The Berlaymont Building: The European Commission Headquarter designed to be a first example for the European New Energy Certificate?

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Abstract

The refurbishment of the European Headquarter in the centre of Brussels is complete. With a low-energy design, sensitive in its choice of materials, the building uses environmentally friendly strategies and meets all modern comfort and environmental standards. This building is choosing to be analysed as the model for the European new Energy Certificate.

HISTORY

The former European Commission Headquarters building in Brussels, known as the "Berlaymont" has been unoccupied since the discovery of 1,400 tons of asbestos in the early 1990s.. The Berlaymont building was originally built for European Commissioners, their cabinets and other linked services - altogether around 3,000 officials. The building is designed in a cross shape including a central core and four non-identical wings (Figure 1). The size was impressive: 200.000 m_, with a suspended steel structure. Some departments had moved to nearby buildings because many occupants felt it was less and less suited to their needs: they complained about the small size of the offices, the wasted space, the outdated air conditioning, and above all the lack of daylight. The Berlaymont needed complete refurbishment, including the removal of asbestos (Figure 2). It lacked shared spaces, and environmental conditions were poor, with an unreliable air conditioning system, and badly sealed and insulated external skin.

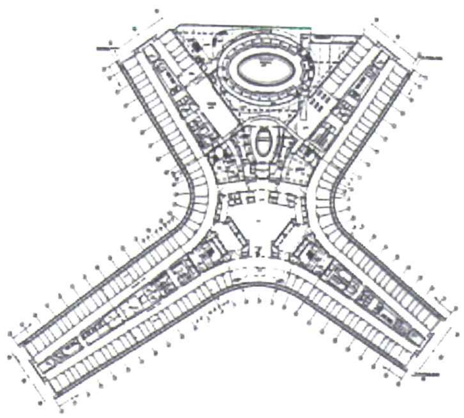

Figure 1: Typical floor plan.

The Berlaymont Building, a relic of the 1960s, was set into an area which was enclosed on three sides, within a mixed urban framework built to a variety of scales. It was too big for its setting and overwhelmed the surrounding public spaces.

In spite of the satellite elements of the plinth, the site perimeter formed a barrier which deprived the neighbouring streets of any real urban identity and the public transport access that was needed.

The tower dominated ill-defined spaces and sterile volumes where traffic conflicts and arid, windy areas were unpleasant for pedestrians. The existing building was also unwelcoming at street level, and the windowless double height lobbies made the interior disorientating.

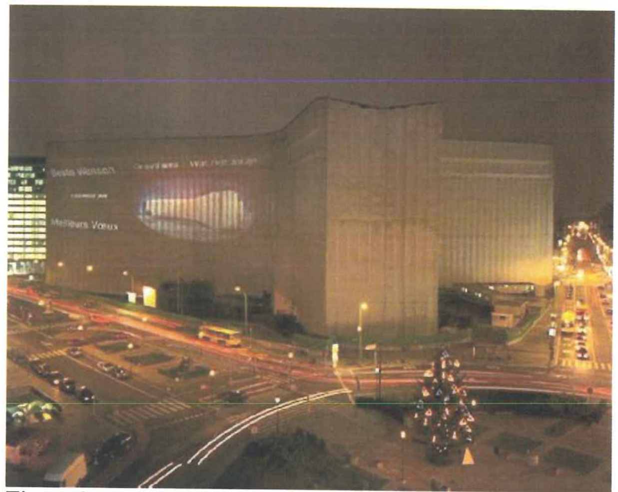

Figure 2 : Asbestos removal from the Berlaymont

The Berlaymont renovation project was launched in 1995 at the initiative of Belgian Minister André Flahaut and European Commissioner Erkki Liikanen, and the removal of the asbestos began. The company "Berlaymont 2000", which had acquired a long lease of 99 years on the building, became the Contracting Authority for the renovation project. In 1996, under the leadership of Professor Henri Vander Eycken, "Berlaymont 2000" put together a team of about 70 people, architects, engineers and administrative staff.

Architects Pierre Lallemand and Steven Beckers took on both the project design and the management of the team of architects. Renovation started in August 1999 after the asbestos had been removed. The building refurbishment is now completed and occupied by the European Commission since October 2004.

