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Green Design and the City

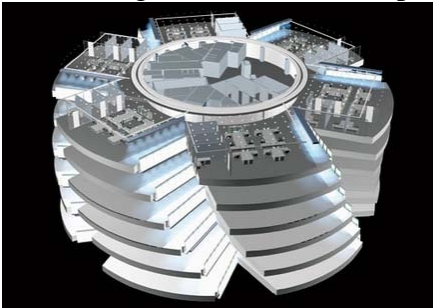
Buildings: The Gherkin, London

October 15, 2009



When looking across the Thames River by Tower Bridge in London it is hard to miss 30 St Mary Axe, nicknamed the Gherkin. It is the second tallest building in the City of London, at 180 meters, and the sixth tallest building in London. It is also the first green tall building in London and the first tall building in 30 years to receive permission to build in the heart of London's financial district ^[13]. The building is located on the 1.4 acre site of what used to be The Baltic Exchange, which was damaged by an IRA bombing in 1992 ^{[7][13]}. Part of the reason why the City of London approved the construction of 30 St Mary Axe was to compete with Canary Wharf, which had been attracting some major finance firms looking to set up offices ^[16]. The building of the skyscraper was surrounded by controversy stemming from the demolition of the Baltic Exchange and received a lot of press due to its unique design and claims of sustainability. The building was originally owned and commissioned by Swiss Re, but was purchased in 2007 by IVG and Evans Randall. Swiss Re holds sustainability as one of its four core values and is still one of the principal occupiers of the building ^{[1][16]}. The architect firm behind the building design was Foster and Partners, who started working on the plans in 1997 ^[2]. Foster and Partners also have a history of green design. They designed the Commerzbank building in Frankfurt. Considered the first ecological office tower, the Commerzbank building included natural ventilation and indoor winter gardens ^[16]. One of the Gherkin's main green claims was that it would be able to use 50% less energy than a comparable office building ^[2]. When looking at the annual low-energy, mixed-mode office building energy consumption guidelines reported by UK's Building Research Establishment, the Gherkin was also supposed to use 14% less energy than the guideline number for low-energy office building ^[18]. The building opened officially May of 2004 and has won a host of awards including the "Stirling Prize" from Royal Institute of British Architects and the "Special Steel Award" from Detail ^[1].

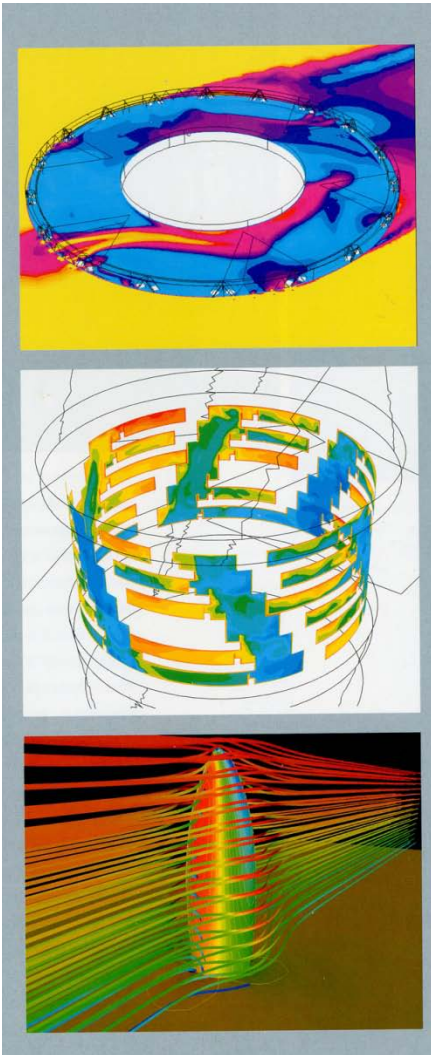
The form of the Gherkin is extremely unique. The building is constructed on a diagrid structure, which minimizes the use of steel to 11,000 tons and incorporates fifty-five hundred glass panels ^{[11][12][13]}. As people occupy the building the diagonal cage contracts and then expands at night as people leave ^[7]. The building has a radial floor plan with six fingers spreading out from a central core that contains elevators and other services, as seen in figure below of a computer model used in the design process ^[15]. Each floor of the



