

Research Grants Council of Hong Kong
Hong Kong – Scotland Partners in Post Doctoral Research
Completion Report

Part A (To be completed by the Awardee)

1. General Information

Name: Dr. Fung, Ivan Wing Hong 馮穎匡博士

Home Institution: Department of Civil & Architectural Engineering,
City University of Hong Kong

Project Period: 5 June, 2013 to 5 Jan, 2014

Project Title: Sustainable Development in Building and Construction: -
Evaluation of Existence Value of Private Ageing Buildings from
social, environmental and physical perspectives

Host Institution: Institute of Building and Urban Design,
School of the Built Environment
Heriot-Watt University (HWU), Edinburgh, Scotland, U.K.

2. Summary of Fellowship

2.1 Objectives as per original application

1. to provide an understanding of the life-cycle of buildings and proposes the following new dimensions in evaluating sustainable development; &
2. to evaluate the existence value of private ageing buildings from the social, environmental and physical perspectives

3. Research Outcome

3.1 Major findings and research outcome

(maximum one page; please make reference to Part 2.1 where necessary)

Acknowledgements:

More than 1 year ago, advised by *Professor Liew K M* and other top management staff (e.g. *Provost*) at CityU, I am better to have more research collaboration and other scholar activities with overseas University and organization. Then, I had planned immediately and to be more actively in connecting overseas professionals and senior academic scholars, finally, with the help of *Professor Liew K M*, *Professor Andrew Leung* and *Professor S M Lo*, I can apply sabbatical leave (8 months) as the Visiting Scholar in HWU, Edinburgh, also with the prompt acceptance of *Professor Stephen Ogunlana* from the host university at Scotland.

However, according to the policy of CityU, no sabbatical leave for Lecturer grade. But with the help of *Prof. Liew KM* and other senior staff/ office staff at CA dept. *Prudence Lau*, staff from RO (*Cecilia Sun*) and HRO (*Katharine Lau*), etc., they were fight for me for this programme and finally, I were granted 8 months leave (incl. pre-used annual leave and no-pay leave, subjected to many complex calculations and exemptions, also communicated by many in-and-out emails)

I want to say thank you here! Many thanks to all. Sorry for the inconvenience and disturbance caused at the special arrangement for me.

Major Findings of Objective 1 (as per original):

Sustainable Development in Building and Construction: - Evaluation of Existence Value of Private Ageing Buildings from social, environmental and physical perspectives

It summarised the problems and findings of urban renewal in HK/UK as:

Site Assembly: Multiple ownership makes it difficult to assemble individual properties into lots for comprehensive re-development; numerous separate legal interests have to be acquired first. This is difficult and sometimes impossible.

Relocation: Urban redevelopment necessitates relocation of residents and businesses, resulting in high financial and social costs. The amended Landlord and

Tenant (Consolidation) Ordinance, 1996, has increased the compensation rate for dispossessed domestic tenants.

Viability: There is a belief that redevelopment must be highly profitable. This may have been the case, but is no longer necessarily the case. The value of redeveloped properties may not cover redevelopment costs, particularly when there is little or no increase, and even a reduction in development density after redevelopment.

It is better to have 'people first' policy, based on four principles:

- 1) owners will receive fair compensation,
- 2) all displaced tenants will be rehoused,
- 3) adverse impacts will be minimised, and
- 4) the community must benefit (through upgraded facilities).

The issues and problems identified by the UK government are similar to those addressed in urban renewal projects worldwide. Hong Kong's situation seems a unique confluence of factors: a rapidly aging population in a relatively wealthy society with a highly skewed wealth and income distributions; a rapidly aging housing stock; limited land availability (and, hence, relatively high prices); heavy private sector involvement; and a relatively immobile population. In other parts of East and Southeast Asia (notably Japan, Taiwan, South Korea and Singapore) urban renewal has faced these issues, but rarely in this combination. This poses a significant challenge for the URA.

Urban renewal in the form envisaged by the URA will be a policy improvement over the 'slum clearance' or 'environmental improvement area' projects of the past. Nonetheless it is only one way of addressing the issue of ageing buildings. The well-being of the city and its residents, as well as its aesthetic beauty would be better served if alternative ways can also be found to complement urban renewal. The URA has recognised that without proper building maintenance, the problem of building decay will continue, and that this cannot be resolved by redevelopment alone. Thus it also includes strategies for rehabilitation and preservation. Consistent with this, we believe that research should also cover building maintenance and renovation. Appropriate and timely maintenance and renovation have the potential of rejuvenating buildings to prolong their serviceability on the one hand, and on the other hand, to minimize the social and disruption costs associated with urban renewal, such as re-housing, costs of compensation, social unrest and adverse political reactions.

Other findings of another *additional* Objectives are still under preparation.

