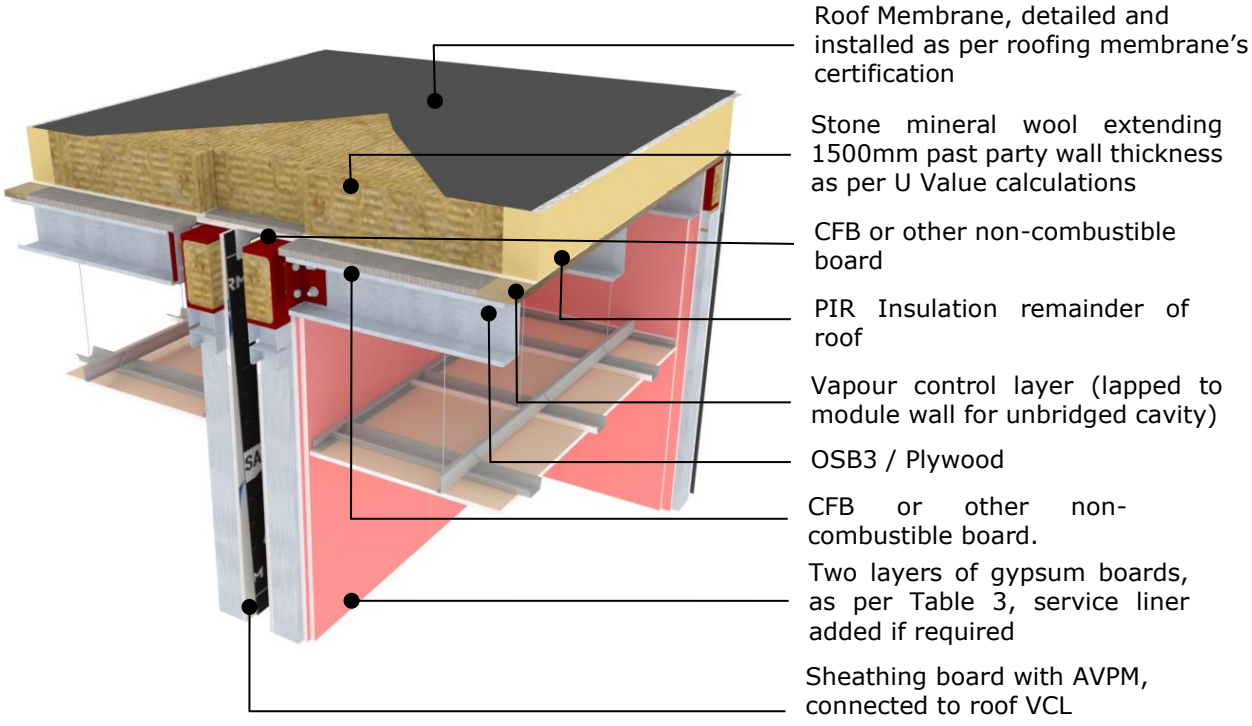


Figure 7: Flat roof to twin separating Wall junction

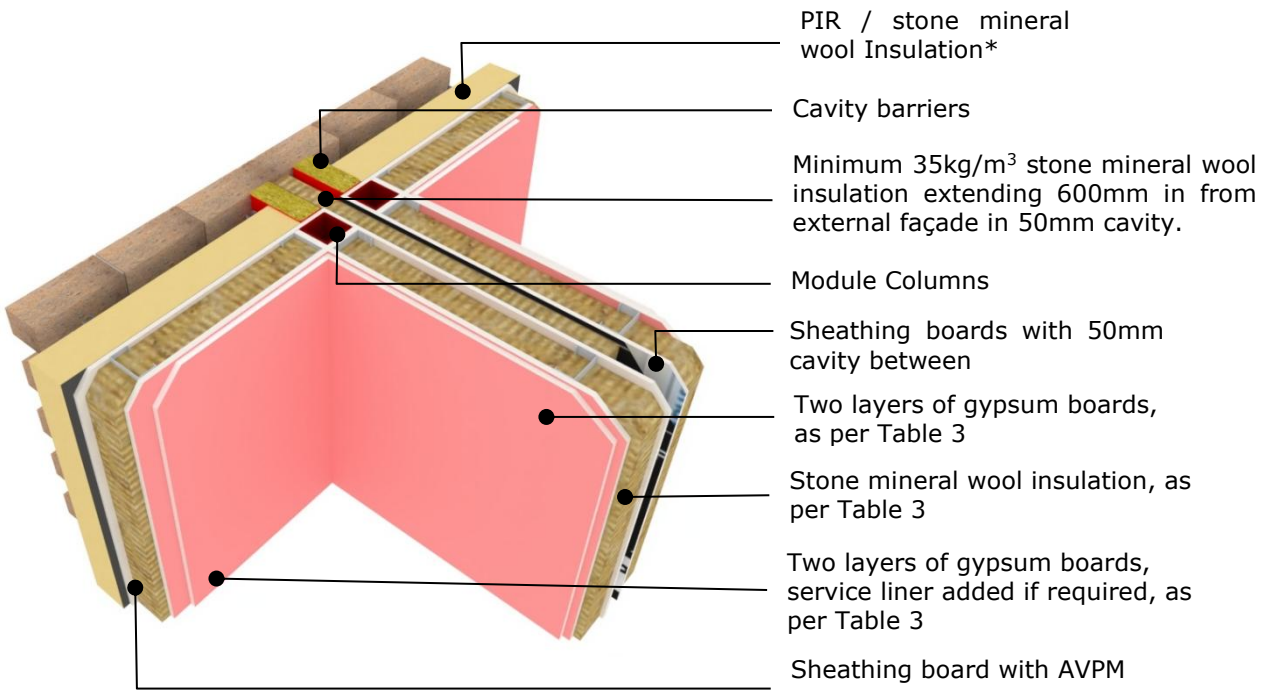


Figure 8: External Wall to Party Wall junction

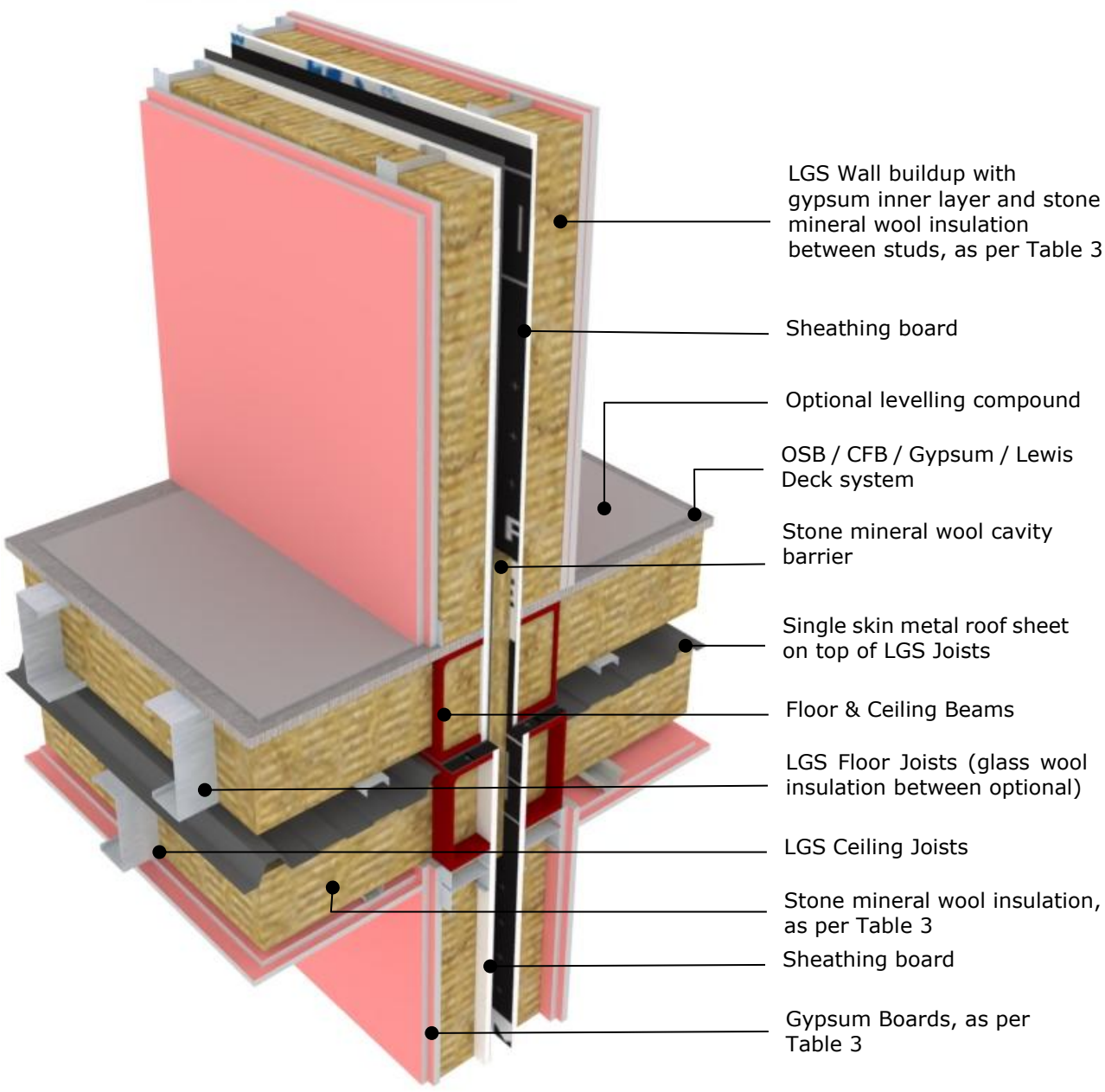


Figure 9: Internal Party Wall to Compartment floor junction

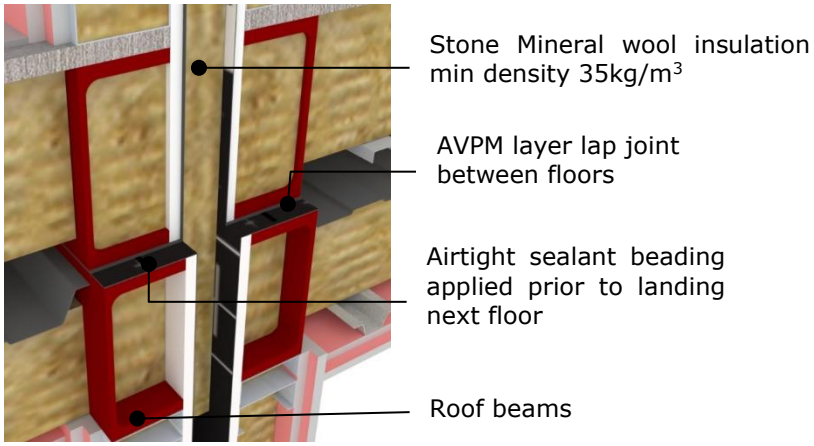


Figure 10: Detail of connection between modules at upper floor / twin separating wall

