DEPARTMENT OF
Civil Engineering
土木工程系 Newsletter
THE UNIVERSITY OF HONG KONG
SEPTEMBER 2021 - FEBRUARY 2022

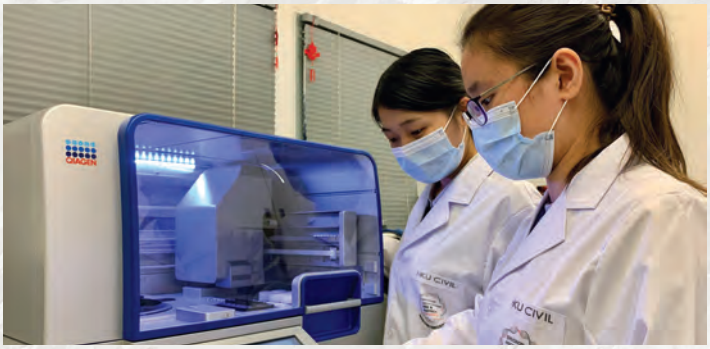
# Innovative Sewage Testing Tools and In-manhole Sampling Robot for Covid-19 Sewage Surveillance

The research team at The University of Hong Kong studying SARS-CoV-2 sewage surveillance. From right: Dr. Deng Yu, Dr. Hein Tun, Professor Zhang Tong, Professor Gabriel Leung Cheuk-wai, Professor Leo Lit-man and Dr. Chui Ho-kwong, Deputy Director of Environmental Protection Department (left).

Under the rapid changing epidemic situation of COVID-19 in Hong Kong, the early detection and surveillance of SARS-CoV-2 virus that causes COVID-19 is a key prerequisite for effective control of COVID-19.

As COVID-19 patients, including mildly symptomatic and asymptomatic carriers, will shed virus into their stool. One sewage sample represents a pooled stool sample of many residents living in the sewerage catchment area, so the sewage surveillance is a very effective and efficient way to identify the risk of having carriers in an area for the government to take the follow-up actions.

Professor Zhang Tong and his research team collaborated with School of Public Health and developed a testing methodology for quantifying SARS-CoV-2 in sewage in the middle of 2020. The testing method consists of several steps after sampling, including inactivation, pre-concentration, nucleic acid extraction, gene testing and data analysis. The testing method has been used as an important tool in the whole control strategy of COVID-19 by Environmental Protection Department and Drainage Services Department since December 2020, and was awarded Gold Medal in the International Exhibition of Inventions of Geneva 2021.

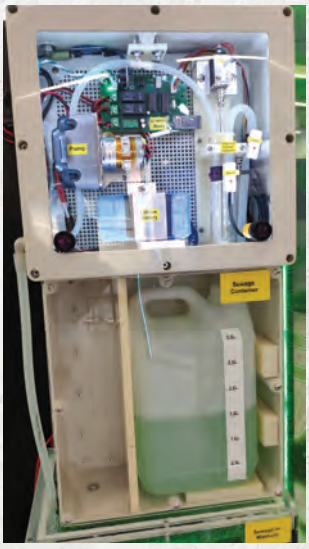


The teammates perform the extraction of SARS-CoV-2 virus from the sewage samples.

Sewage sampling is the first step of the sewage surveillance. Usually, the conventional samplers for sample collection are large in size, difficult to set up and even block the major pedestrian walkways, causing inconvenience to the public. The team of Professor Zhang Tong designed new auto-samplers that can be installed underneath a manhole cover, thus more applicable to manholes on both pedestrian walkways and carriageways for the sample collection. The new auto-sampler save the setup time and manpower, and reduce the footprint of the auto-sampler and minimize the impact on the traffic.

The innovative sampler takes sample in four steps: purging, sampling, discharging and transporting. Every sampling activity can be logged and recorded. Also, the compact auto-sampler could be fully controlled and automated via Mobile App by inputting different sampling parameters, such as the starting time, sampling intervals, no. of cycle and sampling volume. This customizable in-manhole sampling robot was also awarded Gold Medal in the International Exhibition of Inventions of Geneva 2022.

In summary, sewage may tell the health of a city, and such sewage surveillance system also could be used to help control other pathogens in the future as a part of a smart city.



