Customized Wheelchair Stabilization Device for Overhead Weight Lifting Movements

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Medical Need

Chris Kaag is a wheelchair user who backward tips when lifting weights overhead.

No existing solutions on the market

Objective

Build a custom device that:

1. Stabilizes the wheelchair
2. Is handicap accessible
3. Locks the wheelchair in place
4. Allows overhead lifting without tipping

Design Inputs

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Limited to specific customized wheelchair dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility Access</td>
<td>User must be able to operate device with only their upper body</td>
</tr>
</tbody>
</table>

Verification Testing

Vertical Load Test
Load ≥ 490 lbs

<table>
<thead>
<tr>
<th>Total Weight Applied (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
</tr>
</tbody>
</table>

PASS: No bending or cracking

Securement Test
20% of max load (~100)

PASS: No movement

FAIL: Wheel slipped out

Tipping Weight & Angle Test
Angle ≤ 26.84° & weight ≥ 124 lbs

<table>
<thead>
<tr>
<th>Angle theta (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 in.</td>
</tr>
<tr>
<td>1.8°</td>
</tr>
</tbody>
</table>

Conclusion

Accomplished
Built a customized wheelchair that prevents backward tipping during heavy overhead weightlifting

Impact
Solution can be adapted for competitive and commercial use, potentially serving up to 2.7 million wheelchair users

Future Revisions

1. A ramp
2. Use metal for the entire design
3. A guide to stop front wheel rotation

QR Codes

Scan QR Codes for References + Video of Solution

Springs + Support Bars

Wheel Inside Locking Wedges

Metal Wedges Welded on Metal Sheet

Lever

Release Pin

Metal Support Bars

Compressible Springs

Welded Sheet

Locked - springs relaxed

Unlocked - springs compressed

Vertical Load Test

Securement Test

Tipping Weight & Angle Test

PASS

FAIL