

# PROJECT PROFILE

## QUANTIFYING SAFETY IN OFF-SITE CONSTRUCTION



### PROJECT BACKGROUND

By transitioning construction activities to a controlled environment with reduced variability in working conditions, it may seem obvious that off-site construction could provide safer work environments and would result in fewer safety incidents. While this is something we may know intuitively, the topic of safety within off-site construction and the opportunities it can provide with respect to safety performance in the execution of construction activities is lacking research and quantifiable data to support these claims.

To determine whether off-site construction can be considered a safer alternative to conventional methods, the research developed a safety evaluation methodology to quantify safety performance and allow for comparisons of construction methods. The methodology is developed in partnership with a jurisdictional health and safety authority, WorkSafe New Brunswick, and leverages historical safety data to provide input into a risk-based activity-level approach for the process analysis of defined construction methods.

The evaluation method was partially validated in collaboration with a local construction project team and applied to a case study of a mid-rise modular hotel construction project that employed a mix of conventional and off-site construction methods to construct the hotel room units. The evaluation methodology took a construction product-focused approach, in this case, a hotel room module, with emphasis on defining a complete material supply chain to capture all potential risks. The intended use of the model is the industry, to better support decision making in the design and planning phases of the construction project.

### RESULTS

The evaluation consists of three quantifiable values: risk likelihood, severity and exposure. The risk likelihood and severity were extracted from historical data, while the exposure to risk was extracted from the defined construction process, using the activity durations. The product of these values quantified the safety performance, meaning that the lower the value, the safer the identified process.

By evaluating the entirety of the processes for the defined product at an activity level, the safety evaluation of the on-site versus off-site construction of the hotel units was completed. The outcome was a total score of 2109.76 for on-site construction, in comparison to a total score of 433.86 for off-site construction, allowing us to conclude that off-site construction methodologies are safer by presenting fewer risks in the specified context of the case study.

### RECOMMENDATIONS

The development of this evaluation model creates a foundation that additional on-site versus off-site construction comparisons can be built upon. Future research opportunities include additional on-site to off-site construction comparisons to begin to understand whether off-site construction is statistically safer than conventional on-site methods as prior research has claimed. Additionally, future studies could investigate the benefits of implementing digital technologies to simplify and make the evaluation process more efficient and likely to be used by industry. Further development of this model with the implementation of digital technologies will simplify the analysis and create an evaluation technique that can be more easily adopted by industry.