

## II Project Information

Project Title (in English)	Project Title (in Chinese)
Enhancement of Teaching and Learning on Environmental Sustainability	提高教學和學習於環境可持續發展的領域

### A. Project Summary

*(please provide an executive summary of the project proposal in no more than 500 words).*

The Faculty of Science and Engineering has been endeavouring to nurture the students with professional knowledge in resolving practical environmental problems and developing sustainable built environment specific to the Hong Kong environment. A series of environmental engineering and sustainable design courses have been introduced in the programmes of BEng (Hons) in Civil Engineering and BArch (Hons) Architecture. To enhance students' learning experience in environmental sustainability meeting the needs from the civil engineering and building industries, it is our aim to introduce the most up-to-date technologies and engineering practices to students through the day-to-day learning. The proposed project helps accelerate the achievement of this goal through the enhancement of teaching and learning on environmental sustainability.

The proposed project covers four principal areas: 1) traffic noise; 2) indoor air quality; 3) water quality; and 4) sustainable building design including air ventilation assessment and lighting design. All years of students will participate in different stages of the project coordinated by the faculty. The geographical study area of the project will primarily focus on the Tsuen Wan District. The traffic noise study involves field measurement of traffic noise at selected high traffic flow locations, establishment and operation of a wire and wireless WiFi data acquisition system for noise data collection and processing, and assessment of traffic noise impacts. The indoor air quality study will characterize and quantify indoor air pollution in selected institutional and commercial premises through questionnaire survey, *in-situ* measurement and statistical analysis of data. The water quality study involves water sampling and analysis for characterization of water quality in Rambler Channel, and the application of mathematical models for investigation of hydrodynamics and water quality in the channel. Wall-effect of high-rise buildings in Tsuen Wan District is a growing concern. The sustainable building design study will focus on air ventilation assessment using a computational fluid dynamics (CFD) software to simulate the wind shielding effect due to high-rise buildings, and computer simulation of different lighting conditions to assess lighting quality and optimize lighting design for energy saving.

A project website will be established to provide learning materials on environmental sustainability and findings from the study that can be accessible to the students and the public. Exhibitions and talks will be organized within the study period to promote the awareness of environmental sustainability. Final Year Projects will be linked to the proposed project covering all the principal areas. In depth investigations will be conducted by the Year 4 students with supervision from the faculty staff. An Environment and Sustainable Development Centre will be established to provide support on the continuous development of teaching and learning on environmental sustainability.

In summary, the project will give direct benefits to all the students of the faculty through students' direct involvement in the project. It also promotes campus-wide and public awareness of environmental sustainability and increase participation from the College and the community.

## **B. Project Objectives**

*(please identify the needs of the target recipients and explain how the project aims to address the needs).*

Environmental protection and sustainable development not only contribute to a better quality of life but also preserve the living environment for future generations. Education for environmental sustainability develops knowledge and skills for environmental protection as well as positive attitudes towards sustainability. Awareness of environmental sustainability is best to be initiated in the teaching and learning programmes. There are needs to publicize and increase the awareness of environmental sustainability to students. In particular, the students with science and engineering background should also be equipped with hands-on experience in dealing with environmental problems and designing sustainable built environment so as to contribute to the sustainable growth of the society.

Challenging environmental problems require multidisciplinary solutions. Sustainable concept is now integrated into new engineering design but it is not systematically covered in conventional engineering training. Computational simulations are now popularly adopted in modern engineering design but the graduates are in lack of the knowledge on computation. A combination of data collection from field measurement and computational simulation is essential to the success of engineering and sustainable design.

