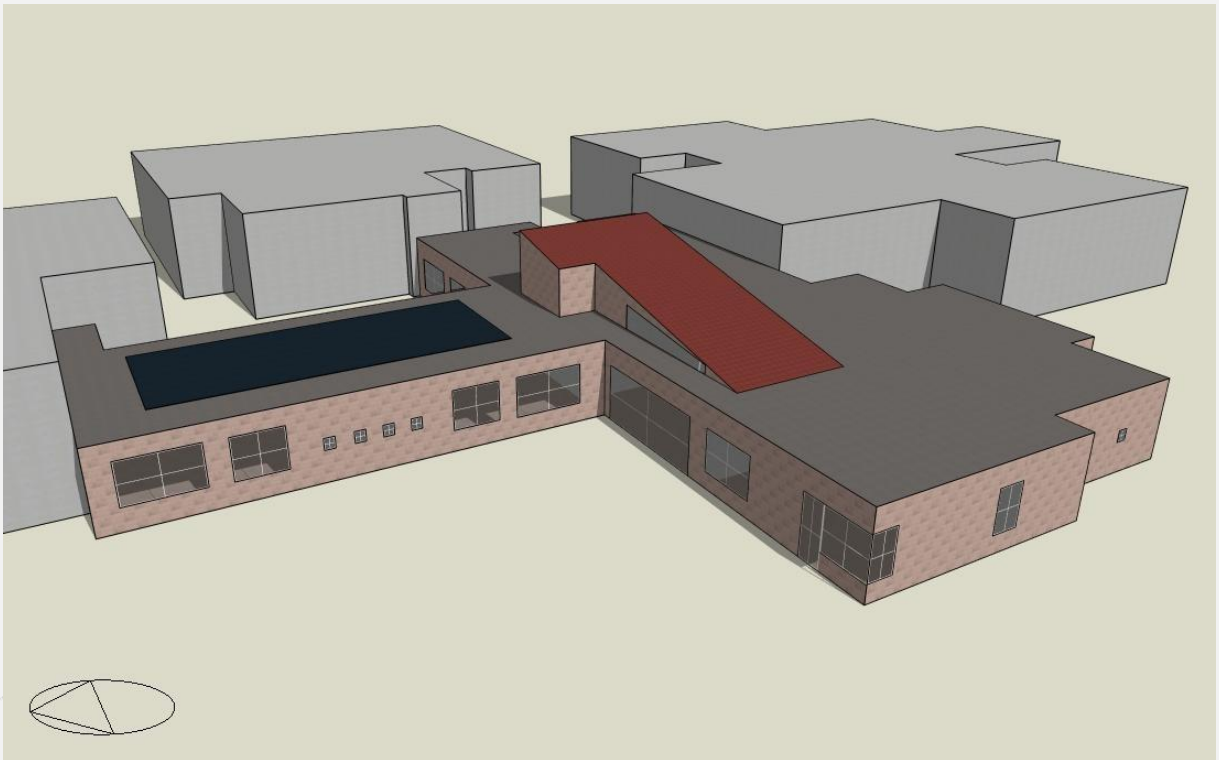




# **GEANEY ENGINEERING CONSULTANTS**

PROFESSIONAL BUILDING SERVICES & ENERGY REDUCTION CONSULTANTS

## ***TGD-033 School Building Projects Part L Compliance Report Overheating Analysis***



***Additional Accommodation Scheme  
Queen of Angels Primary School, Blackthorn Drive, Co.Dublin***

Issue 1  
18<sup>th</sup> August 2025

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## 1.0 Introduction

The purpose of this report is to demonstrate how an A3 BER rating and compliance with Part L of the Building Regulations 2022 can be achieved for the proposed extension at Queen of Angels Primary School, Blackthorn Drive, Co.Dublin.

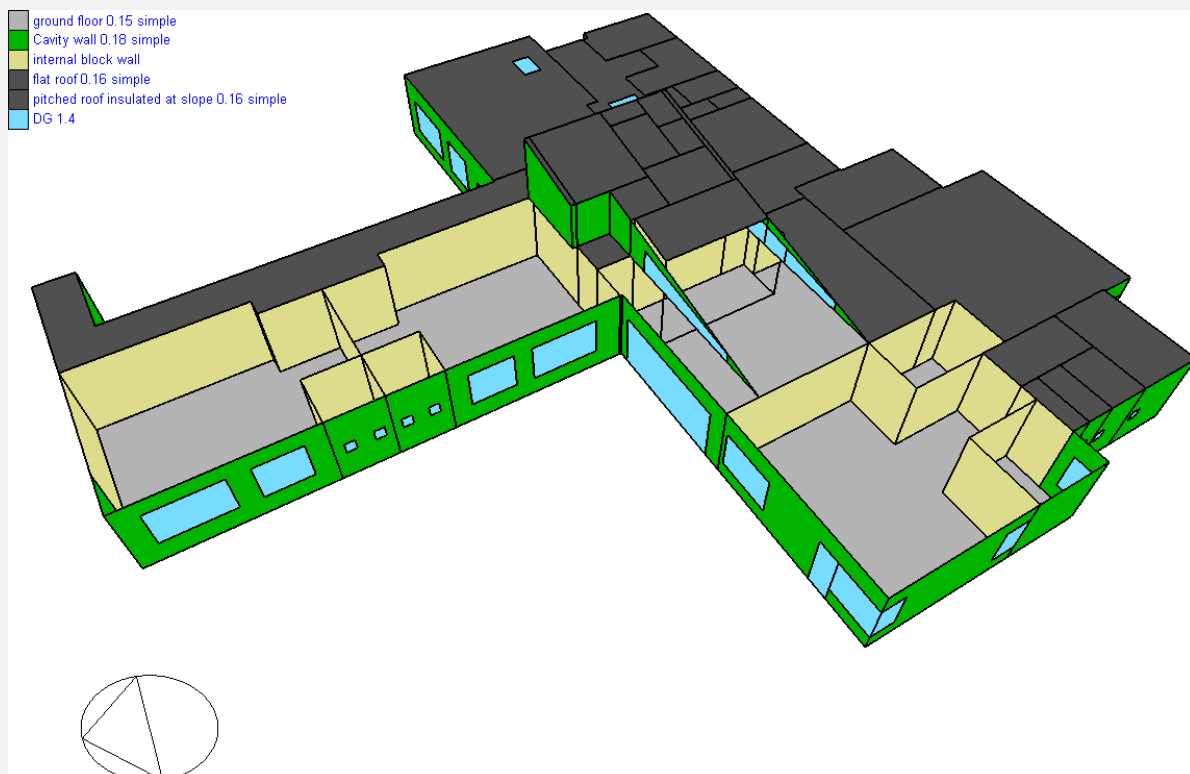
The requirements of the Department of Education & Skills are also followed in this report. The DoES requirements, in some instances, go above and beyond the requirements set out in Part L, i.e. Building Infiltration of  $3\text{m}^3/\text{h}/\text{m}^2$  as opposed to the max allowable of  $5\text{m}^3/\text{h}/\text{m}^2$  as set out in Part L.

The scope of this report is to:

1. Achieve an A3 rating for the extension.
2. Follow the requirements of the Department of Education & Skills.
3. Verify compliance against the Building Regulations Part L 2022; Conservation of Fuel and Energy for extensions to existing buildings.
4. Show agreement with the Overheating Requirements set out in TGD-020, 2017, "General Design Guidelines for Schools Primary and Post Primary Rev 2" and TGD-031 2014 "Amendments to the M&E Building Services Engineering Guidelines (2004) TGD-003 & ICT Infrastructure Guidelines TGD-005 for Post Primary Schools.

DesignBuilder version 6.1.9 has been used to build a 3-dimensional model of the building.

An image of the 3D model is provided in Figure 1.1.



