

Department of Civil and Environmental Engineering 土木及環境工程學系 Newsletter 2018 (Jan-Jun)

HEADLINES

CEE Academics were invited to attend a luncheon hosted by Ms Carrie Lam, the Chief Executive of the HKSAR

Prof. K.F. Chung [Associate Head (Academic Development)], Prof. Y.Q. Ni and Prof. J.G. Teng (Chair Professor of Structural Engineering) were invited to attend a luncheon hosted by Ms Carrie Lam, the Chief Executive of the HKSAR on 13 June 2018 at Government House.



Ms Carrie Lam (7th from left), Prof. Y.Q. Ni (6th from left) and Prof. J.G. Teng (8th from left)



Ms Carrie Lam (right) and Prof. K.F. Chung (left)



Ms Carrie Lam (3rd from left) and Prof. Y.Q. Ni (2nd from left)

Staff Achievement

Prof. You-Lin XU bestowed Guanghua Engineering Science and Technology Award

Prof. You-Lin Xu, Chair Professor of Structural Engineering and Dean of Faculty of Construction and Environment, is one of the three awardees from Hong Kong bestowed with the 12th Guanghua Engineering Science and Technology Award presented by the Chinese Academy of Engineering (CAE).



The three scholars were nominated by the Hong Kong Academy of Engineering Sciences (HKAES). The other two awardees are: Prof. Jian Lu, Chair Professor of Mechanical Engineering at the City University of Hong Kong and Prof. Ed X. Wu, Chair Professor of Biomedical Engineering at the University of Hong Kong. They were among the 30 awardees selected from 296 candidates.

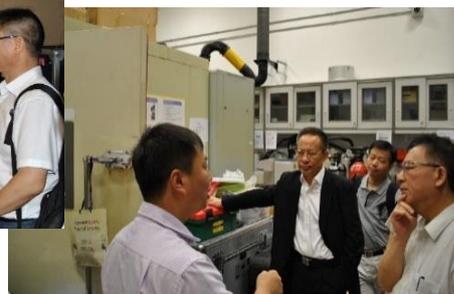
CEE Activities

High-level Guangdong Environmental Officials Visiting CEE's Atmospheric Research Facilities

On 4 May 2018, a high-level delegation from the Department of Environmental Protection of Guangdong Province (GDEPD) visited CEE's atmospheric research laboratories. The delegation comprised Director-general of the GDEPD, Mr Xiulu Lu, Deputy Director-general, Mr Hui Li, and Division chiefs, Mr Fengling Lv and Mr. Weiqing Zhong.



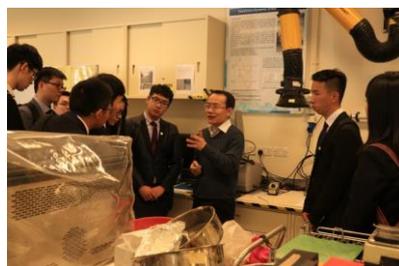
On behalf of the CEE's Environmental Team, Dr Zhe Wang introduced the advanced research facilities and the large-scale project on Photochemical Air Pollution. The two sides explored collaboration in improving the air quality of the Greater Bay Area.



CEE Activities

PolyU and ZJU --- Exchange Programme 2018

An exchange programme between The Hong Kong Polytechnic University (PolyU) and Zhejiang University (浙江大學) (ZJU) was launched on 27 February 2018. About 20 students from ZJU joined this exchange program, participating in the sharing session and visiting laboratories and the National Rail Transit Electrification and Automation Engineering Technology Research Center (Hong Kong Branch). Prof. J.G. Teng, Prof. C.S. Poon, Dr Songye Zhu, Dr Zhen Leng and Dr Guan Lin joined the sharing session.

