

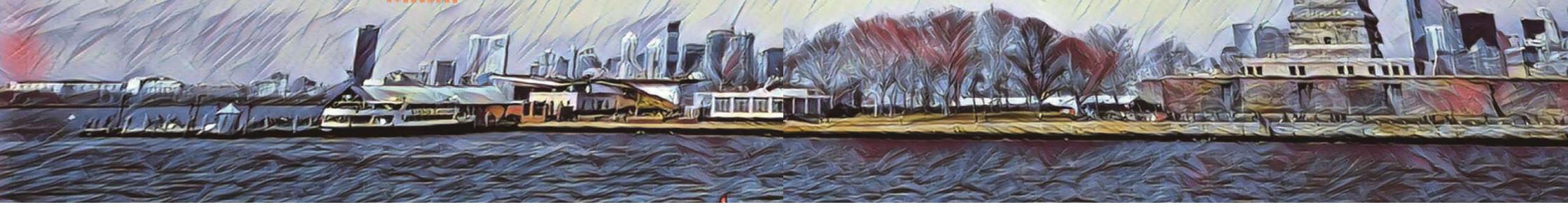
Overseas Delegation 2018

New York City

The future of Global Cities

HKIE THE HONG KONG
INSTITUTION OF ENGINEERS
香港工程師學會

Young Members Committee
青年會員專務委員會



Contents

2	Messages
10	Introduction
16	Identifying Areas of Study
22	Overseas Events
36	Local Events
48	Insights
82	Conclusion
84	Annex





Ir Thomas K C Chan

President, The HKIE

I would like to take this opportunity to congratulate all delegates of this year's YMC Overseas Delegation for having a successful and fruitful trip to New York.

The YMC Overseas Delegation has always been a highlighted event every year for young engineers to get the chance to venture out to explore other countries' engineering marvels and unique culture. This year is no exception with one of the most developed metropolises — New York — as the destination under the theme of "The Future of Global Cities".

Most of us are no stranger to the similarity between New York and Hong Kong. Both of them are global cities where economic activities concentrate, especially in the financial sector. They are also well developed with a high living standard, and house a dense and multi-ethnic population. As a result, they both encounter similar problems such as traffic congestions, an aging population and an urban environment requiring constant upkeeping of

world-class infrastructure. In order to resolve these problems and sustain their competitiveness, they need to transform themselves into Smart Cities.

There are some critical building blocks for a Smart City: Open Data, Internet of Things, Information Digitalization, just to list a few. This trip to New York provides a great opportunity for the delegates to explore and bring back insights for the future of our city. These insights will certainly aid us on the road ahead.

I am sure the delegates themselves have gained much experience from the trip as well. At first, they were just strangers from different engineering backgrounds. Within a few months, they have organized and arranged the delegation professionally as a group and most importantly, made friends who share the same passion in engineering. They are now more prepared than ever to face any challenges both at work and in life.

Lastly, I would like to commend the Delegation Manager, Ir Tak Tang, for his leadership and commitment which are vital to realize the success of this delegation.



Ir Dr Philco N K Wong

Senior Vice President, The HKIE

It has been my pleasure to be part of this year's YMC Overseas Delegation as an adviser. Together, we have embarked on a journey to exchange and learn from the wide portfolio of officials and guests throughout programme.

This delegation served well as a comparative study for our young engineers to understand both the strength and weakness of Hong Kong, in the light of other mega-metropolis, in this case New York. Under the theme of "The Future of Global Cities", the team explored the opportunities and solutions offered by these cities to overcome key challenges in urbanisation, city resilience, aging populations and smart infrastructure.

In preparation, the group has seized the opportunity to organise 10 local site visits and seminars from January, including "Dialogue with Former Secretary of Security" and

seminars on cybersecurity. These were valuable opportunities for engineers from other disciplines to understand the role of engineers in cybersecurity and perhaps more importantly an opportunity to understand how cybersecurity would interact with all aspects of our livelihood.

For 9 days, the group has engaged in a wide spectrum of organisations in New York for insights such as cybersecurity at the New York University and smart city development with the New York City Mayor's Chief Technology Officer. The group also took a visit to the "Rebuild by Design" which supported rebuilding New York City at the aftermath of Hurricane Sandy. Under the guidance of Ir Dr Otto Poon, I believe they have gained a good understanding technological know-how, governance of state and society as well as building city resilience.

Last but not least, I would like to take the chance to express my appreciation to all the guests and officials who have keenly supported the delegation and also Ir Tak Tang for leading his dedicated team as the Delegation Manager.

Messages





Ir Ringo S M Yu

Vice President, The HKIE

Once again, it is my joy to have been invited by YMC to be one of the Delegation Advisors.

My heartfelt congratulations to YMC for the rewarding and successful Delegation to New York this year. I am certain that all delegates have been provided an extremely valuable opportunity for them to broaden their technical horizon and to keep abreast of recent developments of the world.

The theme this year is "The Future of Global Cities". It is a wise selection as there is quite an amount of similarities between Hong Kong and New York. We are both planning our future development, sharing the problem of many global cities including security threats, ageing population and the impact from global warming.

The findings and insights identified by the delegates are presented in this published report and during a sharing session with all HKIE members. Public, professionals and young engineers can get the knowledge and observations and

apply through their work and benefit the society.

I take this opportunity to congratulate Ir Ambrose CHEN, Ir Tak TANG and their team for accomplishing this arduous task of organising and participating in this Delegation.



Ir Dr P L Yuen

Vice President, The HKIE

I write to congratulate the success of the YMC Overseas Delegation to New York 2018. I am pleased to be an advisor and an interviewer, for the first time, for this delegation which has a long history of accomplishment over the years.

Engineers should endeavour to use their professional skillsets to building a better world. In a rapidly changing world, what can young engineers do to help to propel and develop our society towards a better future? With the theme of "The Future of Global Cities", YMC has formed a team of 16 delegates from different engineering disciplines to search for the answer within the broad values of Resilience, Innovation and Security.

As part of this delegation, young engineers acquire professional knowledge through attending a series of seminars, site visits and exchanges with professionals, held both locally and overseas. They are able to cooperate, communicate and create their engineering ideals and aspirations under the intensive programme. Having

successfully completed this program, I believe these engineers are now empowered and emboldened to translate these aspirations into reality.

I hope our young engineers can keep their curiosity and continue to develop their global views. I wish to congratulate Ir Ambrose CHEN, Ir Tak TANG and their team for accomplishing this successful mission of YMC.





Ir Dr Otto L T Poon

Past President, The HKIE

I was delighted to join our young delegates in New York in April 2018 to meet our counterparts in discussing how to review and improve performance of cities and communities, focusing on outcomes from ongoing sustainability efforts across an array of metrics.

I have enjoyed working with YMC over the years. It is heartening to see that YMC continues the tradition of organizing a comprehensive study and a visit to an overseas destination to inspire young engineers to learn and to develop innovative ideas, and to promote the professional image of HKIE and Hong Kong engineers.

The Delegation had prepared a well-planned itinerary that delegates were able to visit a number of representative places and important organizations of New York, and to understand well the city's initiatives and achievements in respect of resilience, innovation and security.

From the eventful programme and the meaningful exchanges with a wide spectrum of organizations both local and overseas, it is evident that the Delegation had achieved its goals. I would therefore like to congratulate the Delegation, under the able leadership of Ir Tak TANG, for this successful trip as well as being an ambassador for HKIE on the other side of the Pacific.



Ir Dr C M Koon

Chairman, the Continuing Professional Development Committee, The HKIE

I would like to express my heartfelt congratulations to the Young Members Committee in successfully organizing a series of local seminars and the overseas visits to study the current status of our city. The theme this year is "The Future of Global Cities" and the events were open to all HKIE members with over 280 members having attended. I was also delighted to serve the interview panel in forming the team of delegates and have dialogues with many young members.

New York and Hong Kong are global cities having strong influence to global economic and cultural development. A portmanteau "Nylonkong" suggests the similarities shared by New York and Hong Kong. Apart from their advancements, they are also facing similar problems. For example, Hong Kong is a very densely populated city and New York is the most densely populated major city in the United States. Impact of extreme weather is also a common problem for the two coastal cities. This delegation provided a valuable

chance to learn from New York's experience in planning and development that may be applicable to Hong Kong for the future. I am sure more exchange of experiences will help us to develop the best strategies in facing the challenges ahead in a sustainable way.

This report also shares the delegates' learning experiences as well as giving presentation to allow other members who did not join the delegation to learn from the experience of the trip. I believe that all the delegates have acquired a good understanding as what we engineers can and need to do to maintain Hong Kong's competitiveness as a global city. I congratulate Ir Tak Tang and his team in organizing this very successful event.





Ir Ambrose H T Chen

Chairman, YMC, The HKIE

Last year when I led the delegation, we had a chance to discuss climate change with Mr Lam Chiu Ying. Despite the in-depth discussion on climate change, the delegation team also ran through a very interesting topic – “where Hong Kong should go as a city”.

Hong Kong has been a unique city since its founding in the 19th century. The special colonial history of Hong Kong has made her citizens, including engineers, equipped with a unique thinking process which combined the benefits of the culture of east and west. During the sharing, Mr Lam commented that we engineers should keep up this unique thinking process and professionalism to meet the challenges ahead, and to build the city smarter, more sustainable and better. Therefore I am very impressed and delighted when I learnt that the theme of this year’s delegation is about “The future of global cities”.

This delegation is a sustainable, yet extraordinary event by the YMC in collaboration with the Continuing Professional Development Committee of the HKIE. This event does not stop at inspiring the delegates, but all young

engineers in the HKIE shall benefit from the insights and findings which the delegates are going to present. I am sure that this report will be a source of inspiration for all of us in the building for the betterment of Hong Kong.

My theme set for the YMC this year is “Redefine”, hoping to search and redefine the position of young engineers both in the industry as well as our community. This delegation extended the spirit of this year’s theme to strive for unique and quality solutions for the upcoming challenges. From the long discussed climate change and how Hong Kong is resilient and prepared for it, to the use of innovative solutions to improve living standard and enhanced protection against the threats from the outside world. Through this delegation, the team is here to share some of their young insights which I would urge you to take a look in it.

In closing, my heartfelt thanks to the sponsors and CPDC for their generous support which had made this delegation a success. My special thanks should also to the advisors of this delegation for taking time off their busy schedules for conducting interviews, sharing their insights and joining the trip.

Last but not least, I must congratulate Ir Tak Tang, Ir Kenneth Cheung, Mr Peter Bi and all delegates for their excellent efforts in organising this delegation and made Hong Kong a step closer in becoming a truly smart city.



Ir Tak W T Tang

Delegation Manager
Deputy Chairman, YMC, The HKIE

“The future is not a gift. It is an achievement.” Every generation of engineers help to shape the future. We set out in search for the answer for “The Future of Global Cities” on how we can transform lives and safeguard our future through resilience, innovation and security. It also echoes our President’s invitation to Engineering a New Horizon from 70 Years’ Foundation.

On behalf of the delegates, I would like to express our gratitude to the Continuing Professional Development Committee and sponsoring companies for their generous financial support to make the Delegation a success.

I would also like to thank the overseas organizations for hosting us and giving us an insight into the resilience preparedness, innovation initiatives and security policies and practices in New York. Particular thanks should go to the Consulate General of the United States of America in Hong Kong for their advice and assistance in the liaison work. We were also thankful for the warm reception held by the American Society of

Civil Engineers and the New York University Tendon School of Engineering, allowing us to continue to foster international relationships with corresponding engineering institutions around the globe.

We are indebted to the unwavering support by our advisors Ir Thomas CHAN, Ir Dr Philco WONG, Ir Ringo YU, Ir Dr P L YUEN, Ir Dr Otto POON and Ir Dr C M KOON. They gave us valuable advice in the planning of the delegation and shared insights into the key study areas.

I am proud to have worked in a great team of young members, who are intelligent, enthusiastic, devoted, energetic and thoughtful. We carried out local and overseas research; drafted technical papers and presentation materials; identified and liaised with our New York counterparts; coordinated on the itinerary, flight, accommodation, transport, insurance and catering; arranged matching local seminars and visits in Hong Kong open to all HKIE members; raised thoughtful questions during the visits and discussed critically what we learnt. This comprehensive report is a testament to the dedication of our delegates.

I must thank the delegation team for their hard work and great efforts to make the Delegation a successful and memorable one. It is my honour to be part of the team. We as young engineers are looking forward to using our knowledge to build Hong Kong for the future!





Introduction



★ Background of YMC Delegation

Since 1991, YMC has been organizing Delegations to various parts of the world. A specific theme is chosen for each Delegation with the following objectives:

- To widen the vision and horizon of young engineers
- To appreciate latest engineering practices around the globe and assess the applicability of these practices in Hong Kong
- To promote Hong Kong and its engineering practices
- To enhance the relationship between HKIE and overseas Institutions

These objectives can be achieved through the Delegation and a series of local seminars and visits held before and after the Delegation.

★ Theme of the New York Delegation 2018 — The Future of Global Cities

With the theme of “The Future of Global Cities”, the delegates visited New York, a world-class city at the centre of the international stage. The delegates had an opportunity to explore the latest developments in innovation, cybersecurity and work to build up resilience. The delegates studied how American engineers explore new ideas, apply emerging technologies and make reference to proven practices in building more sustainable communities, thus preparing the city for the future.



★ Objectives

The objective of this Delegation is to allow young engineers to learn how engineers in New York apply their professional knowledge to improve the quality of life. Sixteen young engineers, as known as the delegates, visited New York, the United States.

The delegates focused their study in three key areas, namely:

1. Resilience
2. Innovation
3. Security

After carrying out comparable project researches in Hong Kong, visiting selected project sites, and exchanging ideas with relevant professionals in New York, the delegates are able to compare and contrast the practices in New York and Hong Kong.

The Overseas Delegation 2018 to New York has the following specific objectives:

- To acquire new experience and global exposure in visiting sites and exchanging with engineering professionals in New York
- To inspire young engineers to develop innovative ideas and appreciate the roles engineers play in safeguarding the future
- To encourage young engineers to extend their network and broaden their horizon
- To enrich HKIE members with technological advancement and applications for the city's sustainable development
- To promote the professional image of HKIE and Hong Kong engineers

This report shares the overseas findings observed by the delegates and a comparison is drawn with Hong Kong.





★ **Composition of Delegates**

Promotion materials were published in November 2017 to invite young engineers to join this Delegation. An overwhelming response was received. Sixteen delegates were chosen from a group of elite young engineers by advisors through interviews. These delegates came from a wide range of engineering disciplines, including Building Services, Chemical, Civil, Geotechnical, Mechanical, Logistics and Transportation, Structural. They work in different sectors of engineering professions, ranging from government departments, public organizations, consultants and contractors. The delegates are in essence a representation of overall young engineer community in Hong Kong.

★ **Why New York**

Hong Kong prides itself as “Asia’s World City”; what exactly does it mean? What do we have in common with our global cities? How do we better prepare our city for the future? With a view to inspire our future leaders in shaping the city, the YMC has planned this study mission to investigate the meaning of global cities, reflect upon the success, tap into the worldwide challenges and examine the formulation of solutions by other major cities on how to “future-proof” our city.

“Nylonkong” (New York -London-Hong Kong) share the fame as the most remarkable cities in the 21st century and, therefore, we turn to New York as our destination of this year’s delegation in search of our answers.

To facilitate the in-depth research, the delegates began by reviewing the current status in Hong Kong under each of the aspects. A series of 10 local seminars and visits were organised, which were open to all HKIE members and over 300 members attended.



New York is a suitable destination for this comparative study as it shows similarities with Hong Kong in aspects including geographic, population size, and economic development for drawing meaningful comparisons and facilitating sound exchange of experiences with our counterparts. New York is under continuous development through its reinvention of public space and enhancement of public facilities. Many of its directions echo Hong Kong’s 2030+ plan and the Smart City Blueprint for Hong Kong. In particular, we set out to study how the public are engaged in the decision-making process to shed light on how projects in Hong Kong can gain popular support and be delivered more smoothly as we anticipate an increasing demand for public participation.

We completed 15 technical visits in New York, covering representative organisations of the state, market and the civil society. We visited governments of different levels including the United Nations, departments of the New York City and under the Mayor’s Office to discuss various policies and the state’s role. In the private sector, we visited Autodesk that developed cutting-edge organic building material and generative design

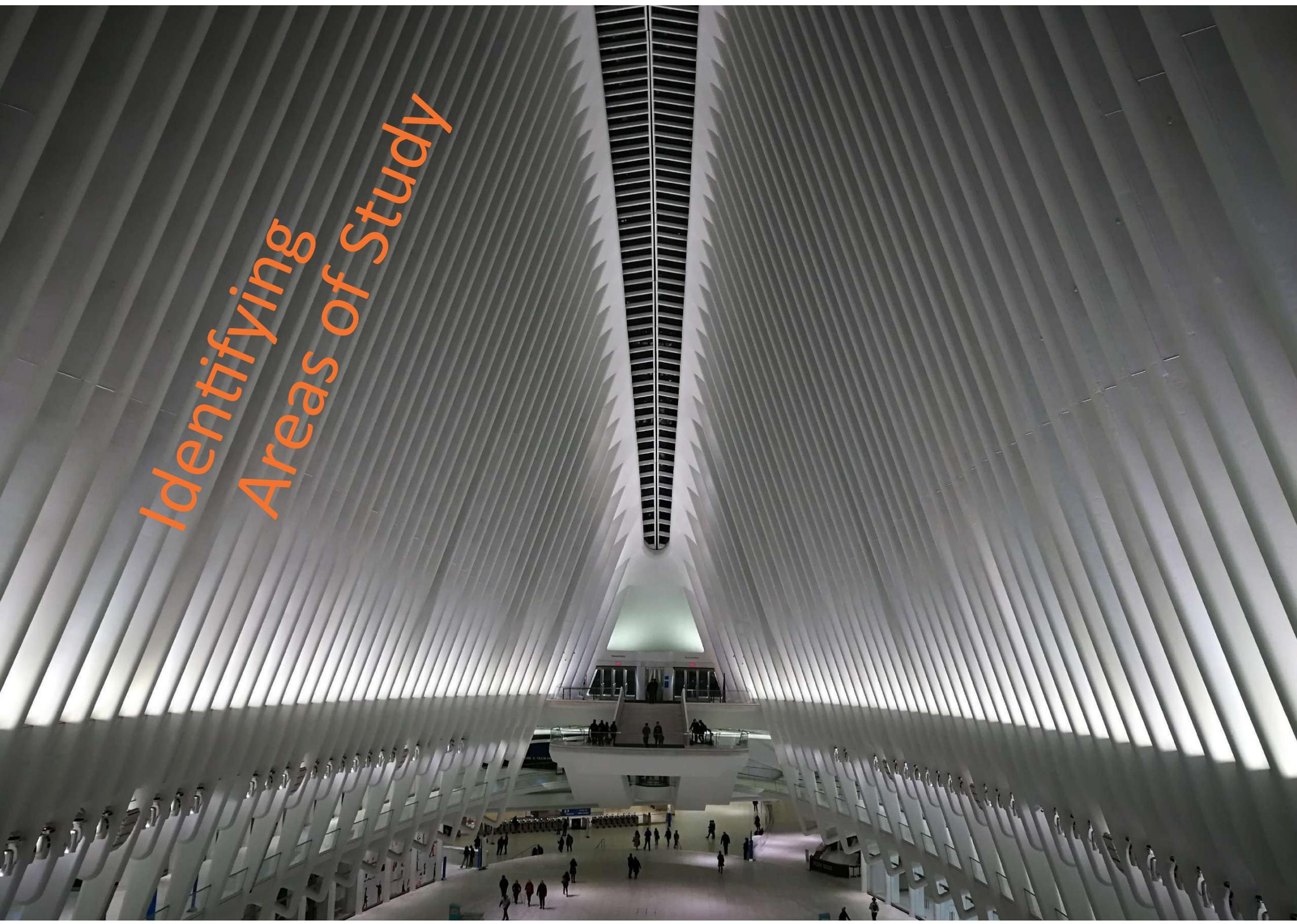
approach combining virtual reality and artificial intelligence. We also witnessed the construction of the 3.1-mile cable-stayed New New York Bridge with state-of-the-art sensors system. Furthermore, we met with teams from Bank of America headquarters and Nomura Holding America Inc. in learning their facilities in-built resiliency against natural hazards as well as cyber-attacks.

More interestingly, we obtained insights into the maturity of the civil society in the United States by studying the success of the society-led projects including the Rebuild by Design that gathers global experts in rebuilding New York at the aftermath of Hurricane Sandy, and the High Line that revitalised a neighbourhood by creating a park on a neglected elevated railway.

To foster international relationships, we also fulfilled our duties of representing the HKIE in meeting on separate occasions with students of the Tendon School of Engineering at NYU, members of the American Society of Civil Engineers and the US Green Building Council to exchange our views on how young engineers can join hands in combating a range of global challenges.



Identifying
Areas of Study



Three study teams were formed among the delegates, with each team focusing on the following:

- ★ Resilience
- ★ Innovation
- ★ Security

Resilience

In dictionary, resilience can be defined as “the quality of being able to return quickly to a previous good condition after problems” (Cambridge, 2008). To a city, resilience means the ability to reduce the damage and risk brought by disasters, accompanied with the ability to bounce back to the stable state (United Nations, 2016).

With the growing impact of climate change, diverse hazards are threatening Hong Kong. These hazards include heavy rain, storm surge and tropical cyclones. The extreme events can cause flooding and landslides, which result in serious casualties and damage to the city infrastructure including coastal defense and transport system. In the recent years, Hong Kong government took holistic reviews on the strategy to tackle with these imminent threats. To enhance city’s capacity towards extreme weather events, Drainage Services Department (DSD) adopted the concept of resilience in the drainage system, replacing the former concept of resistance.

Apart from physical resilience, it is crucial to ensure that the infrastructure can connect to the society and bring multiple benefits to the community. Drainage Services Department takes proactive approach to build multifunctional infrastructure, including the rainwater harvesting in the drainage facilities and revitalization of river channel. Not only can the infrastructure make better use of the water resources, but also promote water-friendly culture to the community. Besides, DSD collaborated with Hong Kong Observatory (HKO) and



Home Affairs Department (HAD) to develop an early storm surge alert system in the low-lying areas where they are prone to flooding. In case of storm surge, the government department and community will be alerted to take proper preventive measures.

