The Hong Kong Community College
The Hong Kong Polytechnic University

Client:
The Hong Kong Polytechnic University

Project Manager:
Campus Development Office,
The Hong Kong Polytechnic University

Project Architect:
AD+RG Architecture Design and Research Group Ltd.

Architectural Collaborators:
AGC Design Ltd.
Wang Weijen Architecture

Geotechnical & Structural Engineer:
Meinhardt (C&S) Ltd.

Building Services Engineer:
Parsons Brinckerhoff (Asia) Ltd.

Quantity Surveyor:
Davis Langdon & Seah HK Ltd.

Landscape Consultant:
Team 73 (HK) Limited

Acoustic Consultant:
Westwood Hong & Associates Ltd.

Main Contractor:
Chevalier (Construction) Company Ltd.

Foundation Contractor:
Sunley Engineering & Construction Co. Ltd.

Submission for
GREEN BUILDING AWARD 2008
(I) Introduction

The Project is a high-rise 19-storey institutional building for the Hong Kong Community College.

It aims at providing a dynamic and interactive space for youth education while incorporating the sustainable design considerations and construction techniques into the building.

4 main design and engineering concepts:

- Sustainable multi-storey building for the 21st century campus
- Design for identity, adaptability and flexibility
- Optimizing public communal space to inherit PolyU’s campus quality
- Effective circulation design consideration for high-rise campus
(I) Introduction

The Hong Kong Community College (HKCC) serves as a new campus for the Hong Kong Polytechnic University to cater for the Associate Degree programmes at Hung Hom Bay.
(I) Introduction

Careful programmatic distribution in the multi-storey building:

- **Effective pedestrian circulation** at podium low block

- 2 large **communal landscape plazas** at UG/F & 4/F being reinforced as nodal points of the whole campus

- Sky-gardens at high block become **Green Buffers** as well as public communal spaces
0.0 Project Brief

(I) Introduction

- Effective circulation design consideration for high-rise campus
  - Escalators are used to serve the low levels where mass teaching spaces accommodated
  - Lift landings at strategic communal spaces
  - Lift traffic study was conducted to determine the **optimum lift number and zoning arrangement** for effective and efficient energy use strategy.
0.0 Project Brief

(II) Master Plan Consideration

Site opportunities and constraints

Locating at nearby sites, HKCC and the existing PolyU Student Hostels should each have appropriate identity in terms of form, massing and spatial quality, but well integrated visually and linked physically.

Design response

- Raised landscaped decks on top of the multi-purpose hall to provide greenery public space
- Continuous spiral-chain of communal sky-gardens
- Careful disposition of high-rise block for best view enjoyed by the users and optimum inter-block lighting/ventilation exposure
(III) Modular Planning Design

Modular Planning Design

- The premises target to cater ever-changing teaching needs in future as well as developing technologies

- A flexible “modular system of spatial combination” capable of future transformation has been developed to facilitate the need of adaptability / flexibility

- Pre-cast R.C. construction can be adopted for better environmental and construction management consideration
0.0 Project Brief

(III) Modular Planning Design

Modular design for elevation

Response is made to the spiral communal space organization in the elevation design.

Modular design for elevation is articulated by square-shaped planning modules to match the communal space organization and enhance air flow across the building mass.
0.0 Project Brief

(IV) “Green Standard” Achieved

The Project has been rated for provisional GOLD standard in HKBEAM assessment and targeting for PLATINIUM standard subject to further post occupancy re-measurement.

The actual “Green Features” achieved by the project to be illustrated in the following 4 categories:

1) Quality
2) Resources
3) Sustainability
4) Innovation
1.0 Quality

1.1 Indoor Environmental Qualities

1.2 Bioclimatic & Landscape Qualities

1.3 Neighbourhood Amenities

Quality
From various building service implementations and structural system integration to the architectural layout planning and design, different simulations and prudent testings and commissioning aim at achieving a high quality building in terms of enhancing the indoor and outdoor air, visual enhancement, transportation and circulation, acoustic and noise attenuation etc.
1.0 Quality