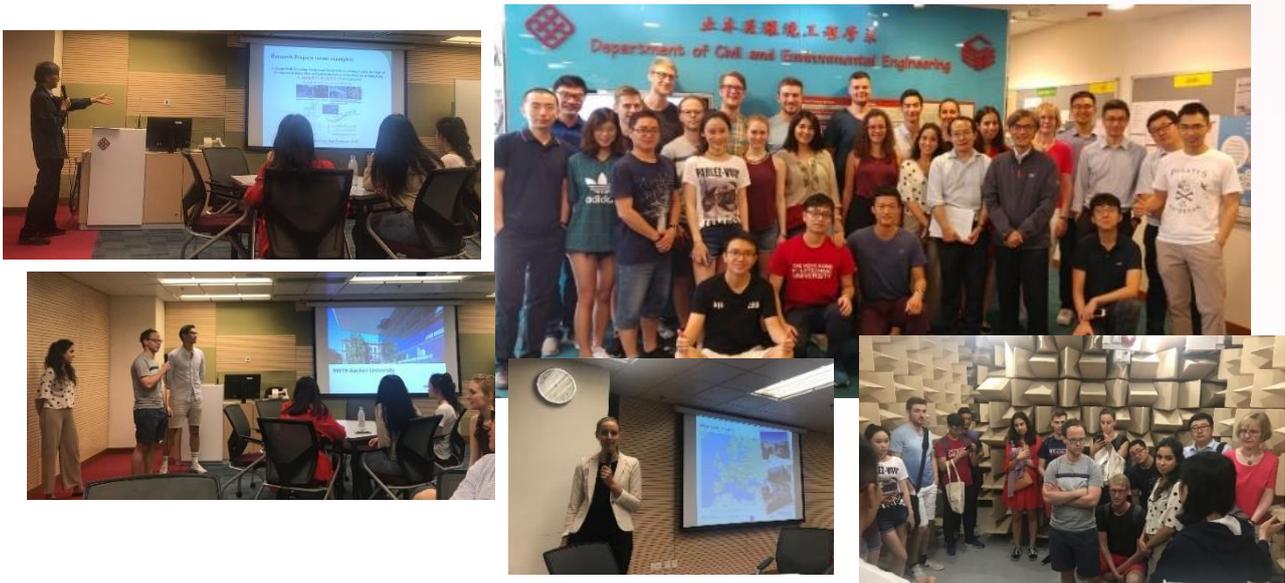


CEE Activities

Delegation from the Faculty of Civil Engineering of the RWTH Aachen University, Germany

On 18 May 2018, CEE hosted a delegation of 15 students and 3 staff members from the Faculty of Civil Engineering of the RWTH Aachen University, Germany.

During the visit, Prof. C.S. Poon first introduced our Department and RWTH Aachen University student representatives also introduced their Faculty and University. There was a good interaction session between students of the two departments, followed by a laboratory tour. Dr Songye Zhu, Associate Professor of CEE, attended the event as well to discuss the possibility of student exchange between two universities.



“Smart Engineering for 2030 and Beyond”

A Symposium on “Smart Engineering for 2030 and Beyond” organized by the Civil and Environmental Engineering Alumni Association (CEEAA) of The Hong Kong Polytechnic University was held on 2 February 2018.

Mr Michael Wong, JP, Secretary for Development Bureau, The Government of the HKSAR, was invited to give an opening address to the symposium. Representing CEE which was the co-organizer of the event, Prof. Tao Wang gave a talk on “Photochemical Air Pollution in Highly Urbanized Subtropical Regions: From Micro Environments to Urban-Terrestrial-Oceanic Interactions”. The Symposium successfully attracted over 150 attendees.



Mr Michael Wong (7th from left), Prof. Tao Wang (2nd from right), Ir Prof. William H.K. Lam (Head of CEE) (5th from left), Prof. K.F. Chung (1st from right) and CEEAA representatives



CEE Activities

The University Fellowship Conferment Ceremony 2017/18

Mr Kwok-fai Yau, a CEE alumnus, was awarded the University Fellowship presented by PolyU in recognition of his significant contributions to the University and community.

The University Fellowship Conferment Ceremony 2017/18 was held at the Jockey Club Auditorium on PolyU campus on 30 January 2018.



Civil and Environmental Engineering Alumni Association (CEEAA) Biennial General Meeting (BGM)

The BGM of CEEAA was held on 18 May 2018. Mr Andy Cheung, General Manager of Spatial Technology Limited was elected as the President of CEEAA for a term of 2-year from 2018 to 2020. During the meeting, CEE Student Society (CEESS) was given an opportunity to present its year plan and discuss potential collaboration with CEEAA.

