Entry Form
Project of the Year – Public Use

This Award recognises the new build or refurbishment of a Public use building that most effectively demonstrates high levels of user satisfaction and comfort; and delivers outstanding measured building performance, energy efficiency and reduced carbon emissions. Examples of buildings that would be suitable for this category include, but are not limited to, education, healthcare, and other government and local authority buildings.

Entries in this category must be from within the United Kingdom (see International Project for projects outside the UK), and projects must have completed during the period 1 September 2012 - 31 August 2014. Entries may be submitted by any or all members (together) of the project team and should be accompanied by a full year of operational data.

Please complete the entry form below. The headings reflect the judging criteria and the judges will be looking for you to provide the relevant information under each heading.

Submission instructions
1. Complete and save this document
2. Click here to submit your entry online
3. Complete the required fields and follow the instructions on the online entry system
4. Upload your entry form and supporting documents.
5. Click finish to submit your entry

If you have any questions then please contact us on 020 7880 7625 or by email to lois.hunt@redactive.co.uk.

Enterrant details

<table>
<thead>
<tr>
<th>Full name</th>
<th>Job title</th>
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<tbody>
<tr>
<td>Jessica Taylor</td>
<td>Marketing Assistant</td>
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Organisation

Architype

Project Details

Project name
As you wish the project to be referred to throughout the competition.
Wilkinson Primary School

Project Address
Wilkinson Primary School, Walter Road, Bilston, Wolverhampton, WV14 8UR

Project completion date
February 2014 (inclusive of Landscaping)

Date the building was first fully in use after the project completed
6th January 2014

Start of the 12 month period for which performance data is provided
6th January 2014

Organisations
Please provide the names of all organisations that you would like to be credited in your entry. Please ensure that the company names you list are accurate as we may reproduce these on screen and in print. It is essential that you have the consent of all those named below to include them.

<table>
<thead>
<tr>
<th>Building Services Engineer:</th>
<th>E3 Consulting Engineers</th>
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<tbody>
<tr>
<td>Building Owner:</td>
<td>Wolverhampton City Council</td>
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<tr>
<td>Building Occupier:</td>
<td>Headteacher: Tina Gibbon</td>
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<td>Project Manager:</td>
<td>Carillion &amp; The Local Education Partnership</td>
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<td>Quantity Surveyor:</td>
<td>Smith Thomas Consulting</td>
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<td>Brief Consultant:</td>
<td>Jacobs</td>
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Summary
Please provide a synopsis of the project and its building performance, low carbon and energy efficiency objectives.

Wilkinson Primary School is Architype’s most recent Passivhaus School and the product of continuous improvement and lessons learned from 3 previous successful Passivhaus schools. Replacing their original school building, which was subject to an arson attack, the new school is an exemplar in sustainability and 21st Century school design, bringing delight and a safe environment to 420 pupils and their teachers.

The design rationalises the brief requirements into a flexible layout that focuses on a central ‘hub’ space, from which various learning and recreation areas connect, providing learning spaces, quiet break-out and messy play. Key Stage 1 and the nursery are situated on the ground floor, and share hall facilities and external soft play areas with Key Stage 2, located on the first floor. The deliberate floor split was a design decision to reflect the progression made by pupils as they move up through the years.

The site is located on an old forge and the client was keen to express the site’s Black Country history in the building. In stark contrast to the all-natural interior, the corten and clay tile façade are a contemporary response to the sites rich industrial heritage, also acting as a visual deterrent to vandals.

In terms of building performance, it was an aim for the whole team to deliver an exemplar project, advancing on the results of previous Passivhaus Schools through employing lessons learned. Architype has monitored the building performance and thermal comfort during the first year of occupancy, and the results have been outstanding, drastically improving on the results of a measured conventional school and substantially improving on our previous Passivhaus schools.

The fabric first approach and the use of a central heat recovery ventilation strategy help reduce the heating demand to less than 10% of a conventional school. Temperatures are controlled in the summer by well-considered solar shading and a natural ventilation strategy, creating ideal comfort conditions for learning and teaching. The mixed mode ventilation allows the classrooms to benefit from CO₂ levels 5 times lower than regulations all year round (reference graph 4), aiding wellbeing and concentration.

Entry criteria
Please outline how your entry meets each of the entry criteria – judges will be looking for information in each of the sections when assessing the entries.

Documents, charts or photos should be referenced and included in your supporting documents.

One year’s evidence of measured building performance and energy use data. (Ideally including a DEC or ESOS report and an entry on the CarbonBuzz website)

(PLEASE NOTE: We are only just entering the 15th month of occupation and as such do not yet have a DEC Report. We are trying to usher this along and hope to obtain it imminently. We will upload the DEC on the Carbon Buzz link once it has been issued.)

