



Formula Student

- 3000+ students at Silverstone Event
- 250+ industry professionals
- 150+ Universities competing

Formula Salford

- 20 highly motivated students
- Business and Engineering links
- Build a strong team, build a great car.
- 5 year plan
- Developing soft and hard skills for students with real life applications

**Award winning start up project – winners of the social enterprise award 2016
for improving the business and engineering skills of students**



The Plan

2015

Build a capable team

2016

Design Car, build support & funding

2017

Build & test the car

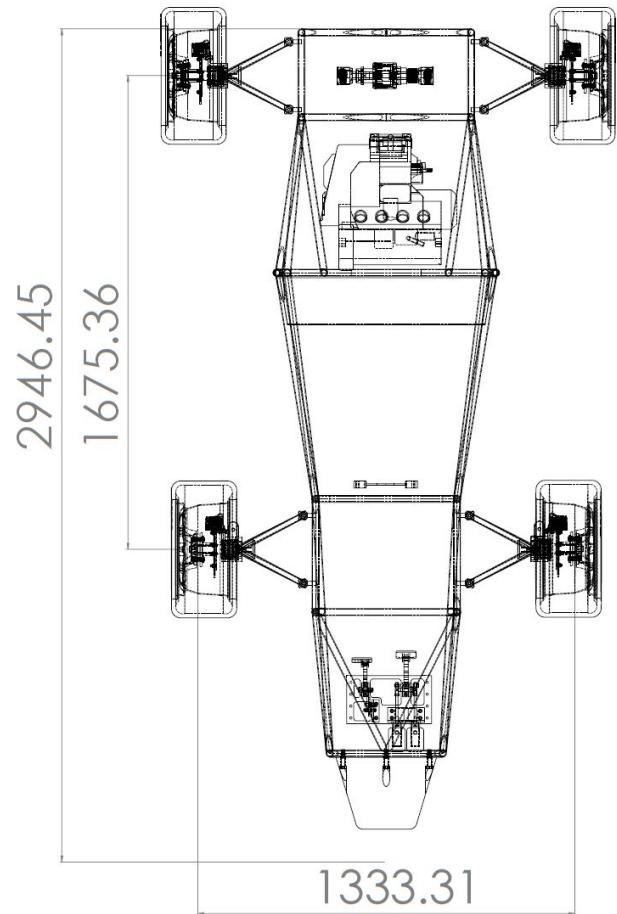
2017 Summer

Compete at Silverstone



So far

2015-2020





ROPT510 (roll over protection tube) is a carbon based cold drawn seamless with high strength, easy to form and great welding properties.

Tensile Strength : 510 N/mm² minimum

0.2% Yield Strength : 370 N/mm² minimum

Elongation : 25% minimum.

Profiles:

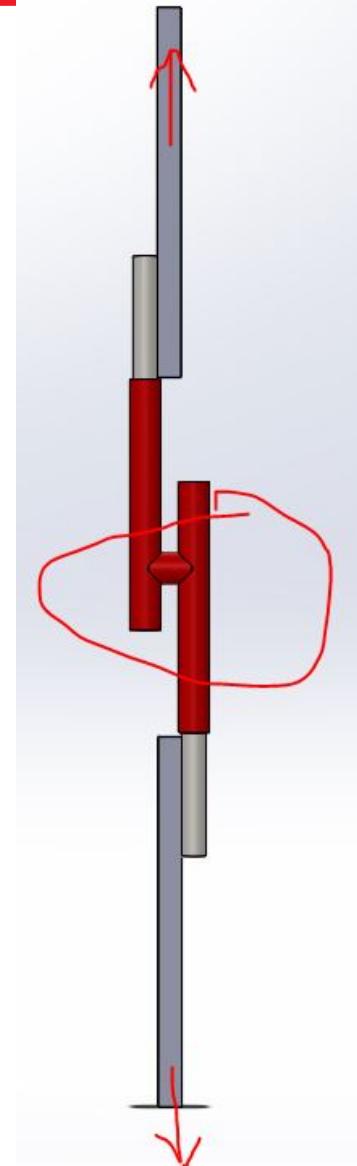
1" OD 16swg ~ 25.5mm OD/ 1.6mm thick wall

