

2011 MSc Research Grant Scheme

Project title: Non destructive evaluation of bonding of CFRP in reinforced concrete retrofitting

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Aims of research: The bond between CFRP sheets and concrete is an important issue that must be considered in order to achieve safe and properly designed CFRP strengthened composite structures. Whilst the CFRP provides enhance properties in flexure and strength, the break of bonding under successive loading will have adversely affect the performance. The primary aims of this research project will be:

- A better understanding about the quality of CFRP bonding at different surface finishes using non-destructive techniques, such as Impact Echo by capturing the shift of natural frequencies.
- Investigate the degradation of bonding under successive loading to monitor the deterioration stage at which the bond starts to break

Description of method: To achieve the core research objectives listed above, the research methodology is divided into six tasks described below:

Task 1: Literature Review

Perform a comprehensive literature review from different parts of the world on CFRP materials including literature on the design and application of CFRP fitted concrete

Task 2: The bond performance of CFRP at different surface finishes

Perform a laboratory study to investigate bonding strength of CFRP laminate and the concrete beams (1200mm X 135mm X 90mm) with various surface finishes such as smooth, rough, voided and damp top surface. Issues such as the sensitivity of Impact Echo on capturing the changes in natural frequencies with single, and multiple layers of CFRP and at different curing stages after fitting CFRP laminates will also be investigated.

Task 3: The degradation of bonding under incremental loading

Perform elemental laboratory tests on CFRP fitted concrete beam to investigate the breaking of bonding at incremental loading. A number of beams will be produced with C35 concrete and will be fitted with a single and double layer CFRP laminate. Each beam will undergo incremental loading and NDT will be performed at each loading case to investigate the shift in natural frequencies.

Task 4: Performance of CFRP bonding

Develop a relationship between layer debonding and natural frequencies from above experimental works supported by vital engineering data and recommendations for further works.

Benefits to structural engineering: The successful completion of this project will give the following key benefits:

- Better understanding of NDT based evaluation of bonding of CFRP in reinforced concrete retrofitting
- Enhanced knowledge on the performance of bond in different surface finishes
- Enhanced knowledge on bond breakage at successive loading
- A potential tool for practicing engineer for NDT based monitoring of CFRP performance in real structures
- Training to postgraduate student to deepen his/her knowledge, and understanding in order to devolve necessary skills for a research degree.

Proposed finish date: 04/2011