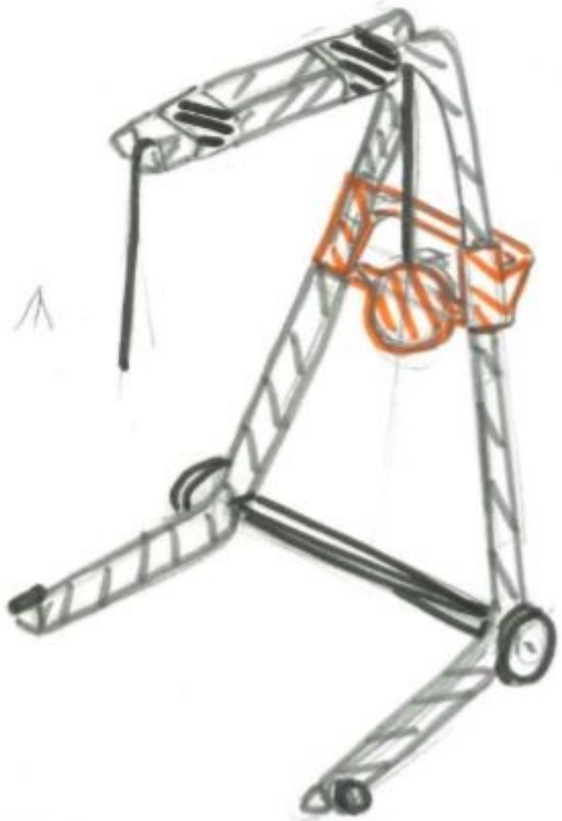
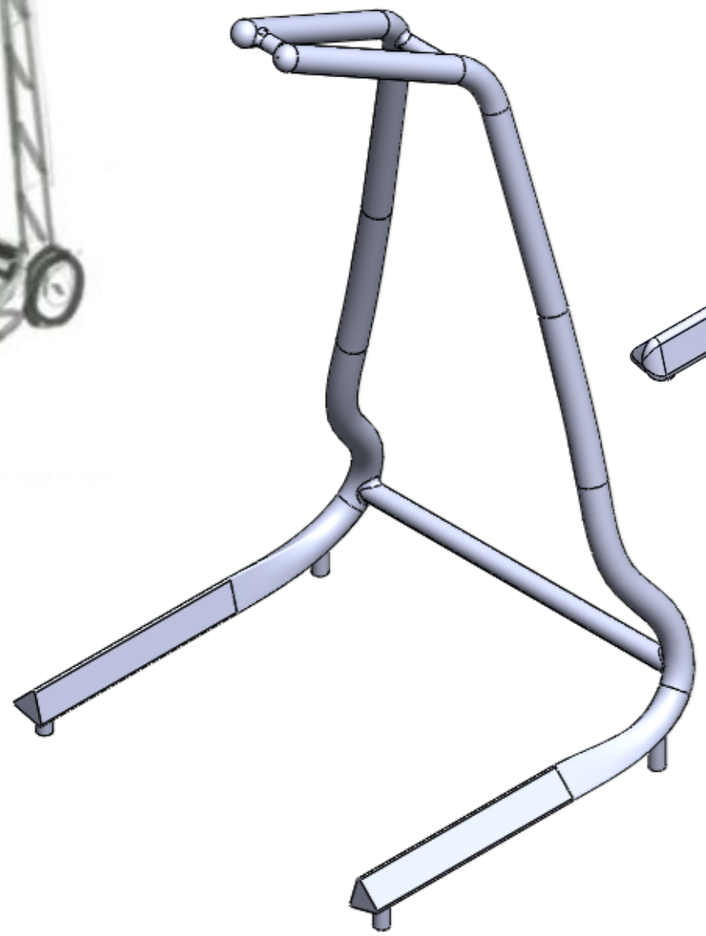
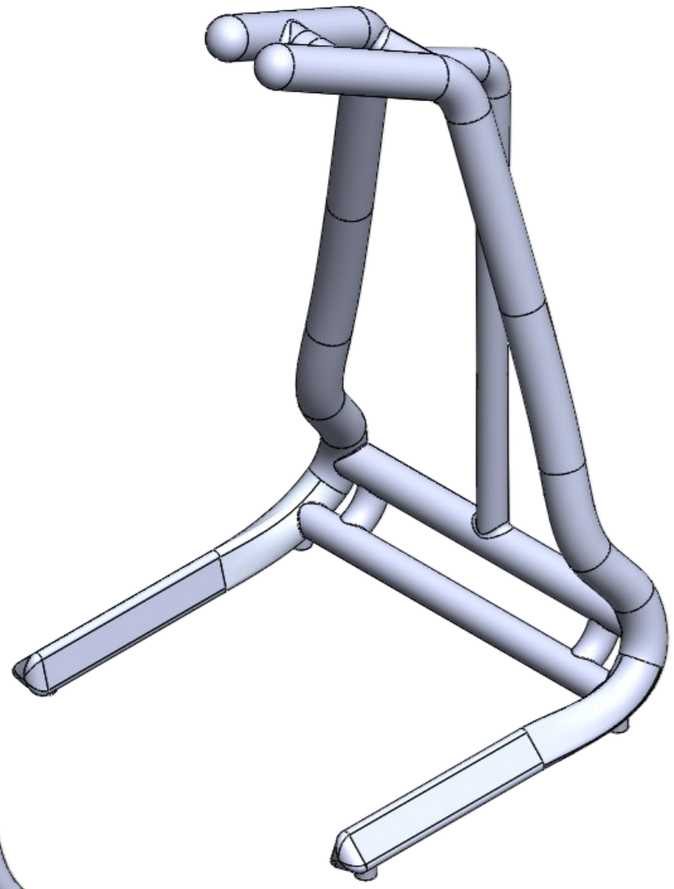






DESP:2000 2019/20 - PROJECT 2

Digital Prototyping of a Hand Cranked Hoist proposal

- with the existing product-form taken from one of three brands

DESIGN REQUIREMENTS

Form Redesign of the existing product form, which must remain reflective of the existing brand culture and accommodate the key product features, functions and interactions
Technical Design requires a detailed modelling and specification of the structural & articulating components, detail of the gear-train, necessary hoist features easy of operation by the operator and for managing the pay-load, wheel assembly, bearing sub-assembly where relevant.

CAD MODELLING OUTPUTS

A full digital prototype is required, which will include a detailed proposition of all ASSEMBLY COMPONENTS, SUB-ASSEMBLY OF GEAR TRAIN, SUB-ASSEMBLY BEARING DETAILS
General Assembly and Sub-Assembly arrays will be modelled in full detail.
In modelling this prototype consideration must be given to the hoists' general operation and issues of feasible manufacture, product assembly, ongoing maintenance regimes and disassembly.

Design guidelines and digital-modelling guidance shall be provided in respect of product usability, product functions, user-interactions, design of fabricated or formed frames, stock componentry where relevant, assembly detailing if assemblies to form the general assembly

Drive - De Vilbiss Healthcare	Harnser Solutions	FISKARS Logistics
https://www.drivedevilbiss.co.uk/	http://www.harnsersolutions.com/	https://www.fiskars.com/en-gb
Health Care Application Hand Operated Geared Winch	Construction Applications Hand Powered Geared Winch	Loading Moving Logistics Appl. Hand Powered Geared Winch
		

Project 2 Submission Banner Proposal PDF + Print Output

- Branding Rational of Proposal Form – *Mood Board, Adjectives Word Cloud*
- Proposal Sketch-Book Pro Rendered Elevation Visuals – Front, Side, Plan
- Perspective Digital Visuals – 3 view points
- Exploded Assembly Visual – 1 view Points
- Scaled Technical Drawing Elevations – Front, Side, Plan
- 3D-PDF of completed assembly model – *exclude from banner PDF + printed banner*
- 3D PDF of assembly components – *exclude from banner PDF + printed banner*
- Full set of General Assembly, Sub Assembly and Part Technical Drawings
- 120 second video composition illustrating the products' brand-form, key functions, interactions and assembly nomenclature

SUBMISSION COMPONENTS

- Proposal Banner PDF + proposal-narrative video file shall be uploaded
- Proposals Banner PDF shall be printed
- Personal VIDEO composition shall form part of a show-reel of the entire groups' submissions

Marking Sheet 2019/20	DESP:2000 CAD for Product Design 2 **Project 2:** **Digital Prototyping of a Hand Cranked Hoist proposal**

Project Summative Assessment

Deliverables Checklist:	Student Check	Assessor Check
Time record of a coherent and structured digital modelling process		
Fully detailed digital prototype SW master model, part files and assembly files		
Record of the application of digital based testing processes in the developmental and summative evaluation of digital prototypes		
Digital Portfolio Presentation of the proposals digital prototype		
Set of digital prototype output files - STL, DXF,3D-PDF, SW		
Set of technical drawings + associated detailed tolerancing		

A*	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	CF	F
100-80%	79-77	76-73	72-70	69-67	66-63	62-60	59-57	56-53	52-50	49-47	46-43	42-40	39-30	29-0

Terms 2 2018/19 | **Student Name:**

Marking Criteria:	weighting	module LO's	marks
Evidence a coherent and structured Digital Prototyping Process	**10 %**	1,2,3,4	
Evidence detail in the digital modeling of the form, features sub-assembly components and general assembly components	**30%**	1,2,3,4	
Evidence the application of digital based testing processes in the developmental and summative evaluation of digital prototypes	**10%**	3,4,5,6	
Prepare a digital portfolio presentation (PDF + Webpage) of the proposal prototype	**20%**	5,6,7,8,	
Prepare a set of archived files for related digital prototype outputs - STL, DXF,3D-PDF, SW	**15%**	7,8,	
Generate comprehensive set of technical drawings which are compliant to BS 8888 and associated tolerancing standards	**15%**	5,6,7, 8,	
Mark descriptors are the University's marking framework for assessment. Based on generic criteria, they cover a broad range of disciplines. Use of the descriptors is supported by full guidance can be found in your Subject & Programme Guide ('Marking Criteria). The generic mark descriptors form part of the University's regulations		Final Grade	

Assessor	**Moderator:**	**Date:**

Project 2 Technical Drawings Deadline 09:00am Monday 16/03/2020 WK-25
Project 2 Summative Submission Deadline 09:00am Monday 30/03/2020 WK-27

DESP:2000 CAD for Products Designers 2: Project 2 2019/20

Project 2 2019/20

Digital-Prototype-Modelling of a Hand Cranked Hoist re-design proposal

Study Weeks	TUTOR DIRECTED STUDY Lecture Series 1hr per week	Rm: 1.32 CAD LAB Workshops 1.5 hrs per week Digital Prototyping Process Phases	Recorded Tutorials + Published PDF tutorials	SELF-DIRECTED STUDY 8.5 hrs per week
Week 15 06/01/2020	PROJECT WEEK 1 **Project Process Overview** **Digital Prototyping of Functional Performance** *Solidworks Analytical Tools* *Video Based proposal Narratives*	***SW Motion Study*** ***Linkage + Structure Modelling***	*Modelling 'structural-rig' of the existing product configuration* *Prepare a base animation of the movement limits*	**GENERATE SKETCHBOOK PRO SCALED RENDERED ELEVATIONS** Based on the existing product configuration generate concepts visuals of re-designed product brand form
Week 16 13/01/2020	PROJECT WEEK 2 **Application of Digital Analytical Tools in Product Development**	***Solidworks*** ***Framework Form Modelling***	*Modelling a brand re-design of the 'structural-rig' of the existing product configuration*	**UNDERTAKE MODELLING OF STRUCTURAL ELEMENTS AND PRIMARY HOIST FUNCTIONS –** movement scope and range Apply re-brand-design culture from inserted Sketchbook Pro- renders
Week 17 20/01/2020	PROJECT WEEK 3 **Iterative Digital Modelling in optimising functional performance**	***Solidworks FEA***	*Modelling a test of the load-structural capacity and balance of the lift function*	**UNDERTAKE MODELLING OF HOIST FEATURES –** consider assembly issues, usability and manufacturability
Week 18 27/01/2020	PROJECT WEEK 4 **Gearing Principles, Types and SW gear mate feature**	***Solidworks Gear-mate***	*Modelling a gearing assembly and animating gearing advantage*	**COMPLETE A SCHEMATIC MODE OF THE GEAR-TRAIN –** undertake a motion study to demonstrate performance parameters
Week 19 03/02/2020	PROJECT WEEK 5 **Detailing of engineered mechanisms as SW models**	***Modelling Sub-Assemblies***	*Modelling bearing subassemblies of a handle - drive acting on a gearing mechanism*	**COMMENCE RESOLUTION OF THE DIGITAL PROTOTYPE** Resolve finalisation of Master File details, part-files sand sub-assembly files. ARCHIVE FILES
Week 20 10/02/2020	PROJECT WEEK 6 **BS888 standards and the contemporary alternative – Model Based Definition**	***BS:8888 overview*** *Review on GA's + Part Files + Sectional Details Dimensions*	*Review case study of tech drawings submission – Strategy for Layout of GA, Component, Sub-Assemblies*	**DEVELOP GENERAL ASSEMBLY MODEL -** Based on part files + sub-assemblies, plus the Masterfile. ARCHIVE FILES
Week 21 17/02/2020	PROJECT WEEK 7 ***BS:8888 Tolerances +*** **Tolerancing Strategies**	***BS:8888 Tolerances + Tolerancing Strategies*** for general assembly, sub-assembly and single part components	*Case Study Exercises Dimensioning of drawings and applying Tolerancing of Geometry, Dimensions and assembly fits*	**GENERATION OF TECHNICAL DRAWINGS** GA, Sub assembly, Part Drawings as sheet layouts with consideration of scale, areas for dimensioning and notation. ARCHIVE FILES
Week 22 24/02/2020	EMPLOYABILITY WEEK	PROGRAMMED ACTIVITIES		
Week 23 02/03/2020	PROJECT WEEK 8 **Compiling Proposal Technical Drawings + Specification Notation**	***SW Visualise scripted animations***	*Generating scripted animations of product functions + performances*	**DIMENSIONING AND SCHEDULE OF TOLERANCES *on*** *geometry, dimensions and fits across all drawing sheets*
Week 24 09/03/2020	PROJECT WEEK 9 **Compiling Product Proposal Video Narratives**	***Adobe Premier*** *Compositing multiple-aspect video presentations*	*Compile video narratives of product form, interactions and performative functions*	**CRIPTED ANIMATION PROPOSAL FUNCTION** *Generating scripted animation of your proposal product function + performance*
Week 25 16/03/2020	PROJECT WEEK 10 PREVIOUSLY RECORDED **Bonus Lecture** *SW - Topology Optimisation*	***PROJECT 2A Technical Drawings Submission uploaded 09:00am 16/03/2020*** ***Technical Drawings Presentations – see tutorial slots Groups C & D***		**PROPOSAL SHOW REEL CLIP** *Compile video narrative of product form, interactions and performative functions – use animations, stills, apply timed-annotation*
Week 26 23/03/2020	PROJECT WEEK 11 PREVIOUSLY RECORDED **Bonus Lecture** *SW – Fatigue Analysis*	***Technical Drawings Presentations – see tutorial slots Groups A & B***		**COMPILE PROJECT SUBMISSION** *– see the submission requirements* *To be completed well in advance of the submission deadline*
Week 27 30/03/2020	PROJECT WEEK 12 PREVIOUSLY RECORDED **Bonus Lecture** *SW – Model based definition*	***PROJECT 2b All individual complete-project submissions to by uploaded by Monday 09:00am 30/03/2020*** *Studio Pin-up of Proposal Presentation Banners* *Screening of Proposal Video Presentations to the group audience*		PORTFOLIO BUILDING PRACTICE *accessing support materials* **NB: *CAD Lab is Booked for standard tutorial times***

