Sustainable Building Design in Architectural Services Department

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1.0 Introduction

Descriptions of "science" tend to be all embracing. This is understood due to the complexities involved. The same can be said for sustainable building design, because as new technologies evolve and our understanding of test results and performance increase, we able to review and improve on our targets.

Architectural Services Department has long been a forerunner in environmental issues, being one of the first in Hong Kong to be certified under ISO 14001. Our environmental report has been awarded a distinction which indicates the level of input the Department has applied.

Why is sustainable building design so difficult? Several major points are, each site is different, each project is different, in each country and climatic regions differ and sustainability is constantly being reviewed and amended, use of day light, environmentally friendly materials etc.?" In some ways they are and can be treated generally, however they need to be carefully established in the context of country and each site.

Another major point is that the approach should be holistic, commencing on day one of the project design. This means everything starts with a common set of goals and the team including the clients and users works towards achieving or bettering them. Of course compromise and review are necessary, but this is better one earlier in the design than later.

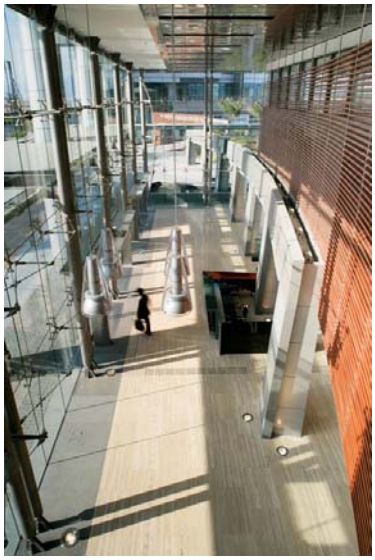
To best illustrate some of these complexities, the following diverse projects of differing sizes and complexity have been selected.

2.0 The Hong Kong Science Park, Phase 1

The Hong Kong Science Park Phase 1 was a very fast track project with a changing client brief. The site is located on new reclamation at Pak Shek Kok Shatin and has wonderful sea views to the front. It has a major highway and railway along the back with hillside views. The site orientation and knowledge that no high rise structures will be built to shade the site allowed the exploitation of photovoltaic cells for renewable energy.

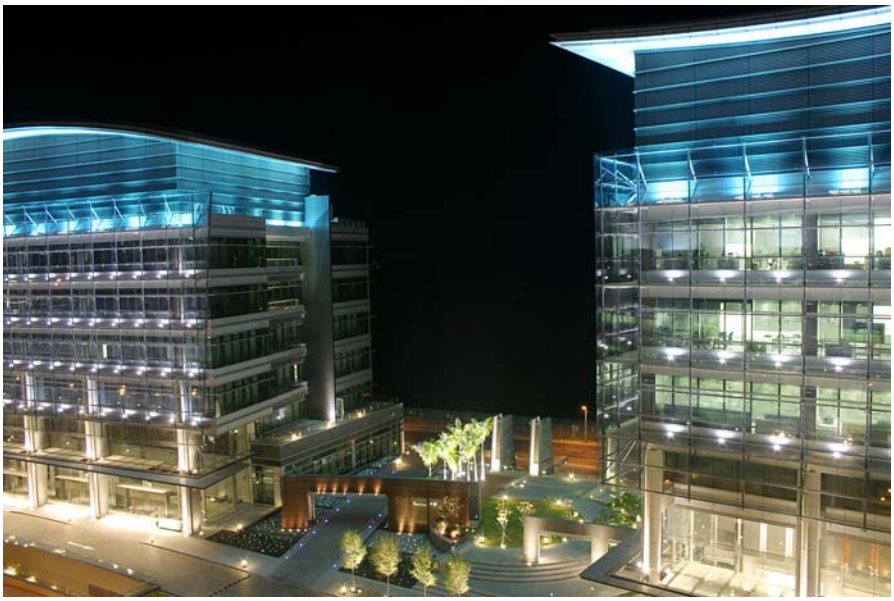
The nine buildings and master plan layout required maximum site development within height restrictions. This gave a problem of less external landscape park areas therefore the concept of bringing the outside in through glass walls, atriums, landscaped internal streets and lobbies was developed. Roof terraces and balconies created new external spaces. The building orientations were best suited to the site therefore the building designs had to consider minimizing heat gain through innovative façade designs for the southwest

facing elevations. In several cases a double façade was used where the warm air rises like a chimney effect to draw in cooler air from below. This treatment was used also to block out noise from the road and railway. As a result the heat gain was reduced by 1.56w/m^2 and the noise by 6 to 7 decibels. To add further value to the approach photovoltaic see through glass panels were used as part of the outer skin creating renewable energy and providing some sun screening. A major advantage of using a glazed envelope approach was to maximize the use of daylight.



