Eco Architecture

Professor Patrick Lau

Professor of Architecture
The University of Hong Kong
|
Chairman, Professional Green Building Council

HKSAR

Eco Architecture seeks to provide a high quality environment at an affordable cost. The Australian International School, HKIA Medal of the Year 2001 is an example of simple low-tech solutions utilized in construction of this building to achieve these goals as well as the upholding the broader interests of sustainability.

Through the careful selection of building materials and design detailing, efforts have been made to put the basic principles of sustainable architecture into practice.

Exposure to Sunlight and Overheating

Reducing the exposure to direct solar gain is a primary goal in the establishment of a sustainable environment. By minimizing overheating caused by the sun, the demands on costly limited or non-renewable energy resources to cool the building are also greatly reduced.

A large part of the school is provided with open balcony corridors that serve to save on energy expenditure.

Firstly, the extent of the balcony projection from the face of the building provides significant solar shading. The greatest amount of window area into the classroom has been located along these corridors, allowing natural daylight into the space, without direct sunlight penetration into the enclosed spaces. These corridors primarily protect the South elevation of the building, which has the greatest potential source of heat load on the classrooms.

Secondly, the balcony corridors and most of the circulation spaces within the building, are open to external air and are naturally ventilated. This significantly reduces the volume of area in the building that needs to be cooled. Even the internal corridors of the large Gymnasium block are subject to natural ventilation with sufficient openings to provide more than adequate light and air to permeate the building.

Plenty of opportunities for cross ventilation are made throughout the building to permit a nature means of cooling. Classrooms are also provided ceiling fans in addition to air conditioners so that cooling may be provided in temperate days with a more efficient means of air circulation. Almost the entire ground floor is open air with the enclosed indoor spaces raised up on a stilted structure to allow for the natural cooling of breezes below the building.

Windows to the large Gymnasium block are kept small and face east to minimize the potential solar gain. Few windows are positioned to face south in this block. The main classroom areas in this block face westward and away from the most intense sunlight of the day. By placing the swimming pool on the large roof of the Gymnasium a significant part of the interior of the building is also insulated from the overheating effects of the sun.

Use of Building Products and Materials

A basic principle behind the selection of building products was to utilize commonly available materials and standard sized mass produced elements in the construction of the building. Many common products require a lower energy expenditure in their manufacture than specialized items and are often produced from naturally

occurring renewable resources. The design challenge was to use a minimum variety of these cheap off-the-shelf products in inventive and interesting ways.

For the most part, the building products selected for use in this project are of standard grade and sizes. Few specialty items were necessary as the design detailing sought to utilize readily available materials and products.

For example, doors are of standard size and thickness, and most are constructed of solid core chipboard with wood that is recycled or from a sustainable source. Door frames and interior window frames are factory built and constructed from a sustainable hardwood source.

Windows utilize standard extruded aluminium sections suited to specific windload and use. This allowed for a minimal sized window sections from a material that has a high potential to be recycled.

Simple cement sand screeding and bedding is used for fixing tiles to all walls and floors. Lime mortar plaster for interior walls utilized a spray plaster system that ensured a smooth finish with minimal thickness and use of material. Also, using these readily available natural materials from within the local region minimizes the embodied energy needed for transporting materials from farther points of origin, further reducing production costs. Reliance on insitu finishes such as painted on external rendering also reduced potential construction material wastage.

The durability of materials and the ability to replace or repair finishes are important factors in the lifecycle costing of building. Products that have had a good track record for durability, maintenance free service, ease of replacement and low cost were important in the value-for-money attitudes that were applied to material procurement.

Zero Net Soil Transport

Minimal excavation was required to construct the building in order to avoid extensive transportation and dumping of soil off site. The existing levels of the site were taken into consideration in determining the final design levels of the carpark, pitch and covered play areas so that there would be only local site transport of existing ground material.

This is one of the principle reasons the Swimming Pool is located on the roof level of the Gymnasium block, to further avoid the need for any extensive and costly excavation.

Landscaping

Most of the existing trees within the site have been repositioned or maintained in their original condition. Significant effort has been made to introduce new tree growth in the Kowloon Tong area by providing plants and trees along the site boundary for the benefit of the general public. Natural vegetation is also intended to act as a soft noise barrier around the perimeter of the site.

An artificial grass pitch was installed to save on the long term maintenance cost of natural grass landscaping. Though this may initially seem contrary to the concept of a sustainable environment, in considering the resource investment required for maintenance of a natural grass pitch alternative, there is a sizable merit to the use of artificial grass. The extensive need for fresh water, fertilizers, care and replacement of natural grass that is abused by regular sports is significant. And unlike a hard paved play surface, the pitch surface is permeable to minimize potential rainwater runoff.

The materials used in the artificial pitch are all from recycled rubber and low grade plastics that have few second hand applications. In this respect, the pitch offers a chance to reuse material that would have traditionally been destine for a landfill site, at a relatively low net energy cost. Providing opportunities to reuse waste material is a large part of what sustainable building is all about.

Economic Design

The school design was purposely made very compact by the need to minimize the building footprint and overall height. The area allowed for circulation is tight at only about 25% of the total gross floor area and storey heights are kept to the minimum functional clearances for the required spaces. There is very little wasted space in the building as all surplus area is put to use for required storage or utility purposes.

Whilst this approach may lead to an economic use of materials, it puts a great demand on the need to design for quality spaces. The building mass remains dense, though the balcony corridors to classrooms permit a tremendous sense of openness. Also, the large mass of the Gymnasium block is infused with light and air by linking void spaces floor to floor, creating a multiple storey open space that is capped by a tree-like glass and steel canopy structure.