EXPERIMENTAL AND ANALYTICAL STUDY OF VIBRATIONS IN LONG SPAN DECK FLOOR SYSTEMS

by

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Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
IN
CIVIL ENGINEERING

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April 29, 2008
Blacksburg, Virginia

Keywords: Floor Vibrations, Long Span Deck Floor Systems, Natural Frequency, Accelerations

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(ABSTRACT)

Experimental and analytical research was conducted to address the vibration properties of Long Span Deck Floor Systems (LSDFS). The research comprised three stages. In the first part, experimental in-situ tests were conducted on thirteen bays of buildings under construction. The natural frequencies and acceleration responses were captured to observe the vibration behavior of the tested floors.

In the second part, a laboratory footbridge was constructed to determine the fixity level attained at the supports when a LSDFS is supported by CMU walls. For this purpose, the footbridge was tested with three support conditions, and a number of experiments were carried out to determine the dynamic properties of the structure. Static tests using both point and distributed loadings were conducted to measure the deflections at the footbridge midspan. The static test results were compared to the theoretical deflections for a pinned-end beam and a fixed-end beam. Dynamic tests using experimental modal analysis techniques were conducted to determine the natural frequencies and mode shapes of the structure. The measured fundamental natural frequency of the footbridge was compared to the frequencies calculated for a simply supported beam and a beam with fixed ends, to determine the degree of fixity attained in the connection between the LSDFS and the supporting walls.

In the last part of the research, three analytical procedures to predict modal characteristics of long span deck floor systems are studied. Floor frequencies are

calculated using finite element analyses. Two design guides for floor vibration analysis were used to calculate natural frequencies and response accelerations. The predicted results obtained from the analytical methods are compared to the experimental results to determine their accuracy. Recommendations for the use of the analytical methods are provided.

ACKNOWLEDGEMENTS

I would like to extend my gratitude to my advisor, Dr. Thomas Murray, for his patience and guidance during these past two years. When I walked the through his office door the first time, I knew that I was going to meet a wonderful researcher. Now that I am leaving, I can say that that wonderful researcher is also a wonderful human being. His friendship and mentoring will be missed. I must also thank Dr. Samuel Easterling for accepting my invitation to be part of my committee and for supporting my application to the Masters program at Virginia Tech. In addition, I am grateful to Dr. Finley Charney for serving on my committee and for his encouragement to push my intellectual abilities to the limits. I will remember him as the most challenging professor that I have ever had during my student life.

The Fulbright Commission in Ecuador deserves my gratitude as well for giving me an opportunity to attain my professional goals. Without their sponsorship, I could not have pursued my graduate studies in Structural Engineering.

I would also like to thank Metal Dek®, the sponsor of the project, for their financial support.

I would like to recognize the efforts and help of the Structures and Materials Lab technicians, Brett Farmer and Dennis Huffman, during the experimental part of this research. I also want to express my special thanks to my friend and most active member of VTTFV, Brad Davis. His friendship and willingness to guide me during the conduction of my research is greatly appreciated. I would like to thank my friends in Blacksburg: Daniel Axon, Adam Bowland, Sudhir Dahal, Ben Dymond, Sneha Ghate, Stephanie Koch, Bryan Loflin, Justin Marshall, “The Mike,” Jordan Pitt, Nick Redmond, Pratik Shah, Greg Snow, Rakesh Pathak, and Winston Yaw. You guys will be deeply remembered for all the great times we spent together.

My family deserves a special recognition. Their love and support have been my continual source of motivation to pursue my dreams. No matter how far I am from home, their presence is felt every day.

Finally, I thank the Lord for being my companion and guide during this phase of my life.

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