Left: The workers install the In-manhole sampling robot for sample collection.
Right: The prototype of the In-manhole sampling robot.

# Departmental Events

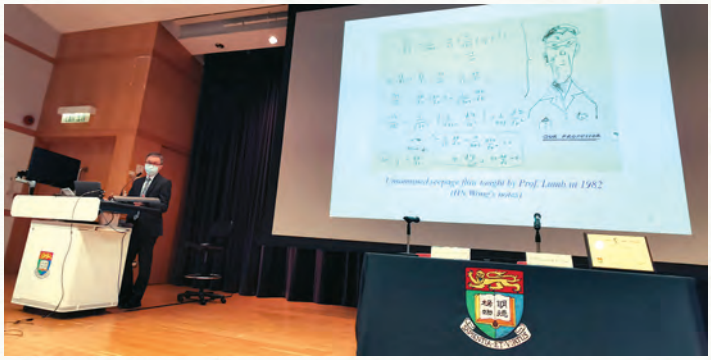
## *The 11th Lumb Lecture*

Professor Peter Lumb was a pioneer, educator and builder of geotechnical engineering in Hong Kong. He taught at the Department of Civil Engineering from 1954 to 1986 and developed his thirty-two years of distinguished academic career in Hong Kong. To mark his contributions, the Department of Civil Engineering and HKIE Geotechnical Engineering Division established a distinguished lectureship known as "The Lumb Lecture". The lecture is delivered biennially by an internationally recognized expert in geotechnics.

The Eleventh Lumb Lecture was presented by Ir Professor Wong Hok-ning in the evening of December 3, 2021. Ir Professor Wong is a practitioner with over three decades of esteemed professional career in geotechnical engineering, including serving as the Head of the Geotechnical Engineering Office (GEO). For long years, he has provided pivotal leadership to GEO's world-acclaimed landslide prevention initiatives and the related research and development work, which conduces to advancing slope engineering knowledge and the contemporary landslide risk management strategy and practices. As a popular and respected keynote speaker in international forums with over 50 publications on the subjects, he is recognized for his expertise in landslide investigation, urban slope engineering, modeling of landslide mobility and quantitative landslide risk assessment. Apart from being a key figure in the local geotechnical profession, he has also served in prominent international bodies in slope engineering and landslide risk management, including representing Hong Kong as a Core Member in the Joint Technical Committee on Landslides and Engineered Slopes (JTC-1) for 15 years. Through these, he contributed to promoting the state of the art in slope safety management and enhancing landslide resilience worldwide.

The title of this 11th Lumb Lecture is "Bridging the Gap between Theoretical and Actual Slope Performance". Ir Professor Wong showed, with reference to the available data and selected case histories, the extent and causes of the disparity between the theoretical and actual slope performance in Hong Kong. He illustrated the importance of robust geotechnical design and holistic landslide risk management in general. He pointed out the caution and issues against complacency particularly in the wake of the new challenges that may arise from climate change. He discusses some possible solutions.

Professor David Srolovitz, Dean of HKU's Faculty of Engineering, warmly welcome and congratulated Ir Professor Wong and discussed engineering challenges and education in Hong Kong before the lecture. Ir Professor Jun Yang, Associate Head of the Department of Civil Engineering, introduced the background of Lumb Lecture and HKU's Geotechnical Engineering on behalf of the Lumb Lecture Committee. Ir Tony Ho, the Chairman of the HKIE Geotechnical Division, introduced Ir Professor Wong. After the lecture, Ir Dr. Raymond Cheung, Head of the Geotechnical Engineering Office, presented the vote of thanks to this lecture. Ir Professor S.C. Wong, Associate Dean of Faculty of Engineering, presented the souvenirs to Ir Professor Wong, on behalf of Professor David Srolovitz, Dean of HKU's Faculty of Engineering. Ir Professor Z.Q. Yue chaired this 11th Lumb Lecture. 114 participants joined the Lecture physically in Rayson Huang Theatre while 493 participants attended online. More details including the lecture video can be found in the Departmental web page: http://www.civil.hku.hk/h6v1_4_event.html.




