

National Assembly for Wales

Description of building

The £41m National Welsh Assembly building, opened in January 2006, was created to signal a new style of government and is a incredible example of innovation and imagination. The building is situated in a prime location on the waterfront of Cardiff Bay close to the new Wales Millennium Centre. This landmark building faces south west and offers spectacular views over the bay. Visually the 5000m² building is unprecedented, a glass façade encasing the entire building is complemented by an undulating lightweight steel roof.

The building contains a main public hall which is arranged on two levels, a debating chamber including a public viewing gallery, three committee rooms and the Cwrt (Court); an area where discussions can take place before and after debates. The building also features a tea room and two external courtyards one on each side of the building.

Sustainability was a key consideration throughout the design and construction of the building, and the building's environmental credentials are demonstrated by the award of an Excellent rating under BRE's Environmental Assessment Method (BREEAM). Sustainability is at the core of all Welsh Assembly policies and this building raises the bar for best practice, establishing a standard for new public buildings. The Welsh Assembly's constitutional requirement taking environmental issues into account in construction is now addressed through requiring a BREEAM Assessment for all their buildings.

The Welsh Assembly building was assessed under the bespoke BREEAM scheme. In a bespoke BREEAM assessment BRE adapt the standard BREEAM issues to suit the function of the building and write appropriate criteria for the building. The Welsh Assembly building has achieved the highest BREEAM score compared with other buildings assessed in Wales, and it achieved the third highest bespoke BREEAM assessment score, certified nationally this financial year.

Key features and design elements

Transparent at a public level, symbolising an open democracy, the glazed concrete frame building sits on a slate plinth. A lightweight undulating roof covers both internal and external spaces, and is drawn down in one area to form a funnel like enclosure over the debating chamber. This funnel acts to introduce daylight into the chamber and also assists the natural ventilation strategy with a wind cowl at its head drawing in fresh air. The private areas of the building have a slate external façade, drawing on available local materials and blending into the Welsh landscape.

The concrete frame was selected for its robust properties and ability to resist blasts, important when security is paramount. The other main environmental advantage of using concrete is its high thermal mass. This high thermal mass contributes to a reduced cooling load by acting as a heat sink during the building's occupied hours and allowing heat to dissipate during the unoccupied hours (e.g. night time), subsequently reducing emissions from cooling services. The concrete is also an aesthetic feature conceptualised by the architects and therefore has a high quality finish.

A standing seam roof finishes the lightweight steel frame roof structure with insulation and guttering, internally the roof is finished with a timber soffit. The structural frame of the roof comprises five identical modules and one unique module designed to support the funnel. Not only was the roof designed to be repeated modules, assisting in both fabrication and buildability, but also the finishes were designed to be repeatable, again with ease of construction in mind. Modules were pre-assembled in the factory to minimise erection problems on site.

Inside the building

Two of the three levels within this building are open to the public. The two public levels are housed in the main hall and allow access to the reception/information area, a café and events area, the debating chamber's public gallery, public committee rooms and the public area of the external courtyards.

The large circular debating chamber is the focal point of the building and the striking feature of this spherical space is the dramatic funnel which drops from the main roof. Accessed via the main hall, the public viewing gallery is situated around the outer edges of the chamber on the level above chamber seating.

The committee rooms have been designed to be flexible in terms of size, and can be separated or combined depending on the number of people present. Rooflights and the adjacency to the external courtyards maximise the amount of natural daylight flooding into these rooms.

Environmental features/ aspects

With sustainability at the heart of the design process the design brief required the following:

- A BREEAM rating of Excellent
- A 100 year design life
- Use of indigenous materials
- Minimal operational energy consumption and waste
- The application of renewable technologies
- To be "exemplar" in terms of sustainability

In order to meet these requirements Taylor Woodrow and their design team adopted the following three-step approach:

- Reduce demand of resources (energy, water and materials)
- Where the demand for energy exists utilise sustainable and renewable technologies.
- Cover any outstanding demand with highly efficient technologies

In response to the objectives outlined above, the following characteristics have been incorporated into the building.

Ventilation

The roof top plan turns down to form a funnel over the debating chamber. At the top of the funnel sits the roof cowl and the lantern structure. The roof cowl has been designed to rotate in response to changes in wind direction and it is this movement, which generates a negative pressure on the leeward side of the cowl, draws warm air from the debating chamber to the outside and allows fresh air to flow in.

To reduce the overall energy consumption of the building, natural ventilation has been integrated as the primary source of ventilation. It has been possible to eliminate air conditioning in many areas, by introducing air through outlets in the floor and allowing it to escape through windows or roof vents.

Where areas have a widely varying occupancy e.g. in the debating chamber, committee rooms and public viewing galleries, a mixed-mode ventilation system has been adopted offering both natural ventilation and air conditioning. Where occupancy loads are increased or there is a requirement for a stricter temperature control, there is a facility to switch to air conditioning pushing cooler air in through the outlets in the floor.

Heating and cooling

The assembly building is largely heated and cooled through a system of under floor pipes and an earth heat exchanger system. The earth heat exchanger, a geothermal heat pump system, uses the earth as a heat sink in the summer and a heat source in the winter. In practice this means that in summer hot water is pumped from the building through the earth heat exchange system, cooled in the ground and pumped back in to the building to cool the space. The reverse is true in the winter when the system is used to heat the building.

To further reduce carbon dioxide emissions from heating, a biomass boiler has been installed. A biomass heater uses wood chips or wood pellets as a fuel source, and these have the environmental advantage of being effectively carbon neutral.