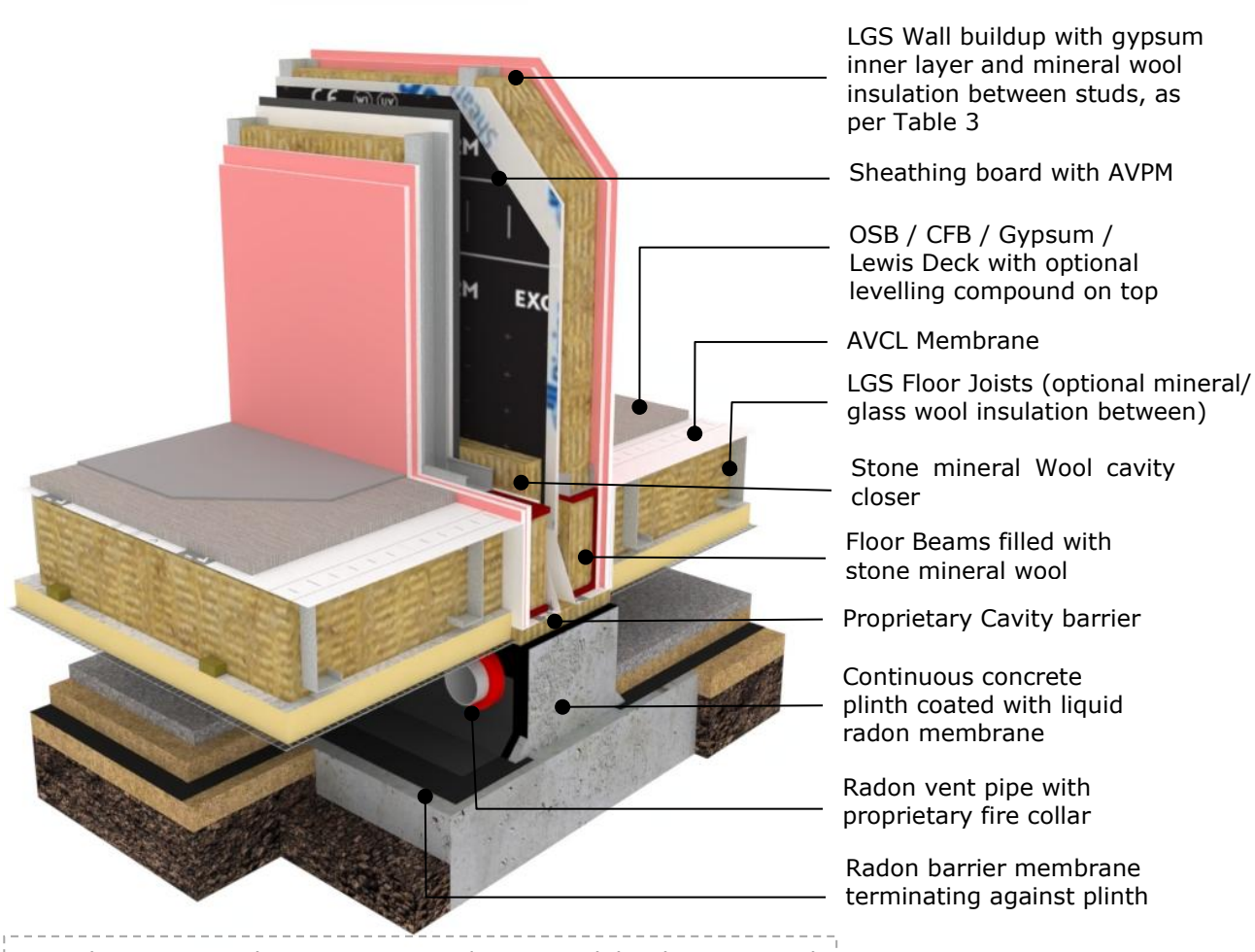


Figure 11: Internal Party Wall to Ground junction

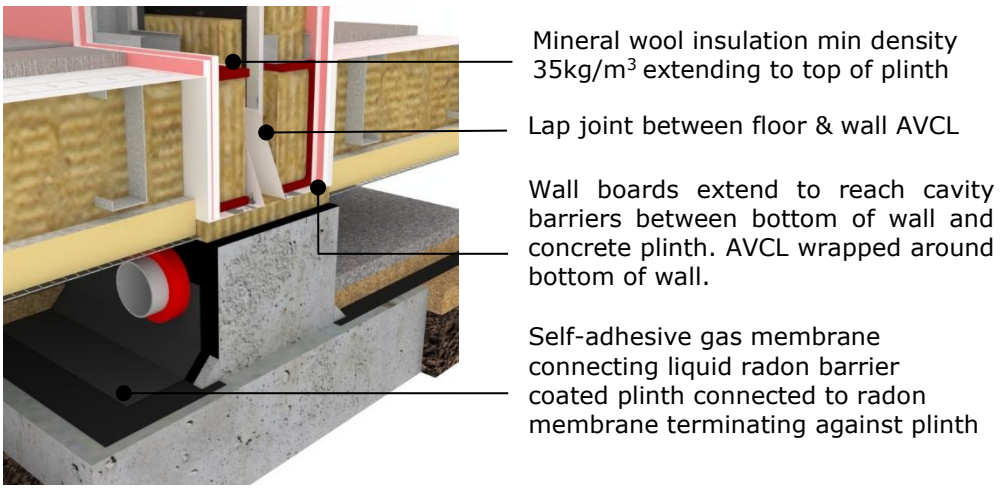


Figure 12: Detail of twin separating wall junction with substructure

*Refer to Part 1 of certificate in respect of External Fire Spread requirements (B4 & B9).