## *2022 Online (zoom) Symposium of Recent Research Development in Elasticity and Geomechanics*

Professor Z.Q. Yue of the Department of Civil Engineering organized the 2022 Online (zoom) Symposium of Recent Research Development in Elasticity and Geomechanics on January 15, 2022. Twenty five researchers and professors

were invited to oral presentations on their research progress and findings. They come from nineteen institutions and universities including Army Engineering University of PLA, Beijing University of Technology, CAS Institute of Geology and Geophysics, China Institute of Water Resources and Hydropower Research, China University of Geosciences, China University of Mining and Technology, Lakehead University, Nanjing University of Science and Technology, Ocean University of China, Peking University, Shandong University of Science and Technology, Shanghai Jiao Tong University, Shenzhen Geotechnical Investigation & Surveying Institute, Shenzhen Integrated Geotechnical Investigation & Surveying Company, University of Hong Kong, Tongji University, Tsinghua University, University of Chinese Academy of Sciences, and University of Shanghai for Science and Technology.


Their invited lecture topics are listed below. About 100 people attended this online symposium. More details including abstracts and lecture videos can be found in the Departmental web page: http://www.civil.hku.hk/RRDEG2022/

01) Dynamic Buckling Mechanism of Pillar Rockbursts Induced by Blasting Waves

02) Vertical Site Response to Earthquake Loading: A Missing Issue?

03) Guided Circumferential Waves in a Double-walled Carbon Nanotube

04) Several Developments of Analytical and Semi-analytical Methods in Geomechanics

05) Theoretical Framework for Crack and Dislocation Interaction in 3D FGMs

06) New Boundary Element Methods for Analyzing the Fracture Mechanics of Layered and Graded Materials

07) Macro and Micro Mechanical Characteristics and Constitutive Behavior Evolution of Rocks Affected by Multiple Environmental Factors

08) Experimental Study on Dynamic Rupture of Coal and Rock Caused by High-pressure Gas

09) Digital Geomaterial - Research Status and Prospects

10) New Boundary Element Methods for Group of Elastostatic Problems in Advanced Materials

11) 3D Parametric Characterization of Weathering Crust Structure and Its Engineering Significance

12) Deep Weathering of a Group of Thick Argillaceous Limestone Rocks near Three Gorges Reservoir, Central China

13) Discussions and Lunch Break

14) Evaluation of Rock Mass Quality Based on Drilling Process Monitoring Technology

15) Development and Application of Drilling Process Monitoring Methodology for Hydraulic Rotary Drilling in Ground Investigation

16) Settlements Induced by Lining Seepage of Running Metro Tunnels at Shallow Depth in Saturated Soft Soils

17) Design, Construction and Mechanical Behavior of Relics of Complete Large Longyou Rock Caverns Carved in Argillaceous Siltstone Ground

18) Manually Directional Splitting of In-situ Intact Igneous Rocks into Thin Sheets of Large-area

19) New Coal Breaking Technology and Roadway Reinforcement Theory based on the Mechanical Characteristics of Coal and Rock

20) Strength Growth Theory of Grouting Reinforcement for Broken Rock Mass

21) The Jetted Precast Concrete Sheet Pile Foundation Technique and Its Application in Engineering

22) Approach for Estimating End-Bearing Capacity of Rock-Socketed Piles in Strain-Softening Hoek–Brown Rock Mass

23) Full Scale Real-Time Monitoring of A Huge Landslide in Yantian, Shenzhen

24) Dynamic Characteristics of Long-runout Landslides and Associated Chain Disasters in Mountainous Region of Southwest China

25) Positive and Negative Effects of Check Dam against Debris Flow

## World-Leading Researchers

Two academics have been named by Clarivate in its list of "Highly Cited Researchers 2021" as the most influential in the world. Their works have been highly cited by fellow academics and are hence making a significant impact in ongoing research in their respective fields of study.

- Professor C.Y. Tang in the Cross-field category.
- Professor Zhang T. in the Environmental and Ecology, Microbiology category.

# Staff Awards/Activities/News

## Staff Awards

### *HKU Researcher Recognised as Top International Slope and Landslide Researcher*

**Dr. Clarence E. Choi** of the Department of Civil Engineering, The University of Hong Kong, has been named the presenter of the 3rd Hutchinson Lecture. The Hutchinson lecture is awarded to a top international scholar, aged 42 or less, who has significantly contributed to the development of knowledge in the field of slope stability and landslides.