1.1 Indoor Environmental Qualities

- Internal courtyards with glass enclosure
- Photo Oxidation Disinfection Unit for MVAC System
  - Photo oxidation disinfection unit / Nano photocide technology is installed for AHU/PAU. Nano photocide technology is applied to air conditioning systems in Lecture Theatres to improve air quality.
- Odour Control System
  - As a 25 ACH ventilation is allowed for all toilets and a 20 ACH ventilation is allowed for refuse chamber, it is adequate for odour control.
- Fresh Air Intake
  - Fresh air intake is located away from the possible traffic contamination and other pollutant sources.
1.0 Quality

1.1 Indoor Environmental Qualities

• Air Filtration
  - Electrostatic precipitator (EP) filters with air sampling and monitoring are provided for air handling units and primary air units.

• Air flow Control for Workshop
  - Exhaust system is provided to maintain the workshop at negative pressure to prevent smell from spreading to other areas.

• Low Level Exhaust for Toilets
  - Low level exhaust is provided for each toilet cubicle. Ventilation fan is located above false ceiling of the toilets and discharged to open air.

• Purging mode of AHU / PAU available
1.0 Quality

1.2 Bioclimatic & Landscape Qualities

- **Sky gardens and green roof**
  - Enhance natural ventilation

- **Integration of Greenery into the Elevations**
  - Along periphery of building and parapet walls / outside classrooms - strip planting to enhance natural ventilation and to screen off unpleasant view

- **Internal courtyards with glass enclosure**

- **Foot Massage Pathways**
  - Foot massage pathways are installed at 4/F landscape deck
1.0 Quality

1.3 Neighbourhood Amenities

- Integration of Greenery into the Elevations
  - Feature trees/palms are located at semi-open communal spaces as a focus to create a unique *landmark* for orientation
2.0 Resources

2.1 Energy Flows & Energy Future

2.2 Material Use & Water Conservation

2.3 Waste Management & Pollution Control

Originality
The first fully pre-cast and modular unit system (including columns, beams, ribs, facades, staircases, etc) adopted in this high-rise institutional building with the objectives to promote off-site fabrication and reduce material wastage.

The maximized amount of sky gardens intends to bring in more fresh air and enhance the indoor air quality, meanwhile, provides visual comfort to visitors and users.
2.0 Resources

2.1 Energy Flows & Energy Future

- **Solar Panel Installation on Building Roof**
  - For shower rooms, solar water heaters supplemented with electric water heater are adopted. The solar water heating system is capable to provide hot water for 15 nos. showers and serve a maximum of 60 persons per day.
2.0 Resources

2.1 Energy Flows & Energy Future

- Varied Ceramic Fritted Patterns on glass panels applied at different places of the building
  - There are three different types of glass used in the building. They have different degrees of transparency. This is controlled by means for different percentage of ceramic fritted pattern on the glass. For the Glass on the outermost of the building, it has about 50% transparency: this helps reducing heat gain, and thus saving energy for cooling. For the inner glass, it is either clear glass or glass with 30% fritted pattern: this helps maintaining outside views.
2.0 Resources

2.1 Energy Flows & Energy Future

- Varied façade treatments in response to environments
  - Façades facing different directions of different contexts are treated specifically through the manipulation of number and density of aluminium louvers, distribution of glazing areas and types of glass used
  - Outside views of the users are optimized while energy saving aspects are also well considered for best use of natural lightings and minimized air-conditioning loading
2.0 Resources

2.1 Energy Flows & Energy Future

- Energy saving standard of luminance is adopted for particular locations in the building
  - Luminance of 300 lux is adopted for classrooms
  - Luminance of 100 lux is adopted for corridors

- Maximizing the openable window provisions to the internal corridors in order to reduce electricity consumption
  - Windows are introduced at the ends of the internal corridors on typical floors of the Tower Block

- Night Mode chiller
  - 4 big water-cooled chillers and one 1 small water-cooled chiller are adopted. The small chiller is used as nighttime or light load chiller to optimize the efficiency of the equipment.
2.0 Resources

2.1 Energy Flows & Energy Future

- **CO₂ Sensors**
  - CO₂ sensors are adopted to control the outdoor air quantity supplied to the interior spaces. The total outdoor air quantity from the primary air handling unit is also regulated by adjusting the fan speed using frequency inverter. This can minimize the fresh air loading on air-conditioning system.