To promote awareness and enhance the capability of our students to be able to provide sound environmental sustainability solutions, the project is aimed to:

- enhance teaching and learning on environmental sustainability by introducing the latest engineering technologies and practices to the students;
- provide opportunities for the students to gain hands-on experience in dealing with environmental problems and designing sustainable built environment through direct involvement in the project;
- conduct a traffic noise study to develop and apply a wire and wireless data acquisition systems for noise monitoring, and to teach students how to assess traffic noise impacts;
- conduct an indoor air quality study to train students the air sampling techniques and how to characterize and quantify indoor air pollution;
- conduct a water quality study to collect and analyze water samples and to apply mathematical models for simulation of complex coastal hydrodynamic and water environment;
- conduct an air ventilation assessment for students to learn how to use a CFD software for simulation of air flow around high-rise buildings and minimize wind shielding problems in urban development;
- conduct a lighting design study by application of computer simulation to improve lighting quality and optimize the lighting design for energy saving;
- establish a project website to make available the learning materials on environmental sustainability and the study findings to the students and the general public;
- organize exhibitions and talks to promote awareness of environmental sustainability;
- support Year 4 students' Final Year Projects to perform in-depth investigations of the identified principal areas; and
- establish an Environment and Sustainable Development Centre to provide continuous support to the teaching and learning on environmental sustainability.

### **C. Outcomes and Deliverables of Project**

*(please include the expected number of target beneficiaries and explain how they will benefit from the project).*

The major outcomes of the project are: 1) enhancement of teaching efficacy with the support of the advanced measurement equipment, data acquisition system and state-of-the-art computational modeling tools; 2) practical experience and skills gained by the students from conducting studies on real-life environmental problems and sustainability issues; 3) enhancement of student employability through the learning process; 4) support to the Final Year Project/Dissertation to investigate the most popular environmental sustainability topics; 5) strengthening of the programmes on environmental sustainability education; and 6) improvement of awareness to the students of the College and the community on environmental sustainability.

About eight teaching staff from the Faculty of Science and Engineering will be involved in teaching courses relevant to the project and actively involved in project implementation as well as to supervise students to carry out the field measurement, data acquisition and analysis, computer modeling, assessment and design. This provides continuous development opportunities to the teachers in updating their teaching skills and knowledge on the most up-to-date environmental and sustainability technologies. With the application of the advanced supportive teaching tools such as noise level meter, air quality monitor, wire and wireless data acquisition system and educational version of modeling software, the teacher can also be benefited from improving teaching effectiveness and student learning in line with the aims of the proposed project.

Successful teaching and learning require a consistent approach and continuous participation from staff and students. A three-year period of the project is proposed to lay the groundwork for developing a long-term strategy for continuing the teaching and learning programme on environmental sustainability. Students in all years from the faculty are required to take the environmental and sustainability courses to acquire the fundamental concepts. The students will participate in different learning activities by involving in the planning, design, implementation, assessment and promotion of the project. Through the direct involvement in various aspects of the study areas and different stages of the project, the students' understanding on the actual problems and problem solving skills will be improved. This also facilitates and enhances employability of students on the environmental and sustainable development markets. Upon the commencement of the project, all the existing Year 1 to Year 4 students of the Faculty will immediately be able to participate in the planning and design of the project. For a three-year period of the project, there will be new Year 1 students joining the programmes and participating in the project. It is estimated that the students who will directly benefit from this project are up to 300 within a three-year period of the project.

The project provides a range of excellent topics that can be assigned to the Final Year Project/Dissertation. It is planned to generate about five to eight final year projects or dissertation reports covering all the principal areas of this project. This strengthens the research capability of the students for pursuing higher degree opportunities.

Being one of the objectives of the project, the concepts of environmental sustainability will be publicized and promoted to all the students of the College. Findings of the studies will also be uploaded to the project website to attract students' attention of the environmental pollution and sustainable built environment, hence improve their awareness of environmental sustainability. As a result, a total of more than 1,000 students of the College will also benefit from the project. The benefit created by the proposed project can also be extended to the community as the proposed exhibitions and talks will raise public interest and awareness of the environmental pollution of their living environment and the ways to minimize the pollution.

The establishment of the Environment and Sustainable Development Centre provides long-term support to the teaching and learning on environmental sustainability, serving as a learning platform for the engineering students to be able to become skilled at the updated industrial practices in environmental engineering and sustainable building design.