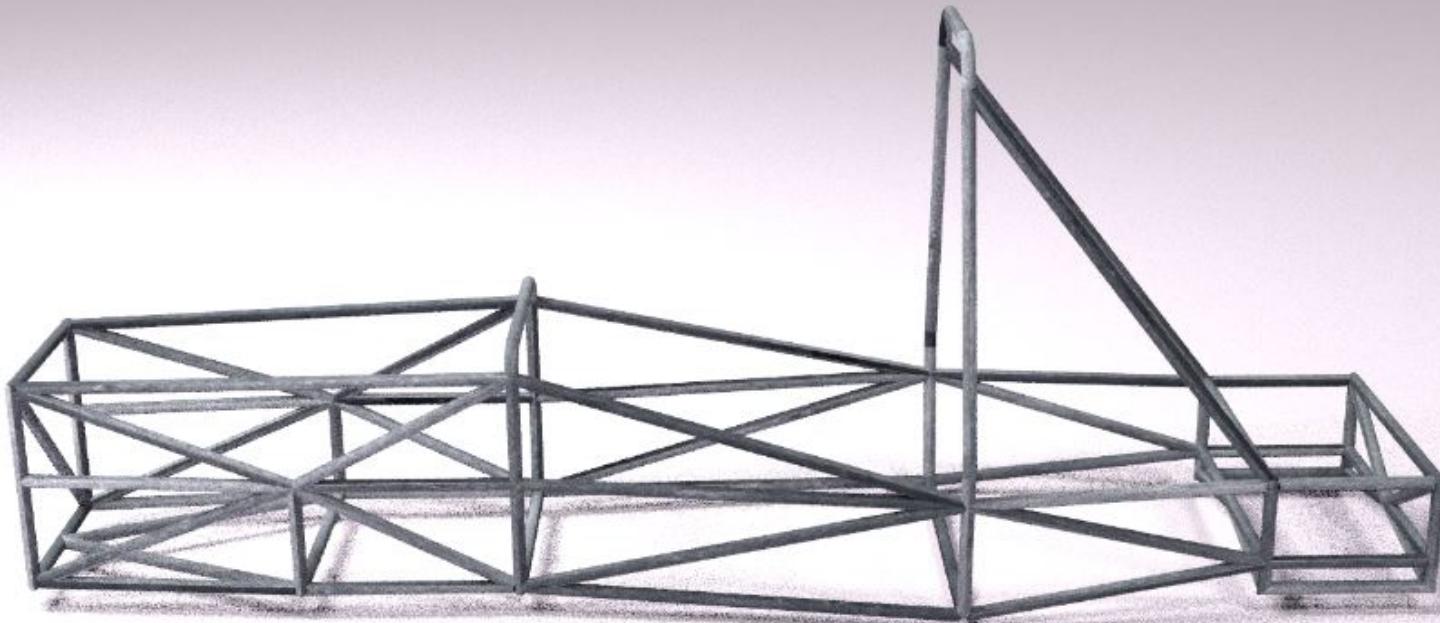
1" OD 12swg ~ 25.4mm OD/ 2.5mm thick wall

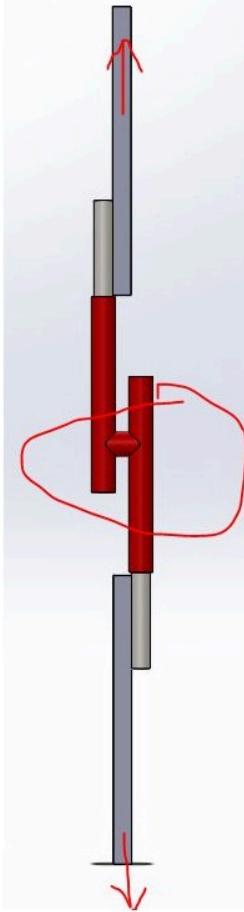
Manufacturing operations required:

- Steel Cutting to size
- Ends milling or grinding to slot for welding
- Mig welding
- Painting / powder coating if available
- Sample mig weld tested to support 3.75 tons (37.5kN) load