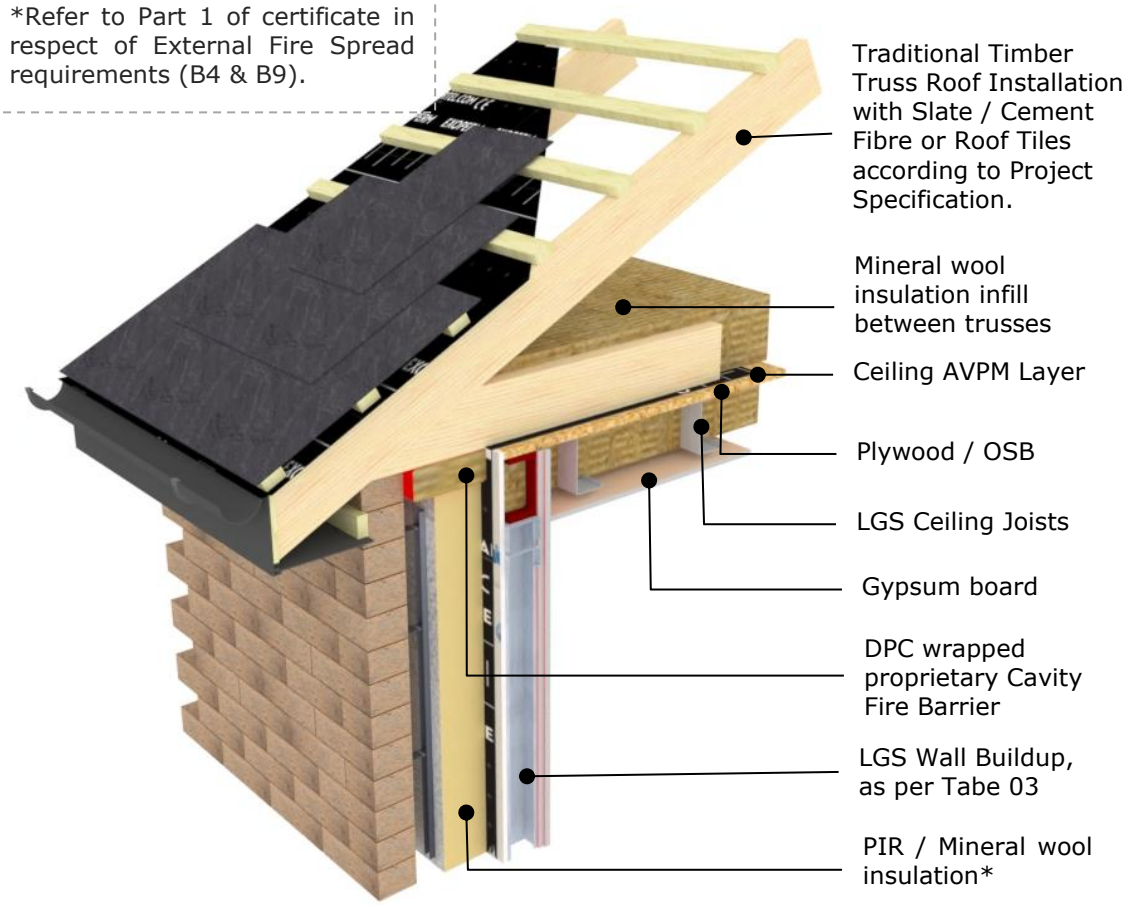


Figure 13: Module with traditional timber roof trusses – External View

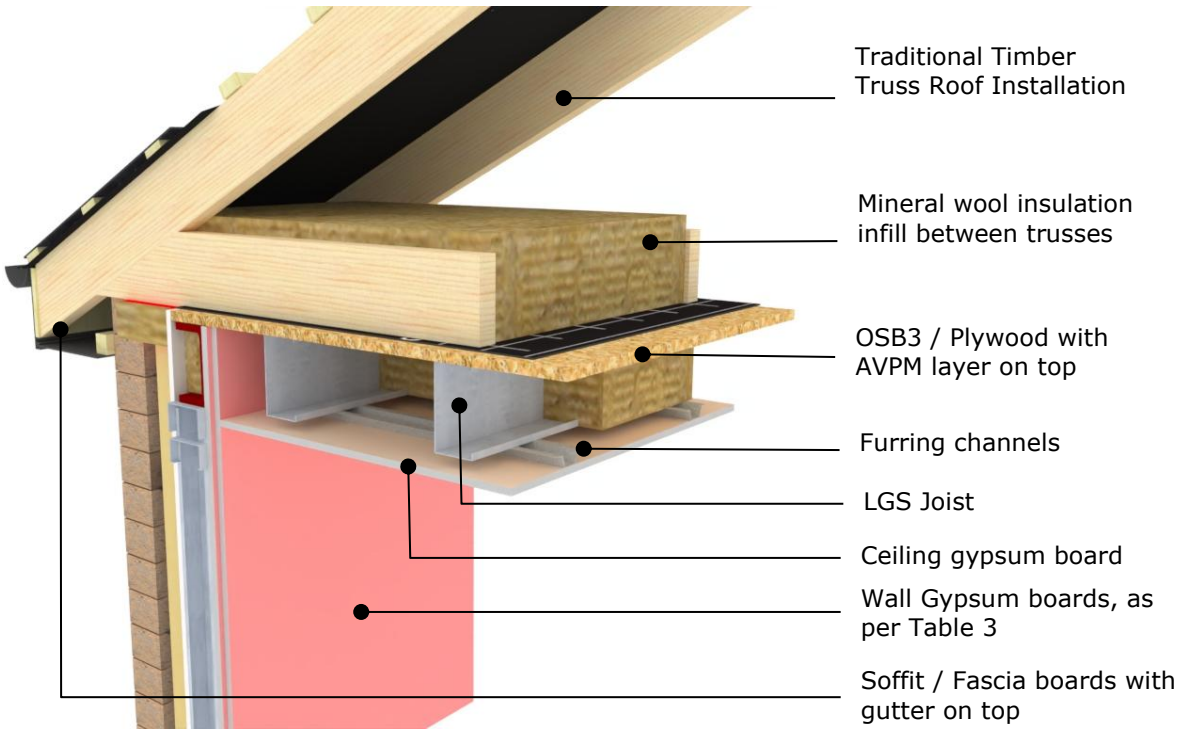


Figure 14: Module with traditional timber roof trusses – Internal View

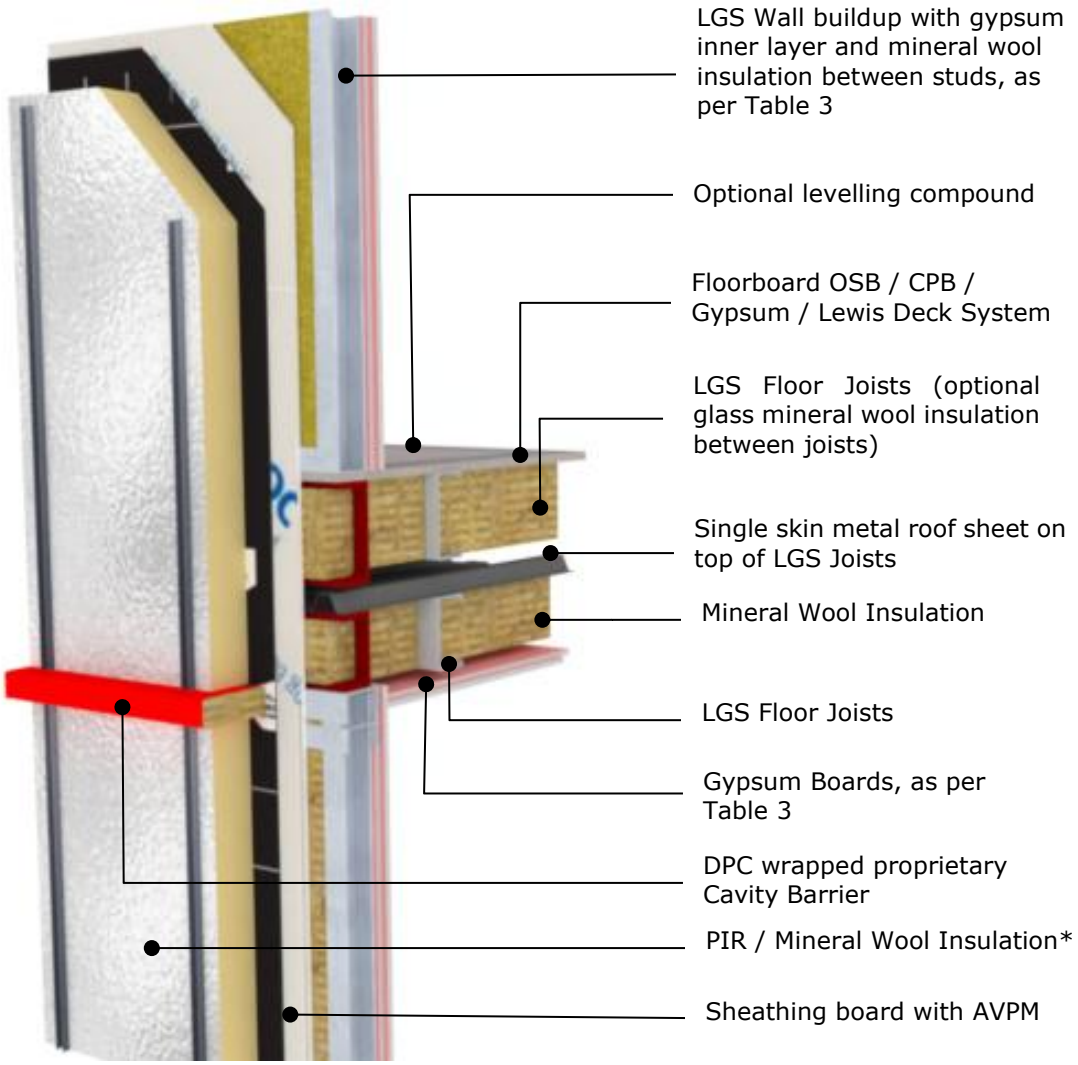


Figure 15: Intermediate floor to external wall buildup – External View

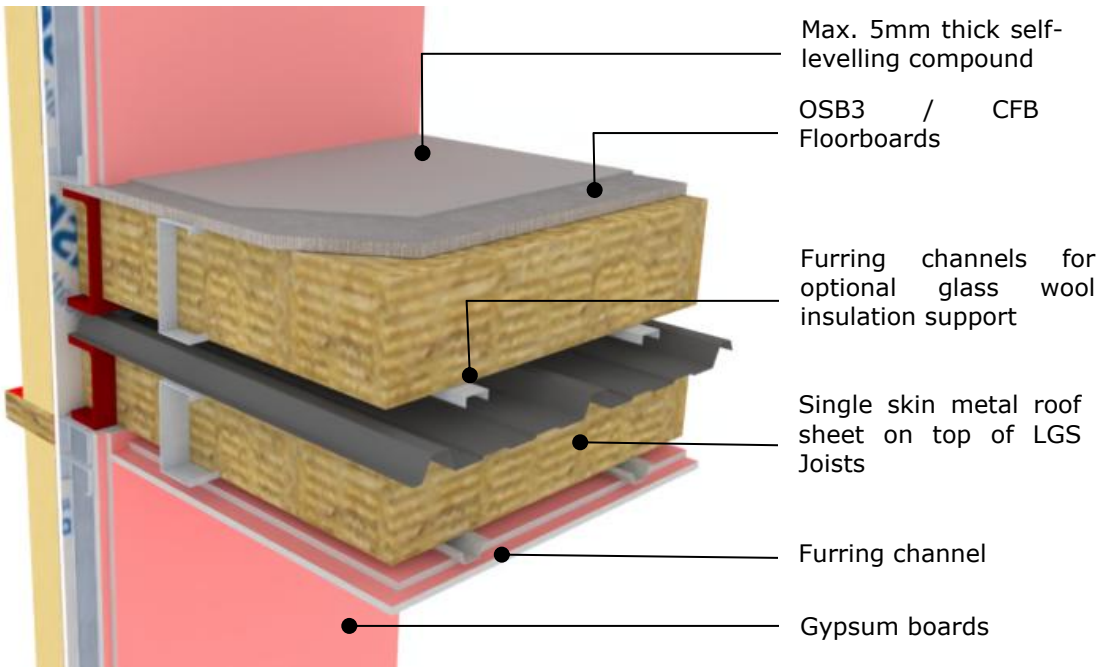


Figure 16: Intermediate floor build-up - Internal View

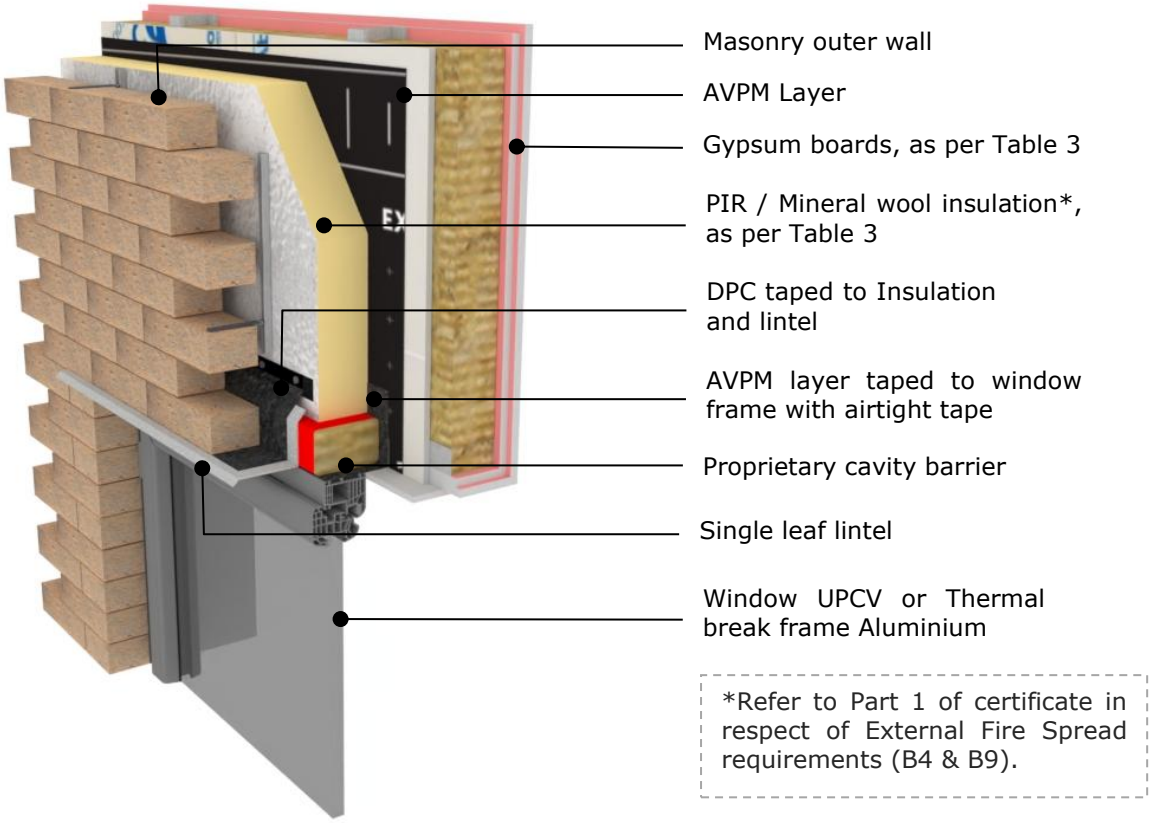


Figure 17: Window head detail with masonry outer leaf

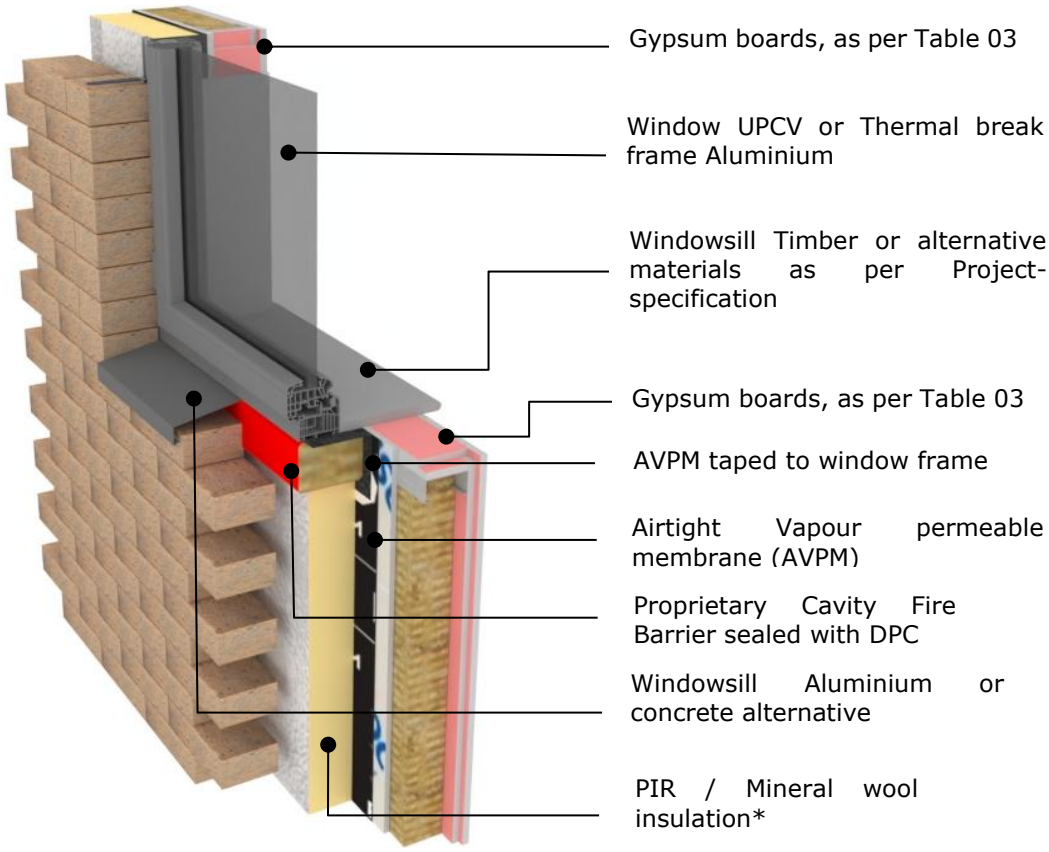


Figure 18: Window cill detail with masonry outer leaf

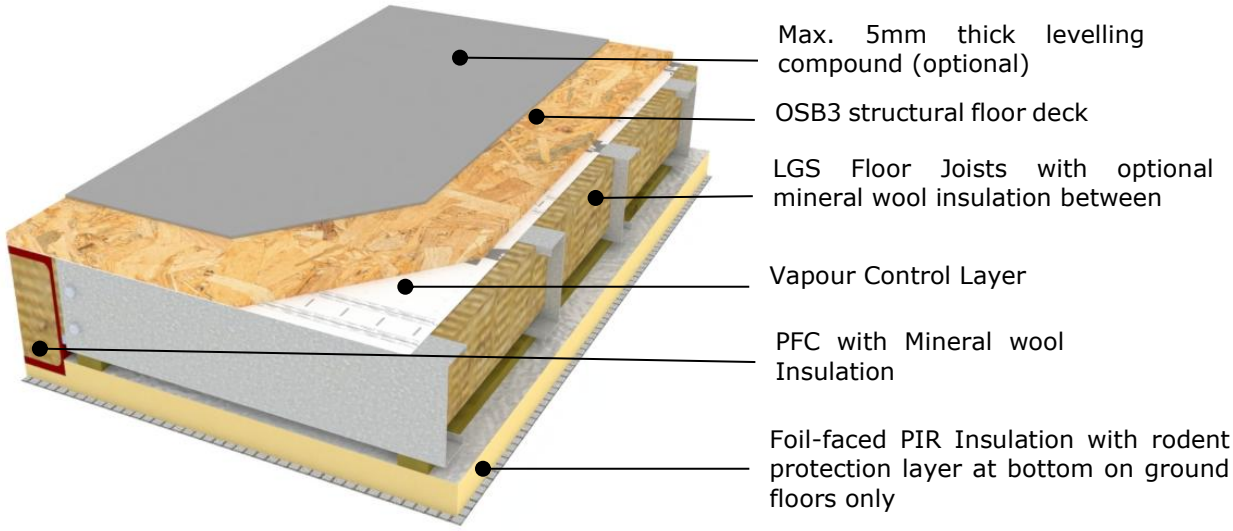


Figure 19: Floor Assembly OSB Decking

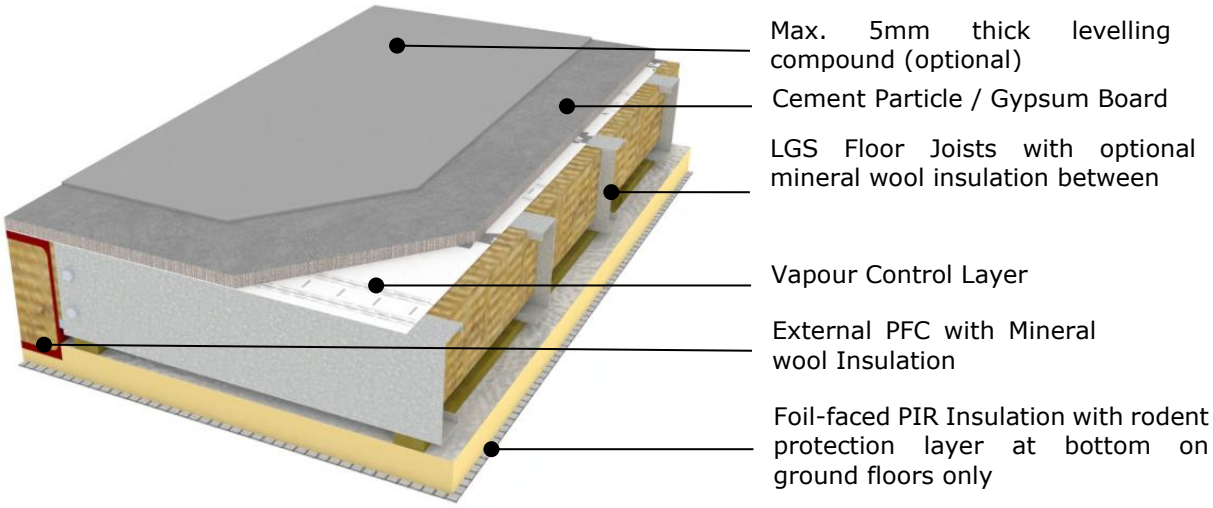


Figure 20: Floor Assembly CPB/Gypsum Board

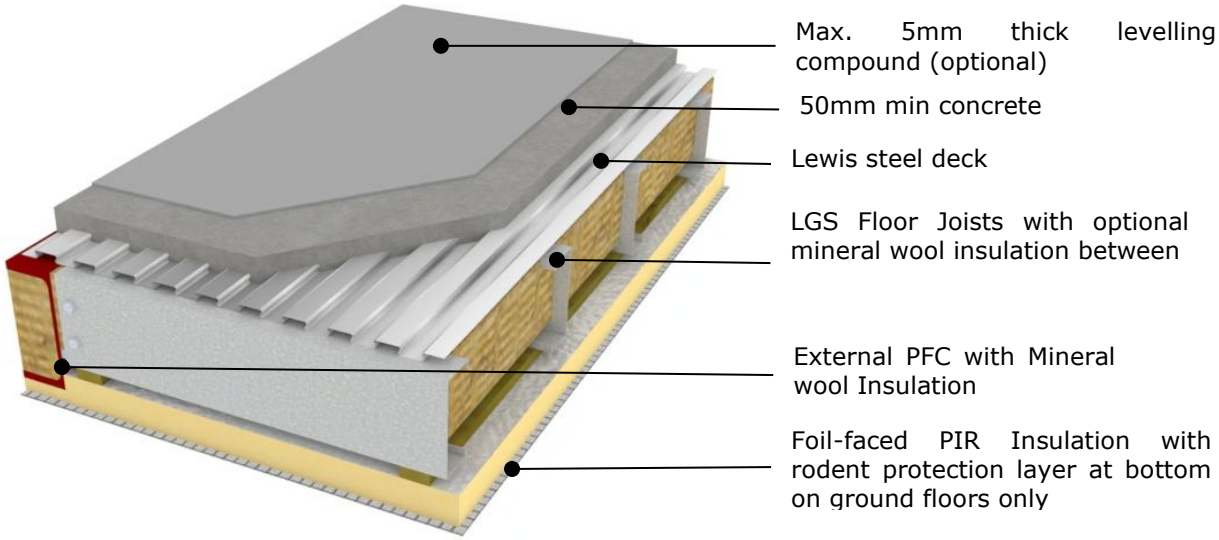


Figure 21: Floor Assembly Lewis Floor deck

3.1 STRENGTH AND STABILITY

3.1.1 General

The Vision Built 3D-Volumetric Building System is intended for use where the Architect's finalised construction and fire strategy drawings are available and satisfy the Building Regulations. The Building Owner/Client-appointed architectural and engineering design team is responsible for ensuring that architectural drawings and overall building design comply with the Building Regulations.

