Liverpool Daily Post & Echo(1973) / Royal Insurance HQ(1976)

First Commercial Integrated Environmental Design Buildings

These two buildings have been linked together because they were effectively part of the same development on adjacent sites. They were the first private (ie. non-electricity board) commercial buildings in Europe designed using the heat-recovery air conditioned approach to environmental control. This technique had first been applied to the MANWEB Headquarters building in Chester as described earlier. Seepage water from the River Mersey was available to both buildings for cooling purposes.

Liverpool Daily Post & Echo

As with the MANWEB building much was made at the time in promotional literature about the fact that this building did not require a conventional boiler for heating because the building would generate sufficient heat from lighting, people and machinery to keep its workforce at a comfortable ambient temperature in winter. However, unlike the MANWEB building this complex had two distinct 'Balance Point' temperatures according to whether the presses were running or not. It had been calculated that the building would not require heating when the outside temperature was above -4°C if the presses were running and above +1°C if they were not.

Unfortunately, the presses actually installed were more efficient than those that had originally been taken into account and the heat generated by them was significantly less than had been assumed. This did lead to some problems initially in getting the system to balance satisfactorily.

The actual hardware used was very similar to that in the MANWEB Headquarters building, including the use of two large thermal storage vessels and electrode boilers for pre-warming the building after a shutdown. Both the Electricity Council and MANWEB were involved as advisors on the project from start to finish. The main difference was that here the cooling of the condensers was by means of Mersey water when there was no demand for heat in the building or the thermal stores, rather than with a cooling tower. The open plan offices were illuminated to 1000 lux compared to the 1100 lux which had been the standard in the MANWEB building and there was a similar arrangement in that luminaires near to the windows could be switched off on bright days.

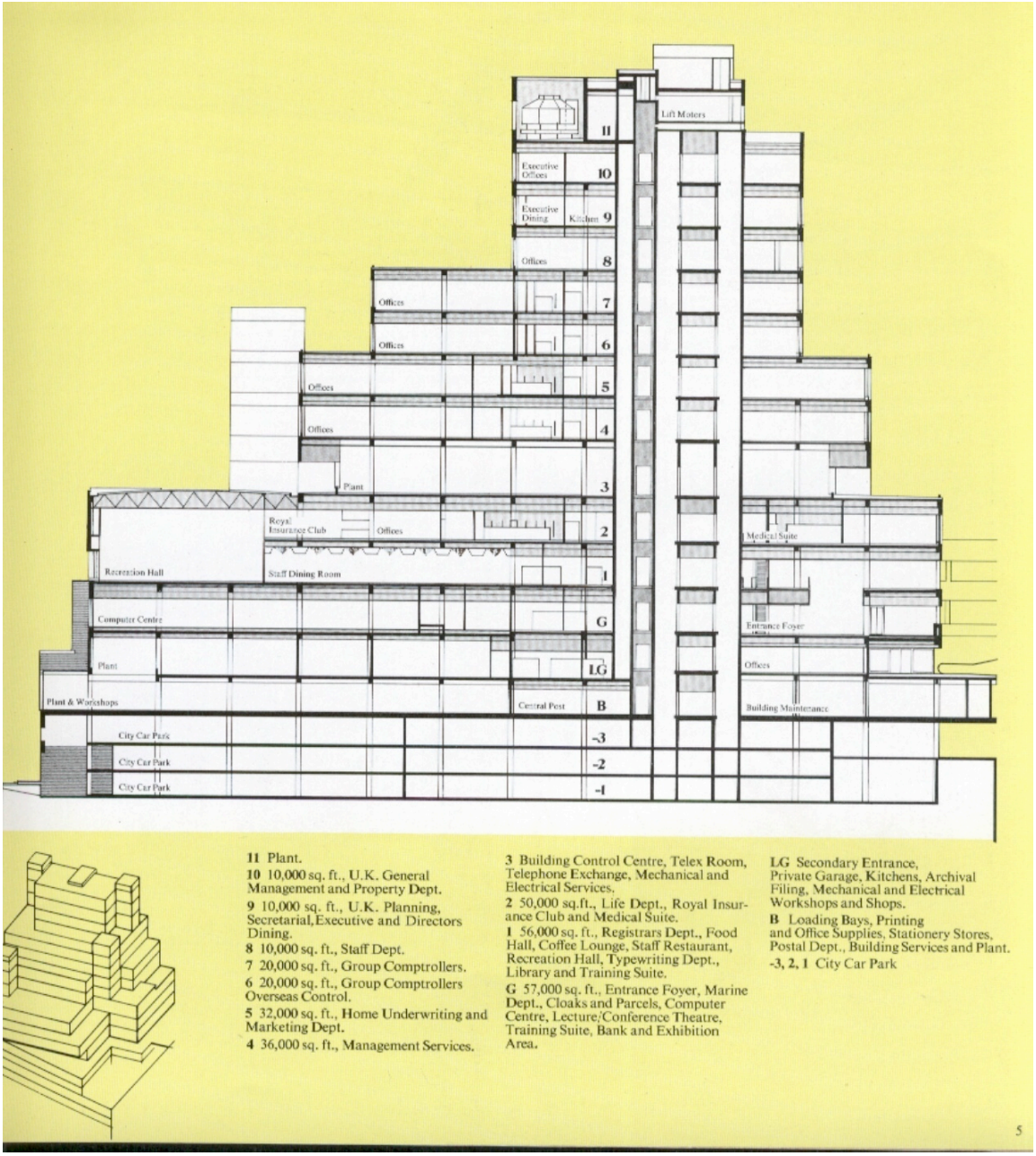
About 3000 gallons of water every hour permeate through the bedrock of the River Mersey into the headings between the inner and outer linings of the Mersey rail tunnel between James Street and Hamilton Square and this had in the past merely been discharged into the dock system. This water is at a steady 13°C and is pure enough to be used in the sprinkler storage tanks for this complex as well as for cooling purposes. The extraction system is shared with the Royal Insurance (now Royal Sun Alliance) Headquarters building next door.