Gherkin rotates 5 degrees from the one below it with core to perimeter lengths ranging from 6.4m to 13.1m ^[1]. The circumference of the building increases as it rises before decreasing to a point at top. This was due to the constraints of the space at ground level and the desire to build less of a footprint on the ground to maximize public use ^[2]. The maximum circumference of the building is only 2 meters less than the building's height and the only piece of curved glass in the entire structure is the lens found at the top of the building ^[1]. The public plaza at the base of the building would not have been possible with a rectilinear building with the same floor space ^[3]. Half of the ground floor of the building is a public area that houses shops ^[14]. Additionally, the building's form allows for more transparency and allows more natural light to reach the outside streets ^[13]. Interestingly, during construction the grave of a Roman girl was found and then stored in the Museum of London during construction before being returned to the base of the building ^[1]. The Gherkin is situated near public transit and in the midst of restaurants and shops, as well as other corporate companies (as seen in Additional Figures). The top of the building houses a restaurant/lounge with an uninterrupted 360 degree view of London ^[1]. The entrance to the building is reached through the passage of a pedestrian plaza, which contain artwork called *An Arcadian Dream Garden*, designed by Ian Hamilton Finlay ^[1].

The building has quite a few sustainable features. The circular design of the building required up to 25% less surface area than a rectilinear building, which meant less area for heat loss in the winter or solar gain in the summer ^[16]. The entire building has a double-skinned façade with a double glazed outer layer and a single glazed inner layer with a

center space that allows for ventilation ^[11]. Ventilation is maximized by sets of six spiraling lightwells, or atriums, which also allow natural light into the building ^[11]. The atriums are two to six floors tall to prevent updraft within the building ^[13]. The ventilation system reduces conventional air conditioning use due to the aerodynamic shape of the building, which creates air pressure differentials in the double skin and moves air up the building and across offices, as seen in the computer generated ventilation models to the left ^{[14][16]}. The building's glass facade and the column-less floor plan both reduce the need for artificial lighting due to the building's ability to maximize natural light penetration ^{[1][2]}. Additionally, lights are on level and motion sensors, reducing unnecessary lighting. All of this helps to reduce the building's heating and cooling loads and its total energy needs. Within the double skin facade are blinds that can intercept solar radiation, at a 15% solar transmission rate, and the building can then reclaim heat from the solar radiation or reject it depending on the cooling or heating needs of the building ^{[1][16]}. The blinds are computer controlled to raise or change their tilt depending on input data ^[13]. The windows of the building are also computer controlled and are designed to open when the external temperature is between 20 degrees Celsius and 26 degrees Celsius and the wind speed is less than 10 mph ^[15]. The glass panels in the atriums are also tinted to reduce glare and solar gain ^[16]. The building received a Grade A specification for including a dual power supply, low energy services and envelope design, design criteria of one person per 10 square meter, 4 pipe fan coil AC system with ability to naturally ventilate, 2.75m floor to ceiling height, 150mm raised floors, 16 high-speed, high-capacity passenger lights, and a 1.5m planning grid ^[1]. Raychem electric heat-tracing systems were also installed in the building. The system



provides frost protection, snow melting, and energy-efficient water temperature maintenance ^[6]. The main energy source that the building uses is gas. The mechanical heating and cooling system is de-centralized so that several zones on each floor can be individually temperature controlled ^[12]. In fact, it was reported that the building could potentially turn off much of its mechanical cooling and heating system for up to 40% of the year ^[13]. Wherever possible the building has installed low energy light fittings. The designers and owners of the building also wanted to discourage motor vehicle use by the building's tenants. The basement of the building provides three times the bicycle space, 118 spaces, than the minimum required ^{[1][13]}. The building does not have car parking for visitors or employees, just 5 handicap spaces and 52 motorcycle spaces. Alternative transportation is also encouraged through the availability of showering and changing facilities. The circular form of the building also reduces the amount of wind deflected to the ground compared to a rectilinear skyscraper of similar size and uses less structural material as the aerodynamic form also reduces wind load ^{[2][9]}.

The building has had some issues and the sustainability success of the building is very questionable. In 2005, a glass window detached from the building and fell 400 feet, as seen in the figure to the right ^[4]. Serious injuries were avoided due only to the fact that the space below was deserted at the time. The building had to close down the plaza and sealed shut 770 similar windows temporarily while the incident was investigated ^{[4][5][15]}. The building eventually replaced 1540 window opening devices after they discovered that the cause of the accident was an opening device that had worn down ^[15]. There has also been some criticism regarding the building's "urban design and contextual relationships, architectural scale and aesthetic expression" ^[9]. The building is a skyscraper in the midst of low- and mid-rise buildings and its circular design "no way acknowledges differences in orientation or exposure...it takes no notice at all of its neighbors", according to Roger K. Lewis, an architect and professor at the University of Maryland ^[9]. The Gherkin has also been named in polls on the ugliest building in London. Its highly customized nature also meant that the structure was not cheap to fabricate and build ^[9]. Then there is the somewhat ironic aspect of having to build ways to reduce solar