This lecture is awarded by the Joint Technical Committee on Natural Slopes and Landslides (JTC1) of the Federation of the International Geo-Engineering Societies (FedIGS), which includes the learned societies of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), International Society for Rock Mechanics and Rock Engineering (ISRM), The International Association for Engineering Geology and the Environment (IAEG), and the International Geosynthetics Society (IGS). Each region nominates a single candidate from the learned societies to compete for the Hutchinson Lecture.

Dr. Choi is the youngest to deliver the Hutchinson Lecture. The Hutchinson Lecture is scheduled to be presented in Oslo, Norway, in Spring, 2023, at the 3rd JTC1 Workshop with a provisional title of Landslide initiation, prediction, and risk mitigation. The plenary lecture will be published in an international journal.

The Hutchinson lecture was established to remember the contributions that John Hutchinson, Emeritus Professor of Soil Mechanics at Imperial College, made in the landslide field. Professor Hutchinson was best known for his pioneering contributions to geomorphology, earth surface processes, civil engineering and slope processes. The inaugural lecture was held in 2017. The previous Hutchinson lecture was awarded to Professor Núria Pinyol of the Universitat Politecnica de Catalunya and was delivered in HKSAR in 2018.

**Professor C.Y. Tang** received the 2021 Water Reuse and Conservation Award for Outstanding Professional from the International Desalination Association.

## Staff Activities

**Professor C.Y. Tang** delivered the following keynote/plenary speeches:

1. C.Y. Tang, "Interlayered thin film nanocomposite membranes: mechanisms and applications", Keynote speech (online talk), 5th International Conference on Desalination using Membrane Technology, November 14-17, 2021, Shanghai, Elsevier.
2. C.Y. Tang, "Permeability-Selectivity Upper Bound of RO & NF Membranes", Plenary Speech (online talk), Advanced Membrane Technology Summit for Water Treatment, October 15-17, 2021, Shanghai.
3. C.Y. Tang, "TFC Polyamide RO and NF Membranes: The Upper Bound and Strategies to Overcome the Upper Bound," International Master Forum (Inaugural Lecture, online), September 24, 2021, SPT® International Lectureship on Separation & Purification Technology, Elsevier.

**Professor Jun Yang** delivered a Distinguished Lecture entitled "Geotechnical Engineering for Sustainable Development: Some Personal Perspectives" at the First ASCE Greater China Conference on December 4, 2021. In this lecture he discussed four general ways to make geotechnical engineering more sustainable and introduced HKU's research endeavours in the development of environmentally friendly piling technology.

## Staff News

**Dr. Clarence E. Choi** has been appointed Editorial Board Member starting January 2022 for Engineering Geology, published by Elsevier. Engineering Geology is a Q1-ranked journal with a Tier 1 ranking according to the Chinese Academy of Sciences with an impact factor of 6.755. The journal is a premier platform for publishing top-tier research that bridges the fields of the earth sciences and engineering, particularly geological and geotechnical engineering.

**Dr. Jintao Ke** joined the Department of Civil Engineering at the University of Hong Kong as an Assistant Professor in October 2021. He was a Research Assistant Professor at the Department of Logistics and Maritime Studies at the Hong Kong Polytechnic University. He received the B.E. and Ph.D. degrees from the Department of Civil Engineering, Zhejiang University, and the Department of Civil and Environmental Engineering, Hong Kong University of Science and Technology, in 2016 and 2020, respectively. His research interests include shared mobility on demand, transportation big data analytics, multimodal intelligent transportation systems, transportation pricing, short-term travel demand forecasting, etc. The vision of his research is to develop novel models, algorithms, and conduct data-driven quantitative analyses to better manage, operate, and regulate shared mobility and other emerging mobility services. He has published around 30 SCI/SSCI indexed research papers in top-tier journals in the field of transportation research and

data mining, such as Transportation Research Part A/B/C/D/E, IEEE Transactions on Intelligence Transportation System, IEEE Transactions on Knowledge and Data Engineering. He received the best paper award at the 19th COTA International Conference of Transportation and Professionals, and the 9th International Workshop on Computational Transportation Science. He was awarded the Honorable Mention of HKSTS Outstanding Dissertation Award in 2020.