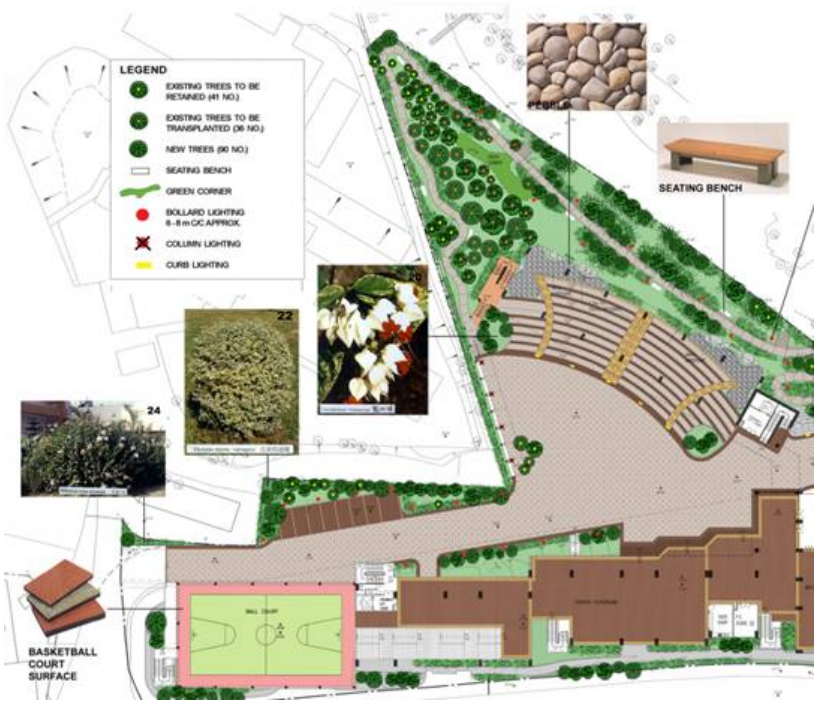
The other key features about the science park buildings are their flexibility and adaptability allowing easy tenant move ins and later changes. Prefabrication, modular design and precast units reduced construction waste plays as does the use of shared facilities such as the combining of service tunnels with car parks. Shared facilities are very sustainable and the central suction refuse collection system is both clean, efficient and can serve the whole of the Park including the future second and third phases. Energy efficiency and sustainable materials where appropriate have been used.

Improvements to the environment through the creation of the park with 4263 new trees to add to the greening of Hong Kong are considerable. The Hong Kong building assessment method BEAM achieved was excellent for all of the phase b and c buildings.



3.0 Secondary school at Wong Chuk Hang

From a mega project to a secondary school in Aberdeen shows the application of sustainable building design on the diverse range of projects. The site has a long noisy street frontage and a steep quieter green hillside behind. The building blocks are orientated to block out the noise, make best use of the East West axis and reduce cutting into the slopes whilst at the same time creating a south facing central courtyard. To reduce the bulk and scale of the noise reducing blocks they are broken into three separate pieces, thus the buildings respond best to the site. Natural ventilation, careful boundary detailing and new soft landscaping features help blend the school with the surroundings. As for all ArchSD projects now, water saving devices are used in toilet areas.



4.0 NTS Regional Police HQ

The NTS Regional Police HQ featured the interesting challenge of different functional needs on a fairly small site. The project used a design and build procurement method and it was also very highly assessed according to the HK Beam standards. With part of the site not to be built over and restrictions on two sides the positioning and massing of the blocks was of paramount importance. The lower larger block shields noise from the higher block behind and the angling allows some soft landscape perimeter planting. Some trees were retained in place, some transplanted and some new trees planted. A sky garden for staff features on the high block. Energy efficiency is of major importance with reduced size east west facades. Ventilated curtain wall systems have been used on these facades with sunscreens also resulting in excellent noise reduction and low OTTV's. Daylight has been maximized, flexibility of internal layouts is featured and metering to allow energy audits is provided.

