

# CAPSTONE FESTIVAL KEY RESULTS.

## Optimized Design of Crumple Zone on Vehicles

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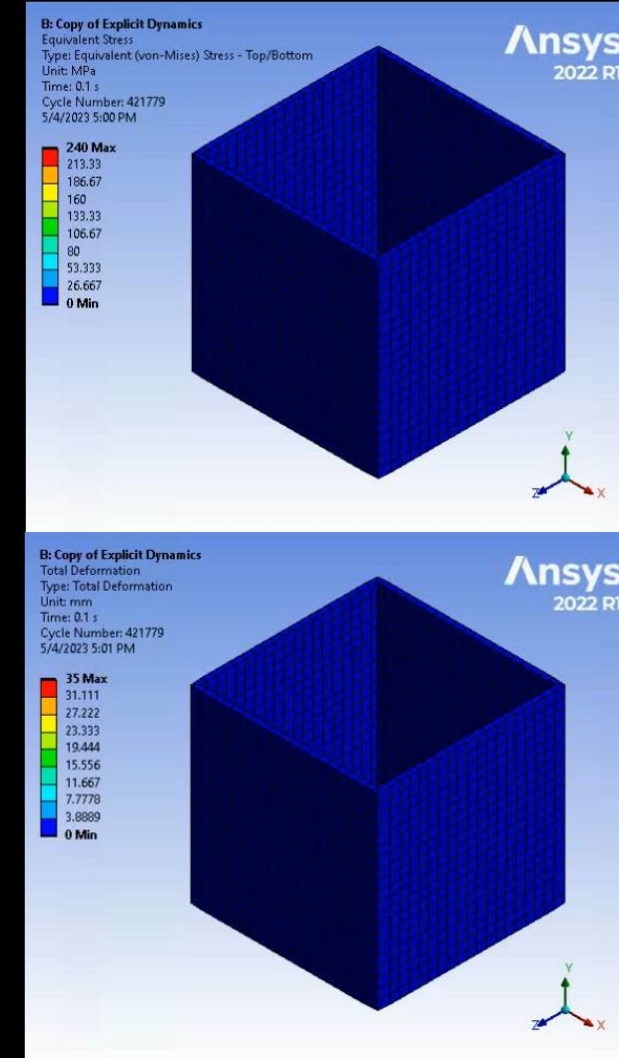
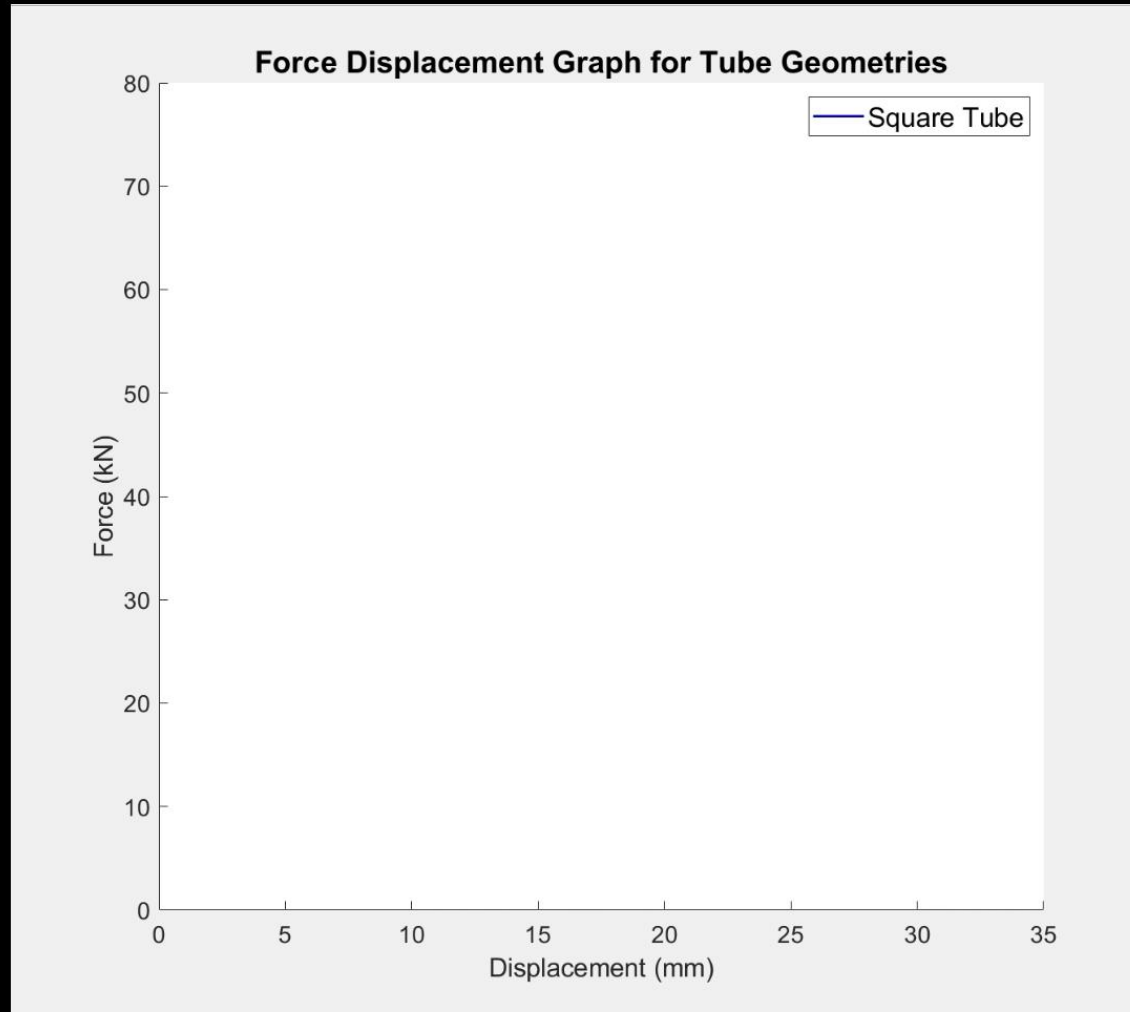
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جامعة نيويورك أبوظبي