Vision Built Structures Limited, using an experienced, competent Chartered Structural Engineer, are responsible for the structural design of the Vision Built 3D-Volumetric Building System.

3.1.2 Certificate and Structural Compliance

Vision Built Structures Limited is responsible for the design, manufacture, supply, installation and certification of the volumetric, modular building system. Buildings constructed using the Vision Built Building System shall be certified by a competent, Chartered Structural Engineer.

3.1.3 Superstructure Design

The design shall be in accordance with I.S. EN 1990+NA[50], I.S. EN 1993-1-1[34] and Part A[1] of the Building Regulations.

The structural assessment of the Vision Built 3D-Volumetric Building System shall be site and project-specific and a Chartered Structural Design Engineer, suitably experienced in this type of structure, shall undertake the structural engineering of every building element designed by Vision Built. In accordance with I.S. EN 1990+NA[50], Eurocode – Basis of Structural Design, a DSL2 (Design Supervision Level 2) shall be employed to check the design in line with good practice.

The design shall cover all structural elements of the system (e.g. primary main steel elements, LGS infill, connection design, stability) and consider all loading scenarios during manufacture, transport, lifting and the permanent state.

The structural design certificate shall cover the adequacy of all the cold formed and hot rolled elements within the structure in question. It shall also address the dimensions and thickness of each element and member making up the steel frame superstructure and assess the suitability of the interface between the superstructure and the external cladding. The structural certificate of compliance must also confirm that there is sufficient uplift resistance and that there is adequate racking and load bearing capacity to either side of any opening to ensure the stability of the wall.

The heights and area of buildings built using this system must comply with the categorisation of Consequence Class 1, 2A or 2B as per I.S. EN 1991-1-7+NA[48].

The design of a typical building has been examined by the NSAI Agrément and demonstrates compliance with the above standards and current Irish Building regulations.

3.1.4 Substructure Design

The design of the building's substructure is outside the scope of this Certificate. Refer to Section 2 of this Certificate.

The design of the substructure is the responsibility of the Building Owner/Client's and their appointed Engineer. The Engineer will need to be a suitably qualified Chartered Structural Engineer, and the design will need to be in accordance with the relevant codes and standards, i.e. foundations shall be designed in accordance with I.S. EN 1997-1[21], TGD to Part A[1] and TGD to Part C[4].

Vision Built's Structures Limited Engineer will be responsible for undertaking a load takedown for the structure and providing this information to the Building Owner/Client's appointed structural Engineer for use in the design of the substructure.

3.1.5 Design Loads

During the design process, loads are determined by Vision Built depending on the intended use of the building and Building Owner/Client's requirements, using I.S. EN 1991-1 suite and designed with reference to:

- Dead and imposed load to I.S. EN 1991-1-1[52]
- Snow load to I.S. EN 1991-1-3[54]
- Wind loads based on I.S. EN 1991-1-4[53]
- I.S. EN 1993-1-3[51]
- I.S. EN 1993-1-8[49]
- I.S. EN 1993-1-1[34] (and timber roof trusses to I.S. EN 1995-1-1[55])

Design wind and snow loads shall be based on Diagrams 1 and 14 of TGD[1] to Part A of the Irish Building Regulations. Buildings designed in accordance with the System Design Manual[73] will have adequate resistance to wind and snow loads

as per TGD[1] to Part A of the Building Regulations. For very exposed sites on hills above the general level of the surrounding terrain, the system may be specifically designed to meet the requirements as defined in I.S. EN 1991-1-4[53].The system may be designed to be used in all locations in Ireland.

3.1.6 Structural Testing

Where it is required, structural testing may be used to verify the relevant aspects of the structure where the design falls outside the scope of I.S. EN 1993-1-1[34]. No structural testing has been carried out as part of the NSAI Agrément certification assessment.

3.1.7 Disproportionate Collapse

The Vision Built Structural Engineer is responsible for disproportionate collapse design and the risk of exceptional loads occurring. See also Section 2.4.

3.2 FIRE

3.2.1 General

Buildings using the Vision Built 3D-Volumetric Building System shall be designed to comply with the relevant requirements of TGD's[2][3] to Part B of the Building Regulations**.**

The building details of the system incorporate suitable cavity barriers and fire stops to satisfy the requirements of Sections 3.6 of TGD's[2][3] B of the Building Regulations. Additional guidance is contained in BS 9991[56] & BS 9999[57].

The Vision Built 3D-Volumetric Building System shall be designed with the required boarding specification to meet the minimum resistant to fire requirements of Table A1 of TGD[3] to Part B, Vol. 2 and Tables 31 and 32 of TGD[2] to Part B, Vol. 1 of the Building Regulations and the minimum reaction to fire requirements of Table 13 of TGD[2] to Part B Vol. 1 and Section 2.4 of TGD[3] to Part B Vol. 2 of the Building Regulations for all purpose groups to which this certificate applies, and any other building specific structural fire performance requirements.

All roof coverings in conjunction with the system shall be designated B_{ROOF} (t4) as per TGDs[2][3] to Part B of the Building Regulations. Other NSAI Agrément approved roof coverings may also be used with the system under the guidance of the Vision Built nominated Chartered Engineer.

3.2.2 Fire Resistance of Compartment Walls

Table 3 lists the fire resistance tests for non-loadbearing and loadbearing elements, in accordance with I.S. EN 1364-1[58] and I.S. EN 1365-1[59]. All fire testing has been conducted with service penetrations in the walls, where appropriate.

The single frame compartment wall can provide up to 60-minutes load bearing fire resistance, while the twin-frame separating wall can provide up to 90-minutes load bearing fire resistance.

Refer to TGDs[2][3] to Part B for reaction to fire and resistance to fire classification requirements depending on the purpose group and building height.

Any compartment wall providing fire compartmentation shall be carried up through any roof space and brought up to the underside of the roof cladding to provide adequate fire stopping. Refer also to Sections 2.1.7 and 2.1.7.2.

Separating walls shall be continuous, shall run the full height of the building in a continuous vertical plane and shall be constructed of materials having a reaction-to-fire classification Class A2 – s3,d2, or better, as per Section 3 to the TGDs[2][3] to Part B.

Refer to Section 2.1.7 for more information on compartment walls including any service provisions.

3.2.3 Fire Resistance of Compartment Floors

Table 3 lists the fire resistance tests for loadbearing floor elements in accordance with EN 1365-2[60]. The Vision Built 3D-Volumetric Building system compartment floor is designed to provide 60-minute fire resistance from the underside. The compartment floor can provide a non-combustible build up for use with residential care facilities and all buildings where the height of the top storey is 11m or more by using a floor deck option with a reaction-to-fire classification of Class A2-s3, d2 or better. When creating separating floors, the ceiling of the lower module and the floor of the upper module are combined when determining the performance of the floor.

Refer to Section 2.1.8 for more information on compartment floors including any service provisions.

3.2.4 External Fire Spread

Table 3 lists the fire resistance tests for external walls in accordance with I.S. EN 1365-1[59]. All fire testing has been carried out with service penetrations in the walls. External walls can provide up to 120 minutes load bearing fire resistance from inside.

Distance to relevant boundary, purpose group and height of the topmost storey shall be evaluated when determining the reaction to fire classification requirement of external walls as per TGDs[2][3] to Part B of the Building Regulations on a project-specific basis.

3.2.5 Internal Fire Spread (Linings)

Reaction to fire classification of surface linings of walls and ceilings shall be in accordance with the classification requirements within the TGDs[2][3] to Part B of the Irish Buildings Regulations.

3.2.6 Compartment Junctions

Where a compartment wall or compartment floor meets another compartment wall or compartment floor, or an external wall, the junction shall maintain the fire resistance of the compartmentation. Refer to the TGDs[2][3] to Part B of the Irish Building Regulations and Section 2 of this Certificate.

3.3 AIRTIGHTNESS

Airtightness testing is a mandatory requirement of TGDs[11][12] to Part L of the Building Regulations and shall be carried out by an NSAI certified Air Tightness Tester[75] or similar approved. Testing shall be carried out as specified in I.S. EN ISO 9972[61] with additional guidance given in the NSAI's "Certified Air Tightness Tester Scheme Master Document" [75] and TGDs[11][12] to Part L of the Building Regulations.

The airtight membranes and tapes shall be installed as per Vision Built 3D-Volumetric Building System Installation Manual[74] between modules, at external wall junctions, external wall to party wall junctions, roof junctions and at window and door openings.

3.4 VENTILATION

The Vision Built 3D-Volumetric system can accommodate ventilation solutions, designed by an MEP Engineer competent in the design of multiple occupancy buildings, that meet the requirements of TGD[7] to Part F of the Building Regulations. These shall be verified using an NSAI registered ventilation validator.

3.5 WEATHERTIGHTNESS AND DAMP PROOFING

The system has adequate DPCs and DPMs to resist the passage of moisture. Good building practice such as stepped DPCs and weep holes are essential to ensure that moisture within a cavity is deflected to the outside of the building. Roof coverings will provide adequate weather resistance when completed in accordance with this Certificate and the manufacturer's instructions.

Buildings constructed using the Vision Built 3D-Volumetric Building System can readily accommodate adequate rainwater gutters and down pipes.

3.5.1 External Cladding

Where the external façade is constructed of a masonry/brick outer leaf it must incorporate a minimum 40mm clear, drained cavity to minimise the risk of water reaching the cavity face of the inner leaf. Weep holes as per this Certification shall be provided.

In the case of aluminium window cills, they shall be provided with stop ends. In the case of concrete sills, they shall either be stooled or be 75mm wider than the window opening and be provided with the wraparound DPC.

In the case of rainscreen claddings, as described in section 2.1.5.2, the system includes a minimum 20mm clear, drained cavity to minimise the risk of water reaching the cavity face of the inner leaf. The systems shall be installed as per the respective manufacturer's installation guidance, typical details and , where applicable, the cladding system's Irish Agrément or other recognised Third-party certification. Any external cladding system shall be reviewed and approved by the Vision Built Chartered Structural Engineer as suitable for use with the Vision Built 3D-Volumetric Building System and for the particular exposure conditions of the project-specific site, building height and proposed use.

Please note that cladding protects the underlying structure which is a **Key Element** as defined in TGD to Part A[1]. Therefore, the external cladding (wall finish) is considered a critical building element, and it must achieve a durability life span relevant to the building purpose group, to protect the building system structure, from damage or moisture ingress. **Note**: The Building Owner/Client must ensure the durability for the selected external cladding system is suitable for the building use, height, site-specific location and exposure.

Joints in the insulation lining the module substrate are weatherproofed and any penetrations are sealed. Secondary membranes shall be provided over window and door heads to protect vulnerable interfaces. Good building practice such as secondary membrane and weep-holes are essential to ensure that moisture within a cavity is deflected to the outside of the building.
Refer also to Section 2.1.5 above.

3.6 MECHANICAL, ELECTRICAL AND PLUMBING SERVICES

Mechanical, Electrical and Plumbing (MEP) services are outside the scope of this Certificate.

However, in designing and installing these services it is essential that the following procedures are followed, and precautions are taken to minimise the risk of long-term damage to the steel frame or the services;

- At the design stage, it is essential that the positions and sizes of services are established in advance to allow for full coordination of services prior to release of design information

to production. Special holes may need to be cut in the factory to help with the rapid and economic installation of services and it is essential these are considered in the design for structural integrity and practicality of construction.

- In general, the steel frame at each floor level shall be connected directly onto the main earthing terminal in the main fuse box and all earth connections in the circuit wired back to this point. This measure is necessary to control the flow of electric current to earth without the risk of corrosion of critical structural components. The earthing system shall be installed in accordance with I.S. 10101[33].
- Where plastic coated electrical wiring is in contact with insulation, then the cables must be enclosed in a suitable conduit, e.g. Metal or PVC as outlined in I.S. 10101[33].
- The integrity of the linings of separating elements walls and floors should not be breached to allow for the installation of services, except where necessary to allow services pass through these compartment walls or floors, in accordance with Section 3.5.7 of TGD B, Vol. 1[2]. Walls shall be battened out to provide a false service zone in which to distribute electrical services in these fire rated build-ups.
- The enclosure of cold-water pipe work within the external wall should be avoided as condensation on the pipe work could lead to wetting of the steel frame with a consequent risk of corrosion. If enclosure is unavoidable, the cold-water pipework shall be insulated with suitable tubular plastic insulation, which must be accurately cut at junctions and at changes of direction and held firmly in place with adhesive tape. Where hot water pipework is enclosed in the inner leaf of the wall, contact between copper pipes and the galvanised frame must be avoided using rubber or plastic grommets.
- Additional slots, notches or holes shall not be cut through any steel member without the approval of the Chartered Structural Engineer responsible for the overall design of the structure.
- All electrical services shall be in accordance with I.S. 10101[33] requirements for installation, inspection and testing.
- All sanitary conveniences and washing facilities shall be in accordance with TGD G[8] (Hygiene) of the Irish Building Regulations.
- All Drainage and Wastewater Disposal systems shall be in accordance with TGD H[9] of the Irish Building Regulations.

3.7 WINDOWS AND DOORS

Windows and doors are outside the scope of this Certificate. However, indicative details are provided above of how they may be installed to limit heat loss and moisture penetration.

Other considerations for the design of windows and doors include:

- Escape in the event of fire,
- Safety and security,
- Thermal performance.

