



LONDON CITY HALL | A Holistic Design Approach

Architect: Foster + Partners

Location: London, England

Completed: 2002

Size: 130,000 sq ft

Structural Engineer: Arup

Owner: More London Development Ltd.

Current Tenants: Greater London Authority

THE ENVIRONMENTAL CRISIS

Since the turn of the millennium, a heightened awareness of the world's environmental issues has surfaced. Studies done around the world have concluded that buildings are responsible for consuming half of the total amount of energy consumed in the developed world. In addition, few people are aware that buildings are responsible for producing half of the world's carbon dioxide emissions.

With this rising knowledge, it is apparent that architecture and the incorporation of innovative design strategies have the potential to dramatically influence the earth's well being. As technology continues to develop, the ability to explore

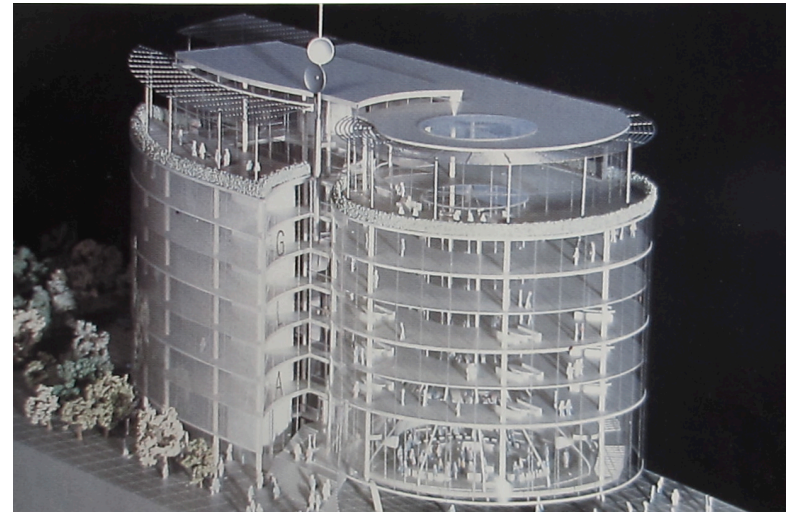
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innovative methods of utilizing alternative and renewable resources comes with greater ease. In addition, the development of advanced digital design tools allows architects to explore environmentally responsible strategies, while simultaneously analyzing their success. Overall, greater access to these innovative design technologies has, and will continue to allow architects to take on a more holistic approach to design, just as Foster and Partners did with London City Hall (Fig 1) (4).

BACKGROUND

In the 1980s, London's local government had been dissolved and the old government building was transformed into a hotel and aquarium. With Prime Minister, Tony Blair's commitment to bringing back a London-wide government in 1997, the election of a new Mayor and Greater London Authority called for a new government building (7).

The City Hall project was an opportunity to express the values of the newly formed governing body and act as a symbol of change for London (11). The project brief called for a building to house the Greater London Authority (GLA), which consists of the Mayor, London Assembly and their support staff (8).

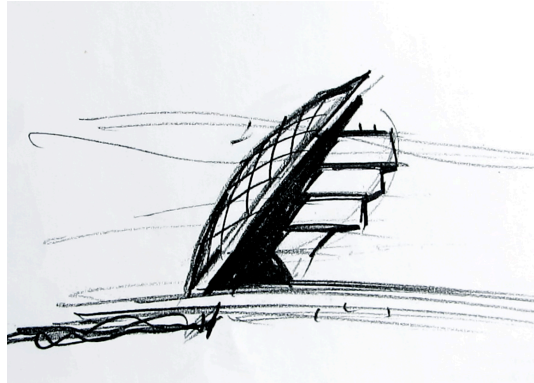


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DESIGN LAUNCH

The design for London City Hall was part of a developer-led competition, which asked for submissions according to a design brief that required the promotion of transparency and democracy (9). In addition to these requirements, Foster and Partners incorporated their own environmental goals for the project. In order to produce an energy-conscious design, architects began to collaborate with engineers, Arup, early on in the design process. Together, Foster and Partners and Arup worked to design the initial London City Hall submission, which took the form of a conventional office block with a debate chamber positioned at the end (Fig 2) (4).