#### **D. Implementation Details**

Upon award of the project, a project team, which consists of experienced teaching staff in the field of environmental sustainability, will be formally established to take up this challenging project. The organization structure of the project team comprises of a Project Manager, a Deputy Project Manager, Area Leaders and supporting teaching staff. A majority of the team members are PhD degree holders and registered architects, and are experienced in pollution control and environmental sustainability.

The Project Manager will lead the implementation of the project ensuring that the outcomes of the project meet the project objectives at the highest attainable standard and is responsible for the day-to-day management and self-evaluation of the project. The Deputy Project Manager will assist the Project Manager in undertaking the various study tasks, coordinating with the team members, and liaising with the external parties. Each of the identified principal areas (traffic noise, indoor air quality, water quality, air ventilation and lighting) will be led by an Area Leader, who will supervise the study and provide training to students. The Area Leaders will also be responsible for planning exhibitions and talks to promote awareness of environmental sustainability to the College and the community. A group of teaching staff from the Department of Civil Engineering, Department of Architecture and Department of Computer Science will be involved in teaching relevant courses to provide fundamental knowledge to the students on various disciplines of environmental sustainability and IT knowledge. These Year 1 to Year 4 courses include Environmental Engineering, Environmental Pollution Control, Sustainable Development, Professional Studies, Introduction to Environmental Science, Building Technology and Sustainability, Traditional Sustainable Built Environment, Active & Passive Systems in Sustainable Design, Holistic Approach in Sustainability, Computer Networks, Distributed Systems, Network Security, and Final Year Project/Dissertation.

The College and the Faculty of Science and Engineering are committed to provide resources for supporting the implementation of the project. The teaching activities are financially supported by the College. The grant provided by the Quality Enhancement Grant Scheme will mainly be used to support the enhancement of students' learning of industrial practices and advanced technologies through: 1) provision of additional teaching materials and training in the routine teaching activities; 2) acquisition of advanced equipment for field measurement and state-of-the-art modeling tools for computational simulation of complex environmental phenomena; 3) establishment of a project website for distributing learning materials and publishing study findings; 4) research activities in the Final Year Project/Dissertation; and 5) organization of exhibitions and talks to the College and the community for promotion of awareness.

The proposed project will be implemented in three stages over a three-year period: 1) planning and project design; 2) study execution; and 3) dissemination of study outputs and evaluation of outcomes

##### Stage 1 – Planning and Project Design (July 2009 – June 2010)

The first stage is planned for project preparation and staffing arrangement during the summer term break before the commencement of the academic year in September. The project team will hold meetings to define project scope and responsibilities of the team members, formulate the study methodology and schedule a study programme. Purchase of measurement equipment and modeling software will be commenced in order to ensure the timely commencement of the field measurement activities in September 2009. The design work of the project website and all the studies will also be initiated at this stage.

##### Stage 2 – Project Implementation and Execution of Studies (July 2010 – June 2011)

**Five major studies** covering the noise traffic, indoor air quality, water quality, air ventilation assessment and lighting design will be conducted by students and supervised by Area Leaders with the support from teaching staff.

The **Traffic Noise Study** will conduct traffic noise measurement using sound level meters at selected high traffic flow locations. A wire and wireless data acquisition system will be set up for data logging, transmission and storage. Students will be trained to operate the system and analyze data for comparison with the noise criteria for road traffic noise specified by Environmental Protection Department (EPD). The traffic noise measurement will record  $L_{10}$  (1 hour) dB(A) during the AM and PM peak hours of normal weekdays, and will be conducted regularly for three years at selected locations within the Tsuen Wan District. The collected field data will generate a road traffic noise database.

The **Indoor Air Quality Study** will carry out measurement of carbon dioxide, carbon monoxide, humidity, temperature, respirable suspended particulate, nitrogen dioxide and formaldehyde in selected institutional and commercial premises. A questionnaire will be designed and distributed to the occupants of the premises to collect feedbacks so as to identify the indoor air quality conditions and any potential medical symptoms. Monitoring of indoor air quality will then be conducted after the questionnaire survey. The collected data will be compiled and analyzed to establish correlation between occupants' perceptions about indoor air quality and the measurable parameters as well as to compare with the relevant criteria, e.g. IAQ Objectives for Offices and Public Places.