Project 2A Technical Drawings

Layout and Presentation

10 The information provided is perfect / very near perfect
08 The layout is clear and the presentation is appropriate, but minor improvements could be made
06 Wrong / inappropriate views have been submitted, but on balance the layout is clear and the presentation is appropriate
04 Not all the information has been presented and wrong / inappropriate views have been submitted
02 The information provided is extremely poor; the USB could not be manufactured from this information
00 No information was submitted

General assembly Page

10 The information provided is perfect / very near perfect
08 The GA clearly shows the product being produced, the parts to produce to make this product and where the manufacturing information about those parts can be found
06 The GA shows the product being produced but as an index to the technical document it could be clearer.
04 The GA neither clearly shows the product being produced nor provides an index to the technical document
02 The GA is little more than an orthographic view
00 No information was submitted

Presentation of Technical Drawings

10 The information provided on the technical drawings is complete
08 The information provided on the technical drawing is excellent; very few questions are raised when studying the document
06 The information provided on the technical drawings is good; some questions are raised when studying the document
04 The information provided on the technical drawings is adequate; but further information would be required to manufacture the USB
02 The information provided on the technical drawings is very poor
00 No information was submitted

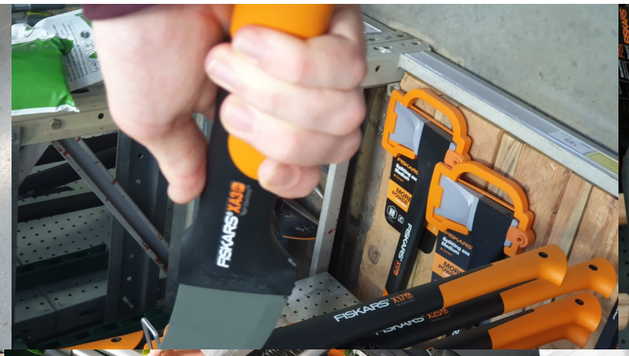
Ability to manufacture the parts from this document

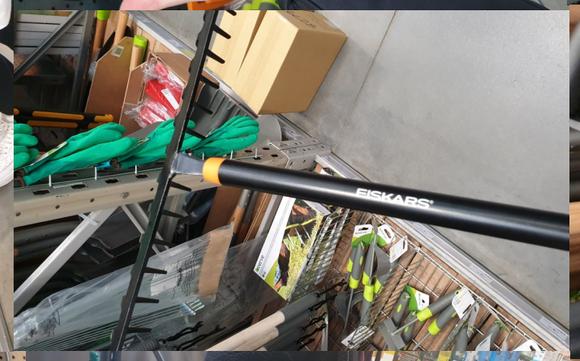
10 The USB can be fully manufactured from the information provided
08 The USB can be manufactured from the information, but may not be fully accurate
06 The USB can be manufactured from the provided information with only minor questions needing to be asked of the designer
04 The USB can be manufactured from the provided information, but major information is required from the designer
02 The USB cannot be manufactured from the provided information
00 No information was submitted

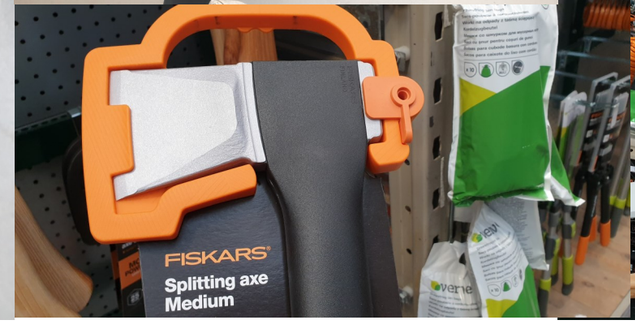
Selection of tolerances and manufacturing processes for all the USB parts

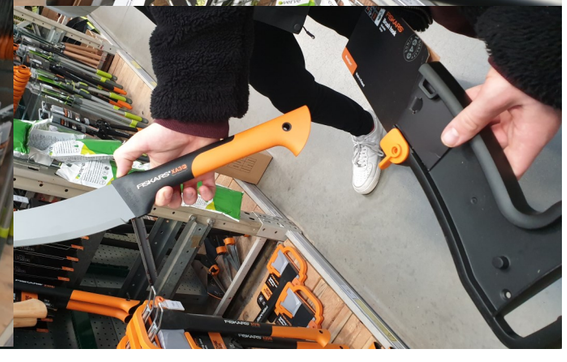
10 The information provided is perfect / very near perfect
08 The tolerances provided can be accurately manufactured from the information and they fit in most iteration
06 The majority of tolerances provide work but some are wrong
04 There are some tolerances provided that work but the majority are wrong
02 The tolerances provided will not work in reality
00 No information was submitted

Week Set	Task	Completed?	Feedback
15	Build Frame	Yes	Relatively easy to do, followed well and was able to recreate in spare time
15	Stress test	Yes	Slightly confused in tutorial but followed guide at home and understood it better.
15	Design Board	Yes	Design board completed
15	Initial Design Page	Not started	-
15	Brand Page	Not Started	-









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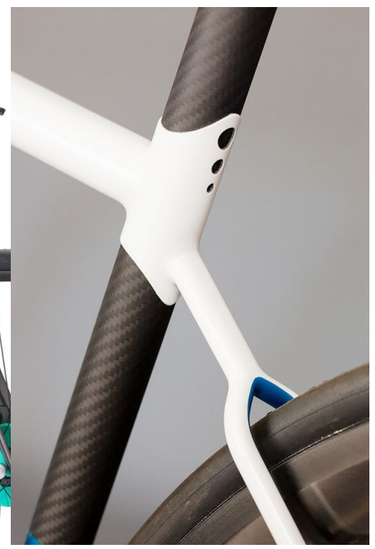
Primary Form Research

Chris Barnes Design

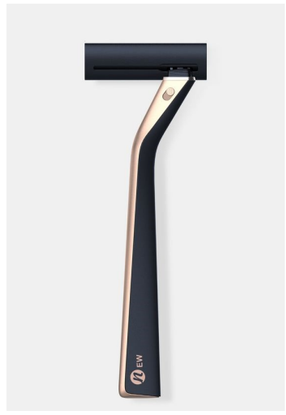














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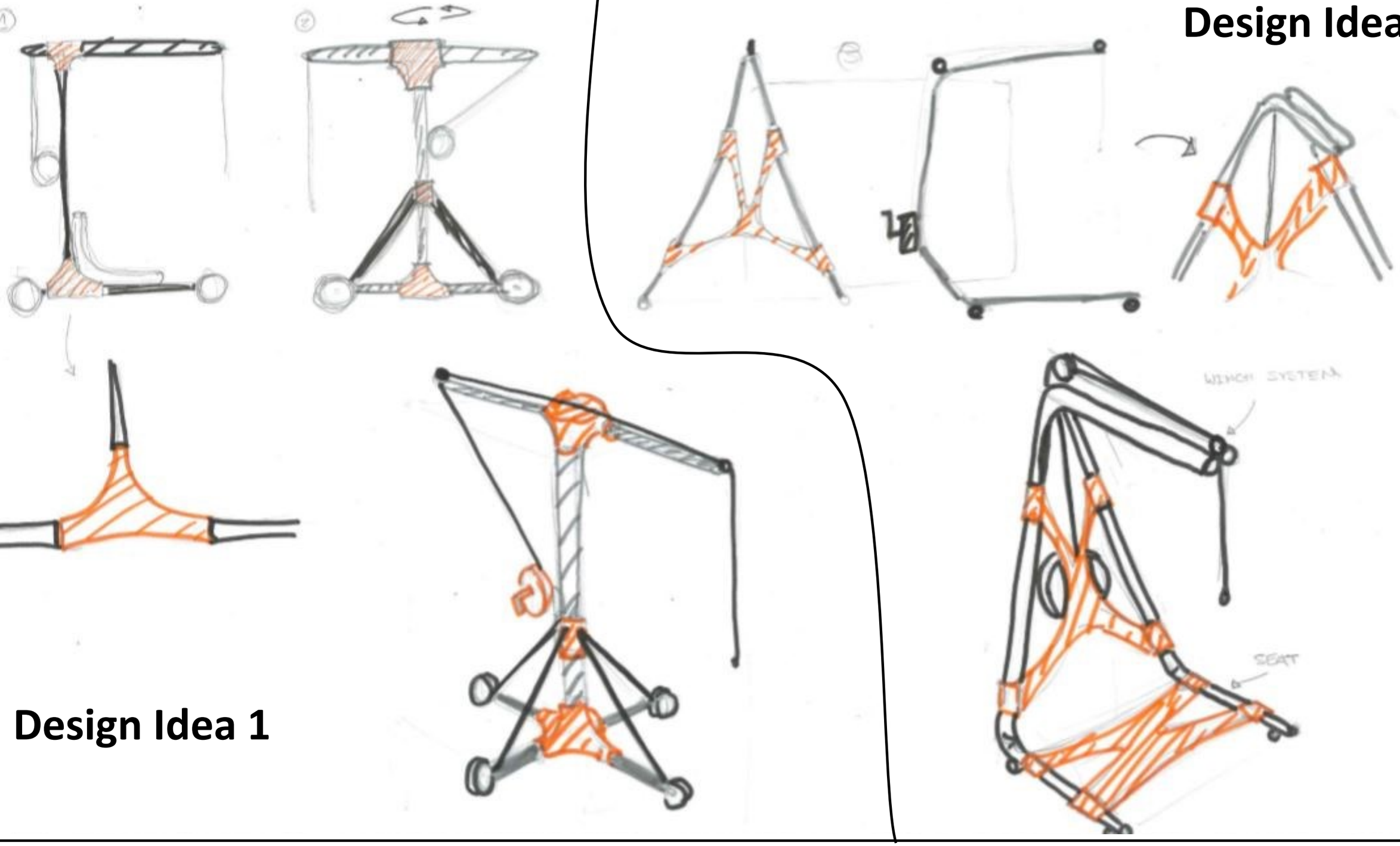
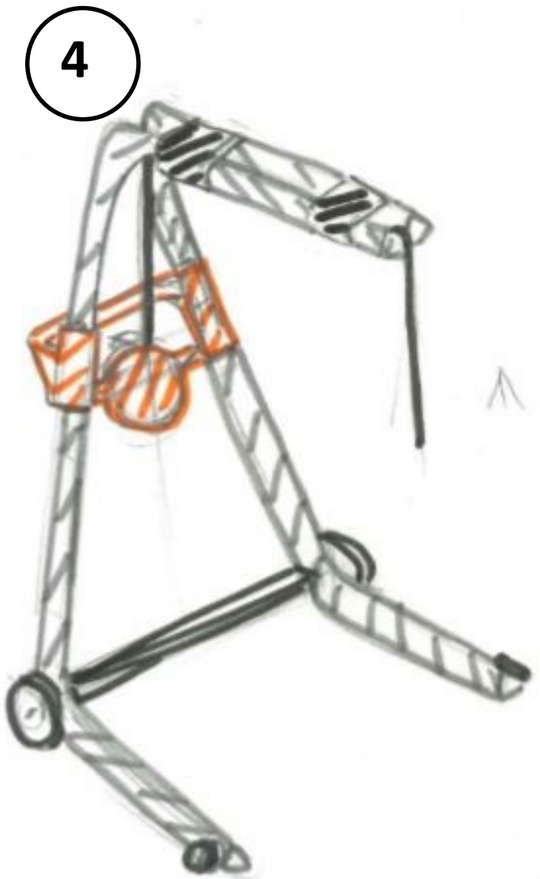
Secondary Form Research