**Figure 1.1: Image of DesignBuilder Model**

## 2.0 Construction

The following values have been used in the simulation and must be adhered to in order to achieve the indicated results.

| Building Element - Extension      | Target U Value (W/m <sup>2</sup> K) |
|-----------------------------------|-------------------------------------|
| Cavity Wall                       | 0.18                                |
| Flat Roof                         | 0.16                                |
| Pitched Roof – Insulated on slope | 0.16                                |
| Ground Floor                      | 0.15                                |
| External Door                     | 1.6                                 |
| Windows & Rooflights              | 1.4 (0.5 g-value, 0.71 light)       |

Table 2.1: Building Element Target U Values

U Values must be calculated as per method specified in I.S. EN ISO 6946: 1997. U-values of components involving heat transfer to the ground, e.g. ground floors with or without floor voids, basement walls, must be calculated by the method specified in ISO 13370:2017.

Cavity Wall U Value 0.18 W/m<sup>2</sup>K can be achieved with 100mm partial fill insulation with a thermal conductivity of 0.022 W/mK.

Flat Roof U Value 0.16 W/m<sup>2</sup>K can be achieved with 130mm insulation board with a thermal conductivity of 0.022W/mK in a warm deck timber flat roof construction.

Pitched Roof – Insulated at slope U Value 0.16 W/m<sup>2</sup>K. U Value can be achieved with 100mm insulation board with a thermal conductivity of 0.022W/mK between the rafters and a 73mm insulated slab with a thermal conductivity of 0.022W/mK.

Ground Floor U Value 0.15 W/m<sup>2</sup>K U can be achieved with 80 mm PIR with a thermal conductivity of 0.022W/mK.

External Floor U Value 0.6 W/m<sup>2</sup>K Refers to the overhang floors which are exposed to the outside. External floor U Value can be achieved with 30mm insulated board with a thermal conductivity of 0.022W/mK.

Glazing Solar & Light Transmittance Values have an impact on the BER & Part L Compliance as higher values will allow more light and solar gain into the space but consequently can cause excess solar gain and contribute to overheating.

## 2.1 Thermal Bridging Values

| Junction                         | W/mK                         |
|----------------------------------|------------------------------|
| Type of junction                 | Not involving metal cladding |
| Roof to wall                     | 0.12                         |
| Wall to ground floor             | 0.16                         |
| Wall to wall (corner)            | 0.09                         |
| Wall to floor (not ground floor) | 0.07                         |
| Lintel above window or door      | 0.30                         |
| Sill below window                | 0.04                         |
| Jamb at window or door           | 0.05                         |

**Table 2.2: Thermal Bridging Details**

Thermal Bridge Values must be as per Acceptable Construction Details (ACD's) as per Appendix B. If there is a deviation from ACDs an NSAI registered thermal modeller will be required to model these junctions to demonstrate the Psi value is equal or better than the values listed above.

Documentary evidence must be provided that demonstrates that the details have been conformed to. This requires that:

- 1) The relevant drawings clearly show the relevant details and that these details are checked and signed off by the developer/builder, site engineer or architect.
- 2) As built Plans/ Sections/ Elevation drawings showing all key junction locations and reference to detailed drawing.

Only the insulated roof panel involves metal cladding in this project. Constructions involving metal cladding are roof or wall systems where metal forms an integral part of the construction, such as metal twin skin systems where the insulation is located between the metal skins and where the metal skins are typically 0.4mm to 1.2mm thick.

Junctions involving metal cladding have higher default thermal bridge values and therefore have a negative effect on the BER so if there are changes and additional metal cladding becomes an option the effects of this must be checked.

## 2.2 Building Infiltration

| Building Infiltration                                          |     |
|----------------------------------------------------------------|-----|
| Air permeability at 50 Pa ( $\text{m}^3/\text{h}/\text{m}^2$ ) | 3.0 |

**Table 2.3: Air permeability target**

Pressure test certificates must be in compliance with I.S. EN ISO 9972: 2015 "Thermal performance of buildings: determination of air permeability of buildings: fan pressurization method" and CIBSE Technical Manual TM23 "Testing Buildings for Air Leakage".

A copy of the pressure test certificate must be provided with the following details:

- address of the building
- date of the pressure test.
- Permeability (air leakage rate in  $\text{m}^3/\text{hr}$  divided by envelope area  $\text{m}^2$  at 50 Pascal pressure difference).

### 3.0 Lighting

| Room                                                        | Lighting Efficacy (lumens/W) | Control Type       |                                     |               |             |                                     |
|-------------------------------------------------------------|------------------------------|--------------------|-------------------------------------|---------------|-------------|-------------------------------------|
|                                                             |                              | Occupancy Controls | Parasitic Power (W/m <sup>2</sup> ) | Photoelectric | Sensor Type | Parasitic Power (W/m <sup>2</sup> ) |
| Circulation, Stores, Shower, Toilets                        | 125                          | Auto-on-off        | 0.1                                 | None          | -           | -                                   |
| Office, Sensory Classroom, Daily Living, Central Activities | 125                          | Manual on/Auto off | 0.1                                 | Yes           | Dimming     | 0.1                                 |
| Quiet Space                                                 | 125                          | -                  | -                                   | -             | -           | -                                   |

**Table 3.1: Lighting Design Table**

**Lighting must have certified luminous efficacy of 125 luminaire lumens/circuit watt as opposed to lamp lumens/circuit watt.**

#### 3.1 Parasitic Power

The parasitic power or the standby power is the power required to operate the lighting controls and detectors.

The parasitic power value must be verified with the following;

As Built electrical lighting drawings and specification marked up to show zones,

Technical data sheets on the lighting controls which clearly state the parasitic/standby power of the sensor.

### 4.0 HVAC

| Room                                                             | HVAC System         | Ventilation Type              | Heat Recovery      | Specific Fan Power (W/l/s) |
|------------------------------------------------------------------|---------------------|-------------------------------|--------------------|----------------------------|
| Sensory Classroom, Daily Living, Central Activities, Quiet Space | Rad central heating | Mechanical with Heat Recovery | 75% Plate Heat Ex. | 1.5                        |
| Circulation, Stores, Office                                      | Rad central heating | Natural                       | -                  | -                          |
| Shower, Toilets                                                  | Rad central heating | Local Mechanical Exhausts     | -                  | 0.3                        |

**Table 4.1: HVAC Table**

#### 4.1 Specific Fan Power

The SFP must be calculated according to EN 16798-3:2017. Performance data must reference test standard EN 16798-3:2017. Design air flow through the system required to calculate the SFP along with input power at design flow rate.

## 4.2 Heat Recovery Seasonal Efficiency

Heat Recovery Performance Data must reference EU/Ecodesign Directive 1253/2014 & Test Standard EN 13141-7 and EN ISO 5801 or EN 13141-8 and EN ISO 5801.

## 4.3 Space Heating/Cooling & HWS

| Heating Plant System                                      | Cooling Plant System | Hot Water System                   |
|-----------------------------------------------------------|----------------------|------------------------------------|
| Heating System 1 - Radiator central heating               | N/A                  | HWS 1 - Heat Pump Air Source       |
| Heat Source 1 - Heat Pump Air Source                      |                      | SCOP - 2.0                         |
| SCOP - 3.1                                                |                      | Fuel Type – Electricity            |
| Fuel Type - Electricity                                   |                      | Storage Loss - 2.0 kWh/day         |
| Heat Source 2 (serves remaining 10%) - Natural Gas Boiler |                      | Secondary Circulation Loss - 8 W/m |
| Seasonal Efficiency - 93%                                 |                      | Loop Length –165 m                 |
| Fuel Type - Nat. Gas                                      |                      | Pump Power - 0.166 kW              |
|                                                           |                      | Time Control – Yes                 |
|                                                           |                      |                                    |

**Table 4.2: Heating, Cooling & HWS Systems**

The chosen heat pump must be compliant with the relevant Ecodesign and Energy Labelling Directive (EU 813/2013 or EU 206/2012 or EU 2016/2281) and have EN 14825 accredited test data in order for the seasonal space heating efficiency to be certified.

The chosen gas boiler(s) must be compliant with EU/Ecodesign Directive 813/2013 and have EN 15502-1:2012 accredited test data in order for the space and hot water heating generator seasonal efficiencies to be certified.