The **Water Quality Study** will focus on the tidal flushing capacity and seasonal water quality conditions in Rambler Channel, which is a navigable waterway separating the Kowloon Peninsula and the Tsing Yi island. Tidal inflow and outflow through the entrance/exit at both ends of the channel are limited by its width and configuration. Discharges of contaminants from the existing stormwater culverts cause pollution to the water body of the channel. Water samples will be collected at different locations of the channel and at the exits of identified stormwater culverts and delivered to an HOKLAS laboratory for analysis of water quality parameters. The water quality parameters to be analyzed include suspended solids, biochemical oxygen demand, chemical oxygen demand, pH, salinity, unionized ammonia, total inorganic nitrogen, *E. coli*, reactive phosphorus and total phosphorus. The Delft3D suite of models, which are commonly used in environmental impact assessment (EIA) of major infrastructure projects in Hong Kong, will be used to build a hydrodynamic and water quality for simulation of the tidal pattern and water quality conditions in the channel and compared with the field measured data and the Water Quality Objectives of the Western Buffer Water Control Zone. The College owns the license of a well-known near-field model "CORMIX", which will also be used to simulate initial mixing of the pollutant plumes generated at the outlet of the stormwater culverts and assess the water quality impacts.

The **Air Ventilation Assessment** will use a computational fluid dynamics software "PHOENICS" to simulate the air flow around the newly proposed and the existing high-rise buildings in Tsuen Wan and at pedestrian levels to identify a better option for arrangement of building blocks and the impacts on the local environment. The study will follow the *Technical Guide for Air Ventilation Assessment for Developments in Hong Kong* issued by the Planning Department for model simulation and assessment.

The **Lighting Design Study** will apply the "Radiance" design software to simulate illumination, visual quality and evaluate different lighting conditions and light levels in selected offices to improve the lighting quality of a design. Energy consumption will be audited for different lighting designs to work out recommendations for optimization of lighting design and energy saving. Students will be involved in the design, model simulation, audit and evaluation of the results.

These five major studies will be linked to the Final Year Project/Dissertation of the three departments of the Faculty. It is anticipated that five to eight Year 4 students will complete their project/dissertation reports with in-depth investigation of the five principal areas proposed for this project at this stage.

All the field measurement data, initial modeling results and findings will be uploaded to the project website on a regular basis. Relevant learning materials relating to five principal areas will also be designed and made accessible to the students and the general public on the website.

A **talk series** covering three public talks on environmental sustainability will be given to the students of the College and the public. Some initial findings of the studies will be shared to the students and the public. Invitations will be sent to the secondary schools to invite their participation. A **mid-project exhibition** will be conducted in Feb 2011 to display the background of the project and the preliminary study results so as to promote environmental sustainability to the community.

Project monitoring and self-evaluation will be conducted at all stages of the project to ensure that the quality of the studies conducted by the students is up to professional standard and the milestones of the identified deliverables can be completed on a timely manner.

An **Environment and Sustainable Development Centre** is planned to establish in Oct 2010, well using the experience learnt from the implementation of the project. During the study period of the project, the project team members will be the key staff of the Centre. The College will provide additional resources to the Centre for the effective management and operation. The Centre will provide continuous support to the project and will also support the teaching and learning on environmental sustainability to the College after completion of the project.

**Stage 3 – Project Finalization and Dissemination of Study Outputs (July 2011 – June 2012)**

This final stage of the project will focus on the report writing for each of the studies with the presence of all the field measurement data, computational and assessment results, and findings. There will be five Final Study Reports to cover the areas on traffic noise, indoor air quality, water quality, air ventilation and lighting design. Important findings and recommendations will be uploaded to the project website. A Project Report will also be prepared to record all the stages of the project works, achievement and recommendations on further study and research.