NYU ABU DHABI

# COMPARISON BETWEEN SQUARE AND ENNEAGONAL TUBES

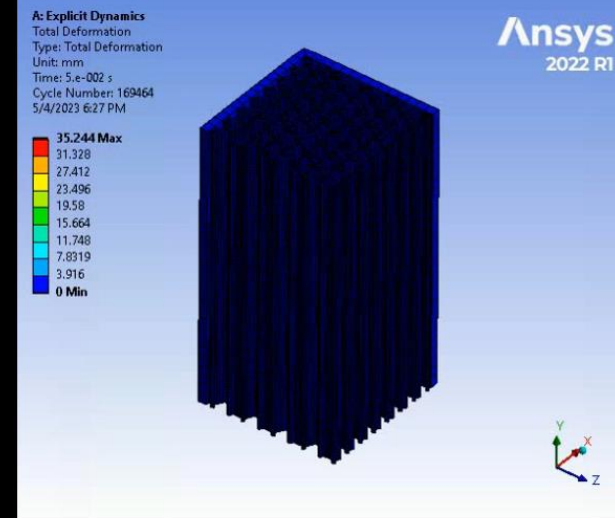
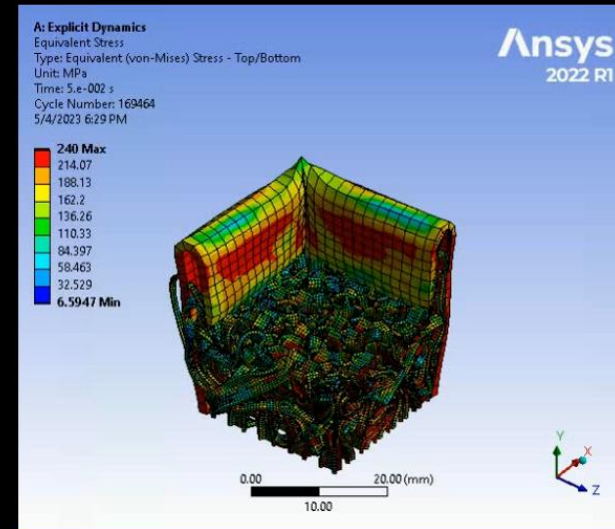
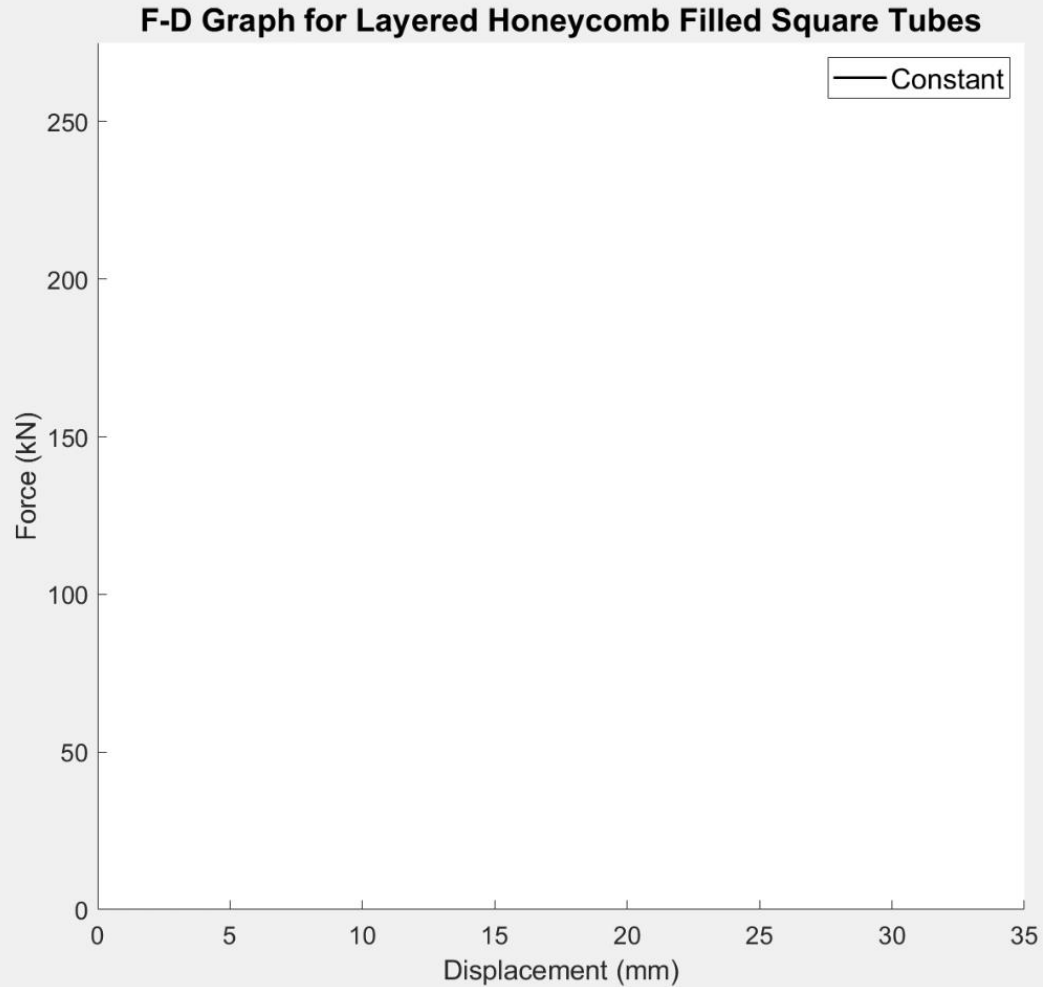