Note: NSAI's Window Energy Performance (WEP) Scheme provides full details of the energy performance aspects of window systems.

Good attention to detail is essential when installing window sills, DPCs, cavity trays and thresholds to ensure the structure is protected from weather and ground moisture in use. Thresholds shall be detailed to allow level access (as required). Weep holes and cavity vents should be avoided in immediate threshold areas.

3.8 THERMAL PERFORMANCE

The modules are designed as a hybrid warm frame assembly where the LGS/SHS/RHS/PFC perimeter of the module walls of the building are located on the warm frame side of the insulation and insulation is also provided between the steel components. The Vision Built 3D-Volumetric Building System may be designed for a wide range of required elemental U-values.

Some building elements, namely the roof, external cladding, ground floor, windows and doors may be site and project-specific. Therefore, the U-value of these elements shall be calculated before overall compliance with Part L of the Building Regulations shall be determined.

3.8.1 Limiting Thermal Bridging

The linear thermal transmittance Ψ-value (Psi-value) describes the additional heat loss associated with junctions and around openings. The certificate holder has carried out Ψ-value calculations for a range of common thermally bridged junctions, see Table 8 and Table 9 below.

The Dwelling Energy Assessment Procedure (DEAP) used to produce the Building Energy Rating (BER) for a dwelling takes account of the total effects of thermal bridging through the input of the "y" value, which is a multiplier applied to the total exposed area of the building.

Where limited provisions are made to eliminate any risk of surface condensation or mould growth, the default "y" value of 0.15 shall be taken. When all building junctions are demonstrated to be equivalent to or better than the corresponding Acceptable Construction Details (ACD), then the "y" value shall be taken as 0.08.

Alternatively, the transmission heat loss coefficient due to thermal bridging (H_{TB}) may be calculated out by summing up the Ψ-values for each junction and multiplying by the linear length

of each junction. The "y" value is calculated by dividing H_{TB} by the exposed surface area.

Ψ-values for other junctions outside the scope of this certificate shall be assessed in accordance with the BRE IP 1/06[18], BRE Report BR 497[19] and Appendix D of TGD's[11][12] to Part L of the Irish Building Regulations.

U-values and Ψ-values are to be calculated by an NSAI approved thermal modeller as per Section 4.3.

3.8.2 Internal Surface Condensation

As part of the assessment carried out to determine the Ψ-values, internal surface temperatures (f_{Rsi}) are also checked, see Table 8 and Table 9 below. To limit the risk of surface condensation or mould growth, fRsi should be greater than or equal to the critical value (fCRsi), which is 0.75 for Institutional Residential and School buildings[12]. In all cases best practice shall be adopted to safeguard against the risk of surface condensation occurring under normal occupancy and humidity class levels.

3.9 INTERSTITIAL CONDENSATION

3.9.1 Condensation in Walls

Condensation risk analysis shall be carried out by Vision Built Structures Limited to assess the build-up proposed, considering the site-specific location of the building, the building occupancy and fire purpose group.

All external walls have an airtight vapour permeable membrane (AVPM), and floors and roofs have an air vapour control layer (AVCL) on the warm side of the insulation to protect against the risk of interstitial condensation in the elements build-up. Continuity of the AVPM/AVCL layer is maintained by the application of suitable tapes, sealants and proprietary service penetration grommets.

The external wall construction passes the risk criteria in I.S. EN ISO 13788[64] for hygrothermal performance. Refer also to Section 4.4 on technical investigation of interstitial condensation.

3.9.2 Condensation in Roofs

Roof ventilation shall be provided in accordance with TGD Part F[7] of the Irish Building Regulations and the recommendations of BS 5250[17].

In the case of cold flat roofs, a cross-ventilated void, not less than 50mm deep, between the slab or deck and insulation shall be provided in conjunction with the VCL being provided on the warm side of the insulation. Ventilation openings shall be provided to every roof void along two opposite sides of the roof and shall be equivalent in area to a continuous opening of not less than 25mm at each side. It should also be noted that the dimensions of the cross-ventilated void and the ventilation depend on the size of the roof.

In the case of warm flat roofs, the risk of surface condensation is dependent on the nature of the supporting structure. With all flat roofs, there is a risk of interstitial condensation forming between the thermal insulation and the waterproof covering. To avoid this risk, an VCL shall be provided immediately above the supporting structure on the warms side of the insulation.

In the case of inverted flat roofs, it is essential that the thermal insulation used resists water absorption and is sufficiently load bearing to support the protective finish of ballast, paving or soil.

3.10 SOUND

As per TGD[6] to Part E of the Building Regulations, all buildings, post completion, shall be subjected to acoustic testing. Acoustic testing shall be carried out in accordance with TGD[6] to Part E of the Irish Building Regulations.

Correct detailing of the system is necessary to meet the requirements of the TGD[6] to Part E of the Irish Building Regulations.

Refer to Section 4.5 for technical investigations on acoustic performance.

3.11 MAINTENANCE

Maintenance will be required at a level comparable with that for buildings of traditional construction. Regular inspections shall be made over the life of the system. The system shall be inspected and maintained in accordance with the Certificate holder's instructions, as detailed in the project-specific Operations & Maintenance (O&M) manuals provided at project handover, including advice note on importance of maintaining the integrity of the plasterboard linings, fire stopping and cavity barriers for protection from fire.

Below is a non-exhaustive list of maintenance inspections and works which should be undertaken regularly:

- Visually inspect the render and architectural details for signs of damage or water ingress (at least annually).
- Necessary repairs shall be carried out immediately and shall be in accordance with the Certificate holder's instructions to prevent deterioration or damage, and to protect the integrity of the system.
- Sealants shall be subject to regular inspection (at least annually) for signs of cracking, peeling or loss of adhesion. Sealant shall be removed and replaced if there are signs of deterioration or damage.

- Sealants shall be replaced as required and fully replaced every 18 to 20 years to maintain performance. The seals to windows and doors reveals may require resealing at approximately 10-year intervals.
- Synthetic finishes may be subject to aesthetic deterioration due to exposure to UV light. They shall be re-painted/re-coated at least every 18 to 20 years, or as necessary, to maintain appearance.
- Repainting shall be carried out in accordance with the relevant recommendations of BS 6150[66].
- Timber boarding, fascia, soffits etc. where used, shall be treated with an appropriate paint system or translucent stain and shall be maintained by periodic re-coating using a paint or stain suitable for external applications, applied in accordance with the manufacturer's instructions.
- Care should be taken to ensure that the synthetic finish used is compatible with the original system and that the water vapour transmission or fire characteristics are not adversely affected.
- Visual inspection to ensure all downpipes and gutters are watertight and not leaking causing excessive localised water on the façade.
- Any visible streaking on the façade shall be thoroughly investigated and resolved.
- Necessary repairs shall be carried out immediately and shall be in accordance with the Certificate holder's instructions to prevent deterioration or damage, and to protect the integrity of the system.

Taking account of the above variable criteria, it is not possible to accurately determine a cyclic period for planned maintenance. However, regular cleaning and inspections will assist in maintaining a fully functioning, aesthetically pleasing façade.

It shall be the responsibility of the Building Owner to monitor the condition of the building and commission maintenance and repairs as required and in accordance with BS 8210[67], and the building specific Vision Built Structures Limited O&M manual for the 3D-Volumetric Building System, as erected and assembled.

4.1 STRENGTH AND STABILITY

The assessment of the structure was carried out to I.S. EN 1993-1-1[34] and Part A of the Building Regulations. Refer to Sections 2 and 3 of this Certificate.

The design of a typical building has been examined by the NSAI and demonstrates compliance with the TGD[1] to Part A of the Irish Building Regulations when designed and constructed in accordance with this Certificate.

4.2 BEHAVIOUR IN FIRE

4.2.1 Fire Resistance

Assessment of test results to I.S. EN 1365-1[59], I.S. EN 1364-1[58] and I.S. EN 1365-2[60] shows that buildings constructed using the Vision Built 3D-Volumetric Building System can meet the Building Regulations requirements in relation to fire resistance as shown in Table 3.

The Vision Built 3D-Volumetric Building System shall be designed with the required boarding specification to meet the minimum requirements of Table A1 of Volume 2[3], TGD B of the Building Regulations for purpose class 1(a), 1(b) & 1(d); and to meet the minimum requirements of Table 31 and 32 of Volume 1[2], TGD B of the Building Regulations for all other purpose classes to which this certificate applies, and any other building specific structural fire performance requirements. Table 3 of this Certificate provides a table of tested fire results, including boarding specifications, element material build-ups and their associated fire resistance performance, demonstrating stability for the stated period in the event of fire.

The fire resisting elements of the construction that are specified in Table 3 of this Certificate provide for 30-, 60- and 90-minutes' fire resistance, for a range of specifications. See also section 2.1.7, 2.1.7.2 and 2.1.8 of this certificate for compartmentation using this building system.

Building designers must take into consideration calculation of unprotected areas and distance from the relevant boundary in respect of external walls and in accordance with Table 3 of this certificate.

4.3 THERMAL PROPERTIES

Assessment of U-value calculations shows that the Vision Built 3D-Volumetric Building System meets and can exceed the maximum back-stop elemental U-value requirements of Table 1 of TGD's[11][12] to Part L of the Irish Building Regulations.

Table 4 of this certificate provides the elemental wall U-values in W/m^{2}K for an external wall with either PIR or stone mineral wool cavity insulation and traditional masonry outer leaf.

Table 5 of this Certificate provides the elemental wall U-value in W/m^{2}K for an external wall when used with a rainscreen cladding.

Table 6 provides the various elemental wall U-values in W/m^{2}K for the ground floor build-up with various decking options.

Table 7 of this Certificate provides the elemental wall U-value in W/m^{2}K for a flat roof for use with the module building system.

4.3.1 Limiting Thermal Bridging

Table 8 and Table 9 of this certificate provide Ψ-values for a range of Vision Built 3D-Volumetric Building System typical junctions along with their associated flanking elemental U-values.

A full listing of ψ-value calculations, along with the building details on which calculations are based, are contained within the certificate holder's technical data sheets for ψ-values.

U-values and Ψ-values are to be calculated by an NSAI approved thermal modeller – a register of these may be found on the NSAI's Thermal Modellers Scheme webpage.

4.3.2 Internal Surface Condensation

Table 8, and Table 9 of this Certificate provide internal surface temperature factors (f_{Rsi}) for a range of typical building junctions.

As outlined in clause 3.8.2 of this certificate, when internal surface temperatures (f_{Rsi}) are greater than 0.75, the typical assessed building junctions along with their associated flanking elemental U-values as described in Table 8 and Table 9 shall satisfy the requirements of Section D.2 of Appendix D of TGD's[11][12] to Part L of the Irish Building Regulations.

4.4 INTERSTITIAL CONDENSATION

4.4.1 Condensation in Walls

Dynamic hygrothermal analysis to I.S. EN 15026[65] has been carried out for a range of typical external wall and ground floor build-ups, as covered by this certificate. They predict that moisture content and humidity risk levels are within acceptable levels and interstitial condensation is unlikely; and if it should occur, it will dry out within a sufficient timeframe so as to

prevent any risk of damage to performance of materials within the external wall and meet the risk criteria in I.S. EN ISO 13788[64]. The calculations are based on the airtightness levels assumed in the analysis being achieved on site.

4.5 SOUND

4.5.1 Separating Walls

The acoustic performance of the separating wall specified in Section 2.1.7 has been assessed by laboratory and on-site testing of buildings constructed using the Vision Built 3D-Volumetric Building System and third-party acoustic assessment calculations. The testing included sound airborne insulation tests on separating walls in accordance with I.S. EN ISO 16283-1[68]. Results from on-site testing are shown in Table 10.

The separating wall in the Vision Built 3D-Volumetric Building System has been assessed and when constructed in accordance with this certificate can meet the requirements of TGD[6] to Part E of the Irish Building Regulations.

4.5.2 Separating Floors

The acoustic performance of the Vision Built floor as specified in Section 2.1.8 has been assessed by on-site testing of the building constructed using the Vision Built 3D-Volumetric Building System and third-party acoustic assessment calculations. The testing included sound airborne insulation tests in accordance with I.S. EN ISO 16283-1[68] and impact sound insulation tests in accordance with I.S. EN ISO 16283-2[69]. Results from on-site testing are shown in Table 10.

The separating floor in the Vision Built 3D-Volumetric Building System has been assessed and when constructed in accordance with this certificate can meet the requirements of TGD to Part E of the Building Regulations. The acoustic performance is achieved through layers of boards and resilient layers. These layers attenuate sound by absorption and by the air gaps between the layers.

4.5.3 Acoustic Testing

Successful acoustic tests were carried out on the Vision Built 3D-Volumetric Building System. The testing included:

- sound insulation tests on separating floors and walls in accordance with I.S. EN ISO 16283-1[68].
- impact sound insulation tests on separating floors in accordance with I.S. EN ISO 16283-2[69]
- Indoor ambient noise levels to determine Building envelope intrusive noise
- Reverberation times to I.S. EN ISO 3382-2[70]

4.6 DURABILITY

The durability of the system will be influenced by project-specific performance criteria, such as the exposure class, climate, environment, building use/purpose group and building life cycle. Buildings constructed using the Vision Built 3D-Volumetric Building System will, when constructed in accordance with Vision Built 3D-Volumetric Building System Installation Manual[74], the requirements of this Certificate, along with all relevant codes of practice, and a suitable, adequately-maintained external cladding, have a minimum design life of at least 60 years in accordance with BS 7543[72].

The steel frame structure and LGS infill has been assessed as capable of achieving a minimum design life of 60 years. All steelwork is provided with corrosion protection as per Section 2.4.2 of this Certificate. In addition to this, the steel is kept in a "warm frame" environment, which should prolong the life of the steel. Where there is a risk of water ingress, DPC/DPM/weepholes/drainage are provided to ensure the steel is not in contact with water.

