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APPENDICES

APPENDIX A: QUESTIONNAIRE

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……

Dear Sir / Madam,

Regarding Dissertation – MSc in Project Management

I am a post graduate candidate in Project Management at University of Moratuwa. Currently, I am conducting dissertation research entitled "Application of Off-Site Construction in Sri Lanka".

Your opinion on using off-site construction techniques is crucial to the success of my research. The survey is very straightforward and will take less than 10 minutes. I will deeply appreciate if you complete the survey at your earliest convenience. The participation is completely voluntary, but again I need your help to accomplish this effort.

Please be assured that your response will be held in strictest confidence. Under no circumstance, will your company's information be available to any individual or organization. If you have any questions about this survey, please feel free to contact me at sanjeevan.ravi@gmail.com or 0771125093.

Click the button below to start the survey. Thank you for your participation!

Respectfully requested,
R. Sanjeepan.
Post Graduate Student,
Department of Building Economics,
University of Moratuwa.

Begin Survey

QUESTIONNAIRE SURVEY FOR RESEARCH ON APPLICATION OF OFF-SITE CONSTRUCTION IN SRI LANKA

Introduction

Although the use of offsite methods of construction provides several significant advantages and is a possible solution for addressing time, quality and cost concerns often associated with 'traditional' construction, the use of these methods is limited in the Sri Lankan building industry.

In this study off-site construction techniques are defined as those construction techniques that accomplish off-site applications where building systems or assemblies are manufactured or fabricated away from the building site prior to installation.

The primary aim of this study is to investigate the application of off-site construction, investigate the benefits and to determine the challenges that are encountered in using different types of OSC techniques adopted in the building sector of Sri Lankan construction industry, and find solutions to the challenges that limit the use of these construction techniques. The findings and recommendations of the study would lead to enhance the usage of offsite construction methods in Sri Lanka.

This study is conducted as part of my postgraduate study at Department of Building Economics, Faculty of Architecture, University of Moratuwa. I strongly belief that the participants will provide practical and convincing answers to the questions below and thereby enable me to complete my research successfully. Any confidential information related to your organization's project will be not disclosed in this report or any other document relating to this study. The information provided will be treated with strict confidence. Thank you in advance for your contribution to this research study.

Thank you.

R. Sanjeepan

Post Graduate Student,
Department of Building Economics,
University of Moratuwa.

QUESTIONNAIRE SURVEY FOR RESEARCH ON APPLICATION OF OFF-SITE CONSTRUCTION IN SRI LANKA

Guidelines

Please go through the following guideline before attempting to fill-in the questionnaire in order to assist you and make yourself comfortable to understand.

- **It is not compulsory for you to disclose your name and /or the name of the organisation you are attached to. It is at your discretion to give such information.**
- **Please try to give a genuine opinion when selecting answer for the questions irrespective of personal biases.**
- **In order to clarify ambiguous/less familiar terms relating to this research, a glossary of key words and their meanings are listed below.**

<u>Definition Of Terms</u>

Off-site construction (OSC) are components which are manufactured in a factory and transported to the site to assembly.

Panelized units are produced in a factory and assembled on-site to produce a three dimensional structure. Open panels consist of a skeletal structure only, whereas more advanced panels may include lining material, insulation services, windows, doors, internal wall finishes and external claddings.

Volumetric construction involves the production of three-dimensional modular units in controlled factory conditions prior to transport to site.

Hybrid techniques combine both panelized and volumetric approaches. Typically, volumetric units (sometimes referred to as pods) are used for the highly serviced and more repeatable areas such as kitchens and bathrooms, with the remainder of the dwelling or building constructed using panels.

Sub-assemblies & accessory system include larger components that can be incorporated into either conventionally built or MMC dwellings. These items are not full housing systems and are generally factory made.

