香港大學土木工程系

DEPARTMENT OF CIVIL ENGINEERING

The University of Hong Kong

Head's Message

Professor S.C. Wong

Over the last century, the Department of Civil Engineering at The University of Hong Kong (HKU) has nurtured many brilliant leaders in the civil engineering discipline and made significant contributions to the local and overseas community. We are constantly looking ahead to enhancing our goals in education, research and community services in order to keep abreast of the ever-changing demands of modern society.

The Department has developed new and innovative 4-year curricula to equip students with knowledge beyond traditional civil engineering subjects, for example the double degree in business and the minor programmes. In our new 4-year curricula, greater emphasis is placed on experiential learning in the form of project-based design, where students will participate in engineering projects relevant to their fields of study.

Since 2004, the Department has also established the Project Mingde, where arrangements are made for our students to take up the design and construction of real life projects in Mainland China, locally in Hong Kong or overseas. The first project - Mingde Building, a primary school, was built in the Guangxi province in 2005 and the second project - Gewu Building, a dormitory for the Rong Shui Vocational Training School, Guangxi province, was completed in 2008. The third project was to rebuild a kindergarten in Chongzhou, Sichuan Province damaged in the Wenchuan Earthquake and it was completed in 2011. Students are currently working on the construction of a community and cultural centre at Dabao Village, Guangxi province. Through the Project Mingde, the educational goal of bringing real projects into the classroom and, vice versa, bringing the classroom into the projects, is realized. The Department is very fortunate to have a group of dedicated alumni to provide professional guidance and mentorship to our students for these various projects.

The Department has continuously attracted top students and earned a good reputation in both academia and the industry. We ranked 10th in the world under the QS University Subject Ranking 2014 in the subject area of Civil Engineering. With the government's implementation of mega-infrastructure projects, there is a great demand for civil engineers. Moreover, the booming economy in the Mainland also opened up new opportunities for young and enthusiastic civil engineers to participate in the boundless infrastructure developments in China. The Department of Civil Engineering will continue to devote itself to teaching and research for the betterment of society.

Contents

Teaching & Learning

Undergraduate Programmes

In line with the changing roles of civil engineers, the undergraduate programmes are now becoming more versatile. Besides the main stream civil engineering programmes, students of the civil engineering programmes may also take a minor programme from a range of disciplines, such as in Business, Finance or Economics. A double degree in BEng in Civil Engineering and Bachelor of Business Administration (BBA) is also available. All courses are fully accredited by The Hong Kong Institution of Engineers. At HKU, we emphasise on creative thinking and problem-solving skills, and our Department will continue with the fine tradition of nurturing the next generation of leaders in the civil engineering profession through our undergraduate programmes.

Postgraduate Programmes

Research Postgraduate (RPg) Programmes

The Department offers world-class research postgraduate programmes (RPg) for degrees of Master of Philosophy (MPhil) and Doctor of Philosophy (PhD). RPg studies are supervised by leading researchers in various areas of civil engineering, including environmental, geotechnical, structural and transportation engineering and infrastructure project management.

Taught Postgraduate (TPg) Programmes

Taught postgraduate programmes are offered for part-time/full-time study. The taught Master of Science in Engineering (MSc(Eng)) programmes provide advanced education in various fields to cater for the increasing demand for further specialisation in civil engineering. The MSc(Eng) degree programmes include:

- Environmental Engineering
- Geotechnical Engineering
- Infrastructure Project Management
- Structural Engineering
- Transportation Engineering

Student Activities

Civil Engineering Society

The *Civil Engineering Society* is a student-run, academic-oriented organisation under the Department of Civil Engineering in HKU. It is the sole organisation of civil engineering programmes that represents students, and over 95% of full time undergraduates of the curriculum are a member of the Society. The objectives of the Society include serving the civil engineering students and facilitating communication between the Society and external bodies. Nonetheless, the Society also aims to promote civil engineering to the general public and to other students of HKU.

