BEHAVIOUR OF LINK SLAB WITH FRP REBARS IN JOINTLESS BRIDGE DECKS

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Degree of Master of Science in Structural Engineering

Department of Civil Engineering
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August 2025

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: Date: 25th August 2025

The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisors: Signature of the Supervisors:

Prof. (Mrs.) J.C.P.H. Gamage

Dr. Nadun Alwis

Date: 25th August 2025

DEDICATION

I dedicate this thesis to my family, whose unwavering support, encouragement and love have been my greatest strength throughout this journey. Their unwavering belief in my potential has inspired me to overcome challenges and strive for excellence.

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ABSTRACT

This research investigates the design, structural behaviour and performance of bridge link slabs reinforced with conventional steel and Glass Fibre Reinforced Polymer (GFRP) bars that play a vital role in the development of modern jointless bridge systems. Link slabs are increasingly used to provide continuity between adjacent spans or between the deck and abutments, effectively eliminating traditional expansion joints. This jointless approach enhances the ride quality, reduces long-term maintenance requirements, and significantly improves the durability and structural integrity of bridge systems.

The study specifically focuses on the application of GFRP reinforcement in link slabs, aiming to overcome the limitations associated with steel reinforcement, particularly corrosion-induced deterioration. GFRP bars offer notable advantages, including corrosion resistance, a high tensile strength to weight ratio, and non-magnetic properties. However, their relatively low modulus of elasticity introduces challenges in terms of crack control, deformability, and anchorage performance.

The research methodology comprises experimental testing of link slabs reinforced with both steel and GFRP bars to analyse their flexural behaviour under the moving load from heavy vehicular traffic which is considered as HB load in British codes. Numerical modelling using Finite Element Analysis (FEA) is employed to validate the experimental results and explore additional parameters. Furthermore, a detailed cost analysis is conducted to evaluate the practical feasibility of implementing GFRP reinforced link slabs in the construction industry.

Ultimately, this study aims to demonstrate the viability of GFRP as a durable, low maintenance alternative to traditional steel reinforcement in link slabs, thereby contributing to the advancement of resilient, long-lasting and sustainable bridge infrastructure.

Keywords: Link-slab, GFRP, Bridge-deck, FEA

TABLE OF CONTENTS

LIST OF FIGURES

Figure **Description** **Page**

LIST OF TABLES

Table **Description** **Page**

LIST OF ABBREVIATIONS

Abbreviation	Description
FRP	Fibre Reinforced Polymer
GFRP	Glass Fibre Reinforced Polymer
FEA	Finite Element Analysis
UTM	Universal Testing Machine
ECR	Epoxy Coated Rebar
ECS	Epoxy Coated Steel
HSR	Highway Schedule of Rates
HPFRCC	High Performance Fibre Reinforced Cementitious Composite
ECC	Engineered Cementitious Composites
SHCC	Strain Hardening Cementitious Composite
ABC	Accelerated Bridge Construction
FE	Finite Element

LIST OF APPENDICES