In this delegation, the delegates performed comparative study on the ways to enhance physical and social resilience through government policies and infrastructure in Hong Kong and New York. The delegates also studied the collaboration model adopted in infrastructure projects to enhance public participation by conducting a detailed case study.

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Innovation

Despite being a beacon of modernization and prosperity nowadays, Hong Kong has faced its fair share of challenges in the past. There was a period of water shortage in the 1960s and fatal landslides were prevalent in the 1970s. These times of crisis is a wake up call for innovative solution with new technology and new approach. Two reservoirs were constructed at sea, which were the first of its kind in the world, that account for over 87% of water storage capacity in Hong Kong. Moreover, Hong Kong now becomes the world’s leading city in landslide management with its landslide warning system, extensive retaining walls and slope maintenance experience. As time passes, the quality of living improves and there is less life-threatening problems in Hong Kong. Challenges in today’s Hong Kong have shifted to a higher level of needs. Problems like deteriorating urban environment, traffic congestion and lacking a new engine of growth plague this city. They are sophisticated problems which involves a wide spectrum of stakeholders from different sector. Hence, innovation is needed once again in order to solve these complications. Then and only then, Hong Kong can improve its efficiency, stays competitive among global cities and be sustainable in the long run.

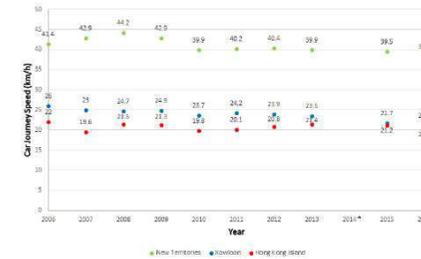


Figure 1: Car Journey speeds in different districts of Hong Kong (2006 - 2016)*

Hong Kong and New York, as global cities, are facing similar challenges for development. One part of this delegation was to study and appreciate innovative solutions including technologies and approaches that New York had used to tackle social problems.

Under the raising demand in urban areas, the congestion problems gradually emerge due to the limitations of infrastructure within many global cities. According to the Annual Transport Digest of Transport Department (2017), the growth of total road length is expected to slow down to around 0.4% p.a. up to 2020 due to the physical and spatial constraints. However, the current growth rate of vehicle fleet has reached about 3.4% p.a. in the meantime. On average, our roads are dense with 354 licensed vehicles for every kilometer. Consequently, the average car journey speed in urban areas dropped by about 16% from 24.6km/h in 2003 to 20.7 km/h in 2016. Congestion imposes a negative influence on the competitiveness of cities and companies as it causes an increase of logistics costs and limits the capacity in urban distribution.

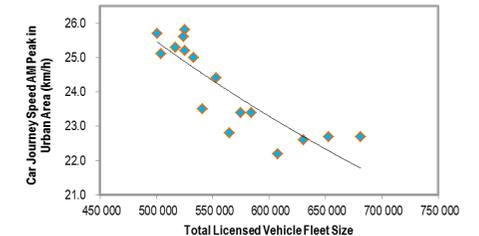


Figure 2: Historical relationship between vehicle fleet size and car journey speed in urban areas



* The car journey speeds for 2014 are not available due to the Occupy Movement





As the world is facing consequences of global warming, sustainability is an important issue for global cities like Hong Kong and New York. Part of study area in this delegation was to study green buildings and development of new recycled materials in New York. Green buildings reduce carbon emission and energy usage while the use of recycled materials reduce wastes by using organic and existing waste materials.

Another area of study about innovation is the application of artificial intelligence for structural design. The Living in New York applied generative design to produce better structural design and indoor space planning.

As Hong Kong transition to a knowledge-based economy following the financial crisis in 1998, the Steering Committee on Innovation and Technology was formed and has published two publications to guide Hong Kong in future development. The Applied Science and Technology Research Institute (ASTRI) was established to provide mid-stream research and development and transfer the result to various industrial and commercial application. The Hong Kong Science and Technology Parks Corporation was set up to support technology start-ups in their research and production stages through funding and incubation programme. Coincidentally, the Cyberport Infrastructure project was completed to provide a cluster of facilities that supports information technology, telecommunication and digital media. It serves as an incubation ground for start-ups and foster cooperation between technology companies. In 2015, the Innovation and Technology Bureau (ITB) was found. It coordinates effort from different sectors and strengthens support for the innovation and technology sector. As a result, more funding and incubation programme are available and the innovative industry is stronger than ever. The

accumulation of new technologies and a pro-innovation environment will be an excellent bedrock for a Smart City. Moreover, ITB published "The Smart City Blueprint for Hong Kong" which highlights six major development directives for Smart City development and gives a clear picture to the future of the city. All in all, the growth in the innovation and technology sector will be a key to solve existing problems and the future of a Smart Hong Kong is very promising.

Security

The concept of security can be described as insufficiently explicated at any level (David A. B., 1997) and easily connects with a variety of values such as military security, social security, physical security and so on. For the study, the sub-theme "security" will focus on Cybersecurity to echo with the main theme on smart city with the extensive use of data/ IoT.

With reference to Report on the Survey on Information Technology Usage and Penetration in the Business Sector, the usage of information technologies has been growing drastically in Hong Kong (Census and Statistic Department, 2017). In year 2017, 268,189 business establishments are using computers with 86% of enterprises routinely using internet and 72% using cloud computing service in their daily operations. Although 96% of the enterprises have put in place IT security measures, 6,506 security incidents were recorded in 2017. It is anticipated that the trend of threats will continue to increase steadily in the future (see Figure 3).



The cyber attacks and threats in Hong Kong were mostly associated with financial sector. As shown in Figure 4, there was a 207% upsurge in cybercrime from year 2011 to 2014 until the establishment of Cyber Security and Technology Crime Bureau (Legislative Council, 2017). Over 2,300 million Hong Kong dollars lost were suffered from malwares, malicious URLs, bots and ransomware threats. The worldwide outbreak of the ransomware "WannaCry" occurred in May 2017 was a wake-up call for the public.

Other than the commercial industries, the use of mobile applications especially for electronic payment is becoming overwhelmingly popular. Over 200 mobile applications from Hong Kong Google Play Store were

scanned for bad behaviors with 3 apps identified as high risk (HKCERT, 2018). Thus it would not be safe in the cyberworld nowadays without taking appropriate security measures.

The security of critical infrastructure of a city, particularly the electric grids, health care systems and nuclear plants are essential for laying a foundation in the development of future global cities. The following part of this report will look into the regulatory, policies and enforcement aspects with the aid of technological advancement by the government or non-government bodies of Hong Kong and New York to perform an insightful comparative study.

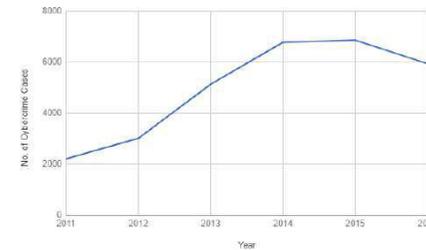


Figure 3 Reportable security incidents in Hong Kong



Figure 4 Number of Cybercrime Cases with Financial Losses

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Overseas Events

1 April
am

★ Visit to the High Line

Led by Ms. Merry Aronoff, the delegates were brought to one of the most famous landscapes in New York - the High Line. While the destination is well known as a 2.33km long elevated linear park situated on the west side of Manhattan, it is also the city's former Central Railroad spur for carrying goods to and from Manhattan's largest industrial district.

As the last train ran on the spur in 1980, the High Line had become a stretch of abandoned elevated railroad under threat of demolition. Unexpectedly, the proliferation of the self-seeded plants that grew on the abandoned tracks became a source of inspiration to the co-founders of the Friends of High Line, Joshua David and Robert Hammond, who brought this disused infrastructure to revitalization. The High Line was opened to public as a landscaped space in 2009 and is now being maintained, operated, and programmed by Friends of the High Line, in partnership with the New York City Department of Parks & Recreation.

Astounded by the integration of historical architecture and urban greening throughout, the delegates would like to give a vote of thank you to Ms. Merry for her informative and keen guided tour.



2 April
am

★ Visit to Autodesk Research Studio

The delegates visited the LIVING, an Autodesk research studio. Mr. John Locke, the Principal Research Scientist gave us an overview of a few iconic and innovative projects in the field of architecture, art, industrial design, aerospace, computer science, engineering, manufacturing and synthetic biology.

A project that he has extensively involved with was called Hy-Fi which used a new low-energy biological building material, manufactured 10,000 compostable bricks, constructed a 13-meter-tall tower that hosted public cultural events for three months, disassembled the structure, composed the bricks, and returned the resulting soil to local community gardens. The advanced computation design tool, emerging biological material together with the custom workflows enable many possibilities for future construction of more responsive, intelligent and sustainable architecture practice.

A new concept, generative design was introduced to architecture and engineering. Designers or engineers input design goals into generative design software, along with parameters such as materials, manufacturing methods, and cost constraints. Then, using cloud computing, the software explores all the possible permutations of a solution, quickly generating design alternatives.

John has presented two generative design projects. The first one was to apply the concept on the workflow of architectural space planning. A variety of office layouts that locates all necessary programs and users was created by a computational design model along with a set of parameter inputs. Then six unique objectives (Adjacency Preference, Work Style Preference, Buzz, Productivity, Daylight and Views to Outside) were defined to evaluate each layout based on architectural performance as well as worker-specific preferences. Finally, a set of designs was selected using a multi-objective genetic algorithm (MOGA) to search through the high-dimensional space of all possible designs.

The second project was about redesigning a partition inside commercial aircraft. The goal was to reduce its weight by 50%. as weight reduction is critical to the aerospace industry to reduce fuel consumption, cost of flying, and carbon emissions. At the meantime, the partition must withstand a crash test. In order to minimizing weight and minimizing structural weakness, an agent-based algorithm growth strategy was used to create individual instances of designs based on a small number of input parameters. These parameters were then controlled by a genetic algorithm to optimize the final design.



2 April pm

★ Visit to New York University's Center of Cybersecurity

The NYU Center for Cybersecurity (CCS) was established in 1999 as Information, System and Security Lab. It is a interdisciplinary research institute aiming to train up Cybersecurity professionals and to shape the public discourse and policy, legal, and technological landscape on issues of Cybersecurity. It is believed that Cybersecurity is not only a study regarding computer science, but it is also a combination of different areas of study such as politics, laws and regulations, social behaviors and psychology. The visit to the New York University's Center for Cybersecurity has given us a lot of insights in enhancing Cybersecurity in the society.

Shortage of Cybersecurity talents and professionals is certainly a hurdle when there is increasing Cyber threats among the society. With support from the government such as the National Science Foundation



The NYU Center for Cybersecurity (CCS) was established in 1999 as Information, System and Security Lab. It is a interdisciplinary research institute aiming to train up Cybersecurity professionals and to shape the public discourse and policy, legal, and technological landscape on issues of Cybersecurity. It is believed that Cybersecurity is not only a study regarding computer science, but it is also a combination of different areas of study such as politics, laws and regulations, social behaviors and psychology. The visit to the New York University's Center for Cybersecurity has given us a lot of insights in enhancing Cybersecurity in the society.



(NSF), some students could enrol to the NYU CCS's program with funding and they would then serve as Cybersecurity specialists in the government.

Cyber Security Awareness Week (CSAW) is another highlights of the NYU CCS, and the largest student-run Cybersecurity event in the world which engaged a lot of Cybersecurity talents in different countries. At the same time, CSAW provides a platform that allows collaboration and knowledge transfer between Cybersecurity programs and academic institutions across the world.

The continued support from the government and different institutions allows NYU CCS to nurture more Cybersecurity specialists to cater the development of a smart, innovative and resilient city.

★ Visit to Nomura

Shortage of Cybersecurity talents and professionals is certainly a hurdle when there is increasing Cyber threats among the society. With support from the government such as the National Science Foundation

(NSF), some students could enrol to the NYU CCS's program with funding and they would then serve as Cybersecurity specialists in the government.

Cyber Security Awareness Week (CSAW) is another highlights of the NYU CCS, and the largest student-run Cybersecurity event in the world which engaged a lot of Cybersecurity talents in different countries. At the same time, CSAW provides a platform that allows collaboration and knowledge transfer between Cybersecurity programs and academic institutions across the world.

The continued support from the government and different institutions allows NYU CCS to nurture more Cybersecurity specialists to cater the development of a smart, innovative and resilient city.



3 April am

★ Visit to Rebuild by Design

Rebuild by Design convenes a mix of sectors - including government, business, non-profit and community organizations - to gain a better understanding of how overlapping environmental and man-made vulnerabilities leave cities and regions at risk. Rebuild's core belief is that through collaborative research and design, communities can grow stronger and be better prepared to stand up to whatever challenges tomorrow brings.

Rebuild by Design began as a design competition, launched by the U.S. Department of Housing and Urban Development (HUD) in partnership with non-profit organizations and the philanthropic sector, in response to Hurricane Sandy's devastating impact on the eastern U.S. The premise was simple: raise the bar for response, preparedness, and resilience. Driven by innovation and collaboration, the Rebuild by Design Hurricane Sandy Design Competition became a model to help governments create research-based, collaborative processes that prepare communities and regions for future challenges.

Forward Design — When the government foresees



there are potential hazards to the city, an infrastructure will be put in place to address such hazards. This is considered to be a backward design that the design was produced as a solution to a problem. However, Rebuild by Design had another approach that engaged people to understand the expectations and needs of them such that the facilities could serve more purposes in addition to the solution to natural hazards.

Multi-function Infrastructure — In the conventional infrastructure design, the facilities usually have single function and the land is sterilised for other uses by the citizens. Rebuild by Design required the teams to produce multi-function infrastructures to ensure the facilities would serve as recreation facilities and allow people to gather at the place for leisure activities.

3 April
pm



★ Visit to Hoboken

Hoboken is a town located by the Hudson River with 70% of land below the 1 in 10 year flood height, susceptible to precipitation, high sea level and tide. With its urbanized catchments and combined sewerage system, the combination causes Hoboken to be vulnerable to localized flooding, sewage backflow and combined sewage overflowing into the Hudson River.

To alleviate these issues, Hoboken adopts a comprehensive strategy that incorporates both traditional "Grey Infrastructures" and the sustainable "Green Infrastructure" towards flood management. The project is planned to be implemented under four parts, namely Resist, Delay, Store and Discharge.

Resists – Physical barriers along the coastal regions during high tide and storm surge events, incorporating both grey infrastructures (sea walls and bulkheads) and green infrastructure (berms and levees).

Delay – Green roofs and rainwater harvesting to reduce the volume of stormwater entering into the combined sewerage system.

Store – Wetland, rain garden and subsurface storage to temporarily detain and filter the stormwater.

Discharge – Pumping stations in place to actively convey stormwater away from the combined sewerage system during rainfall events.

The project also advocates the integration of physical resilience with social resilience to be profitable to both sides. Financial incentives have been setup for the developers in abiding the flood management strategies in their design. i.e. For new buildings, if the developer provides at least 50% of green roof, the remainders can be used for roof deck.

★ Visit to the United Nations

The United Nations (UN) is an organization of sovereign states, which voluntarily join the UN to work for world peace established in 1945. Currently, 193 countries are UN members. The UN is a forum, a meeting-place, for virtually all nations of the world. It provides them with the mechanism to find solutions to disputes or problems, and to act on virtually any matter of concern to humanity.

Delegates visited six main organs of the UN - the General Assembly, the Security Council, the Trusteeship Council, the Economic and Social Council, the International Court of Justice, and the Secretariat. While the Headquarters in New York serves as the nerve centre of the organisation, it plays a central role in reducing international tensions, preventing conflicts and putting an end to fights already under way.



4 April
am

★ Visit to Department of City Planning

The Department of City Planning (DCP) is a department of the New York Government who is responsible in setting the City's physical and socioeconomic framework. The mission of DCP is "to plan for the future of New York City". DCP is responsible for land use and environmental review, preparing zoning plans and policies, and providing to government agencies. The seminar with DCP was focused on resilient neighborhood and special zoning rules about floodplain. Floodplain is area near the river bank that experience flooding during high water level. DCP is working on floodplain to identify zoning and land use strategies to reduce flood risk and increase resilience through adaptive planning.

Policy — After the hurricane Sandy damaged New York in 2012, DOCP looked into the building and zoning policy that would help in minimizing the damages to buildings in floodplain. The state government granted money to households that were suffered from Sandy for reconstruction. DOCP pulled out relevant policies to elevate buildings and move critical utilities out of basements in civilian household. The height restriction on building was relieved by the same headroom of the basement such that the citizens could store the original function of the basement to the upper floors of the building. In order to encourage

citizens who were not suffered from Sandy and did not have the recovery funding to adopt the flood-resilient design, reduction of flooding insurance premium will be given to the citizens that use such design in their houses.

Physical Resilience — Due to climate change and rise in sea level, there will be more occurrence of disasters like Sandy that threaten people in low-lying area. With premise close to rivers, there is large area in the New York City that is vulnerable to flooding hazards. By improving the physical resilience of the city, it means that the city has a bigger capacity to recover from or adapt to disasters. With the policy deployed by DOCP, the loss in properties and human lives can be reduced. Also, there will be less damage to the critical utilities by flooding and it makes the city easier to recover and resumes its routine.

Social Resilience — From the experience of Heat Wave threatening Chicago in Year 1995, people started to develop social resilience in neighborhood. By social resilience, people are of stronger connection with neighbors such that people can help each other when disasters come. With such strong bonding between people, it is expected that the neighborhood will have a higher capacity to adapt to the challenges.



4 April
pm

★ Visit to Mayor's Office of the Chief Technology Officer

In order to develop an understanding of the Smart City directives and policies from the government's perspective, the delegates visited the Mayor's Office of the Chief Technology Officer. This Office is responsible for applying technology to create civic impact and social good. The delegates were introduced to the various developmental directives by the responsible officials.

Currently, a third of New Yorkers do not have access to broadband service. The first directive is to bring broadband internet service to all residents in New York by 2025. Most Smart City initiatives require access to the internet, so this is the fundamental of future development. Equality, internet performance, choice and privacy are indicators for measuring the success of the project. Establishing a digital literacy centre where citizens will be taught to use the internet is also important to achieve digital inclusion. This can ensure human rights on the internet, health of the internet and accessibility to resources are upheld and preserved.

The second directive is to make New York a data-driven city. Open Data can be used by anyone without the restrictions from patents or copyright. Therefore, open source researches are promoted which can expedite technological development and allow the government to make informed decision. The aim of the project is providing Open Data access to the public by 2018. Open Data Week promotes the data sharing platform and raise awareness to the potential of Open Data. The

official also stated that personal privacy is still a concern in Open Data, and the digitalization and disclosure of government resources should be guided by public request.

The third directive is about coordinating paradigm-shifting technology and innovation like Uber and Airbnb, to better suit the needs of the society and avoid conflicts of interest. Moonshot Projects are competitions for companies to solve problem in the society with real-world testing ground. Moreover, underserved communities are consulted to find potential solution with technologies.

The final directive is to facilitate Internet of Things. Projects like Smart Water Meter and Smart Light Pole are already underway. Smart Water Meter can identify leakage in pipelines in addition to transfer usage data wirelessly. Smart Light Pole monitors its surrounding with sensors and communicates with vehicles nearby. The connections between different elements of the city not only provide convenience to the citizens but also act as a source of Big Data.

The visit ended with a souvenir presentation with our Delegation Manager Ir Tak Tang to thank the presenters.

5 April
am



★ Visit to Department of Transportation

Urban traffic congestion is always a challenge for cities around the globe, together with other mobility issues, they have already raised much attention. Besides, Smart Mobility has also been incorporated into our Smart City Blueprint, as an essential component. It would be one of our major focus under the study areas for the Overseas Delegation to New York. In the view of this, we hope to gain deeper insight of Intelligent Transport System (ITS) implementation through the visit to New York City Department of Transportation.

The New York City Department of Transportation (NYCDOT) is an agency of the New York City government, which is responsible for the management of much of New York City's transportation infrastructure. NYCDOT is also responsible for oversight of transportation-related issues, such as authorizing jitney van services and permits for street construction, transportation safety issues, etc.

The visit started with an introduction given by Mr. Mohamad Talas, Deputy Director of System Engineering/Traffic Operations, NYCDOT. Mr. Talas has

briefly shared the vision of the department and the initiatives on pedestrian safety and traffic control with the installation of microwave sensors, video cameras and E-ZPass readers at intersections. He has also given a short presentation on the Connected Vehicle Pilot Project, which aims to improve the safety of travelers and pedestrians in the city.

Followed by a guided tour to Traffic Monitor Centre and Incident Management Center, delegates had the opportunity to learn more of connected vehicle technology and applications in tightly-spaced intersections. The system could help traffic controllers to visualize every incident on road, and automatically perform remote adjustment to Midtown traffic signal patterns to clear congested areas or isolated backups. Shared video cameras in the center also allow joint-department coordination for emergency management.

Delegates have the chance to understand the latest technology deployments in transportation management and outline the elements of smart mobility. The sharing and discussion between was fruitful and in-depth.



5 April
pm

★ Visit to New NY Bridge

The delegates visited the New NY Bridge, which is a twin cable-stayed bridge built to replace the original Tappan Zee Bridge across the Hudson River between Rockland and Westchester counties. The original Tappan Zee Bridge was opened to traffic in 1955 and has operated for 62 years at its retirement in 2017. A new bridge was necessary since the bridge traffic grew to 140,000 vehicles daily which is much more than the design capacity of 100,000 vehicles daily. The accident rate was also twice the average rate of the rest of Thruway system. In addition, there is also no emergency lanes or shoulders.

A presentation was given by the Thruway Authority to introduce the background and design features of the New NY Bridge. The bridge costs \$3.98 billion and was designed and constructed to last 100 years without major structural repairs. The north span officially opened on 26 August 2017 and to serve the traffic of the original Tappan Zee Bridge. Tappan Zee Constructors then began demolishing the old bridge. The construction of south span was expected to be completed by the end of 2018.

The two independent spans can serve the purpose of design redundancy. During an emergency and one of the span had to be closed, traffic on one span could be transferred to other span to maintain traffic flow. The bridge was also designed to withstand potential future mass transit system loading. Cashless tolling is another design feature. Tolls would be collected via E-ZPass and by mail and vehicles do not need to slow down for payment. A structural health monitoring system was also installed to monitor the structural behavior in real-time.

