

Disability Resources Electric Mobility Tricycle:

REAR AXLE DESIGN EVALUATION

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OUTLINE

- *Background*
- *Problem*
- *Initial Designs*
- *Prototype and Testing*
- *Analysis*
- *Future Work*

BACKGROUND



BACKGROUND

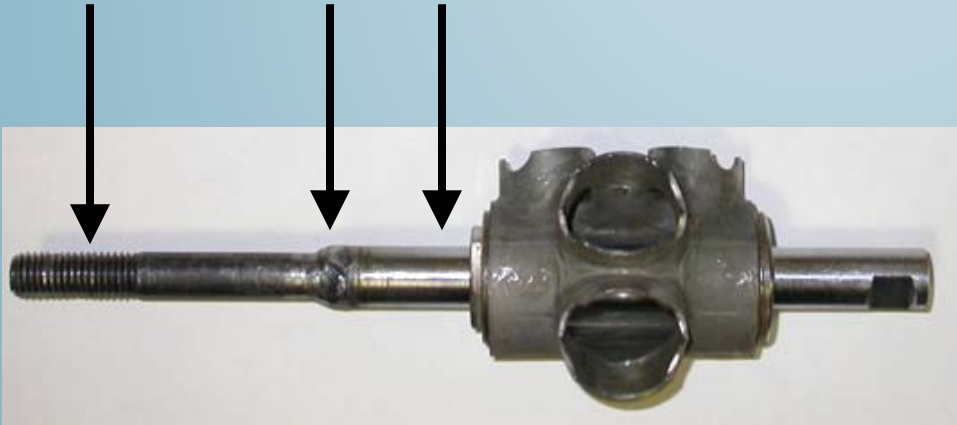
- *First Design*



- *Uniform Frame Design*



AXLE ASSEMBLY



PROBLEM

- *Bending of the axles*



- *Wear on axle surfaces*

New

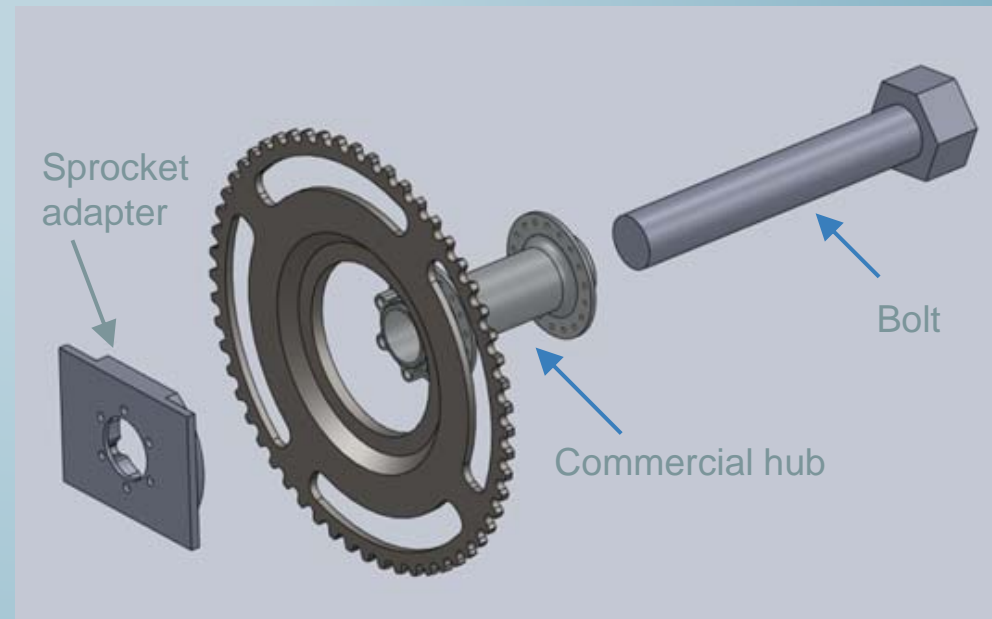


Used



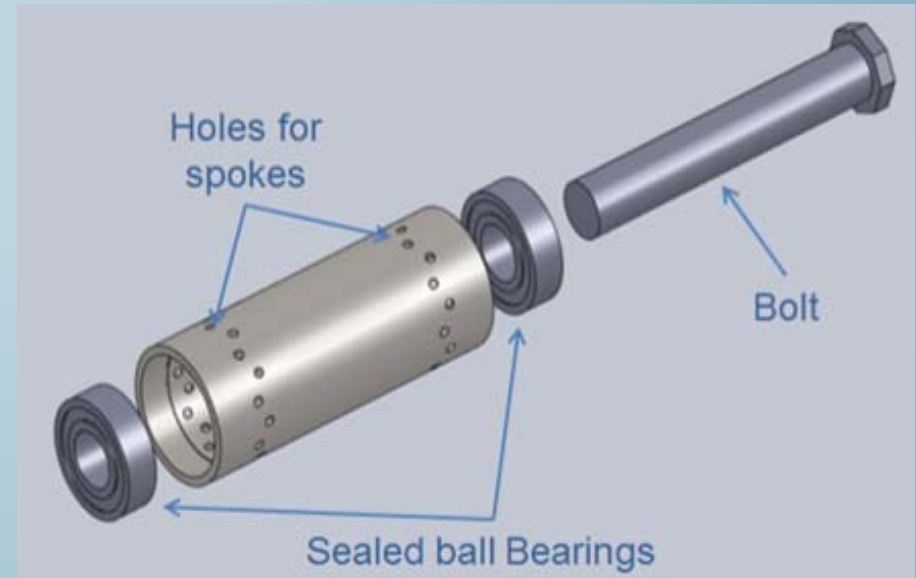
INITIAL DESIGN: EXPORTED HUB

- *Advantages*
 - *Quality parts*
 - *Axle size*
 - *Compatibility with current design*
- *Disadvantages*
 - *Cost*
 - *Exported components*



SECOND DESIGN: IN-HOUSE HUB

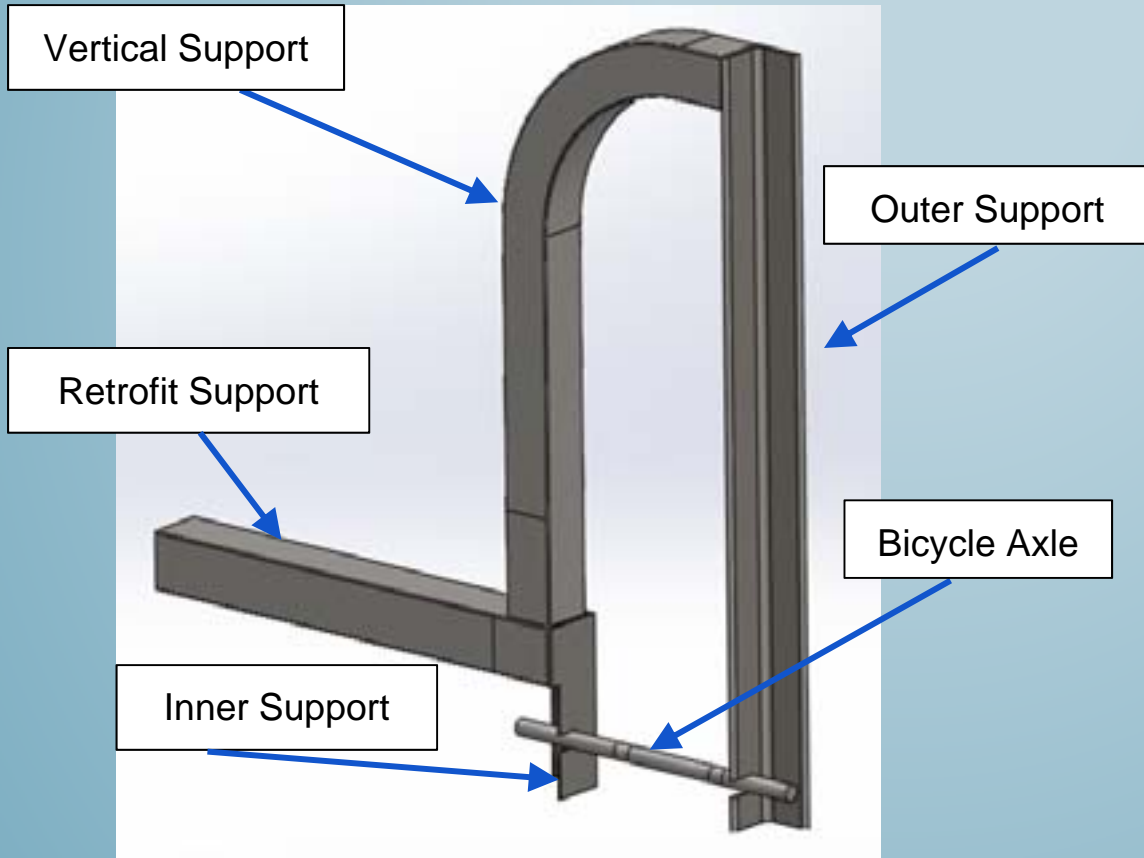
- *Advantages*
 - *Quality parts*
 - *Sealed bearings*
 - *Axle size*
 - *Cost*
- *Disadvantages*
 - *Manufacturing time*
 - *Additional tooling required*
 - *Exported components*



DOUBLE SIDED SUPPORT (DSS)



DOUBLE SIDED SUPPORT (DSS)



Retrofit Support

PROTOTYPE AND DEFLECTION TESTING

- *January 2013 Burkina prototype*



PROTOTYPE AND TESTING

- *Spring 2013: Installed prototype on existing tricycle*
- *Began long-term testing*



AXLE WEAR TEST PROCEDURE

- *Disassemble hub*
- *Inspect assembly components for wear*
 - *Cone nuts, ball bearings etc.*
- *Collect grease samples*
 - *Inspect for contamination*

Good Grease



Bad Grease



RESULTS OF AXLE WEAR TEST CONTINUED

Cone nut at mile 700



RESULTS OF AXLE WEAR TEST

(Left)