## 4.4 Hot Water Generation, Storage & Distribution

The chosen heat pump must be compliant with the Ecodesign and Energy Labelling Directive and have **EN 16147** accredited test data in order for the water heating energy efficiency to be certified.

The hot water cylinder must have EN 12897:2006 or EN 12977-3: 2012 accredited test data in order for the storage losses to be certified.

If there is HWS secondary circulation, circulation losses (W/m), pump power (kW), loop length (m) & evidence of time control required.

## 4.5 Metering & Controls

Minimum controls packages outlined in tables 3 - 4 below;

In addition to tables 3 - 4, self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building shall also be installed.

| Table 3 Minimum Controls Packages for New Boilers and Multiple Boiler Systems |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Effective Rated Space Heating Output                                          | Package | Minimum Controls                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <70kW                                                                         | A       | Timing and temperature demand control which should be zone specific where the building floor area is greater than 150m <sup>2</sup> .<br><br>Weather compensation except where a constant temperature supply is required.                                                                                                                                                                                                                                                           |
| 70kW to 500kW                                                                 | B       | The BMS should include:<br><br>(a) Controls Package A above.<br>(b) Optimum start/ stop control with either night set-back or frost protection outside occupied periods.<br>(c) Sequence control on multiple boilers to provide efficient part load performance.<br><br>Note: The heat loss from non-firing boiler modules should be limited by design or application. For boilers that do not have low standing losses it may be necessary to install isolation valves or dampers. |
| >500kW individual boilers                                                     | C       | Controls Package A and Controls Package B.<br><br>For gas-fired boilers and multi-stage oil-fired boilers, fully modulating boiler controls.                                                                                                                                                                                                                                                                                                                                        |

| Table 4 Minimum Controls Packages for New Heat Pump Systems                                                                      |                                                                                                       |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heat Source/<br>Sink                                                                                                             | Technology                                                                                            | Minimum Controls Package |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| All types                                                                                                                        | All technologies                                                                                      | A                        | a. On/ off zone controls. If the unit serves a single zone, and for buildings with a floor area of 150m <sup>2</sup> or less, the minimum requirements is achieved by default.<br>b. Time control.                                                                                                                                                                                                                                                                                                                          |
| Air-to-air                                                                                                                       | Single package<br>Split package<br>Multi-split system<br><br>Variable refrigerant<br>flow system      | B                        | a. Controls Package A above.<br>b. Heat pump unit controls for:<br>(i) control of room air temperature (if not provided externally)<br>(ii) control of outdoor fan operation<br>(iii) defrost control of external airside heat exchanger<br>(iv) control for secondary heating (if fitted)<br>c. External room thermostat (if not provided in the heat pump unit) to regulate the space temperature and interlocked with heat pump unit operation.                                                                          |
| Water-to-air                                                                                                                     | Single package<br>energy transfer<br>systems (matching<br>heating/ cooling<br>demanding<br>buildings) | D                        | a. Controls Package A above.<br>b. Heat pump unit controls for:<br>(i) control of room air temperature (if not provided externally)<br>(ii) control of outdoor fan operation for cooling tower or dry cooler (energy transfer systems)<br>(iii) control for secondary heating (if fitted) on air-to-air systems<br>(iv) control of external water pump operation<br>c. External room thermostat (if not provided in the heat pump unit) to regulate the space temperature and interlocked with heat pump unit operation.    |
| Air-to-water<br>Water-to-<br>water<br>Ground-to-<br>water                                                                        | Single package<br>Split package<br><br>Variable refrigerant<br>flow system                            | E                        | a. Controls Package A above.<br>b. Heat pump unit controls for:<br>(i) control of room air temperature (internal and external as appropriate)<br>(ii) control of water temperature for the distribution system<br>(iii) control of outdoor fan operation for air-to-water units<br>(iv) defrost control of external airside heat exchanger for air-to-water systems<br>c. External room thermostat (if not provided in the heat pump unit) to regulate the space temperature and interlocked with heat pump unit operation. |
| Gas-engine-<br>driven heat<br>pumps are<br>currently<br>available only<br>as variable<br>refrigerant<br>flow warm air<br>systems | Multi-split<br><br>Variable refrigerant<br>flow                                                       | F                        | a. Controls Package A above.<br>b. Heat pump unit controls for:<br>(i) control of room air temperature (if not provided externally)<br>(ii) control of outdoor fan operation<br>(iii) defrost control of external airside heat exchanger<br>(iv) control for secondary heating (if fitted)<br>c. External room thermostat (if not provided in the heat pump unit) to regulate the space temperature and interlocked with heat pump unit operation                                                                           |

| Metering Provision                     | System Controls                    |
|----------------------------------------|------------------------------------|
| Provision for Metering – Yes           | Variable Speed Pump - Yes          |
| Alarms for “Out of range” values – Yes | Central Time Control – Yes         |
| Electric Power Factor <0.9             | Optimum Start / Stop Control – Yes |
|                                        | Local Time Control – Yes           |
|                                        | Local Temperature Control – Yes    |
|                                        | Weather Compensation Control - Yes |

Table 4.3: Metering & Controls

#### **4.6 Submetering with Monitoring & Targeting for Heating System**

Required as per DoES Energy Conservation and Mechanical and Electrical Building Services Design Note 2020 01 July 2020. Documentary evidence required demonstrating that the heating system is separately metered. M&T system must have alarm for “Out of Range” values.

#### **4.7 Electric Power Factor**

A power factor of >0.95 can only be used in a new building where there is adequate documentary evidence to support the installation of power factor correction equipment within the building or where a suitably qualified electrical engineer has produced a report detailing the expected power factor for the building.

### **5.0 Photovoltaic**

| Photovoltaic (PV) |                                                           |
|-------------------|-----------------------------------------------------------|
| Type              | 2 kWp PV system facing south 30° tilt (no overshadowing). |

Copies of technical data sheets from manufacturer in compliance with IS EN 61215 or IS EN 61646 are required.

### **6.0 Electric Vehicle Recharging Infrastructure**

For new buildings, where there are more than 10 car parking spaces and where the car park is located inside the building, e.g. a basement car park; or the car park is physically adjacent to the building, i.e. the car park is within the curtilage of the site, electric vehicle recharging installation should be provided. Please see Section 1.4.7 TGD L 2022 for details.

## 7.0 Overheating

TGD L 2022 Section 1.3.6 provides guidance on limiting overheating and lists a number of factors to help reduce or avoid solar overheating; building layout, solar shading, thermal mass, ventilation, reducing internal gains, cooling.

### 7.1 Internal Gains & Setpoints

|                      | Lighting            | People                   | Plug and Process    | Heating Setpoint Temp. | Indoor Min Temp. Control |
|----------------------|---------------------|--------------------------|---------------------|------------------------|--------------------------|
|                      | (W/m <sup>2</sup> ) | (m <sup>2</sup> /person) | (W/m <sup>2</sup> ) | (°C)                   | (°C)                     |
| L0:AMBWC             | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:ASSHOWER          | 7.5                 | 7.07                     | 4.85                | 22                     | 24                       |
| L0:CENTRALACTIVITIES | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:CIRC              | 7.5                 | 9.09                     | 2                   | 15                     | 24                       |
| L0:CLASSROOM1        | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:CLASSROOM2        | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:CLEANERSSTORE     | 7.5                 | 8.26                     | 0                   | 20                     | 22                       |
| L0:DAILYLIVINGSKILLS | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:DCC               | 7.5                 | 10.38                    | 50                  | 20                     | 24                       |
| L0:LOBBY             | 7.5                 | 9.09                     | 2                   | 15                     | 24                       |
| L0:MAINCLASSROOM1    | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:MAINCLASSROOM2    | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:MAINCLASSROOM3    | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:OFFICE            | 7.5                 | 9.71                     | 11.99               | 21                     | 22                       |
| L0:QUIETSPACE1       | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:QUIETSPACE2       | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:RECEPTION         | 7.5                 | 8.66                     | 5.59                | 20                     | 22                       |
| L0:SENSORY           | 7.5                 | 2.44                     | 4.7                 | 18                     | 22                       |
| L0:STAIRS            | 7.5                 | 9.09                     | 2                   | 15                     | 24                       |
| L0:STORE1            | 7.5                 | 8.26                     | 0                   | 20                     | 22                       |
| L0:STORE2            | 7.5                 | 8.26                     | 0                   | 20                     | 22                       |
| L0:STORE3            | 7.5                 | 8.26                     | 0                   | 20                     | 22                       |
| L0:STORE4            | 7.5                 | 8.26                     | 0                   | 20                     | 22                       |
| L0:UAWC              | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:WC1               | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:WC2               | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:WC3               | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:WC4               | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |
| L0:WC5               | 7.5                 | 9.09                     | 5                   | 15                     | 22                       |