The Society was established in 2001. Throughout the past thirteen years, the Society organised various activities such as site visits, experience sharing with engineers and networking with external professional engineering bodies, hoping to broaden the horizons of our members. Every August, the Society organises an Orientation Camp to welcome fresh undergraduates to embark upon their journey in civil engineering at HKU. An academic forum is held in the open area of the University to encourage discussion on recent civil engineering projects and controversial issues.

The Society organises the Civil Annual Dinner in November to highlight a memorable milestone. With professors, guests and students of different years, the Annual Dinner is a good opportunity for distinguished alumni and civil engineering students to gather together and pass on valuable traditions.

Student Activities

Experiential Learning Experience in Engineering – Project Mingde

By combining learning and practice, Project Mingde provides a platform for civil engineering students to volunteer on community-based projects and contribute to the society. Mingde, in Chinese, being part of the motto of HKU means "understanding the human virtue". Since 2004, Project Mingde has united nearly 350 students and teachers, together with about 80 alumni, in a common cause. In the end, the project is not only about volunteering, it is about training a new generation to take up duties of the society. Until now there were four projects completed namely the Mingde Building (2005), the Gewu Building (2008), the Zhengdong Jie Kindergarten (2011) and the Yingdong Footbridge (2013).

In the first project, students in civil engineering were invited by a donor to design and supervise the construction of Mingde Building, a primary school in Dalang Village in the mountainous area of Rongshui County in Guangxi Province, China. Upon completion of the building, students raised funds among themselves for the purchase of books and equipment to provide a better learning environment in the school.

The scale of Zhengdong Jie Kindergarten project in Chongzhou completed in 2011 was the largest compared with the other projects. The original building collapsed during the 512 Sichuan earthquake in 2008. Due to site constraints and stringent earthquake resistant requirements, this project was much more complicated. The project was blessed with continuous supports from many professional alumni contributing their valuable time and effort voluntarily, to guide and supervise the work of the students. Over 200 students were involved in this project. Through the monthly supervision visits at the construction site, students witnessed the ruins caused by the earthquake and learnt various earthquake resistant systems proposed for new structures.

The latest project is a school and community centre to be completed by 2014 in Dabao Village of Rongshui. The layout of the building is unique and is embedded into the surrounding rice terraces that poses a lot of challenges to the students.

Project Mingde is undoubtedly a pioneer programme of experiential learning at HKU. It provides our students with the opportunity to apply and utilize their knowledge and skills gained in the classroom to hands-on multi-disciplinary civil engineering projects in the process of becoming competent and accountable engineers. Also through participation in real-life projects, students understand the needs of the society; learn how to communicate with different parties and to contribute to the society with their own efforts and expertise. This experience will not only fortify their confidence and interests in the civil engineering discipline but also give them a sense of satisfaction while caring for the society.

Student Activities

Internship Programmes

All civil engineering undergraduate students have to complete at least 4 weeks of internship and the Mandatory Basic Safety Training (MBST) course as part of the Bachelor of Engineering Civil Engineering degree programme. Most students would take their training in Hong Kong while some would go abroad. They usually work as engineer's assistant with consultant or contractor firms. In recent years, students have had some new training programmes held in the Mainland China, such as those in Beijing and at the Three Gorges and Jinsha River sites.

Students having summer training at Jinsha River sites

Site Visits and Field Trips

Site visit to study large-diameter bored pile construction in Hong Kong

Students' field trip to a dam site in China

Students' field trip to the ruins of 5.12 Sichuan Earthquake in China

Research Activities

Structural Engineering

Computational mechanics; finite element and finite strip analysis; earthquake engineering; tall buildings; bridge engineering; reinforced concrete structures; fibre-reinforced polymer composites; steel structures and fire resistance of metal structures; concrete-filled composite structures; concrete technology; soil-structure interaction; computer-aided design/analysis; strengthening and repair of civil engineering infrastructure.