QUESTIONNAIRE SURVEY FOR RESEARCH ON APPLICATION OF OFF-SITE CONSTRUCTION IN SRI LANKA

Details Of The Respondent

1. Name of respondent (optional)

2. Name of the organisation employed to (optional)

3. Type of organisation

- ○ Consultant
- ○ Contractor

4. Designation

- ○ Project Manager
- ○ Architect
- ○ Engineer
- ○ Quantity Surveyor
- ○ Other

5. Years of experience in off-site constructions

- ○ Less than 5 years
- ○ 5 to 10 years
- ○ 11 to 15 years
- ○ More than 15 years

6. How will you rate your knowledge in off-site construction techniques?

- ○ Very High
- ○ High
- ○ Average
- ○ Below Average

7. Please indicate your overall satisfaction of your past experience of using off-site construction techniques by selecting the number that best represent your experience.

	Highly Unsatisfied	Unsatisfied	Neither Unsatisfied or Satisfied	Satisfied	Highly Satisfied	Not Experienced
Volumetric Systems	○	○	○	○	○	○
Hybrid Systems	○	○	○	○	○	○
Panelized Systems	○	○	○	○	○	○
Sub-assemblies Systems	○	○	○	○	○	○

QUESTIONNAIRE SURVEY FOR RESEARCH ON APPLICATION OF OFF-SITE CONSTRUCTION IN SRI LANKA

Questionnaire Fill-up

8. What kind of project or building sectors would be more appropriate for each of these offsite construction techniques by your understanding?

	Residential	Commercial	Industrial	Others
Volumetric Constructions	☐	☐	☐	☐
Panelized constructions	☐	☐	☐	☐
Hybrid constructions	☐	☐	☐	☐
Sub-assemblies	☐	☐	☐	☐

9. As a offsite construction practitioners, please tick the following building components that lend themselves easily to prefabrication?

- ☐ Wall Panels
- ☐ Roof Panels
- ☐ Floor Panels
- ☐ Plumbing and service walls
- ☐ Frame structure of the building.

10. On the basis of a cost analysis, which one is more expensive;

- ○ Off-site construction
- ○ In-situ / conventional means of construction

11. Which of these do you prefer?

- ○ Off-site construction
- ○ In-situ / conventional means of construction

12. What are the motivations to use off-site construction techniques in your project?

- [ ] Waste reduction
- [ ] Noise limitation
- [ ] Short 'weather window'
- [ ] Work time and other restrictions in sensitive sites
- [ ] Lack of work space around the building for site storage

13. Did the waste reduction by the off-site construction techniques (OCT) help reduce the total cost of the project?

- [ ] Yes.
- [ ] No.

14. Based on your experience, how significant was the cost reduction due to use of offsite construction?

- [ ] Less than 5%
- [ ] 5 – 10 %
- [ ] 10-15%
- [ ] 15-20%
- [ ] Above 20%

15. Is there the possibility that using offsite construction methods could increase the general contractor's profit margin?

- [ ] Yes.
- [ ] No.

16. How would you describe materials used in place of the traditional materials used in offsite construction?

- [ ] Fragile
- [ ] Sustainable
- [ ] Robust
- [ ] Adequate

17. How significant the following reasons are for your company to use off-site construction techniques. If your firm has not specified off-site construction techniques, please skip this question, and go to next question.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
To compensate for the shortage of skilled craft workers	○	○	○	○	○
To compensate for weather condition	○	○	○	○	○
To reduce design duration	○	○	○	○	○
To reduce construction duration	○	○	○	○	○
To increase product quality	○	○	○	○	○
To reduce overall project cost	○	○	○	○	○
To increase overall labour productivity	○	○	○	○	○
To compensate for the restricted working space onsite	○	○	○	○	○
To reduce material waste generated on site	○	○	○	○	○
To improve project safety performance	○	○	○	○	○
To increase your company's profit margin	○	○	○	○	○
To enhance your company's reputation	○	○	○	○	○
To ensure time certainty	○	○	○	○	○
To ensure cost certainty	○	○	○	○	○
To increase value	○	○	○	○	○
To increase sustainability	○	○	○	○	○
To reduce snagging and defects	○	○	○	○	○