Afterward, the delegates were brought to a site visit on a ship and had a close observation of the bridge.



6 April
am

★ Visit to Bank of America Tower

The Bank of America Tower, opened in 2010, is considered as one of the world's most environmentally responsible high-rise office buildings. It is the first skyscraper obtaining the Leadership in Energy and Environmental Design (LEED) Platinum certification based on its green design features. The building has also achieved an "Innovation in Design" credit for Indoor Environmental Quality (IEQ) through continuously monitor multiple IEQ parameters such as carbon dioxide, carbon monoxide, volatile organic compounds (VOC) and small particulates.

Many green features are installed and implemented in the building. The delegates first gathered at the main lift lobby with natural light capturing, then visited the green roof and saw the rainwater harvesting system. After that, the Chief Engineer, Mr. James Klein introduced the management system of the chilled water system at the control room. A 4.6 MW gas turbine cogeneration system operates with a composite efficiency in excess of 67.1%. The chilled water plant design allows for waste heat absorption cooling to ensure that gas turbine thermal production is based-loaded year-round. As the building has been operated for 8 years, a new problem was found related to the chilled water plant temperature differential (commonly referred to as delta-T or ΔT). The team thus further optimizes the entire chilled water system with specialized control algorithm to maintain optimal differential system pressure, reduce excessive pumping energy and increase system deliverable tonnage on systems suffering from a diminished refrigeration effect.

After visiting the chiller plant, the group visited an ice storage tanks room that consisting of 44 ice storage tanks which are activated during off-peak hours and brings down the overall electricity expenses of the building. The ice created during the night is used to cool the building during the day for peak demand shaving.



Reference

- Donnolo, M., Galatro, V. and Janes, L. (2014). Ventilation in Wonderland. [online] Hpbmagazine.org. Retrieve from: <http://www.hpbmagazine.org/attachments/article/11791/14Su-Bank-of-America-Tower-at-One-Bryant-Park-New-York-City-NY.pdf>.



★ Seminar on LEED Green Building

The United States Green Building Council (USGBC) promotes a sustainable future through Leadership in Energy and Environmental Design (LEED) green building certification programme which is the most widely used green building rating system and other initiatives. Dr. Bhatt, Director of Cities and Communities in USGBC gave a sharing on what is USGBC currently working on and its plan to expand LEED.

USGBC was established in 1993. At that time, the terms 'Sustainability' or 'Sustainable development' were not well-known to the public. As the frequency and intensity of natural disasters increased and the signal of climate change made more clearly to the public, green buildings have been getting more traction over the years. As a result, USGBC and its LEED programme grow in popularity and recognition every day. Nowadays, there are 54 USGBC chapters in various states and cities in USA and its headquarters locates in Washington DC.

LEED has been updated over the years to align with real-world issue and improve its credibility. LEED v4 is the current version and it takes a performance-based approach and use measurable results throughout a building's life cycle to determine its rating. The upcoming LEED v4.1 addresses concerns for the deviation in a building's performance after a LEED rating is been given. A real-time performance monitoring platform, called Arc platform, will be integrated in LEED v4.1 to ensure buildings are able to benchmark their performance with other buildings and their performance is in line with their LEED rating.



As the LEED green building certification programme gets refined to a reliable rating system, USGBC will start to shift its focus to a LEED for cities. The aim of LEED for cities is to support continuous progress towards a better city or a higher quality of life. It will help a city to set performance goals and implement strategies to achieve them. For example, if a city wants to reduce the electricity usage during peak hours so the power grid can be more efficient, LEED for cities can introduce Smart Grid to the city and rewards buildings that participate in load shedding demand response programme. LEED for cities will also track performance data to measure progress towards said goals with a city-level Arc platform. Finally, it will leverage a wide range of rating systems, standards, protocols and guidelines to guide and benchmark cities around the world to achieve sustainability in a global scale.



7 April
am



★ Visit to Vaughn College of Aeronautics and Technology

The Cybersecurity is essential for air traffic management. Potential threats such as insertion of malware on the air traffic system, spoofing of radio signal or usurpation of flights would seriously affect the operation of airport infrastructure. Mr Edward Mandell, the Program Manager Airport Security from Thales mentioned the best practices for cybersecurity as stated below:

ANTICIPATE Cyber-threats

The risk could be evaluated by vulnerability analysis of the infrastructure. End-to-end (E2E) security is also critical for IoT to prevent Distributed Denial of Service (DDoS) attack. The system spans via different network interfaces so that each element of the IoT chain is of specific management layers to avoid collapse of the entire system.

DETECT & RESPOND to Security Incidents

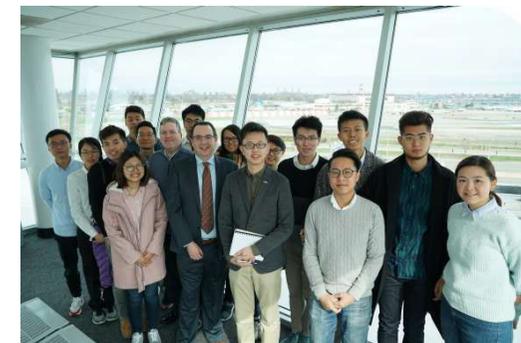
Real-time incident detection was implemented in the

JFK airport. The response team in the Security Operation Centre is responsible for the crisis management and post-incident forensics/ malware analysis. It is anticipated that the investment would be enormous to support the daily operations and safety of the airport.

COMPLY with Policies & Regulations

One of the challenges of cybersecurity is the compliance of security policies and make changes accordingly from time to time. The trained person shall define clearly the policies and take control the deviation of system from one.

International targeted attack and untargeted attacks by criminals, terrorists and hackers against State's critical infrastructure systems continue to be common and widespread. With the increasing sophisticated threats in the States, increased preparedness is required for the infrastructures.



Local Events





★ Local Visit Series

3 February 2018

Visit to MindSphere Application Centre

10 March 2018

Visit to Tsing Ma Control Area

17 March 2018

Visit to MTR Tsing Yi Operation Control Centre

24 March 2018

Visit to LSCM R&D Centre

14 April 2018

Visit to Kai Tak Landscaped Deck

★ Local Seminar Series

10 January 2018

Seminar on Smart City Blueprint for Hong Kong

28 February 2018

Seminar on Cybersecurity Fortification Initiative

8 March 2018

Seminar on Eco-shoreline In Hong Kong

14 March 2018

Seminar on Cybersecurity In Financial



10 January am

★ Seminar on Smart City Blueprint for Hong Kong



In December 2017, the government released the Smart City Blueprint with a vision to shape Hong Kong into a citizen-centric smart city to address future urban challenges such as aging population and dense road network. On 10 Jan 2018, HKIE-YMC was privileged to invite Mr. Albert Wong, Director of PricewaterhouseCoopers Advisory Services Limited, to share the key elements in smart city development and the opportunities arising from technological advancements.

What is smart city? What are the needs of citizens? How can we develop a smart city from a citizen's perspective? How can we implement the smart initiatives? Those are the central questions that Mr. Wong addressed. Smart Hong Kong will embrace sophisticated technologies to improve the quality of living as well as to drive sustainable economic development. Development strategies and initiatives were characterised under 6 interrelated aspects of mobility, living, environment, people, government and economy.

Engineers are the prime driver in smart city planning while innovation and technology (I&T) are the key enabler. Hong Kong has been recognised as a technologically advanced metropolis with numerous

opportunities in I&T development. For example, lamp poles on streets are capable to integrate with Fibre Ethernet, Wi-Fi connection and even facial recognition system to gather shareable information from general public. The ultimate goal is to create insights from human behaviour through building a big data analytical platform. The speaker pinpointed every city had its unique characteristics and there was no panacea that is universally applicable in any situation.

The successful movement towards a smart city requires a collaborative governance while public and private sectors should opt for the same goal orientation. The government could promulgate public-private partnership through pilot projects and encourage private sectors to open data for public usage. Inevitably, collaborative relationship between different stakeholders improves the efficiency and effectiveness in delivering policies and services to citizens.

The success of smart city development largely depends on what we are endeavouring and how public and private sectors collaborate. Nevertheless, the use of data is complex and challenging whilst cybersecurity development becomes more crucial so as to protect the technology deployed.



3 February
am

★ Visit to MindSphere Application Centre

A technical visit to MindSphere Application Centre (MAC) of Siemens Limited on 3 February 2018 was jointly organized by the HKIE-YMC and the HKIE Continuing Professional Development Committee. There are 24 participants attended. The visit is one of the local events of the YMC Overseas Delegation 2018.

The MindSphere Application Centre, which was newly opened in December 2017, has been designed to develop new business model, digital solutions and services as well as industrial applications in focus verticals using MindSphere. MindSphere is an open cloud-based IoT (Internet of Things) operating system with data analytics and connectivity capabilities. It provides infrastructure providers and start-ups a platform to make use of data and come up with innovations tackling city challenges which in turn lead to more solutions for smart city development in Hong Kong.

The visit began with a brief introduction by Mr. Yuelin Liang, Technical Director of MAC. He shared about the Connected City Solutions (CCS), a prototype of "Smart Street Light Pole" with functions of WiFi, air quality measurement and surveillance camera. Then he presented and demonstrated the City Performance Tool Air (CyPT Air), a tool designed to help cities achieve

their air quality targets while analyzing the potential impact of infrastructure-related decisions on job creation and growth of the infrastructure sector. The demonstration unit showed the real-time air quality of the Hong Kong Science Park.

The group was then showed how to connect and collect data from programmable logic controller to the cloud with MindConnect (a data collection gateway) for data analytics. Meanwhile, the speaker also mentioned the cyber security is fundamental and crucial to digitalization. All of the sessions was followed by a question-and-answer session.

Finally, two videos of MindSphere and Big Data Analytics were showed as a summary to conclude the interrelationship of various smart city solutions. The event ended with a souvenir presentation to the speaker from Ir. Tak Tang, the Delegation Manager of the YMC Overseas Delegation 2018.

On behalf of the HKIE-YMC and HKIE-CPDC, we would like to thank Siemens staff at MAC for supporting the visit. The participants gained a better understanding of available ingenuities to develop Hong Kong into a smart city.



28 February
pm



★ Seminar on Cybersecurity Fortification Initiative

On 28 February 2018, the YMC jointly organized the captioned seminar with the CPDC. The seminar was hosted by Dr Lucas Hui, Senior Director of Security and Data Sciences of The Hong Kong Applied Science and Technology Research Institute (ASTRI).

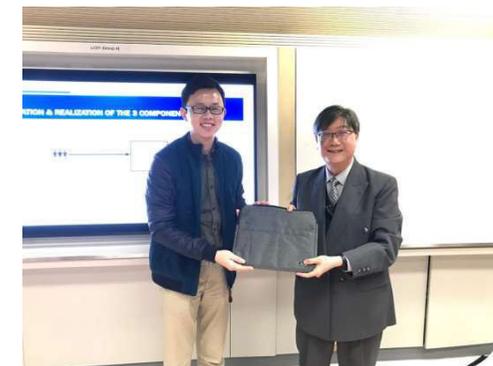
Dr Hui started the seminar by introducing the vision, mission and the domains, such as data analytics, penetration test and cryptography of the ASTRI Security Lab. ASTRI is actively supporting different government departments and the financial industry in promoting and enhancing cybersecurity in Hong Kong.

Then Dr Hui explained the launch of Cybersecurity Fortification Initiative (CFI) which was proposed by the Hong Kong Monetary Authority. The 3 major components of CFI include:

- 1) Cyber Resilience Assessment Framework - risk-based framework for banks to assess their own risk profiles
- 2) Professional Development Programme - aims to increase the supply of qualified professionals in cybersecurity
- 3) Cyber Intelligence Sharing Platform - allows sharing of cyber threat intelligence.

Dr Hui also discussed different case studies in the financial sectors, including the cyber hack via SWIFT system and cyberattack of Bitcoin. Nevertheless, cybersecurity cases in other sectors like medical sector, infrastructure, and IoT devices were introduced by the speaker.

All participants were impressed by the in-depth analysis of CFI overview and cases study given by Dr Hui. On behalf of the HKIE-YMC and HKIE-CPDC, we would like to express our sincere gratitude to Dr Lucas Hui for his in-depth sharing.



★ Seminar on Eco-shoreline in Hong Kong

As the world is progressively facing different challenges, acute shock and chronic stresses, the era for mono-functional infrastructure is slowly coming to an end, while multi-functional and resilient infrastructures are becoming a global trend. Projects in Hong Kong have just demonstrated transformation, turning simple drainage improvement projects into something more resilient and educational to the public.

On the 8 March 2018, the HKIE YMC invited Professor Kenneth M.Y. Leung, the Deputy Director of School of Biological Sciences, and Scientist at the Swire Institute of Marine Science from HKU to present their research on eco-shoreline. They explained throughout the collaboration with ecologists and engineers, new design of multi-functional artificial structures were developed to serve for costal defenses and functional ecosystems.

The conception of eco-shoreline is to rebuild an ecosystem along the coastal area, drainage channels and rivers which were long lost due the process of urbanisation. The presenters highlighted the following research areas of the eco-shoreline:

1) Design of eco-blocks – different crenelation provides a rough surface for microorganism and organic matters to be retained and acts as a bio-film layer, in addition to providing shading, water holding ability to promote biodiversity.

2) Selection of bio-filters – oysters and mussels are well known for their ability to improve water quality, the research team is currently conducting research on their optimum performance in a range of water samples across Hong Kong.

3) Selection of vegetation – the trial plantings are carefully selected to suit for the desire purpose and the surrounding environment (i.e. mangroves can be selected for water polishing, but it can only sustain in water with appropriate salinity). The species must also be considered as to avoid competition and intrude with the local species.

Professor Leung added, no matter how successful the artificial shoreline turned out to be, destroyed eco-system can never be retrieved to the level it began with. It remains the public's responsibility to protect the natural resources.



★ Technical Visit to Tsing Ma Control Area

Tsing Ma Bridge, built in 1997, is the world's 11th-longest span suspension bridge and is the longest bridge that carries both road and rail traffic. The HKIE-CPDC and HKIE-YMC jointly organized a visit to Tsing Ma Control Area on 10 March 2018. Mr. Stephen Tang, Project Coordinator in TMCA & TSCA Government Monitoring Team of Highways Department, gave an overview on the Tsing Ma Control Area and led a visit to the Tsing Ma Bridge.

There are three highway bridges in the Tsing Ma Control Area: Tsing Ma Bridge, Kap Shui Mun Bridge and Ting Kau Bridge. Mr. Tang first introduced the bridge operation of Tsing Ma Bridge under high wind. When wind speed is over 40km/hr, all vehicles over the height of 1.6 meters have to divert via the lower deck of Tsing Ma Bridge. When wind speed is over 60km/hr, no vehicle can travel on the upper deck.

Different types of inspection are implemented on highway bridges. Apart from principal inspection once in the contract period, the inspectors carry out general inspections once in 6 months, 1 year and 2 years. There

are also special inspections but only required under some circumstances like after accident or lightning strike. Most of the inspections were done visually by the inspectors.

Apart from visual inspection, Wind and Structural Health Monitoring and Evaluation System also helps to maintain the health of Tsing Ma Bridge. 283 sensors were installed to provide real time monitoring data of the bridge. The sensors include accelerometers, temperature sensors, global positioning systems, etc. The real time data allows assessment of the bridge's health status and sends out alarm when the reading exceeds the acceptable limit.

The visit group was then brought to the control center of Tsing Ma Control Area. The control center monitors all the traffic through the CCTVs in the control area. It also manages the traffic signals and traffic arrangement of Tsing Ma Bridge. If a traffic accident happened, the control center would communicate and coordinate with other emergency services like Hong Kong Police Force and Fire Services Department.



14 March
am

★ Seminar on Cybersecurity in Financial Industries

Cybersecurity has become a hot topic in recent year with famous attack such as Wannacry, Shadow Brokers and Cloudbleed etc. Cybersecurity is important not only to Hong Kong's large financial sector but to the wider economy and indeed to the society. In 2016, the Cybersecurity Fortification Initiative (CFI) was initiated by Hong Kong Monetary Authority (HKMA) to enhance the resilience of Hong Kong banks against cyber-attacks.

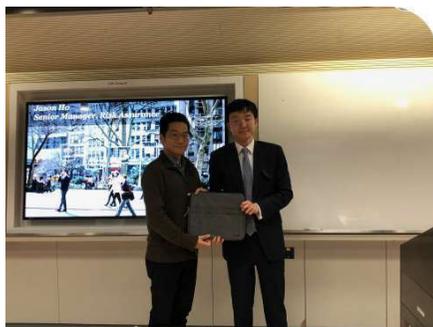
On the evening of 14th March 2018, we were honor to have Mr. Jason Ho, Senior Manager of Risk Assurance in PricewaterhouseCoopers (PWC) sharing some insights on this topic. Mr. Ho has more than 11 years of professional advisory and assessment experiences in information and cybersecurity.

Mr. Ho first shared with us some basic background of cybersecurity threat including different types of attacks and their basic operation principles. He then shared more on the broken in the traditional methodology of assessing cybersecurity maturity. A mature system should includes the company structures, key assets or tools, attack surface, weapons and threat agents etc. With this break down, it is far more easy to assess for the vulnerability of the system in order to prevent any attacks.

Apart from the background information, Mr. Ho also shared with us on the Cybersecurity Fortification Initiative (CFI). It basically includes 3 parts: 1) Cyber Resilience Assessment Framework, 2) Professional Development Programme and 3) Cyber Intelligence Sharing Platform. They are the strategies to uplift the cyber resilience among the Hong Kong banks industry including to establish a risk-based framework to assess risk profiles and benchmark the resilience required, to provide training for qualified cybersecurity professional and to establish sharing platform among banks to enhance collaboration.

The seminar finally ended with overwhelmed response during the Q&A session. All participants were deeply

inspired by the sharing brought by Mr. Ho. On behalf of CPDC and YMC, we would like to express our sincere gratitude to Mr. Ho for his valuable sharing.



17 March
am

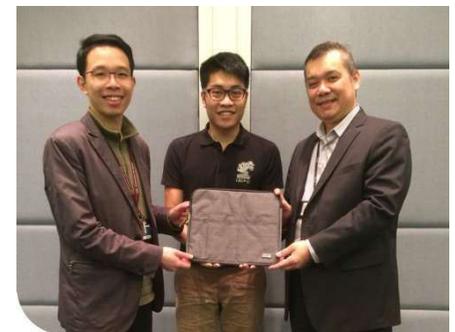
★ Visit to MTR Tsing Yi Operation Control Centre

On 17 March 2018, a technical visit to the MTR Operation Control Centre was organized by the YMC. There were 22 participants joined the visit hosted by the Operation Manager, Mr. Andy Leung.

Mr. Leung started the visit by delivering a brief presentation on the MTR operation and the on-going system upgrading works. MTR was pushing forward the RailGen 2.0 to improve the frequency of trains and the passenger experience. Mr. Leung introduced the signaling system improvement works by migration the system from fixed block system to moving block system. In the original fixed block system, the rail was divided into blocks and the signal would only allow the train to proceed if there were two empty blocks ahead. Thus, the headways were sometimes more than the safe distance. With the advancement of communication technology that allowed real-time positioning of trains, the headway could be reduced by maintaining a minimal

buffer distance between trains. Therefore, the frequency of train could be increased to reduce waiting time of passengers.

Then Mr. Leung explained the challenges of the system upgrading works and how the engineers planned the works to be completed during the short non-service hours during mid-night. There were concerns on the safety of the workers and the passengers that a supervisory system on the works was adopted to monitor the workers and ensure the railway was safety to resume services on the next day. Lastly, the work in OCC was introduced. The participants visited the control room for the MTR urban lines and the daily work of the operators was introduced. Mr. Leung also shared his experience in handling the incident that a dog trespassed into the East Rail Line to minimize the impacts to the passenger safety.



24 March
am

★ Visit to LSCM R&D Centre

A technical visit to The Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies (LSCM) on 27 March 2018 was jointly organized by the YMC and the HKIE Continuing Professional Development Committee. The visit is one of the local events of the YMC overseas delegation 2018 with 19 participants attended.

The LSCM R&D Centre, which was founded in 2006 with funding from the Innovation and Technology Fund of the HKSAR Government. Since its inception, LSCM's mission has been to foster the development of core competencies in logistics and supply chain related technologies and to facilitate the adoption of these technologies by industries in Hong Kong and Mainland China. The Centre is hosted by three leading universities in Hong Kong, namely the University of Hong Kong, the Chinese University of Hong Kong, and the Hong Kong University of Science and Technology. The establishment of the Centre marks the realisation of the concerted effort and enthusiasm on the part of the government, industry, academia and research institutes.

The visit began with a brief introduction by Mr. Anthony Kwok, Business Development Director of LSCM, about the background and the funding program of the centre. He then presented with the latest development of enabling technologies in Hong Kong and around the world, namely IoT (Internet-of-Things), Robotics, Big

Data Analytics and AI (Artificial Intelligence). During the presentation, Mr. Chris Tong, Business Development Manager of LSCM, has shown the group some of their RFID products applied in the industry for wine authentication and signboard identification.

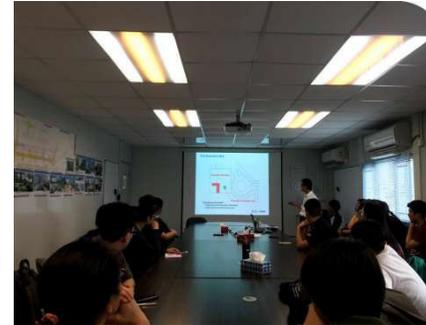
The later session of the visit was a Technology Showcase at Showroom with demonstration by LSCM's staff. Technologies displayed include Thermal Sensing and RFID Alert System for Elderly Caring Service; RFID Blind Cane Navigation System; Human Following Robot; mmWave Fusion Sensor and Virtual Reality Cave. The group was given a hand-on experience on these technologies and under the design principles behind.

Following the showcase session, the visit was summarized with a wrap-up discussion, Mr. Kwok again express his vision on the future technology development and emphasized the importance of support from the industry. The event ended with a souvenir presentation to the speaker from the Manager of the YMC overseas delegation 2018.