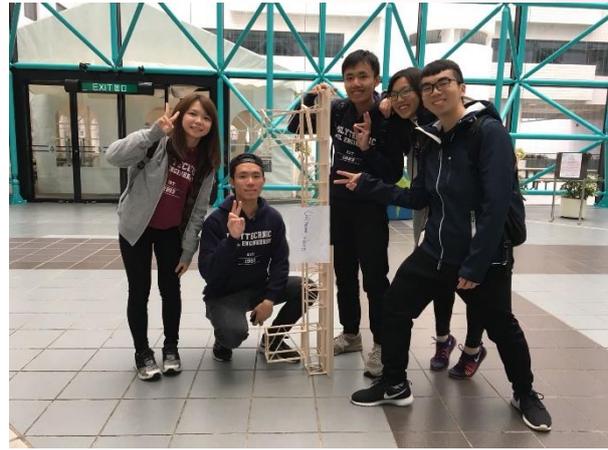


Student Awards

CEE Team was “Model Building Competition 2018” Champion

On 27 January 2018, a team formed by six final-year students of Civil Engineering Degree Programme was the Champion in the Model Building Competition 2018 organized by the Graduates and Students Division of ICE Hong Kong Association.

CEE team members: Mr Yu-Sum Chan, Mr William Wai-Lim Cheng, Miss Nok-Hei Kwok, Miss Yee-Ling Lam, Mr Chung-Hang Lau and Mr Yat-Him Tsang



Undergraduate Research Award Scheme 2016/17, The Institution of Structural Engineers, the UK

In the 2016/17 Undergraduate Research Grant Scheme of The Institution of Structural Engineers, UK (published on its website on 13 December 2017), Miss Tsz-Ling Ho, 2017 graduate of BEng (Hons) Civil Engineering, won a runner-up prize on her final year project poster “Confinement effect of high strength concrete with nominal compressive cylinder strength of 100 MPa in concrete-filled steel circular tubes.”

Miss Ho’s final year project was supervised by Dr Tak-ming Chan.



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學
DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING
土木及環境工程學系

Confinement effect of high strength concrete with nominal compressive cylinder strength of 100 MPa in concrete-filled steel circular tubes

Final Year BEng Student: Miss Tsz-Ling HO



The Institution
of Structural
Engineers
Undergraduate Research Grant

1. Background
Concrete-filled steel tube (CFST) is commonly used in high-rise building nowadays. High strength concrete (HSC) with nominal compressive cylinder strength exceeding 50 MPa has the advantages of high compressive strength and high stiffness but it is relatively brittle. To improve the ductility of HSC, circular steel tube can be used to confine the HSC.

2. Aims
This project aims to investigate the confinement effect of high strength concrete in concrete-filled steel circular tubes and to extend the current design approaches in Eurocode 4 in which the design of concrete-filled tubular column limits the concrete compressive cylinder strength up to 50 MPa.

3. Test Specimens

Specimen Types	Average Measured Strength
 Plain concrete cube x 10 Length: 150 mm Width: 150 mm Height: 150 mm	Compressive cube strength, f_{cu} = 50 MPa, 50 MPa
 Plain concrete cylinder x 6 Diameter: 150 mm Height: 300 mm	Compressive cylinder strength, f_{cy} = 63 MPa, 57 MPa
 Hot-finished hollow steel tube x 4 Height: 300 mm	(Circular hollow section) CHS219.7 x 9 (Class 1) Yield strength, f_y = 462 MPa CHS219.7 x 12.5 (Class 1) Yield strength, f_y = 507 MPa
 Concrete filled steel tube x 8 Height: 300 mm	Load cell (Axial load) Loading steel plate Strain gauges Transducers (Axial shortening)

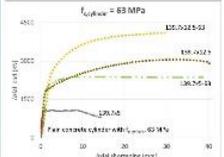
4. Deformed Shapes
Specimens have been designated by the following notation:
139.7x12.5-62
Steel tube diameter, d $f_{cylinder}$
Steel tube thickness, t