|                    |     |       |       |    |    |
|--------------------|-----|-------|-------|----|----|
| L1:AWC             | 7.5 | 9.09  | 5     | 15 | 22 |
| L1:CIRC.           | 7.5 | 9.09  | 2     | 15 | 22 |
| L1:CLASSROOM       | 7.5 | 2.44  | 4.7   | 18 | 22 |
| L1:DCC             | 7.5 | 10.38 | 50    | 20 | 24 |
| L1:GRAPHICSROOM    | 7.5 | 2.44  | 4.7   | 18 | 22 |
| L1:LIFT            | 7.5 | 9.09  | 2     | 15 | 22 |
| L1:MULTIMEDIAROOM  | 7.5 | 2.44  | 4.7   | 18 | 22 |
| L1:MUSICROOM       | 7.5 | 2.44  | 4.7   | 18 | 22 |
| L1:PASTORALOFFICE  | 7.5 | 9.71  | 11.99 | 21 | 22 |
| L1:SR              | 7.5 | 8.26  | 0     | 20 | 22 |
| L1:STAFFWC         | 7.5 | 9.09  | 5     | 15 | 22 |
| L1:STAIRS1         | 7.5 | 9.09  | 2     | 15 | 22 |
| L1:STAIRS2         | 7.5 | 9.09  | 2     | 15 | 22 |
| L1:STUDENTSTOILETS | 7.5 | 9.09  | 5     | 15 | 22 |
| L1:TE.TILEROOM     | 7.5 | 2.44  | 4.7   | 18 | 22 |

Table 7.1: Internal Gains & Setpoints

## 7.2 Weather File

The standard Dublin NCM Weather file was used for the Provisional BER/Part L assessment.

The overheating analysis was carried out using detailed weather data for Dublin. The *DUBLIN-DSY-1995.epw* weather file was used. This file is used to assess overheating as it incorporates high summertime temperatures.

## 8.0 Building Regulations Part L 2022 Results

To comply with Part L of the building regulations, Conservation of Fuel and Energy for buildings other than dwellings, there are performance criteria in terms of limitation of Primary Energy and limitation of Carbon Dioxide (CO<sub>2</sub>) emissions.

Extensions have different criteria to standalone new builds. There is no requirement for an extension to achieve a Maximum Permitted Energy Performance Coefficient (MPEPC) and a Maximum Permitted Carbon Performance Coefficient (MPCPC).

The renewable aspects are also not a TGD Part L requirement when dealing with existing buildings/extensions, therefore photovoltaic provision for a connected extension to an existing school building should be developed only using the base electrical load (typically 2 kW for primary schools and 4kW for post primary schools) as the basis for PV design which is more appropriate in this case, as noted in section 4.8 TGD 033.

The performance criteria for the building fabric and building envelope elements is the same as for a new build in terms of U Value requirements.

### 8.1 Part L Results

#### Heat Transmission through Building Fabric

| Element                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | U <sub>a</sub> -Limit | U <sub>a</sub> -Calc | U <sub>i</sub> -Limit | U <sub>i</sub> -Calc | Surface with maximum U-value*       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|-----------------------|----------------------|-------------------------------------|
| Walls**                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.21                  | 0.18                 | 0.6                   | 0.18                 | L0 - Amb WC_W_4                     |
| Floors (ground and exposed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.21                  | 0.15                 | 0.6                   | 0.15                 | L0 - Amb WC_S_3                     |
| Pitched roofs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.16                  | -                    | 0.3                   | -                    | "No heat loss pitched roofs"        |
| Flat roofs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.2                   | 0.16                 | 0.3                   | 0.16                 | L0 - Daily Living Skills_R_6        |
| Windows, roof windows, and rooflights                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.6                   | 1.4                  | 3                     | 1.4                  | L0 - Amb WC_G_5                     |
| Personnel doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1.6                   | -                    | 3                     | -                    | "No ext. personnel doors"           |
| Vehicle access & similar large doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.5                   | -                    | 3                     | -                    | "No ext. vehicle access doors"      |
| High usage entrance doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                     | -                    | 3                     | -                    | "No ext. high usage entrance doors" |
| U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)]<br>U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)]<br>U <sub>i</sub> -Limit = Limiting individual element U-values [W/(m <sup>2</sup> K)]<br>U <sub>i</sub> -Calc = Calculated individual element U-values [W/(m <sup>2</sup> K)]<br>* There might be more than one surface with the maximum U-value. ** Automatic U-value check by the tool does not apply to curtain walls whose area-weighted average and individual limiting standards are 1.8 and 3 W/m <sup>2</sup> K, respectively. |                       |                      |                       |                      |                                     |

Table 8.1: U Value Results

## 8.2 Indicative BER – School Extension

DesignBuilder SBEM v6.1.9 (SBEMIE v5.6.a.0)

# Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is:

**A3**

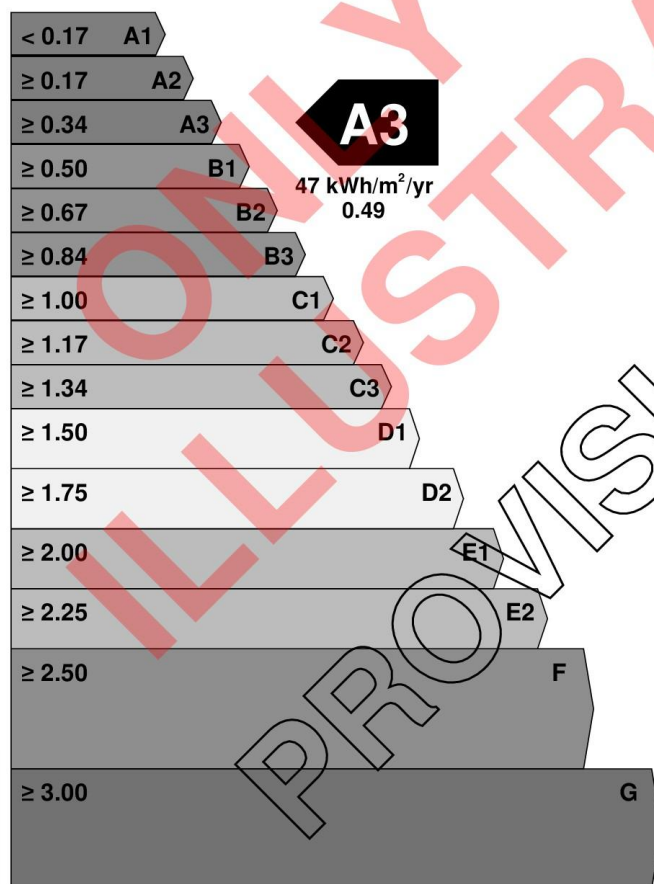
Queens of Angels Primary School  
Blackthorn Drive  
Dublin 16  
D16 AX05

The Building Energy Rating (BER) is an indicator of the energy performance of this building. It covers energy use for space heating and cooling, water heating, ventilation and lighting, calculated on the basis of standard operating patterns. It is accompanied by a CO<sub>2</sub> emissions indicator. These indicators are expressed as respective ratios of primary energy use and CO<sub>2</sub> emissions, relative to what would apply for a similar building generally satisfying the Building Regulations 2005. 'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

BER Number: voidvoidvoid  
Useful Floor Area (m<sup>2</sup>): 783.6  
Main Heating Fuel: Grid Supplied Electricity  
Building Environment: Heating and Mechanical Ventilation  
Building Type: Non-residential Institutions: Primary Education

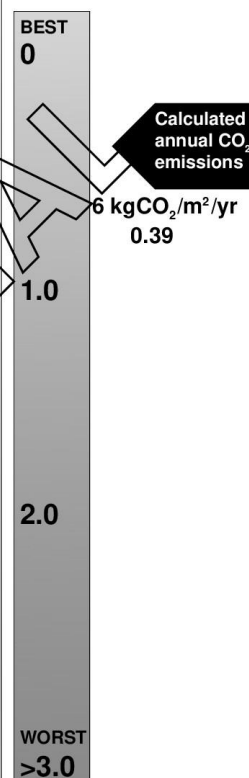
Date of Issue: 18 Aug 2025  
Valid Until: 17 Aug 2027  
BER Assessor No.: 110106  
Assessor Company No.: 105819  
Assessor Scheme: SEAI

Building Energy Rating  
(Indicator)  
MOST EFFICIENT



LEAST EFFICIENT

Carbon Dioxide (CO<sub>2</sub>)  
Emissions Indicator



The less CO<sub>2</sub> produced, the less the building contributes to global warming.