Stonecutters Bridge

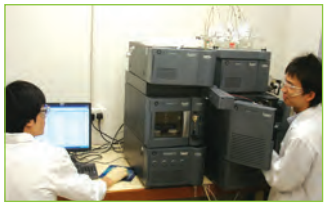
Resonant column testing system for soil dynamics research

Geotechnical Engineering

Soil/structure interaction - foundation engineering, tunnelling, cavern engineering, monitoring; rock and slope engineering - landslide investigation, mitigation; ground improvement; geoenvironmental engineering; soil mechanics – micromechanics, unsaturated soils, soil particle wettability, soil dynamics and earthquake engineering; advanced testing – field testing, field studies, laboratory testing; numerical modelling of geomaterials – constitutive modelling, continuum modelling, discrete element modelling.

Water and Environmental Engineering

Hydrology; environmental hydraulics and fluid mechanics; wind engineering; water quality modeling; advanced water and wastewater treatment; environmental biotechnology; solid and hazardous waste management; material resources recovery; environmental impact assessment.



Environmental Analysis

The Hong Kong Transportation System

Traffic and Transportation Engineering

Continuum modeling in transportation; dynamic traffic assignment; game theoretic approaches to transportation and logistics; public transportation; road safety; traffic and pedestrian flows; traffic management and control; traffic signals; transportation demand modeling; transportation, land use and the environment; transportation logistics; transportation network design; transportation network reliability; transportation systems engineering.

Construction Engineering and Management

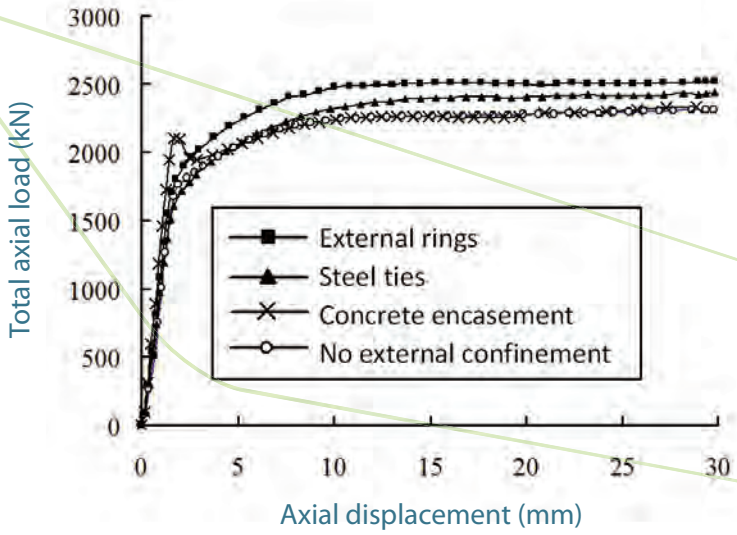
Zero carbon building; life cycle assessment; building information modelling; infrastructure asset management; project delivery; supply chain and logistics management; construction informatics; advanced construction technologies; off-site prefabrication and lean construction; technology transfers; construction industry development.

Brainstorming and refining R&D outputs with Industry

Recent Research Projects

Uni-axial Behaviour of Concrete-Filled-Steel-Tube (CFST) Columns with External Confinement

Concrete-filled-steel-tube columns have been increasingly adopted for construction of columns of tall buildings because of their improved strength, stiffness and ductility. It reduces the consumption of steel, cement and concrete, and thus contributes to a greener construction environment. However, one of the problems for CFST columns is that the confinement of steel tube is not fully effective during the initial elastic stage due to the different Poisson ratios of steel and concrete. To overcome the problem, different forms of external confinement, including steel rings and ties, to confine the steel tube as well as the concrete core that enables a perfect interface bonding, have been adopted. A series of uni-axial compression tests have been carried out in the Department of Civil Engineering since January 2011. It was found from the test results that the externally confined CFST columns had superior strength and stiffness when compared with the ordinary CFST columns without external confinement.