Carbon Buzz link… http://www.carbonbuzz.org/publishedproject.jsp?pid=214814
- Actual fossil fuel consumption between January 2014 and January 2015 is 10.96kWh/m² versus TM46 benchmark of 150kWh/m². The school uses natural gas for the main building heating and hot water to the kitchen. The fossil fuel consumption, only 7.3% of the benchmark, is remarkably low due to the building being highly insulated.

- Actual electricity consumption between January 2014 and January 2015 is 50.4kWh/m² versus TM46 benchmark of 40kWh/m². The electricity consumption is higher than the benchmark which can partly be attributed to extra load from all electric appliances in the kitchen and electric water heaters.

- Total Primary Energy between January 2014 and January 2015 is 143kWh/m² a

* we are identifying the cause of this being over 120 kWh/sqm a through post occupancy monitoring, and with the soft landings programme, expect to reduce this during the 2nd and 3rd year of operations.

Special challenges, objectives or constraints and the design solutions adopted.

The original school building was destroyed in October 2010, leaving the staff and pupils in temporary accommodation on-site for three years. During this period, funding was sought and works began on site in October 2012, with phased occupation and final completion in February 2014. The project was delivered on time and in budget, despite some on-site challenges.

Sharing the site with the occupied temporary porter cabins involved careful planning and logistics to ensure the upmost safety and compliance with programme. Separate access was created, with the close proximity of the temporary accommodation cut off by a fire-rated site hoarding boundary wall, providing protection from construction and further potential arson attacks during the build phase.

The site itself is the former Iron Works of John Wilkinson, the namesake of the school and a Black Country industrialist from the industrial revolution. Coincidentally, an old forge was identified that restricted the location of the foundations, as not to disturb the ground integrity. Mine shafts were speculated on initial surveys but never discovered, however an archaeological watching brief was employed for the first stages to ensure site safety.

Specific elements of excellence and innovation in terms of design, equipment or application including lighting, heating, and cooling, façade or public health services.

The design strategy underpinning the excellence in building performance is the Passivhaus Standard, for which Wilkinson Primary has been certified.

Passivhaus is a rigorous, simple energy strategy focusing on high levels of insulation, airtightness and solar-gain to deliver a low-energy, comfortable and healthy building. Some of the details necessary in achieve Passivhaus at Wilkinson Primary included:

- Insulating the foundation slab: the structural slab ‘floats’ on a thick layer of insulation so heat is not lost through the ground.
- Maintaining the air tightness line: Creating a continuous airtightness line stops heat leaking from the building. Passivhaus demands an airtightness of 0.6 ach @ 50 pascals Wilkinson achieved 0.34 ach
- Triple Glazing: Wilkinson is specified with triple glazed windows, with specialist detailing to reduce heat loss.
- Thermal bridging: Walls and floor details are simplified as much as possible to improve airtightness and the thermal envelope.

Heating, Cooling & Ventilation

Wilkinson Primary School operates a mixed mode ventilation strategy. In the summer months, the building internal environment is maintained using a passive fabric first approach and there is no
reliance on mechanical cooling. Mechanical ventilation is required only in the WC areas and the Kitchen.

To maintain this comfortable and productive environment a robust natural ventilation strategy is required with cross ventilation in the classrooms enhanced via attenuated air paths into the central hub. This is provided via manually opening windows and secure night vents at a reachable height so the occupants have full control; high level windows in the hall and circulation spaces are controlled by the BMS with manual override. The BMS control approach has been simplified and enhanced compared to previous schemes, with an emphasis on local control by building occupants.

In the winter the Passivhaus principles of excellent thermal performance and exceptional air tightness with mechanical ventilation minimises the demand for heat and a single 90kW gas boiler is all that is required to meet the school’s heating needs.

The winter ventilation strategy uses a centralised heat recovery system to supply minimum fresh air into the classrooms and hall, extracting air from the central hub area via the attenuated air paths.

The shading strategy approach has been developed from the outset with close collaboration between Architype and E3 Consulting Engineers. The objective was to minimise summer solar gains while maximising beneficial winter solar gain and not impacting daylight levels. Overheating potential was reduced by carrying out iterative trials on a building simulation model. Elements of the structure such as roof overhangs and play canopies were designed as part of the shading strategy and as a result no dedicated brise soleil system was required.

The shading angles have been developed to ensure maximum shading, whilst allowing light to cascade through to the deep span spaces through internal glazing.

