ANNEX 3-B

Case study

CHAMBER OF COMMERCE
LUXEMBOURG

The new headquarters of the Chamber of Commerce in Luxembourg expresses the use of steel in its architecture and achieves energy savings through a water-cooled stainless steel-faced sinusoidal composite slab.

LUXEMBOURG'S CHAMBER OF COMMERCE

The new headquarters of the chamber of commerce of the Grand Duchy of Luxemburg located on the Kirchberg plateau, comprises an existing building of 5 000 m² which is totally restored and 20 000 m² of new office space. A conference centre of approximately 8 000 m² completes this building together with 650 underground parking spaces on four levels. The total building area is 52,000 m^2 including car parking. It cost 70.4 million Euros and was completed in 2003.

The new buildings form a succession of four distinct wings linked together by glass footbridges as well as another building along the adjacent street. This ensemble of buildings provides flexibility in office layout. The superstructures are completely detached from the ground floor and the buildings are glazed in serigraphed sun glass shields. The floors are made of prefabricated profiled panels in stainless steel which provide a waved interior facia of the ceiling.

The four and five-storey composite structure consists of hot rolled steel sections and concrete floor slabs with integrated IFB-sections and under-tied main beams. These under-tied beams have a span of 12.5m, which is much longer than conventional application of IFB beams.

The sinusoidal formed stainless steel floor panels have a height of 180 mm and act compositely with the in-situ concrete slab and are supported on the bottom plate of the integrated steel beams. Plastic pipes are placed in the slab and provide for heating and cooling in the winter and summer. Heat gain is also reduced by solar shading to the glass facade. The glass elevators contribute to the lightness of these new headquarters. The internal walls in the office space are modular steel and glass partitions.

The diaphragm action of the floor slabs and vertical concrete stair and lift shafts provide the horizontal stability of the building. Only building C is braced at one side with steel K-bracings.

Application Benefits

- Long-span integrated beam system (12 m span)
- Exposed visually attractive sinusoidal deck profile
- Highly glazed facade
- Fire engineered design
- Energy efficient design using water cooling

Project Team

Architect:	Vasconi Architects
Structural Engineers:	Schroeder and N Green and A Hunt
Service Engineers:	RMC Consulting
Construction Manager:	[not known]

Water heating/cooling pipework laid within the floor slab

Stainless steel profiled decking and lighting/air distribution units

Construction Details

The steel beams span up to 12.5 m and are stiffened by the use of tubular ties below the integrated beams, which increase their span capabilities by 30%. The ties are visually unobtrusive and are exposed below the floor. Services are passed below the beams and above the ties to minimise on the floor depth. The sinusoidal stainless steel decking spans in the same direction as the main beams and is supported by secondary beams at 4 m spacing. The decking supports the weight of concrete and no propping is required during construction.

The integrated beams and steel columns were assessed by a fire engineering analysis, which demonstrated that 60 minutes fire resistance could be achieved without additional fire protection. The IFB beams are partially protected by the concrete slab and support the reduced lad in fire despite the loss of the exposed ties.

The operating conditions of the water-cooled slab is in 3 cycles, as follows:

Summer – night time

In the summer, cool water is passed during the night through plastic pipes embedded in the slab. The water circuit is reversed from 28/33°C to 14/18°C at 8 p.m.

Summer – daytime

If the night-time cooling of floor slab does not reach the parameters fixed previously in the morning (e.g. a maximum temperature of 21°C), the cooling circuit keeps functioning and the water is cooled by the circuit of the absorption machines (at a temperature of 9/18°C). The balance of the heating and the cooling is achieved by chilled beams in the ceiling fed by the heating and cooling networks. The pre-treated air is blown through an exchanger and mixed by a "venturi" effect with the existing air.

Winter

The floor slab is heated in the winter months by passing hot water through the pipes in the floor slab. Heating of the supply water is supplemented by heating via a heat exchanger from heat generated by solar collectors.