Specimen Types	Hot-finished hollow steel tube		Concrete-filled steel tube			
	139.7x5	139.7x12.5	139.7x5-63	139.7x5-90	139.7x12.5-63	139.7x12.5-92
Typical Deformed Shape						

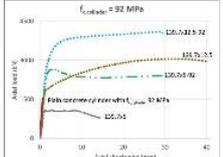
Note:  Local buckling

5. Axial Deformation

$f_{cylinder} = 63 \text{ MPa}$



$f_{cylinder} = 92 \text{ MPa}$



- Compared with plain concrete cylinder, the axial deformation of the high strength concrete filled steel tubes (HSCFST) is increased.
- Compared with 5 mm thick hollow steel tube, the axial deformation of HSCFST is enhanced.

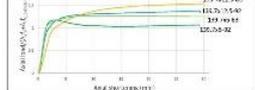
6. Eurocode 4's approach with measured strengths on CFST with circular hollow sections

$$N_{design} = \eta A_c f_{cd} + A_s f_{td} \left[1 + \eta \frac{d}{e} \frac{f_{td}}{E_s} \right] \quad (Eq. 3)$$

Specimens	Measured N_{KN}	Measured N_{KN}	Measured N_{KN}	$N_{design}/N_{measured}$	$N_{design}/N_{measured}$
139.7x5-63	2422	2555	0.95	0.41	
139.7x5-92	2654	2915	0.91	0.56	
139.7x12.5-63	4104	3681	1.12	0.54	
139.7x12.5-92	4101	3876	1.05	0.56	

- Eq. 1 takes into account the concrete strength enhancement due to confinement. The approach overestimates the capacity of 139.7x5 specimens with steel contribution ratio δ of 0.38 and 0.41.
- On the other hand, the approach underestimates the capacity of 139.7x12.5 specimens with δ of 0.5 and 0.54.

7. Basic Eurocode 4's approach superposition
The following figure assesses the ratio between N_{design} and basic Eurocode 4's approach superposition $(N_{design}/N_{superposition})$ against axial shortening.



The above figure shows that the strength enhancement of 139.7x12.5-63 is the highest since the steel contribution ratio δ is the largest from the above table.

8. Conclusions

- Compared with plain concrete cylinder and hollow steel tube, the axial deformation of HSCFST is highly increased;
- Eurocode 4's approach on CHS provides a good prediction on HSCFST with δ of 0.5 and 0.54;
- Basic Eurocode 4's approach with superposition provides a conservative prediction;
- Since the strength and axial deformation of HSC are increased in circular steel tubes, HSCFST can reduce the column size and enlarge the usable floor area. The application of HSCFST is cost-effective.

9. Acknowledgements
The funding for this project from the Undergraduate Research Grant of the IStructE is sincerely appreciated. The author is also thankful to her supervisor Dr Tak-Ming Chan and the support from Mr Alex Zhu at the Hong Kong Polytechnic University.

Student Awards

Outstanding Student Awards of the Department and the Faculty

Mr Dachi Chen, a final-year student of BEng (Hons) Civil Engineering of CEE, received the “Outstanding Student Award of Department” and the “Outstanding Student Award of Faculty” on 26 February 2018 at the Chiang Chen Studio Theatre of PolyU.

Mr Chen participated in an exchange programme at the Imperial College London, U.K. in 2015/16. He was on the Dean's Honours List in 2013/14 and 2014/15.



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Please send this form to Room ZS972, Department of Civil and Environmental Engineering, Hung Hom, The Hong Kong Polytechnic University, Hong Kong (by post), ceenqir@polyu.edu.hk (by email) or (852) 2334 6389 (by fax). Upon receipt of your proforma reply, we will contact you separately for the detailed arrangements. Thank you in advance for your contribution.

July Attractions

PolyU-led project awarded the Largest Grant in the latest round of RGC Theme-based Research Scheme 2018/19

Project name: Sustainable Marine Infrastructure Enabled by the Innovative Use of Seawater Sea-Sand Concrete and Fibre-Reinforced Polymer Composites

**Funding awarded:
HK\$52,463,000**



**Structural Engineering
Research Laboratory**



Laboratory for Advanced Environmental Studies



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