# COMPARISON BETWEEN SQUARE AND ENNEAGONAL TUBES

| Model           | Mass (g) | Peak Crushing Fore (kN) | Total Energy Absorbed (J) | Specific Energy Absorption (J/g) |
|-----------------|----------|-------------------------|---------------------------|----------------------------------|
| Square Tube     | 38.85    | 60.32                   | 476.97                    | 12.28                            |
| Enneagonal Tube | 42.60    | 72.79                   | 967.99                    | 22.72                            |

The enneagonal tube possesses a **greater SEA and peak crushing force** than the square tube, making it a better design consideration for the longitudinal beam design.

# COMPARISON BETWEEN SQUARE AND ENNEAGONAL TUBES



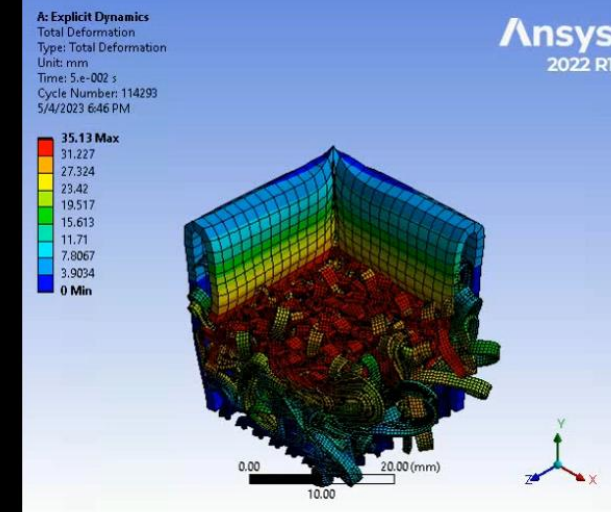
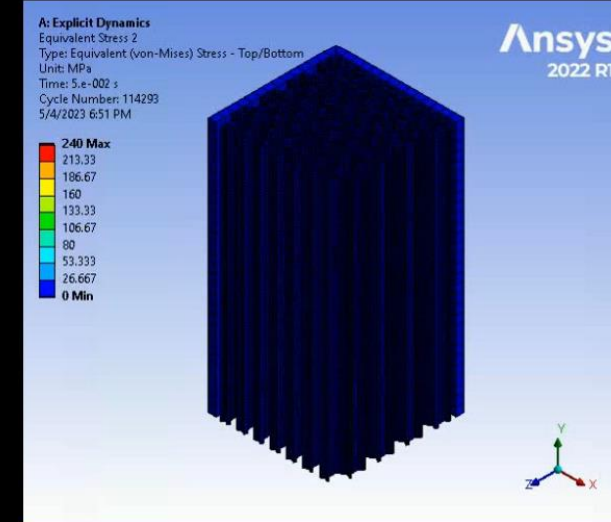
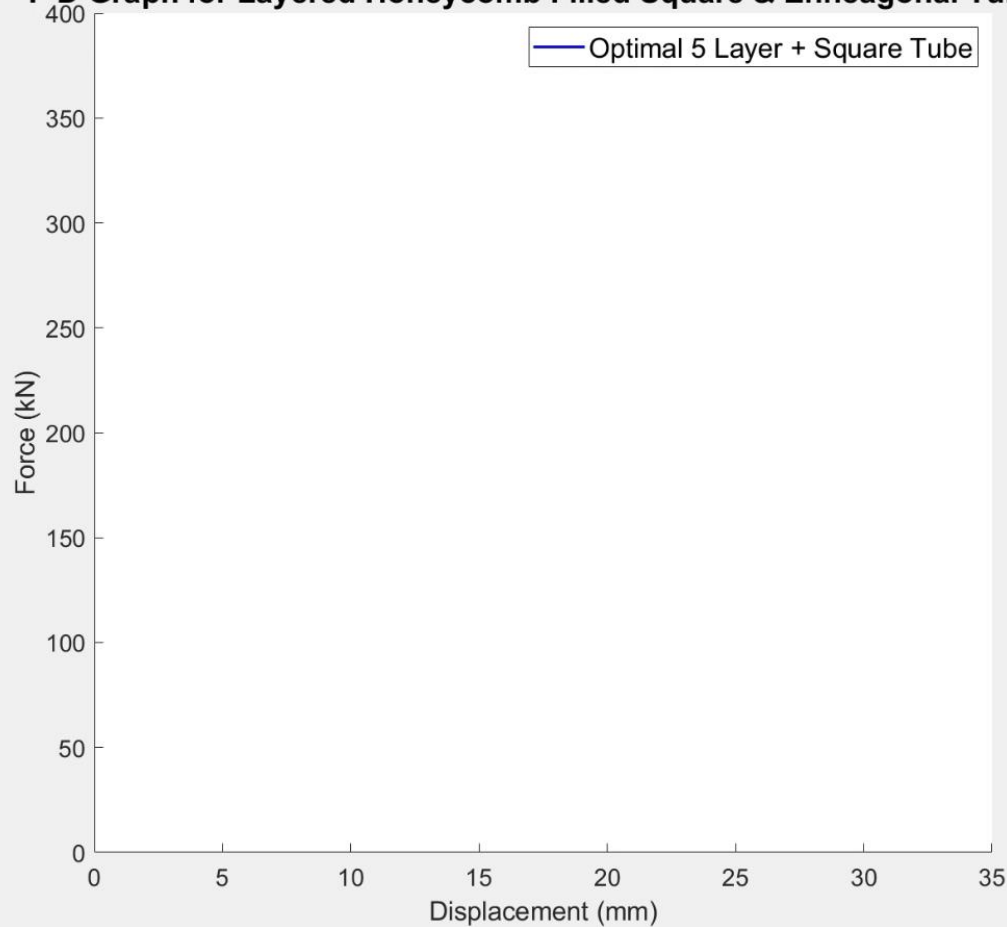
# COMPARISON BETWEEN HONEYCOMB-FILLED SQUARE TUBES