Recent Research Projects

Green Slope Engineering

Extensive development of the hilly urban areas has resulted in many urban slopes in Hong Kong. In recent years, the urge to develop a sustainable society is strong, which makes the traditional slope protection measures using hard shotcrete surfacing no longer favourable to the public. The use of live vegetations for slope upgrading is attractive not only owing to its high ecological and aesthetic values, but also due to its potentials for reducing soil erodibility and water infiltration through mechanical and hydrological actions. Dr. Ryan W.M. Yan and Professor L.G. Tham, together with Dr. Billy C.H. Hau from the Kadoorie Institute of HKU are currently investigating the hydro-mechanical properties of some selected native shrub and tree species and their interactions with soil towards slope reinforcement. The study, funded by the Research Grants Council of the HKSAR Government, is a joint project with experts from the Hong Kong University of Science and Technology and the Chinese University of Hong Kong. The study reports the mechanical properties of roots of the selected species and their spatial distribution in the ground. Furthermore, the study quantifies the effect of vegetation on enhancing the safety margins of soil slopes.

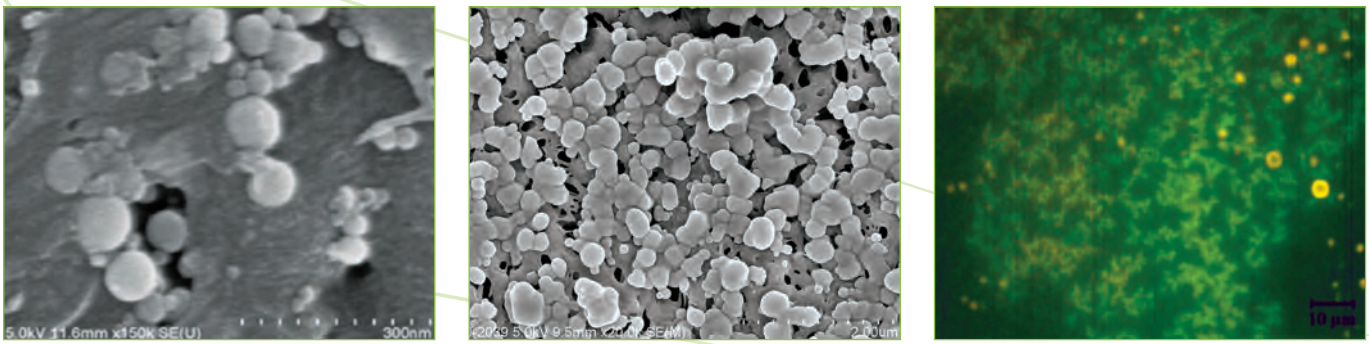
Recent Research Projects

Membrane fabrication

Membranes testing system

Design of Next Generation Anti-Biofouling Membrane for Water Treatment

The ability to control, manipulate, and design novel materials to remediate contaminated natural resources, while avoiding the release of environmental pollutants, will be a major challenge of the 21st century. Pollution of water resources is an emergent issue that is quickly widespread and the technological advancement in water reuse strategy is urgently needed. Therefore, the reliable and efficient membrane technology has become a legitimate alternative to both conventional water and wastewater treatment processes. However, biofouling on the membrane surface significantly reduce the treatment efficiency of membrane systems and is a key need for achieving the membrane technology breakthrough. An innovative surface modification technique with permanent impregnation of alumina nanomaterials into the membrane was invented by the research team in the Department, and the new membrane has proven to effectively reduce the biological adhesion on the surface. This research work had successfully attracted the Innovation and Technology Fund from the government of HKSAR, and the result of technological invention was selected by the university to file as an U.S. patent.



Alumina anchoring, surface modification, and bacteria adhesion reduction on membranes

Recent Research Projects

Improving Bus Services for Tin Shui Wai

With continuous population growth of many large cities, like Hong Kong, new suburban residential areas emerge in the periphery of the cities. Bus services are unique for these suburban residential areas to provide adequate transportation services from the origins inside these areas to the urban working and shopping destinations.