Chris Barnes Design

Design Idea 2



Design Idea 1



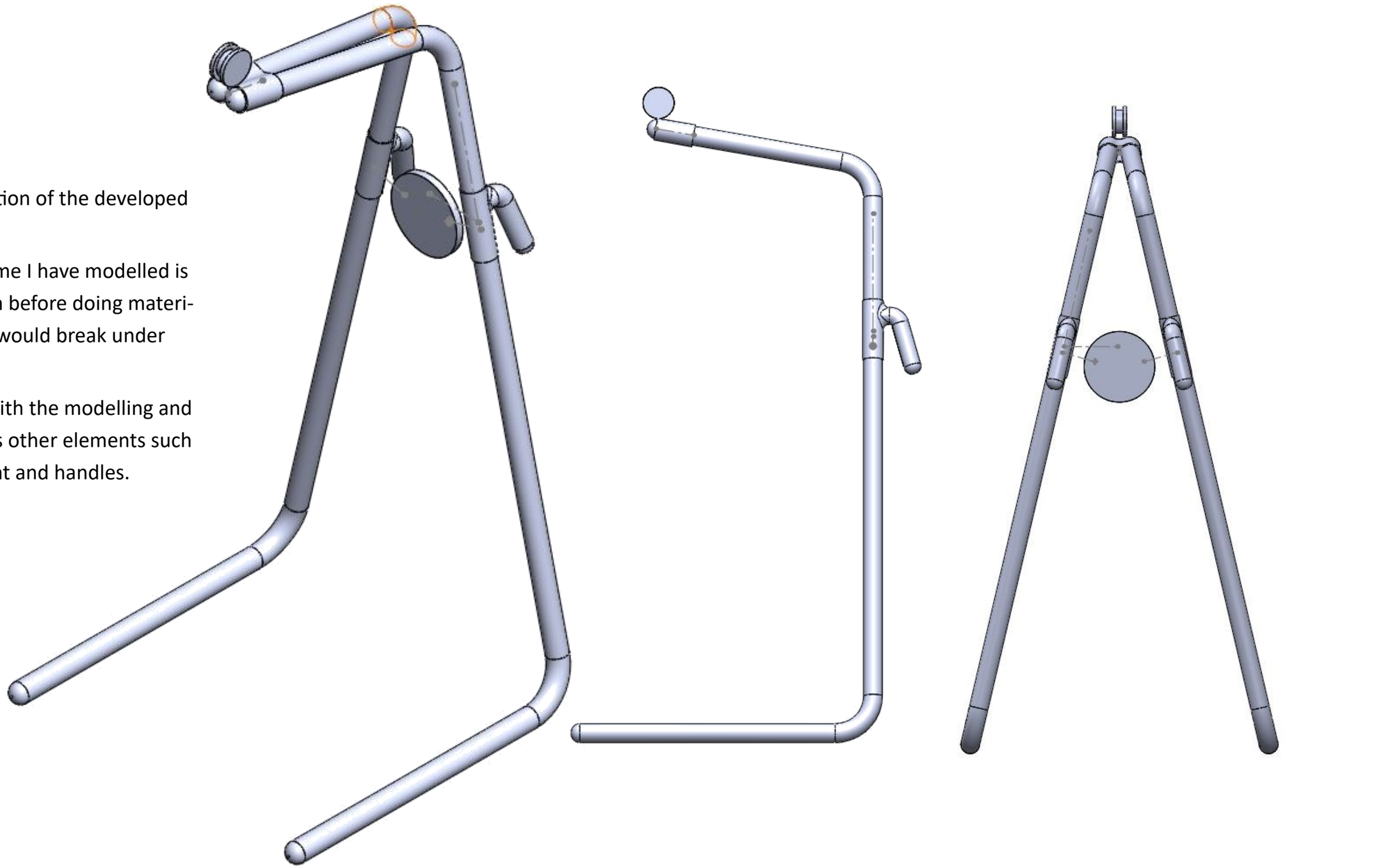
These are 4 design ideas inspired by Design 2 on my Initial Design Drawings page.

From these developments, I decided to go forward with Designs (2) & (4) as I came to the conclusion that these were both the most structurally sound designs and both well presented the Fiskars Brand.

This is my first CAD iteration of the developed designs.

After evaluation, the frame I have modelled is too thin and fragile. Even before doing material testing, I know that it would break under any type of pressure.

I also got carried away with the modelling and started designing various other elements such as the gearbox placement and handles.



Initial Frame form from drawings (Model 1)

Heavy Duty Polyurethane on Cast Iron Castors.

This range of Heavy-Duty castors manufactured in Germany have a strong cast iron centre and bonded with High- Grade polyurethane tread. And strong pressed steel brackets with a zinc and chromated finish. (The swivel version has a high-quality thrust ball bearing and a tapered roller bearing for accurate guidance of the kingpin). It offers you a Non-Marking tread, excellent resistance to abrasion and impact and has a high resistance to oils and greases

	CODE	WHEEL DIAMETER (MM) ▼	TREAD WIDTH (MM)	CASTOR HEIGHT (MM)	TOP PLATE SIZE (MM)	BOLT HOLE SPACING (MM)	OFFSET (MM)	BOLT HOLE DIAMETER (MM)	LOAD CAPACITY (KG)	AVAILABLE STOCK
	P4256	100	35	129	105x85	80x60	-	9	250	3
	P4246	100	35	129	105x85	80x60	46	9	250	4

Front Wheel Dimensions

Rubbathane Tyre

Range: Wheels & Castors

Category: Heavy Duty Industrial Wheels

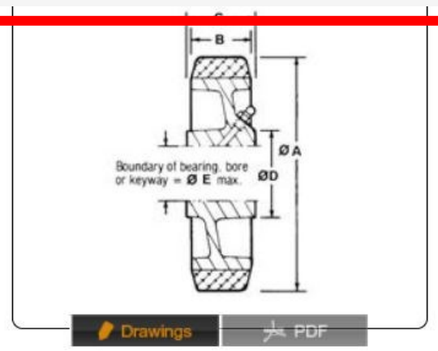
Group: Rubbathane Tyred Wheels

Style: Rubbathane Tyre

Search on complete or part product code

GO

Brauer industrial 'rubbathane' tyred wheels are made from a specially formulated polyurethane material to mimic the characteristics of rubber but with the added benefits of longer life and improved wear. Rubbathane are the least expensive type of tyred wheel and are most suitable for mid-range loads. Rubbathane wheels from Brauer are non-marking, quiet in operation and tested to ensure they out-perform other wheels in their class.

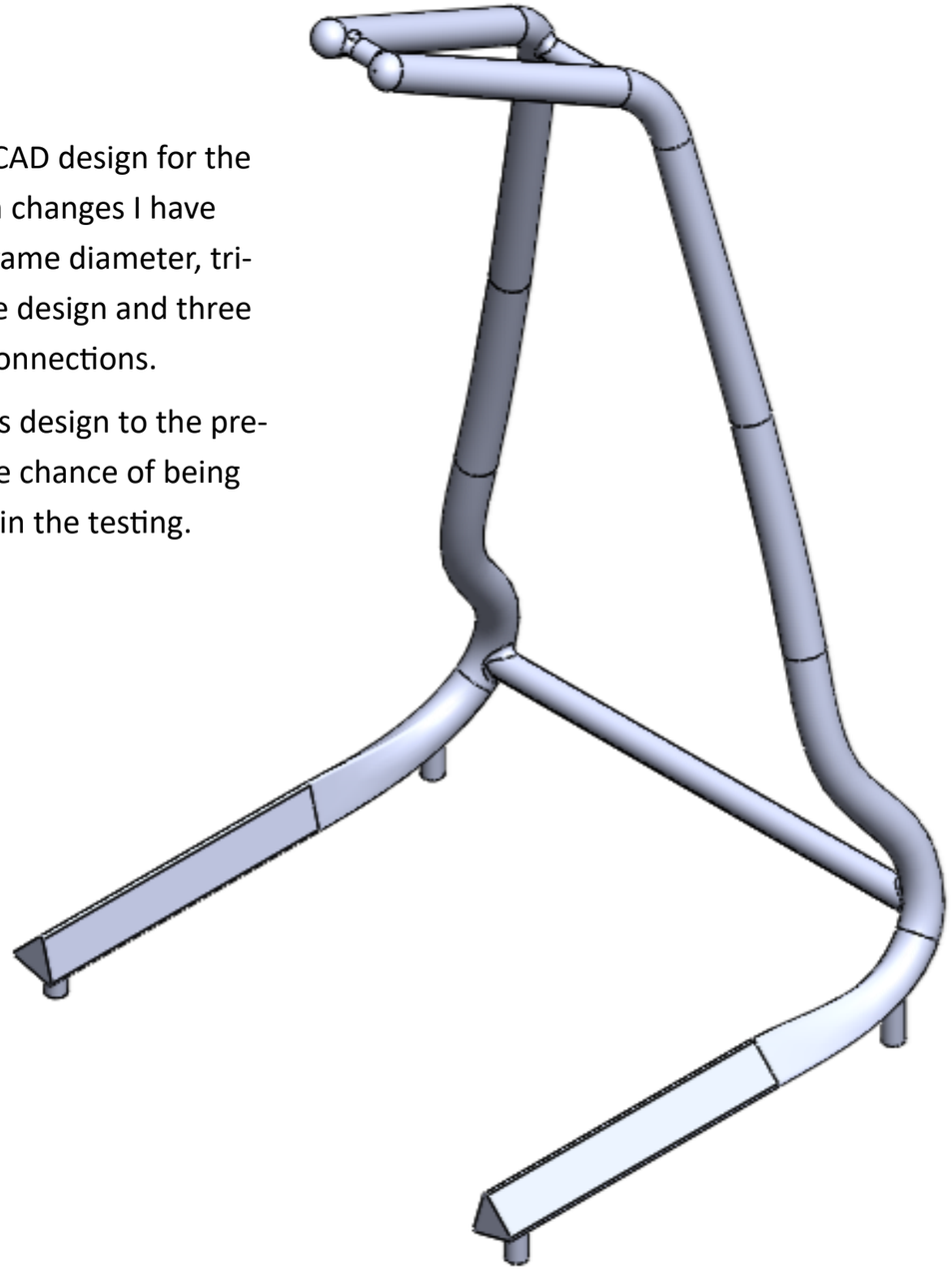


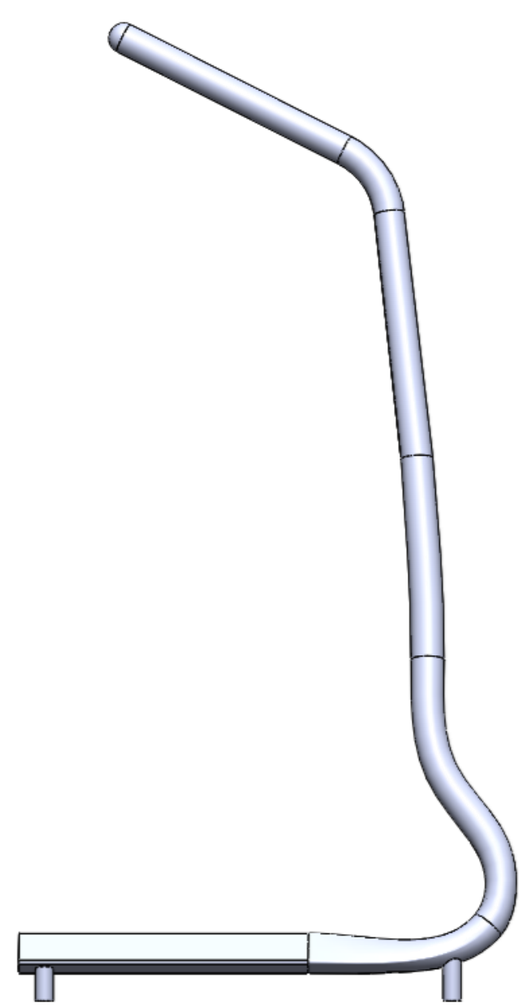
Part No.	A	B	C	D	E	Max Load Kg	Weight Kg	
R100/40	100	40	45	63	45	290	1.5	Show Variants
R125/30	125	30	35	58	40	280	1.5	Show Variants
R150/50	150	50	55	63	45	580	3	Show Variants
R200/40	200	40	50	65	50	580	4	Show Variants

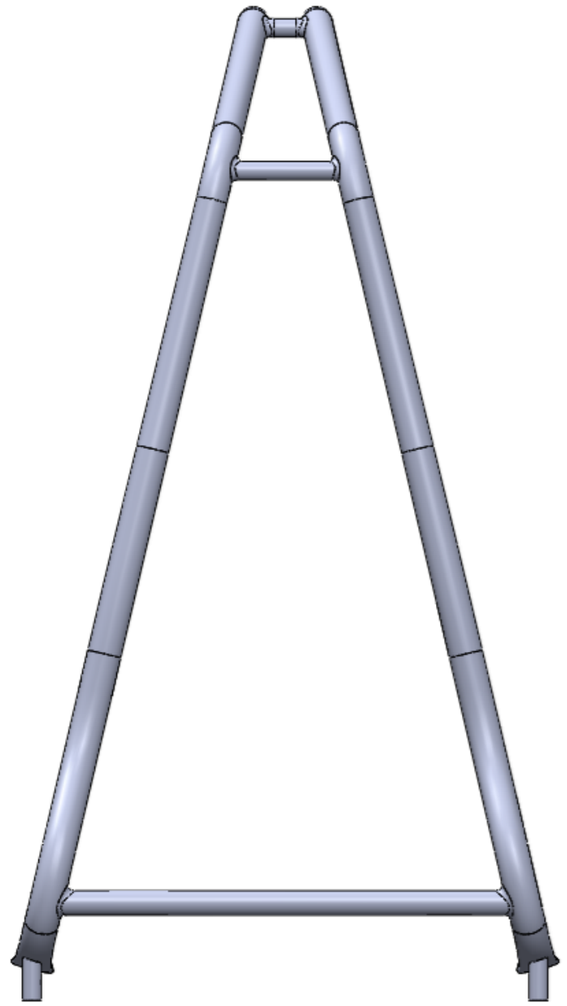
Back Wheel Dimensions

This is my second CAD design for the framework. Design changes I have made are: larger frame diameter, triangular base frame design and three horizontal frame connections.