After selecting Foster and Partners to take on the project, the jury, consisting of political and professional representatives, described the desire for a more iconic building form. With this direction in mind, the design team took the sketch that appealed to the jurors and began to reassess the presence of the brief requirements (Fig 3). At this point, volumetric studies were done by manipulating and altering the weight of the brief (9). As the design sequence progressed, the building began to take the form of a more dynamic shape that was



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conceptually driven by the detailed brief requirements. Advanced computer-modeling techniques helped to create iterative studies of 3D models throughout the design process (Fig 4) (8).

DESIGN CONCEPT

London City Hall's building form is justified according to two main design criteria that consist of democratic and environmental ideals (1).

Democratic criteria

City Hall begins to respond to the necessity for democracy by drawing the public in with its iconic building form. The ground level consists of a sunken outdoor amphitheater that draws the public into an underground café and exhibition space located directly beneath the assembly chamber (Fig 7) (4). A central winding ramp allows patrons to symbolically ascend through all ten stories of the building and above the debate chamber of their elected representatives (Fig 5) (1). The ramp eventually leads past the mayor's



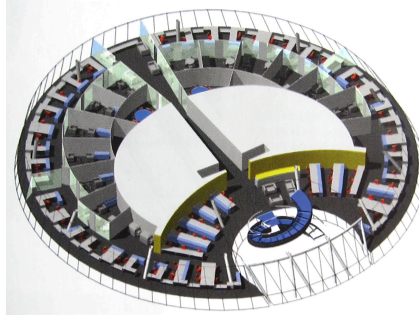
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office to what is known as “London's Living Room”. This space provides an excellent exhibition space with its naturally lit spaces, as well as an outdoor terrace that can accommodate up to 200 guests (4).

The transparent glass exterior allows the citizens of London to feel like they are a greater part of their governing body. The transparent façade allows Londoners to see directly into the operating chamber, symbolizing an open system of government. This idea is enhanced by the building's views over the Thames River, Tower Bridge and cityscape abroad that serve as a reminder of London's role as a historically rooted and ever-developing world-class city. The chamber also contains 250 seats for public and press viewing of the GLA's meetings and debates (8).

Along with the democratic concept, the working atmosphere created inside of the building is admittedly not the spacious office type found in a luxurious office building. Instead, the inside is more of a local-government-style office, where the workspace is pushed to the center and open-plan areas line the perimeter (Fig 6).





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Environmental Criteria

Designed to set the standard for environmentally conscious buildings in London, London City Hall incorporates several passive and active design features to achieve its sustainable merit.

Position

Located on the edge of the Thames, London City Hall takes full advantage of its seclusion from traffic noise and fumes (Fig 8). In addition, the building is positioned to receive the fresh air of the Thames and optimize energy performance according to its position on site and orientation to the sun (4).

Form

The exterior formal moves are derived from the desire to reduce the total glass surface area of the building. In general, a spherical building consumes 25% less energy than cubic building of the same volume. Therefore, the solar heat gain and heat loss through London City Hall's building envelope is minimized (9).

Envelope

Experimental building simulations showed that the energy consumption of an office building could be drastically reduced with the incorporation of thermally efficient cladding. Consequently, the amount of cooling and heating loads would immediately be limited.

The building envelope also responds to thermal mapping results, which were derived using three-dimensional lighting analyses and a daylight simulation technique. This technique calculated the incident solar radiation by calculating the illuminance for each panel and converting it into a heat gain value.

In locations along the façade where the greatest solar impacts occur, the ratio of glazing to cladding is reduced and an operable louver system is used (Fig 9)(4).



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The angles of the stepping floor plate overhang on the southern façade are calculated to take advantage of sunlight during winter and provide natural shading during summer (Fig 10)(1). In contrast, along the Northern façade, where direct sun exposure is minimal, the assembly chamber is completely glazed and unshaded (Fig 11).

The spherical geometry of the structure required the exact measurements of 654 unique panels that were set at different angles.