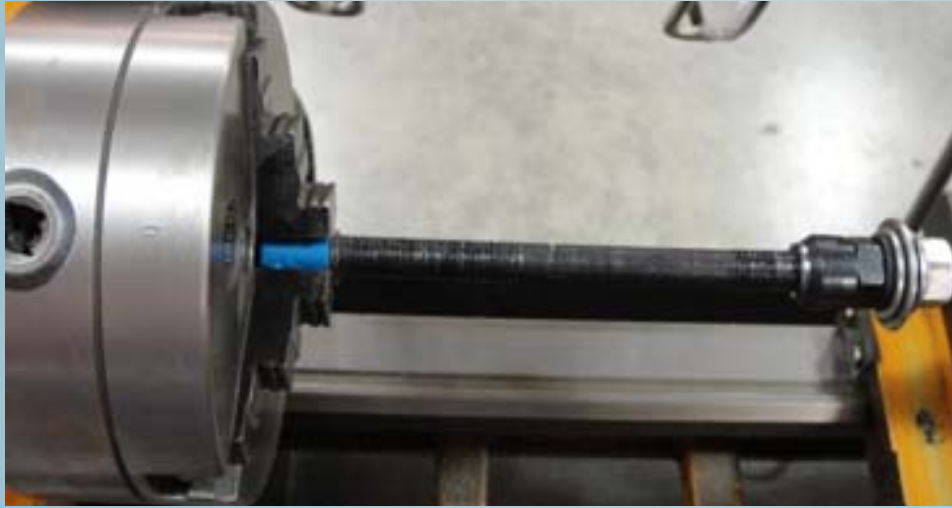
Grease Samples

(Right)