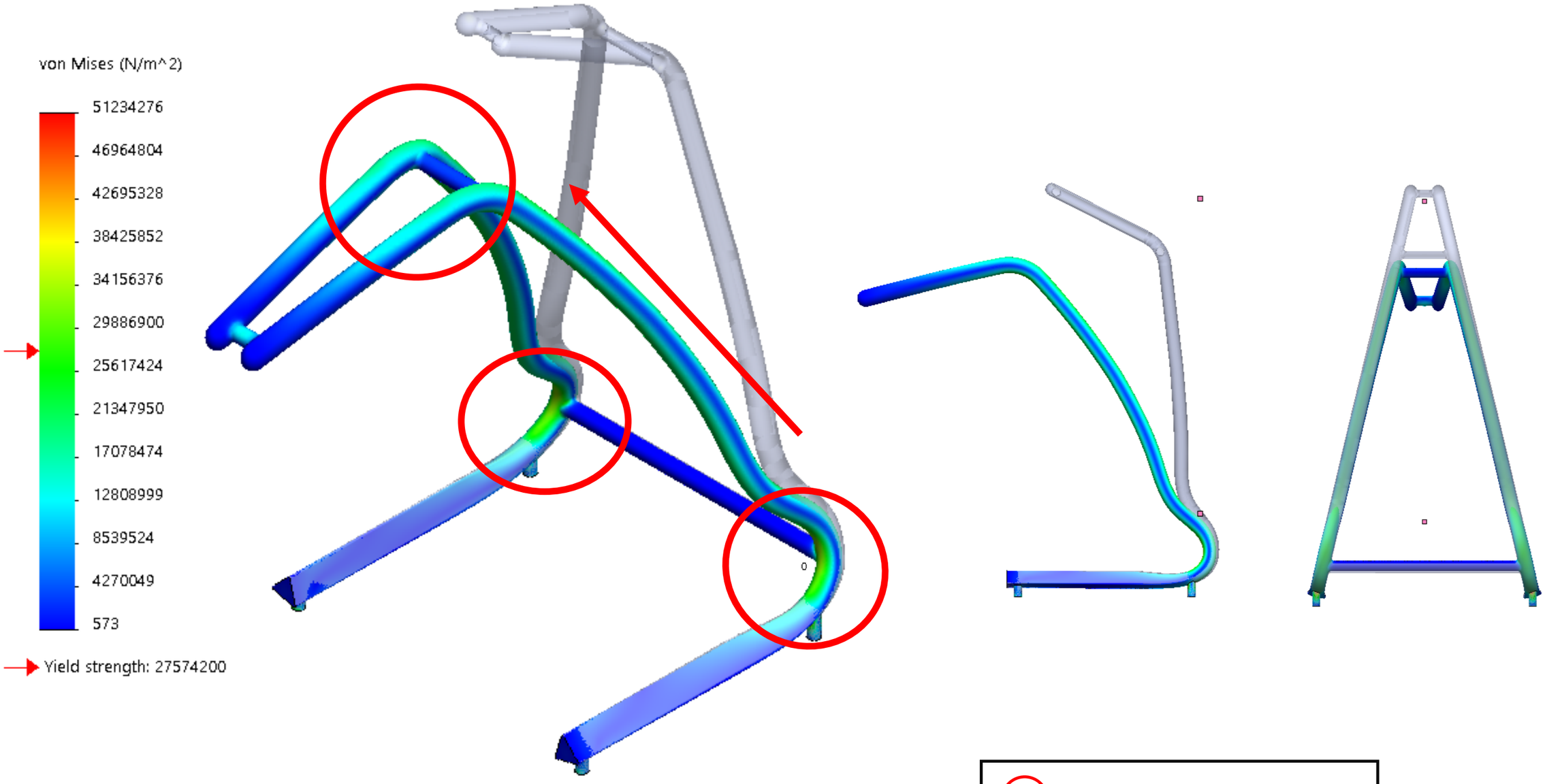
I already prefer this design to the previous and has more chance of being structurally sound in the testing.







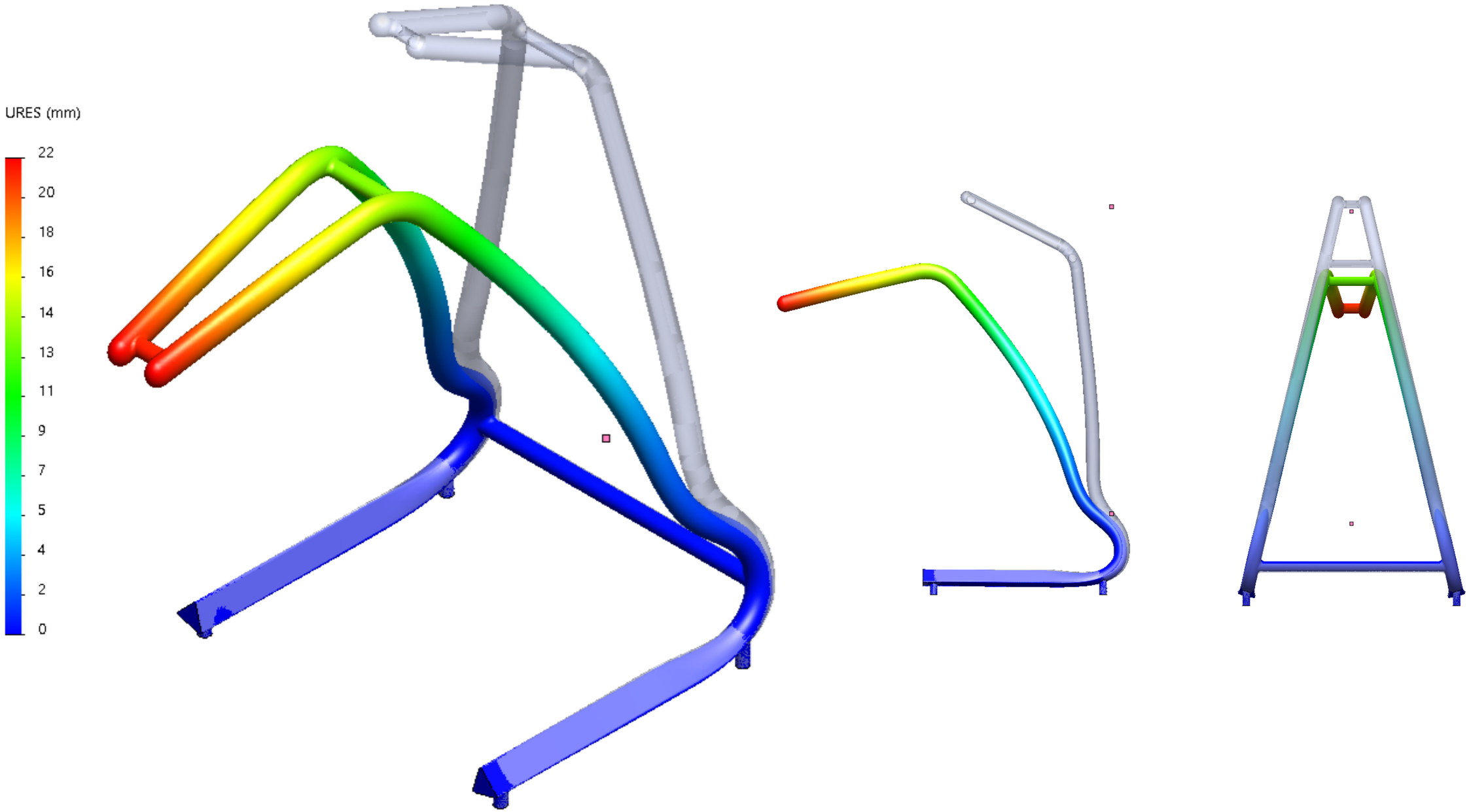
Revised frame form from initial design (Model 2)



= material weakness hotspots

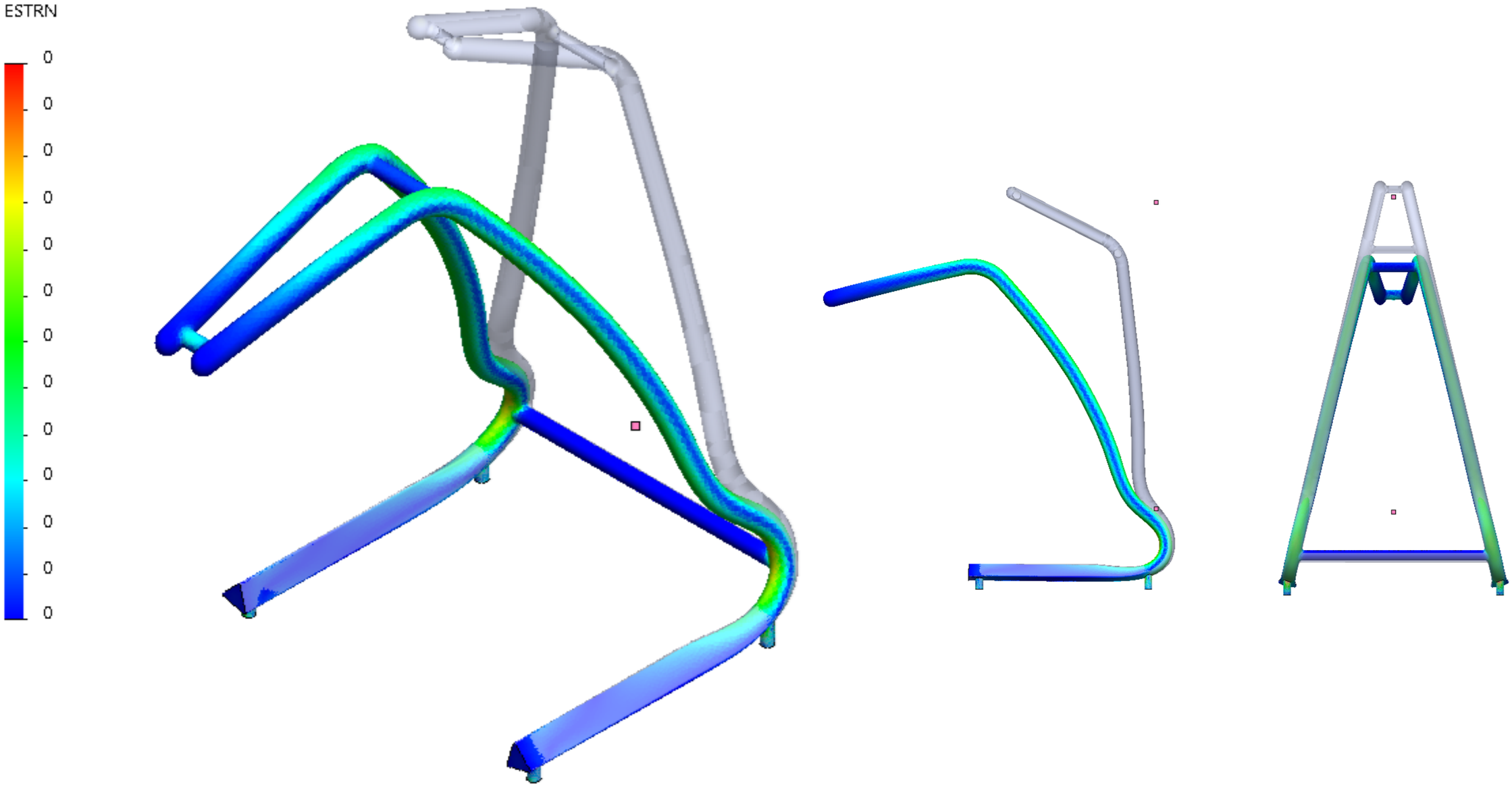
Model 2 Stress Test

Chris Barnes Design



Model 2 Displacement Test

Chris Barnes Design



Model 2 Strain Test

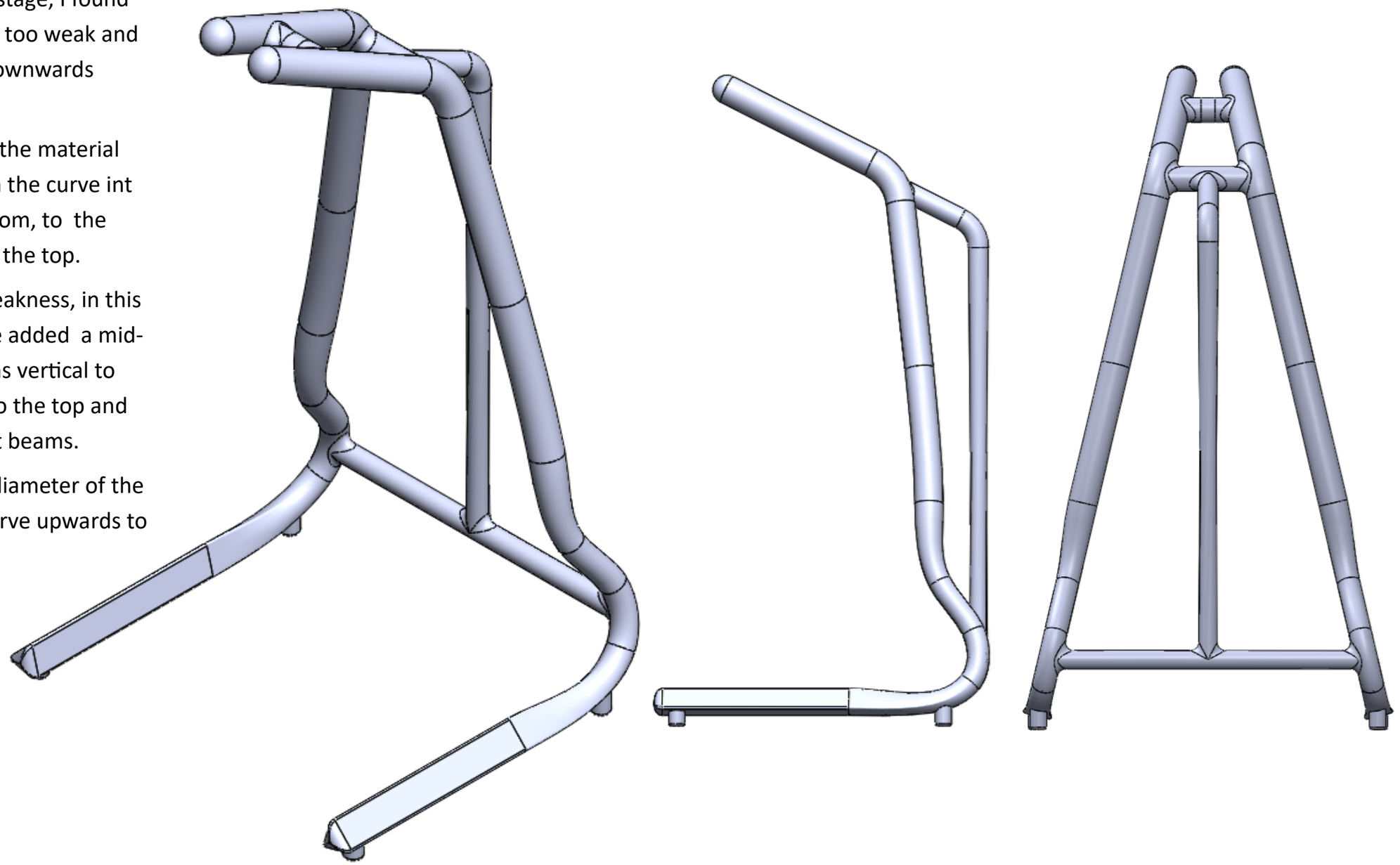
Chris Barnes Design

From the model 2 testing stage, I found out that the structure was too weak and was bending due to the downwards pressure.