**Professor C.Y. Tang**

Fellowship:

- Professor C.Y. Tang is elected as a Fellow of the Royal Society of Chemistry.

Editorship:

- Professor C.Y. Tang is appointed as a co-editor of the *Desalination* journal since February 2022. *Desalination* is a flagship journal of Elsevier, publishing high quality papers on desalination materials, processes and related technologies. According to Clarivate Journal Citation Report, the journal's current impact factor is 9.501, which ranks no. 3 out of 98 journals under the category of "water resources".

# Student Awards

Chan Chak Kwan (CivE 4 2021-22), Kwan Tim Chung (CivE 4 2021-22), Lam Cheuk Yin Bryan (CivE 3 2021-22), Li Chung Wah (CivE 2 2021-22) and To Lok Kan (CivE 4 2021-22) were awarded the YS and Christabel Lung Undergraduate Scholarship for Engineering Students (Renewal 21-22).

Chu Tsz Wai (Grad Jun 2021) was awarded the HKIE Geotechnical Division, AECOM Prize for Best Final Year Geotechnical Project 2021 – Champion.

Fok Pak Hei (Grad Jun 2021) was awarded the HKIE Geotechnical Division, AECOM Prize for Best Student 2021.

Law Felix (CivE 2 2021-22) was awarded the HKU Engineering Alumni Association Scholarship 2021-22.

Leung Ho Yiu (CivE 3 2021-22) was awarded the YC Cheng Engineering Scholarship.

Ting Yu Lap Timothy (Grad Jun 2021) was awarded the HKIE Geotechnical Division, AECOM Prize for Best Final Year Geotechnical Project 2021 - First Runner Up.

Dr. Chen Xing-wei was awarded the Ringo Yu Prize for Best Ph.D. Thesis in Geotechnical Studies 2021/2022 from The Hong Kong Institution of Engineers in March 2022. Dr. Chen completed his Ph.D. studies from September 2016 to March 2021 at Department of Civil Engineering, HKU. His PhD thesis is entitled "Mechanics of dislocation, contact and fracture in multilayered and functionally graded materials". His thesis advanced the theory of three-dimensional multilayered or graded elasticity and has high value for geotechnical engineering, particularly for foundation engineering and road engineering where soils and pavements usually exhibit multilayered or graded inhomogeneity. During his Ph.D. study, Dr. Chen published seven papers in SCI journals including *International Journal of Geomechanics, Journal of the Mechanics and Physics of Solids, and International Journal of Solids and Structures*. His Ph.D. supervisor is Professor Z.Q. Yue.


THE HONG KONG INSTITUTION OF ENGINEERS

*Ringo Yu Prize*
*for the Best PhD Theses in Geotechnical Studies 2021/2022*

Presented to

Dr CHEN Xingwei

of The University of Hong Kong

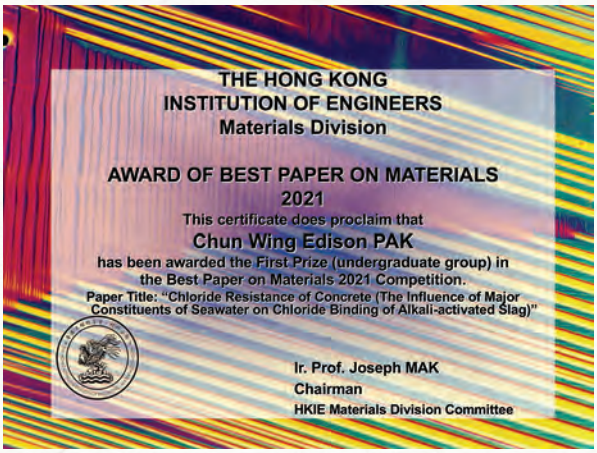
*in recognition of*

the outstanding academic achievements in Geotechnical Studies

Ir Tony Ho
Chairman
Geotechnical Division

March 2022

Chun Wing Edison Pak, supervised by Dr. H. Ye, was awarded the First Prize (undergraduate group) in the Best Paper on Materials 2021 Competition by The Hong Kong Institution of Engineers, Materials Division. The paper title is "Chloride Resistance of Concrete (The Influence of Major Constituents of Seawater on Chloride Binding of Alkali-activated Slag).


