

Testing Summary

Introduction

All four team members conducted the testing of the BraceForce prototype: Julie Huang, Elijah Brickman, Winnie Chen, and Mateo Liguori. Testing took place next to the Ford Motor Company Engineering Design Center. The goal was to evaluate the functionality and impact of the prototype on various materials to simulate different uses in a safe environment. Due to safety considerations, no testing was performed on or with actual users or in real-world settings.

Methodology

We tested the prototype in a controlled environment. Our testing materials included:

- A foam board
- Fruits (apples, oranges, and bananas)
- A 0.5-inch wood board

We evaluated the bracelet by swinging it against each material to observe its impact. During each test, we focused on:

- Range: We swung the bracelet to measure the maximum reach.
- Strength: We tested the bracelet's durability by striking the test materials to observe the damage and checking for deformation.

Results

Range Testing

- The bracelet's fully extended length measured approximately 24 inches from the user's hand to the tip.
- The swinging motion was consistent and provided adequate clearance.

Strength Testing

- Foam board: The bracelet punctured the foam board, which resulted in various holes and tears. (See Figure 1)
- Fruit tests: We selected the following fruits because they are economically available and widely accessible if the tests were to be repeated.
 - Apples: Cracked upon impact. (See Figure 2)
 - Oranges: Split and leaked juice upon impact. (See Figure 3)
 - Bananas: Broke easily upon impact. (See Figure 4)
- Wood Board: The bracelet left a visible dent in the 0.5-inch board, but did not break it. (See Figure 5)

Bracelet condition:

- After multiple attempts, the bracelet showed no signs of mechanical failure, significant wear, or deformation.
- The metal piece and sleeve remained intact and functional.



Figure 1: Foam Board after impact



Figure 2: Apple after impact



Figure 3: Orange after impact



Figure 4: Banana after impact



Figure 5: Wood Board after impact

Discussion

- Range: The bracelet's reach provides a useful distance for keeping the threat at bay.
- Strength: The bracelet withstood repeated impacts without visible damage, suggesting it can endure moderate use in self-defense scenarios.
- Material performance: The bracelet was effective in damaging soft targets like foam board, but only created dents on harder surfaces like wood, indicating potential limitations against tougher materials.
- With more time, tests like these are often conducted using meat products (e.g., whole beef or cow knee) or prosthetic models.