Lighting

The lantern on top of the funnel allows natural daylighting into the debating chamber. A conical mirror reflects additional daylight into the chamber and can be lowered to control the daylighting levels to suit broadcasting requirements. Also on the inside of the funnel are a series of concentric aluminium rings with recessed light fittings. Rooflights and the high level of glazing provide natural lighting for a large part of the office type space, this in conjunction with daylight sensors on internal and external lights reduces the burden on electricity and provides a more pleasant internal environment.

Water

Water saving has been an important issue for the assembly building and water use has been minimised in two ways. Firstly the amount of water required is minimised through low water use devices such as waterless urinals, and secondly mains water consumption is minimised by using rainwater run off, collected from the roof, for WC flushing and irrigation.

Economics

Where possible, and subject to EC Procurement Regulations, indigenous materials and labour has been used. To date some 36% of the total contract price of £40.997m has been spent on Welsh labour and materials.

Whole life costing was also key to the selection of materials and an example of this is the choice of floor finish, carpet would have been a reduced capital cost but a longer term maintenance and replacement cost, hence the slate flooring was positive both in terms of whole life cost and in using indigenous materials.

Accessibility

In an effort to exploit access issues and potential solutions an access advisory board was established in October 2000. The group consisted of representatives from various disability organisations in Wales including the RNIB, RNID, Cardiff Institute for the Blind, Royal Society of Architects in Wales and the Assembly's internal staff working group. The group worked alongside the project team examining the proposed building design, identifying access issues and exploring potential solutions until the building design was finalised.

Key facts and figures

- The earth heat exchanger system consists of 27 boreholes drilled 100m into the ground.
- The floating roof structure consists of 421 tonnes of steel with 21,900 bolts and 2,088 connectors.
- There are 89 reflective tubes on the inside of the funnel
- The project has used more than 1000 tonnes of welsh slate covering approximately 10,000m².
- 45km of wooden slats were used in the timber soffit
- 16,700 tonnes of concrete were used to construct the building
- 55km of data cabling has been installed
- 229km electrical cabling has been installed and 1600 light fittings
- Over 1200 people have worked on the site during construction of the building
- Over 400 drawings have been produced throughout the design and construction phases.

BREEAM assessment breakdown

The building scores very well under the **Management** section within BREEAM (90.91%) due to the excellent procedures in place to ensure commissioning is carried out effectively and also because procedures were in place to manage and mitigate the construction site impacts. There was also extensive consultation with the local community and some feedback implemented. A building User Guide was provided at handover providing a non technical guide to building users and facilities managers on how to operate the building efficiently and effectively.

The building scores well in the **Health and Wellbeing** section of the BREEAM assessment (72.72%) due to its high performance in terms of natural lighting, glare control, the potential for natural ventilation, good artificial lighting where required, and appropriate levels of thermal comfort and background noise.

Because the **Energy** and **Transport** sections within BREEAM both look at reducing CO₂ emissions (from operational energy and transport) these are summed together within BREEAM, and the Welsh Assembly building scores 86.84% within these sections.

The building has a number of energy saving features which allow it to perform well within the BREEAM **Energy** section. These features include maximising the amount of daylight used, efficient internal and external artificial lighting with daylight and timer switches to reduce unnecessary artificial lighting loads. Reductions in emissions from heating and cooling loads result from efficient heating/cooling systems (borehole heat exchange, natural ventilation strategy, biomass boiler), the provision

of heat recovery, speed controls on all fans and pumps and a 10% improvement (compared with regulation) for specific fan power on all fans. The building is also equipped with a Building Energy Management System (BEMS) and appropriate sub-meters to allow energy use within the building to be monitored and therefore managed throughout the building's life.

The building has been centrally located in Cardiff to be easily accessible, and whilst parking spaces are provided other modes of transport such as cycling and public transport are promoted to reduce transport CO₂ emissions to and from the building. These incentives include real time public transport information and good cyclist facilities, such as cycle storage, showers and lockers. The National Assembly for Wales have also prepared a green transport plan for the building users. All of these are rewarded in the BREEAM scheme and reflected in the high score in the **Transport** category.

Reducing mains water consumption has been a consideration in the design and procurement of this building and this is recognised in the high score for the **Water** section (85.71%). The measures implemented include providing a water meter, a leak detection system, rainwater collection and low water use sanitary fittings such as low flush toilets and taps with an automatic shut off device.

The building scores well within the **Materials** section of the BREEAM assessment (78.16%), by addressing the following; use of recycled materials, specification of low impact materials for key building elements ('low impact' is based on the Green Guide to Specification results which address life cycle impact environmental issues), protecting vulnerable areas of the building and thus improving the longevity of the building materials and features, and specification of timber from responsibly managed sources.

In terms of **Land use and Ecology** (50.00%), the building has been rewarded in this section for being procured on a site of previously developed land, which is of low ecological value. There is also no negative change in ecological value post construction so this has also been rewarded.

In the final section, **Pollution** (53.85%), the building is rewarded for reducing its reliance on cooling systems, ensuring that the external lighting does not contribute to light pollution within the area, demonstrating there is no net increase in background noise pollution from the building's operation and for the procurement of insulation with little or no effect on global warming and ozone depletion.

Percentage of credits achieved		10	20	30	40	50	60	70	80	90	100
Management	91%	[Green bar representing 91%]									
Energy	87%	[Green bar representing 87%]									
Transport	87%	[Yellow bar representing 87%]									
Pollution	54%	[Teal bar representing 54%]									
Materials	78%	[Green bar representing 78%]									
Water	86%	[Green bar representing 86%]									
Land use & Ecology	50%	[Yellow bar representing 50%]									
Health & Wellbeing	73%	[Teal bar representing 73%]									