THE HONG KONG
INSTITUTION OF ENGINEERS
Materials Division

AWARD OF BEST PAPER ON MATERIALS
2021

This certificate does proclaim that

Chun Wing Edison PAK

has been awarded the First Prize (undergraduate group) in the Best Paper on Materials 2021 Competition.

Paper Title: "Chloride Resistance of Concrete (The Influence of Major Constituents of Seawater on Chloride Binding of Alkali-activated Slag)"

Ir. Prof. Joseph MAK
Chairman
HKIE Materials Division Committee

## *The Shaking Table Competition 2022*

The Shaking Table Competition organised by the Department of Civil Engineering was held on January 13 this year. This competition aims to encourage students to utilise their

engineering knowledge and creativity to design and build a small-scale physical model and the model would be tested under an earthquake load applied through the shaking table. Each team was given limited materials, mainly balsa wooden sticks and super glue, and limited time to construct a model according to the pre-announced specifications. They were also required to present their engineering justifications to the judging panel for consideration.

There were 6 teams participating in the competition this year. The model of the winning team (Team E) was able to support a total loading of 15.64 kg under a uniaxial seismic load which was a 3-6 Hz gradually increasing sinusoidal wave of the amplitude of 20 mm. The net weight of the model was just 181.4 g. The winning team received a cash prize of HK$1000 and a Certificate of Champion. This competition gave a chance for students to get together in the semester break and all the participants had lots of fun!

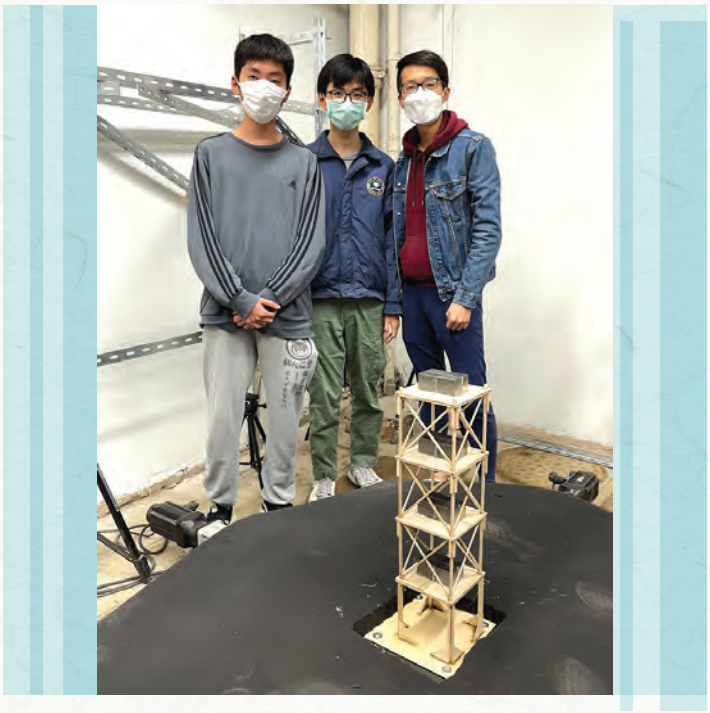


Figure 1. The winning team (from left to right: WU Ho, LI Jeffrey Ka Yin, and LI Cho Hon Gordon – BEng (CivE) III).

(a) Model of Team A

(b) Model of Team B

(c) Model of Team C

(d) Model of Team D

(e) Model of Team E

(f) Model of Team F

Figure 2. Models of Team A to F.

## *Research Grant*

### *Environmental Conservation Fund*

Both Dr. Clarence Choi and Dr. C.Y. Kwok were awarded research projects from the Environmental Conservation Fund, Environmental Protection Department of HKSAR.

Dr. Choi's research project entitled "Towards Sustainable and Negative Carbon Footprint Deep Cement Mixing for Reclamation in Hong Kong"

Dr. Kwok's project title was "Feasibility Study of using Microbially Stabilized Dredged Marine Clay as Fill Materials for Sustainable Land Reclamation in HK".

