

Joint Structural Division Structural Excellence Award 2009 Hong Kong Projects

Commendation Award

Maunsell Aecom Group for the Discovery College



Structural Engineers

Maunsell Structural Consultants Ltd.

Developer

English Schools Foundation

Architect

Integrated Design Associates Ltd

Contractor

Hanison Construction Co. Ltd.

The Discovery College, operated by the English Schools Foundation, is a prestigious international primary cum secondary school situated along the seaside of Discovery Bay in Hong Kong. The school has two main blocks arranged in a horse-shoe configuration. The Teaching Block houses classrooms, specialist teaching rooms, faculty offices and administration offices. The Specialist Function Block houses the gymnasium, sports hall, performing arts centre and swimming pool.

Lantau Island is referred to “the Lungs of Hong Kong” because of its abundance of natural vegetation and scenic terrain. The major challenge for the Project is to demonstrate the benefits of environmental integration to our next generation life styles by means of innovative design and advance technology. Therefore, the initial design concept from the architect and the structural engineer is to adopt a simple structure for the Discovery College.

The architect and engineer are encouraged to build a better and harmonized ETFE roof structure that will integrate with the surrounding natural terrain. The structural form used to form light filled spaces, is of a particular quality and streamline curvature. The structural elements express a highly aesthetic and sustainable form. It consists of air inflated cushions of three layers of modified copolymer Ethylene Tetra Fluoro Ethylene (ETFE), which provides good thermal insulation, allows energy savings, and protects the school from inclement weather conditions. A large deflection type non-linear finite element analysis was

applied for the ETFE membrane. The membrane stresses generated by inflation and wind loads define the overall geometry, the maximum span, radii of curvature and the thickness of the foils.

The engineer and architect have enthusiastic mission to understand each other’s respective fields and goals during the design process. Regular workshops and conferences allowed these common goals and innovations to develop into a harmonized roof canopy. The shape of the supporting steel frame at roof is the result of architectural-structural interaction to achieve the most effective structural form against wind load. References were made to various international Codes of Practice to obtain the most appropriate wind load coefficients for the non-linear nature of the roof surface. Considerable effort has been made to maximize the use of bolt connections, which will improve the overall buildability, durability and environmental friendliness. Our successful collaboration between engineer and architect leads to have less construction costs, resist loading efficiently thus saving material, encourage sustainability and have easy maintenance.

The window wall system adopted a special hinge joint, which allows effective distribution of wind load imposed on the wall to two levels of structural supports and save costs. The typical module of the system indicates the absorption of the vertical movement of the roof without transferring the vertical loads from roof onto the wall. The stability of the complete glass wall system was checked using a second-order analysis with code-recommended values for frame and member initial imperfections. The responses of the structure were checked by a simulation-based design concept, which is one of the most advanced design techniques in building structures.

Site formation and foundation works for the building is kept to a minimal to avoid affecting the surrounding environment. Retaining wall, abutment wall and cut slope are adopted to cater for the level difference between the building site and the surrounding area. This can minimize costly large scale foundation works. The use of open planning, landscaped terraces and green roof garden to integrate with the natural environment compensate the loss of green area. The soil and plants are a good absorber of heat which will provide energy savings for the school building interior.