- 3.2 Potential for further development of the research and the proposed course of action
(maximum half a page)

For Objective 1 (as per original)

On completion of the project, we intend to involve the collaboration of owners' corporations, developers, contractors, management companies, bankers, insurers and government departments on the rejuvenation of Hong Kong and Scottish old buildings. In addition, we envisage extending the research on urban renewal to cover issues of redevelopment and town planning. As already mentioned, at the end of the first area study, we intend to carry out a social impact study and apply for funding from other sources (e.g., Planning and Lands Bureau). In due course we aim at applying for grants from the next GRF funding at 2015/2016.

Another further developments will be done at the mentioned funded projects (refer to section 2.8.)

4. **The Layman's Summary**

(describe in layman's language the nature, significance and value of the research project, in no more than 200 words)

Ageing buildings raise problems as well as opportunities for societal development. Urban renewal, including the rejuvenation of buildings, is a long-standing but under-studied phenomenon in developed countries. In many developing countries, it is only now that first-generation ageing housing complexes are becoming a significant concern for urban planners.

Hong Kong and Scotland are societies where urban renewal is now on the agenda, and decisions and practices taken here will have an impact throughout the region.

There are thousands of ageing buildings in Hong Kong and Scotland. The number of tenants and owners affected is of course much larger. This human dimension is also linked to poverty, as many ageing buildings are providing 'cheap' housing for low-income people, many of whom are elderly people. The focus of this study is local (HK and UK), the issues it deals with are global, and the findings will advance theoretical understanding as well as inform policy formulation and implementation. We envisage the research will lead to publications in local and international journals. Other deliverables include a value age index calculation, journal/conference paper and various presentations to government bodies. In the longer run, CityU's inter-disciplinary research infrastructure in construction, human psychology, social welfare, and inter-region studies will be strengthened to deal with the increasingly important issues of ageing buildings and people. With the outcome of research, we are in a good position to provide evidence-based advice to the Government and the Legislative Council on the topic of ageing buildings.

5. **Peer-reviewed journal publication(s) arising directly from this research project**
(Please attach a copy of each publication and/or the letter of acceptance. All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

For Area No. 1 : Sustainable Environment (as original objective)

The Latest Status of Publications				Author(s)	
Year of publication	Year of Acceptance (For paper accepted but not yet published)	Under Review	Under Preparation (optional)	(bold the authors belonging to the project teams and denote the corresponding author with an asterisk*)	
		<input checked="" type="checkbox"/>		Vivian W. Y. Tam* and Ivan W. H. Fung	
Title and Journal/Book (with the volume, pages and other necessary publishing details specified)				Attached to this report (Yes or No)	Acknowledged the support of this Joint Research Scheme (Yes or No)
Adaptive reuse in sustainable development: an empirical study of Lui Seng Chun building <i>Journal of Professional Issues in Engineering Education and Practice, ASCE</i> (SCI: 0.439 (B+))				Yes (Appendix 1)	Yes (Acknowledged at pp. 29)

The Latest Status of Publications				Author(s)	
Year of publication	Year of Acceptance (For paper accepted but not yet published)	Under Review	Under Preparation (optional)	(bold the authors belonging to the project teams and denote the corresponding author with an asterisk*)	
		<input checked="" type="checkbox"/> After 1 st revision		Vivian W. Y. Tam* , Ivan W. H. Fung , Michael C.P. Sing and Stephen O. Ogunlana	
Title and Journal/Book (with the volume, pages and other necessary publishing details specified)				Attached to this report (Yes or No)	Acknowledged the support of this Joint Research Scheme (Yes or No)
Best Practice of Prefabrication Implementation in the Hong Kong Public and Private Sectors <i>Journal of Cleaner Production, Elsevier</i> (SCI: 3.69, (A+))				Yes (Appendix 2)	Yes (Acknowledged at pp. 25)

For Area No. 4: System Dynamics & System Safety (New)

The Latest Status of Publications				Author(s)	
Year of publication	Year of Acceptance <i>(For paper accepted but not yet published)</i>	Under Review	Under Preparation <i>(optional)</i>	<i>(bold the authors belonging to the project teams and denote the corresponding author with an asterisk*)</i>	
		<input checked="" type="checkbox"/>		Ivan W. H. Fung* , Michael C.P.Sing and Eric W M Lee (2014)	
Title and Journal/Book <i>(with the volume, pages and other necessary publishing details specified)</i>				Attached to this report <i>(Yes or No)</i>	Acknowledged the support of this Joint Research Scheme <i>(Yes or No)</i>
Design and Development of Construction Safety Planning Model for BIM in Hong Kong Construction Industry <i>Safety Science</i> <i>(SCI: 1.426 (B+))</i>				Yes (Appendix 3)	Yes (Acknowledged at pp. 22)