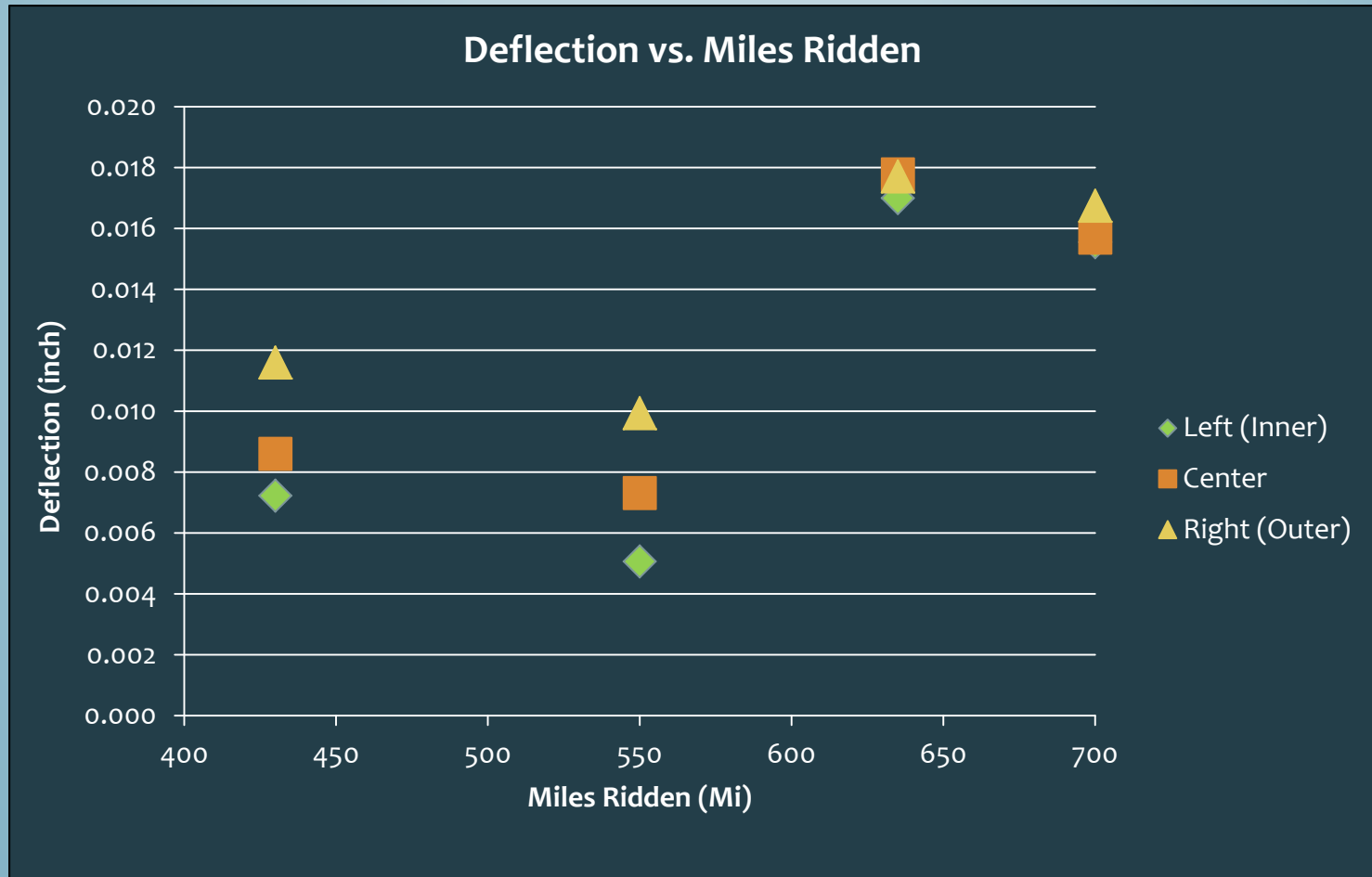


Grease at mile 700: A few particles in the grease

TEST FOR AXLE BENDING



RESULTS: AXLE BENDING



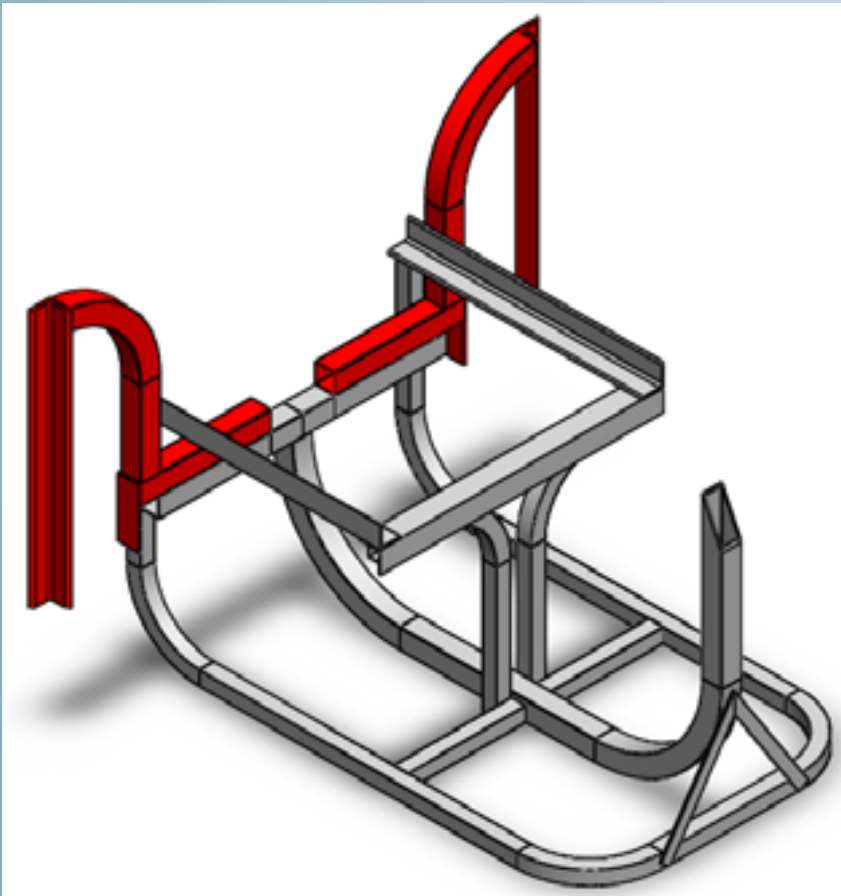
GOALS FOR THE NEW FRAME

- *Integrate the DSS into frame fabrication*
- *Fit through standard door*
- *Eliminate sharp corner*
- *Aesthetically pleasing*

