Small-Scale Experiments For Building Demolition

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ABSTRACT

Excavators have a wide range of uses in many different kinds of projects, but our research primarily focused on their role in construction demolition. More specifically, we have been examining the current models of excavator buckets, which have raised concerns about their work efficiency and environmental safety. We have found that these buckets do not meet modern-day expectations, especially in regards to time, cost and environmental concerns. At the RIDER Lab, we are working to bridge the gap between expectations and reality. We are using small scale excavator prototypes, shown in photos, that are managed by a game-like controller to move debris in a more efficient and timely manner, making debris recycling more achievable and economically reasonable. Our focus also remains on ensuring the amount of time being used to separate debris is cut down so recycling debris is more likely in real-world situations when time is costly. Additionally, we are using light and pressure monitoring to identify and track the best approach to quickly recover debris after a tragedy such as building collapse or detonation or even after a simple building demolition as stated before. The future of this research is promising, as it not only aims to improve efficiency and economics but also works to ensure the safety of our plant and population.

INTRODUCTION & PURPOSE

Excavators are used world-wide for both construction demolition and rescue operations. While they serve a large purpose, we come to find that not only the equipment itself has flaws, but the way they are used. Current excavator buckets raise concern on efficiency and safety, while their usage is raising concerns in not only efficiency as well, but also concerns in an economical and environmental standpoint. Debris from both demolition and rescue operations has the opportunity to be repurposed and reused in new construction sites, while being extremely economically beneficial. It can also be done in a very efficient matter that promotes safety for workers and victims of tragedy that are being uncovered from rubble. Making improvements in these areas of safety, efficiency and environmental and economic concerns would make an immense positive impact on the population as a whole, as well as the planet. To make debris separating and recycling more time and cost efficient, and while improving safety of the planet and workers when using these excavators in demolition and rescue is our main goal here at RIDER Labs.

METHODS

During our research we utilized small-scale excavators controlled by game-like remotes. We used these excavators to move and separate two different colors of debris and wiring. Each researcher started individually moving one debris while being timed. We then combined students and eventually tested having two and three workers at a time to test efficiency. As all the experiments were timed, only some were video recorded from above the work site and tracked in the recording using lights attached to each excavator. These lights provided insight into movements and patterns of work from each excavator and furthered detail in deciding efficiency.

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REFERENCES

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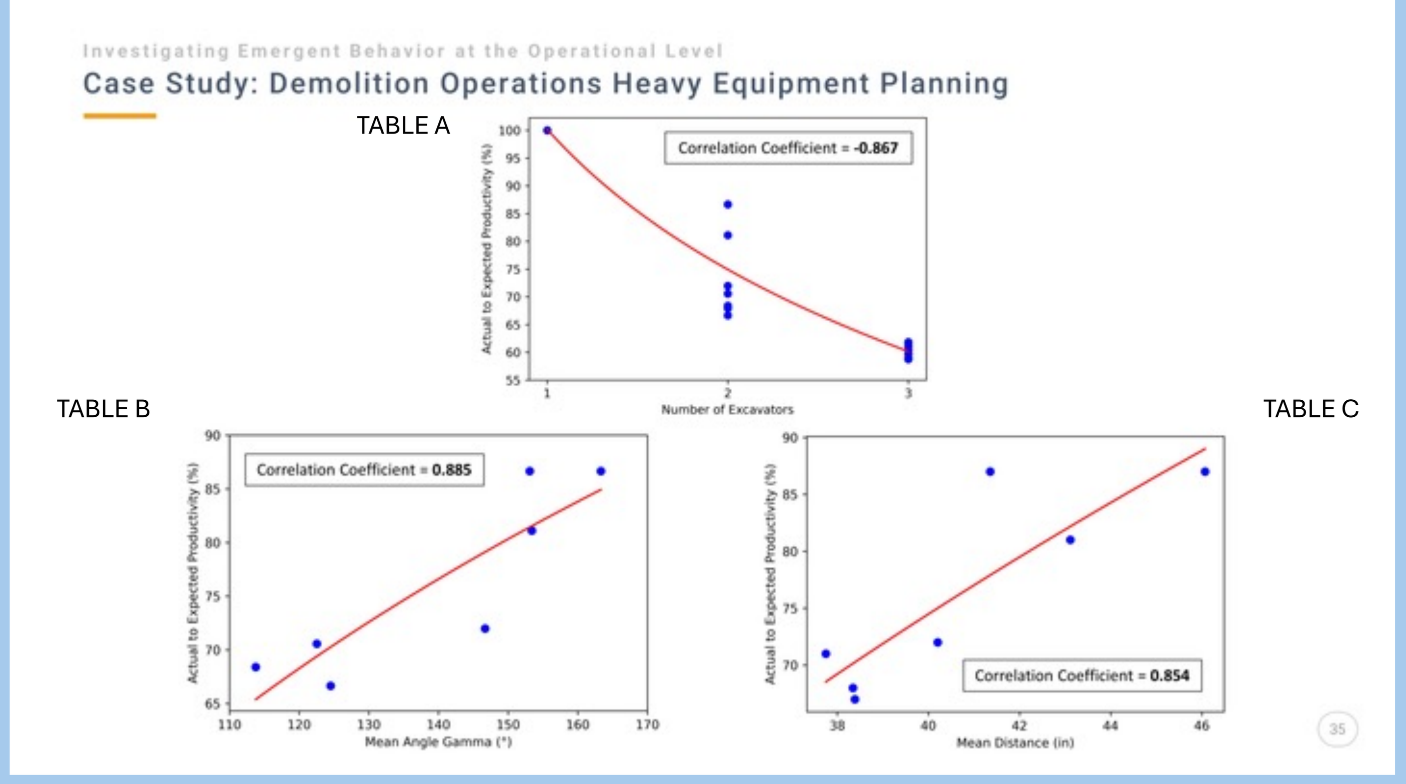
RESULTS

For our end results, we found that working in pairs of two was most efficient in separating and moving debris in the most efficient and timely manner. Below, you can see more in-depth data in reference to spacing between excavators, times, as well as positioning of excavators. We also found that students who worked the fastest individually, worked the fastest together in pairs to other slower student pairings. In the tables below, we can show that Table A will represent the number of excavators and the ratio of actual to expected levels of productivity. In Table B, we see it represent the mean angle between excavators and ratio of actual to expected productivity levels. Table C, is made to represent the mean distance between excavators and ratio of actual to expected productivity levels. In the second table of information, we can see the recorded times and levels of productivity of each student and each student put into pairs. We are able to see who works best, and whether putting them in pairs helped their productivity, left it the same, or maybe even worsened it.



Weight of debis (g):	3452
Pile Center Coordinates (uncalibrated) - (m)	513.4, -5.539

Students	Number of Excavators	Actual Overall Productivity (g/hr)
Charles	1	2837.26
Omarion	1	2837.26
Yasmine	1	3138.18
Nitya	1	2917.18
Katie	1	2837.26
Brooke	1	2917.18
Charles + Omarion	2	4602.67
Yasmine + Nitya	2	4142.40
Brooke + Katie	2	4142.40
Yasmine + Katie	2	3983.08
Yasmine+ Charles	2	5178.00
Yasmine + Omarion	2	5178.00
Charles + Brooke	2	4061.18