gain to minimize cooling loads and be greener in an all glass skyscraper^[16]. The building's design also falls short of being practical. The design of the building with the lightwells, central lift, and services core is extremely space inefficient with 37% of its gross floor space being unuseful space. The open floor plan is also not optimal for business that require confidential discussions with clients and the lightwells allows sound to travel from one floor to another^[15]. However, the atriums and glass façade have been doing a great job of allowing natural light to penetrate to the core of the building. The building is also not saving as much energy as it intended. The building's reported ability to consume 50% less energy and to turn off mechanical temperature systems 40% of the year is far from realized. It was found that tenants were not interested in the green aspects of the building. Most tenants have rejected the energy-efficient package with automated windows and have opted for the year round air conditioning package instead. The energy savings from opting into the energy-efficient package was not enough of an incentive for companies to opt in compared to the rent cost of the building. Tenants have also built partitions in order to maintain confidentiality and those partitions block the natural flow of air. Even if the windows were open there would be no where for the air to circulate. Swiss Re is located on floors 10 and 11 and is the only tenant that still uses the computer controlled windows^{[14][15]}. However, even they are not using the system under its original guidelines and have lowered the temperature at which windows close and the air conditioning turns on from 26 degrees Celsius to 24 degrees after employees complained of stuffiness^[15]. Additionally, the top floors of the building are too high to allow for natural ventilation and air conditioning had to be mandatory^[16]. However, the ventilation that does occur, along with 26 air sensors, does help keep internal temperatures even^[15]. There were also a lot of additional green projects that could not be implemented. The spiral lightwells were originally supposed to house planted sky gardens, but the practical difficulties and the maintenance cost of the project were too great and the idea was never realized^[14]. The building was also not able to implement a water recycling system due to the additional energy and construction needed to pump the water. The building has no photovoltaic panels for solar energy since two-thirds of the building would have to be covered to provide just 10% of its energy needs^[18]. The Gherkin also had questionable success as an economic green investment. Nearly a year and half after the building had

opened 20 of the buildings 38 floors, excluding the restaurant and lounge found on the top two floors, had not been rented ^[15].

The difficulties that the building has had are hardly a shining advertisement for building green in London and the building has fallen short of the energy savings the designers had hoped for. On the other hand, the building has become a tourist attraction and is a major and extremely recognizable part of London's skyline; even if there have been debates as to the aesthetic appeal of the building. The publicity the building has garnered has helped to raise the profile of green building in not only the minds of citizens of London, but also in the minds of everyone who has visited the Gherkin. Additionally, the smaller circular footprint and the aerodynamic design of the building did also help the public good by providing a public plaza with shops and reducing wind tunnel created by tall buildings. In 2009, plans to build a green office block next to the Gherkin were reported. The designers hope to build the structure from recycled glass panels and feature a series of roof gardens ^[17]. It would seem that while the Gherkin may not have been as much of an inspiration as it had hoped to be, its construction certainly hasn't ended the movement of green design in London. It certainly reflected some of the sustainability views of London itself, like calming traffic by promoting alternative transportation. In the end there is no deny the Gherkin's place in London's identity and its importance to London culture. The Gherkin has appeared on the cover of Newsweek, in ads for London's Olympic bid, and as the setting in movies like Match Point, Basic Instinct II, and Bridget Jones ^[16].

Additional Figures

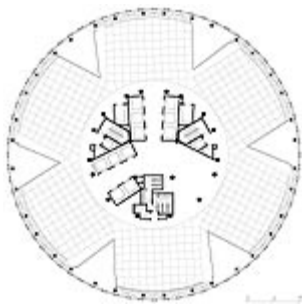
Restaurants/Bars near The Gherkin ^[1]



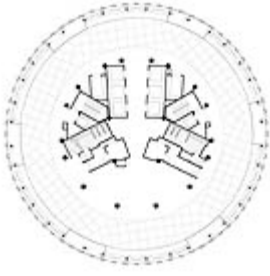
Shopping near The Gherkin ^[1]



Floor Plans ^[11]



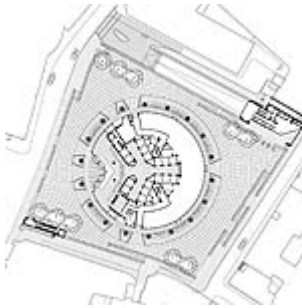
21st Floor



33rd Floor



40th Floor



Ground Floor and Plaza

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