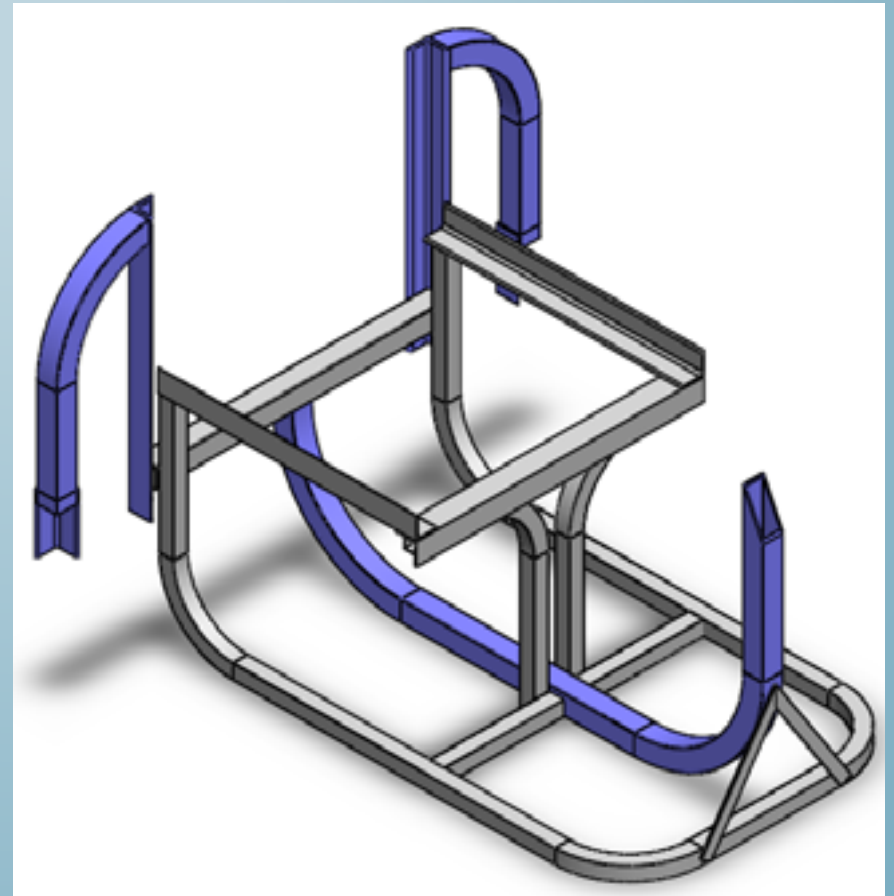


MODELS OF THE FRAME DESIGNS

- DSS



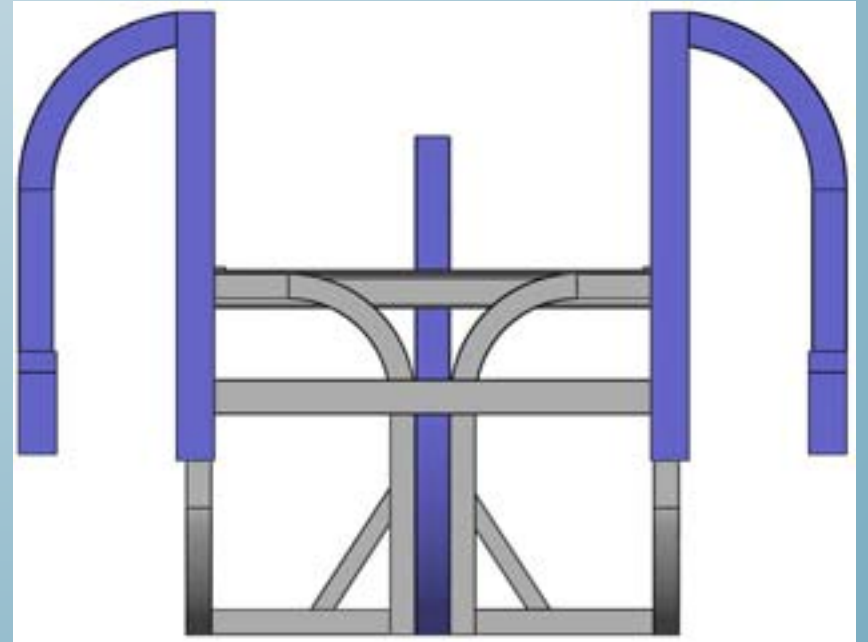
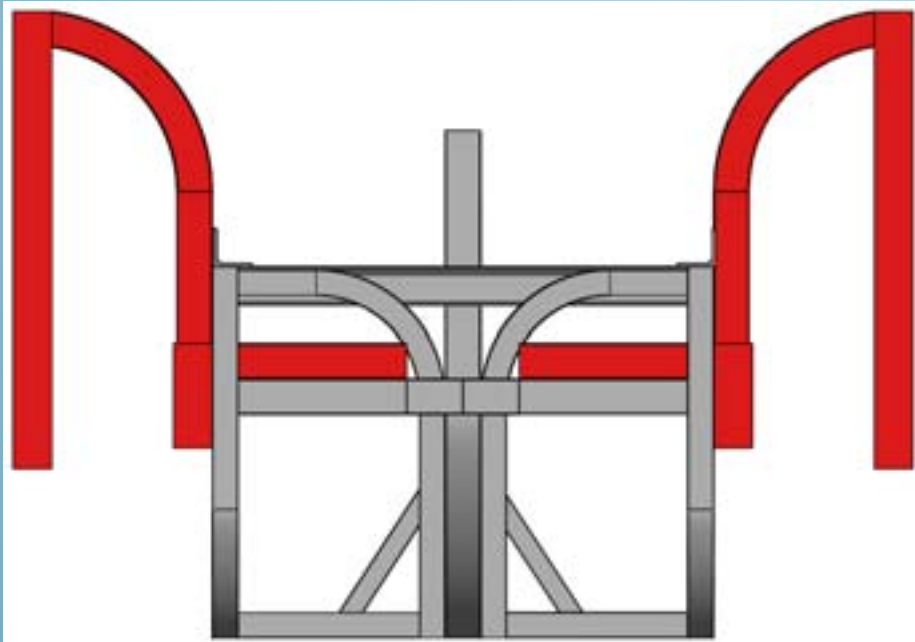
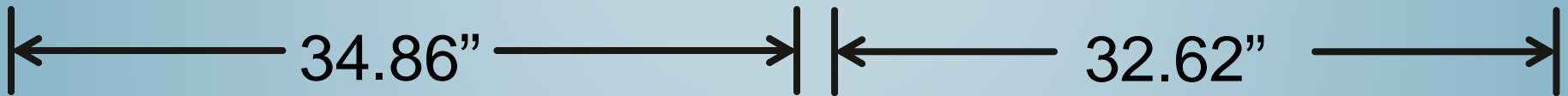
- DSS Inverse



