CASE STUDY 2

4A Tectonics of the Double Skin
Arch 484

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Building: RWE Corporate Headquarters AG, Essen
Architect: Ingenhoven Overdiek und Partner
Date: 2000
The RWE building is located in Essen, the new business capitol of Western Germany. Primarily a low level building area, special planning permission was given to IOK on the basis of a landmark building for the new German business district.

RWE AG, a group of enterprises specializing in energy, mining, chemicals, machinery, telecommunication and construction, needed a new headquarters for its energy department. This building needed to reflect the modern energy consciousness of its German owner, as well create a place that both employees and visitors could work in complete comfort.

These aims were accomplished by allowing everyone individual control of sunlight, room temperature and natural ventilation.

The extremely small (32m) circular plan allows both natural ventilation and daylight to penetrate even to the conference rooms in the center of the floor plate. A minimum of mechanical intervention is needed. The floor to ceiling glazing allows maximum daylight into each of the perimeter offices, as well creating a transparent beacon in the center of the city. Everyone working in the tower can enjoy the panoramic views of their city.

Of course, creating a floor-to-ceiling crystal clear curtain wall presents some problems with solar heat gain and glare; natural ventilation poses difficulties maintaining the office environment; air quality, temperature and pressure in the tower all needed to be addressed when designing the curtain wall.

The architect/clients’ desire to create a transparent building prevented them from using heat-reflective glass, like most American towers. The curtain wall that was developed was a double skin active system. The wall is essentially a triple skin, with two panes of glass on the interior surface and one on the exterior. These are separated by a
500mm gap, to allow cleaning of the cavity. For solar shading, aluminum louver blinds are installed in the cavity; the second skin protects these louvers from weather and damage, and reflects 90% of the solar radiation preventing it from getting into the office behind. Of course, these blinds are fully operable so that in the winter, the radiation can allow into the office. A set of roller cloth blinds are also available to control glare. These two shading devices can be used together to completely control the amount and quality of light that enters the office.

Due to the solar radiation that collects in the cavity, the temperature sometimes rises to over 40 degrees. To help remove this heat, the top and bottom of each story is fitted with operable vents, so the air convects and takes the heat outside.

There are some times of the year, when the heat buildup in the cavity could be used to heat the building. At these times, the building’s thermal storage properties come into play. Constructed of concrete, the slabs and core walls store heat during the day and radiate back into the office at night.

The intake and outtake system was developed in the form of a “fish mouth”. Firstly, the system is in complete control of air quality. Inherently in its shape, air that is allowed into the building is adjusted so that its is neither too fast or too slow. This is important to consider; air that is too fast would blow papers around the office, create whistling noises, or create such a force as to make it almost impossible to open doors. Air that is too slow may not ventilate the cavity or the building properly. As over 70% of the annual air supply to the building is by natural ventilation, the supply air must be constant. By opening the windows in the offices (up to 150mm) the occupants can control wind coming into their office. In the case of it being too hot or cold outside, or just too windy, a mechanical ventilation system has also been installed, which when needed is activated.

Typical Office Section

“Fish Mouth”
installed but is seldom used – twice an hour instead of six times an hour, like in conventional towers of a similar size.

The physical shape of the fish mouth has other benefits as well; it has a removable cover so that all the vents can be easily maintained. By controlling the ventilation, it prevents rain, noise and birds from getting into the building; common problems in buildings with operable windows.

With the intake of one floor being directly above the outtake of the floor below, a system of diagonal streaming of air was implemented so that “used” air, smoke and fire did not travel from one floor to another. Each office on the floor plate has its “fish mouth” divided into two sections, by perforating different sections of the aluminum cover for intake and outtake. As the air is warmed inside the cavity, it diagonally ascends and is exhausted through the outtake. In between each office is a pair of glass panels where the office partitions meet the vertical mullions. These glass panels assure that every office has its own individual supply and return air, and that fire, smoke, and sound do not travel around the perimeter of the floor plate.

Control of the interior environment of the tower is not left completely to the occupant. Forgetting to close windows at night, or absentee employees not lowering their solar shading devices might throw off the system, as a whole. Thus, everything is controlled by a complex computer system. Everything, from the louvers being open or shut, windows being open or closed, mechanical ventilation, artificial lighting levels have a computer controlled override based on a preprogrammed set of criteria.

All of this technological sophistication does not come without a price tag. In Germany, most facades cost 20-24% of the total construction cost. The double skin façade on the RWE building cost over 30% of the total...
the RWE building cost over 30% of the total construction cost. Although double skin curtain walls are supposed to lower operating costs, in the case of this building the capital cost may outweigh any potential savings. Although natural ventilation is the primary source of air in the building, because of the few days of inclimate weather, a full ventilation system had to be installed anyways. If the energy savings payback takes 100 years to achieve, given the current lifespan of curtain walls, when the wall needs to be replaced in 50 years, the cost would completely destroy any savings. And one could imagine, that any system so dependant on moving parts (louvers), computer control, and window maintenance, that the system might have a catastrophic failure at some point.

Having said that, the client / architect has accomplished their goal, to create a symbol of energy efficiency for the corporate image, to place an icon on the skyline. Also, to maximize employee comfort, and to create a high class corporate environment. Presumably, the employees of RWE AG are more content with their new technological masterpiece than they would be in any suburban campus. And then maybe, the cost is irrelevant.

Bibliography

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