<https://skfb.ly/OPKp>

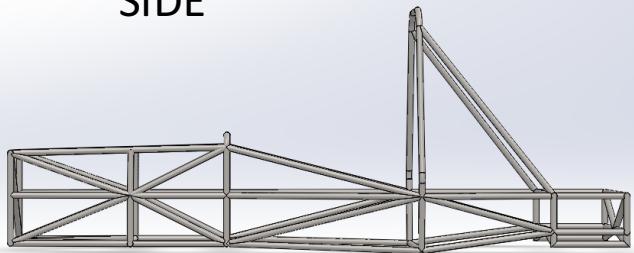




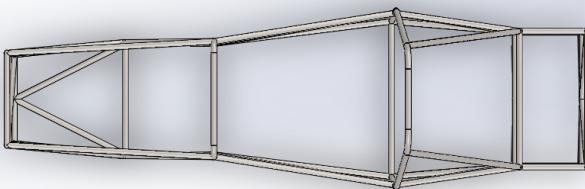




SIDE



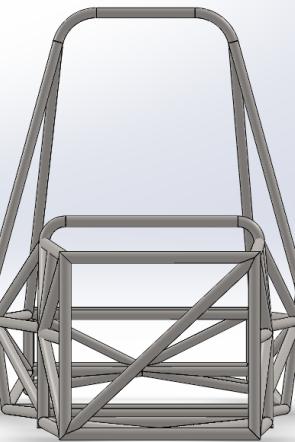
TOP



BOTTOM

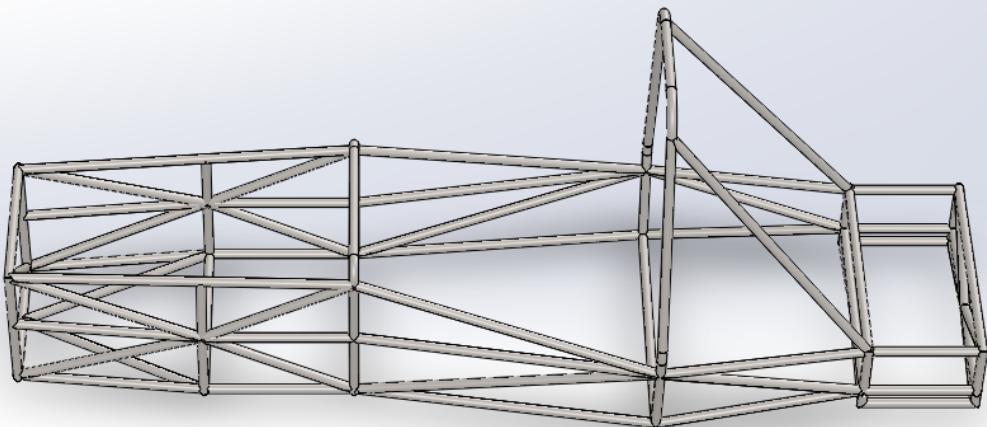