On behalf of the YMC, we would like to thank all staff at the LSCM R&D Centre for supporting the visit. The participants gained a better understanding of available ingenuities to develop Hong Kong into a smart city.



14 April
am



★ Visit to Kai Tak Landscaped Deck

A technical visit to Kai Tak Landscape Deck jointly organized by the HKIE-CPDC and HKIE-YMC was held on 14 April 2018. Led by Civil Engineering and Development Department with AECOM Asia Limited and CEC-CCC Joint Venture, the group of participants was introduced to the Kai Tak Development - Stage 2 Infrastructure Works for Developments at Southern Part of the Former Runway (Contract No. KL/2014/01).

The representatives from CEDD and AECOM first gave a brief introduction on the background and major features of the infrastructure works, which included an elevated landscaped deck, roadside noise barriers as well as road realignment and widening works. The 1.4m long elevated landscaped deck was designed to serve dual roles as an open public place and part of the semi-enclosure noise barrier for the dual 2-lane carriageway underneath. In view of the complexity of the project and



limited site area available, the Building Information Modelling (BIM) was employed to generate clashes reports for identification of footing and cladding clashes in early stage, consequently enhancing the overall construction management of the project.

Subsequent to the presentation, a site visit to the ongoing construction works was arranged by the representatives from the CEC-CCC JV. During the visit, the participants were intrigued by the solutions to the technical construction challenges encountered throughout.

The visit was an inspiring one suffused with technical exchange and valuable experience sharing. On behalf of the Young Members Committee, we would like to give a vote of thanks to the CEDD, AECOM and CEC-CCC JV for their warm host and thoughtful arrangements.





Insights

After describing what the delegates have learnt from local and overseas events in previous chapters, this chapter is to present various insights the delegates have gained throughout this Delegation.

Resilience

★ What is Resilience?

Resilience refers to “the ability of human settlements to withstand and to recover quickly from any plausible hazards” (UN Habitat, n.d.). In other words, this concept depicts the capacity of a system to maintain or recover functionality and rebound swiftly in the occurrence of disruption or disturbance.

As cities are constantly adapting to changing circumstances, the notion of a resilient city becomes pertinent as resilience helps cities to survive, adapt and transform in the face of a wide array of both predictable and unexpected challenges including chronic stresses and acute shocks. Unlike traditional disaster risk management which aims at avoiding or mitigating the casualties arisen from specific hazards, resilience emphasizes on boosting the capacity of a system when encountering various adversities.

In order to identify a common set of factors and systems for a city’s resilience in response to challenges, the City Resilience Framework is produced to help look into the complexity of cities, followed by exploring the strengths and weaknesses of its system. The Framework identifies the significant systems of a city in four areas, namely Health and Wellbeing; Economy and Society; Infrastructure and Environment; as well as Leadership and Strategy; in which each dimension comprises three drivers to exhibit actions cities can take to strengthen their resilience (see Figure 5) (100 Resilient Cities, n.d.).

Rather than just presenting the systems of a city, the Framework also suggests that various city systems need to be reflective, resourceful, inclusive, integrated, robust, redundant and flexible so that they can withstand, respond to and adapt more readily to shocks and stresses.

While the Framework functions to promote a common understanding of resilience and identify factors to build resilience, a city resilience index enables cities to conduct an objective assessment of their resilience and



Figure 5: City Resilience Framework (100 Resilient Cities, n.d.)

keep track of their progress against an initial baseline. Taking into account the component factors including economic, risk quality and supply chain, the FM Global Resilience Index offers a robust foundation to articulate city resilience in a measurable manner. With reference to the 2017 FM Global Resilience Index ranking (FM Global, 2017), New York was ranked 10 while Hong Kong 19 among 130 countries and territories.

★ Why do we need Resilience?

According to the Fifth Assessment Report (AR5) issued by the Intergovernmental Panel on Climate Change (IPCC), with the global warming caused by the increase in emission of greenhouse gases, there were great changes in the global climate system, which were unprecedented. As climate change advances, it causes rises in temperature, rainfall intensity and mean sea level. Extreme weather events will also become more frequent. Thus, it is crucial for us to review what

challenges will be brought by climate change we are going to face in the future.

The rate of increase in average temperature had become faster in the past 30 years, reaching 0.18°C and 0.14°C per decade in Hong Kong and New York respectively. With the growing rate, it is projected that the annual mean temperature will rise by around 6°C by the end of this century for both Hong Kong and New York (HKO, n.d.; NYDEC, n.d.). The significant temperature rise may bring longer and intense summers, causing heat waves over the world. On the other hand, the high temperature will cause increasing rate of melting of glacier, followed by increase in sea level. The mean sea level is rising at a rate of 31mm per decade in both Hong Kong and New York, which is almost twice the observed global rate (18mm per decade) (HKO, n.d.; NYDEC, n.d.). With the projection to 2100, it is estimated that the sea level will rise by 1.07m and 1.83m in Hong Kong and New York respectively. Consequentially, the existing infrastructure may not be able to withstand the threats, causing cause serious flooding in the coastal area.

	New York	Hong Kong
By mid-21st century	3.3°C	1.5 – 3°C
By the end of 21st century	5.6°C	3 – 6°C

Table 1: Projections in Annual Mean Temperature Rise (HKO, n.d.; NYDEC, n.d.)

On the other hand, although the trend of rise in annual rainfall is relatively small, the yearly fluctuation is becoming greater. In Hong Kong, the annual number of heavy rain days increased at an average rate of 0.3 days per decade in the past 70 years, reaching 7 heavy rain days per year in 2017 (HKO, n.d.). In New York, the year-to-year variability in rainfall is also increasing. The amount of rainfall in heavy events increased by more than 70% between 1958 and 2010 across the Northeastern United States (NYDEC, n.d.). In long term, there will be significantly increase in the numbers of extremely wet and dry years, causing the occurrence of extreme weathers. In Hong Kong, with more frequent extreme precipitation events, the hourly rainfall record was broken several times in the last few decades (HKO, n.d.).

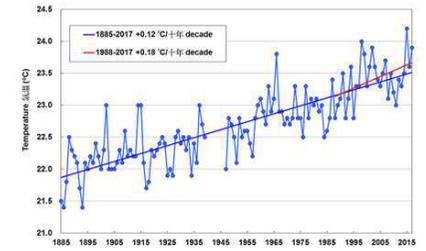


Figure 6: Trend of temperature rise in Hong Kong (HKO, n.d.)

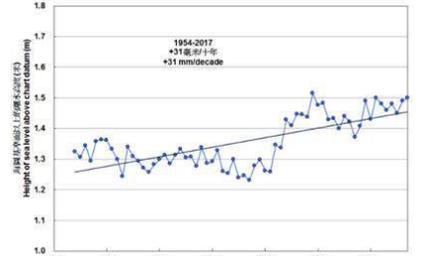


Figure 7: Rise in sea level in Hong Kong (HKO, n.d.)

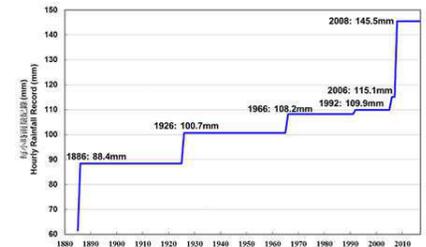


Figure 8: Number of extreme precipitation in Hong Kong (HKO, n.d.)

Rising sea level and extreme weather events threaten homes and infrastructure in the both cities, especially in coastal and low-lying area. In Hong Kong, about 15% of the total land area is below the mean sea level, which is vulnerable to flooding during rainstorms, storm surges or abnormal tidal conditions. In New York, the floodplain covers 49 million square meters of area and 71,500 buildings and both values are expected to increase by around 60% based on 2050s projection. Apart from the geographical features, Hong Kong and New York has high population density of 6,300 and 11,000 people per square kilometre, which increase their exposures to the effect of flooding.



Resilience not only can save lives of citizens, but also save a huge amount of money. According to a study conducted by the National Institute of Building Sciences in the United States, every dollar spent on mitigation activities results in 4 dollars of avoided losses, which implies that an early investment in resilient can save serious money when natural disasters happen. Therefore, to better address the extreme weather events brought by climate change, it is essential for Hong Kong and New York to become resilient cities in the future.

★ **How to Achieve City Resilience?**

Infrastructure and Environment

The rapid climate change poses great challenges to the city's infrastructure. The following chapter investigates the challenges that the cities are facing, the corresponding government policies and infrastructure projects to build resilient cities.

GEOGRAPHICAL ENVIRONMENT

New York City

New York City is characterized by the Hudson River running through the five boroughs of New York City namely Staten Island, Manhattan, Brooklyn, Queens and Bronx. Four of the five boroughs are found on islands and the remaining one is a peninsula, this setting out creates an extensive 520 miles of shoreline bordering ocean, rivers and bays (Bloomberg, 2011).

Hong Kong

Around 24% of the total land area is build-up area, where part of it is located in the coastal area surrounded by natural terrain, while 15% are at the low-lying areas below the mean sea level (Geotechnical Engineering Office, 2012). The steep slopes of mountains increase the surface runoff, causing additional burden to the downstream drainage system. Surrounded by sea, three major islands in Hong Kong form over 1170km shorelines (Leung, 2013).

RECENT EXTREME EVENTS

Owing to the local climatic characteristics and geographical environment, New York City is vulnerable to flooding resulted from storm surge, while Hong Kong is susceptible to flooding caused by extreme rainfall. With the climate change, high-intensity rainfall and

extreme events will become more frequent, and sea level will keep rising. In recent years, natural disasters visited the two cities, causing loss of life and countless financial loss. These events have acted as wakeup calls to both governments to take action addressing this imminent threat. level will keep rising. In recent years, natural disasters visited the two cities, causing loss of life and countless financial loss. These events have acted as wakeup calls to both governments to take action addressing this imminent threat.

New York City

Hurricane Sandy was one of the most destructive natural disasters in the century. The catastrophe hit the coast of Northeastern United States in 2012. The hurricane affected 14 states, causing the death of over 150 people and leaving over 650,000 homeless. The storm damaged the city's infrastructure, including mass transit system and electricity network. The financial loss for property damage alone was estimated to be above USD\$70 billion (Daily News, 2017).



Figures 9 & 10: Homes destroyed by Hurricane Sandy (Daily News, 2017)

Hong Kong

With No. 10 Hurricane Signal hoisted, Super Typhoon Hato was one of the tropical cyclones affecting Hong Kong in 2017. The passage of typhoon Hato resulted in at least 129 injuries, flooding in coast areas and interruption electricity supply to the villages in the New Territories.



Figure 11 & 12: Serious flooding in Heng Fa Chuen caused by Super Typhoon Hato. (Hong Kong Observatory, 2017)

GOVERNMENT POLICIES AND STRATEGIES TOWARDS RESILIENCE

The increasing frequency of extreme events resulted from climate change causes loss of life and damage to the city. Both governments have taken holistic approach to review the challenges the city is going to face and formulate long-term strategies to build a resilient and future-proofing city.

New York City

- One New York: The Plan for Strong and Just City (OneNYC)

In view of the challenges of population growth, aging infrastructure and climate change, the blueprint OneNYC was formulated by the New York City's Mayor in 2015 to tackle the challenges in a strategic way. Four visions were set out based on four main pillars, namely growth, equity, sustainability and resiliency. Recognizing

the imminent threats brought by climate change, the plan established three long-term objectives to build a resilient New York City:

- Eliminate disaster-related long-term displacement more than one year of New Yorkers from homes by 2050
- Reduce the Social Vulnerability Index for neighbourhoods across the city
- Reduce average annual economic losses resulting from climate-related events

To effectively achieve the objectives, the plan outlined a set of initiatives to enhance city resiliency under four perspectives. They were neighbourhoods, buildings infrastructure and coastal defence. Through a series of government policies, funding, and infrastructural projects, the government aimed at improving city's physical, social and economic resilience. The plan also developed a new set of resiliency indicators to measure and monitor the progress towards a resilient city.



Figure 13: OneNYC (Bill De Blasio, 2017)

Figure 14: Vision of One NYC (Bill De Blasio, 2017)

- Vision 2020: New York City Comprehensive Waterfront Plan

With advances in reinventing the shorelines over the past 18 years, Vision 2020 was introduced by the Mayor and the Director of Department of City Planning in 2011 to provide a city-wide framework for the development of waterfronts in the next ten years. Identifying a set of goals and development opportunities, it establishes actions to promote water recreation, enhance public access to waterfront and restore the ecology of the shorelines in New York City. Another part of the plan is a three-year action agenda, which is a commitment by the government on 130 funded projects, including the



creation of waterfront esplanades and construction of waterfront parks.

In responding to the impact of climate change and adverse events with the likes of Hurricane Sandy, the plan has the initiative to strengthening coastal defenses against flooding, sea level rise and storm surge, as well as upgrading infrastructures to withstand severe weather such as transportation, telecommunication, water and energy in view of reducing the impact and promote faster recovery (De Blasio, 2015).

Resilience not only can save lives of citizens, but also save a huge amount of money. According to a study conducted by the National Institute of Building Sciences in the United States, every dollar spent on mitigation activities results in 4 dollars of avoided losses, which implies that an early investment in resilient can save serious money when natural disasters happen. Therefore, to better address the extreme weather events brought by climate change, it is essential for Hong Kong and New York to become resilient cities in the future.



Figure 15: Vision 2020: New York City Comprehensive Waterfront Plan (De Blasio, 2015)

Hong Kong

- Hong Kong 2030+: A Smart, Green, Resilient City Strategy (SRG City Strategy)

To achieve the ultimate planning goal of "creating capacity for sustainable growth" in Hong Kong 2030+, SRG City Strategy was formulated to delineate the initiatives covering a wide range of perspectives. After reviewing the strategies and projects on coastal defense, inland drainage system, water supply and

building planning carrying out by the government, it identifies the challenges that Hong Kong is going to face, including scarcity of resources, aging population and infrastructure and climate change. The report finally suggests directions on city planning and infrastructure to achieve climate resilience for the territorial development strategy in Hong Kong.

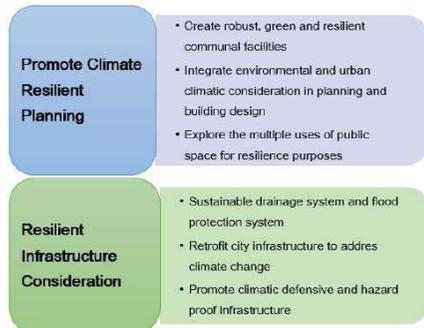


Figure 16: Strategies suggested by SRG City Strategy on city resilience. (Bloomberg, 2011)

RESILIENT INFRASTRUCTURE PROJECTS

Under the government policies, a series of projects were carried out to recover the cities from damage and address the community's vulnerabilities to future risks. It is also a global trend to equip the infrastructures with added values, which bring multiple benefits to the city. Projects in both Hong Kong and New York City demonstrated the transformation, turning a simple drainage improvement projects into resilient and educational infrastructure.

New York City

- Living Breakwaters

With dredging works and the diminishment of the natural oyster reef, it left the Tottenville neighbourhood, which was a coastal community originally known as "the town the oyster build", more exposed to wave action. Suffering from erosion of beach and high-velocity wave, the Hurricane Sandy hit the town heavily. Instead of constructing a physical barrier separating the community from the water, the project team took a comprehensive approach to build resilience in physical, ecological and social aspects.

The multi-layered breakwaters absorb the wave energy and avoid the sudden failure of the defence system. The wave attenuation creates slow-moving water behind the breakwaters. Calm water encourages sedimentation and reduces erosion, which replenishes the beach. Moreover, composed of rocks of different sizes, the breakwaters created tiny pore spaces as shelter, which promotes the growth of marine life and enhances the ecological diversity. With the wide range of marine organisms, apart from serving as a fishing ground, species like oyster can act as a bio-filter improving the water quality of the bay. Furthermore, calm water with improved quality allows people getting access to waterfront and enjoying water sports, in which it brings recreational and economic benefits to the community.

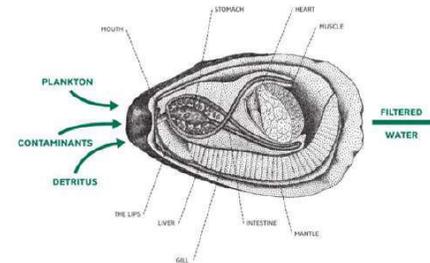


Figure 17: Oyster acting as bio-filter to purify the water (SCAPE, 2017)

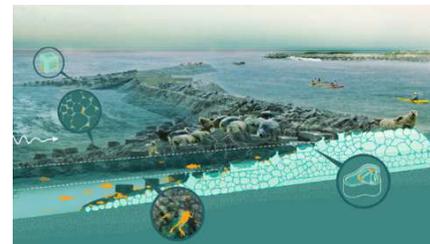


Figure 18: Details of Living Breakwaters (SCAPE, 2017)

- A Comprehensive Urban Water Strategy: Resist, Delay, Store & Discharge

Having two-third of the city lies within the 100-year flood zone, the Hoboken city is susceptible to flash flood and storm surge due to its low-lying waterfront, high population density and highly impervious urban ground.

With the benefit of single governmental jurisdiction over the watershed, the project team proposed a comprehensive strategy, "Resist, Delay, Store and Discharge", to manage water for disaster and long-term growth of the city. In order to recreate a natural water cycle for better water management in a hard-paved city, greenings are integrated with drainage infrastructures. With green roofs and rainwater harvesting, the rainwater is collected and temporarily stored, reducing the runoff. The stored water is released to the planters and bioswales at street level and infiltrated to the subsoil. With the subsurface drainage system, the water is diverted to the constructed wetlands and the subsurface storage. Pumping stations are installed in the critical locations to facilitate the discharge of water and avoiding flooding within the city.



Figure 19: "Resist, Delay, Store & Discharge" Strategy (Rebuild by Design, 2015)



Figure 20: Citywide greening infrastructure. (Together North Jersey, 2013)



Hong Kong

- Three-Pronged Approach & "Sponge City"

As Hong Kong is an Asian city with the highest annual rainfall in the region, the Drainage Services Department (DSD) adopted the Three-Pronged Approach, namely stormwater interception, flood storage and drainage improvement. With years of effort in improving the drainage system in Hong Kong, the flooding blackspots have been reduced from 90 in 1990 to 6 in 2018. The modern stormwater management strategy "Sponge City" was introduced in Hong Kong in recent years. By integrating green infrastructure with drainage system, it allows the infiltration and collection of rainwater for further reuse. Being a highlight in the strategy, the Happy Valley Underground Stormwater Storage Tank was completed in 2017 enhancing the flood protection level of the area.



Happy Valley Underground Stormwater Storage Scheme

- Storage capacity: 60,000m³
- Key features:
 - Movable weirs enhance drainage efficiency
 - Collected surface runoff and groundwater reuse for irrigation
 - Land co-use with the existing racecourse

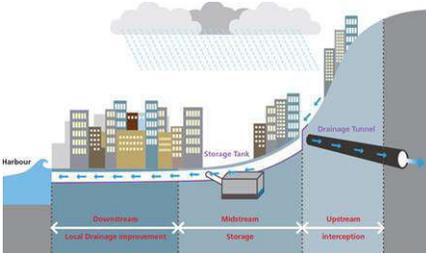


Figure 21: Three-pronged approach drainage system (Drainage Services Department, 2017)



Figure 22: Concept of "Sponge City" (Drainage Services Department, 2017)

- Eco-shoreline

Eco-shoreline is a manmade habitat that provides diverse microhabitats to promote the growth of microorganism and enhance biodiversity. Apart from its ecological value, eco-shoreline serves as an element of coastal defence system. Through multi-layered planting, including mangroves, wetland and trees, it forms a barrier to resist the seawater from going to inland. To promote ecological diversity, sunlight, water and shelter are the fundamental elements. In Hong Kong, most of the natural shorelines were retrofitted by concrete seawall to protect the city from storm surge. However, the vertical seawall and its smooth surface sacrifice the habitat for growth, causing devastating effect to the local ecosystem. Recent studies and experiments have been carried out by the University of Hong Kong to explore the feasibility of rehabilitating the shoreline by installing eco-blocks, which serve as the hard substrate, onto the concrete seawall. These eco-blocks possess water-retaining features and provide a shelter for the growth of the marine life.



Figure 23: Eco-blocks with different substrate creating microhabitats

Social Resilience

What Is Social Resilience?

A social resilient city enhances the connection between people such that people can help each other when disasters come, and people will have a larger capacity to recover. With 1995 Chicago heat wave taking more than seven hundreds of lives, Klinenberg (2015) analyzed the incident and highlighted the importance of connection of people in the community. Figures showed that some neighbourhoods demonstrated less vulnerable than the others. It was reflected by the community's capacity to pull the members together and provide support to the weakest members. Social infrastructure played an important role in establishing community's capacity to connect its members (Klinenberg, 2015). The social infrastructure promotes local social life and enhances contact between neighbours, which avoid people being isolated. To achieve social resilience through infrastructure, community's needs become a crucial element in the design.

How People Get Connected to Infrastructure?

- Transforming Our World: the 2030 Agenda for Sustainable Development

The Agenda, issued by the United Nations in 2015, was a plan of action towards people, planet and prosperity. It encourages the countries over the world to eradicate poverty and achieve sustainable development in the next fifteen years. The agenda establishes 17 Sustainable Development Goals for the countries to follow and accomplish the objectives effectively. In Goal 11, with the statement "Make cities inclusive, safe, resilient and sustainable", it encourages the cities to develop holistic disaster risk management to adapt to climate change. Moreover, it calls for support from the



Figure 24: 17 Sustainable Development Goals (United Nations, 2015)

neighbouring countries, through financial and technical means, to assist the least developed countries to build resilient communities.

- Rebuild by Design
Hurricane Sandy Design Competition was launched by the Rebuild by Design team after Hurricane Sandy hit New York City heavily in 2012. The programme aimed at helping the city to recover from the damage brought by the hurricane and preparing it to be resilient for future challenges. Being a design competition, it encouraged the project teams to generate innovative and resilient solutions. On the other hand, through adopting a range of assessment criteria, it ensured that the project teams recognized the importance of participatory activities in the design process, in order to develop solutions that would address the community's needs.