REFURBISHMENT WITH LOW ENERGY STRATEGIES IN MIND

Structure and office organisation

The superstructure of the Berlaymont, a skeleton to be used as the new headquarters of the European Commission, has many imperatives: a rhythm of tie bars every 2 metres on the façade, heights of storeys limited to 3.3 m and constraints due to the audacity of its creators (such as loads to be spread in a system where the stability of the whole depends on its parts).

The basements are formed of slabs taking considerable lateral thrusts on a multitude of structural grids resting on foundations which cannot take higher loads. This means that a new independent foundation system will have to be built for any additions.

This assembly is an anchor point for the surrounding underground structures (train, metro, road and pedestrian tunnels), which means that demolition would be too complex and expensive. The most appropriate solution, and the one adopted, was re-use of the existing structure of the building (Figure 3) and removal the asbestos.

Figure 3 : The Berlaymont Structure during the building site

The bridge-like steel suspended structure of the existing building, with 12 floor plates suspended from preflex beams at the top, offers very little thermal inertia and supports no temperature variations or movements.

The independence of the superstructure from the base is accentuated, respecting the original concept of a suspended building, and no solid elements touch the tower from the plinth. A continuous glazed strip round the whole perimeter separates the two elements and is seen as a stripe of shade at night and of light in daytime.

The existing structures are retained as far as possible. The ellipse formed by the inner street and the gardens not only responds to the aspects of traffic fluidity and aesthetics, but also meets the imperatives of lateral thrust to be taken up by this "horizontal vault".

Offices are re-organised using a new 1.2 m module (instead of 1 m) which eliminates the corridor effect of standard offices while offering maximum flexibility in occupation thus maintaining the existing capacity. Foundations do not have spare capacity to carry more load. Floor to ceiling height is 2m60, with a raised floor of 70 mm maximum.

The central core and lift lobbies are opened to the outside to provide better orientation. There are also numerous new meeting rooms and shared spaces.

The building (Figure 4) is connected with many public transportation facilities, and therefore encourages use of public transport by the building's expected 3000 occupants and 700 daily visitors. A new train station is built in the basement while the parking area is reduced from 1632 to 1223 spaces.

Materials

Because of the inherited problems involving 1,400 tons of asbestos, the building's new design now avoids hazardous materials such as PVC and MDF, and mineral fibre insulation is sealed in non-PVC plastic bags."

All fibrous materials are packed according to most advanced fibrology knowledge. Special care has been taken with the timber specification. The FSC (Forest Stewardship Council) label system or equivalent is imposed. However, timber from non-European sources is difficult to control, and its transport consumes a great deal of energy. For this reason, European maple was selected for internal joinery.

Where possible, stainless steel rather than aluminium is used in cladding framing to reduce embodied energy. Materials from the partial demolition with not be recycled for fear of asbestos contamination. Water-based paint or eco-labelled paints are preferred from other paints. The choice of materials brings out the quality of the areas by maximising the amount of daylight entering; it meets acoustic requirements and assists with orientation. In addition to aesthetic quality, this choice takes into account durability, maintenance, cost, ecological criteria, and health at work.

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Figure 4: View of the Berlaymont building

Living Façade

The existing façade was removed. Occupants can now open floor to ceiling glazing which is the inner skin of a double façade. The outer leaf of the double façade is offset 1 m (for maintenance access), and consists of mobile glass louvers. Made of laminated glass with an interstitial printed film the louvers appear white (white dots) from outside and transparent from inside (black dots). In cold weather, the façade acts as a high-tech blanket, keeping warmth in the building, and during hot periods, it protects against solar heat, preventing the main façade from overheating (Figure 5).

This strategy of motorised glass louvers, controlled in one-floor deep by 6m wide modules provides excellent views to the outside, solar shading and acts as a light shelf. The façade provides occupants with an extra sound barrier. This living façade responds directly to weather conditions. It reduces solar gains to about 12 % while the average daylight factor is around 6 % which is an increase of 300% towards the back of the 6 m deep office with reasonable uniformity.

Figure 5: The movables louvers of the Façade

The façade system is managed with a computer connected to a small weather station on the top of the building and to the BMS for security modes. It allows the louvers to move in relation with the sun radiation, the temperature, wind and shadow. Wind simulations were made by the Von Karman Institute in Belgium with modelling in wind tunnels. Results show that the louver façade does not act as a smoke chimney and disperses smoke and hot gases in the open mode.