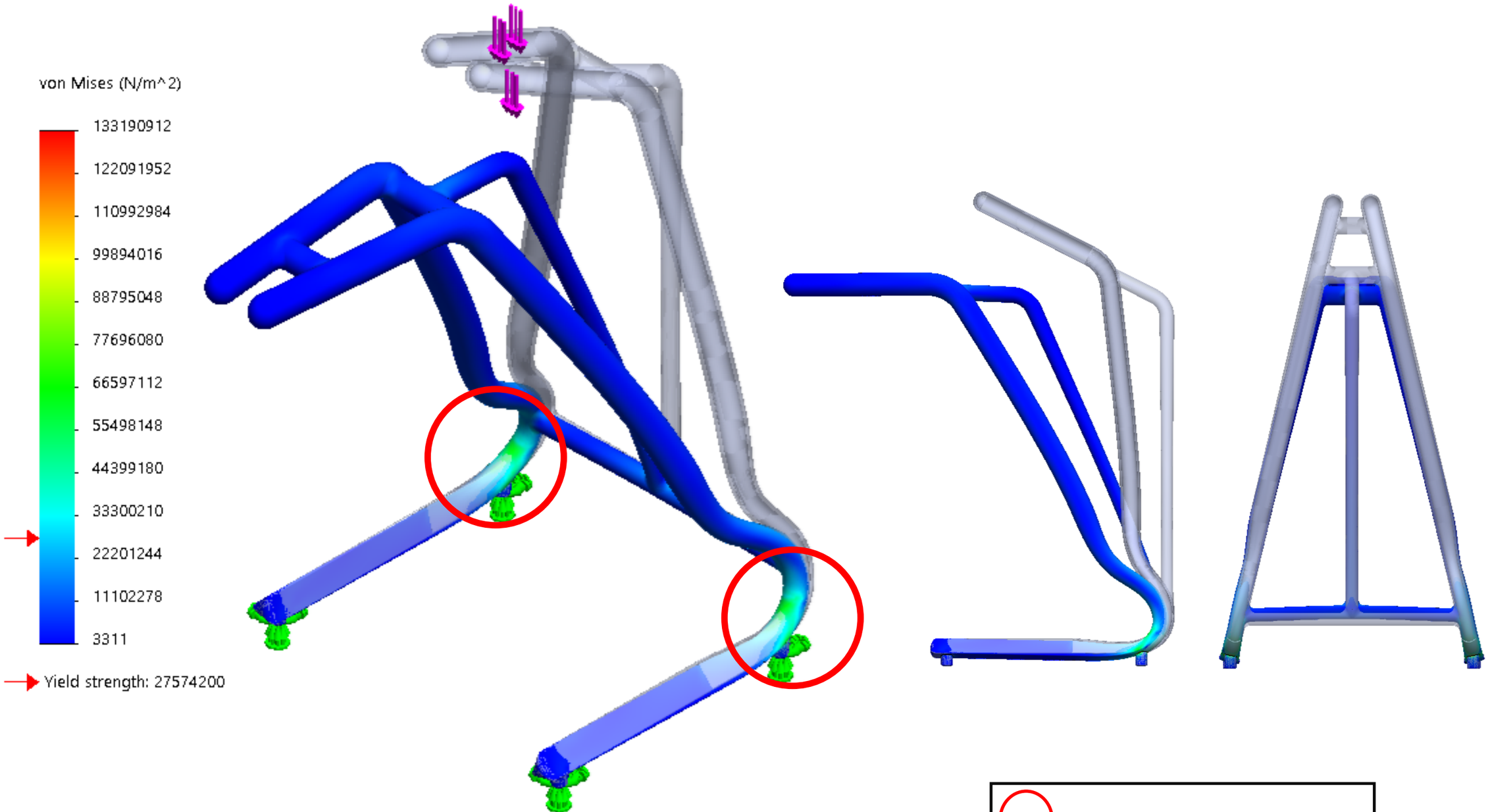
The main hotspots where the material was bending was between the curve int the framework at the bottom, to the curve in the framework at the top.

To try and counter that weakness, in this design of the model I have added a middle support beam that runs vertical to the design and connects to the top and bottom horizontal support beams.

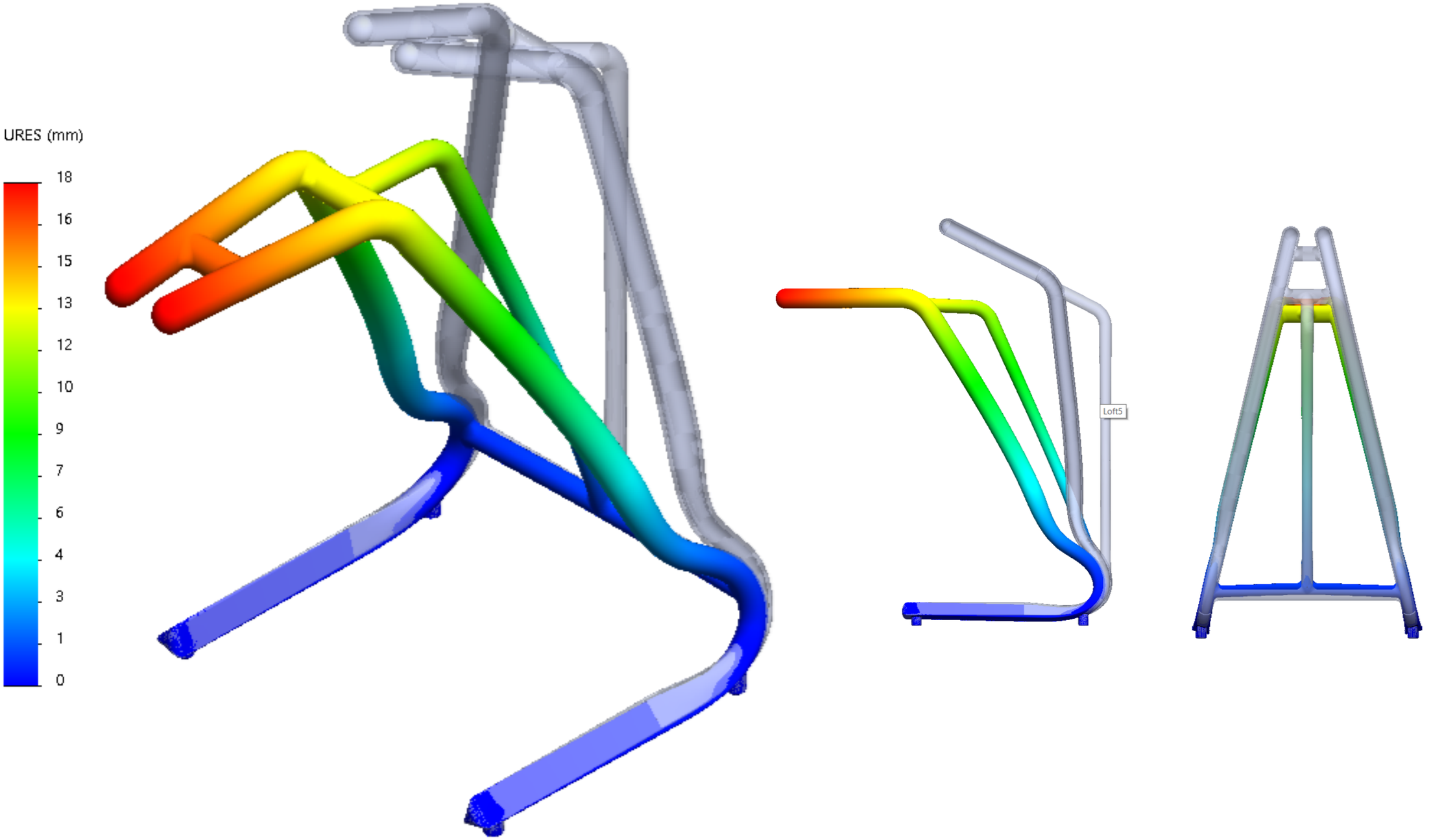
I have also increased the diameter of the frame from the bottom curve upwards to increase the strength.



Revised frame form from Model 2 (Model 3)



Model 3 Stress Test



Model 3 Displacement Test

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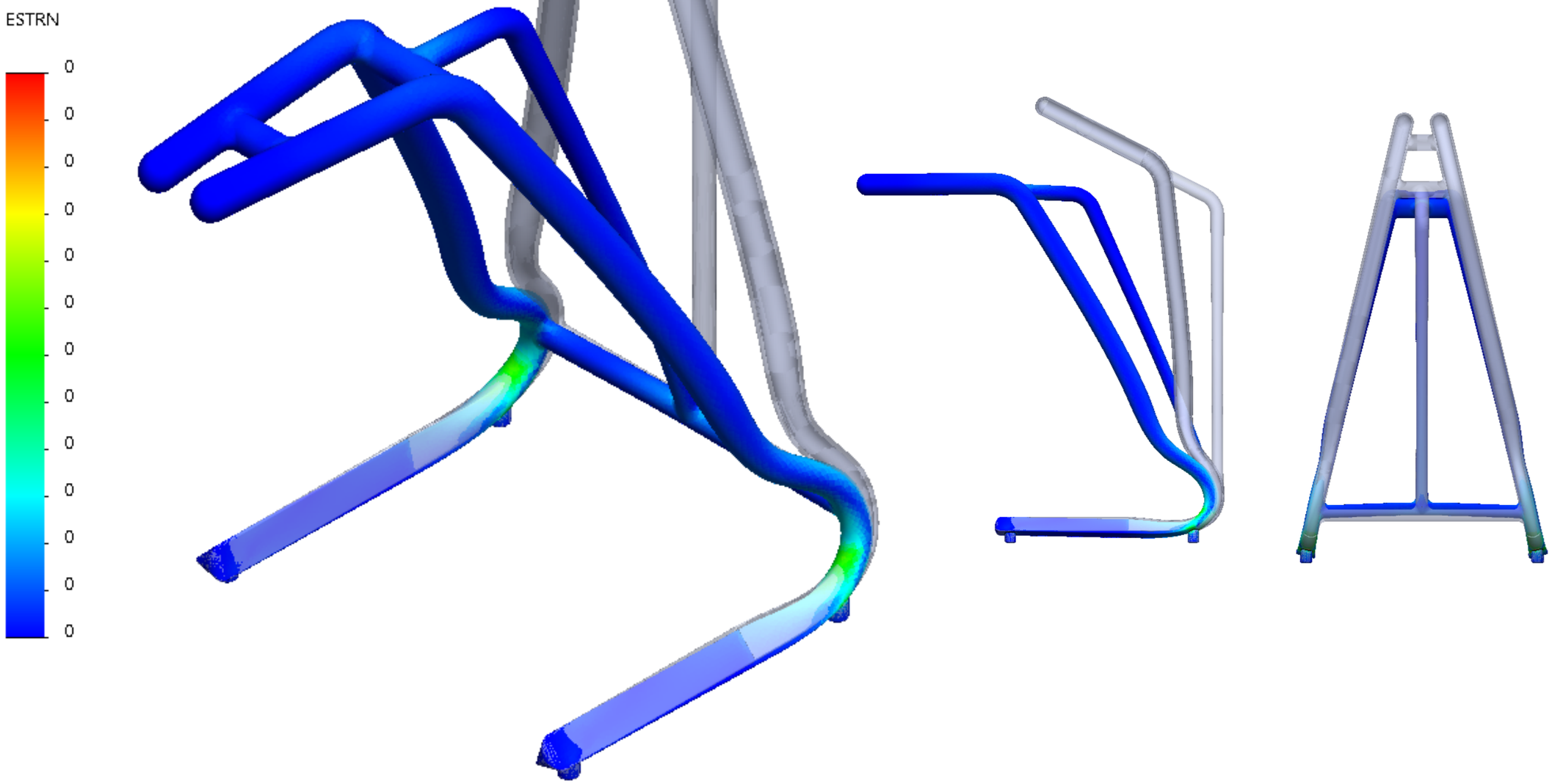
Chris Barnes Design



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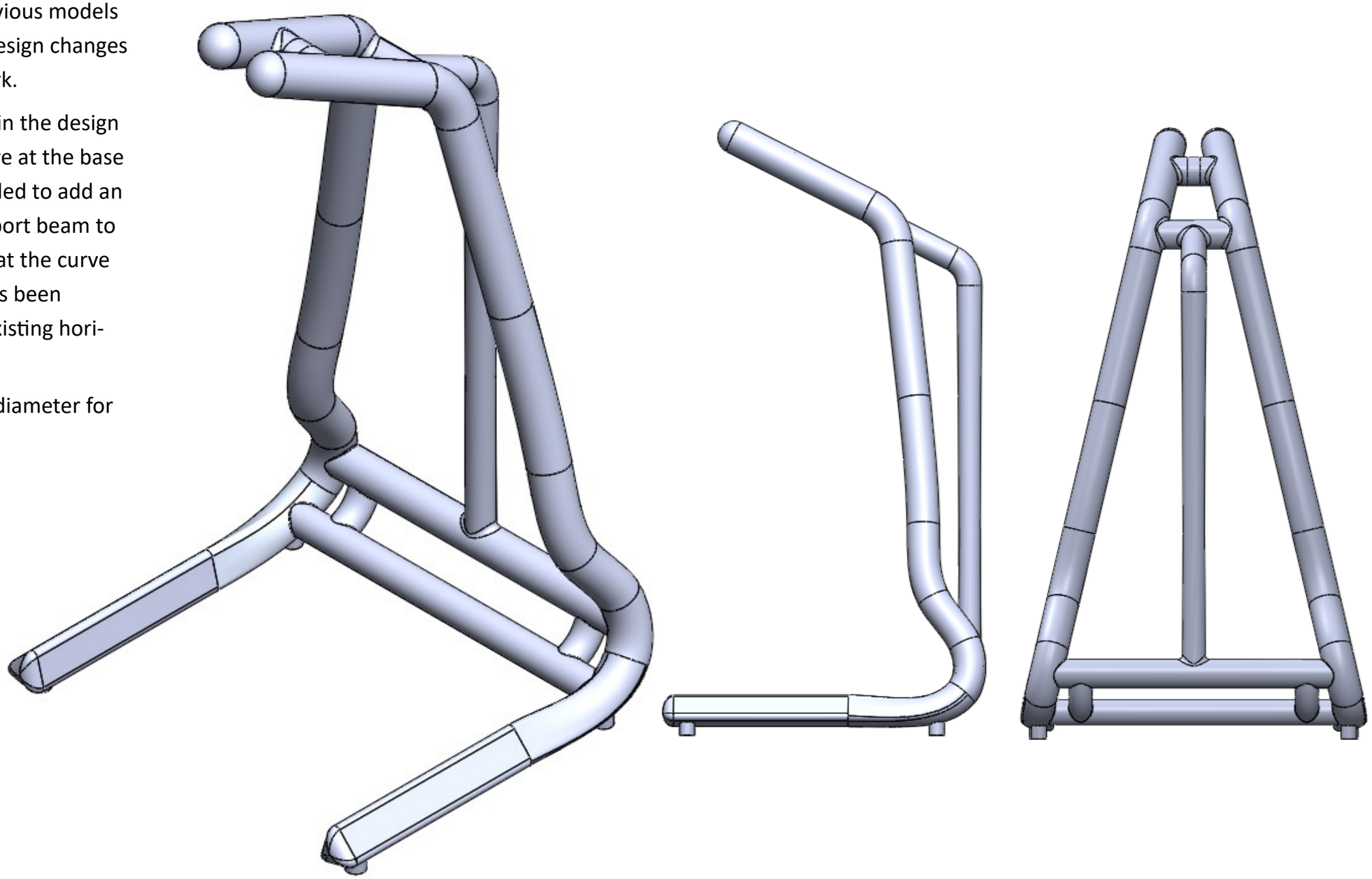
Model 3 Strain Test