**IMPORTANT:** This provisional BER is calculated on the basis of pre-construction plans and specifications provided to the BER assessor, and using the version of the assessment software quoted above. The BER assigned to this building on completion may be different, in the event of changes to those plans or specifications, or to the assessment software.

## **9.0 Overheating Assessment**

TGD-020, 2017 and TGD-030 2014 set out that; The final window design should ensure that a minimum ventilation rate of 8 litres per second per pupil is provided in the space. This rate will probably need to be higher to achieve the objectives outlined above and to prevent overheating in the space. The resultant dry bulb temperature shall not exceed 25°C for more than 5% of the school year in all habitable rooms and teaching spaces.

A primary school's total annual teaching hours are 1,037 hrs. The absolute maximum hours per annum not to exceed 25°C are 51.85 hrs.

In order to carry out the overheating assessment, natural ventilation openings were applied as per the plans and elevations received.

## 9.1 Overheating Assessment Results

The results of the overheating assessment are shown in table 8.1 in TGD-031 2014 format. Table 8.1 shows the results with an Opening Factor based on 5% floor area, i.e. 5% of the floor area is considered as free area.

Table 9.1: Overheating assessment results – 5% of floor area.

| Room Name            | Floor Area<br>Used for<br>Ventilation<br>Analysis | Total<br>Glazed Area | Total Free Area |     | High Level Free Area |     | Low Level Free Area |     | Total Free area and<br>% based on usable<br>floor area |     | Hours Tres<br>> 25 °C on<br>the school<br>year | % of hours Tres ><br>25C on the<br>school year |
|----------------------|---------------------------------------------------|----------------------|-----------------|-----|----------------------|-----|---------------------|-----|--------------------------------------------------------|-----|------------------------------------------------|------------------------------------------------|
|                      | m <sup>2</sup>                                    | m <sup>2</sup>       | m <sup>2</sup>  | %   | m <sup>2</sup>       | %   | m <sup>2</sup>      | %   | m <sup>2</sup>                                         | %   | Hrs                                            | %                                              |
| L0:CENTRALACTIVITIES | 82.82                                             | 23.46                | 4.14            | 18% | 2.07                 | 50% | 2.07                | 50% | 4.14                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:CLASSROOM1        | 70.98                                             | 13.4                 | 3.55            | 26% | 1.77                 | 50% | 1.77                | 50% | 3.55                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:CLASSROOM2        | 73.66                                             | 14.56                | 3.68            | 25% | 1.84                 | 50% | 1.84                | 50% | 3.68                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:DAILYLIVINGSKILLS | 15.62                                             | 1.4                  | 0.78            | 56% | 0.39                 | 50% | 0.39                | 50% | 0.78                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:MAINCLASSROOM1    | 77.92                                             | 9.36                 | 3.90            | 42% | 1.95                 | 50% | 1.95                | 50% | 3.90                                                   | 5.0 | 1.5                                            | 0.1                                            |
| L0:MAINCLASSROOM2    | 73.38                                             | 8.92                 | 3.67            | 41% | 1.83                 | 50% | 1.83                | 50% | 3.67                                                   | 5.0 | 1.0                                            | 0.1                                            |
| L0:MAINCLASSROOM3    | 72.62                                             | 9.02                 | 3.63            | 40% | 1.82                 | 50% | 1.82                | 50% | 3.63                                                   | 5.0 | 1.5                                            | 0.1                                            |
| L0:OFFICE            | 21.28                                             | 0                    | 1.06            | 0%  | 0.53                 | 50% | 0.53                | 50% | 1.06                                                   | 5.0 | 194.5                                          | 18.8                                           |
| L0:QUIETSPACE1       | 13.27                                             | 0                    | 0.66            | 0%  | 0.33                 | 50% | 0.33                | 50% | 0.66                                                   | 5.0 | 165.0                                          | 15.9                                           |
| L0:QUIETSPACE2       | 12.23                                             | 1.85                 | 0.61            | 33% | 0.31                 | 50% | 0.31                | 50% | 0.61                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:RECEPTION         | 13.95                                             | 2.53                 | 0.70            | 28% | 0.35                 | 50% | 0.35                | 50% | 0.70                                                   | 5.0 | 0.0                                            | 0.0                                            |
| L0:SENSORY           | 20.82                                             | 0                    | 1.04            | 0%  | 0.52                 | 50% | 0.52                | 50% | 1.04                                                   | 5.0 | 250.0                                          | 24.1                                           |

Table 9.1: Overheating assessment results – 5% of floor area.

Table 9.2 shows the results in SEN Office, Quiet Space 1, and Sensory Room when mechanical ventilation has been added. A mechanical ventilation rate of 8 l/s per person has been applied. This equates to 17.53 l/s for the Office, 43.51 l/s for Quiet Space 1, and 68.26 l/s for the Sensory Room based on the occupancy.

| Room Name      | Floor Area<br>Used for<br>Ventilation<br>Analysis | Total Glazed<br>Area | Total Free Area |    | High Level Free<br>Area |     | Low Level Free<br>Area |     | Total Free area<br>and % based on<br>usable floor area |     | Hours Tres<br>> 25 °C on<br>the school<br>year | % of hours<br>Tres > 25C<br>on the<br>school year |
|----------------|---------------------------------------------------|----------------------|-----------------|----|-------------------------|-----|------------------------|-----|--------------------------------------------------------|-----|------------------------------------------------|---------------------------------------------------|
|                | m <sup>2</sup>                                    | m <sup>2</sup>       | m <sup>2</sup>  | %  | m <sup>2</sup>          | %   | m <sup>2</sup>         | %   | m <sup>2</sup>                                         | %   | Hrs                                            | %                                                 |
| L0:SEN OFFICE  | 21.28                                             | 0                    | 1.06            | 0% | 0.53                    | 50% | 0.53                   | 50% | 1.06                                                   | 5.0 | 25.0                                           | 2.4                                               |
| L0:QUIETSPACE1 | 13.27                                             | 0                    | 0.66            | 0% | 0.33                    | 50% | 0.33                   | 50% | 0.66                                                   | 5.0 | 7.0                                            | 0.7                                               |
| L0:SENSORY     | 20.82                                             | 0                    | 1.04            | 0% | 0.52                    | 50% | 0.52                   | 50% | 1.04                                                   | 5.0 | 6.5                                            | 0.6                                               |

## 10.0 Conclusion & Recommendations

In terms of verifying compliance against the Building Regulations Part L 2022; Conservation of Fuel and Energy.

An Air Source Heat Pump with a SCOP of 3.1 serving 90% of the heating load with a backup gas boiler (minimum seasonal efficiency 93%) serving the remaining 10%, hot water from heat pump with minimum hot water heating SCOP of 2.0 along with the other values outlined previously in the report, will achieve both compliance with Part L and an A3 rating.

A Final BER cert may be required once the building is complete. We are required to provide documentary evidence for each value used when processing the BER. Acceptable documentary evidence as outlined by SEAI is summarised in Appendix A.