Different from conventional mode of public participation, citizens joined the project teams and collaborated with the expertise from multi-discipline to develop the designs and shape the final solution. Moreover, in the research stage, the project teams carried out a series of intensive fieldworks and community visits to have a nuanced understanding on the region's vulnerability to the future risks. After understanding the needs of the community and having the conceptual design, a variety of community outreach events were conducted allowing citizens to appreciate how the infrastructure could help the community to build resilience and voice out their opinions. Furthermore, designed to be multi-functional, not only would the infrastructure enhance physical resilience for future climate change, but serve recreational and educational purposes to the community, which could connect the community to the infrastructure and deepen their understanding on resilience.

Taking one of the projects as example, Living Breakwaters, the project teams proposed the construction of breakwaters which created habitats for marine life to grow. Not only does the project address city resilience, but also created education ground to the community. The project teams launched an experimental education by constructing a model of oyster reef, which demonstrated the design concept of Living Breakwaters. Through the hands-on experience, it introduced the concept to the community members of all ages.





Figure 25: Children taking hands-on workshop at the model oyster reef (Rebuild by Design, 2015)

Key Characteristics

- Design competition stimulates innovative designs
- Government, expertise and citizens collaborate to develop solutions
- Multi-functional infrastructure brings physical, educational and recreational benefits to the community

- High Line

The High Line was a 2.33km elevated railway constructed in early 1930s running through the west side of New York City. It was served as a major transport facility for the delivery of freight in Manhattan’s industrial area. With the decline in manufacturing industry, the rail traffic on the High Line was reduced and the last train ran in 1980. After that, the High Line had been abandoned for over two decades. As advocated by two New Yorkers, the High Line was preserved and developed into open space as an alternative to demolition. The Friends of High Line, a non-profit organization responsible for managing the High Line, collaborated with the City Council with financial support from philanthropy and transformed the abandoned railway tracks into an elevated public park.

The High Line was designed to serve educational and recreational purpose. As proposed by the landscape architect, James Corner Field Operations, the High Line was retrofitted by blending greenings into the original rail tracks. With the preserved historical features, it reminds the New Yorkers of the influential role of the railway and the transformation of New York City from industry to a

modern city. To introduce aesthetic and recreational elements into the park, it was embellished with greenings and plants. As the High Line spanned across various communities, each section of the High Line was designed with different planting themes, fitting into the local environmental features. With the ancillary facilities like sun loungers and playground, it attracts people to stay and enjoy in the park. Penetrating through streets and buildings in Manhattan area, not only does it become an iconic architectural infrastructure, but also it establishes a relaxing venue gathering people to appreciate the beauty of the city.

Key Characteristics

- New development incorporates historical features
- Multifunctional infrastructure brings recreation and education to the community
- Relaxing features slow down the pace of city life



Figure 26: The original railway tracks were blocked

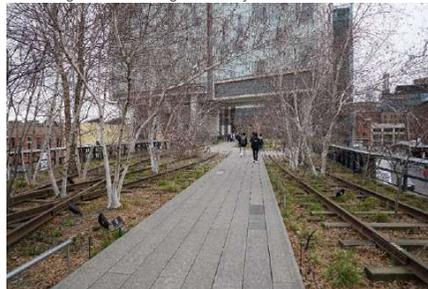


Figure 27: Railway tracks are incorporated with greenings

- Elevated Landscaped Deck in Kai Tak Development

Under the Kai Tak Development, the elevated landscaped deck is constructed on the runway of Hong Kong International Airport in Kai Tak which was decommissioned after the relocation of airport in 1998.

Inherited the history of Kai Tak Airport, the bottom of the landscaped deck is designed to imitate the features of aeroplanes as a physical reminder. With length of about 1.4km, the landscaped deck connects the other development sites along the runway, including the Kai Tak Cruise Terminal. The integration aims at turning Kai Tak into a heritage, green and tourism hub of Hong Kong. Moreover, the runway was originally formed on a reclaimed land separated from the urban area. Integrating with the extension of transport infrastructure, the landscaped deck connects the local community to the entire Kai Tak Development. In addition to the benefits brought to the local communities, the landscaped deck is designed with different planting themes, thus creating quality living environment and promoting the public access to the waterfront of Victoria Harbour.

Key Characteristics

- Landscape architectural design reinvents the waterfront of Victoria Harbour
- Multifunctional infrastructure serves recreational and economical purposes
- New structures imitate the characteristics of former airport



Figure 28: Elevated landscaped deck under construction

Civic Engagement

With the increasing demand from the public on the participation in the policy-making process, nowadays government considers civic engagement as an essential element to deliver effective governance and legitimate public policies. The definition of civic engagement can be given as “an organized process where a government has taken the initiative to involve citizens in all stages of policy development” (CCSG, 2007). There are different forms of civic engagement that allow public participation. International Association for Public Participation (IAP2) (n.d.) developed a spectrum categorizing the public’s involvement in the engagement process, based on the power empowered to the public and their impact on the decision-making process. In the spectrum, on one extreme, the public is only informed with the decision, without the power to intervene. Another extreme is that the public is empowered to make the final decision.

The form of civic engagement can vary in three dimensions (Fung, 2006). The first dimension concerns the selection of participants, which decides what type of participants to involve. The second dimension is the mode of communication, which describes how participants exchange information and make decisions. The third dimension specifies the link between public’s view and the final policy. Combining these three dimensions, participant selection, communication mode and extent of influence, a three-dimensional space will be generated, which can be called as a democracy cube (Fung, 2006). This democracy cube can help to explore suitable kinds of participatory mechanisms to achieve legitimacy, justice and effectiveness in governance.

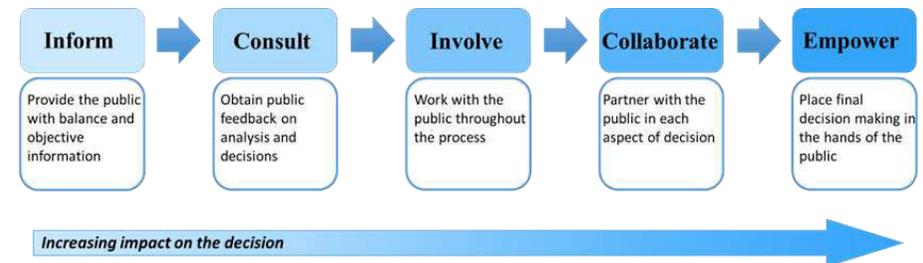


Figure 29: Public Participation Spectrum developed by IAP2 (n.d.)



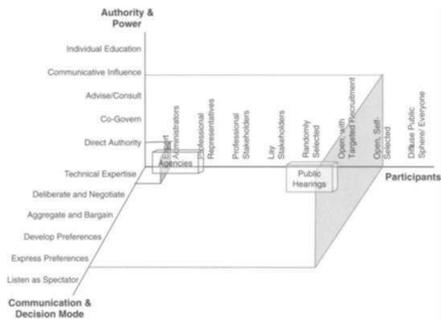


Figure 30: Democracy Cube (Fung, 2006)

Rebuild by Design

- Why did NYC need Rebuild by Design?
Hurricane Sandy hit New York in October 2012, causing the death of over 180 people and destruction of more than 600,000 homes. Abnormally high temperature, strong wind and high tide gave Sandy the devastating impact to New York city. It left behind more than \$65 billion damage and economic loss. In response to the impact brought by Sandy, Rebuild by Design was launched by the US Department of Housing and Urban Development (HUD). Aiming at raising the community's awareness and preparing the city for future challenges, Rebuild by Design adopts collaborative, design-driven problem-solving to help the community to build resilience. Rebuild by Design began as a design competition to encourage the project teams to generate innovative ideas to address the physical, social and ecological vulnerabilities and respond to the community needs.

- Who participated in the design competition?
The Rebuild by Design team comprised of a few members who were experienced in project management and public administration. The team was responsible for the overall management and operation of the design competition. The New York City Mayor, Bill de Blasio, who was representing the New Yorkers and protecting their interests, were also involved in the programme to provide directions. As gathered by Mr Henk Ovink, the Principal of Rebuild by Design, international expertise from broad spectrum of specialized fields, for example ecology, engineering, sociology and climate forecasting, joined the project teams to provide professional insights.

In order to better understand the challenges that the

community is facing, people affected by the hurricane were engaged in the programme. They could voluntarily join as one of the members and collaborate with the project teams to develop the final solution. Alternatively, Citizen Advisory Committee, comprised volunteers from the community, gave advice to the project teams on the community's needs and their priority. The stakeholders were welcomed to join different sizes of community meetings to understand the teams' effort in reinventing the community.

- How did participants exchange information and make decisions?

Apart from guiding the public to explore the community's vulnerabilities to future challenges, the expertise, who had better knowledge than the general public, made decision on the technical questions, such as technical feasibility and funding availability, based on their observations during visiting neighbourhoods in the research stage. During the research stage, project teams might identify more than one design opportunities that could formulate solutions to address the community's vulnerabilities. Based on their observations and discussions with the stakeholders, the project teams may also propose alternative schemes during the design stage. Citizens were invited to vote on these matters to ensure the solutions chosen would suit the community's needs. Moreover, throughout the design competition, the citizens could know about the project progress through sitting in the monthly meeting, in which the project teams would present their monthly work and achievements. They could listen to the team's presentation and observe as a spectator.

In addition to formal meetings, interactive workshops were held to guide the citizens to explore the community's aspiration and expectation on long-term community resilience. The expertise took part in the workshop to provide the community with education on the background knowledge and the reasons why the city has to be resilient. Through asking simple questions like 'What does resilient mean to you?' and drawing exercises, citizens could exchange with the neighbours on their views and reasons, based on their personal experiences. After negotiation and bargaining, a platform was created for the citizens to further understand the interests of the community stakeholders.

It may help them to advance to develop a joint preference which gave a direction for the project team to



Figure 31: Roundtable discussion with the community held by the Principal Henk Ovink (Rebuild by Design, 2015)

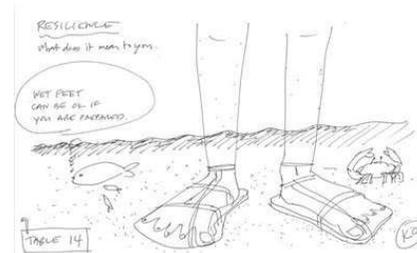


Figure 32: Sketches drawn by citizens to express their aspirations on city resilience (Rebuild by Design, 2015)

- The link between discussions and policy or public action

Throughout the design process, the citizens could participate in the decision meetings, in which they provided advices to the project teams shaping the final solution. At the final stage of competition, the project teams presented their proposals and the eleven-member jury, composed of the Secretary of HUD and a broad spectrum of expertise, evaluated the designs. In the presentation, members of community coalitions were encouraged to help presenting the designs and demonstrated their support to the projects they co-created. Apart from the overall design concept, and the receptivity of state and local authorities to the proposals, the participatory process and stakeholder coalition in the design process were essential evaluation criteria. Although citizens were not included in the final decision process, by establishing the four major assessment criteria, it ensured that the project teams incorporated the community's comments and gained public support.

- The Democracy Cube for Rebuild by Design

With the analysis on the design competition based on the three dimensions of civic engagement, the

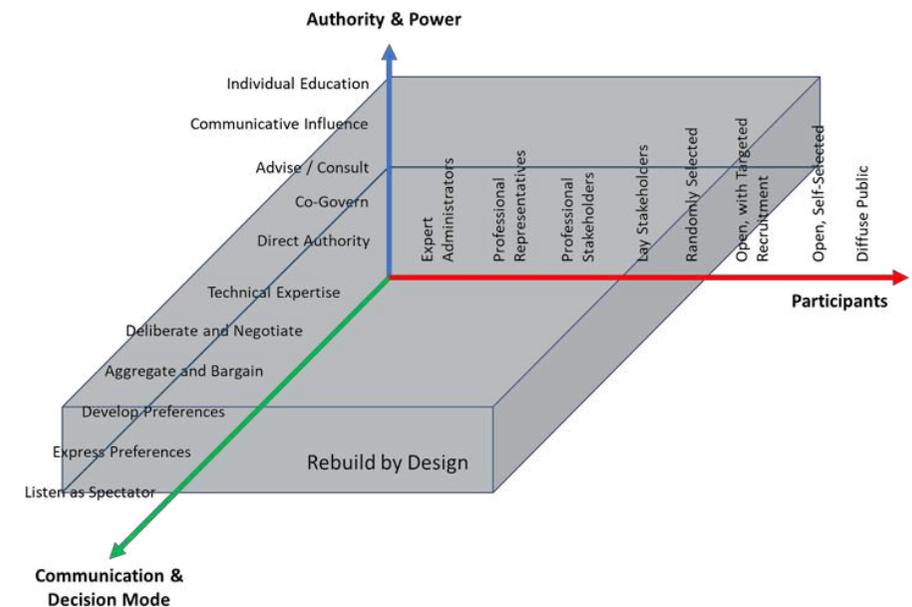


Figure 33: Democracy Cube for Rebuild by Design



democracy cube for Rebuild by Design is drawn in Figure 33. It is observed from the democracy cube that the programme engaged a wide range of participants and adopted various communication and decision modes for the citizens to express their opinions. However, co-governing partnership and direct authority did not happen in this programme. Co-governing allows the citizens to jointly make plans and formulate strategies with the government officials, while in some cases, the government delegates direct authority to the participatory bodies. Although federal government allocated funding for the winning projects at the beginning of the competition, the money was under the management of the local government. In the consideration of implementation of infrastructure projects, apart from the benefits that could be brought to the communities, the local government had to take into account long-term management and maintenance issues. The winning designs possessed resilient and innovative characteristics, but extensive innovative features may create long-term administrative and economic burden to the local authorities, which diminished the capacity for future development. Therefore, the missing elements may not be suitable in this decision-making process.

- Lesson learnt

After the comprehensive study on the design competition model, there are a number of key features in the programme that we can appreciate. With the extensive civic engagement activities, the project teams were encouraged to proactively manage the public

expectations. Moreover, the competition created quick response to address the impact brought by the disasters and mitigate the future risks. The design competition took around half a year and conceptual designs were formulated to cater for the community needs. After the completion of detailed design, part of the construction works was started in the 2018.

- Key Features

- Design for and encourage projects that offer multiple functions and benefits
- Adopt long-term approach to achieve resilience
- Seek supplementary funding sources to support long-term monitoring and maintenance
- Strengthen collaboration among agencies and levels of government
- Encourage coordination across agencies and levels of government
- Gain support from the community through robust public engagement partnerships

These features are valuable for cities that are eager to replicate the design competition model and apply it to the infrastructure projects. Taking 100 Resilient Cities (100RC) as an example, based on the Hurricane Sandy Design Competition model, it is a programme aiming at providing resources to the cities within the network to develop a roadmap towards resilience. In Hong Kong, the collaboration model is commonly found in non-governmental organizations. To embrace the multiple benefits to the community, it is crucial for us to further study the feasibility and implementation in the infrastructure projects.



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Innovation

★ Smart Government

Open Data and Internet of Things (IoT) are the backbone of a Smart City. City-wide policies and infrastructures are required to execute these concepts effectively. Hence, the governing body is responsible to carry out these tasks and determine the depth of the implementation.



New York has established a city-level Open Data platform to provide extensive data in the public sector and it also serve as a sharing platform for research. In order to build a Smart Government, Hong Kong is also promoting an Open Data driven approach to facilitate research and innovation in its Smart City Blueprint (OGCIO, 2018). The Office of the Government Chief Information Officer (OGCIO) has been releasing various governmental datasets and geospatial data from 2015 onwards in DATA.GOV.HK (2018). Although there is a few Open Data portals like The HKSTP Data Studio, Hong Kong still lacks a city-level open data portal. Nevertheless, Hong Kong is on the right track towards a data-driven city.

IoT requires three fundamental infrastructure around the city: data collection points, data centres and Internet connection. The development status of New York and Hong Kong are summarized in Table 2.

	New York	Hong Kong
Data Collection Points	<ul style="list-style-type: none"> Smart Water Meters are installed in buildings to eliminate the needs of hiring meter readers (MOCTO, n.d.) The project "Midtown in Motion" makes use of cameras with video analytic capability to identify traffic congestion and adjust traffic signal accordingly (DOT, 2012) 	<ul style="list-style-type: none"> Under the "Energizing Kowloon East" district transformation project, pilot projects have begun to integrate IoT infrastructures like Smart Poles and Smart Electricity Meters in the urban development.
Data Centres	<ul style="list-style-type: none"> Both cities are the world's financial hub with state of the art data collection and analysis hardware and software. 	
Internet Connection	<ul style="list-style-type: none"> One third of New Yorkers do not have access to broadband network to this day (MOCTO, 2017) New York is aiming to provide internet access to all New York citizens by 2025 and establish digital literacy centres to educate the mass in digital competence (MOCTO, 2017) 	<ul style="list-style-type: none"> Broadband network virtually covers everywhere Citizens have equal access to the Internet and are adapted to the digitalization of the world

Table 2: IoT infrastructures in New York and Hong Kong

Although Hong Kong is just in the early stage in terms of IoT data collection points, it can capitalize on its extensive Internet coverage to match with the pace of New York in the long run. The important point is that the Hong Kong government is committed in building a Smart City. Hong Kong's development plans in the Smart City Blueprint echo with the successes of New York's Smart City development. All in all, Hong Kong is heading in a right direction in terms of Smart City development plan and can take New York's real-world implementation as reference.

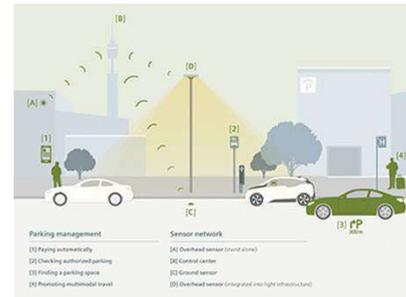


Figure 34: Smart Pole
Source: <https://www.siemens.com/press/en/events/2015/mobility/2015-09-smart-parking.php>

Recommendation

The following three projects in New York address some of the areas which are vital to successfully build a Smart City, and provide insights and inspiration to Hong Kong: privacy, Open Data portal and innovation incubation.

Privacy is a ever-present concern when Open Data and IoT is involved. The privacy law in Hong Kong has a strong foundation to protect the privacy of its citizen. However, it is still immature in regards to handling Open Data. Guidelines for disclosing and sharing data are necessary but there are a lot of means to enforce them and New York is a valuable reference. The New York government has a well-established IoT guidelines. Data are collected for specific purposes, so it will be hard to use the results to trace back to individual information (NYC Guidelines for the Internet of Things. n.d.). For example, traffic monitoring system will analyse and record the pattern of the traffic flow but not the footage



Figure 35: New York Midtown
Source: <https://www.fastcompany.com/1768031/midtown-motion-could-eliminate-nyc-traffic-jams>



Figure 36: Smart Water Meter
Source: http://www.nyc.gov/html/dep/html/customer_services/amr_about.shtml

of the camera. The government recently set up privacy officers to enforce the guidelines in each agency. Privacy officers ensure that is the level of disclosure is standardize across agencies and unauthorized Personally Identifiable Information is not disclosed.

As IoT infrastructures will be in place in the coming years, the Hong Kong government can expand its Open Data to match what New York is doing with their IoT network. In addition to the processed data which OGCIO has been sharing, real-time data from IoT devices can be shared across governmental department and for public use (NYC Open Data. n.d.). The connective infrastructure that will be weaved together can form a holistic picture and provide opportunities to understand the city better and develop new approach to solve existing problems.

NYCx Challenges is a programme that promotes the usage of innovation and new technologies to solve



problems in New York (MOCTO, n.d.). Short competitions like the Moonshot Challenge and the Co-Lab Challenge invites tech-companies or entrepreneurs to use physical test bed in the city to test out solutions (MOCTO, n.d.). The incentive for the contenders is the sole ownership of the solution and the business opportunities for when the solution is applied more broadly in the city. Local communities are often involved in the process so the stages of research and implementation can be efficient and effective. The lack of trust in innovative policies and technologies that have never been tested elsewhere is the main issue that hinders development in Hong Kong. On the road to a Smart City, it is inevitable to incorporate new technologies in the development process. If Hong Kong wants to stay competitive and not fall behind in the innovation industry and Smart City development, the government should embrace new technologies like New York.



Figure 37: Governors Island Connectivity Challenge
Source: <http://www.nyc.gov/html/nycx/challenges.html>

Setting up privacy officers, establishing a City-level Open Data Portal and providing a real-world test bed for innovative solutions are proven initiatives that can only be implemented effectively by the governing body. A Smart Government is the foundation which a Smart City is built upon. Therefore, Hong Kong can make reference of these initiatives and build upon Hong Kong Smart City Blueprint to smoothen the road to become a Smart City.

Mobility Technologies Development

Intelligent Transport System (ITS) applications have been widely applied to reduce traffic congestion in urban area through efficient utilization of existing infrastructures and vehicles capacity. ITS optimizes

traffic control strategies with different sensing and communications devices deployed. Users could improve their management of transport systems with real time information about traffic condition changes. It is also a tool for gathering, analyzing information, and building up link between different transport modes and operators or infrastructure providers.

To tackle the severe congestion problem, information transparency through IoT devices and big data would be very effective. Its effectiveness could be reflected by two areas of technology development, which are smart infrastructure and smart vehicles respectively. Therefore, some related experience in New York for midtown traffic control, Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication will be studied.

The New York City Department of Transportation (NYCDOT) launched the "Midtown in Motion" Program in 2011 to improve traffic conditions of the most congested area. Microwave sensors, traffic video cameras and E-ZPass readers were installed at intersections to measure traffic speeds as shown in Fig. 1. City traffic engineers could then identify and respond to traffic conditions in real time through the networked Advanced Solid State Traffic Controllers (ATSC). ATSC also allows remote adjustment of traffic signal patterns to more evenly distribute traffic flow, helping to clear congested areas, or allowing engineers to clear isolated backups caused by collisions or double-parked vehicles. The high quality digital camera at roadside are also used to identify traffic violation by the video analytics technology.