Chris Barnes Design

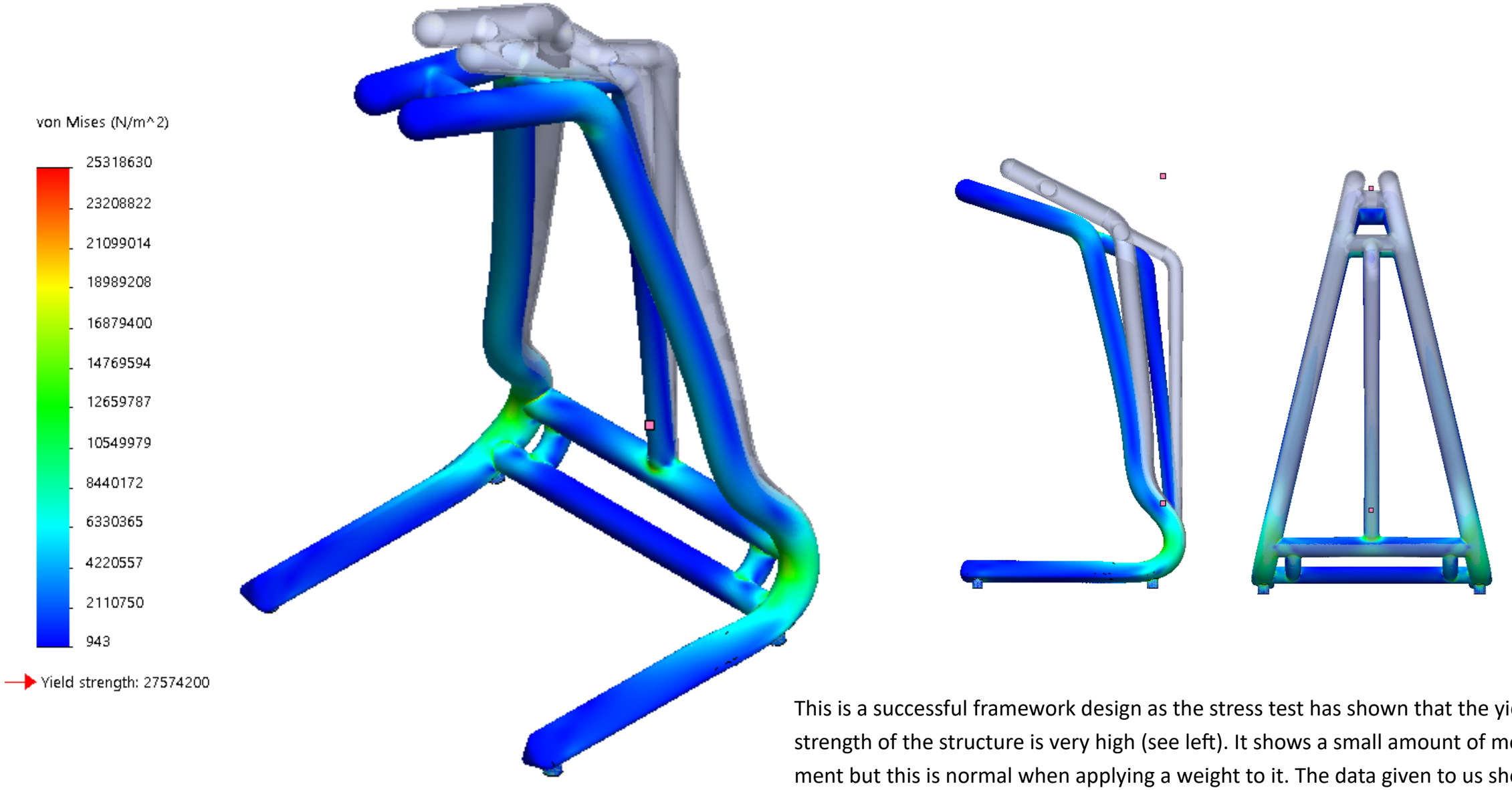
Due to the material weakness points I have identified in the previous models stress test, I have made design changes to reinforce the framework.

I identified the weakness in the design was coming from the curve at the base of the design. I have decided to add an additional horizontal support beam to help distribute the stress at the curve of the framework. This has been attached to the already existing horizontal beam.

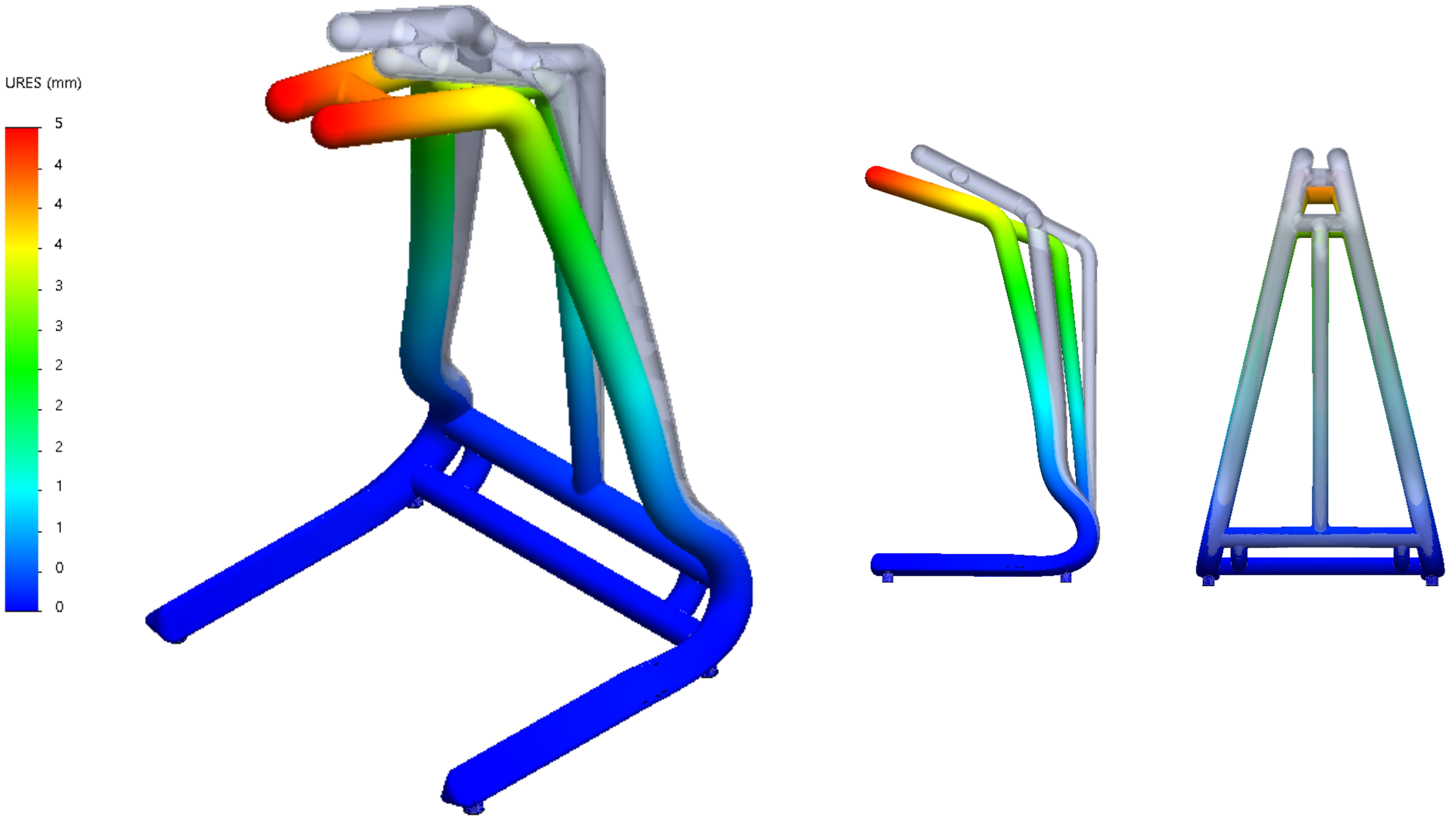
I have also increased the diameter for the whole framework.



Revised frame form from Model 3 (Model 4)



This is a successful framework design as the stress test has shown that the yield strength of the structure is very high (see left). It shows a small amount of movement but this is normal when applying a weight to it. The data given to us shows it will go back to its original shape once the weight has been removed.



Model 4 Displacement Test

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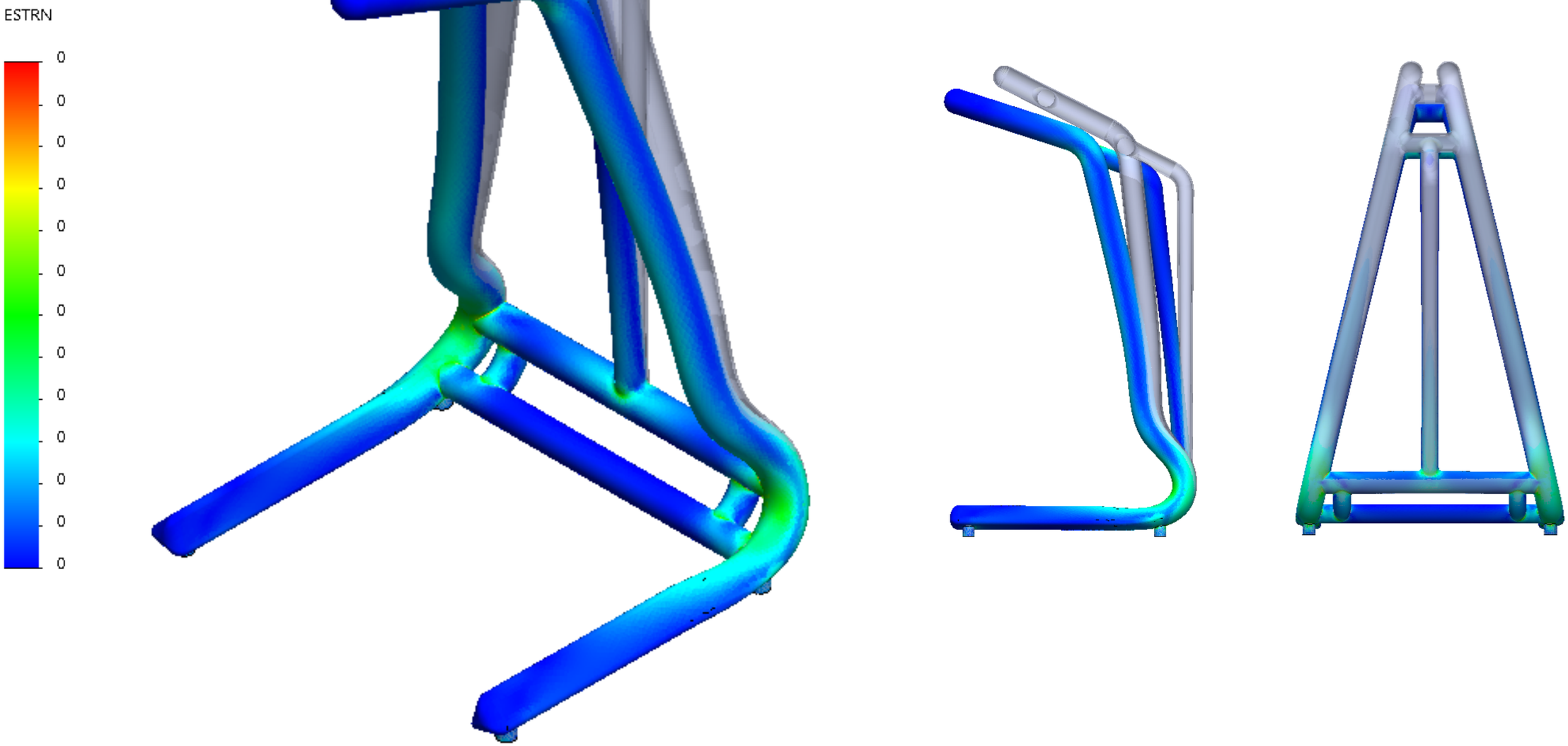
Chris Barnes Design