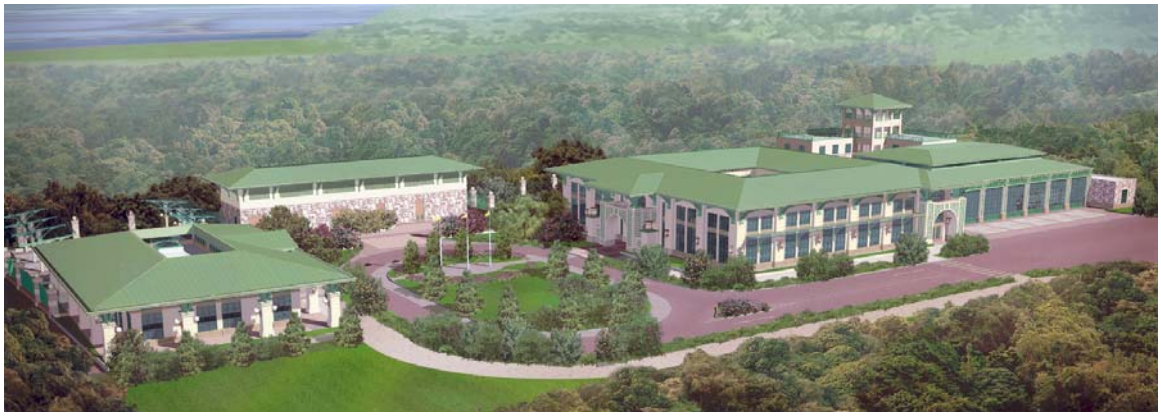
The Class A office environment is enhanced with the social side of sustainable design through the use of the police corporate colors to create their image. Prefabricated materials and precast components feature in the project with modular construction to reduce waste. Major building services plant are housed on the upper roof area with special vibration-free mountings to avoid noise transmission. This also allows some additional insulation for the roof area and easier maintenance without passing through operational areas. With an environmentally conscious client, provision for the sorting of waste is allowed on each floor with a central refuse collection room and saved material store below. These items illustrated contribute to the overall effectiveness of this project from a sustainable design viewpoint.

5.0 Wetland Park

The Wetland Park is Hong Kong's contribution to eco-tourism. In Tin Shiu Wai North it is designed to show visitors the wetland exhibition yet preserve the natural habitat. In approaching the centre, the visitor cannot really see a building only a directional pathway and a green landscaped slope, which is actually the roof of the exhibition centre. This "underground" type approach gives a low OTTV of 16 w/m^2. Another unique feature is the use of a geothermal system for the air conditioning. With the subdued entry, visitors pass through the hillside and are exposed to the north glass façade and atrium exposing the best view of the wetlands. This also allows best use of daylight and natural ventilation for many areas. Other concepts include a satellite building and bird hides set apart from the main building, smaller in scale and using natural materials such as timber from sustainable sources. These buildings are also energy saving and use natural ventilation. For this project, due to the need to form a good sub-base and use concrete as the structure, recycled crushed concrete or PVA has been used in 75% of the concrete work and in the sub base materials. This exhibition and visitor centre which includes a wetland mitigation plan for the area is an excellent example of an eco-tourism sustainable design.

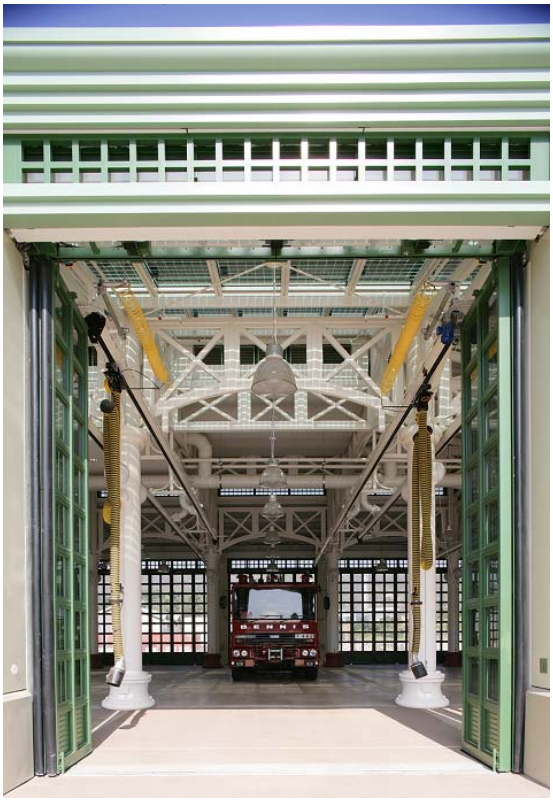
6.0 The Penny's Bay Fire Station and Police Post

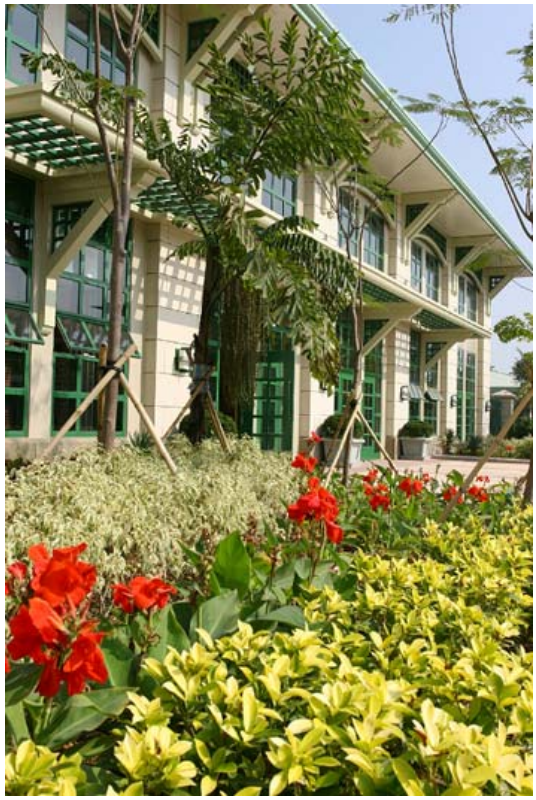
On North Lantau is the back of house utility yard for the theme park, this is the largest station in Hong Kong both surprising and unique. It has strong social and cultural elements in trying to please the Police, the Fire Services Department, the Civil Engineering Department and the Hong Kong International Theme Parks operator, Disney, in producing a garden architecture theme design, which will contribute to the future heritage of Hong Kong.