| Model                             | Mass (g) | Peak Crushing Fore (kN) | Total Energy Absorbed (J) | Specific Energy Absorption (J/g) |
|-----------------------------------|----------|-------------------------|---------------------------|----------------------------------|
| Constant Thickness                | 133.04   | 238.97                  | 1820.84                   | 13.69                            |
| 3 Layered Honeycomb (Best Design) | 133.32   | 239.37                  | 1849.14                   | 13.87                            |
| 5 Layered Honeycomb (Best Design) | 133.04   | 238.29                  | 1806.19                   | 13.58                            |

No significant difference in the performance of the honeycomb-filled tubes based on **number of layers** or **difference between the cell wall thickness across layers.**

# COMPARISON BETWEEN HONEYCOMB-FILLED SQUARE & ENNEAGONAL TUBES

F-D Graph for Layered Honeycomb Filled Square & Enneagonal Tubes





# COMPARISON BETWEEN HONEYCOMB-FILLED SQUARE & ENNEAGONAL TUBES

| Model   | Mass (g) | Peak Crushing Fore (kN) | Total Energy Absorbed (J) | Specific Energy Absorption (J/g) |
|---|----------|-------------------------|---------------------------|----------------------------------|
| 5 Layered Honeycomb (Best Design) + Square Tube     | 133.04   | 238.29                  | 1806.19                   | 13.58                            |
| 5 Layered Honeycomb (Best Design) + Enneagonal Tube | 173.26   | 342.72                  | 4788.35                   | 27.63                            |

The honeycomb-filled enneagonal tube possesses **a greater SEA and peak crushing force**, making it a better design consideration for the longitudinal beam design.

Moreover, in the enneagonal design, the addition of the honeycomb filling increases peak crushing force by **371%** and SEA by **22%**

# SAMPLE OF PHYSICAL COMPRESSION EXPERIMENT