DECREASED OVERALL WIDTH BY 2.24"

- DSS

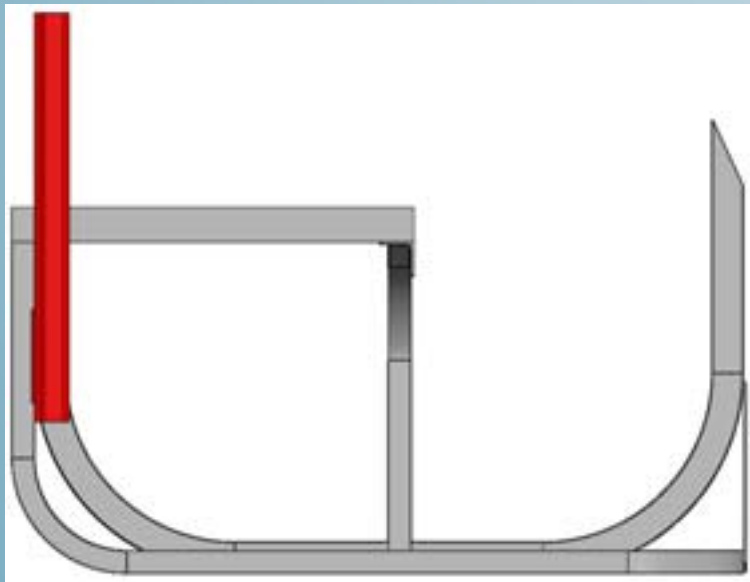
- DSS Inverse



INCREASE IN LENGTH BY 1.63"

