University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

AFIA SIDDIKA IVY

BSc (Military Institute of Science and Technology, 2017)

"Modeling to Support Acceleration of Restoration of a Residential Building System in Southeastern B.C. due to Riverine Flooding"

Department of Civil Engineering

Tuesday, January 14, 2020
1:00 P.M.
Engineering / Computer Science Building
Room 468

Supervisory Committee:
Dr. David Bristow, Department of Civil Engineering, University of Victoria (Supervisor)
Dr. Tara Troy, Department of Civil Engineering, UVic (Member)

External Examiner:
Dr. Andrew Rowe, Department of Mechanical Engineering, UVic

Chair of Oral Examination:
Dr. Graham McDonough, Department of Curriculum and Instruction, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Floods are among some of the most damaging natural disasters. They can cause major interruptions to buildings and infrastructure and can have lasting impacts. In the case of flood damage estimation to buildings, structural and non-structural damages are of interest to most flood risk research. Very few studies, conversely analyze the impact of the recovery timeline on losses. Doing so requires consideration of specific types of building, and what the parts of the building depend upon for restoration.

There is a challenge to clearly understand the cause of failures within an interconnected system such as a building, and the requirements for accelerating restoration to overcome the adverse results of flood in the most convenient way possible.

This work seeks to map the various components involved in functional failures of flood damaged buildings to understand their recovery. A novel model of a residential building is constructed using the Graph Model for Operational Resilience (GMOR) to model the complex interaction among dependencies in building systems to understand the cascade of failure of restoration. This is enabled by integrating models of operational and restoration dependencies with hazard damage relationships and repair times to assess where functions fail and how and when they are restored.

A case study is performed to generate recovery model to simulate the restoration of a single residential building in a flood prone neighborhood of Surrey, BC, Canada. It involves synthesis of available data on residential building's component level dependencies and depth-damage functions to estimate damage. The depth-damage functions, along with construction and repair guides, are used to identify restoration dependencies and to formulate a unique sequence of flood recovery steps for several possible flood depths.

This study demonstrates how restoration can be delayed and probable solutions to improve the resilience of the city through recovery planning of flooded buildings. The results provide insights that should be useful to help emergency managers and other decision makers to develop and implement resilience thinking while revealing the economic benefits associated with increased flood risk management. In future, the custom flood model can be adapted to other locations.