Royal Sun Alliance Building

This building was completed three years after the adjoining Liverpool Daily Post & Echo Building and, although they both use heat-recovery air-conditioning systems, they are very different in both design and function. The tower block in the centre of the Post & Echo building is a regular shape with a square plan and was a requirement of the Planning Office Development Density rules, but was separately let. However, the pyramidal shape of Royal Insurance was dictated by the client's requirement for each insurance department to be on a separate floor and by the fact that these departments varied in size from 4,300 m^2 to 900 m^2. This inevitably led to the lower floors being approximately four times the area of the upper floors and thus to the distinctive shape.

Cover of commemorative brochure 1976

The building is probably best described as ‘bespoke’ since it was specifically tailored to suit the client’s demands. The concept of buildings being ‘loose fit’ was obviously lost on both the client and the architect! As might be expected the requirements changed over the early years of occupation and at some stage part of the basement was converted into offices when extra space was required.



Section shows variation on floor areas

One major difference between the environmental operation of this building and the Echo building is that the Mersey rail tunnel water could be used as a heat source as well as a heat sink. It was perfectly feasible for heat that had been rejected into the water by the Echo building to then be extracted by the Royal Insurance building. This may well have happened in the early years of operation because the light levels in Royal Insurance were 1000 lux when the building first opened but these were reduced to 650 lux after the first year for energy conservation purposes. The lighting used a deep egg-crate louvre to reduce any likelihood of glare. Of course, by the mid-1980s almost every desk had a personal computer with a heat output of about 170w so there was then again a surplus of heat.

Typical 'open-plan' layout showing egg-crate ceiling louvre

The design 'Balance Point' for this building was $0^{o}C$ so that, in theory, the building only needed heat input when the external temperature was below that figure. In fact, the power from the air circulating fans operating the supply and extract systems almost exactly matched the fabric heat loss from the building at that temperature, so the heat from the occupants, machinery and lighting only had to combat the ventilation heat loss. 'Machinery' in this case included the main UK Royal Insurance computer which, at the time of initial occupation, took up half a floor and had a water-cooled central processing unit!

The design ventilation rates for the open-plan offices varied between 8 and 12 air-changes per hour which meant that the total air-handling capacity was approaching 1 million cubic feet per minute (about 500 m^3/s). The cooling and humidification was carried out in each air-handling unit with the final supply temperature in each area controlled by terminal re-heaters fed from the heat-recovery system. Main supply ducts operated at high velocity. The costs of the building services for this building were very similar to the costs of the structure and fabric and so Tysons and Haden Young became Joint Main Contractors.

This building represented one of the first applications in the UK of a Building Energy Management System (BEMS), although that term was not in common usage at the time. A Honeywell Delta 2000 system monitored almost 1800 points throughout the building to check performance of the heating, ventilation and lighting as well as intruder and fire alarms. A central 'Building Control' Office, manned 24 hours every day of the year, is thus able to monitor all aspects of the performance of the various systems and defect alarms alert the operators to any problems. A visual display also shows the position of all lifts and the lifts could, in emergency, be remotely controlled from that office. A white-noise generator in the Building Control office enabled background sound to be provided to any open-plan office through speakers in the ceiling at 2.5m centres at NC45. These speakers could also be used for emergency evacuation announcements if necessary.

Building Control Centre

Two further major changes in heat generated within the building will have affected the way the computerised building control system maintains comfort conditions. It was appreciated soon after the PC revolution that high light levels were not ideal for viewing computer screens and levels were further reduced to about 350 lux. In recent years the replacement of cathode-ray screens by flat screens using liquid crystal display has also affected the energy balance and since the luminous efficacy of fluorescent tubes has improved dramatically over the last 30 years, there is also less heat available from the lighting.

Initially the building had two boilers, one to provide a domestic hot water service and one to provide steam for humidification purposes. The domestic hot water boiler could also be used to provide back-up to the main heat-recovery chiller / heat pump system in emergency. A wet cooling tower was installed in case there were ever any problems with the Mersey water system. The steam boiler was subsequently removed and direct steam injection humidifiers were installed on each air-handling unit as an energy efficiency measure. One further indication that this building was to house a major 'insurance' company was the fact that stand-by generators were installed which could provide 3.4MVA in case of interruption of the mains supply. This was about half the anticipated maximum demand and was provided by two large diesel powered marine engines.

Sources

- Liverpool Daily Post/ Liverpool Echo, Commemorative Brochure 1973
- Royal Insurance New Head Office, Commemorative Brochure 1976
- Two Liverpool Office Buildings; N S Sturrock, RIBA Journal June 1978