- **Intelligent Building Management and Control for public lighting and MVAC system at public area**
  - Group on/off control of the fan coil units and individual control for each Lecture Theatre, using time schedule. The time schedule can be adjusted at the BMS.

- **Variable Speed Drives for Secondary Chilled Water Pumps**
  - Decoupler pumping system is adopted. All secondary chilled water pumps are variable speed pumps with frequency inverter to save energy during part-load conditions as compared with constant speed pumps.
Total Energy Recovery between Exhaust Air and Fresh Air in PAU (Primary Air Unit) Design
- Rotary heat wheel is provided to each primary air unit at 9/F to 14/F for total energy recovery between exhaust air and fresh air.

Free Cooling for Lecture Theatres and Multi-purpose Hall
- When the outdoor enthalpy and temperature is lower than the design room air condition of Lecture Theatres and Multi-purpose Hall, free cooling is adopted. The fresh air volume is controlled to achieve the higher energy efficiency.
2.1 Energy Flows & Energy Future

- **Motion Sensors for Escalators**
  - When the escalator is idled for a pre-determined period, the escalator will be slowed down. If the motion sensor at the entry landing detects a passenger going toward the escalators, the escalator will be switched automatically to the designed speed again.

- **LED Exit Signs**
  - The power consumption of LED exit sign with integral battery / charger is about 3W. It is adopted with long expected life, minimum maintenance and low power consumption.

- **Pressure Step Separator and Dirt Separator for chilled water system**
  - Pressure step separator can extract dissolved gases to prevent poor heat transfer while dirt separator can remove dirt in re-circulating circuit to avoid pressure drop due to blockage.
2.0 Resources

2.1 Energy Flows & Energy Future

- **Occupancy motion sensors for lighting and FCU control in classroom and individual staff offices**
  - Motion detectors (infrared type) are provided at each Lecture Theatres to turn off all lighting and reset the temperature set point to 28°C (adjustable) during unoccupied mode to save energy.

- **T5 Tubes and Electronic Ballasts**
  - Energy saving fluorescent luminaries are provided at classrooms, lecture theatres and staff offices.
  - Optimum energy efficiency and a lumen maintenance level of about 92% with 10,000 burning hours.
  - More environmental friendly for having relatively smaller amount of mercury used, less glass is used in the slimmer tube, less package material.
2.0 Resources

2.2 Material Use & Water Conservation

- Use of Recycled Aggregates and Fine Aggregates for production of paving block – “Eco-paving Block”

- Reuse of Bleed Off Water
  - A bleed off tank located at 4/F is provided to collect bleed off water from cooling towers. The bleed off water is transferred to flushing water tank for flushing purpose.

- Reuse of Condensation Water
  - A treatment plant for recycling condensation water from fan coil units and air handling units is provided. The treated condensation water will be re-used for flushing purpose.

* Academic collaborator:
  Professor C.S. Poon,
  Department of Civil and Structural Engineering,
  The Hong Kong Polytechnic University
2.0 Resources

2.2 Material Use & Water Conservation

- **Use of Transfer Air**
  - Transfer air duct with silencer is provided for air-conditioned areas for transferring air to the corridors, from which the “used” air is then transferred to the toilets where exhaust system is installed. Exhaust air from Lecture Theatres is transferred to Chiller Plant Room/Carpark at LG/F and communal space. This can fully utilize the treated air before exhaust.

- **Use of Non-chemical Water Treatment**
  - Non-chemical treatment supplemented with chemical treatment is provided for A/C plant. A treatment plant for recycling condensation water from fan coil units and air handling units is provided. The treated condensation water is re-used for flushing purpose.