Model 4 Strain Test

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Chris Barnes Design

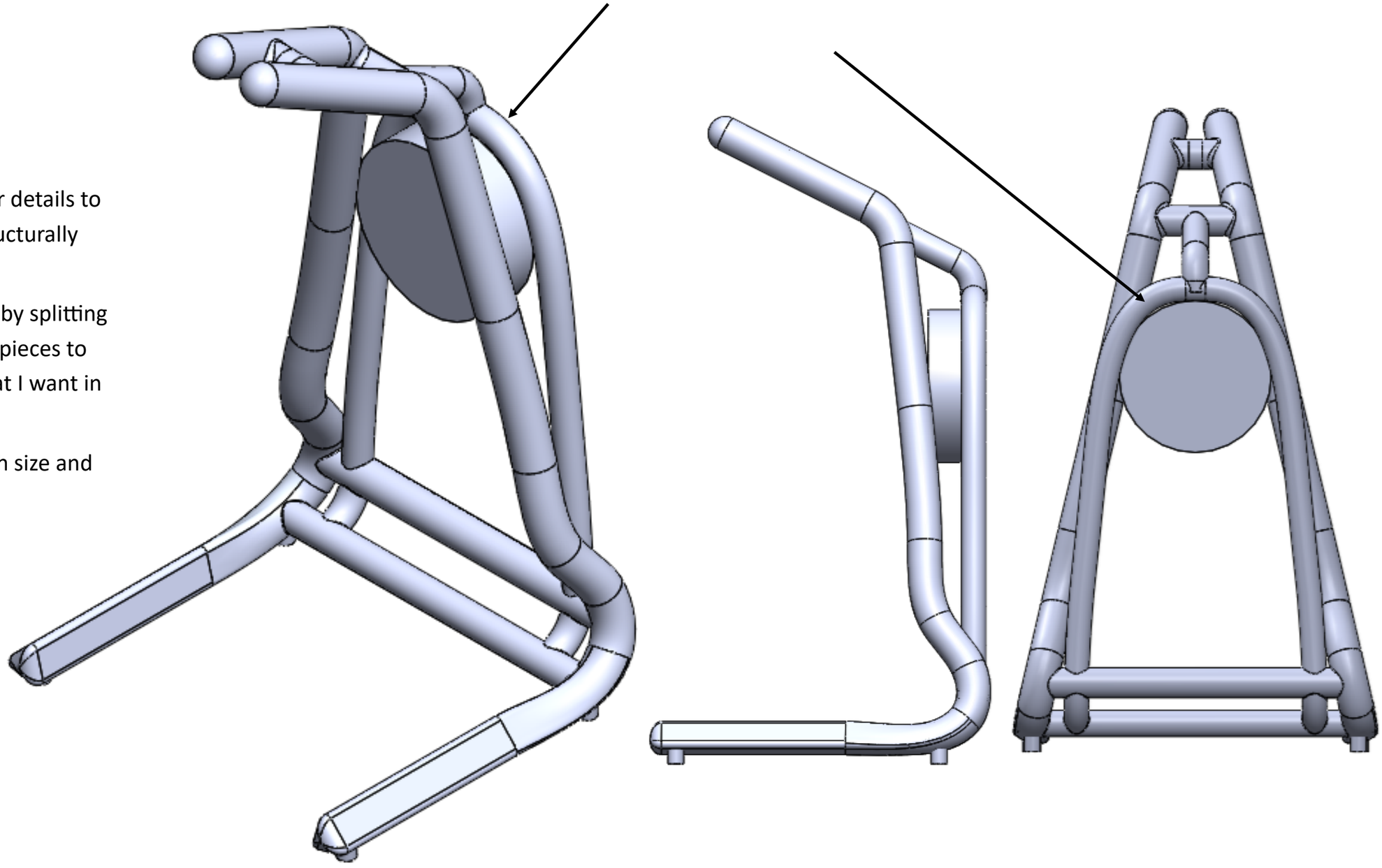
I have started to add the finer details to the design after making a structurally sound framework.

I have made a design change by splitting the vertical support into two pieces to curve around the gearbox that I want in the middle of the frame.

I have also added in the rough size and shape of the gearbox.

Design Change:

Split curved support beam to make space for gear box

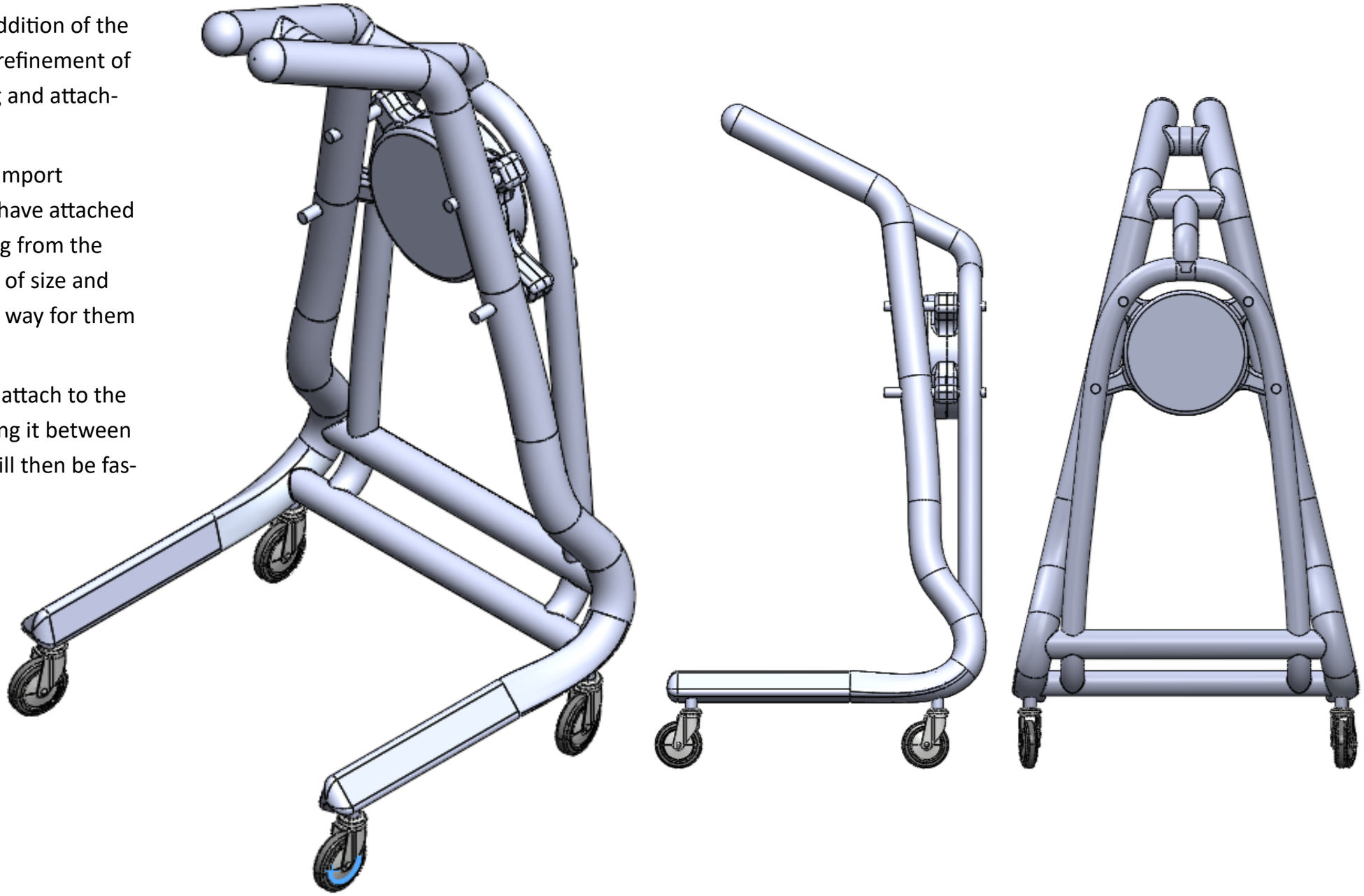


Revised frame form from Model 4 (Model 5)

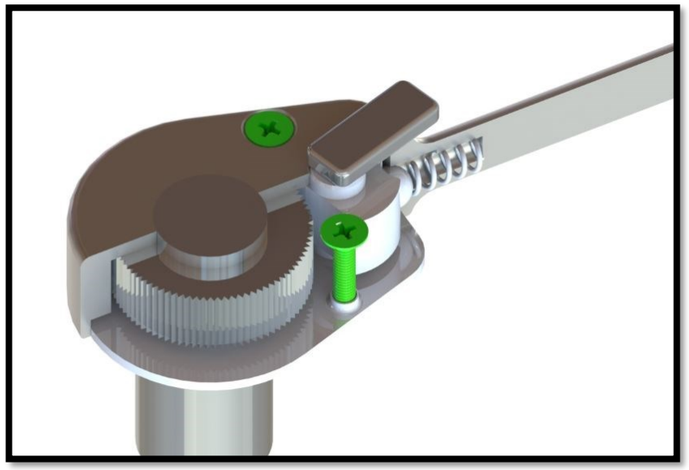
On this page you can see the addition of the CAD imported wheels and the refinement of the Gearbox shape, positioning and attachment to the main frame.

The wheels I have used are an import sourced from a CAD website. I have attached them roughly to pipes extruding from the main framework to get a sense of size and proportion. I still need model a way for them to attach properly.

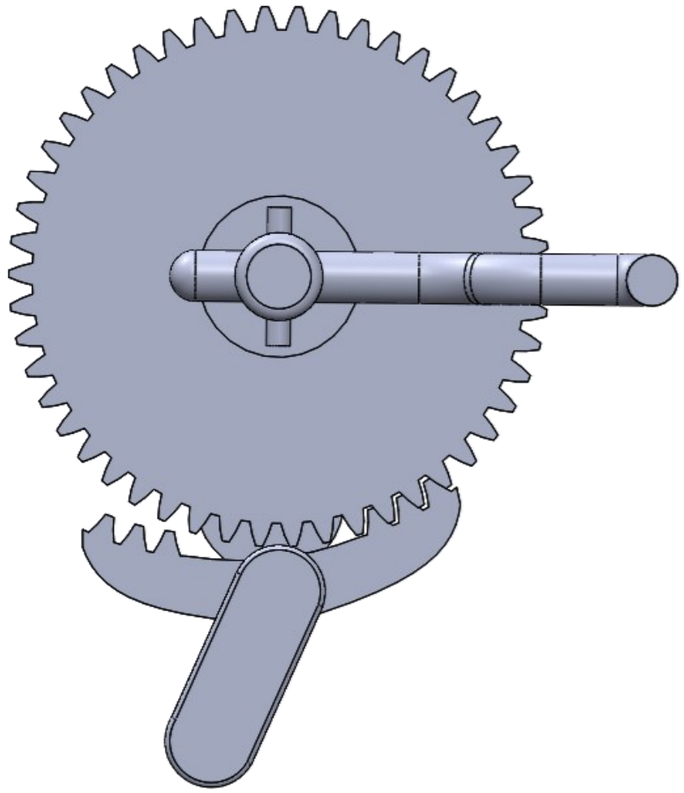
I have modeled the gearbox to attach to the main frame through sandwiching it between the two horizontal frames. It will then be fastened by nuts and bolts.



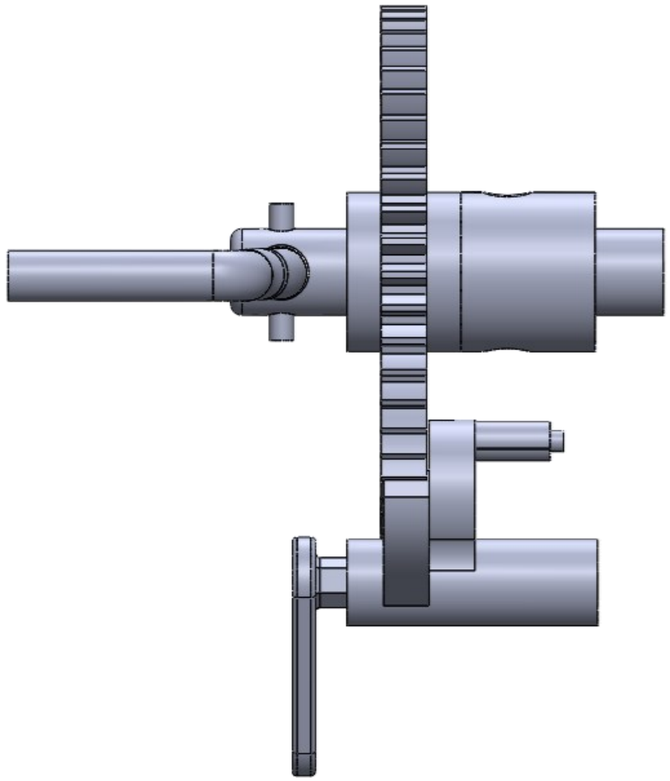
Wheel Attachment and Gearbox casing Refinement



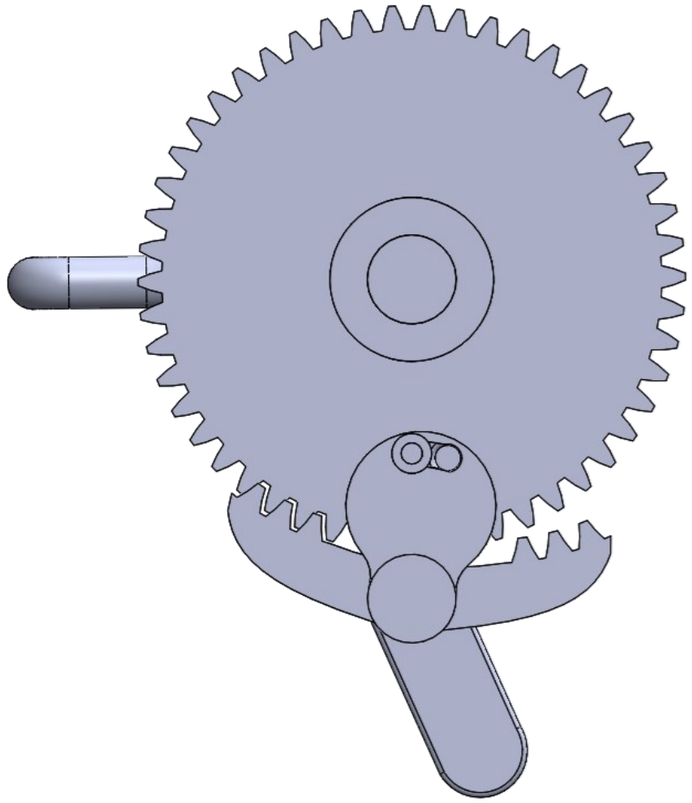
Below shows the mechanism I have created to fit inside of my gearbox for the hand cranked hoist. I drew inspiration for the mechanism from the CAD wrench file that was provided from the module leader in blackboard. The only design change I made between the two was the ball bearing and spring position in the mechanism. The ball bearing and springs job is to prevent the variable winch from moving on its own. On the wrench, it is positioned at the bottom whereas on mine it is positioned horizontally behind cogs.