A post-project public exhibition will be organized in Jun 2012 to display the study results and recommendations on improvement of environmental sustainability to the community.

Monitoring and self-evaluation of the overall effectiveness of the project will be conducted and reported to the College at the end of the project.

**E. Implementation Schedule** *(Please extend this table if necessary.)*

Estimated start date of project: 2 July 2009

<b>Action</b> <i>(please indicate key milestones)</i>	<b>Timeframe</b>	<b>Cashflow Requirement</b>
<p><u>Stage 1 – Planning and Project Design Stage</u></p> <ul style="list-style-type: none"> <li>➤ Project preparation and staffing arrangement</li> <li>➤ Defining project scope and responsibilities of the project team members</li> <li>➤ Study methodology formulation and study programme design</li> <li>➤ Acquisition of measurement equipment and computer software</li> <li>➤ Design work of the project website</li> <li>➤ Traffic noise study and setup of a traffic noise database</li> <li>➤ Indoor air quality study</li> <li>➤ Water quality study</li> <li>➤ Air ventilation assessment</li> <li>➤ Lighting design study</li> <li>➤ Annual quality assurance monitoring</li> </ul>	<p>July 2009 – June 2010</p>	<p>43% of total budget (HK\$839,520)</p>

<p><u>Stage 2 – Project Implementation and Execution of Studies</u></p> <ul style="list-style-type: none"> <li>➤ Traffic noise study and setup of a traffic noise database</li> <li>➤ Indoor air quality study</li> <li>➤ Water quality study</li> <li>➤ Air ventilation assessment</li> <li>➤ Lighting design study</li> <li>➤ Public talks</li> <li>➤ Mid-project exhibition</li> <li>➤ Management of project website and information update</li> <li>➤ Annual quality assurance monitoring</li> <li>➤ Establishment of an Environment and Sustainable Development Centre</li> </ul>	July 2010 – June 2011	28% of total budget (HK\$540,740)
<p><u>Stage 3 – Reporting and Dissemination of Study Outputs</u></p> <ul style="list-style-type: none"> <li>➤ Traffic noise study and setup of a traffic noise database</li> <li>➤ Indoor air quality study</li> <li>➤ Water quality study</li> <li>➤ Air ventilation assessment</li> <li>➤ Lighting design study</li> <li>➤ Preparation of five Final Study Reports</li> <li>➤ Preparation of a Project Report</li> <li>➤ Post-project public exhibition</li> <li>➤ Preparation of a Final Quality Assurance Monitoring Report</li> </ul>	July 2011 – June 2012	29% of total budget (HK\$550,740)

Estimated completion date of project:

31 June 2012

<b>F. Project Budget</b>						
<b>Projected Expenditure</b> <i>(Please provide detailed breakdown under each item)</i>	<b>Amount in HK\$</b>					
	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Total</b>
a. Manpower <sup>Note A</sup>	432,000	432,000	432,000	N/A	N/A	1,296,000
b. Equipment/Facilities <sup>Note A</sup>	316,780	N/A	N/A	N/A	N/A	316,780
c. Services <sup>Note A</sup>	70,740	93,740	93,740	N/A	N/A	258,220
d. General Expenses	20,000	15,000	15,000	N/A	N/A	50,000
e. Others (e.g. auditor's fee)	-	-	10,000	N/A	N/A	10,000
<b>Total Expenditure :</b>	<b>839,520</b>	<b>540,740</b>	<b>550,740</b>	N/A	N/A	1,931,000
Note: A) Detailed breakdown refers to Attachment 1.						
<b>Projected Income</b>	<b>Amount in HK\$</b>					
	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Total</b>
a. (e.g. fees received)	N/A	N/A	N/A	N/A	N/A	
b.	N/A	N/A	N/A	N/A	N/A	
c.	N/A	N/A	N/A	N/A	N/A	
<b>Total Income :</b>	N/A	N/A	N/A	N/A	N/A	
<b>Sources of Funding</b>						
a. Amount of grant sought under this application: <u>HK\$1,931,000</u>						
b. Other sources of funding <i>(this may include donations, contributions from the applicant/its parent organization, etc. Please give the name(s) of the sponsor(s), the amount of funding, and indicate whether the funding has been secured.):</i>						
(i) <u>NIL</u>						
(ii) <u>NIL</u>						
(iii) <u>NIL</u>						