18. How significant are the following reasons that restrain your company from using Off-Site construction techniques.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Company owner restricts using off-site construction techniques	☐	☐	☐	☐	☐
Architect do not specify the use of off-site construction techniques	☐	☐	☐	☐	☐
Local building regulations restrict the use of OSC techniques	☐	☐	☐	☐	☐
Financial institutions restrict the use of OSC techniques	☐	☐	☐	☐	☐
Lack of skilled assembly craft workers onsite	☐	☐	☐	☐	☐
Using OSC techniques will increase the construction cost	☐	☐	☐	☐	☐
Collective bargaining agreement prohibited use of OSC techniques	☐	☐	☐	☐	☐
Limited design options in using off-site construction techniques	☐	☐	☐	☐	☐
Inability to make changes in the field by using OSC techniques	☐	☐	☐	☐	☐
Transportation restraints	☐	☐	☐	☐	☐
Longer lead-in time	☐	☐	☐	☐	☐
Negative image	☐	☐	☐	☐	☐
Lake of guidance and information	☐	☐	☐	☐	☐
Unable to freeze design early on	☐	☐	☐	☐	☐
Complex interfacing between systems	☐	☐	☐	☐	☐

19. Please select the most critical off-site construction challenges (overall) from the list. Then, tick the relevant OSC methods to indicate their level of impact is high in particular OSC method. *(Eg. If the Challenge 1 is a critical OSC challenge and its impact is high in volumetric system, then tick both Critical challenge & Volumetric boxes)*

	Challenges	Sub - Assembly	Volumetric	Hybrid	Panel	Sub - Assembly
Industry Structure and Supply Chain	Defects during transportation	☐	☐	☐	☐	☐
	Existing factories' capability for manufacturing parts	☐	☐	☐	☐	☐
	Difficulty to the storage of prefabricated elements	☐	☐	☐	☐	☐
	Lack of manufacturers and suppliers of prefabricated components	☐	☐	☐	☐	☐
	Lack of experienced collaboration groups	☐	☐	☐	☐	☐
	The fragmented nature of the construction industry	☐	☐	☐	☐	☐
	Transportation of prefabricated elements and access to the building site	☐	☐	☐	☐	☐
	Lack of experienced contractors on prefabrication	☐	☐	☐	☐	☐
	Lack of practices and experiences from local projects	☐	☐	☐	☐	☐
	Suppliers fail to deliver on time	☐	☐	☐	☐	☐
	Suppliers fail to deliver correct components	☐	☐	☐	☐	☐
	Losing factory production slot/production capacity	☐	☐	☐	☐	☐
	Monopoly of techniques	☐	☐	☐	☐	☐
	Poor integration for the supply chain	☐	☐	☐	☐	☐
	Lack of experienced design consultancy and designers	☐	☐	☐	☐	☐
	Longer lead-in time for OSC components	☐	☐	☐	☐	☐
	Irregular features	☐	☐	☐	☐	☐
	Organizational mechanism and culture	☐	☐	☐	☐	☐
	Low infrastructure	☐	☐	☐	☐	☐
	Low productivity	☐	☐	☐	☐	☐

Constructability Implementation	High skill demands for labour	☐	☐	☐	☐	☐
	Problem between joints	☐	☐	☐	☐	☐
	Specific demands for the site logistics for pre-finished elements protection	☐	☐	☐	☐	☐
	Corrosion and defect in reinforcement	☐	☐	☐	☐	☐
	Foundations inaccurate/ unsuitable	☐	☐	☐	☐	☐
	Damage to key pre-assemblies or critical components	☐	☐	☐	☐	☐
	Cracks	☐	☐	☐	☐	☐
	Tower crane position	☐	☐	☐	☐	☐
	Design not suited to construction method	☐	☐	☐	☐	☐
	Water penetrations	☐	☐	☐	☐	☐
	Defects at handover/during liability period	☐	☐	☐	☐	☐
	Highly restrictive construction tolerances	☐	☐	☐	☐	☐
	Inability to make changes in the field	☐	☐	☐	☐	☐
Architectural Performance	Unable to modify design scheme	☐	☐	☐	☐	☐
	Monotonous design with poor aesthetic criteria	☐	☐	☐	☐	☐
	Lack of enough flexibility	☐	☐	☐	☐	☐
	Quality assurance	☐	☐	☐	☐	☐
	Increase in complexity for maintenance	☐	☐	☐	☐	☐
	Structural bulkiness	☐	☐	☐	☐	☐
	Off-site construction techniques limits design options	☐	☐	☐	☐	☐