The insulation materials are durable and will remain effective as an insulant for the life of the building. The roof, internal wall and ceiling linings and the outer leaf of the external wall are constructed from conventional durable materials.

The durability of the external cladding is integral to protecting the steel, insulation and linings of the system and its continued performance for the design life of the system. The external cladding and roof finish, selected on a project-specific basis shall be designed, detailed and constructed to achieve the required design life of the building for its height, location, use and exposure. Regular inspections and maintenance are required for all roof finishes, cladding and external wall finishes, as per manufacturer's instructions. Roof finishes, external cladding, finishes and seals shall be remediated at first signs of deterioration or damage to ensure that the structure and building fabric are sufficiently protected from water ingress and any resultant damage or loss of performance.

In any case, any damage to the surface finish or internal linings shall be repaired immediately and regular maintenance shall be undertaken as outlined in Section 3.11 of this Certificate.

4.7 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING

The following is a summary of the tests and assessments which have been carried out on the Vision Built 3D-Volumetric Building System:

- Sample structural design for a typical building,

- Design and assessment of fixings and connections,
- Behaviour in relation to fire,
- System specific load bearing fire testing to I.S. EN 1365-1[59] and I.S. EN 1365-2[60],
- Durability assessment,
- Desktop study on corrosion of fasteners in normal conditions with a view to a minimum 60-year design life,
- Typical drawing details,
- U-value calculations and thermal modelling for typical junctions,
- Risk of condensation both surface and interstitial,
- WUFI Analysis of external wall and ground floor
- Acoustic performance, resistance to airborne and impact sound transmission.
- Material specifications,
- Compatibility with other materials,
- System and Installation manuals reviewed,
- Quality Control (QC) measures in the factory and during construction,
- Sample on-site Airtightness reports,
- Sample on-site Radon tests.

4.8 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity, environmental impact and the effect on mechanical strength/stability and durability were assessed.

(ii) The manufacturing process was examined including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

(iii) Site visits were conducted to assess the practicability of installation and the history of performance in use of the product.

Table 3: Fire Protection Requirements for Loadbearing Wall and Floor Elements

Type	Element summary description:	Test Standard[+]	Classification	Purpose Group[3]
External Load Bearing Walls[3]				
1	Fire Test conducted on 3000mm x 3000mm x 253mm (w x h x th) panel with total vertical load of 150kN. • Framing Structural Steel - consisting of cold rolled SHS Columns 80x80x5mm, an intermediate SHS column 80x80x5mm & SHS Beams 90x90x5mm with bolted 90x90x8mm steel angle connections. The primary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edge. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. The secondary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edges. • Fire side: 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 25/41mm long drywall screws at 300mm centres • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3) • Single layer of 12.5mm Glasroc X gypsum board fixed to LGS using 25mm long Glasroc X screws at 300mm centres • 125mm Dual Density stone mineral wool slab with at least one fire fixing per panel with stainless steel façade support bracket and U-profiles fixed back to LGS 3no. socket outlets were inserted into the test panel on the fire side, fitted to the plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.	I.S. EN 1365-1[59]	REI 90 mins from inside	1(a), 1(b), 1(c), 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b), 7(a)
2	Fire Test conducted on 3000mm x 3000mm x 253mm (w x h x th) panel with total vertical load of 150kN. • Framing Structural Steel - consisting of cold rolled SHS Columns 80x80x5mm, an intermediate SHS column 80x80x5mm & SHS Beams 90x90x5mm with bolted 90x90x8mm steel angle connection. The primary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edge. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. The secondary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edges. • Fire side: 125mm Dual Density Stone mineral wool slab with at least one fire fixing per panel with stainless steel façade support bracket and U-profiles fixed back to LGS • Class B-s1, d0 Airtight Vapour Permeable Membrane • Single layer of 12.5mm Glasroc X gypsum board fixed using 25mm long Glasroc X screws at 300mm centres • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3) • 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 25/41mm long drywall screws at 300mm centres 3no. socket outlets were inserted into the test panel on the non-fire side, fitted to the plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.	I.S. EN 1365-1[59]	REI 120 mins from outside	1(a), 1(b), 1(c), 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b), 7(a)
3	Fire Test conducted on 3000mm x 3000mm x 208mm (w x h x th) panel with total vertical load of 150kN • Framing Structural Steel - consisting of cold rolled SHS Columns 80x80x5mm, an intermediate SHS column	I.S. EN 1365-1[59]	REI 90 mins from inside	1(a), 1(b), 1(c), 1(d), 2(a), 2(b)

Type	Element summary description:	Test Standard+	Classification	Purpose Group[3]
	80x80x5mm & SHS Beams 90x90x6mm with bolted 90x90x8mm steel angle connection. The primary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edge. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. The secondary frame was lined with 90mm strips of 12.5mm Gyproc Fireline on the outer vertical edges. • Fire side: 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 35mm long drywall screws at 300mm centres. • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3). • Single layer of 12.5mm Glasroc X gypsum board fixed using 25mm long Glasroc X screws at 300mm centres. • Class B-s1, d0 Airtight Vapour Permeable Membrane. • 80 mm foil-faced PIR insulation board secured through Glasroc X to LGS studs with timber battens on the outer PIR surface. • 3no. socket outlets were inserted into the test panel on the fire side, fitted to the plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.			3, 4(a), 5(a), 5(b), 7(a)
Internal Load Bearing Walls[3]				
4	Fire Test conducted on 3000mm x 3000mm x 139mm (w x h x th) panel with total vertical load of 150kN. • Framing Structural Steel - consisting of cold rolled SHS Columns 80x80x6.3mm, 2no. SHS Columns 80x80x6.3mm at centre & SHS Beams 80x80x6.3mm with bolted steel angle connections. The primary frame was lined with 90mm strips of 12.5mm Siniat Weather Defence Board on the outer vertical edge. • Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. The secondary frame was lined with 90mm strips of 12.5mm Siniat Weather Defence Board the outer vertical edges. • Fire side: 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 32/50mm long drywall screws at 300mm centres. • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3). • 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 32/50mm long drywall screws at 300mm centres. • 2no. socket outlets were inserted into the test panel on the both the fire and non-fire sides, fitted to the plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.	I.S. EN 1365-1[59]	REI 90mins from exposed side	1(a), 1(b), 1(c) [1], 1(d), 2(a)[1], 2(b) 3, 4(a), 5(a), 5(b)[1], 7(a)
Load-bearing Separating Walls[3]				
5	**Twin-frame Separating Wall** Fire Test conducted on 3000mm x 3000mm x 127.5mm (w x h x th) panel with total vertical load of 150kN. • Framing Structural Steel - consisting of cold rolled SHS Columns 80x80x5mm, an intermediate SHS Column 80x80x5mm & SHS Beams 80x80x8mm with bolted 90 x 90x8mm steel angle connection. The primary frame was lined with 90mm strips of 12.5mm Gyproc Fireline fillets on the outer vertical edge.	I.S. EN 1365-1[59]	REI 90 mins from either side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b), 7(a)

Type	Element summary description:	Test Standard[+]	Classification	Purpose Group[3]
	• Framing Stud Infill Panels – consisting of Light Gauge Steel 89x45x1.2mm Channels at nominal 600mm centres with noggins at mid-height. The secondary frame was lined with 90mm strips of 12.5mm Gyproc Fireline Type F plasterboard the outer vertical edges. • Fire side: 2no. layers of 12.5mm Gyproc Fireline Type F plasterboard fixed using 35mm long drywall screws at 300mm centres. • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3). • Single layer of 12.5mm Glasroc X gypsum board fixed to LGS using 25mm long Glasroc X screws at 300mm centres. • Two double sockets were included on the fire side. • Single frame build-up as described and tested is mirrored across a 50mm cavity.			
6	Fire Test conducted on 3000mm x 3000mm x 265mm (w x h x th) twin-frame panel • 2no. LGS frames consisting of 6no. 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. A 40mm cavity between LGS frames. 25mm deflection head. • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3) between studs in both LGS panels. • Fire side: 1no. layer of 12.5mm Gyproc Fireline Type F plasterboard fixed using 41mm long drywall screws at 300mm centres. • 1no. layer of 11mm OSB Board fixed using 41mm long drywall screws at 300mm centres. • Non-fire side: 1no. layer of 11mm OSB Board fixed to LGS studs using 41mm long drywall screws at 300mm centres. • 1no. layer of 12.5mm Gyproc Fireline Type F fixed using 41mm long drywall screws at 300mm centres. • 40mm cavity between LGS frames. • 2no. socket outlets were inserted into the test panel on the both the fire and non-fire sides, fitted to the plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.	I.S. EN 1364-1[58]	EI 60 mins from either side	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3, 4(a), 5(a), 5(b), 7(a)
7	Fire Test conducted on 3000mm x 3000mm x 136mm (w x h x th) panel • LGS frame consisting of 6no. 89x45x1.0mm Channels at nominal 600mm centres with noggins at mid-height. 25mm deflection head. • Fire side: 1no. layer of 12.5mm Gyproc Fireline Type F plasterboard fixed to LGS through OSB3 using 41mm long drywall screws at 300mm centres, taped and jointed finish on • 1no. layer of 11mm OSB3 Board fixed to LGS using 41mm long drywall screws at 300mm centres. • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3). • 1no. layer of 11mm OSB Board fixed to LGS using 41mm long drywall screws at 300mm centres. • 1no. layer of 12.5mm Gyproc Fireline Type F plasterboard fixed to LGS through OSB3 using 41mm long drywall screws at 300mm centres, taped and jointed. • 2no. socket outlets were inserted into the test panel on the both the fire and non-fire sides, fitted to the	I.S. EN 1364-1[58]	EI 60mins from exposed side	1(a), 1(b), 1(c),1(d), 2(a), 2(b), 3, 4(a), 5(a), 5(b), 7(a)

Type	Element summary description:	Test Standard[+]	Classification	Purpose Group[3]
	plasterboard. Intumescent Putty Pads were **NOT** installed to the test specimen.			
Intermediate Floor[3]				
8	Floor Supporting an imposed load of 6.48kN/m^2 • Test conducted on 2980mm x 4280mm x 359mm (w x h x th) floor with load applied of 6.48 kN/m^2 • Fire side: 1no. layers of 15mm Gyproc Fireline Type F plasterboard fixed to • 25mm LGS top hats at 400mm centres running perpendicular to joists • 300 x 65 x 2.0mm LGS C-joists at truss at 600mm centres • 100mm Stone mineral wool (density 22kg/m^3) fitted between joists • 18mm thick OSB3 board floor decking	I.S. EN 1365-2[60]	REI 30 mins from below ceiling level	1(a), 1(b), 1(c) 2(b), 3, 4(a), 5(a) 5(b)
Compartment floors[3]				
9[1]	Floor supporting a Uniformly Distributed Load of 1.79kN/m^2 • Test & Assessment conducted on 4280mm long x 2950mm wide x 373mm floor cassette. Consult fire test report for noggin details. • Fire side: 2No. layers of 12.5mm Gyproc Fireline Type Plasterboard fixed using 3.5 x 25/41 mm (Ø x L) screws at 150mm centres at perimeter of boards and 230mm centres in field of boards. • 25mm LGS top hat profiles at 400mm centres. • Ceiling frame: Light gauge steel cassette of 8 No. 89x41x1.2mm C-section profiles at nominal 600mm centres fitted in HRS frame of 150x90mm (24kg/m) PFC. • Stud cavity insulation, 100mm thick stone mineral wool Insulation (Density - 22kg/m^3) in ceiling joists. • 35mm 0.7mm gauge trapezoidal roof sheet[2]. • Cavity between ceiling and floor cassette ranging 28-60mm varying across profiled roof sheet. • Floor frame: Light gauge steel cassette of 9 No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted between edge spanning HRS 150x90mm (24kg/m) PFC. C-section LGS Noggins staggered at midspan. • Non-fire side: 1No. layer of 22mm **OSB3/** 22mm cement particle board/ 28mm gypsum fibre board to LGS joists with 41mm screws at 300mm centres	I.S. EN 1365-2[60]	REI 60 mins from below ceiling level	1(a), 1(b), 1(c) 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b)
10[1]	Floor supporting a Uniformly Distributed Load of **0.78kN/m^2** • Test conducted on 4280mm long x 2950mm wide x 423mm floor cassette. Consult fire test report for noggin details. • Exposed side: 2No. layers of 12.5mm Gyproc Fireline Type Plasterboard fixed using 3.5 x 25/41 mm (Ø x L) screws at 150mm centres at perimeter of boards and 230mm centres in field of boards. • 25mm LGS top hat profiles at 400mm centres. • Ceiling frame: Light gauge steel cassette of 6No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted in HRS frame of 200x90mm (30kg/m) PFC. • Stud cavity insulation, 100mm thick stone mineral wool Insulation (Density - 22kg/m^3) in ceiling joists. • 35mm 0.7mm gauge trapezoidal roof sheet[2].	I.S. EN 1365-2[60]	REI 60 mins from below ceiling level	1(a), 1(b), 1(c) 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b)