Tin Shui Wai (TSW) is one of the suburban residential areas in Hong Kong with a population of more than 300,000 people. Most of the residents in TSW work in the major urban districts. Trunk bus is one of the main commuting modes for TSW residents. The first set of trunk bus routes commenced in the early 1990s. Since then, the number of trunk bus routes serving between TSW and major urban districts has increased with the growth of the TSW area. Completion of new housing estates led to demand for new routes, which were added on the existing basis. Currently, all the routes go out of TSW to the city centre through the Tai Lam Tunnel (TLT) located at the southeast side of the area. Free transfers at TLT bus interchange are allowed.

Because of the lack of systematic design, the existing bus services for Tin Shui Wai are provided in an inefficient manner. Transfer at TLT interchange is required by many passengers. Moreover, many bus services are routed to loop around various zones in Tin Shui Wai. This results in an increase in travel time. As a result, the residents complained about the poor performance of the bus service. To respond to the complaint, the private bus operator plans to restructure the bus routes in TSW to reduce both the number of transfers and total passenger travel time. However, as a private bus operator, it highly concerns its profitability, and does not want to increase the operating cost and the number of buses required as well as lose market share.

Tin Tsz Bus Terminal

This project aims at developing a methodology for the private operator to improve the existing trunk bus services for TSW. The methodology involves formulating the problem as a mixed-integer programming problem using realistic data with the objectives of reducing both the number of transfers and total travel time of passengers, taking into account the requirement of the bus operator. A hybrid meta-heuristic is then developed to solve the problem. The result show that the proposed methodology can generate a design which can simultaneously reduce the number of transfers and total travel time at least by 20.9% and 22.7% respectively compared with the existing design.

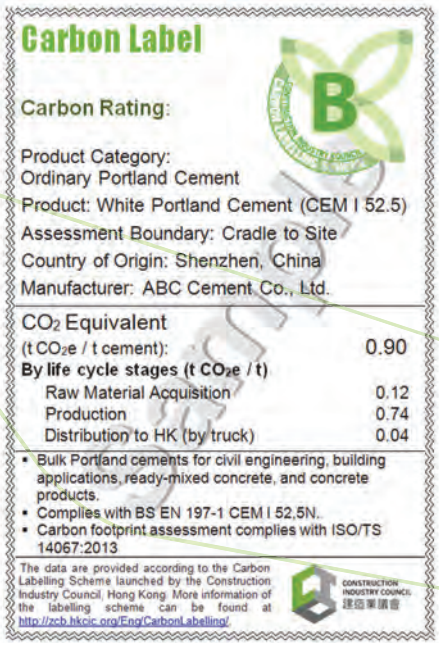
Recent Research Projects

A Hong Kong Based Carbon Labelling Framework for Construction Materials

While Hong Kong aims to be a sustainable low carbon economy city, the construction industry has a critical role to play. Apart from the energy consumed by running assets, the embodied carbon impacts of a construction project associated with the extraction, manufacture, transport, assembly and even decomposition of construction materials would result in significant environmental consequences. Minimising the output of carbon emission in the construction field through prudent selection of construction materials is therefore highly desirable.

Commissioned by the Construction Industry Council (CIC), the research project aims to develop a framework for classifying construction materials according to their greenhouse gas (GHG) emission level and so as to help building Hong Kong into a low carbon economy as envisaged by the Chief Executive in his 2009-10 Policy Address. By measuring and benchmarking the lifecycle carbon footprint of a building product, consumers or those responsible for sourcing can decide which product to order to meet their specific emission goal. More importantly, a recognised carbon labelling scheme will create incentives for designers, contractors and manufacturers to develop novel ideas, select low carbon materials and invest in new technologies to reduce the emission level of construction facilities relentlessly.

This research project marks a milestone in collaboration between the industry and academia for the promotion of sustainability in construction. It is anticipated that the carbon labelling framework for construction materials will help achieve the target of emission reduction as proposed by the government. The findings should also put Hong Kong at the forefront of sustainable development as well as accreditation service and carbon auditing.