HVAC layout plan at 13/F
2.0 Resources

2.3 Waste Management & Pollution Control

- Pre-cast Reinforced Concrete construction
  - Pre-cast R.C. construction is **FULLY** applied to pre-cast facade, structural columns, slabs, beams and staircases (The first fully pre-cast construction for institutional building in HK)
  - Prevent extensive wet trade on the works site and reduce C&D waste/debris generated on site
  - Minimized use of timber formwork / falsework
  - Noise is reduced by less use of vibrator for in-situ concreting works
2.0 Resources

2.3 Waste Management & Pollution Control

- Pre-cast Reinforced Concrete construction

  - Fast track works programming: Without the need to formwork erection and striking for the secondary beams and slabs, and with early programming for production of pre-cast members from the set-up plants, the construction time is shortened. It implies shorter site works time and so as the pollution and nuisance caused to the surrounding environment.
2.0 Resources

2.3 Waste Management & Pollution Control

- Fair-face R.C. applied on façade
  - It reduces the necessity of plastering use, and in turn less material waste results during construction.

- Non-timbering hoarding, metal falsework applied

- On-site sorting of construction and demolition (C&D) waste

- Trip ticket system is adopted and the construction waste is disposed at the Government designated disposal area
2.0 Resources

2.3 Waste Management & Pollution Control

• **Non-HCFC/ Halon Portable Fire Extinguishers**
  - Non-HCFC/ halon portable fire extinguishers are provided inside electrical and mechanical plant areas, laboratories and other specified areas.

• **CFC-Free Refrigerant**
  - The chillers are operated on R134a or CFC-free refrigerant to minimize ozone depletion and global warming effect.
3.0 Sustainability

3.1 Life Cycle Perspective

3.2 Building Amenities

3.3 Sustainability Policy & Feedback Loops

Practicality
All treatments and planning of the building involve in-depth research on the practical use viewpoints, medium and materials selection, plant species for greening and its supporting devices, actual maintenance and operation issues. The output is achieved through successful collaborations with PolyU’s environmental and engineering professors and practitioners.
3.0 Sustainability

3.1 Life Cycle Perspective

- **Solar Water Heating System**
  - The system aims at providing sufficient hot water for 16 numbers of shower to serve a maximum of 30 numbers of person per hour.
  - 60 numbers of solar collectors are installed on upper roof floor and as pre-heat system for such showers.
  - The solar water heating system is a closed circuit solar water heating system. The proposed solar collector system can rise the circulating water temperature above 80 degrees Celsius while the heat is transferred to the potable water through the calorifier tanks.
3.0 Sustainability

3.2 Building Amenities

- **Intelligent Building Management and Control**, for public lighting and MVAC system at public area
  - group on/off control of the fan coil units and individual control for each Lecture Theatre, using time schedule. The time schedule can be adjusted at the BMS

- **Occupancy Motion Sensors for Lighting and FCU Control in Classroom and Individual Staff Office**
  - Motion detectors (infrared type) are provided at each Lecture Theatres to turn off all lighting and reset the temperature set point to 28°C (adjustable) during unoccupied mode to save energy.

- **CO₂ Sensors**

- **Motion Sensors for Escalators**
3.0 Sustainability

3.2 Building Amenities

- **Use of dual-flush water tank for water closet**
  - Users could choose different flushing volume of 7.5 litre and 3 litre for water conservation

- **Infra Red Sensor for Water Taps**

- **Free Cooling for Lecture Theatres and Multi-purposes Hall**
  - When the outdoor enthalpy and temperature is lower than the design room air condition of Lecture Theatres and Multi-purposes Hall, free cooling is adopted. The fresh air volume is controlled to achieve the higher energy benefit

- **LED Exit Signs**
  - LED exit sign is adopted with long expected life, minimum maintenance and low power consumption
3.0 Sustainability

3.3 Sustainability Policy & Feedback Loops

Close Relationship among different parties

Partnering workshops among end-users, project manager, consultants and contractors are organized to foster a partnering approach in the project development.

Facilities Programming Workshops

Three facilities programming workshops are conducted to develop the project brief and design layouts through the discussion with the Community College’s representatives, Campus Development Office, Facilities Management Office and the Project Team.
3.0 Sustainability

3.3 Sustainability Policy & Feedback Loops

User's response and feedback system

- Different events and workshops are arranged at different stages of the project with all stakeholders for better interaction, sense of involvement and feedback engagement.
- A standard form of report is designed for users' feedback. All defects would be analyzed and reviewed by the project team. Joint inspections are carried out to ensure all problems would be handled carefully.