Type	Element summary description:	Test Standard+	Classification	Purpose Group[3]
	• Cavity between ceiling and floor cassette ranging 17-49mm varying across profiled roof sheet. • Floor frame: Light gauge steel cassette of 6No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted between edge spanning HRS 150x90mm (24kg/m) PFC. • Non-fire side: 1No. layer of 22mm **OSB3/** 22mm cement particle board/ 28mm gypsum fibre board fixed to LGS joists with 41mm screws at 300mm centres.			
11[1]	Floor supporting a Uniformly Distributed Load of **1.75kN/m²** • Test conducted on 4184mm long x 3184mm wide x 480mm floor cassette. Consult fire test report for noggin details. • Exposed side: 2No. layers of 15mm Gyproc Fireline Type Plasterboard fixed using 3.5 x 25/41 mm (Ø x L) screws at 150mm centres at perimeter of boards and 230mm centres in field of boards • 25mm LGS top hat profiles at 400mm centres • Ceiling frame: Light gauge steel cassette of 11No. 150x45x1.2mm C-section profiles at nominal 400mm centres • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m³) in ceiling joists • 12mm Cement Particle Board on non-fire side of ceiling cassette • Cavity between ceiling and floor cassette created by 125mm spacer LGS cassette assembled from 89x45x1.2mm LGS C Sections with 2no. layers of 15mm Gyproc Fireline fixed to inner face • Floor frame: Light gauge steel cassette of 8No. pairs of back-to-back 150x45x1.5mm C-section profiles at nominal 400mm centres • Non-fire side: 1No. layer of 18mm **WBP** fixed to LGS joists with 41mm screws at 300mm centres within felid of board and at 150mm centres at board perimeters	I.S. EN 1365-2[60]	REI 60 mins from below ceiling level	1(a), 1(b), 1(c) 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b)
12[1]	Floor supporting a Uniformly Distributed Load of **1.79kN/m²** • Test & Assessment conducted on 4280mm long x 2950mm wide x 373mm floor cassette. Consult fire test report for noggin details. • Exposed side: 2No. layers of 12.5mm Gyproc Fireline Type Plasterboard fixed using 3.5 x 25/41 mm (Ø x L) screws at 150mm centres at perimeter of boards and 230mm centres in field of boards • 25mm LGS top hat profiles at 400mm centres • Ceiling frame: Light gauge steel cassette of 8 No. 89x41x1.2mm C-section profiles at nominal 600mm centres fitted in HRS frame of 150x90mm(24kg/m) PFC • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m³) in ceiling joists • 35mm 0.7mm gauge trapezoidal roof sheet[2] • Cavity between ceiling and floor cassette 28-60mm • Floor frame: Light gauge steel cassette of 9 No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted between edge spanning HRS 150x90mm (24kg/m) PFC • Non-fire side: Lewis profiled metal deck with 50-60mm cement screed or anhydrite lightweight screed	I.S. EN 1365-2[60]	REI 60 mins from below ceiling level	1(a), 1(b), 1(c) 1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b)
13[1]	Floor supporting a Uniformly Distributed Load of **0.78kN/m²**	I.S. EN 1365-2[60]	REI 60 mins from below ceiling level	1(a), 1(b), 1(c)

Type	Element summary description:	Test Standard+	Classification	Purpose Group[3]
	• Test conducted on 4280mm long x 2950mm wide x 423mm floor cassette • Exposed side: 2No. layers of 12.5mm Gyproc Fireline Type Plasterboard fixed using 3.5 x 25/41 mm (Ø x L) screws at 150mm centres at perimeter of boards and 230mm centres in field of boards • 25mm LGS top hat profiles at 400mm centres • Ceiling frame: Light gauge steel cassette of 6No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted in HRS frame of 200x90mm (30kg/m) PFC • Stud cavity insulation, 100mm thick Stone mineral wool Insulation (Density - 22kg/m^3) in ceiling joists • 35mm 0.7mm gauge trapezoidal roof sheet[2] • Cavity between ceiling and floor cassette 17-49mm • Floor frame: Light gauge steel cassette of 6No. 150x45x1.2mm C-section profiles at nominal 600mm centres fitted between edge spanning HRS 150x90mm (24kg/m) PFC • Non-fire side: Lewis profiled metal deck with 50-60mm cement screed or anhydrite lightweight screed			1(d), 2(a), 2(b) 3, 4(a), 5(a), 5(b)

Notes:

The above build-ups are summaries of those tested to the referenced standards and assessed as part of the Agrément certification process – they should not be taken as an exhaustive list. For full details of test reports and assessments, the Certificate Holder should be contacted.

Fire performance of elements to be determined on a project-specific basis and in accordance with TGDs[2][3] to Part B for purpose group, building height and layout.

For alternative approaches to fire safety requirements, refer to TGDs to Part B of the Irish Building Regulations.

In situations where there is no fire requirement for non-loadbearing walls, alternative non-loadbearing wall boarding specifications may be used once they have been agreed and signed-off by Vision Built Structures Limited, provided the boarding supplier has supplied supporting fire test data.

In situations where the element continues to have a fire and/or load bearing performance requirement, any change to the build-up or materials of the test specimen requires that the specimen fire performance is verified by fire testing to relevant EN standard or by technical assessment by a suitably qualified competent professional in accordance with I.S. EN 15725[35] and I.S. CEN/TS 15117[36].

Type F plasterboard refers to the particular type of plasterboard tested in the respective fire tests to I.S. EN 520[32] and the details are available directly from Vision Built Structures Limited.

Stone mineral wool refers to the particular type and density of stone mineral wool used in a particular fire test and the details are available directly from Vision Built Structures Limited.

BS and I.S. versions of EN standards listed in this table have been confirmed as currently equivalent, at time of issue of this certificate, through i2i Platform.

Fire performance of elements to be determined on a project-specific basis and in accordance with TGDs[2][3] to Part B for purpose group, building height and layout.

* Non-load bearing wall fire resistance data is provided from the load bearing data and may be utilised under the Field of Direct Application whereby the load may be decreased on the specimen.

1 All materials to have a fire classification to EN 13501-1[16] of Class A2-s3, d2, where used in buildings:

- of purpose groups 1c, 2a, 2b or 5 where the topmost storey is above 11m, as per table 19 of TGD B[2] Vol.1, 2024.
- compartment walls for purpose group 2(a)
- in any purpose group where the topmost storey is above 11m for compartment floors and walls

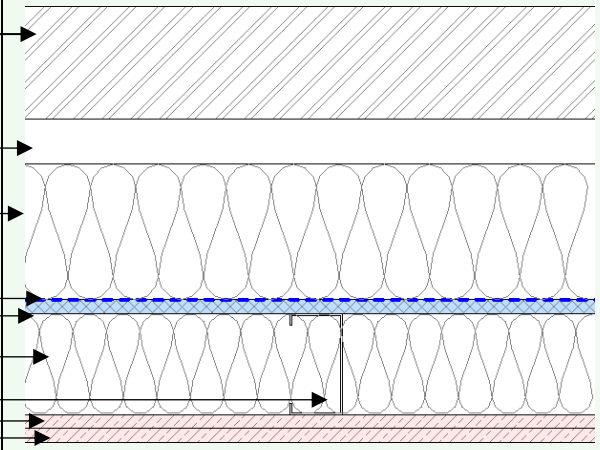
2 A coating to the steel trapezoidal sheet with a Class A1 rating to EN 13501-1[16] is available for use where all materials in the floor build up are required to have a fire classification to EN 13501-1[16] of Class A2-s3, d2, as per note 1 above.

3 Design to be dictated by project-specific loading requirements on a case-by-case basis to meet the requirements of Part B of the Building Regulations, not exceeding test specimen load

Table 4: Sample U-value Calculation for External wall with masonry outer leaf

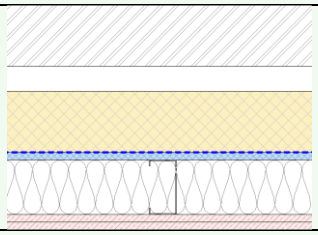
Wall build-up (non-combustible):

Layer 1: Masonry outer leaf
Layer 2: 50mm Cavity
Layer 3: 125mm Rockwool Duo
Layer 4: AVPM layer
Layer 5: 12.5mm Glasroc X Sheathing Board
Layer 6: 100mm Mineral Wool (0.044 W/m.K)
Layer 6: 1.2mm gauge Steel C section stud
Layer 7: 15mm Plasterboard
Layer 8: 15mm Plasterboard



Layer	Description	% Bridged	Thickness [mm]	Thermal conductivity **λ** [W/m.K]	Thermal resistance **R** [W/m²K]
	R_{se}				0.040
1	Brick outer leaf		102.5	0.770	0.134
2	Cavity- unventilated		50	R-value	0.180
3	Rockwool Duo		125	0.035	3.571
4	AVPM Layer				-
5	Glasroc X		12.5	0.190	0.66
6	Stone mineral wool	0.003	100	0.044	2.273
	Steel Stud (@ 400mm c/c)				
7	Type F plasterboard		15	0.240	0.063
8	Type F plasterboard		15	0.240	0.063
	R_{si}				0.130

	Ru Total =	6.508	
	RL Total =	7.762	
From BRE Digest 465[62]	P = 0.565, $R_T = pR_{max} + (1-p)R_{min}$ =	5.749	
nf = 3No./m², Af = 12.5mm², λ_{fixing} = 17 W/m.K	Correction term, ΔU =	0.002	
	Corrected U-Value =	**0.174**	W/m²K
	Corrected U-Value (rounded) =	**0.17**	W/m²K

Replacement of the 125mm Rockwool Duo with **100mm PIR** Insulation (0.022 W/m.K)	**U-value: 0.15 W/m²K**	

Notes:
Calculation complies with BRE Digest 443[63] Conventions for U-value calculation and BRE Digest 465[62] U-values for light steel-frame construction.

Airgap corrections used in the calculation is level 0, i.e. there is no air void within the insulation or only minor air voids (not exceeding 5mm) are present.

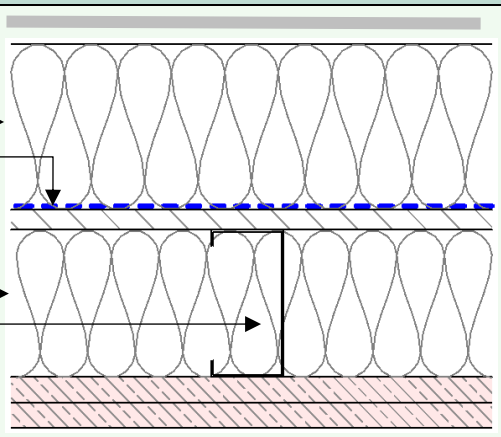
Wall ties used in the calculation are stainless steel wall ties, 3no. recurring per m² and cross sectional are of 12.5mm²

Calculation based on steel studs with 1.2mm gauge at 400mm centres.

Table 5: Sample U-value Calculation for External wall with rainscreen cladding

Wall build-up:

Layer 0: Rainscreen cladding with drained+ventilated cavity
Layer 1: 180mm Rockwool Duo Slab Insulation
Layer 2: AVPM layer
Layer 3: 12.5mm Glasroc X Sheathing Board
Layer 4: 100mm Mineral Wool (0.035 W/m.K)
Layer 4: 1.2mm gauge Steel C section stud
Layer 5: 15mm Plasterboard
Layer 6: 15mm Plasterboard



Layer	Description	% Bridged	Thickness [mm]	Thermal conductivity **λ** [W/m.K]	Thermal resistance **R** [W/m²K]
	R_{se}				0.040
1	Rockwool Duo Slab		180	0.035	5.143
2	AVPM Layer				-
3	Glasroc X		12.5	0.190	0.66
4	Stone Mineral wool	0.003	100	0.044	2.273
	Steel Stud (@ 400mm c/c)				
5	Type F plasterboard		15	0.240	0.063
6	Type F plasterboard		15	0.240	0.063
	R_{si}				0.130

	Ru Total =	7.767	
	RL Total =	6.019	
From BRE Digest 465[62]	P = 0.600, $R_T = pR_{max} + (1-p)R_{min}$ =	7.068	
nf = 3No./m², Af = 12.5mm², λ_{fixing} = 17 W/m.K, nb =3No./m², λbrackets = 0.01 W/m.K,	Correction term, ΔU =	0.032	
	Corrected U-Value =	**0.173**	W/m²K
	Corrected U-Value (rounded) =	**0.17**	W/m²K

Notes:

Calculation complies with BRE Digest 443[63] Conventions for U-value calculation and BRE Digest 465[62] U-values for light steel-frame construction.

Airgap corrections used in the calculation is level 0, i.e. there is no air void within the insulation or only minor air voids (not exceeding 5mm) are present.

Wall ties used in the calculation are stainless steel wall ties, 3no. recurring per m² and cross sectional are of 12.5mm²

Calculation based on steel studs with 1.2mm gauge at 400mm centres.

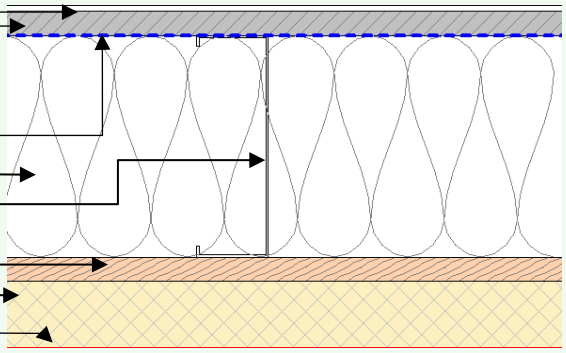
Calculation accounts for 3no. aluminium rainscreen brackets per m²

Point loss for the rainscreen brackets are provided by the manufacturer.