**Please note that this is a very specific guide, and any changes need to be checked to ensure compliance is still being achieved and BER rating is still on track. The space heating and hot water systems outlined in this report must be checked and approved by the mechanical consultant and the assigned certifier.**

In terms of showing agreement with the Overheating Requirements set out in TGD-020 2017 and TGD-031 2014. The dry resultant temperature does not exceed 25°C for more than 5% of the occupied time in teaching spaces or habitable rooms that have windows with when a free area equivalent to 5% of the floor area is applied. The SEN Office, Quiet Space 1 and the Sensory Room don't have windows so requires mechanical ventilation. A mechanical ventilation rate of 17.53 l/s, 43.51 l/s, and 68.26 l/s for the SEN Office, Quiet Space, and Sensory Room have been applied respectively. This is based on the default rate of 8 l/s per person.

## 11.0 Appendices

### 11.1 BER Check List

| <u>Element or System</u>               | <u>Details Required</u>                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Element                   | <b>As built</b> drawings showing the makeup of walls, floors & roofs including the insulation type & thickness OR copies of invoices detailing the work. ( <i>drawings must be marked as built</i> )                                                                                                                                                                                                                                          |
| Thermal bridges                        | If Acceptable Construction Details have been conformed to, the relevant drawings must clearly show the relevant details and these details must be checked and signed off by the developer/builder, site engineer or architect. As built drawings must show all key junctions and reference detailed drawings.                                                                                                                                 |
| Windows and Doors                      | Provide details of the window and door manufacturer and model and ensure they can provide a test cert outlining the U-value, Solar Transmittance & Light Transmittance values in line with the values specified                                                                                                                                                                                                                               |
| Building Infiltration                  | A copy of the pressure test certificate must be provided with the details as outlined previously                                                                                                                                                                                                                                                                                                                                              |
| Power Factor                           | Detail of installed power factor correction equipment or a signed report from a suitably qualified electrical engineer detailing the expected power factor for the building                                                                                                                                                                                                                                                                   |
| Heating System(s)                      | Copy of as built HVAC drawings & specs and copy of technical details from O&M manuals with the details as outlined previously                                                                                                                                                                                                                                                                                                                 |
| Hot Water System(s)                    | Copy of as built HVAC drawings & specs and copy of technical details from O&M manuals with the details as outlined previously                                                                                                                                                                                                                                                                                                                 |
| Mechanical Ventilation & Heat Recovery | Copy of as built mechanical drawings & specs and copy of technical details from O&M manuals with the details as outlined previously                                                                                                                                                                                                                                                                                                           |
| Local Mechanical Exhaust               | Copy of as built mechanical drawings & specs and copy of technical details from O&M manuals with the details as outlined previously                                                                                                                                                                                                                                                                                                           |
| Lighting                               | For full lighting design option there must be a signed statement from a suitably qualified consultant responsible for the lighting design showing the installed power and installed illuminance for each of the zones OR where full lighting design not available, as built electrical lighting layout drawing with manufacturers data sheets for each lighting type including luminaire efficacy (luminaire lumens per circuit watt (lm/cw)) |

|                   |                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Lighting Controls | As built electrical lighting drawings & specs & technical data sheets on the lighting controls from Operational and Maintenance manuals. |
| Photovoltaic      | Copies of technical data sheets from manufacturer in compliance with IS EN 61215 or IS EN 61646                                          |

## 11.2 Sample Thermal Bridge Free Details

The following is an example of how to meet the Acceptable construction details. All details need to be approved by the engineer and photographs taken of each junction. When the job is complete the engineer will sign off on each junction as built in accordance with the acceptable construction details.

| (1) WALLS:- INSULATION IN CAVITY                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ground Floor - Insulation Below Slab                                                                                                                                                                                                                                                                                                                                                                                         | DETAIL 1.02a, 2011 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <p><b>THERMAL PERFORMANCE</b><br/>CHECKLIST<br/>(TICK ALL)</p> <p>Ensure partial fill insulation is secured firmly against inner leaf of cavity wall <input type="checkbox"/></p> <p>Install perimeter insulation with a min. R-value of 1.0 m<sup>2</sup> K/W <input type="checkbox"/></p> <p>Floor insulation to tightly abut blockwork wall <input type="checkbox"/></p> <p>Ensure wall insulation is installed at least 225 mm below top of floor <input type="checkbox"/></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>AIR BARRIER - CONTINUITY</b><br/>CHECKLIST<br/>(TICK ALL)</p> <p>Seal between wall and floor air barrier with a flexible sealant OR seal gap between skirting board and floor with a flexible sealant <input type="checkbox"/></p> <p>Seal all penetrations through air barrier using a flexible sealant <input type="checkbox"/></p> <p><i>Complying with checklist will help achieve design air permeability</i></p> |                    |
| <p><b>GENERAL NOTES</b></p> <p>The wall insulation installed below the wall DPC must be fit for purpose with regards to water absorption</p> <p>Keep cavities clean of mortar spots and other debris during construction</p> <p>Detail applicable:- Ground-bearing floor; raft foundation; in-situ suspended ground floor slab; pre-cast suspended ground floor; concrete and screed. Insulation below slab</p>                                                                    | <p><b>AIR BARRIER - OPTIONS</b><br/>OPTION<br/>(TICK ONE)</p> <p><input type="checkbox"/> Masonry inner leaf with wet-finish plaster, or</p> <p><input type="checkbox"/> Masonry inner leaf with scratch coat, and finished with plasterboard, or</p> <p><input type="checkbox"/> Inner leaf with plasterboard on dabs, with continuous ribbon of adhesive tape around all openings, along top and bottom of wall, and at internal and external corners, or</p> <p><input type="checkbox"/> Airtightness membrane and tapes</p> |                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |
| ACCEPTABLE CONSTRUCTION DETAIL                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ground Floor - Insulation Below Slab                                                                                                                                                                                                                                                                                                                                                                                         | DETAIL 1.02a, 2011 |

### 11.3 BRIRL Document

# BRIRL Output Document

Compliance Assessment with the Building Regulations (Ireland) TGD-Part L 2017

This report demonstrates compliance with specific aspects of Part L of the Building Regulations. Compliance with all aspects of Part L is a legal requirement. Demonstration of how compliance with every aspect is achieved may be sought from the Building Control Authority.

## Queen of Angels NS

Date: Mon Aug 18 15:27:36 2025

### Administrative information

#### Building Details

Address: Queens of Angels Primary School, Blackthorn Drive, Dublin 16, D16 AX05

#### NEAP

Calculation engine: SBEMIE

Calculation engine version: v5.6.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.9

BRIRL compliance check version: v5.6.a.0

#### Client Details

Name:

Telephone number:

Address:

#### Energy Assessor Details

Name: Sean Croke

Telephone number: 051 874675

Email: sean@jotenergy.ie

Address: Warecourt, Waterford, X91 DD83

### Primary Energy Consumption, CO2 Emissions, and Renewable Energy Ratio

The compliance criteria in the TGD-L have been met.

|                                                                    |                     |
|--------------------------------------------------------------------|---------------------|
| Calculated CO2 emission rate from Reference building               | 10.4 kgCO2/m2.annum |
| Calculated CO2 emission rate from Actual building                  | 6.1 kgCO2/m2.annum  |
| <b>Carbon Performance Coefficient (CPC)</b>                        | <b>0.58</b>         |
| <b>Maximum Permitted Carbon Performance Coefficient (MPCPC)</b>    | <b>1.15</b>         |
| Calculated primary energy consumption rate from Reference building | 59.2 kWh/m2.annum   |
| Calculated primary energy consumption rate from Actual building    | 46.6 kWh/m2.annum   |
| <b>Energy Performance Coefficient (EPC)</b>                        | <b>0.79</b>         |
| <b>Maximum Permitted Energy Performance Coefficient (MPEPC)</b>    | <b>1</b>            |
| <b>Renewable Energy Ratio (RER)</b>                                | <b>0.35</b>         |
| <b>Minimum Renewable Energy Ratio</b>                              | <b>0.1</b>          |

