Project:	*LSE New Academic Building*
Client:	*London School of Economics (LSE)*
Architect:	*Grimshaw*
Structural Engineer:	*Alan Baxter Associates*
Main Contractors:	*Geoffrey Osborne Ltd* *McGee Group Ltd for demolition*
M&E Engineer:	*Battle McCarthy Ltd*
Cost Consultant:	*Davis Langdon LLP*

Project Description:

An early steel-framed building is adapted, extended and re-used as a new academic building for the London School of Economics and Political Science (LSE). Operational energy is reduced by a range of measures with an option of future installation of wind turbines on the *Corefast* steel lift cores.

Re-use of existing buildings and their adaptability to meet new demands is important aspect of sustainable construction. This imperative to re-use and adapt our building stock, wherever possible, has been dramatically illustrated by the conversion of this 1912, steel-framed, former Public Trust Office next to Kingsway, London into a modern academic building for the LSE.

The Portland stone-clad façade and the outer bay of the internal fabric of the building has been retained but a new steel structure has been erected within to support four lecture theatres, 18 class-rooms, offices and research facilities. This required construction of a storey-high steel truss of 17.5 m span, which is itself supported on concrete-filled, circular hollow section columns that extend through the new-build part of the structure. The existing foundations were extensively re-used and loads on the new structure were carefully distributed to avoid any local over-load.

The new structure comprises a lightweight and resource efficient composite steel frame. Regular openings were provided in the webs of the steel beams for routing services within the structural zone. Attachment of the steel frame to the existing columns and filler joist floors were made by bolting and site-welding.

New steel load transfer beams were installed progressively from the top of the building, to allow certain columns within the retained section to be removed. This required complex stitching of the new components to the existing ones.

The fast construction programme, planned to meet the start of the 2008 academic year, was facilitated by the installation of Corus's *Corefast* lift core in only four weeks, which saved an estimated 10 weeks from the construction programme achievable using a traditional concrete core. The two *Corefast* cores were manufactured with attachments for a vertically-orientated wind turbine, which may be installed on the building in the future, as part of the energy saving strategy of the LSE. Ground sourced 'free' cooling is provided by ground water extracted form by boreholes beneath the building.

The overall construction cost for the 12,600 m^2 floor area including auditorium space was £32 million. A minimum BREEAM rating of *very good* was the target for the project and it is likely that, in practice, it will achieve an '*excellent*' rating.

New steel structure with service routing

Floors hung from long-span steel truss

Construction Details:

The new composite steel structure comprises eight floors and two basement levels supported on an existing 'raft'. The original 1912 steel structure was based on a 3.6 m grid, which was too narrow for academic use and certain columns had to be removed and others strengthened. The measured steel yield strength of the rolled beams and columns was approximately 220 N/mm^2, which is about 20% less than modern steel, but still acceptable for current use. The current design loads were compared to those existing in 1910.

The new floors are supported around the atrium by two 560 mm diameter concrete filled tubular columns and hangers from a deep truss at roof level. Connections between the new and existing floors were made by welded brackets and bolted connections.

The choice of the *Corefast* cores based on double skin Bi-steel panels was primarily made for reasons of speed of construction, but also because the large pre-fabricated components could be lifted into place easily at times dictated by the local traffic conditions, which minimised neighbourhood disturbance. A traditional slip formed concrete core could have taken 14 weeks on-site, rather than the four weeks for *Corefast*. The *Corefast* core was fabricated in segments and bolted together. Concrete infilling could subsequently be carried out 'off the critical path'. Attachments for lift guide-rails were welded to the core units off-site to further speed up later lift installation and commissioning.

The energy efficiency strategy for the building also includes provision for the future provision of roof-mounted wind turbines. These vertically orientated air Aeolian turbines can produce up to 200 kWh peak energy, which can save up to 50% of electrical energy use. The servicing strategy for the building includes a 'mix' of air-conditioning, on the more noisy Kingsway elevation of the building, to natural ventilation on the quieter Lincoln Inn façade. 'Free' cooling through a ground-sourced groundwater is also used as part of this strategy.

The new atrium measures 13 × 16 m. Its glass roof is supported on six, 13 m span 'bowstring' trusses. A further steel truss at ground level supports the concrete ribs of the roof to the basement level lecture theatre. The steel installation was completed ahead of programme despite its complexity.

Key Sustainability Features:

- **Re-use of much of the existing steel structure and foundations**
- **Retention of the original façade**
- **New steel structure provides flexible use of internal space**
- ***Corefast* dramatically reduced the construction programme**
- **Attachments have been made the core for the installation of wind turbines on the building on the future**
- **Ground sourced water cooling is used to cool the lecture theatres**
- **Solar hot water collectors are mounted on the roof**
- **Water efficient fittings: spray taps and low flow showers, low volume flush toilets, waterless urinals**
- **Minimum disturbance during construction work – energy, water and waste streams where measured and managed throughout the construction phase of the project**
- **The renovation of the building is on target to achieve a BREEAM 'Excellent' rating.**