The main roof overhang is a continuation of the 15 degree pitch roof on the first and double height floor windows, complimented by the play canopies, also designed at 15 degrees. These canopies are aligned with the highest window transom, allowing light to be bounced into the classroom at a high level.

Glazed areas are pre-certified components and engineered to be less than the previous Passivhaus school schemes, whilst still achieving excellent daylight levels, and adequate passive solar gain.

Domestic hot water is provided using local electric water heaters rather than a centralised system, to minimise heat loss from circulatory hot water pipework.

Microbore copper pipework has been used between hot water heaters and outlets, with each pipe precisely sized to suit the flow rate of the relevant tap. This has meant that no electric trace heating or hot water return pipework has been necessary, and deadleg volumes are kept to an absolute minimum. This is an innovation that has proved successful in use and has led to significant energy savings.

The average power for lighting is 6.87W/m² for the building with 5.6W/m² being used in the classrooms. Daylight dimming is used in the classroom lighting adjacent the windows to further reduce lighting load. Daylight switching with PIR (passive Infrared Sensor) is used in the circulation spaces to ensure the lighting is not left on when the space is adequately day lit.

The kitchen supply and extract system has been completely re-designed compared to previous Passivhaus schemes with a run-around coil heat recovery system with an efficiency of 50%.

Wilkinson Primary School achieved an A rated EPC without the need for renewables.
Key Construction Details and Innovations

There are a number of special innovations explored on the Wilkinson Primary School project which has contributed to the success of the building.

With the hindsight and experience of delivering previous Passivhaus schools, we found that relying heavily on the Building Management System (BMS) was actually less effective than allowing the occupants to regulate the internal conditions on their own. At Wilkinson, we made all of the opening windows within classrooms manually operated, with only the clerestory windows controlled by actuators.

We persuaded the Passivhaus Institute to accept a higher internal gain factor, due to the higher density of children in UK schools compared to German schools, enabling the whole design to be optimised. This led to reduced areas of glazing, a smaller heating system, better comfort and lower energy consumption.

Other fabric improvements that we made from the lessons learned on previous Passivhaus Schools include;

The Foundation Slab
- The foundation detail is a repeat of the earlier Passivhaus schools, with a continuous insulation layer around the building, starting underneath the slab and vertically up the walls. The timber frame design allows for the structural element to sit on the slab thus transferring the loads, with the thermal ‘duvet-layer’ aligned with the insulation formed around the slab. The internal air-tightness layer is also continuous, using 18mm OSB3 boards taped at the joints with air-tightness tape.

First Floor Detail
- This detail has been revised since the first Passivhaus schools and is now more simple to construct. The previous schools were designed so that the first floor was supported by installing directly onto the ground floor walls, thus making the air-tightness line convoluted and exposed to potential damage during construction. On Wilkinson School, we worked closely with the timber frame sub-contractors at an early stage and designed this detailed so that the air-tightness line was a continuous line of OSB air-tightness layer, resulting in the frame becoming a type of ‘Balloon frame system.’

Windows and Curtain Walling
- The windows and curtain walling are Guttmann triple glazed units, however we worked extremely closely with the cladding sub-contractor to find an economical and aesthetically pleasing window surround detail. This detail allowed the window-surround to be glazed in, forming a designed edge to each of the two cladding materials. The window surrounds also incorporated their own drainage system, which prevented the potential for staining from the Corten cladding material, which can be an issue over the first few years of occupation.

Sprinkler Pump House
- Through monitoring of the first Passivhaus school’s (Oak Meadow and Bushbury Hill), it was found that the industry wide standard non-insulated GRP sprinkler pump houses were consuming approximately half of the entire schools energy to keep them heated at the required regulation temperature.
- This monitoring gave us the opportunity to learn and revise the way the pump house was designed for Wilkinson School. Instead of using standard off-the-shelf GRP pump housing, we designed a very simple well insulated box to accomodate the pump. This was based on Passivhaus principles in so much as thermal bridging was eliminated by the use of a
continuous insulation layer and air-tightness was included within the design.

- This has been highly successful and consequently, this is now being applied to the previous Passivhaus Schools, to remediate the excessive energy usage.

**Kitchen**

- The kitchen has been designed from first principles to reduce the amount of heat generated and reduce the overall energy demand. The kitchen does not use gas cooking equipment, instead using energy efficient cooking equipment such as electric induction hobs. The benefit of this is twofold; firstly, the combustion make up air is significantly reduced thus decreasing the extract hood ventilation rate to much lower than a standard kitchen. As a result the kitchen extraction equipment is smaller and less energy is used operating the cooker hood.
- Secondly, heat generated into the space is reduced by using induction hobs compared with a conventional gas hob and thus the comfort of the room is improved for the end users. The kitchen ventilation system also utilises heat recovery to temper the supply air into the kitchen when necessary to minimise cold draughts.