6. Recognized international conference(s) in which paper(s) related to this research project was/were delivered *(Please attach a copy of each conference abstract/paper)*

For Area No. 4: System Dynamics & System Safety (New)

Month/Year/ Place	Title	
August, 2013 Pakistan	Keynote Conference Paper: How Much Does Safety Matter To A Starving Construction Worker? Ramya Kanaganayagam, Stephen O Ogunlana and <u>Ivan W H Fung*</u> (2013)	
	Conference Name	Attached to this report <i>(Yes or No)</i>
		Acknowledged the support of this Joint Research Scheme <i>(Yes or No)</i>
	International Conference on Safety, Construction Engineering and Project Management- Issues, Challenges and Opportunities in Developing Countries, August 19-21, 2013 Islamabad, Pakistan.	Yes (Appendix 4)
		No

Month/Year/ Place	Title	
Jan, 2014 Nigeria	Invited Conference Paper: Psychological climate in Occupational Safety and Health: Safety awareness of construction workers in South China <u>Ivan W H Fung*</u> , Stephen O Ogunlana and Karen K W Tang (2014)	
	Conference Name	Attached to this report <i>(Yes or No)</i>
		Acknowledged the support of this Joint Research Scheme <i>(Yes or No)</i>
	CIB W107, Construction in developing countries and its contribution to sustainable development, 28-30 Jan 2014, Lagos, Nigeria. Orchid Hotels & Event Centre	Yes (Appendix 5)
		Yes (Acknowledged at pp. 490)

Month/Year/ Place	Title		
June, 2014 Sweden	<u>Accepted</u> Conference Paper: Development of Interactive Mobile Apps of Risk Assessment for Safety Officers in Hong Kong Construction Industry Ivan W H Fung* , Stephen O Ogunlana and Kaman K M Wong (2014)		
	Conference Name	Attached to this report (Yes or No)	Acknowledged the support of this Joint Research Scheme (Yes or No)
	CIB W099 International Conference on Achieving Sustainable Construction Health and Safety, 2-3 June 2014, Lund, Sweden, Ingvar Kamprad Design Centre (IKDC)	Yes (Appendix 6) (Abstract only)	Yes (To be added)

Book Chapter :

Month/Year/ Place	Title		
To be confirmed	<u>Proposed</u> Book Chapter: Modern Risk Management Software and Programmes Ivan W H Fung* and Tori Basher		
	Book Name	Attached to this report (Yes or No)	Acknowledged the support of this Joint Research Scheme (Yes or No)
	Risk Management in Engineering and Construction: State of the art tools and techniques Editor and Main Authors: Prof. Stephen Ogunlana and Prof. Prasanta Dey Publisher: Taylor & Francis	No (under preparation)	Yes (to be added)

7. Other impact (e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, etc.)

From the additional areas stated as section 2.2, which create the other impacts and give me to collaborate with the following research institutions:



Host Institution:

Heriot-Watt University (HWU), Edinburgh, Scotland, U.K.

Other Institutions:

- 1) School of Computing, Engineering and Mathematics, **University of Western Sydney, Australia**
- 2) **Curtin University Australia, Kent Street, Bentley, Perth, Western Australia**
- 3) **Culham Centre for Fusion Energy (CCFE), UK**
- 4) **Bristol - Oxford Nuclear Energy Centre, UK**
- 5) **Aston Business School, Aston University, UK**
- 6) **Department of Environment and Technology, University of the West of England, UK**
- 7) **Management School, Lancaster University, UK**
- 8) **Institute of Health and Wellbeing, University of Glasgow, UK**
- 9) **The Centre for the Social History of Health and Health Care, University of Strathclyde, Glasgow, UK**
- 10) **Radioactive Wastage Management Unit, Harwell Oxford, UK**
- 11) **State Administration of Work Safety, P.R. China**
- 12) **International Research Institute of Disaster Science, Japan**

Outputs led by this fellowship programme:

TDG Project drafted and awarded within the project period at UK, approved by EDGE,

TDG No. 6000455 (on-going)

Project Number 6000455

Title Off-campus Experiential e-Learning for Students during Construction Site Visits: Development of Innovative Mobile App in Safety Audit for Civil and Construction Projects

Principal Investigator Dr. Ivan Wing-hong FUNG (CA)

Associate Investigator Dr. Chun Hung YUEN (CS)

External Investigator Prof. Stephen O. OGUNLANA (Heriot-Watt University, UK)