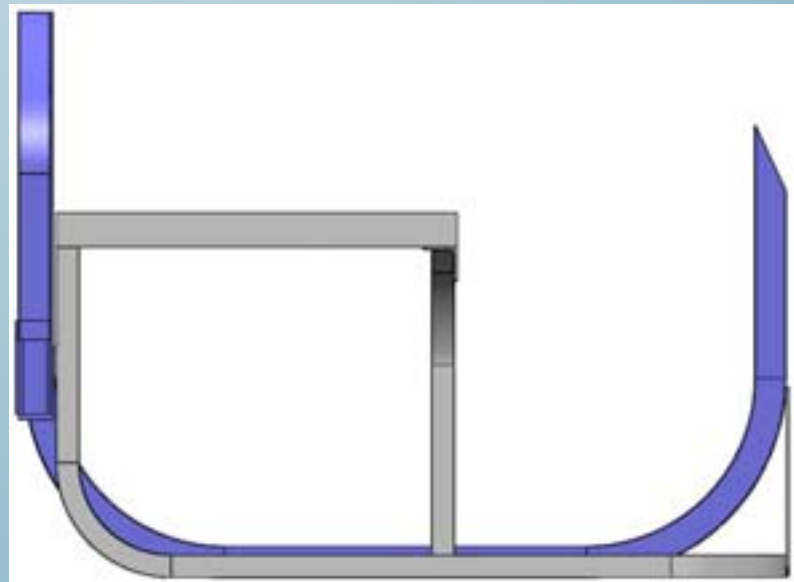
- DSS

← 31.74" →

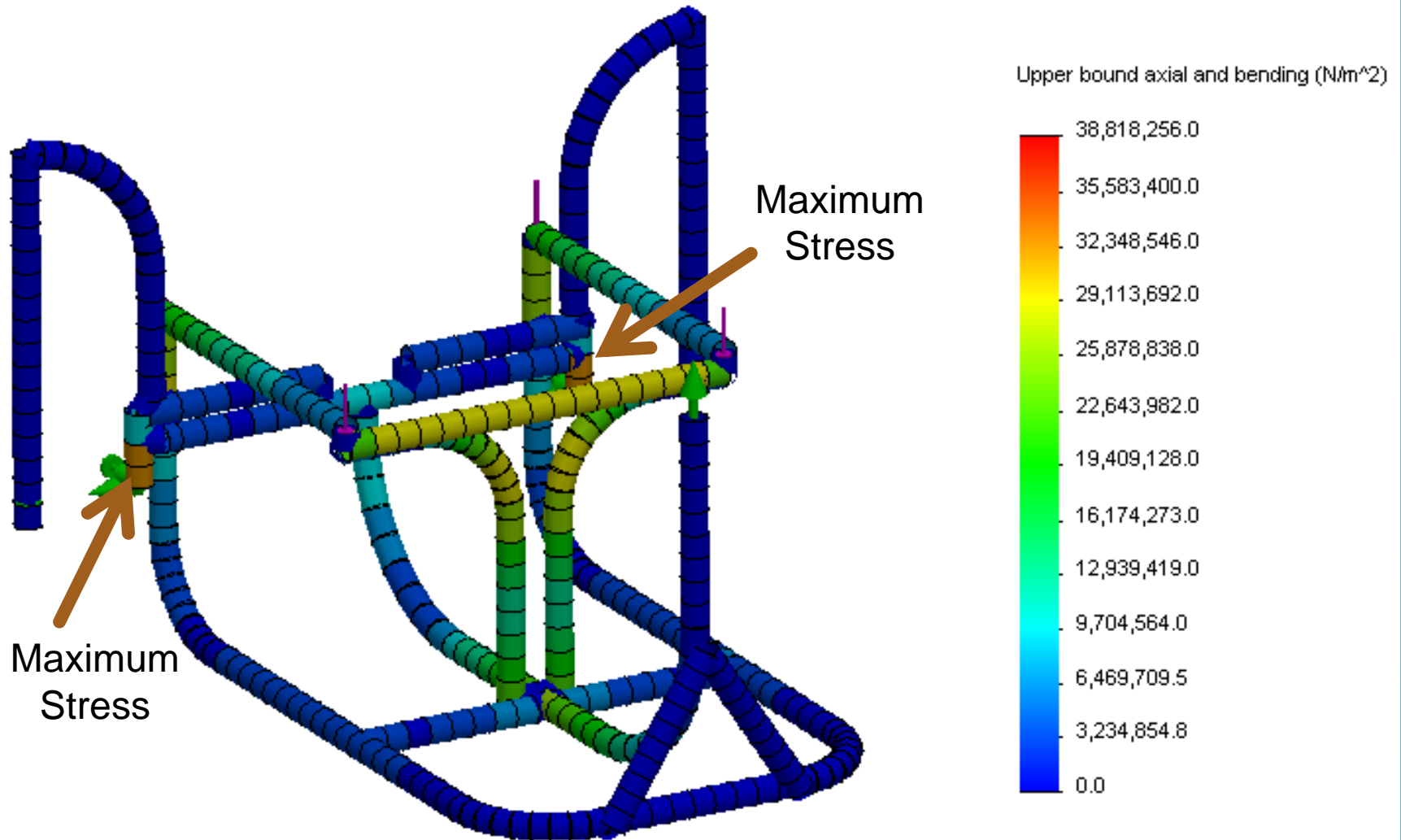


- DSS Inverse

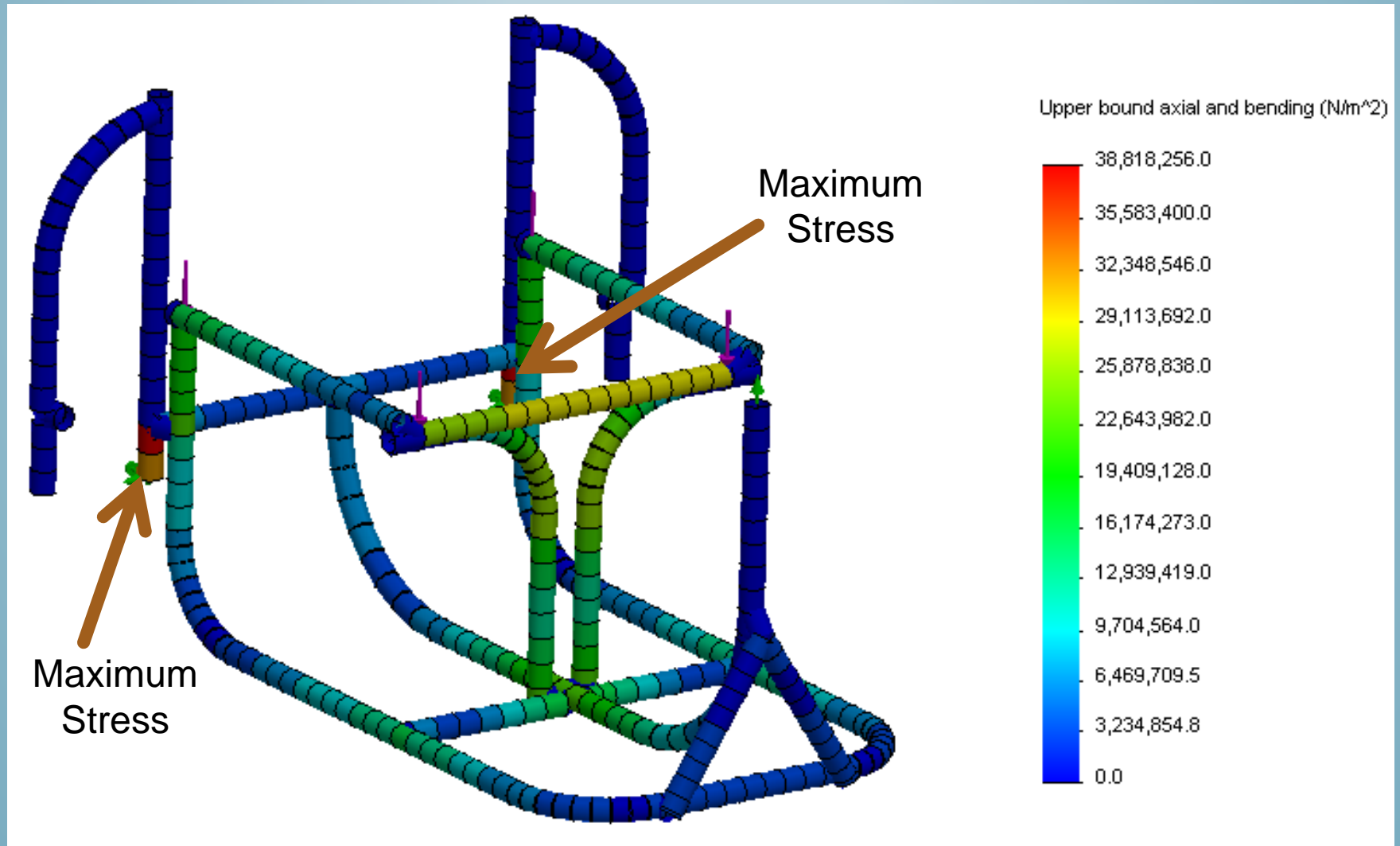
← 33.37" →



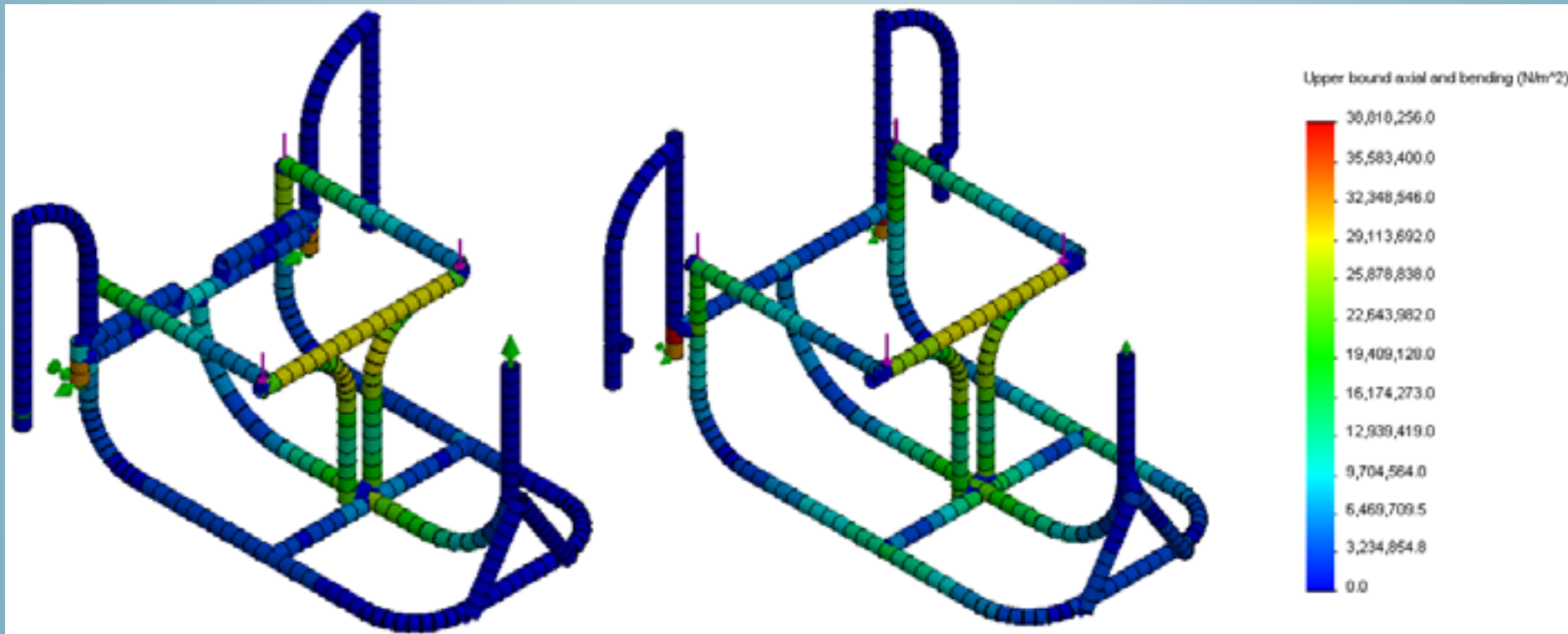
DSS ANALYSIS



DSS INVERSE ANALYSIS



DSS VS. DSS INVERSE ANALYSIS



INTERPRETING SOLIDWORKS RESULTS

| Results | DSS | DSS Inverse |
|----------------------|------|-------------|
| Maximum Stress (MPa) | 33.8 | 38.8 |
| Safety Factor | 7.4 | 6.4 |

- *Yield strength of steel is 250 MPa*

COMPARISON

| Qualification | DSS | DSS Inverse |
|-------------------------|-----|-------------|
| Shorter length | ✓ | |
| More seat adjustability | ✓ | |
| Sharp corner eliminated | | ✓ |
| Looks better | | ✓ |
| Fits through door | | ✓ |
| Less material | | ✓ |

FUTURE WORK

- *Further testing of axles*
- *Construct DSS Inverse frame*
 - *Make necessary fixtures*
 - *Create construction manual*

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 - *Mr. Andrew Patton*
 - *Mr. Ryan Frederick*
 - *Ms. Jean Zipagan*
 - *Mr. Judah Mendez*

QUESTIONS?