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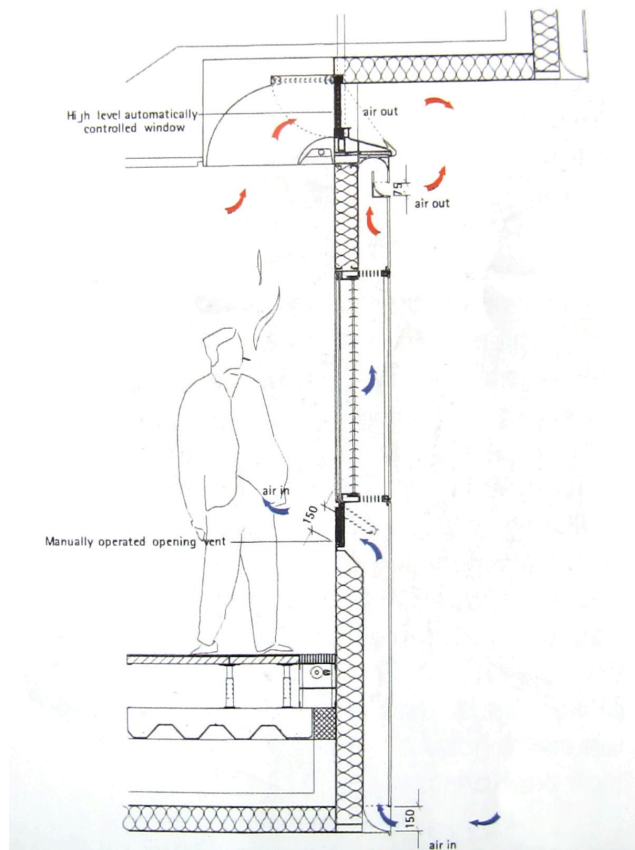
For the creation of these panels, vector points were individually fixed according to computer coordinates. For each panel of glazing, four vector points were chosen and the planning contractor then created offsets, which allowed a machine to measure and cut the exact size and shape of each panel (9). Each panel is composed of high-performance solar-control glazing, insulated opaque panels and operable vents.

Ventilation

London City Hall's environmental strategies also begin to incorporate passive control systems that allow the building to operate more efficiently. Amongst these systems are displacement floor grills placed below windows that supply fresh air to the office spaces. Operable vents

along the edge of the building also allow for natural ventilation (Fig 12). Displacement ventilation systems are used to cool the committee rooms and debate chamber.

During winter, a hygroscopic thermal wheel extracts heat and moisture from the air and is used to preheat the air supply. During the summer, the same system is used to cool the incoming air supply.



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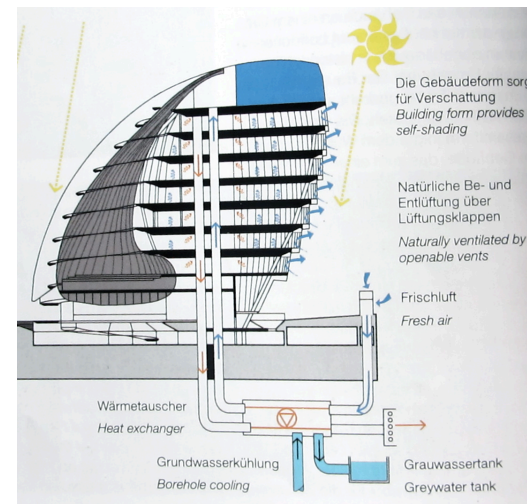
Heating and Cooling

Chilled beams along with low-level air supply serve as the main forms of cooling.

Borehole cooling allows cool groundwater to be pumped up from the ground to chiller beams in the ceilings (Fig 13). After cooling the building, the borehole water is recycled and used for flushing toilets.

During the winter, mass amounts of heat are lost through the exposed external wall of the chamber. In order to heat the chamber, the diagrid façade structure is used as a large radiator and convective heater.