This kind of living façade designed for the first time, is considered by experts [4 &5] as one of the most high-performance façades of its kind from the point of view of energy saving, accessibility, comfort and quality of natural light.

Ventilation and cooling

The Berlaymont building does not only use passive techniques by lack of thermal mass and the cellular planning. Occupants also have the control of their light and can open a window for natural ventilation. Opening these windows switches chilled ceilings but allows mechanical ventilation, with air entering above the windows and exhausted via lightfittings to corridor and lobbies, then entrance piazza and basement car park.

Air intakes are placed at the top of the building, where the air is less polluted. Fresh air requirements are reduced by the re-use of air from prime areas of high air charge in common areas. Most air intake is made via heat exchangers that reduces the difference between outside temperature and internal temperature. The quality and flow of fresh air are calculated according to the quality of the outside air and the dust emission in the work place. 75 m_ of fresh air will be brought in per hour, per person (twice Belgian standards).

A chilled ceiling system is provided for supplementary cooling. It is estimated that the temperature design standard is between 20 to 23 °C (for an external temperature of −10°C to 28°C). In the worst case, when the external temperature rises above 28°C, for every two degrees, the indoor temperature is allowed to rise by 1°C.

Heating and CHP

Winter heating is mostly provided by a 2 MW Combined Heat Power (CHP), which also supplies 40% of the peak electrical load (Figure 6). This system allows the reduction of CO_2 emissions by 80% in comparison with grid electricity.

Figure 6: The CHP engine

It is important for room heating to counter the tendency for strong downdraughts at the windows. The first line of ceiling panels is on an independent loop allowing for heating by radiation, inverting downdraught and heating the room. Incoming fresh air is pre-heated by exchange plates.

Lighting

The design team is applying environmentally conscious strategies in every aspects such as the choice of energy efficient light fittings. There are light sensors and movement detectors able to turn off light when there is no need for artificial light or when a particular area of the building is empty. Every office is fitted with such a device. Switching the light is automatically set to a minimum.

The façade system designed for the Berlaymont will increase and spread uniformly natural light into the offices. Individual control over one's environment is essential for comfort. Each individual can modify the light level, temperature, ventilation and opening of the windows from the predetermined optimal levels for the offices as a whole.

Figure 7: The internal blinds and the automatic sensor system

Internal blinds enable occupants to hide the window and cut out glare. The special feature of the blinds is that they are located at the bottom of the window and close upwards for screening. So when the blind is partly closed to protect against glare, daylight continues to penetrate the office from above the blind (Figure 7). This avoids the "blinds closed light on" syndrome.

Water treatment

95% of wastewater is recycled in a biological water treatment system in the basement and used for WC flushing and the rest for irrigation of planting in lobbies and outdoors, cleaning, water features and also for cooling towers. Rain water is also collected to be used or stocked..

Figure 8 : The Berlaymont Building

Energy consumption and European Energy Certificate

The energy consumption of the Berlaymont depends on different low energy strategies employed. The building with CHP consumes 120 kWh/m_/year (estimated) and with thermal storage & heat recovery chillers & future technology engineering. This Building was presented during the PLEA (Passive and Low Energy Architecture) 2000 International Conference in Cambridge University in July 2000, and received the PLEA Award [8].

The Directive on the Energy Performance of Buildings (2002/91/EC) will require public buildings to display an energy performance certificate in order to raise awareness of energy efficiency issues among citizens. Although Member States have until January 2006 to implement this and the other measures in the Directive, the refurbishment of the Berlaymont building offers an excellent and timely opportunity for the European Commission to lead the way by undertaking an energy europan certification process for its newly refurbished headquarters, the Berlaymont Building.

The Energy Demand Management Committee at the DG TREN, agreed to set up a working group of participating Member States that will issue their own certificates and analysis of the energy performance of the Berlaymont Building (Figure 8). These Member State experts will use their own calculation methods to determine the energy performance of this building. In this framework, GREENARCH Architecture + Environment working with COMASE Consulting are involved to collect buildings data's and to participate at this innovative task [9]. The European new Energy Certificate will be evaluated by Member State experts and results will be available soon.

CONCLUSION

The European Commission is concerned both to be green and to be seen to be green. The major refurbishment of the Berlaymont building now completed shows that strategies can be found to create a model for low-energy building and maybe for the European new Energy Certificate.

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Pictures and Photography are from Berlaymont 2000 and Greenarch Architecture + Environment.