Ease of operation and maintenance, cost effectiveness

- For maintenance considerations, alternatives of materials and fittings were adopted for the project and with long term maintenance costs considered and studied.
- Value Engineering was extensively employed at all stages to provide a true comparison of alternatives and options, taking into account the life cycle costs, tangible and sometimes intangible values of different choices.
3.0 Sustainability

3.3 Sustainability Policy & Feedback Loops

Flexibility for changing needs

- Future expansion has been reserved at the building design stage. Teaching clusters formed by modules of 8.4m x 8.4m, separated by folding partitions, allow flexibility for spatial arrangement and possibility of reorganization. The clusters are arranged in a dynamic and vibrant vertical composition to create spaces of different scales and characters for social interaction and teaching purposes.

- The design can minimize disturbance in case of future alteration and additions, in view of inevitable changes of teaching and curriculum requirements over the life span of the Community College.
4.0 Innovation

4.1 Computer Modeling

4.2 Integration of building service with structure

4.3 ”Immunized Building”

Innovation
The project systematically and practically achieves a great success of combining innovative ideas and environmental objectives with architectural design. It not only gives a new atmosphere to its surrounding but also to a larger extent defines new paradigm of how a high-rise institution building could integrate with the natural environment and the surrounding in an urban climate at an urban scale.

Valuable inputs were made from PolyU’s research collaborators, facilities management and campus development colleagues and the design team.
4.0 Innovation

4.1 Computer Modeling

*Computer-aided* renderings, physical and computer models of different scale, elevation studies, computer fluid dynamic model, and other cutting edge simulations are utilized and reviewed at client-consultant meetings to discuss and illustrate the continuous development of the project.

*Computer simulation* on the construction of Pre-cast Reinforced Concrete is adopted to enhance the structural design as well as assembly process and planning of the pre-cast elements. Different parties of the project teams have also been facilitated substantially to visualize the structural system and construction process of the main structure frame.

![Computer simulation of pre-cast R.C. construction process](image)
Building service is well integrated with the structural system to cater for future alterations. The main service trunks run along the corridor, with branch pipes branch off into function room. Hence it becomes flexible for future service and architectural layout modification if the space are re-partitioned.


4.0 Innovation

4.3 * "Immunized Building"

Sustainable Immunized Building (SIB)

- The project adopts the “Immunized Building” concept as a new dimension of building quality

- New principles are introduced for strategic building modeling and its system on the delivery of a safe, healthy and comfortable environment having the effective use of energy

- The principles formulate various holistic, pathological and system indices for total approach of health management in a building for people, space and system

* Academic collaborator:
Professor Chan Wai Tin, Daniel,
Department of Building Services Engineering,
The Hong Kong Polytechnic University
4.0 Innovation

4.3 “Immunized Building”

Electronic Operation and Maintenance Manual (EOMM)
- EOMM is developed from the concept and research output of the “Immunized Building”
- It is a tool for transformation of available data and information to well organized the knowledge database aiming at producing a total solution for the operation and maintenance management and to the intended innovative quality – harmonization of building health and sustainability.

* Academic collaborator:
Professor Chan Wai Tin, Daniel,
Department of Building Services Engineering,
The Hong Kong Polytechnic University
5.0 Conclusion

The original objectives of the building by PolyU aim at ascertaining greening initiatives and opportunities of how a high-rise building could integrate with the natural environment and the surrounding in an urban climate at an urban scale.

With the successful collaboration with PolyU, their property and management departments, aggregated efforts from the consultants team, and cutting edge researchers, esteemed professors and practitioners from PolyU; the building with different greening applications and sustainable growing system in the local context demonstrates successful integration with the current local practices as well as management and maintenance issues.

Opposite to the wall effect high-rise building, the building shows that greening has potentially multi-fold benefits. It enhances building thermal performance and improves outdoor comfort. To a large scale, it leads to improvement in urban ecology and provides visual relief and improvement to a dense urban environment.

The project systematically and practically achieves a great success of integrating innovative ideas and environmental objectives with architectural design to attain a quality building design. By serving as a public building, the building is open to the public, the podium garden and the continuous sky gardens could be made highly accessible and user friendly to encourage higher patronage.