Cost	High initial & capital cost	☐	☐	☐	☐	☐
	Longer capital payback period	☐	☐	☐	☐	☐
	Increased cost due to higher quality/rapid construction	☐	☐	☐	☐	☐
	Difficulty of bidding price from contractors	☐	☐	☐	☐	☐
	Error and mistakes in documentation and taking-off	☐	☐	☐	☐	☐
	Price fluctuations during the construction phase	☐	☐	☐	☐	☐
	Off-site construction techniques increases design cost.	☐	☐	☐	☐	☐
	Additional cost and care required when manufacturing	☐	☐	☐	☐	☐
	Increase in designer fees	☐	☐	☐	☐	☐
Policies and Regulations	Lack of design codes and standards for prefabricated components	☐	☐	☐	☐	☐
	Lack of governmental regulations and incentives	☐	☐	☐	☐	☐
	The local zoning ordinance restricts the use of off-site construction techniques.	☐	☐	☐	☐	☐
	The local building regulation restricts the use of off-site construction techniques.	☐	☐	☐	☐	☐
	The financial institution restricts the use of off-site construction techniques.	☐	☐	☐	☐	☐
	Legal issues	☐	☐	☐	☐	☐
Technological Innovation	Lack of local R&D institutes and services	☐	☐	☐	☐	☐
	Lack of technologies and testing institute to prefab. components	☐	☐	☐	☐	☐
	Reluctance to innovation and driven	☐	☐	☐	☐	☐
	Designing off-site construction components requires special computer software.	☐	☐	☐	☐	☐
	Poor technology	☐	☐	☐	☐	☐
	Monotony of structure type	☐	☐	☐	☐	☐

Social Climate and Attitudes	The owner's negative perception	☐	☐	☐	☐	☐
	Lack of awareness of prefabrication by the market and public	☐	☐	☐	☐	☐
	Dependence of traditional construction method	☐	☐	☐	☐	☐
	Poor quality impression	☐	☐	☐	☐	☐
	Lack of confidence of the industry in offsite production	☐	☐	☐	☐	☐
	Public preference for use of conventional construction materials	☐	☐	☐	☐	☐
	Durability of prefabricated unproven	☐	☐	☐	☐	☐
	Lessons and attitudinal barriers due to historic failures	☐	☐	☐	☐	☐
Other Challenges	The inability to freeze the design early on	☐	☐	☐	☐	☐
	Project planning and coordination	☐	☐	☐	☐	☐
	Unpredictable planning decisions	☐	☐	☐	☐	☐
	Uncertainty of market demand	☐	☐	☐	☐	☐
	Health and safety hazards	☐	☐	☐	☐	☐
	Project scheduling issues	☐	☐	☐	☐	☐
	Late appointment of contractor/manufacturer	☐	☐	☐	☐	☐
	Manufacturer insolvency	☐	☐	☐	☐	☐
	Potential unemployment issues to workers	☐	☐	☐	☐	☐
	Inefficiency of labours	☐	☐	☐	☐	☐
	Uncertainty of weather condition	☐	☐	☐	☐	☐
	Wastages	☐	☐	☐	☐	☐
	Service installation faults	☐	☐	☐	☐	☐
	Longer lead-in time during design stage	☐	☐	☐	☐	☐