### Heat Transmission through Building Fabric

| Element                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | U <sub>a</sub> -Limit | U <sub>a</sub> -Calc | U <sub>i</sub> -Limit | U <sub>i</sub> -Calc | Surface with maximum U-value*       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|-----------------------|----------------------|-------------------------------------|
| Walls**                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.21                  | 0.18                 | 0.6                   | 0.18                 | L0 - Amb WC_W_4                     |
| Floors (ground and exposed)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.21                  | 0.15                 | 0.6                   | 0.15                 | L0 - Amb WC_S_3                     |
| Pitched roofs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.16                  | -                    | 0.3                   | -                    | "No heat loss pitched roofs"        |
| Flat roofs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.2                   | 0.16                 | 0.3                   | 0.16                 | L0 - Daily Living Skills_R_6        |
| Windows, roof windows, and rooflights                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.6                   | 1.4                  | 3                     | 1.4                  | L0 - Amb WC_G_5                     |
| Personnel doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.6                   | -                    | 3                     | -                    | "No ext. personnel doors"           |
| Vehicle access & similar large doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.5                   | -                    | 3                     | -                    | "No ext. vehicle access doors"      |
| High usage entrance doors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3                     | -                    | 3                     | -                    | "No ext. high usage entrance doors" |
| U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m2K)]<br>U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m2K)]<br>U <sub>i</sub> -Limit = Limiting individual element U-values [W/(m2K)]<br>U <sub>i</sub> -Calc = Calculated individual element U-values [W/(m2K)]<br>* There might be more than one surface with the maximum U-value. ** Automatic U-value check by the tool does not apply to curtain walls whose area-weighted average and individual limiting standards are 1.8 and 3 W/m2K, respectively. |                       |                      |                       |                      |                                     |

| Air Permeability   | Upper Limit | This Building's Value |
|--------------------|-------------|-----------------------|
| m3/(h.m2) at 50 Pa | 5           | 5                     |

## Building Services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Building Regulations documents for details.

|                                                                                              |      |
|----------------------------------------------------------------------------------------------|------|
| Whole building lighting automatic monitoring & targeting with alarms for out-of-range values | NO   |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

1- rads HP/boiler 90/10

|                                                                                                                                                           | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| <b>This system</b>                                                                                                                                        | 2.51               | -                  | -                  | -             | -             |
| <b>Standard value</b>                                                                                                                                     | 2.75               | N/A**              | N/A                | N/A           | N/A           |
| <b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>                                                      |                    |                    |                    |               | YES           |
| ** No automatic check on chiller efficiency has been performed by the tool in this case. Refer to Building Regulations documents for limiting efficiency. |                    |                    |                    |               |               |

1- DHW from HP SCOP 2.0

|                                                                                | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|--------------------------------------------------------------------------------|--------------------------|-----------------------------------------|
| <b>This building</b>                                                           | 2                        | 0.002                                   |
| <b>Standard value</b>                                                          | 0.8*                     | N/A                                     |
| * Standard shown is for all types except absorption and gas engine heat pumps. |                          |                                         |

### Local mechanical ventilation, exhaust, and terminal units

| ID | System type in Building Regulations documents                                                           |
|----|---------------------------------------------------------------------------------------------------------|
| A  | Local supply or extract ventilation units serving a single area                                         |
| B  | Zonal supply system where the fan is remote from the zone                                               |
| C  | Zonal extract system where the fan is remote from the zone                                              |
| D  | Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery |
| E  | Local supply and extract ventilation system serving a single area with heating and heat recovery        |
| F  | Other local ventilation units                                                                           |
| G  | Fan-assisted terminal VAV unit                                                                          |
| H  | Fan coil units                                                                                          |
| I  | Zonal extract system where the fan is remote from the zone with grease filter                           |

| Zone name                | ID of system type     | SFP [W/(l/s)] |     |     |     |     |     |     |     |   | HR efficiency |          |
|--------------------------|-----------------------|---------------|-----|-----|-----|-----|-----|-----|-----|---|---------------|----------|
|                          |                       | A             | B   | C   | D   | E   | F   | G   | H   | I | Zone          | Standard |
|                          | <b>Standard value</b> | 0.3           | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 |               |          |
| L0 - Amb WC              |                       | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | N/A      |
| L0 - UA WC               |                       | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | N/A      |
| L0 - AssShower           |                       | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | N/A      |
| L0 - Quiet Space 2       |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - Classroom 2         |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - Quiet Space 1       |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - Classroom 1         |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - Sensory             |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - WC 4                |                       | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | N/A      |
| L0 - WC 3                |                       | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | N/A      |
| L0 - Main Classroom 1    |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |
| L0 - Daily Living Skills |                       | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | 0.65          | N/A      |

| Zone name               | SFP [W/(l/s)] |     |     |     |     |     |     |     |   |   | HR efficiency |          |
|-------------------------|---------------|-----|-----|-----|-----|-----|-----|-----|---|---|---------------|----------|
| ID of system type       | A             | B   | C   | D   | E   | F   | G   | H   | I |   |               |          |
| Standard value          | 0.3           | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 |   | Zone          | Standard |
| L0 - WC 6               | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | - | -             | N/A      |
| L0 - WC 5               | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | - | -             | N/A      |
| L0 - Central Activities | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | - | 0.65          | N/A      |
| L0 - WC 2               | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | - | -             | N/A      |
| L0 - Main Classroom 3   | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | - | 0.65          | N/A      |
| L0 - Main Classroom 2   | -             | -   | -   | 1.5 | -   | -   | -   | -   | - | - | 0.65          | N/A      |
| L0 - WC 1               | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | - | -             | N/A      |

| General lighting and display lighting |  | Luminous efficacy [lm/W] |      |              | General lighting [W] |
|---------------------------------------|--|--------------------------|------|--------------|----------------------|
| Zone name                             |  | Luminaire                | Lamp | Display lamp |                      |
| Standard value                        |  | 60                       | 60   | 22           |                      |
| L0 - Amb WC                           |  | -                        | 125  | -            | 24                   |
| L0 - UA WC                            |  | -                        | 125  | -            | 28                   |
| L0 - AssShower                        |  | -                        | 125  | -            | 25                   |
| L0 - Lobby                            |  | -                        | 125  | -            | 19                   |
| L0 - Quiet Space 2                    |  | 125                      | -    | -            | 63                   |
| L0 - Store 4                          |  | 125                      | -    | -            | 4                    |
| L0 - Classroom 2                      |  | 125                      | -    | -            | 271                  |
| L0 - Quiet Space 1                    |  | 125                      | -    | -            | 68                   |
| L0 - Classroom 1                      |  | 125                      | -    | -            | 257                  |
| L0 - Sensory                          |  | 125                      | -    | -            | 93                   |
| L0 - Office                           |  | 125                      | -    | -            | 132                  |
| L0 - Reception                        |  | -                        | 125  | 15           | 50                   |
| L0 - Store 3                          |  | 125                      | -    | -            | 14                   |
| L0 - WC 4                             |  | -                        | 125  | -            | 30                   |
| L0 - WC 3                             |  | -                        | 125  | -            | 21                   |
| L0 - Store 2                          |  | 125                      | -    | -            | 4                    |
| L0 - Main Classroom 1                 |  | 125                      | -    | -            | 279                  |
| L0 - Daily Living Skills              |  | 125                      | -    | -            | 63                   |
| L0 - WC 6                             |  | -                        | 125  | -            | 31                   |
| L0 - WC 5                             |  | -                        | 125  | -            | 31                   |
| L0 - Central Activities               |  | 125                      | -    | -            | 295                  |
| L0 - Store 1                          |  | 125                      | -    | -            | 11                   |
| L0 - Cleaners Store                   |  | 125                      | -    | -            | 13                   |
| L0 - DCC                              |  | 125                      | -    | -            | 9                    |
| L0 - WC 2                             |  | -                        | 125  | -            | 39                   |
| L0 - Main Classroom 3                 |  | 125                      | -    | -            | 264                  |
| L0 - Main Classroom 2                 |  | 125                      | -    | -            | 277                  |
| L0 - Stairs                           |  | -                        | 125  | -            | 43                   |
| L0 - Circ                             |  | -                        | 125  | -            | 223                  |
| L0 - WC 1                             |  | -                        | 125  | -            | 18                   |