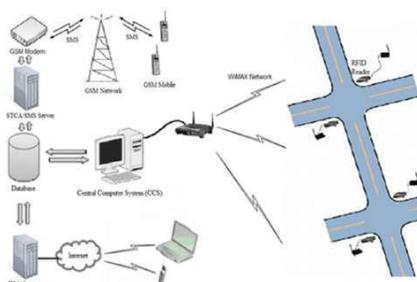


Figure 38: The layout of the Vehicle Traffic Congestion Estimation environment

NYCDOT has converted over 10,000 signalized intersections to this advanced technology. All the real-time Midtown in Motion traffic information is shared with the public on Website, Smart Phone Apps, etc through existing WiFi network. With the help of ITS, authorities can also have a more transparent view of the traffic flow in different area, and hence more effectively execute their policies and restrictions on different road sections. As a result, the system provides an overall 10% improvement in travel speeds.

The NYCDOT is also leading the "Connected Vehicle Pilot" Program in New York City, which aims to improve the safety of road users in the city. The pilot system will be implemented on August 2018 to evaluate the performance of technology and applications in dense urban transportation system with tightly-spaced intersections.

As shown in Figure 39, Connection between vehicles, infrastructures and pedestrians is facilitated by different communication devices. ASTC plays a critical role here in the system, which is provisioned with CV capabilities to be able to exchange DSRC messages (i.e. SPaT, MAP, SRM, SSM) with the "Connected Vehicle Pilot Deployment" system. ASTC is monitored and controlled by Traffic Control System which also will communicate



Figure 39: Streets with V2I applications in Connected Vehicle Pilot Program

with the Roadside Units and monitor their operational status.

The maturing technologies enable multi-channel communication and improving the interoperability, which brings more flexibility and reduces implementation cost for an integrated system. It is able to make use of existing hardware to facilitate new ITS applications. For example, E-ZPass is a New York electronic toll collection system, but it could also be used for collecting real-time traffic data as an integrated in-vehicle units (IVUs).

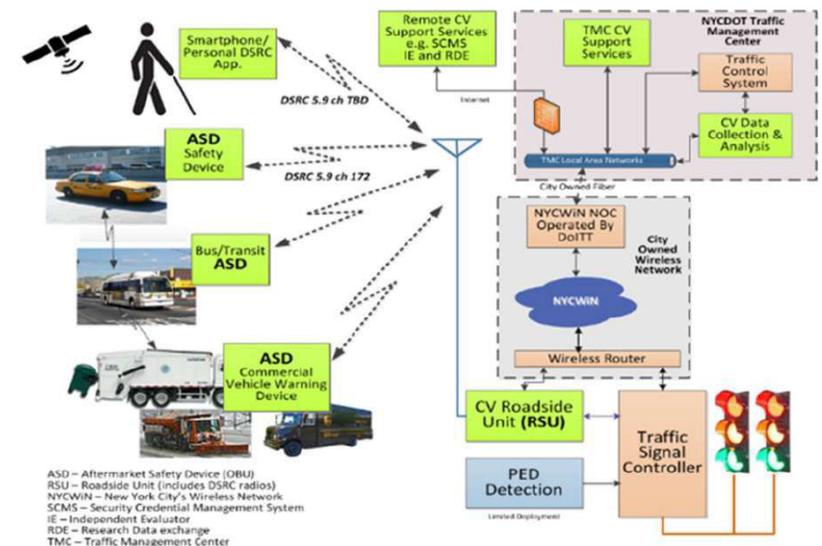


Figure 40: The overall Connected Vehicle project concept

Meanwhile, On Board Diagnostic Device in vehicle will alert and advise drivers with real-time information to help them save money (Reward scheme for off-peak travel and on less travelled routes), save time, and drive more safely. Conversely, drivers can help improving incident and emergency management through the use of in-vehicle devices which would automatically notify the authority with any incident on the road.

It is foreseeable that the connected vehicle technology will be integrated with vehicle automation in the future. An electronic co-driver can help monitoring nearby traffic, vehicles movements and alerting possible collision with data from internal sensors and other systems. With such driving system, autonomous vehicles control can be achieved by the central monitoring station and onboard vehicle diagnosis unit. It could also assist the driver in more stabilized driving so as to promote environmental friendly driving pattern.

Information Sharing makes travel easier

Hong Kong has developed a strategic development plan to advance ITC application in the Hong Kong Smart City Blueprint. Traffic detectors will be installed in all strategic routes to provide real time traffic information by 2020; and pilot intelligent traffic signal systems at road junctions starting from 2021.

"Connected Vehicle" or "Midtown in Motion" program are common in that their ideas are to deliver the right information to the right person, receive their feedback to form a connected network. Government shall support the promotion of sharing culture and provision of ITS

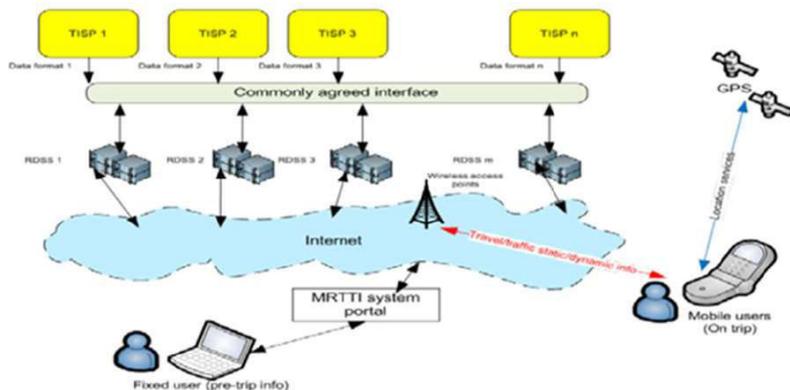


Figure 41: Overall architecture of an integrated information platform

infrastructure. For example, providing incentives for drivers to install IVUs and make these devices profitable to attract private sector involvement.

Privacy and Security are always the major concerns when related to data collection. Existing experience applied Encryption and Obfuscation process to protect detailed personal data. Besides, Multi Channel DSRC technology also support the security features to reduce the risk of security break through.

EU Commission (2012) have already pointed out the necessity for the information flow along the value chain in boosting e-commerce. Logistics industry could benefit from a dynamic scheduling model that linked to real-time traffic and road works information. In the report of Taniguchi et al. (2001), it was found that vehicle routing and scheduling systems can result in journey-time savings of 10 – 15% by giving drivers advices on how to avoid congestion. More advanced modelling and comparison with historical baseline data are also facilitated by emerging technologies.

The emerging use of wireless technology, such as WIMAX and DSRC technologies, facilitates mobile two-way information exchange between users and environment. Under the idea of "people as sensors", there could be a collective information network (as illustrated in Fig. 4) to generate ideas, and make predictions very soon. The interactions between such users then lead to the emergence of an "intelligent" global behavior. (Magliocchetti et al., 2011)

★ Generative Design: Use of artificial intelligence in design process

In Hong Kong, engineering and architecture designs often include a set of objectives and constraints such as abstract notions of function and aesthetic, performance, project requirements, site constraints and construction costs. To respond to these complexities, a set of design instances and alternatives are required to be developed and assessed against predefined criteria. Human designers must investigate different design options by manually varying individual parameters and evaluating each option using their own criteria and intuition.

Nowadays, development in design software and programming language enables designers and engineers to carry out sensitivity analysis to obtain design solutions in a deeper and more dynamic way. The Living, part of Autodesk Group in New York, applies the concept of generative design that incorporates both quantitative and qualitative objectives to find the highest performing design. The use of algorithm also assisted in automatically generating a large amount design options.

The framework of generative design includes three main components:

- A generative geometry model that defines 'design space' of possible design solutions.
- A series of measures or metrics that describes the objectives or goals of the design problem.
- A search algorithm that can search through the 'design space' to find a variety of high performing designs options. For example, one of the algorithms is the multi-objective genetic algorithm (MOGA), which uses principles of evolution to create sequential generations of designs and improve the design to obtain higher performance.

Generative design is an example of the application of artificial intelligence. The algorithm allows the parametric model to automatically produce many design variations based on the input constraints. The model also uses the input objectives to discover novel and high-performing results within the variations for a given design system. The following two projects are examples of how generative design can be applied.

Example Project 1: Design of a Partition in an Aircraft

The first application of generative design introduced by The Living was a partition design inside commercial aircraft. The design space/parametric models were initiated based on the behavioral algorithm inspired by the growth of slime mould in nature, which is an example of MOGA. The slime mould produces highly efficient and redundant networks connected to the food sources. (Nagy, 2018) It was hypothesized that a similar logic would be beneficial for connecting structural attachment points to resist structural loads as shown in Figure 42. The constraints included connection points and maximum deflection of partition. The objectives included minimization of total weight and maximization of utilization of stress allowance of the material. The generative algorithm used this set of constraints and objectives to automatically search the range of possible designs. (D. Nagy, et al., 2017)

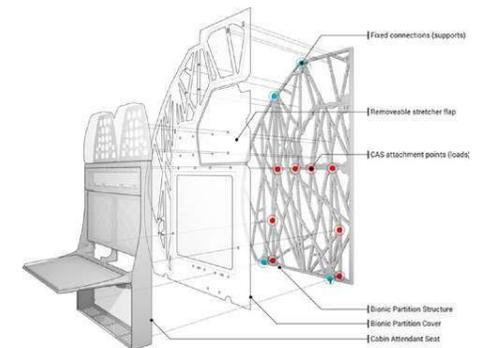


Figure 42: Nagy, D., Zhao, D., & Benjamin, D. (2018). Nature-Based Hybrid Computational Geometry System for Optimizing Component Structure. In Humanizing Digital Reality (pp. 168). Springer, Singapore.

The result of optimization process reduced 50% of weight of the partition while maintaining the original strength. This partition is currently undergoing testing and certification to be integrated into future airplanes. In future, The Living would study the possibility to refine the design of entire aircraft structure using this bionic principle.



Example Project 2: Office Space Planning Project

The second application of generative design was an office space planning project where The Living applied the Data-drive Planning Process. The process included three components as shown in Figure 43: The Plan(s), Stakeholders and Planning agency. The Planning Agency collected views and preferences from stakeholders and uses the information for optimization. The information was processed with the help of generative design algorithm to create many different Plans(L.Villaggi, et al., 2017). The selected Plan is then presented to the Stakeholder through applying technologies of visualization. The overall process aims to create better design than generic design method.

Similar to the aircraft partition design, the framework of the generative design consisted of design space, metrics of objectives and search algorithm. The first step was to define the goals of design. However, the design objectives of the office were measured by the user satisfaction such as adjacency, daylight and views to outside which were typically considered to be qualitative. It is more complex to quantify these goals compared to those in structural component design. To transfer the qualitative information into specific quantitative data, surveys of future occupants were conducted regarding the spatial and work style preference. The survey results were quantified through the knowledge of related researches to produce a series of metrics to represent the objective and constraints. Then an architectural concept of breaking up the floorplan into a series of individual neighborhoods was used for setting up of the design space. A generative space planning model was

established to simulate the arrangement of neighborhoods within the building floodplain, the location of shared amenity spaces, and the assignment of placement of teams and individual workers in the neighborhoods. The computer automatically created a large variety of valid floor plan layouts for the office. An algorithm was then operated to find a set of optimal design.

To further improve the design process, The Living used virtual reality to present the design and discuss with the stakeholders. Internet of Things (IoT) sensors were also installed in the office in post-occupancy stage to collect live data to further improve the design. The feedback and data collected were input to the generative space planning model again and the whole process was repeated to optimize the design.

This design approach integrates artificial intelligence which automatically evaluate qualitative properties of office space design. The final design was therefore much more humanistic.

Recommendation

The above two projects have demonstrated the capabilities of generative design to create better design in achieving structural performance and occupant desires. It reveals that future development in Hong Kong shall move towards a more dynamic and collaborative interaction between computer design software and human designers. This innovative and more humanistic design approach is worth learning and may be applied for designs in Hong Kong.

This project has shown the transformation of qualitative survey information to quantitative data. Similar methodology can also be applied to public consultation and engagement of public infrastructure projects, for example, public recreational facilities, commercial buildings and shopping malls. Surveys of potential occupants and end-users can be converted to quantitative data while the performance can be measured based on the related objectives.

Moreover, to make the process more comprehensive, not just the structural members but other constructions factors such as labour costs, material costs and times can also be integrated into the workflow. Large amount of structural monitoring data are being available during and after the construction because of rapid development of IoT. The collection of these digital data can be used to further calibrate and refine the process.

"Mushroom Brick": A new biological material

The computation power of computer can also be integrated with the use of new biological material. It offers a new paradigm for the future of manufacturing and design. The Living created a novel biological material, mycelium, in the Hy-Fi project to produce bricks.

solid mass in a very short time without energy input. It is also completely organic and can be quickly and easily broken down to create high quality soil through composting. In this project, the brick was made from a combination of corn husks and hemp collected from local farms. The process also made use of materials sourced from the existing agricultural waste stream (D. Nagy, et al., 2015).

The Living designed a 40-foot tall branching tower made of 10,000 bricks of mycelium that was able to sustain the weight of the structure under gravity and potentially hurricane-level wind loads. A fast material innovation cycle was developed to take the feedback from physical tests and structural simulation to improve the strength of the material. One challenge of this project is structure's complex, doubly-curved surface. A computational design tool was created to describe any arbitrary surface and optimize the stacking of brick modules.

This innovative material is produced by wastes and also prevent further production of wastes since it is easily decomposed and returned to nature. However, it still has some limitations. To ensure the simulation model can accurately predict the structural behaviour, a good definition of the structural properties of the material is necessary. The researchers must carry out a series of material tests to understand the structural properties of an entirely new material. Besides, verification of long-term performance is required. Still, it provides an alternative solution for temporary outdoor facilities for construction use, event hosting and exhibition in Hong Kong. For example, the brick can be engineered and customized for small loading temporary structures on construction sites such as formworks and hoardings.

A research team in Hong Kong Chinese University have also studied the mushroom bricks. They have regarded mushroom as the ultimate recyclers in nature (Mingpao, 2018). The principle of production of their mushroom bricks are like those one used in Hy-Fi projects. However, the research team have explored other applications and material properties of this biological material. It can be simply used as the replacement of styrofoam in package industry due to their energy absorption ability. Another outstanding chemical property of the mushroom bricks is its incombustibility



This material is made of only organic and existing waste materials. The key ingredient is mycelium which is the root structure of mushrooms. When it is combined with other plant material, the mycelium filament-like micro root structures grow and bind the material to produce a

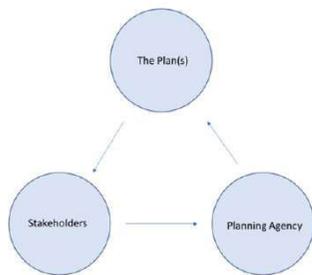


Figure 43: Data-drive Planning Process

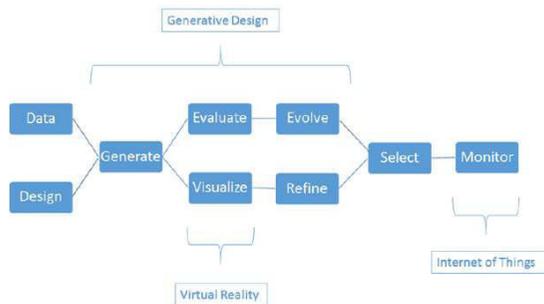


Fig.44: Data-drive Planning Process



which makes it a suitable insulation material for fire resistance of buildings. However, when the moisture content and temperature of surrounding environment is appropriate, the mushroom will continue to grow which may affect the structural integrity. Therefore, the growth of mycelium must be terminated by going through a high energy intensity process. To further improve this mushroom blocks, some researchers have been working on a unique process to suppress the growth of mycelium while maintaining its ability to repair itself.

Environment / Building

Hong Kong is a major seaport, financial centre and business hub of Asia. The tiny portion of land has led to a concentrated high-rise environment and very high population density. According to Hong Kong Special Administrative Region (HKSAR) Government Report (Environmental Bureau, 2015), there are over 8,000 of government facilities, 42,000 of building in private sector, over 50 buildings taller than 200m and more than 270 buildings taller than 150 meter using energy, water, and other resources and the way to protect occupant health and improve employee productivity. In the other side of the globe, New York City has a diverse building stock encompassing about 1 million structures of various types and combinations of use (NYC Special Initiative for Rebuilding and Resiliency, 2013). With about 6,300 high-rise buildings, New York City has a heritage of skyscraper history like no other city (Emporis, 2018).

Evolving into smart cities, both Hong Kong and New York City are determined to adopt different measures as their plans in “Smart City Blueprint for Hong Kong” (2017) and “Building a Smart + Equitable City” (2015) respectively. Building and environment are key aspects in the smart city plans with their concentrated high-rise environment. A statistic found that people spend about 90% of time indoors (Klepeis, et al., 2001) that shows



Fig.45: Hong Kong Special Administrative Region Government Report (Environmental Bureau, 2015)

the importance of buildings to human, especially for residents in New York and Hong Kong with many skyscrapers. In order to realize a sustainable future, the next generation of green building must focus on the development of smart cities and resilient communities. Major cities like New York and Hong Kong are eager to be pioneer to champion equitable, safe and healthy development policies, implement interoperable platforms and advanced technologies that improve the performance of their communities and cities, and continue to incorporate concepts like wellness and human experience into city planning, development and management. Meanwhile, citizens are demanding more transparency and information about the places where they live, work, learn and play.

As a result, United States and Hong Kong develops their green building standards as the Leadership in Energy and Environmental Design (LEED) and the Building Environmental Assessment Method (BEAM Plus) respectively to address built environmental concerns as well as the economy considerations. To go the extra miles in developing a better environment and improving life for citizens around the world, the United States Green Building Council (USGBC) promotes the LEED for Cities certification program which is a global scale for cities to compare and benchmark aspects of their performance to other cities, in a simple way.

Under this programme, a city can measure and manage its water consumption, energy use, waste, transportation and human experience. Till May 2018, there are 5 cities, including Washington, D.C., Phoenix, Arlington of the United States, Songodo of South Korea and Savona of Italy are using LEED for Cities to communicate continuous performance. (USGBC, 2018).

To demonstrate our commitment to sustainability, human health and economic prosperity, Hong Kong can take the next steps with leveraging data analytics and deeper engagement of citizens, together with the Smart City Blueprint for Hong Kong and Energy Saving Plan for Hong Kong’s Built Environment 2015-2025+.



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Security

★ Cybersecurity Enhancement - Comparisons and Insights

With the rapid advancement of information technology and the popularisation of computer and mobile devices, cyber intrusions are becoming more common, more dangerous, and more sophisticated. Cybersecurity enhancement requires collaborative efforts from both the government, corporations, as well as citizens themselves. During the Delegation, a comparative study has been conducted to review the cybersecurity development in both Hong Kong and New York. In the coming sessions, the overview on the regulatory system between Hong Kong and New York would be given first. Then an analysis regarding the current cooperation between the public and the private sectors through cybersecurity sharing platforms would be conducted.

The concluding chapter will discuss on how to build up trust in society so as to achieve cybersecurity enhancement.

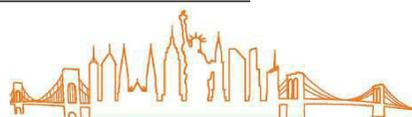
★ Policies and Regulations

Both the Governments of Hong Kong and the New York City Government are dedicated to combat cyber crimes, which have caused HKD\$2,301 million and USD\$106.2 million (HKD\$828 million) financial losses in 2016 accorded to reports from the Legislative Council Commission (2017) and the Federal Bureau of Investigation (2016) respectively. Throughout the study on regulations, penalties, enforcement, general data protection policies, cybersecurity framework and risk management, the regulatory difference between Hong Kong and New York City has been summarised in Table 3 below.

	New York City	Hong Kong
Cybersecurity Regulation	At the federal level, Computer Fraud and Abuse Act and the Wiretap Act regulates computer related crimes in the United States. The New York State Government has implemented Article 156 of New York Penal Law (NY Penal Law S156) which is a single and clear law relating computer-related crime.	For the time being, Hong Kong does not have a stand-alone cyber crime legislation. Regarding the Computer Crime Ordinance enacted in 1993, it has amended the Crimes Ordinance, the Telecommunications Ordinance and the Thief Ordinance to regulate any violations in the cyber world.
Cybersecurity Risk Management	<p><u>The Enterprise Information Security Office (EISO)</u> This Office oversees and coordinates with state agencies and is capable to assist organisations for complying cybersecurity standards, managing risks and responding to incidents.</p> <p><u>The Information Sharing and Analysis Centre (ISAC)</u> ISAC, a non-profit organisation of 21 different sectors, provides a central resource and information gathering platform on cyber threats to critical infrastructure and acts as an sharing platform between the government and enterprises.</p>	<p><u>Hong Kong Computer Emergency Response Team Coordination Centre (HKCERT)</u> The HKCERT works closely with the Government Computer Emergency Response Team Hong Kong (GovCERT) to collect, consolidate and share information on cybersecurity threats and cybersecurity incidents with the public.</p> <p><u>Cyber-attack Intelligence Sharing Platform (CISP)</u> Cyber Security and Technology Crime Bureau (CSTCB) of the Hong Kong Police Force has recently launched CISP to counteract with the dynamic cyber threat landscape and the complex cyber attack techniques.</p>
Penalty	<p><u>New York Penal Law 156</u> Computer tampering offence is regarded as a serious crime and the maximum penalty is USD \$5000 (~HKD\$40,000) and 15 years' imprisonment.</p>	<p><u>The Theft Ordinance (Cap 210)</u> Under the ordinance, computer tampering offence will lead to a maximum of 14 years' imprisonment.</p>

	New York City	Hong Kong
Government Cybersecurity Framework	<p><u>The Office of Information Technology Services</u> The authority oversees, directs and coordinates the establishment of information technology policies, protocols and standards for the New York State government.</p> <p><u>The United States Government Configuration Baseline</u> An initiative provides federal agencies with guidance for best practices in information security configuration.</p>	<p><u>The Office of Government Chief Information Officer (OGCIO)</u> The OGCIO supports the information technology development and sets technical and professional standards.</p> <p><u>The Baseline IT Security Policy</u> An outline specifies the mandatory security requirements for the protection of government's information systems and data assets</p> <p><u>The IT Security Guideline</u> A guideline elaborates on the policy requirements and sets the implementation standard.</p>
Financial Services Cybersecurity Framework	<p><u>The New York State Department of Financial Services</u> Financial services companies have to achieve the requirements in the cybersecurity regulation (23 NYCRR 500). This regulation requires financial services providers to put a continuously maintained cybersecurity programme in place as well as to protect the customers from losses.</p>	<p><u>The Hong Kong Monetary Authority</u> The "Cybersecurity Fortification Initiative" (CFI) implemented for the bank services to provide robust preventive and detective controls to reduce and mitigate cybersecurity risks.</p> <p><u>The Securities and Future Commission</u> The "Guidelines for Reducing and Mitigating Hacking Risks Associated with Internet Trading" implements 20 baseline requirements to enhance their cybersecurity resilience.</p> <p><u>The Insurance Authority</u> The "Guidance Note on Corporate governance" (GN10) has included cybersecurity requirements of policies and procedures to identify, prevent, detect and mitigate cybersecurity threats.</p>
General Data Protection	<p><u>The Stop Hacks and Improve Electronic Data Security Act</u> This Act has extended the requirements on handling sensitive private information and notifying breaches. Failure to comply with the Act will result in a civil suit and penalties.</p>	<p><u>The Personal Data (Privacy) Ordinance</u> PDPO regulates the collection, use and handling of personal data and is based around a set of data protection principles. Breach of the PDPO will lead to civil or criminal sanctions</p>
Enforcement Bodies	<p>3 levels of government include,</p> <ol style="list-style-type: none"> Federal Bureau of Investigation New York State Police New York City Police Department <p>These three levels are responsible for investigation of cyber crimes and other property-related offenses in New York.</p>	<p>The Cyber Security and Technology Crime Bureau (CSTCB) of the Hong Kong Police Force is the leading department in combating socketing technology crimes and maintaining a safe cyberspace in Hong Kong.</p>

Table 3: Regulatory difference between Hong Kong and New York City



Aligned regulations on the Computer-related Crimes

Although there is no single cybersecurity law in Hong Kong, the coverage of existing ordinances adopted a generic approach to address distinct offences as specified in the NY Penal Law S156 including unauthorised use of computer, computer trespass and computer tampering. Economist (2017) research ranked Hong Kong as the fifth in the world for digital security in 2017. The existing regulatory on the cybersecurity remains effective to ensure the cyberspace is safe.