### **G. Monitoring and Self-evaluation Mechanism**

A Project Quality Assurance (QA) Team will be formed at the beginning of the project. The members of the Project QA team are the Project Manager, the Deputy Project Manager and the Area Leaders. The chairman of the Project QA team is the Project Manager. Evaluation forms will be designed to distribute to the Area Leaders, supporting teaching staff and students to collect their views and comments on the effectiveness and outcomes of the project on an annual basis.

The QA team will submit the evaluation results and a summary report to the Dean of Faculty of Science and Engineering. The Dean will prepare and submit an Annual Quality Assurance Monitoring Report to the College's Quality Assurance Committee for review and endorsement. Any comments and suggestions from the Quality Assurance Committee will be given to the Dean and then the Project QA Team for improvement of the project quality.

There will be three Annual Quality Assurance Monitoring reports to be submitted to the Quality Assurance Committee. A Final Quality Assurance Monitoring Report will also be submitted from the Dean to the Quality Assurance Committee at the end of the project to summarize all the evaluation results, improvement and achievement.

### **H. Management Support and Key Personnel Involved**

The College and the Faculty of Science and Engineering are committed to nurture our students with professional knowledge in environmental sustainability. The senior management including the President, Vice President and Dean of Faculty of Science and Engineering will give advices and guidance to the project team for implementation of the project to attain a professional standard. Clerical and technical supports will also be provided to the project team.

Key personnel of the project team are listed below:

Project Manager:	Dr. KL Pun, Head of Department of Civil Engineering
Deputy Project Manager:	Dr. Edith Ngai, Assistant Professor, Department of Civil Engineering
Team Members:	Mr. Paul Chu, Head of Department of Architecture (registered architect)
	Dr. KT Wan, Assistant Professor, Department of Civil Engineering
	Dr. HH Tsang, Assistant Professor, Department of Civil Engineering
	Dr. Keith Cheung, Assistant Professor, Department of Computer Science
	Mr. FM Li, Lecturer, Department of Architecture (PhD candidate and registered architect)

**I. Special Justifications if the Grant Sought Exceeds \$2 million**

N/A

### III Other information

**1 Project Sustainability** *(If applicable, please describe how the recurrent expenditure involved will be met after completion of the proposed project)*

The valuable and up-to-date knowledge learnt by the key and supporting teaching staff involved in the project will be sustained and passed on to the new students. An Environment and Sustainable Development Centre will be established in Stage 2 of the project to provide support for the continuous development of teaching and learning on environmental sustainability. After completion of the project, the Centre will expand the areas of interest to cover other important environmental issues such as waste management, air pollution, energy, acoustics and external lighting. The Centre will also provide funding for research works.

**2 Preparatory work done** *(If any)*

The courses mentioned in Section D Implementation Details to provide fundamental knowledge on environmental sustainability have been offered to the students of the three programmes, i.e. BEng (Hons) in Civil Engineering, BArch (Hons) Architecture and BSc (Hons) in Computer Science. All the subject lecturers are well prepared for teaching students the basic concepts, monitoring techniques and data analysis skills.

The Department of Civil Engineering will provide in-house monitoring equipment (sound level meter and aerosol monitor) and modeling software (CORMIX expert system) to support the field measurement and modeling works. Our Year 3 and Year 4 students have received training to use the in-house equipment and software.

**3 Past experience in organizing projects of similar or relevant nature and achievements** *(If any)*

The project team members are a group of PhD degree holders and registered architects. They are experienced in consultancy projects including Environmental Impact Assessment and Engineering Feasibility Studies. Their expertise covers the proposed principal areas of the project, i.e. traffic noise, indoor air quality, water quality, air ventilation assessment and lighting design.