Thesis Project Portfolio

IDEA Factory Design-Build Response to a Request for Proposal

(Technical Report)

Structural Reliability and Resilience: Contextual Limitations of Risk-Informed Design

(STS Research)

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Executive Summary

The technical portion of this project involves developing and presenting a formal response to the University of Maryland's Request for Proposal (RFP) for the design and construction of the Innovate, Design, and Engineer for America (IDEA) Factory. The IDEA Factory is a 61,000-square-foot building featuring four above-grade stories and a basement housing laboratory spaces critical to the research and educational goals of the university. Acting as the Design-Build General Contractor, the team developed preliminary design documents for the basement waterproofing and foundation drainage, construction processes and phasing plans, a cost estimate, and a detailed construction schedule. This information was submitted in a written response to the RFP and presented to simulated representatives of the owner, the University of Maryland, to demonstrate team qualifications, capabilities, and ideological alignment with the owner's objectives. The project proposal and award process highlighted the competitiveness of the industry and the importance of developing reputations and relationships between engineers, clients, and the public.

One of the most important ways engineers can foster trustworthiness is by thoughtfully and appropriately managing risks. These risks can appear as cost overruns, project delays, or life safety concerns, but as a fundamental responsibility of engineers, risk management methods must thoroughly consider risks to public safety. The sociotechnical research section extensively reviews literature on risk-informed design philosophy, which is the foundation for modern structural design practice. By providing economic and historical context, methodological effectiveness is evaluated to consider some key constraints. With an in-depth understanding of the critical assumptions in risk-informed design and structural design code calibration, relevant case studies are reviewed, and the economic implications of operation and maintenance costs are

evaluated across multiple infrastructure market sectors. As a result, the question of whether current methodologies appropriately account for actual conditions with limited, inconsistent funding for infrastructure maintenance arises.

The role of engineers can be simplified as risk managers. During design, construction, operation, and maintenance, uncertainties pervade every decision. Current methodologies, understandably, do not account for many of these risks. To address these disparities, several recommendations are made that prioritize public safety. Implementing and expanding upon these recommendations can improve industry practices and design standards to better serve the engineer's critical responsibility of limiting excessive risk exposure and upholding public safety.