The combination of these energy-saving cooling strategies eliminates the need for mechanical chillers and

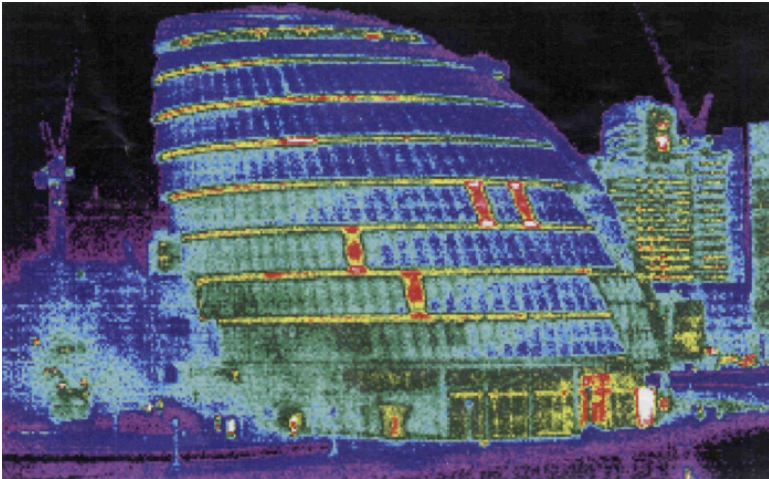


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reduces the annual energy consumption of the building's mechanical systems by approximately 25% that of a typical office building (4).

PERFORMANCE CHECK

After a year of operation, London City Hall was consuming a reported 50% more energy than it had been predicted to consume (Fig 14). Prior to construction, the building was predicted to use 236kWh/sq m, while the recorded consumption in 2003 was 376kWh/sq m. Because the many were persuaded of the building's form due to its environmental merits, this news was startling to officials. A Greater London Authority spokesman commented that the building program was used differently than initially intended, while it also acted as a conference center and tourist attraction (2). David Kong explained that in addition to this, many factors out of the architect's hands had an influence. This included the tenant housing more employees in the building than predicted, which



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created more heat that the cooling loads could compete with. In addition, lights were generally kept on all day, producing extra heat loads. David Kong's final response emphasized that despite what reports may say, London City Hall was a groundbreaking office building that implemented sustainable technologies, which had never been entirely incorporated into one London building before. He added that all included technologies, such as borehole cooling, a high performance façade and photovoltaics, will undoubtedly produce less carbon emissions in the end (9).

RETROFITTING

By August 2007, a solar photovoltaic system was installed on the roof of London City Hall (Fig 15)(2). Because photovoltaics did not adhere with the initial construction program, special measures were taken to ensure that the roof structure had the ability to be retrofitted with photovoltaics when government funding was available (9). Benefits of solar photovoltaics include providing clean, inexhaustible energy from the sun while producing zero carbon emissions (8).



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CONCLUSION

Standing monumentally as a part of the “More London” development, London City Hall, successfully uses innovative practices to declare itself visibly and functionally as a technologically groundbreaking building.

With Foster and Partners' holistic design approach, the architects were able to deliver not only a transparent and democratic building, but a building that incorporated the most groundbreaking and sustainable technologies of its time.

Today, the building stands proudly, with success radiating visibly from its transparent façade and literally from its functioning chiller beams. Marked by its success, London City Hall will continue to act as a role model and precedent for many iconic, environmentally responsible buildings to come.



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ACKNOWLEDGEMENTS

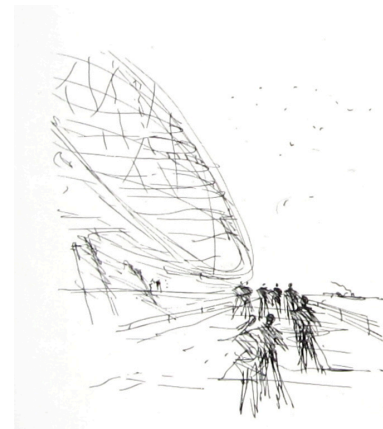
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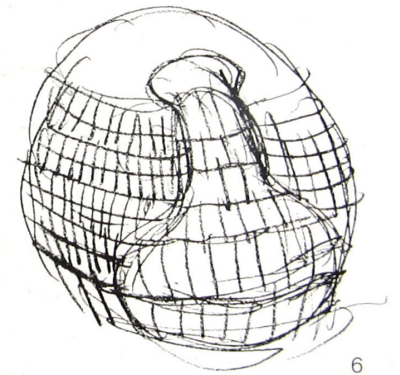
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