**Specific energy efficiency aspects of the project, such as energy metering, monitoring and targeting, use of recycled/recyclable materials and other low carbon features.**

The building energy and water consumption is metered and monitored by the BMS. This includes:

- Heating system
- Hot water heaters (gas and electric)
- Distribution boards (power and lighting)
- Water (Main school and kitchen)

Metered data has been collected as part of the soft landings process in order to compare the school with the previous Passivhaus buildings designed by the team and to compare them against benchmarks. The metered data shows the school is more energy efficient against its precedents and vastly superior to conventionally designed buildings.

**Material Specification**

Preference has been given to recycled and reclaimed materials where possible, to reduce the overall embodied carbon of the building and their subsequent impact on the environment.

**Domestic Timber Frame**

- The construction type is timber frame, sourced from domestic FSC certified timber.
- Timber frame involved less processes and is from a renewable source.
- Exposing the timber frame internally has inspired a natural interior aesthetic, showing off the bold building form in a soft and welcoming way.
- The timber requires no finish and is a healthy internal material that keeps the school smelling fresh, natural and non-toxic.

**Corten Steel**

- The industrial heritage of this site provided inspiration for the exterior cladding, which leans away from Architype's commonly specified, natural finish. The striking and contrasting Corten, weathers to a vivid orange patina offering a contemporary response to sites history.
- Corten is a sustainable choice, with no maintenance required as the surface develops to a stable rust-like appearance. Allowing the steel to forms a protective coating that slows the rate of future corrosion.

**Weinerberger Tiles**

- The major external finish is Wienerberger polished clay tiles, which have been specified for a number of reasons. Due to the arson attack, it was decided that timber cladding would not be celebrated externally, since it was important that the facade act as a visual deterrent for future
attacks. This helped to reassure the community about the school's improved fire resistance. Furthermore, the smooth dark grey cladding complemented the design aesthetic to link the school with the site's industrial heritage, and makes for a striking contrast with the orange Corten.

**Wool Wood Ceiling Panels**
- These acoustic panels are made from a mixture of pine, spruce, and poplar wood fibre strands bound with magnesite and treated with natural salt.
- This low-energy product makes use of low-grade timber, complementing our intention of creating a healthy environment, with a natural finish and acoustic benefits.

**Recycled Rubber Tyre Tile Flooring**
- Specified around access points and areas of heavy footfall, these recycled carpet tiles are made from used rubber tyres and offer a great ecological solution for heavy duty use.

**Kitchen**
- The specification of the specialist kitchen equipment was thought about at an early stage and discussed with the end user. For instance, the use of induction hobs instead of gas burners was specified to reduce the heat generated but they are also very efficient.
- The energy efficiency for all equipment was one of the main factors, e.g., specifying chest freezers instead of upright ones, and to ensure the energy rating for all equipment was as high as possible.

**Ecological Paints**
- Wall finishes are mineral-based paints; a protective, toxin-free finish.

**Plywood Finishes**
- Many internal finishes are made from sustainably sourced birch plywood with exposed edges that create a fun, textured finish, coated with natural Osmo oil.
- Plywood finishes include timber stairs and balustrades, window edging, integral furnishing as well as wall skirtings, which are specified to shin height to prevent wall scuffs, keep the building looking fresh and clean, and reduce future maintenance.

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**Evidence of costs and expected savings associated with these measures and anticipated payback periods.**

The project was delivered on time and within budget, with Passivhaus requirements incurring no additional cost to the design or construction. Because Passivhaus reduces energy consumption in the first instance, it was felt not necessary to have bolt-on renewable energy, as the consumption is already very minimal.

In terms of monetary savings, the school is expected to save approximately £40k-£50k per year, in their annual energy and maintenance costs compared to that of a similar-sized school building built to UK Building Regulations.

**Description of commissioning, handover and soft landings processes, and how they contributed to achieving the designer's intended building performance.**

Prior to Wilkinson Primary School, Architype has designed and delivered 4 schools and 1 community centre on behalf of Wolverhampton City Council. Unusual to the design and construction process, we maintained the same design team (structural/civil engineers, building services engineers, landscape architects) on all of these projects and this included the main contractor and majority of subcontractors too. This very deliberate continuity of relationships, helped develop a progress evolution of the design and construction process; taking lessons learned and collaborating to develop better, more refined and optimised solutions. With a much greater awareness of best practice, correct installation methods, allocation of the right amount of time required and more refined strategies, the commissioning process brought limited complications and difficulties.
As Passivhaus is a fully integrated process involving input from all disciplines, relevant subcontractors, the main contractor, the building services engineers, and the architect have been fully involved in the testing and commissioning, to collectively work on optimising the systems to suit the school and Passivhaus.