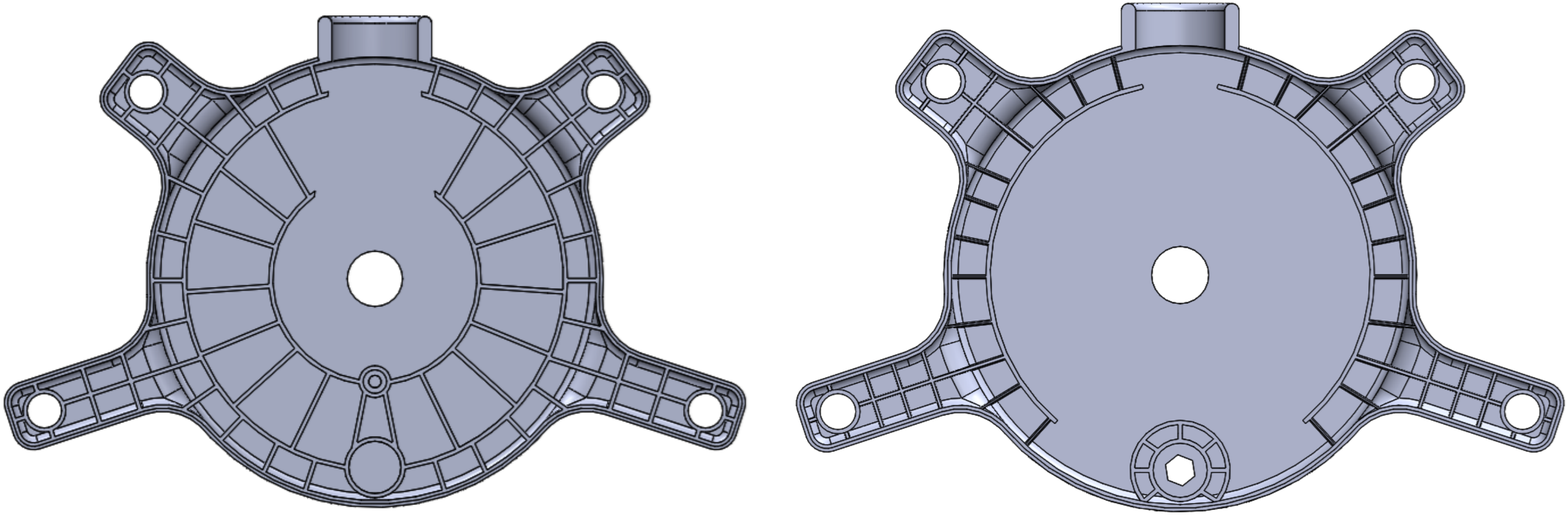
Front



Side



Back

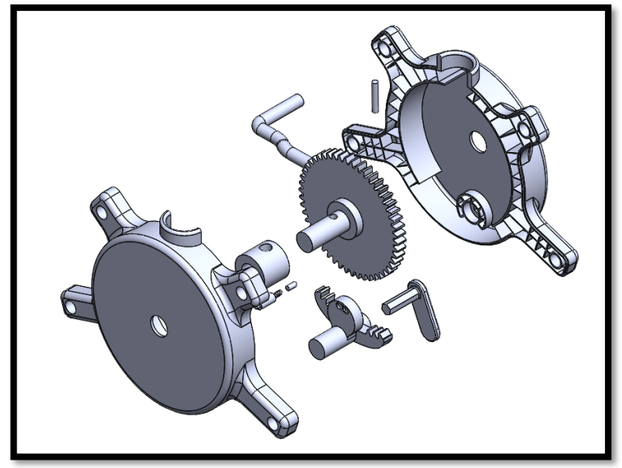


Above: the two halves of the injection moulded gearbox casing

Outer Casing 1

Main Gear

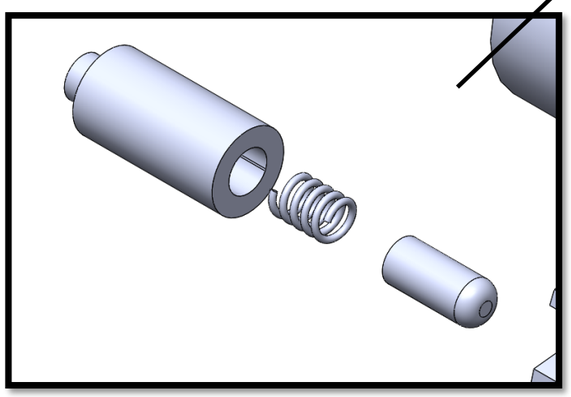
Handle



Opposite angle view

Large Washer

Spring mechanism for brake winch

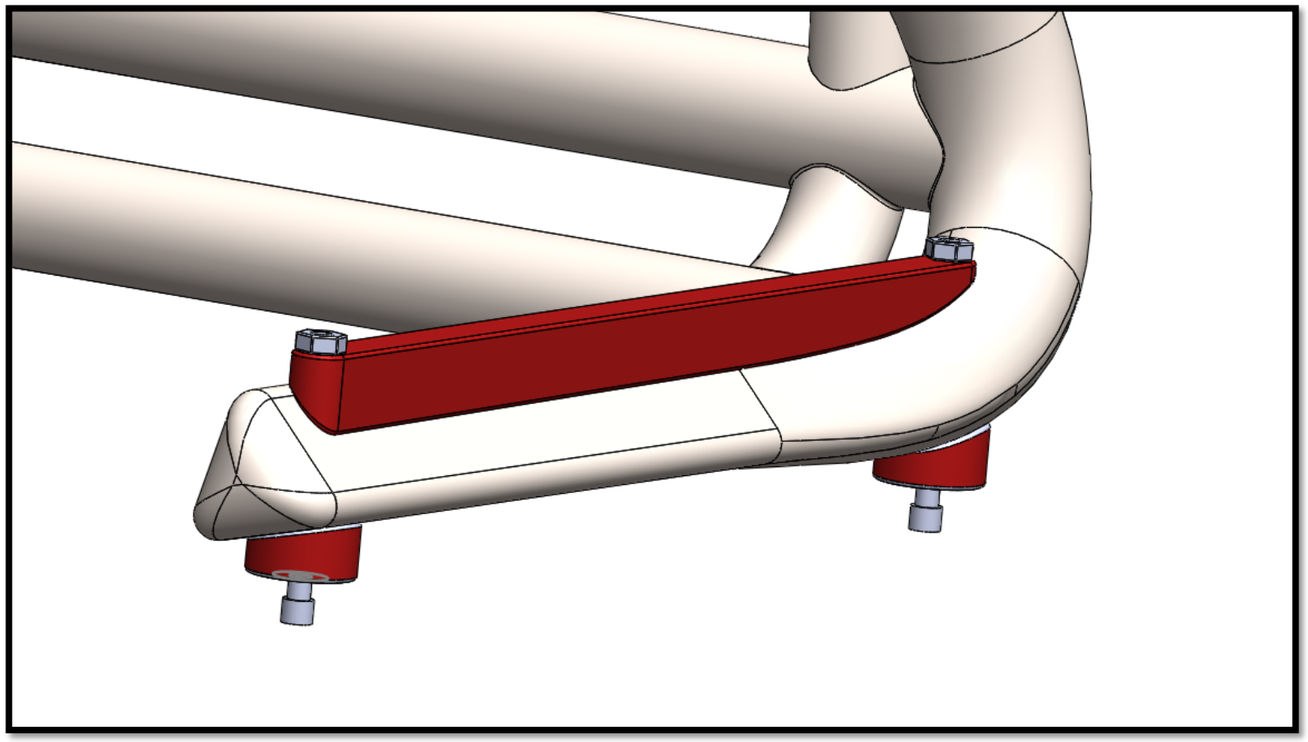


Brake winch reverse mechanism

Hexagonal Safety Key

Outer Casing 2

Gearbox subassembly Exploded view



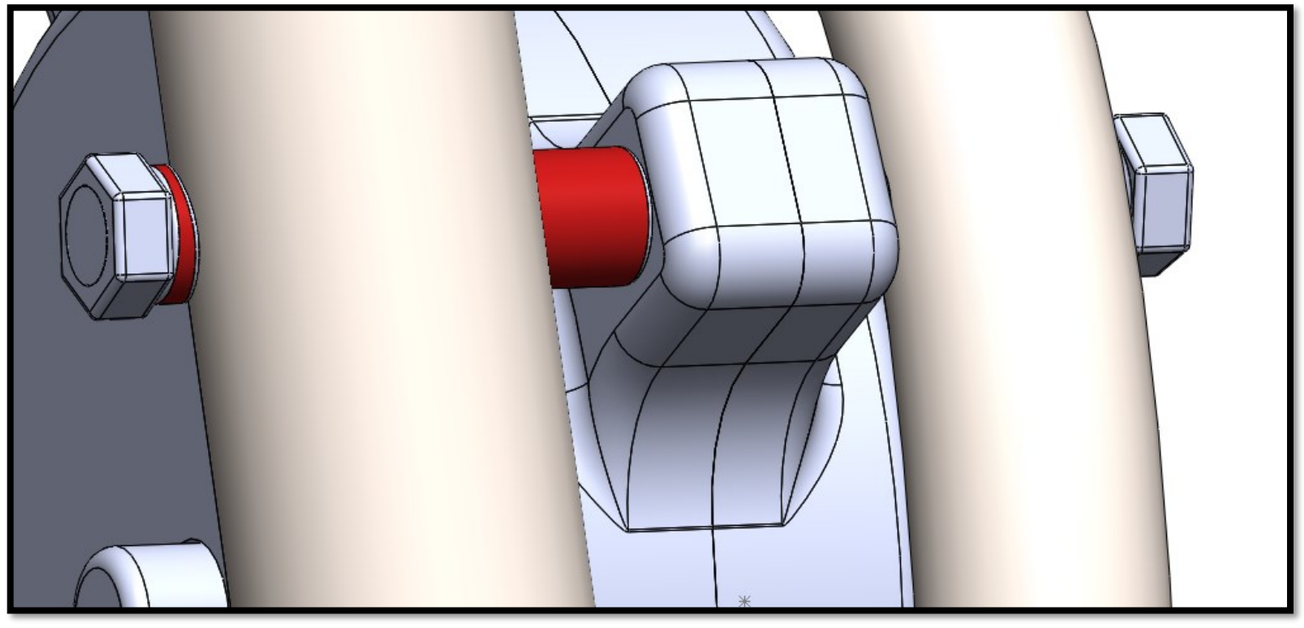
Washers for Wheels and flat bar attachment

The screenshot on the left highlights the washers for the wheels and the flat bar attachment. The ‘Wheel washers’ were designed to allow the wheels to sit properly on a flat surface. Due to the base pipes unusual triangular design, the wheels could not sit flat on the surface.

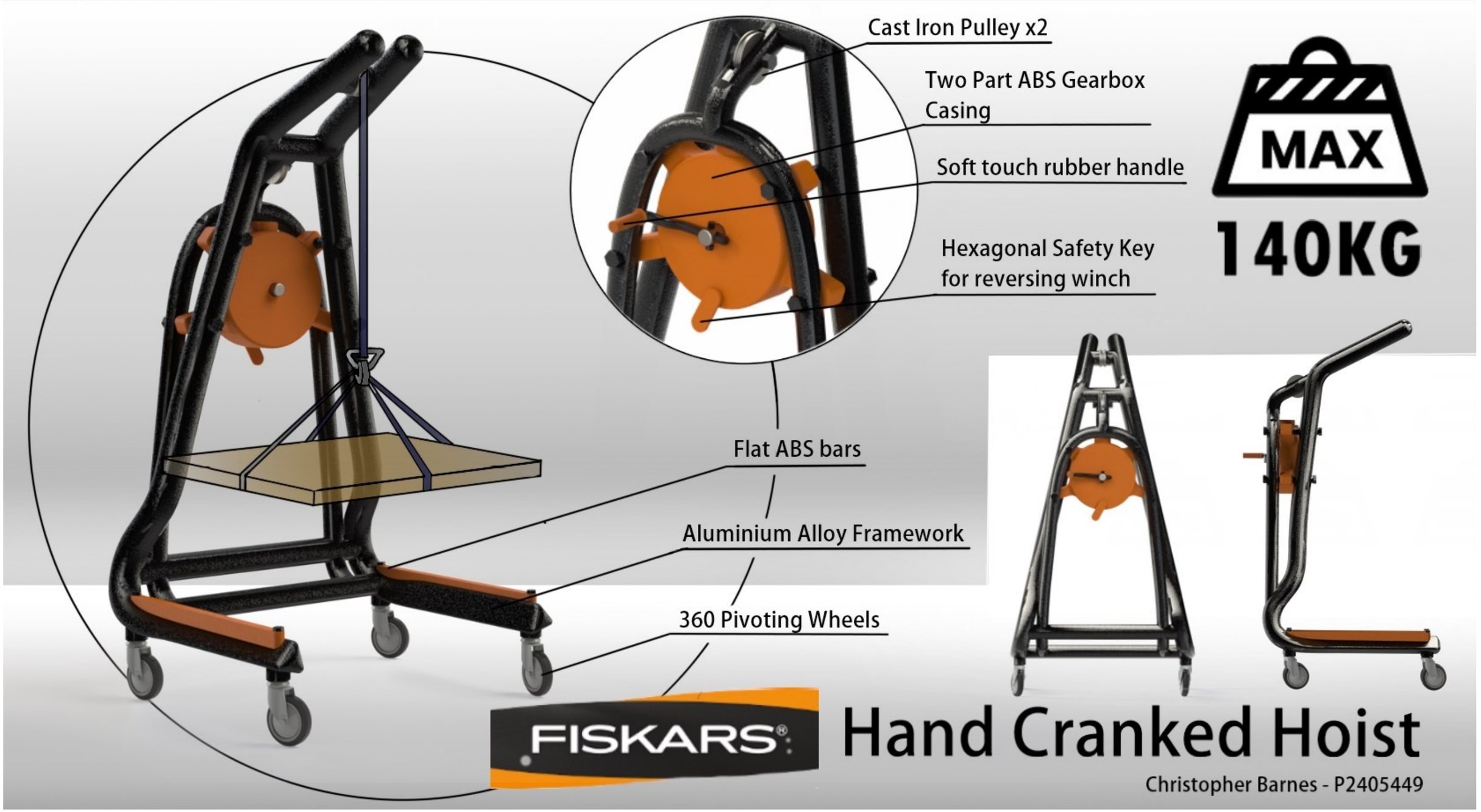
The flat bars were an additional design feature added during the modelling process. It allows the user to rest some of the weight of the stock onto it as it is being transported.

Gearbox to main frame attachment washers

The washers highlighted in red, right, were designed and modelled to ensure that the gearbox was secured tightly. Due to a lack of flat surfaces, I designed two injection moulded pieces to fit around the framework to create a flat surface for the screw, and to stop the gearbox rattling between the two framework pipes.



Final Renders



Concept Board