It used an integrated holistic sustainable design approach from day one and is innovative in the use of renewable energy and rainwater recycling.

The orientations of the site mainly east/west and knowledge that there would be no buildings overshadowing the site in future, allowed some sustainable rezoning first, followed by all the longer roof elevations facing the south to have solar panels for renewable energy. The pitch roof design blends with the garden architecture them and provides the frame for the panels, which are actually used as the roof, not added on top. This gives double benefits in the solid areas and triple benefits in the appliance bay where controlled daylight is also allowed in. 10% of the energy required is provided by renewable energy.





The design encouraged large roof overhangs and pergolas shading the facades bringing the OTTV values down to 10.72 w/m^2 and 12.64 w/m^2. The structure of the appliance bay was selected as steel to allow visual integration of the design theme and the buildings services as well as economic benefits.

In respect to quality of space and living, a courtyard was introduced in the centre of the fire station office area. This has many benefits, the close relationship of inside and outside spaces, pleasant outlook for offices, more daylight introduced, possibility to use natural ventilation, introduction of a water feature, improvements to micro climate and a quiet place for stress relief. A terrace outside the canteen was also introduced.

Rainwater is collected and reused for vehicle washing and irrigation. The collection allows about 10 months free supply, with top up only needed in two months of the year. This is an example for the future of what can be done.

Shared facilities on this project are the refuse collection point, the entrance roundabout and the shared building services plant building which allows easy maintenance without affecting operations. It also frees up space in the functional buildings and assists in keeping clean smooth low rise roof lines.

Quality was achieved by benchmarking the expectations of Disney, good communications and the use of prefabrication. Finishes selected were, GRC for natural stone columns and base stonework, GRP for timber brackets, pergolas, entrance frameworks, lattice work etc. Cultured stone was used for some base levels and all of these minimized the need to deplete natural resources and allow for easy long life future maintenance. The modular construction also reduced construction wastage.

As the project was on new reclamation the introduction on this small site of extensive soft landscaping, 200 new trees and 14,000 shrubs will greatly enhance the microclimate. Excavated materials from the site were reused in the ongoing reclamation and the contractor achieved many green awards during construction. The project is designed and measured to HK BEAM platinum standards.

Of Key importance was the introduction of visitors to Fire Stations, which was a first as was the involvement of partnership and coordination resulting in very successful conclusions.

7.0 EMSD HQ

This project illustrates the three R's of sustainable architecture Reuse, Reduce and Renew.

The reuse comes in the conversion of an existing building into new uses saving much energy and building materials. It is fortunate to be able to match a Client brief with a building that has suitable vehicular access to many levels.

The reduction is estimated as demolition waste equivalent to around four floors of football pitch sizes, construction waste of one floor of football pitch and renewed construction cost of the equivalent of approximately 6 schools.

The orientation of the building is fixed therefore the design had to accommodate the environmental influences. A deep roof canopy was introduced, ventilated double-layered glass wall and metal sun shades/

perforated panels used to control heat gain and minimize noise. Internally flexibility allowing cross ventilation and minimizing air-conditioning requirements to occupant zones was used. Amenity green roofs have been introduced using timber from sustainable sources in South America.

As the building has quite a deep plan, sunpipes have been used to bring natural light deeper into the interior. The project also has photovoltaic panels creating renewable energy sufficient for 5% of the building consumption. For the air conditioning cooling system, the project is large enough to accommodate an ice-making machine using off peak electricity to generate ice for cooling. A special waste management system and energy efficient building services elements feature. In addition, the project includes an exhibition centre to assist the public who visit, understand sustainable features better. This combined with the building elements themselves make this also very innovative and informative for all.

8.0 Conclusion

The projects demonstrate some of the many ways sustainable design can be developed. As new technologies develop and more information becomes available, Architectural Services Department will continue to promote and implement sustainable architecture for the betterment of our future generations and we are happy for enquires on the subject.