Throughout the year the school has been monitored and season testing and tweaking of the systems has been proactively dealt with as part of the soft landings programme during the first year.

Subsequently the client has agreed to a full soft landings programme of an additional 2 years, and is benefiting from continuous optimisation and professional advice on how to operate their school optimally.

Examples of areas of specific improvement have included:

REVIEW OF BMS SETPOINTS
It was found that the BMS set-point values and settings that control indoor air temperature, and air change rates need to be adjusted during the first year of occupancy according to occupants requirements, actual sensor locations and delivered systems.

For example the BMS setting relating to the extract damper of the hub-space was found to be responsible for an imbalance in the air-handling unit that caused low supply air temperatures, and this was corrected.

AUTOMATIC CONTROL OF NATURAL VENTILATION
Building users perceived high-level windows operation in the hub-space as random and “opening when not needed”, and was associated with draught and cold sensation on the ground floor and classrooms.

This indicated that there was a possible requirement to increase the overheating threshold that triggers window opening (initially at 24 °C = normal room temperature + 2 °C).

An alternative strategy was proposed, with manual operation of high-level windows by setting a much higher overheating threshold, to allow natural ventilation on demand.

To assess the effectiveness of the changes, ongoing monitoring of indoor temperatures was employed to investigate how the vertical difference between high level windows in the hub-space and classroom floor level affected thermal comfort, while draught discomfort was higher in the ground floor classrooms.

In addition, as part of Architype’s ongoing research with the University of Coventry, the school has also been subject to an intensive monitoring programme, covering building user satisfaction and internal comfort levels across six schools – one 1970s schools, two BREEAM rated schools (one Very Good, one Excellent), and three passivhaus schools, of which Wilkinson is the most recently completed.

This has involved data collection using the following metrics:
- Black Globe Temperature
- Air Temperature
- Relative Humidity
- CO2 Concentration levels
- Window and blind operation classrooms
- Energy consumption

This monitoring has proved that the design intent has exceeded the building performance predictions, and that the soft landings modifications, including those outlined above, have been effective.

For example:

Thermal energy has dropped from 70/110kWh/sqm.a in our BREEAM Schools, to 25/30kWh/sqm.a in
the first Passivhaus schools, to 10kWh/sqm.a in Wilkinson.

CO2 levels in winter at Wilkinson have been maintained at below the limit of 1500ppm, rarely peaking about 1000ppm, compared to regular peaks at between 2,500 and 3,500ppm in the naturally ventilated schools, which despite these levels were considered by users to be comfortable and performing well.

Winter temperature levels at Wilkinson have proved to remain constantly within designed limits – with start of day temperatures around 21 degrees and peaking at less than 23 degrees, whereas previous non-passivhaus schools are regularly at less than 19 degrees at the start of the school day, and do not reach 21 degrees until late morning.

In conclusion the soft landings process has been instrumental in optimising the building performance, to ensure design performance is achieved. The monitoring of a range of measures have proved beyond doubt that Wilkinson school is not only meeting design intentions, but is exceeding the performance of all the other (well performing) schools in Architype’s year long monitoring study, and achieving thermal energy reductions of around 90% compared to CIBSE benchmarks.
real sense of scale and progression for the children as they move through the school with the older pupils on the upper floor’ Tina Gibbon / Headteacher

Quote:
‘The school feels really airy, which we were especially thankful for during the hot summer’ Teaching Assistant / Wilkinson Primary School

Quote:
‘The finished school is an absolute delight for staff and pupils, who moved into a school that they were already familiar with, given the involvement they had in the design and construction phases. The building flows perfectly with everything to hand.’ Marc Webb, Sites and Building Strategy Manager, Wolverhampton City Council (Client)

Further information
Please provide any further information, evidence or references that you would like to include in your entry.

Please see PDF attached

Supporting documents check list
Entries should include supporting documents or evidence to supplement this written part of the submission. All supporting documents should be collated into one PDF document for upload.

- DEC
- ESOS Report
- BREEAM Certificate
- LEED Certificate
- CarbonBuzz entry (please supply a link): Click here to enter text. http://www.carbonbuzz.org/publishedproject.jsp?pid=214814
- Other (please specify): Brukl, Passivhaus Certification