Besides online blackmails and ransomware attacks, swindlers use online social media as a pretext for committing crimes, such as phone phreakers and social networking traps. The variety of criminal activities through the information teleology and telecommunication is surprisingly diverse. In the near future, huge numbers of IoT devices will be used for managing the manufacturing process, analysing big data, and even, motivating our life. Our development and usage on connected technology is growing faster than our ability to secure it. Therefore, regular reviews and updates on current cybersecurity standards and best practices are crucial to cope with the rapid changes in technological advancement. Cybersecurity is becoming increasingly

complex because of the increasing number of sophisticated cyber attacks. Therefore, the Government shall conduct regular reviews on the existing cybersecurity structure to keep pace with the legislative and technological developments. In the longer term, an Inter-departmental Working Group on Computer Related Crime (Security Bureau, 2000) in Hong Kong recommended that new legislation or amendments to existing legislation should be fully aware of the requirements in the information age. There is a need to develop an explicit legislation on cyber crimes in the future rather than adjoining with current regulations on physical crime as in the current practice. However, the review on existing well-established legal concepts and principles would take a long time to question the jurisdictional rules.

Coherence in policy and regulation

As cyberspace becomes the dominant medium for commerce, a secure legal platform for electronic commerce is vital for the continual growth of the industry. The New York State Government has coped with the increased focus on cybersecurity and implements 23 NYCRR 500 which regulates financial services companies to meet the minimum standards for protecting the businesses as well as the public. Moreover, New York, as a leading financial hub, is the first in the series of States adopting their own cybersecurity regulation regime. The regulation incorporates the essence of communication to form an effective defensive system. Financial sectors in New York must implement appropriate risk-based cybersecurity programmes and proactively interact with each other to exchange information on cyber-attacks.

Despite the fact that Hong Kong has no explicit regulation for the cybersecurity requirements for financial sectors, the relevant Authorities in Hong Kong have provided comprehensive guidelines in setting their cybersecurity framework and securing their businesses and customers. The concept of effective communication and cyber

defense system has been reflected from the CFI framework. In forthcoming years, it is therefore crucial for businesses in Hong Kong to ensure that they put in place robust cyber protection to meet the growing requirements and to conduct regular reviews and audits of their cybersecurity system to keep pace with the legislative developments.

★ Sharing and Defence

Effective information sharing is very important for combating cyber security crime. The cyber world is changing so fast and becoming sophisticate, there is a hacker attack in every 39 seconds (Security Magazine, 2017). The rapidly changing cyber world and innovative attack techniques pose great difficulty for an individual to defend and safeguard the sensitive data on her/his own. Information sharing platform is crucial to avoid peers within the security industry taking the same missteps and implement immediate measure to avoid attacks in their own networks.



Figure 47: 24/7 security operations centre (Don, 2018)

Apart from that, their security automation are a new revolution for information sharing. The security automation is the automatic handling of security operation-related tasks which allows companies to investigate incoming threats, such as in scanning for vulnerabilities, respond immediately and without human intervention. Cyber intelligence helps to improve the efficiency of cybersecurity protection operation, reduce the time resolution and shortage of security talent.

Hong Kong

Similar to New York, Hong Kong has numerous cybersecurity sharing platforms.

Most of them serve as an one-stop portal for the IT professionals and general public to effectively access information and resources on cybersecurity as well as measures and best practices for prevention of cyber crimes. Most of them are aim at increasing the awareness of the public on cybersecurity to raise the overall capabilities of Hong Kong's computer users in preparing for and managing cybersecurity incidents. Platforms that provide security alerts, advisories, report, newsletter, seminar and forum include but not limited to:

1. InfoSec – Established by Office of the Government Chief Information Officer (OGCIO), The government of the Hong Kong Special Administration Region (HKSAR)
2. Cyber Security Information Portal (CSIP) – Established by OGCIO, HKSAR
3. GovCERT.HK – a governmental computer emergency response team
4. Hong Kong Computer Emergency Response Team Coordination Centre (HKCERT) - Managed by the Hong Kong Productivity Council (HKPC)
5. Collaboration Teams of Cyber Security Division (CoI CSD), Cyber Security and Technology Crime Bureau (CSTCB), Hong Kong Police Force

Apart from providing resources and advice, some platforms are more advance on having computer emergency response teams. For Information and

New York City

One of the major information sharing platform in New York is the Information Sharing and Analysis Centres (ISACs). ISACs are trusted entities established by Critical Infrastructure Key Resource (CI/KR) owners and operators to provide comprehensive sector analysis, which is shared within the sector, with other sectors, and with government. ISACs take an all-hazards approach. One of the major services provided by ISACs is information sharing. It has a 24/7 security operation centre which gather information about threats against different industries.

Who Are The Adversaries?

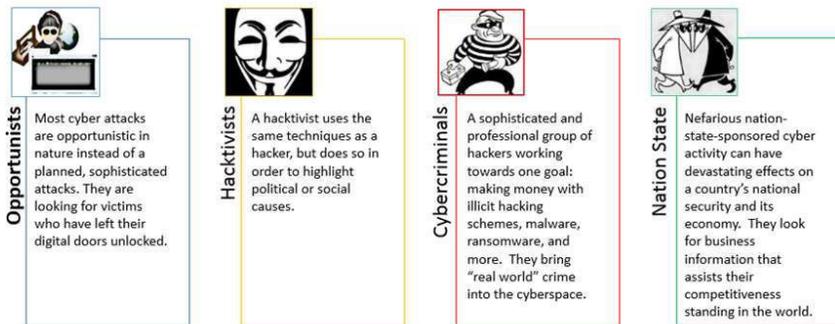


Figure 46: Who Are The Adversaries? (Don., 2018)



Cybersecurity within the government, the Information Security Incident Response Teams (ISIRTs) comprising management and technical staff have been established to deal with all matters on a day-to-day basis to prepare for, detect and respond to information security events and incidents.

In the wider community, the Hong Kong Computer Emergency Response Team Coordination Centre (HKCERT) coordinates computer security incident response for local enterprises and Internet Users. Its missions are to facilitate information disseminating, provide advices on preventive measures against security threats and promote information security awareness. HKCERT operates its Security Alert Monitoring and Early Warning system, which monitors security vulnerability and development of viruses and worms. Whenever necessary, the system would issue alerts to warn the public to mitigate the impact of these threats. Their free 24-hour hotline services for incident reporting gives advice on incident response and recovery. All the reported incidents will be kept confidential. They have good collaboration with overseas CERT teams for cross-border incidents.

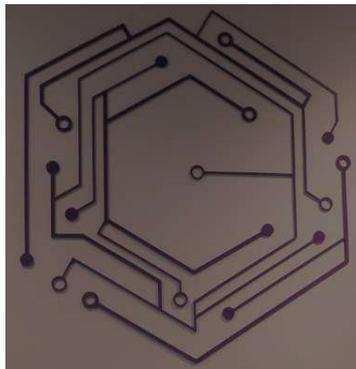
Sharing as a Defence to Cyber crime

As mentioned in the opening, collaboration is the key in fighting cyber crimes. When something is happening to others in your community, it can happen to you too. To be forewarned is to be fore-armed. With information sharing, we all have an incredible level of threat intelligence to learn the lesson from others and take immediate prevention measures for our security system.

However, there are still a lot of obstacles in implementing information sharing. Firstly, companies awareness on the benefit of information sharing can be further enhanced. Most of the organization are wary of sharing sensitive cybersecurity information. They are worried that such information can jeopardize the security posture of the organization as well as damage the impressions from customers and even affect their stock values. It is hard for security professionals to explain to their boards, and potentially stockholders, why they should be sharing this information in the first place. Secondly, they are worried about what type of information should be shared. With the increase in concern on the protection of personal data, organization tend to avoid sharing sensitive information. They also concern the liability for providing such sensitive information. Last but not least, it is a matter of trust. They are worry that sharing such information will expose their trade secret and afraid that their competitors will take benefit of it.

How should we overcome the cybersecurity information sharing challenges? The government could cooperate with the cybersecurity industry to provide more education to the companies to promote the benefits of information sharing, for example, possibility of sharing essentially intelligence cost, increase in efficiency cybersecurity protection etc.

The government could develop guideline for information sharing on the topic of what type of information should be shared to reduce concern from organizations. The development of the guideline can take reference from some existing guidance around the world, for example the Guidance on Public Private Information Sharing against Cybercrime (World Economic Forum, 2017) published by the World Economic Forum.



★ Trust and Society

When talking about cybersecurity, it is often associated with computer sciences and technological advancement. Yet in this complex and technological world where we are living, human side of cybersecurity cannot be neglected (Evans, Maglaras, He & Janicke, 2016), in which economics, psychology and sociology are involved.

Society cannot function without trust. Technology enables trust to scale. Technology-driven trust mechanism enables us to interact and conduct transactions through the Internet and online systems. Trust or credit can be built up easily with strangers. However, it should be understood that no security system is perfect and solely rely on technological advancement to protect everyone's interest is impossible.

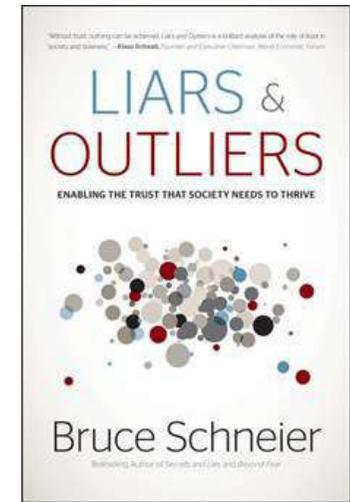
No matter how much societal pressure is deployed, there is always defectors (Schneier, 2012). By means of morality, reputation, regulation and security system, trust can be built up in society more readily, thus protecting us against defections.

Morality

Moral is an individual value that affect one's decision making process as we evaluate potential trade-offs, which also encompass internal reward mechanism for both cooperation and defection. Hauser (2006) believed that human have a moral instinct that unconsciously directing us to judge right and wrong.

At the same time, morality can be cultivated by education (Noddings, 2002). During the visit to the New York University's Center of Cybersecurity, it is observed that the center aims to offer interdisciplinary curriculum to students as they believe that cybersecurity is combination of different areas of study such as electrical engineering, politics, laws and regulations, social behaviours and psychology.

Yet, individual behaviours of people vary with different moral standards and when societies become larger, morals scale badly (Schneier, 2012). While most



people will cooperate most of the time, some people may defect when conflict of interest arises. Hence, other methods have to be imposed together with morality.

Reputation

We spend a lot of time and effort to build up and maintain reputation as it is being treated seriously. With good reputation, people are able to gain trust from others and cooperate with one another. With known buyers and sellers, customer and merchant reputation used to be a more important deal than it is today. Reputation is systemised nowadays into for examples ratings, reviews or even "numbers of mutual friends" in social networking sites. The enormous development of systemised reputation has allowed society to scale globally through the Internet. eBay (Resnick & Zeckhauser, 2002) is a one of the best known examples that runs the Internet reputation system.

However, this systemised reputation can be gamed and people can have fake positive online reputation. Reputation system is shifting to the cyber world as it provided a shortcut for Internet users to associate a person, a brand or a company's reputation easily by a



single trust decision to a system. For examples, instead of trusting buyers and sellers individually in eBay, a trust to the rating system allows users to process a huge number of individual trust decisions. Potential defectors may hence attack reputational system through cyber attacks. Hence reputation system have to be protected by security system to ensure the system cannot be hacked and manipulated.

Regulation

Laws, regulations and rules which are established by the governments, corporations and other institutions provide formal, codified and tangible sanctions or incentives so that people would agree to obey. They are believed to be important part of achieving security and motivating trust.

As discussed in the previous chapter regarding regulatory system developed in Hong Kong and New York, both governments have provided cyber protection by establishing different cybersecurity frameworks and regulations to cater the cities' own needs. For example, the Article 156 of New York Penal Law (NY Penal Law S156) is implemented to regulate offences in computer-related crimes. While in Hong Kong, cyber crimes are not regulated by any single law but they were well-covered in the Crimes Ordinance, the Telecommunications Ordinance and the Thief Ordinance.

The uniqueness of regulatory system in different region may however lead to potential troublesome in international coordination in cyber issues and it is not always possible to enforce a law across borders. Cyber attacks have become a global epidemic which outpace the ability of the legal system to respond. Ransomware attacks such as Petya and WannaCry (Hern & Gibbs, 2017) spread rapidly across the world, impacted multiple organisations and countries due to differences in values, levels of preparedness as well as degree of interests and risks among countries.

Laws, regulations and rules can have loopholes and may fail sometimes. For examples, some laws and regulations may fail to anticipate new technological development and hence laws and regulations are

sometimes not enough for some people. And that is why other means have to be applied to enhance society's trust and security.

Security System

Security system is believed to be the last layer of defence and it is the most scalable defence against defection. Security systems are not only limited to defences, but also includes intervention, detection and response, audit and forensic, as well as recovery system. So many security systems have been involved in daily living while many of them hidden in plain sight. It is common to believe that a good security system is sufficient enough to enforce compliance, which however it is rare that this is true.

Small or unknown loopholes in security system can lead to failure in the transaction systems due to increasingly sophisticated tools and techniques of hackers. In 2017, some well-known financial transaction platforms were hacked including SWIFT and Bitcoin platform, which were believed to have established and comprehensive security systems.

However, as attackers generally innovate faster than defenders, the security gap cannot be eliminated. Yet choosing a general and reactive security system that concentrate on the board motivations for the attackers helps to secure the society better.

Defection and Society

All the four aspects including morality, reputation, regulation and security system shall be considered to build up trust, which at the same time enhance security and minimise defections in society. However, eliminating defections is impossible as we all defect at some times regarding somethings such as self interest, associated group interest or norms and we share different values and moral judgements. As attackers generally innovate faster than defenders, it is also believed that society needs defectors. There are good defectors and bad defectors while we cannot always distinguish one from the other. Defection represents an engine for innovation which serve as a catalyst for society to change and evolve.

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Global cities face a wide range of challenges in the 21st century. From the effects of climate change and growing population, to the outbreak of cyber attacks, these challenges deteriorate our quality of living. In view of the growing impact of these challenges, we need diverse and innovative solutions to help cities transform and adapt to these challenges, responding to the needs of the society.

As New York is a coastal city which is susceptible flooding caused by storm surge, climate change becomes a dominant threat to the city. Not only does the Rebuild by Design programme help recovering the communities from the disaster, but also equip the city with future resilience to adapt to climate change. In developing the city for the future, LEED for Cities certification programme provides a set of indicators to measure the performance in developing cities towards a better living environment and sustainability. With the rapid technological advancement in the 21st century, plenty of programmes and software are developed to assist our design work in the engineering field. Generative design provides a framework on the application of innovative technologies to optimize the engineering solutions that best-fit the needs. To ensure the accuracy of these innovative solutions, big data is indispensable for the iteration of the solutions. At the same time, cybersecurity becomes another important concern in view of cyberattacks. Apart from legislation to

protect our privacy, sharing of data among the society can connect people to form a robust "firewall" to screen out the attacks.

In Hong Kong, a number of plans were formulated to shape the development towards 2030, including the Smart City Blueprint and Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030. Incorporating the lesson learnt from New York can further make the plans more robust and prepare Hong Kong for the future challenges.

Blue green infrastructure and sponge city concepts have been promoted by the Drainage Services Department in urban and rural areas, respectively, in recent years to build climate resilience in drainage infrastructure. To further enhance the social resilience in the community,

involvement of public in the infrastructural projects will be an essential element to connect the individuals in the community to the infrastructure. On the other hand, technologies like building information modelling and virtual reality have been introduced to the engineering fields to visualize the products during design stage. Not only can the introduction of generative design approach help engineers to explore unlimited possible design solutions, but also better manage the expectation on final outcome by incorporating augmented reality. As data is a key to the generative design approach, installation of sensors will be next hot topic, in order to capture information for improving the models. Information will be limited without sharing. In addition to government policies and legislation, building up trust in the community will form the platform for data sharing and nurturing the big data environment.

Conclusion



Annex





Ir Thomas K C CHAN
Vice President,
The HKIE

Ir CHAN is a Registered Professional Engineer in Electrical and Building Services Disciplines. He is also a Fellow of The Institute of Healthcare Engineering and Estate Management (IHEEM), The Chartered Institution of Building Services Engineers (CIBSE) and The Institution of Engineering and Technology (IET). Ir CHAN has over 34 years of solid experience in the field of power and building services engineering involving in numerous major prestigious building developments and power projects in the Asia Region. He is currently a Director, Building MEP, China Region of WSP (Asia) Limited, a renowned international engineering consultancy company.



Ir Dr Philco N K Wong
Senior Vice President,
The HKIE

Ir Dr Wong is a chartered engineer who has over 35 years of experience in large-scale infrastructure projects in Hong Kong, the Mainland of China and overseas. He is currently the Projects Director of MTR Corporation responsible for the delivery of new railway projects from design to completion.

Ir Dr Wong is enthusiastic in participating in community and professional services. He is a Fellow of Hong Kong Institution of Engineers and the Institution of Civil Engineers in the United Kingdom. He is the chairman of the Benevolent Fund Committee of The Lighthouse Club. He is also currently an adjunct professor in the school of civil Engineering of Tsinghua University in Beijing.



Ir Ringo S M YU
Vice President,
The HKIE

Ir YU is the Founder and Managing Director of Fraser Construction Co., Limited. He is a Professional Engineer and Fellow Engineer in the Civil, Geotechnical and Structural Disciplines of the Hong Kong Institution of Engineers. He is the Geotechnical Division Chairman (2010-11) of the HKIE and Vice President of the 68th Council (2015-16) of Hong Kong Construction Association. With over 30 years of experience working for both the consultants and contractors, Ir YU is actively serving the public in different public bodies: Construction Workers Registration Board, the Hong Kong Institution of Engineers and Employee Compensation Assistance Fund Board.



Ir Dr P L Yuen
Vice President,
The HKIE

Ir Dr PL Yuen joined the Hong Kong Hospital Authority in the 90s as an engineering executive looking after full range of public hospital engineering services up to present. He has an EMBA degree and incited by the 2003 SARS episode an Engineering Doctorate by researching into strengthening of the hospital ventilation for infection control. Professionally he has been devoting on many public hospital construction projects in Hong Kong for nearly 40 years, and involved in recent time the 2016 and 2018 launched two multibillion 10-year hospital construction development plans in Hong Kong.



Ir Dr Otto L T Poon,
BBS, OBE
Past President,
The HKIE

Ir Dr Poon is a Chartered Engineer with over 50 years of E&M engineering experience. He is the Founder and Chairman of ATAL Engineering Group. Over the years, he has been participating in public services both to the community and the engineering profession. He is a Past President of the Hong Kong Institution of Engineers, and Life President of Hong Kong Federation of Electrical and Mechanical Contractors. Presently, he serves as the Chairperson of Lift and Escalator Safety Advisory Committee, Member of Governing Council of Hong Kong Quality Assurance Agency, and Director of the Hong Kong Green Building Council.



Ir Dr C M KOON
Chairman, CPDC,
The HKIE

Ir Dr KOON has more than 35 years of experience in the building construction industry. He is a Fellow of the Hong Kong Institution of Engineers and a chartered engineer of UK institutions. He was the Chairman of Technical Committees for the Code of Practices on Foundations, Precast Concrete Construction, Loadings, Site Safety Supervision and Guidelines for Bamboo Scaffolds. Ir Dr KOON also actively participates in community services. He is the Chairman of the Community Services Committee of the Hong Kong Institution of Engineers, and a member of the Engineers Registration Board.

Profile of Advisors





Ir Tak TANG
Civil Engineering
Delegation Manager

Tak obtained his Master's degree in Civil Engineering and in Public Administration from Imperial College London and the University of Hong Kong, respectively. He acquired professional qualification from professional institutes of Hong Kong and the United Kingdom. He is currently working as an engineer in the Civil Engineering Office of the Hong Kong Government and is responsible for the formulation and implementation of the territory-wide Greening Master Plans. He is now the Deputy Chairman in Session 2017/2018. He has represented Hong Kong young engineers at overseas events, such as Young Engineers of the ASEAN Federation of Engineering Organisations Conference.