## Solar Gain in Summer

| Zone                     | Solar gain limit exceeded? (%) | Internal blinds used? |
|--------------------------|--------------------------------|-----------------------|
| L0 - Amb WC              | N/A                            | N/A                   |
| L0 - UA WC               | N/A                            | N/A                   |
| L0 - AssShower           | N/A                            | N/A                   |
| L0 - Lobby               | N/A                            | N/A                   |
| L0 - Quiet Space 2       | NO (-70.6%)                    | NO                    |
| L0 - Store 4             | N/A                            | N/A                   |
| L0 - Classroom 2         | NO (-39.6%)                    | NO                    |
| L0 - Quiet Space 1       | N/A                            | N/A                   |
| L0 - Classroom 1         | NO (-18%)                      | NO                    |
| L0 - Sensory             | N/A                            | N/A                   |
| L0 - Office              | N/A                            | N/A                   |
| L0 - Reception           | NO (-60.2%)                    | NO                    |
| L0 - Store 3             | N/A                            | N/A                   |
| L0 - WC 4                | N/A                            | N/A                   |
| L0 - WC 3                | N/A                            | N/A                   |
| L0 - Store 2             | N/A                            | N/A                   |
| L0 - Main Classroom 1    | NO (-54.8%)                    | NO                    |
| L0 - Daily Living Skills | NO (-57.7%)                    | NO                    |
| L0 - WC 6                | N/A                            | N/A                   |
| L0 - WC 5                | N/A                            | N/A                   |
| L0 - Central Activities  | NO (-40.6%)                    | NO                    |
| L0 - Store 1             | N/A                            | N/A                   |
| L0 - Cleaners Store      | N/A                            | N/A                   |
| L0 - DCC                 | N/A                            | N/A                   |
| L0 - WC 2                | N/A                            | N/A                   |
| L0 - Main Classroom 3    | NO (-29.3%)                    | NO                    |
| L0 - Main Classroom 2    | NO (-44.5%)                    | NO                    |
| L0 - Stairs              | N/A                            | N/A                   |
| L0 - Circ                | N/A                            | N/A                   |
| L0 - WC 1                | N/A                            | N/A                   |

## Overheating

| Zone               | Risk of overheating |
|--------------------|---------------------|
| L0 - Amb WC        | Low risk            |
| L0 - UA WC         | Moderate risk       |
| L0 - AssShower     | Low risk            |
| L0 - Lobby         | Low risk            |
| L0 - Quiet Space 2 | Moderate risk       |
| L0 - Store 4       | Low risk            |
| L0 - Classroom 2   | Significant risk    |
| L0 - Quiet Space 1 | Moderate risk       |
| L0 - Classroom 1   | Significant risk    |
| L0 - Sensory       | Low risk            |

| Zone                     | Risk of overheating |
|--------------------------|---------------------|
| L0 - Office              | Moderate risk       |
| L0 - Reception           | Moderate risk       |
| L0 - Store 3             | Low risk            |
| L0 - WC 4                | Low risk            |
| L0 - WC 3                | Low risk            |
| L0 - Store 2             | Low risk            |
| L0 - Main Classroom 1    | Significant risk    |
| L0 - Daily Living Skills | Moderate risk       |
| L0 - WC 6                | Moderate risk       |
| L0 - WC 5                | Moderate risk       |
| L0 - Central Activities  | Significant risk    |
| L0 - Store 1             | Low risk            |
| L0 - Cleaners Store      | Low risk            |
| L0 - DCC                 | High risk           |
| L0 - WC 2                | Low risk            |
| L0 - Main Classroom 3    | Significant risk    |
| L0 - Main Classroom 2    | Significant risk    |
| L0 - Stairs              | Low risk            |
| L0 - Circ                | Moderate risk       |
| L0 - WC 1                | Low risk            |

#### Primary Energy Contributions to RER

| Technology                                       | kWh/annum      |
|--------------------------------------------------|----------------|
| Photovoltaic systems                             | 2030           |
| Wind turbines                                    | 0              |
| Solar thermal for water heating                  | 0              |
| Biomass for space and/or water heating           | 0              |
| Biogas for space and/or water heating            | 0              |
| Heat pumps for space and/or water heating        | 17490.8        |
| CHP generators for space and/or water heating    | 0              |
| District heating for space and/or water heating  | 0              |
| Process energy                                   | 0              |
| <b>Total for renewables</b>                      | <b>19520.8</b> |
| <b>Total for renewables &amp; non-renewables</b> | <b>55943.0</b> |

## Technical Data Sheet (Actual vs. Reference Building)

### Building Global Parameters

|                              | Actual | Reference |
|------------------------------|--------|-----------|
| Area (m2)                    | 784    | 784       |
| External area (m2)           | 2131   | 2131      |
| Weather                      | DUB    | DUB       |
| Infiltration (m3/hm2 @ 50Pa) | 5      | 3         |
| Average conductance (W/K)    | 501.93 | 593.57    |
| Average U-value (W/m2K)      | 0.24   | 0.28      |
| Alpha value* (%)             | 12.9   | 17.63     |

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

### Building Use

| % area | Building Type                                            |
|--------|----------------------------------------------------------|
|        | Retail/Financial and Professional services               |
|        | Restaurants and Cafes/Drinking Est./Takeaways            |
|        | Offices and Workshop businesses                          |
|        | General Industrial and Special Industrial Groups         |
|        | Storage or Distribution                                  |
|        | Hotels                                                   |
|        | Residential Inst.: Hospitals and Care Homes              |
|        | Residential Inst.: Residential Primary schools           |
|        | Residential Inst.: Universities and colleges             |
|        | Secure Residential Inst.                                 |
|        | Residential spaces                                       |
|        | Non-residential Inst.: Community/Day Centre              |
|        | Non-residential Inst.: Libraries, Museums, and Galleries |
| 100    | <b>Non-residential Inst.: Primary Education</b>          |
|        | Non-residential Inst.: Primary Health Care Building      |
|        | Non-residential Inst.: Law Courts                        |
|        | General Assembly and Leisure, Night Clubs and Theatres   |
|        | Others: Passenger terminals                              |
|        | Others: Emergency services                               |
|        | Others: Miscellaneous 24hr activities                    |
|        | Others: Car Parks 24 hrs                                 |
|        | Others - Stand alone utility block                       |
|        | Non-residential Inst.: Post-primary Education            |
|        | Residential Inst.: Residential Post-primary schools      |

### HVAC Systems Performance

| System Type                                                                                                              | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEFF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |
|--------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|---------------|---------------|------------------|------------------|
| [ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas |                   |                   |                    |                    |                   |               |               |                  |                  |
| Actual                                                                                                                   | 63.1              | 20.6              | 7.4                | 0                  | 4                 | 2.36          | 0             | 2.51             | 0                |
| Reference                                                                                                                | 38.6              | 43.4              | 13.1               | 0                  | 2.1               | 0.82          | 0             | ----             | ----             |

### Key to terms

|                   |                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------|
| Alpha value (%)   | = percentage of the building's average heat transfer coefficient which is due to thermal bridging |
| Heat dem (MJ/m2)  | = Heating energy demand                                                                           |
| Cool dem (MJ/m2)  | = Cooling energy demand                                                                           |
| Heat con (kWh/m2) | = Heating energy consumption                                                                      |
| Cool con (kWh/m2) | = Cooling energy consumption                                                                      |
| Aux con (kWh/m2)  | = Auxiliary energy consumption                                                                    |
| Heat SSEFF        | = Heating system seasonal efficiency                                                              |
| Cool SSEER        | = Cooling system seasonal energy efficiency ratio                                                 |
| Heat gen SSEFF    | = Heating generator seasonal efficiency                                                           |
| Cool gen SSEER    | = Cooling generator seasonal energy efficiency ratio                                              |
| ST                | = System type                                                                                     |
| HS                | = Heat source                                                                                     |
| HFT               | = Heating fuel type                                                                               |
| CFT               | = Cooling fuel type                                                                               |