# Updates on Project Mingde

## *About Project Mingde*

Project Mingde was established by the Department of Civil Engineering in 2004. It provides an open platform for nurturing our students to acquire not only hard skills, but also to possess soft skills, such as a sense of social responsibility, by participating in real-world on-going civil engineering projects in remote impoverished regions in China and other Asian countries. We have a slogan "We grow as we build" and that is the core value of Project Mingde. Project Mingde attracts not only Civil Engineering students, but also students from other disciplines and institutions to participate in this meaningful programme. We hope that students would have personal growth through this experiential learning opportunity and participation in various real-life projects; and also education in impoverished localities in China could be provided. For more information about Project Mingde, please visit our official website at http://www.civil.hku.hk/mingde/.

Alumni are welcome to join Project Mingde and if you are interested to be part of us, please contact Dr. C.P. Wong at cpwryan@hku.hk (for projects) or Dr. K.H. Law at adalaw@hku.hk (for communications).

## *Restoration and Expansion of Guigang Duling Primary School*

This winter, Project Mingde organized a training programme from 28 December 28, 2021 to January 14, 2022, in which 20 students joined and they worked under Dr. Ryan Wong's supervision. They updated the BIM model of the Composite Building (with kindergarten for early childhood education and teacher dormitory) according to the revision on architectural drawings, and involved in the design of a new toilet for the kindergarten students based on the questionnaire survey results we obtained.

For the on-site construction, a 5.4m height retaining wall was constructed to support the slope next to the Composite Building, and serve as a part of the school fencing. Besides, the Composite Building was building in progress. The reinforced concrete frame of the first floor was completed and the remaining parts are anticipated to be completed by this June according to the construction programme.

A retaining wall was constructed to support the slope next to the Composite Building.

The Composite Building was building in progress, the reinforced concrete frame is anticipated to be completed by this June.

## *Renovation of St. Barnabas' Society and Home*

Project Mingde started a new project in Hong Kong to help St. Barnabas' Society and Home on the renovation and maintenance works of their two-storey building located at Shek Tong Tsui. In January, 18 students from Civil Engineering and Architecture participated in a 3-day multidisciplinary design workshop, and provided their design concepts for renovating the indoor area and gardens to the representatives from St. Barnabas' Society and Home. The project team is finalizing the designs with all the stakeholders, and the renovation work will be commenced later this year.

In addition, under our on-site inspection, there was a water seepage problem on the roof. It was because of ageing of the waterproofing materials between roofing panels and screw holes. A contractor was hired to replace the old sealants, and the roof maintenance work was successfully carried out in February. Upon the completion, students participated in the water sprayed test at the roof area to verify the quality of workmanship. As agreed by St. Barnabas' Society and Home, solar panels will be further installed on the roof to absorb heat from sunlight and generate electricity. The project team

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is looking for a contractor for construction of solar panels.

Students presented their design concepts to the representatives from St. Barnabas' Society and Home.

Roof maintenance work was completed, and students participated in the water sprayed test at the roof area to verify the quality of workmanship.

**Name of students participated in various projects:**

**December 28, 2021 - January 14 (Winter Training Programme):**

LAI Chun Wing, HUNG Chi Yung William, LI Ka Yin Jeffrey, NG Cheuk Hin Ivan, LO Chun Ming, WONG Yi Shan Yisa, LUI King Chi, CHAN Tsz Ming, WONG Sui Yu Zoe, CHUI Cheuk Yu Heidi, CHAU Cheuk Man, WANG Wai San Sunny, KAM Chun Yu, LUI Man Kit, LEE Scott, CHAN Shun Sing, LI Xusen, CHEUNG Pak Lam Ken, HUI Kwan Ming Jimmy, KAM Tsz Fung Marco

**January 5-7 (3-day Multidisciplinary Design Workshop):**

CHENG Yu Hin (Architecture), CHIU Yeuk Tung (Architecture), GONG Tianshu Sky (Architecture), LIU Chengxi Nancee (Architecture), LIU Yichu Chelsea (Architecture), TSE Yu Ying Scarlett (Architecture), WANG Qianhui (Architecture), ZHANG Yifan (Architecture), SUN Ziyue (Architecture), CHOY Jan Yip Joseph (Architecture), CHUI Cheuk Yu, HUI Ching Kit Jacky, LEE Scott, LO Chun Ming Daniel, LUI Man Kit Dickson, MOK Dickens, WONG Yi Shan, LI Ka Yin Jeffrey

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