Synopsis

Accidents and deaths at construction sites have risen in the past few years, reaching 3,160 accidents with 24 fatalities last year - the highest in the past seven years. Safety audit is considered as a systematic tool to monitor the effectiveness of safety management performance of the civil and building construction industry. It is indicated that there is a lack of responsive or interactive instrument to assist civil and construction students the learning of effective safety and risk assessment on-site practices in civil engineering and building construction project. Current textbooks/ notes are primarily text-based standalone check-sheet type tools which are either accessed via paper or software interface at workstations. Nowadays, the current and growing movement of mobile applications in the construction technology curriculum [e.g. 4-D ArcGIS (India), ConSafeNet (USA) and 4-D BIM (Finland), etc.] is offering new means and approaches to improve the inefficiencies of paper-based / powerpoint-based learning methods in these areas. Based on the basic concepts of 14 elements of Safety Planning Model (TDG 2011) and the contents of Educational BIM Safety Model (TDG 2012), and aligned with Discovery-Enriched Curriculum (DEC) by EDGE at CityU, a new innovative educational mobile/iPad app for safety audit and risk assessment at construction site, i-safe, will be proposed with intensive student participation.

Along with "Discover & Innovate" culture, the experiential learning mobile app will be developed for construction students together with discovering different scopes of risk assessment at the site visits (e.g. builder's work, civil engineering work and renovation maintenance, alternation and additional work, RMAA, etc.). After providing a series of DEC with D&I activities, such as a new DEC Web equipped with Flipped Classroom concepts, Brainstorming workshops in planned tutorials & lectures, construction students can use i-Safe, with corresponding risk assessment for each scope of construction project/ work (during visiting & studying the real project

sites) by using iPads pre-installed, and finally draft the Safety and Risk Audit Report to that specific sites. Student, like an actual safety inspector on site, will learn what it means to create new knowledge in risk assessment, how to communicate it, curate it, and cultivate it to benefit construction company through this type of off-campus experiential e-learning! Finally, selected output of the student report submission will be sent to specific construction site management team for their references, comments and even action! (which can encourage students in active learning!) All comments will be delivered to the students for feedbacks. Selected good reports will be participated in OSHC Best Project Award Competition 2015-16, yearly held by Occupational Safety and Health Council in Hong Kong in terms of public and professional assessment.

Grant Type	CityU Teaching Development Grant (TDG(CityU))
Discipline	Civil Engineering, Building Surveying and Construction (7)
Status	On-going
Approval Date	22-Oct-2013
Commencement Date	01-Nov-2013
Scheduled Completion Date	30-Apr-2015 (18)

New ideas generated with the Research Group in Campus of HWU, Scotland, UK:

Next ITF Proposal 2015:

Proposed Title:

The development of RFID-based Total Project Management System for High-rise Building Construction

無線射頻識別(RFID)全天候項目管理系統之研發

Proposed Abstract:

Radio frequency identification (RFID) technology is currently being used in such areas as agriculture, athletics, manufacturing, security and law enforcement, and transportation, but few applications have been developed that are related to the civil and building construction sites in Hong Kong. Especially no application considered for high-rise building construction in congested site area, which creates intensive labour and material logistics, with also safety problems.

Lack of standardisation, additional costs of implementation, slow technology development and deployment risks, and the lack of skilled labour are all contributors currently preventing the adoption of new RFID technologies in the construction industry in Hong Kong.

This project propose to integrate some main construction processes for applying RFID in Total Project Management (TPM). A large number of scenarios can be formulated but for better utilize, they will be distilled into representative ones including management of Materials, Men (labour and

other personnel), and Machinery (MMM). It is known that that up to 70% of the overall construction cost is direct cost relating to materials, men, and machinery. Our product, a computerized RFID-TPM system, also equipped with innovative sense (e.g. using Genetic Algorithm-based Model to optimize the multi-level layout planning of material logistics) and matched with most recent technology (e.g. using Near Field Communication technology, NFC as a safety risk assessment tool) is to manage materials, men, and machinery in more effective, safe, fast manner and with higher productivity by one single platform. And together to bring about better creativity and competitiveness to the industry.

The final system should be validated by real projects with the helps of several construction companies for test, seek improvements and maintain its sustainability.

Future studies are recommended as integrating itself (1) with the developments of RFID in other industries, (2) with Building Information Model (BIM), and (3) with people, project, and process in construction.

Dr. Ivan Fung will revise the lecture notes for CityU CA student by referring *Prof. Stephen Ogunlana's* references: (subject to be reviewed and approved)

For example, the notes of Construction Management area (related course CA3411, CA4412, etc.)

For the area of "Theories of Accident Causation", can be extended to 8 more items: (as original, only the first 3 items):

- Domino Theory of Accident Causation (original)
- Human Factors Theory of Accident Causation (original)
- Accident/Incident Theory of Accident Causation (original)
- Epidemiological Theory of Accident Causation (new)
- Systems Theory of Accident Causation (new)
- Combination Theory of Accident Causation (new)
- Behavioral Theory of Accident Causation (new)
- Drugs and Accident Causation (new)
- Depression and Accident Causation (new)
- Management Failures and Accident Causation (new)
- Obesity and Accident Causation (new)