Courtesy of the Construction Industry Council

OUTSTANDING

VERY GOOD

GOOD

FAIR

IMPROVEMENT NEEDED

Student Awards

- Mr. Chen Wen (2011 graduate) secured the top geotechnical awards in project competitions for final year undergraduate students of local Hong Kong universities in 2011-12, including the AECOM Prize for Best Final-Year Geotechnical Project Award from HKIE Geotechnical Division and the Best Paper Award (in Geotechnical Division) from ICE Hong Kong Association. His award-winning project was entitled "Permanent deformation of sand under cyclic loading" (supervisor: Dr. J. Yang). He also received the Best Final Year Project Award from ASCE Hong Kong Section.

- Miss Tse Fong Fong Jennyfer (2011 graduate) received the Best Paper Award in the Structural and Materials Discipline from the Institution of Civil Engineers, ICE, (Hong Kong Section) for her project "Teaching Structural Engineering Sense" (Supervisor: Dr. S.T. Smith).

- Mr. Ling Shao Keat (Year 3 BEng student) was awarded the HKSAR Government Scholarship Fund (Renewal 2012-13) and HKU Foundation Scholarships for Outstanding International Students (Renewal 2012-13).

- Mr. Wong Cheuk Lun (Year 3 BEng student) was awarded the CL Tse Prize in Civil Engineering 2011-12, YW Kwok Scholarship 2011-12 and CMA and Donors Scholarship 2012-13.

- At the CIB W099 International Conference on "Modelling and Building Health and Safety" (September 10-11, 2012, Singapore), a HKU student team, comprising Mr. Ren Aoxiang (MPhil student of the Department, supervised by Professor M.M. Kumaraswamy) and Mr. Li Jingkai (from Department of Real Estate & Construction, supervised by Professor Steve Rowlinson), won an award in the 'BIM & Safety Competition' with a discretionary prize of 1000 SGD.

Mr. Li (left) and Mr. Ren (middle) receiving the award in Singapore

- Miss Deng Yunqiao (PhD student) was awarded the Hong Kong Association of University Women Postgraduate Scholarship 2012-13.

- Mr. Kong Alvin Jit Sieng (Year 1 BEng student) was awarded the HKSAR Government Scholarship Fund 2013 and the HKU Foundation Scholarships for Outstanding International Students 2012-13.

Student Awards

- Dr. Li Bing (2011 PhD graduate) was awarded the Award for Outstanding Research Postgraduate Student 2010-2011, for submitting thesis of exceptional quality and demonstrating outstanding performance in his research field. The Graduate School Award Presentation Ceremony was held on December 12, 2012.

- PhD student Mr. Wei Ya received the Young Scientist Award from the 7th International Conference on Advanced Computational Engineering and Experimenting, ACE-X 2013, held in Madrid, Spain, from 1-4 of July, 2013 for the paper "Effects of Thermal Creep of Prestressing Steel on Post-tensioned Concrete Slabs in and after Fire, Y. Wei and F. T. K. Au"

- Mr. Wong Cheuk Pong (PhD student) was awarded Sir Edward Youde Memorial Fellowships for Postgraduate Research Students 2012-13. He received the award from Lady Pamela Youde.

- Mr. Chai Tsz Ho (Year 1 CivE student) was awarded The HKIE Scholarship 2012-2013.

Mr. Chai Tsz Ho (back row: 1st from left)

- Mr. Chau Tsz Kin (Year 1 BEng student) and Mr. Larik Sharjeel (Year 1 CivE student) were awarded the Talent Development Scholarship under the HKSAR Government Scholarship Fund 2012-13.

- Mr. Wong Cheuk Him (Year 1 BEng student) was awarded the Reach Out Award under the HKSAR Government Scholarship Fund 2012-13.

- Dr. Ye Lin (2012 PhD graduate) was awarded the Award for Outstanding Research Postgraduate Student 2011-2012, for submitting a thesis of exceptional quality and demonstrating outstanding performance in his research field. The Graduate School Award Presentation Ceremony was held on December 9, 2013.

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