Mr Peter BI
Geotechnical Engineering
Deputy Manager

Peter obtained his Master Degree in Civil Engineering in 2012 and Master Degree in Sustainable Energy Future in 2013 at Imperial College London. He is currently working as a Assistant Geotechnical Engineer at ATKINS in Hong Kong office. As part of his training towards a professional Geotechnical and Civil Engineer, Peter has had experiences in designing for excavation and lateral support, site formation works and foundation. Peter believes this delegation will not only enrich his knowledge on technological development and applications on innovation, but also social responsibility of engineers and one's contribution to the world.



Ir Kenneth CHEUNG
Civil Engineering
Deputy Manager

Kenneth obtained his Bachelor of Applied Science in Civil Engineering from the University of British Columbia in Canada and Master of Science from the University of Hong Kong. He is currently working as the Senior Project Engineer of the Third Runway Division in the Hong Kong Airport Authority. He has been actively participating and contributing himself to the HKIE and is the Past Chairman of the HKIE-YMC.



Mr Michael CHAN
Civil Engineering
Secretary

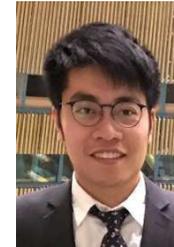
Michael obtained his MSc in Civil Infrastructural Engineering and Management at the Hong Kong University of Science and Technology. He is currently working as an assistant engineer in Black and Veatch Hong Kong Limited. He works under the hydraulics team specializing in the drainage and sewerage division. His roles include conducting assessments associated with drainage and sewerage improvements works with consideration of the effect of climate change.

Michael believes the delegation to New York will be invaluable experience to understand the city planning concept, also to learn how New York is preparing for adaptation to the impacts of climate change.



Mr Ken Wong
Civil Engineering
Treasurer

Ken obtained his Bachelor of Civil and Structural Engineering from the City University of Hong Kong. He is currently working in Water Supplies Department as a Civil Engineering Graduate. He is in civil discipline and responsible for the project of updating of Tung Chung fresh water supply system. He believes that through the delegation he can understand how to prepare Hong Kong to become a global city in future.



Mr Samson PUNG
Civil Engineering
Local Liaison Officer

Samson graduated from The University of Hong Kong and is currently working in AECOM as Assistant Resident Engineer. He belongs to civil engineering discipline and working on Tung Chung New Town Extension (East) project. Samson believes the Delegation could allow him to gain hands-on experience and bring the smart city initiatives to Hong Kong.



Mr John CHAN
Logistics and Transportation Engineering
Local Liaison Officer

John graduated from The Hong Kong Polytechnic University with a Bachelor's Degree in Logistics Engineering with Management. Upon his graduation, he joined Hong Kong Logistics Technology & Systems Limited as a Graduate Engineer and mainly participated in projects of logistics consulting and planning, including automation implementation, equipment throughput & usage analysis, functional layout and traffic flow design, etc. He is also an engineering trainee currently undertaking the HKIE "Scheme A" training.



Mr Thomas LAM
Chemical Engineering
Overseas Liaison Officer

Thomas obtained his Bachelor Degree in Chemical and Environmental Engineering from the Hong Kong University of Science and Technology in 2016. He is currently working in CLP Power Hong Kong Ltd., responsible for the overhaul, modification and maintenance of fuel and material handling systems in power plants. He joined HKIE-YMC as a helper in Session 2016/17 and is now a Committee Member.

Profile of Delegates





Ms Eileen CHENG
Environmental
Engineering
Overseas Liaison
Officer

Eileen obtained her Bachelor Degree in Environment and Sustainable Development from the Hong Kong Polytechnic University. She is currently working as a Graduate Trainee in the ATAL Engineering Limited, and is responsible for projects related to water and solid waste treatment.



Ms Rita LEUNG
Energy Engineering
Overseas Liaison
Officer

Rita obtained her Bachelor of Engineering in Manufacturing Systems Engineering and Master of Science in Energy and Environment from City University of Hong Kong. She is currently working as the Energy Engineer of Siemens (HK) Limited – Building Technologies and focuses on energy efficiency solutions and renewable energy projects.



Mr Stanley LAI
Civil Engineering
Logistics Officer

Stanley obtained his Master Degree in Civil Engineering from the Hong Kong Polytechnic University. He is currently working in Airport Authority Hong Kong and responsible for contract administration and construction supervision for the Three Runway System. He believes this delegation will expand his experience in the future of global city and widen his horizons in different engineering exposures.



Ms Kimmy CHEUNG
Environmental
Engineering
Logistics Officer

Kimmy obtained her Bachelor Degree in Chemical and Environmental Engineering from the Hong Kong University of Science and Technology. She is currently working as an Environmental Engineering Graduate in the Environmental Protection Department of the HKSAR Government and has been involved in various environmental-related projects including the T-Park, Integrated Waste Management Facilities and West New Territories Landfill. As a delegate, she aspires to enhance her global vision in the engineering field.



Ms Clara Sin
Civil Engineering
Logistics Officer

Clara obtained her Master Degree in Sustainable Urban Development from the Hong Kong Polytechnic University. She is currently working in Airport Authority Hong Kong and responsible for construction management and supervision on the new APM depot project. She believes this delegation will enrich her knowledge and experience in city planning and sustainable development in global cities.



Mr Keith CHENG
Mechanical
Engineering
Publication Officer

Keith obtained his Bachelor Degree in Mechanical Engineering from the University of Hong Kong. He is currently working in CLP Engineering Limited as an Engineer Trainee. He is undertaking the HKIE "Scheme A" training and rotating between different engineering departments.



Mr Jerry WONG
Civil Engineering
Publication Officer

Jerry obtained his Bachelor's Degree in Civil Engineering from Hong Kong Polytechnic University. He joined AECOM Transportation after graduation and participated in design of civil engineering projects including highway bridges, footbridges, covered walkways, noise barriers and road drainage. He is currently working as an Assistant Resident Engineer at Anderson Road Quarry Site and is responsible for construction work supervision and contract administration. He believes that the delegation can provide a valuable opportunity to learn from New York's experience in planning and development that is probably applicable to Hong Kong in future.



Ms Sibyl CHUN
Civil Engineering
Publication Officer

Sibyl obtained her Bachelor of Civil Engineering from The Hong Kong Polytechnic University. She is currently working as the Geotechnical Graduate Engineer at AECOM, with design experience of tunnel, reclamation, ELS and site formation among Middle East, South East Asia and Hong Kong. She believes this delegation will enrich her knowledge in global city and inspire her how to utilize her engineering abilities to contribute to the society.



Ir Tak Tang

NYC – what a vibrant and dynamic city! It is my first time to set foot on the Americas and my impression of the NYC based pretty much on the sitcom “Friends”, portraying the metropolitan life and the spirit of the New Yorkers. Touring around the world-renowned museums, jogging in the Central Park, travelling on the subway during rush hour and buying lunch from the food truck were the quickest ways in getting the feel of the urban life. Through which, we could appreciate the many similarities and challenges we share in Hong Kong. The way the New Yorkers embrace the future with optimism and hope is a major driving force in bringing improvements to the city with ingenuity and creativity. We try to capture some of the insights in this report and apply to what we do in Hong Kong. The success of this research has been a true testament to the commitment and the hard work of the team since the drafting of the proposal as early as July 2017. I cannot thank enough the people who have helped us along the way. I feel proud to have gained this experience with a wonderful team of caring, smart and diligent young engineers who supported one another throughout the journey.

Ms Kimmy Cheung

I have always been fascinated by the prescient advancement of New York as one of the world-leading global cities, and this memorable Delegation witness its successful achievement in person. I was particularly impressed by the transformation of New York from a resistant to a resilient city in hope to cope with the forthcoming acute shocks and chronic stresses brought about by climate change through a combination of city planning, engineering solutions and social enhancement. The international exposure and experience we have gained throughout the journey will help us as young engineering professionals to contribute to the future development of Hong Kong into one of the smartest cities.

I would also like to take this opportunity to express my gratitude to our advisors, Young Member Committee and the 15 delegates for their concerted effort in making the Delegation a success.

Ms Eileen Cheng

The delegation to New York is a truly inspiring one as we looked into key elements for the future of global cities. All the technical seminars and visits in Hong Kong and New York enable us to explore the joint effort from private and public sectors in both cities so that they could evolve into smart, innovative and resilient ones. At the same time, cyber threats may increase when cities embrace smart city technologies. Through the research, studies, conversations and exchange conducted throughout the delegation, I am able to gain insights and learn concepts that I would not have been obtained without the delegation.

I am really thankful to be part of the Overseas Delegation 2018. Special thanks to all the organisations and speakers in supporting the delegation, and I would also like to thank all the delegates for making this meaningful journey happens.

Ms Sibyl Chun

The HKIE YMC Overseas Delegation to New York is an unforgettable learning and traveling experience for me. The delegation is a way of travelling that enrich my growth in leadership, presentation and management. I especially enjoy the planning process of our study area in cyber security which allows me to explore a new field through critical thinking and in-depth discussion with my teammates. The visits and technical seminars in both Hong Kong and New York were all technically intensive and their inspiring ideas reminded me there is always a better way to do things. I will keep that in mind to make my work and life more fruitful and meaningful!

I am very glad to be participated in the Overseas Delegation 2018. I really appreciate to all the organisations and speakers for their effort to enrich our learning experience. Special thanks to all the delegates who walked with me through this wonderful journey.

Ms Clara Sin

Hong Kong and New York are both popular global cities and that people like to compare the development and infrastructures. It is my honor to join this delegation so I can experience the NYC styles of living in this 9-day trip. Through the dialogues with the professionals and governmental officers during the trips, I started to think about what we as engineers can learn from New York's experience to contribute to transforming Hong Kong into a future global city. We gained insights on three focus areas which we found that are key factors in making global cities. I was impressed by the “Rebuild by Design” projects that the state government was willing to engage the citizens in the design of infrastructures.

I would like to thank the team, who made this trip a wonderful and memorable one. I hope we all can contribute to the society with the experience we gained from this trip and make Hong Kong a better global city.

Mr Michael Chan

This delegation to New York completed my puzzle of “Nylonkong”, I have always been curious on how a small city like Hong Kong can be comparable to the major cities with the likes of New York and London. This trip went far beyond my expectations, it was not merely a regular traveling trip but an appreciation of the similarities and differences between both cities throughout the exchanges sessions. After all, size does not matter, somewhere that cannot even be distinguished on the map can still shine on the global stage. I can proudly say I am from Hong Kong. I cannot express my gratitude enough to the team. There had been moments of highs and lows but at the end of the day, it is friendship between the 16 delegates. I have never regretted to join the trip despite its strong commitment, otherwise I would have missed out on the sceneries, friendships, self development and last but not least a life coach.

Mr John CHAN

New York, as one of the world leading global cities, shares a lot of similarities with Hong Kong in terms of living style, development and challenges facing. This is a memorable and honorable experience to be a part of the HKIE-YMC overseas delegates. This delegation provided a great engineering exposure on the technological applications will be used in our future cities, from building management to transportation system planning, from environment preservation to community security, there are a lot of “smart” development taking in part. I hope to leverage the knowledge and experience gained to contribute the society of Hong Kong by introducing advanced technologies, especially in the logistics and transportation discipline.

Mr Ken Wong

The delegation to New York is really an inspiring one which allowed us to explore the essential features of a future global city. Through the delegation, not only could we look into the application of innovative solutions in the social infrastructure, but also appreciate the commitment to build New York City as a resilient city after hit by Hurricane Sandy. Impressed by Rebuild by Design project, I appreciated the collaboration mode among the expertise and citizens, and the dedication of the project teams to involve the affected community in the projects.

It is an honour to be part of the Delegation team. I would like to thank the delegation team, who spent a lot of effort and made the delegation wonderful and unforgettable. After the tour, we are looking forward to contributing to preparing Hong Kong as an innovative and resilient city for the future.





Acknowledgement

We would like to express our deepest gratitude to the following organisations for their helpful guidance and enduring support leading to the success of this Delegation:

American Society of Civil Engineers	New York City Mayor's Office of the Chief Technology Officer
Autodesk – The Living	New York University's Centre of Cybersecurity
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City of Hoboken	PricewaterhouseCoopers Advisory Services Limited
Civil Engineering and Development Department	Rebuild by Design
Friends of High Line	Siemens - MindSphere Application Centre
Highways Department	Thales USA
Hong Kong University	Hong Kong Applied Science and Technology Research Institute
Logistics and Supply Chain Management	The New NY Bridge
MTR Corporation Limited	U.S. Green Building Council
New York City Department of City Planning	United Nations
New York City Department of Transportation	Vaughn College of Aeronautics and Technology

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Mr Keith CHU	Mr Caleb D. STRATTION	Mr Adam DEVITO
Mr Edward MANDELL	Ms Jennifer S. GONZALEZ	Mr Mafuzul MASHUD
Mr Michael J. BRADY	Ms Mary KIMBALL	Ms Kristin CHU



Acronyms

100RC	100 Resilient Cities
AR5	Fifth Assessment Report
ATSC	Advanced Solid State Traffic Controllers
BEAM	Building Environmental Assessment Method
CCSG	Centre for Civil Society and Governance
CERT	Computer Emergency Response Team
CFI	Cybersecurity Fortification Initiative
CI/KR	Critical Infrastructure Key Resource
CISP	Cyberattack Intelligence Sharing Platform
Col CSD	Collaboration Teams of Cyber Security Division
CSIP	Cyber Security Information Portal
CSTCB	Cybersecurity and Technology Crime Bureau
DOT	Department of Transportation
DSD	Drainage Services Department
EISO	Enterprise Information Security Office
GN10	Guidance Note on Corporate Governance
GovCERT	Government Computer Emergency Response Team
HAD	Home Affairs Department
HKCERT	Hong Kong Computer Emergency Response Team Coordination Centre
HKO	Hong Kong Observatory
HKPC	Hong Kong Productivity Council
HK SAR	Hong Kong Special Administrative Region
HKSTP	Hong Kong Science and Technology Parks Corporation
HUD	US Department of Housing and Urban Development
IAP2	International Association for Public Participation
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change
ISAC	Information Sharing and Analysis Centre
ISIRTs	Information Security Incident Response Teams
ITS	Intelligent Transport System
IVUs	Integrated In-Vehicle Units
LEED	Leadership in Energy and Environmental Design
MOGA	Multi-objective Genetic Algorithm
NYC	New York City
NYCDOT	New York City Department of Transportation
NYDEC	New York Department of Environmental Conservation
OGCIO	The Office of the Government Chief Information Officer
OneNYC	One New York: The Plan for Strong and Just City
SGR City Strategy	Hong Kong 2030+: A Smart, Green, Resilient City Strategy
UN	United Nations
USGBC	United States Green Building Council
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle



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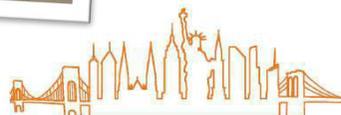


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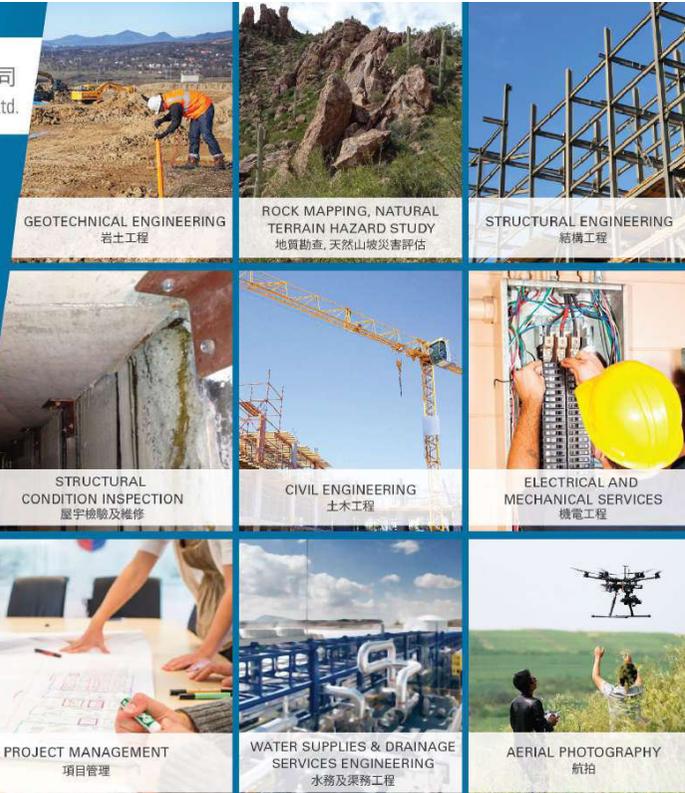
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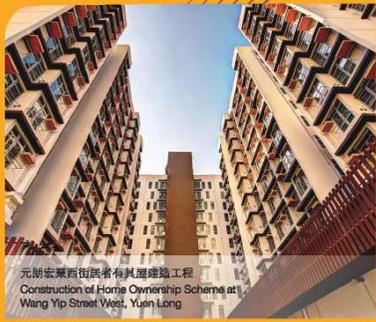
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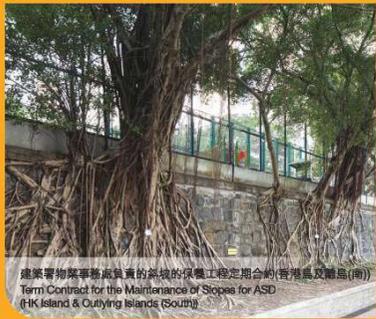
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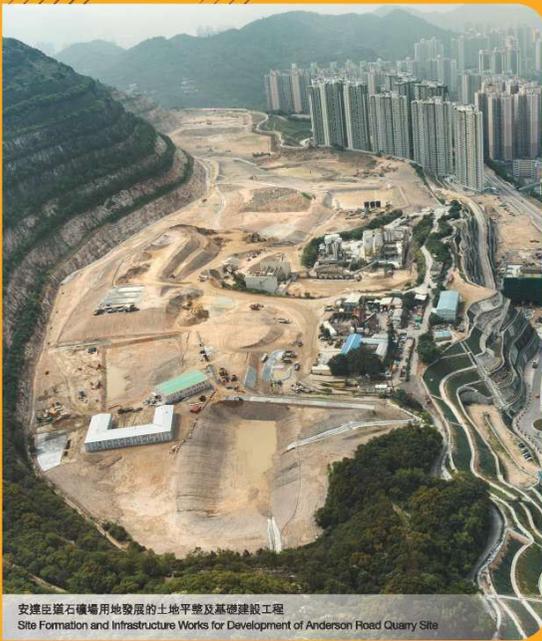
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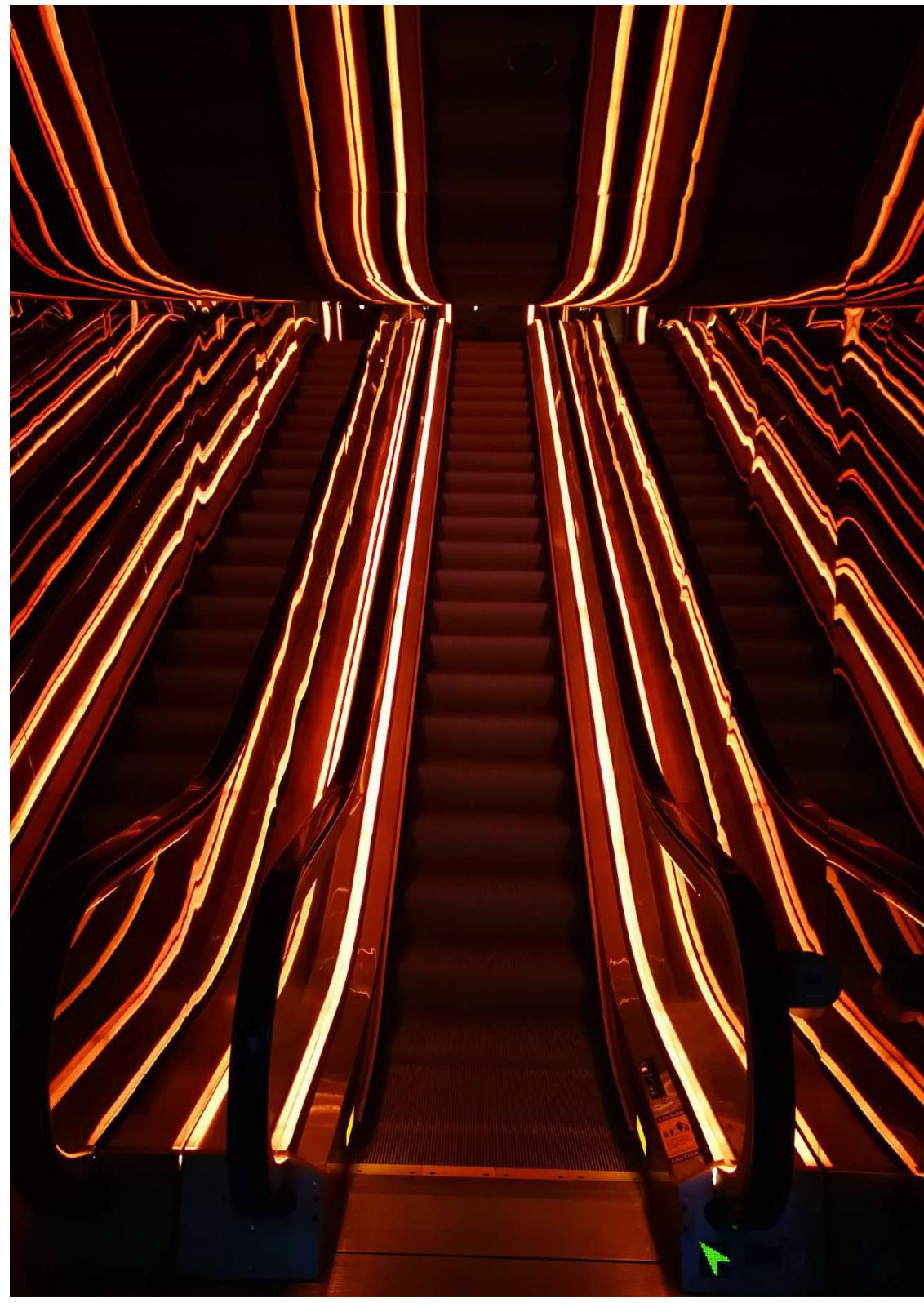
元朗宏業西街長者住屋興建工程
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安達臣道石礦場用地發展的土地平整及基礎建設工程
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