Table 6: Sample U-value Calculation for Ground Floor with CPB

Floor build-up:

Layer 1: 5mm optional levelling compound
Layer 2: 22mm Cement Particle Board
Layer 3: AVCL Layer
Layer 4a: 150mm stone mineral wool
Layer 4b: 150 x 45x1.5mm LGS C section joist
Layer 5: Treated timber cross battens
Layer 6: 60mm PIR Insulation
Layer 7: Rodent mesh/metal lining



Layer	Description	Thickness [mm]	Thermal conductivity λ [W/m.K]	λ Bridge [W/m.K]	% Bridge	Thermal resistance **R** [W/m²K]	R Bridge
	R_{si}					0.170	
1	Optional levelling compound	5	1.150			0.004	
2	T&G Cement Particle Board	22	0.350			0.063	
3	AVCL Layer	-	-			-	
4a	Stone Mineral Wool	150	0.044			3.409	
4b	Steel C-Joists (@ 400mm c/c)	150 x 50		50	0.00375	-	0.0030
5	Timber cross battens	22	0.130			0.169	
6	PIR Insulation	60	0.022			2.727	
7	Rodent Mesh/Metal lining	10	50				
	R_{su}					0.170	

	Ru Total =	6.687
	RL Total =	3.952
From BRE Digest 465[62]	P = 0.433, $R_T = pR_{max} + (1 - p)R_{min}$ =	5.136
No fixings	Correction term, ΔU =	0.000
	U-Value =	**0.195** W/m²K

Ground Parameters

Perimeter (P)	1.000m	Ground Type- Sand Gravel Λ	2.0 W/m.k
Area (A)	4.00m²	Rse	0.04 m²K/W
P/A=	0.250	Resistance on solum Rg	0.000 m²K/W
Depth of underfloor space (below ground)	0.150m	Mean wind speed	5.00 m/s
Floor height (above ground)	0.22m	Wind Shielding factor	0.050
U-value of walls above ground	0.18W/m²K	Ventilation openings per meter length	0.0015m²/m
Wall thickness	0.300m		

U-value for ground (Ug)	0.554	
U-value for floor deck (Uf)	0.195	
Ventilation equivalent U-value (Ux)	0.069	
Corrected U-Value =	**0.15**	W/m²K

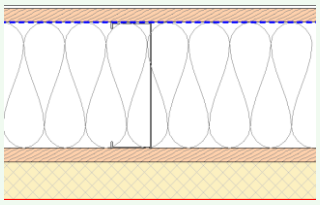
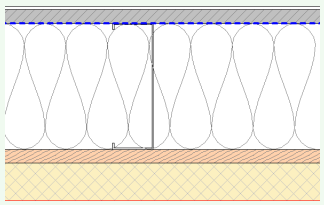
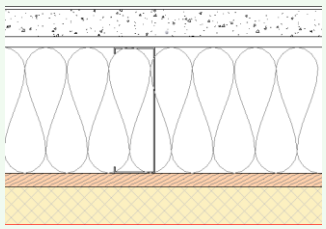
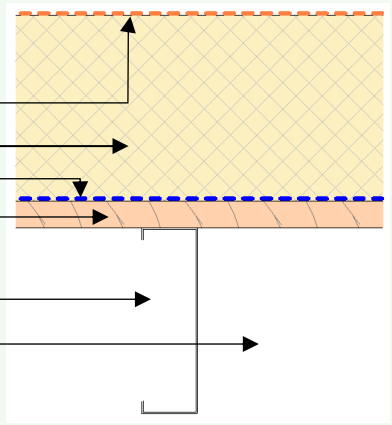
As per calculation above except for replacement of the 22mm FCB deck with **22mm OSB** (0.13 W/m.K) (calculated without infill stone mineral wool insulation)	**U-value** **0.15 W/m²K**	
As per calculation above except for deeper joists, **180mm Rockwool Rollbat between 180mm C-Joists** (0.44 W/m.K) and 65mm PIR below.	**U-value** **0.15 W/m²K**	
As per calculation above except for replacement of the 22mm OSB deck with **0.5mm gauge 16mm Lewis deck composite floor with 50mm C25 concrete screed, 150mm C-joists at 600mm c/c**	**U-value** **0.15 W/m²K**	
Notes: Calculation complies with BRE Digest 443[63] Conventions for U-value calculation, BRE Digest 465[62] U-values for light steel-frame construction and I.S. EN ISO 13370[71]. Calculation based on 150 x 45 x 1.5mm steel C- section joists at 400mm centres, unless stated otherwise. Perimeter ratio of 1:4 assumed in calculations.		

Table 7: Sample U-value Calculation for Volumetric Flat Roof

Wall build-up:
Layer 1: Flat roof PVC membrane
Layer 2: 150mm foil-faced PIR Insulation
Layer 3: AVCL Layer
Layer 4: 18mm WBP plywood
Layer 5: Unventilated cavity
Layer 8: 150 x 45x1.5mm LGS C section joist



Layer	Description	% Bridged	Thickness [mm]	Thermal conductivity λ [W/m.K]	Thermal resistance **R** [W/m²K]
	R_{se}				0.040
1	Roof membrane		1	-	-
2	PIR Insulation		150	0.022	6.818
3	AVCL Layer		-	-	-
4	Plywood deck		18	0.130	0.138
5	Air layer – unventilated	0.00375	150	R-value	0.160
	Steel joists (@ 400mm c/c)				
	R_{si}				0.130

	Ru Total =	7.256	
	RL Total =	7.230	
From BRE Digest 465[62]	P = 0.757, $R_T = pR_{max} + (1 - p)R_{min}$ =	7.250	
No fixings in Layer 2	Correction term, ΔU =	0.000	
	Corrected U-Value =	**0.138**	W/m²K
	Corrected U-Value (rounded) =	**0.14**	W/m²K

Notes:

Calculation complies with BRE Digest 443[63] Conventions for U-value calculation and BRE Digest 465[62] U-values for light steel-frame construction.

Airgap corrections used in the calculation is level 0, i.e. there is no air void within the insulation or only minor air voids (not exceeding 5mm) are present.

Calculation based on 150 x 45 x 1.5mm steel C- section joists at 400mm centres.

Please note: All U-value calculations illustrated in the above and below U-value tables should be taken as examples of performance that may be achieved. It is strongly recommended that U-value calculations are produced on a project-specific basis by a competent person as U-value calculations may increase or decrease depending on a wide range of parameters such as number of fixings per square meter, size of fixing, emissivity of PIR surface facing into cavity, etc. therefore U-values should be recalculated if the build-ups differ from those described in Tables 04-11.

Table 8: Target linear thermal transmittance (ψ) for different types of junctions with external wall with masonry external leaf					
ACD Ref:	**Junction Description**	**Temperature Factor fRsi (Min = 0.75)***	**Vision Ψ-value (W/m.K)**		**TGD L Default Ψ-value (shown for indicative purposes only)**
5.02	External wall with masonry external leaf with Ground Floor - Insulation below, OSB deck	0.77	0.326	>	0.141
5.02	External wall with masonry external leaf with Ground Floor - Insulation below, CPB deck	0.76	0.336	>	0.141
5.03	External wall with masonry external leaf with Intermediate Floor- OSB deck	0.93	0.135	>	0.021
5.03	External wall with masonry external leaf with Intermediate Floor-CPB deck	0.92	0.135	>	0.021
5.03	External wall with masonry external leaf with Intermediate Floor- Lewis deck	0.95	0.186	>	0.021
5.04	External wall with masonry external leaf with Separating Wall (plan)(1)	0.88	0.148	>	0.103
5.05	Unventilated/Ventilated Attic to Separating Wall (section) (1)	0.95	0.055	<	0.520
5.07/ 5.08	External wall with masonry external leaf junction with eaves- Unventilated/Ventilated Attic	0.90	0.122	>	0.030
5.13	External wall with masonry external leaf junction at gable end detail- Unventilated/Ventilated Attic	0.86	0.082	>	0.011
5.19	External wall with masonry external leaf Ope - Lintel	0.91	0.056	>	0.006
5.20	External wall with masonry external leaf Ope – Jambs	0.89	0.066	>	0.023
5.21	External wall with masonry external leaf Ope - Sill	0.91	0.042	>	0.012
5.23.1	External wall with masonry external leaf external corner detail	0.86	0.080	>	0.075
5.23.2	External wall with masonry external leaf internal corner detail	0.97	-0.056	<	-0.045
-	Door Threshold	0.85	0.695	-	-

Notes:

(1) Value of ψ is for whole junction. Half of the value shall be applied to each dwelling on either side.

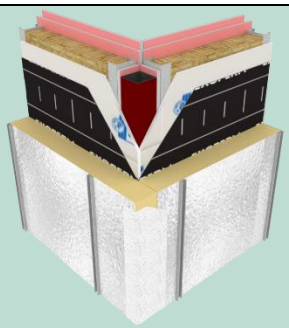
(2) Some ψ-values do not meet the default ψ-values; however, all junctions pass f_{Rsi} assessments.

(3) Flanking element U-values for walls, roof and floor thermal models above were based on U_W = 0.15 W/m^{2}K,U_F = 0.15 W/m^{2}K, U_R = 0.14 W/m^{2}K. Detail 5.04 was based on U_W = 0.12 W/m^{2}K, Detail 5.15 was based on U_W = 0.13 W/m^{2}K, U_R = 0.10 W/m^{2}K.

Modelled junction ψ-values are based on typical Vision Built Volumetric Building System typical details above and may be used in y-value calculations, if relevant detail is applicable.

Table D5 of the current Steel frame Acceptable Construction Details 2021, supplementary to TGD[11] to Part L, default values are shown for indicative purposes only, in the absence of U Value target ranges that correspond to the Vision Built detail set.

* As Per TGD[12] to Part L for Buildings other than dwellings, to limit the risk of surface condensation or mould growth, F_{Rsi} shall be greater than or equal to critical value F_{CRsi}. This critical value depends upon the internal and external environments and applies generally to the whole of the internal surface. For buildings other than dwellings, the F_{Rsi} results must exceed the critical temperature factors provided in Table D1 of TGD to Part L Conservation of Fuel and Energy – Buildings other than Dwellings and Tables 1 and 2 of BRE IP 1/06[18].

Table 9: Target linear thermal transmittance (ψ) for different types of junctions with external wall with rainscreen cladding					
ACD Ref:	**Junction Description**	**Temperature Factor fRsi (Min = 0.75)***	**Vision Ψ-value (W/m.K)**		**TGD L Default Ψ-value (shown for indicative purposes only)**
5.02	Rainscreen external wall junction with Ground Floor - Insulation below, OSB deck	0.79	0.372	>	0.141
5.02	Rainscreen external wall junction with Ground Floor - Insulation below, CPB deck	0.78	0.392	>	0.141
5.03	Rainscreen external wall junction with Intermediate Floor- OSB deck	0.91	0.27	>	0.021
5.03	Rainscreen external wall junction with Intermediate Floor- CPB deck	0.91	0.272	>	0.021
5.03	Rainscreen external wall junction with Intermediate Floor-Lewis deck	0.93	0.306	>	0.021
5.18	Rainscreen external wall junction to flat roof - parapet	0.90	0.161	>	0.093
5.19	Rainscreen external wall Ope - Lintel	0.91	0.124	>	0.006
5.20	Rainscreen external wall Ope – Jambs	0.94	0.036	>	0.023
5.21	Rainscreen external wall Ope - Sill	0.91	0.108	>	0.012
5.23.1	Rainscreen external wall external Corner Detail	0.82	0.161	>	0.075
	Door Threshold	0.85	0.695		

Notes:

(1) Value of ψ is for whole junction. Half of the value shall be applied to each dwelling on either side.

(2) Some ψ-values do not meet the default ψ-values; however, all junctions pass f_{Rsi} assessments.

(3) Flanking element U-values for walls, roof and floor thermal models above were based on U_W = 0.17 W/m^{2}K,U_F = 0.15 W/m^{2}K, U_R = 0.14 W/m^{2}K

Modelled junction ψ-values are based on typical Vision Built Volumetric Building System typical details above and may be used in y-value calculations, if relevant detail is applicable.

Table D5 of the current Steel frame Acceptable Construction Details 2021, supplementary to TGD to Part L, default values are shown for indicative purposes only, in the absence of U Value target ranges that correspond to the Vision Built detail set.

* As Per TGD[12] to Part L for Buildings other than dwellings, to limit the risk of surface condensation or mould growth, FRsi shall be greater than or equal to critical value F_{Rsi}. This critical value depends upon the internal and external environments and applies generally to the whole of the internal surface. For buildings other than dwellings, the FRsi results must exceed the critical temperature factors provided in Table D1 of TGD[12] to Part L Conservation of Fuel and Energy – Buildings other than Dwellings and Tables 1 and 2 of BRE IP 1/06[18].

Table 10: Acoustic Performance Results*				
Separating construction	**Airborne sound insulation DnT,w dB**		**Impact sound insulation L'nT,w dB**	
	Performance Target	**Result**	**Performance Target**	**Result**
Walls (compartment wall as per Table 3, item 05 with service cavity)	≥53dB DnT,w	57-73	N/A	N/A
Walls (Internal loadbearing wall as per Table 4, item 07)	≥45dB DnT,w(1)	45-53	N/A	N/A
Floors (Compartment floor as per Table 3, Item 11)	≥53dB $D_{nT,w}$ dB	57-65	≤58dB $L'_{nT,w}$ dB	46-47

* The results above were obtained from on-site project-specific testing, Results may vary based on project-specific conditions but must always meet or exceed TGD Part E performance requirements.

(1) Department of Education and Youth's requirement for classroom use types as per *SDG 02-05-03: Acoustic Performance in New Primary & Post Primary School Buildings* requirements, Oct 2020[76]

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process/building system and the quality of the materials used in its manufacture and certifies the product/process/building system to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of latest revision so long as:

(a) the specification of the product or building system is unchanged.

(b) the Building Regulations 1997 to 2024 and any other regulation or standard applicable to the product / building system, including processes for its manufacture, installation or use, remain unchanged.

(c) the product / building system continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product / building system continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this Certificate.

(f) the registration and/or surveillance fees due to NSAI are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes/building system in respect of which a valid Certificate exists. If the Certificate becomes invalid, the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process/building system; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process/building system; or

(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product / processes / building system are preconditions to the validity of the Certificate. However, the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act[77], or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **26/0452** is accordingly granted by the NSAI to **Vision Built Structures Limited** on behalf of NSAI Agrément.

Date of Issue: **16 July 2026** (Original Certificate)

Signed

Martin Searson
Head of MMC Certification

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. www.nsai.ie

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END OF SECTION