FRONT

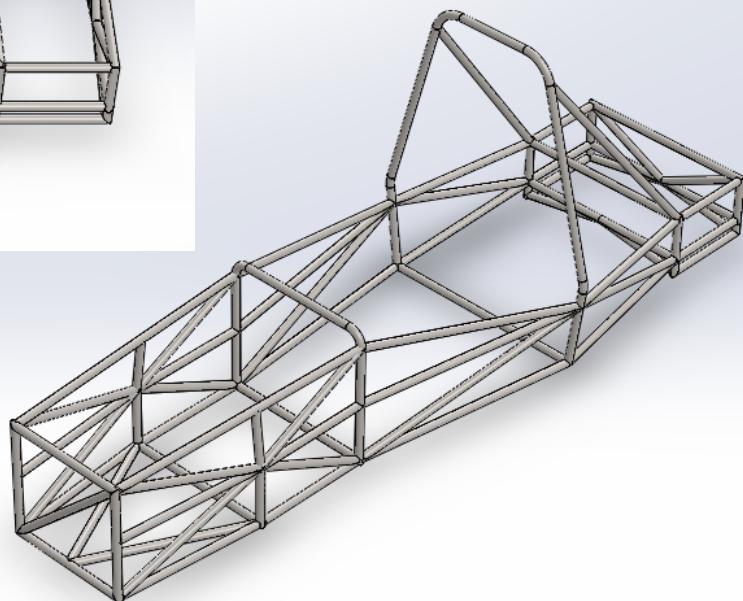




ISOMETRIC SIDE

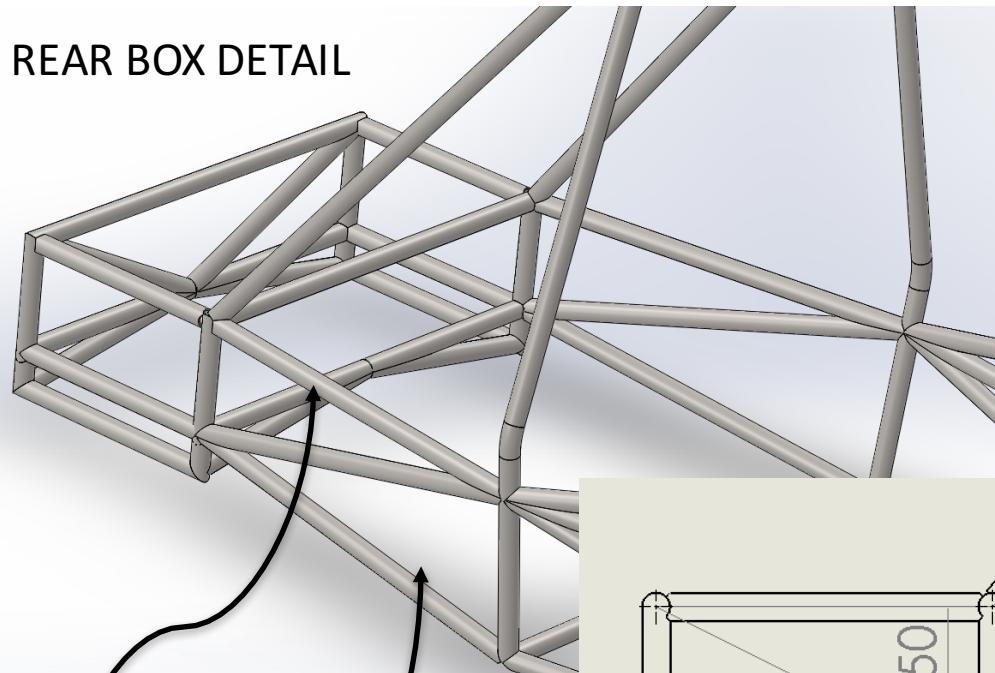


ISOMETRIC TOP



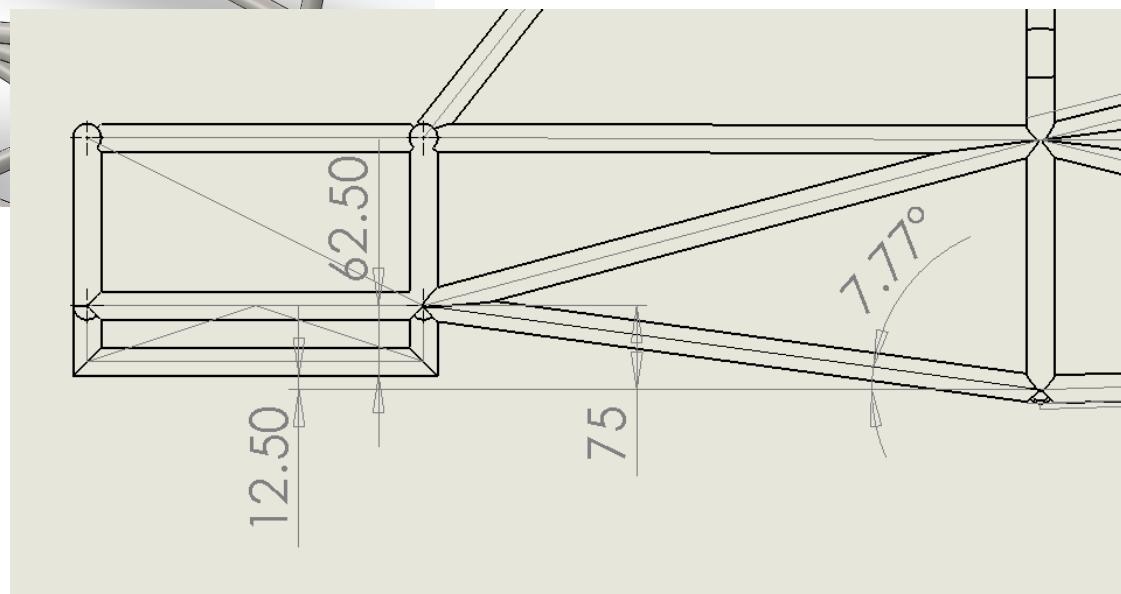


REAR BOX DETAIL



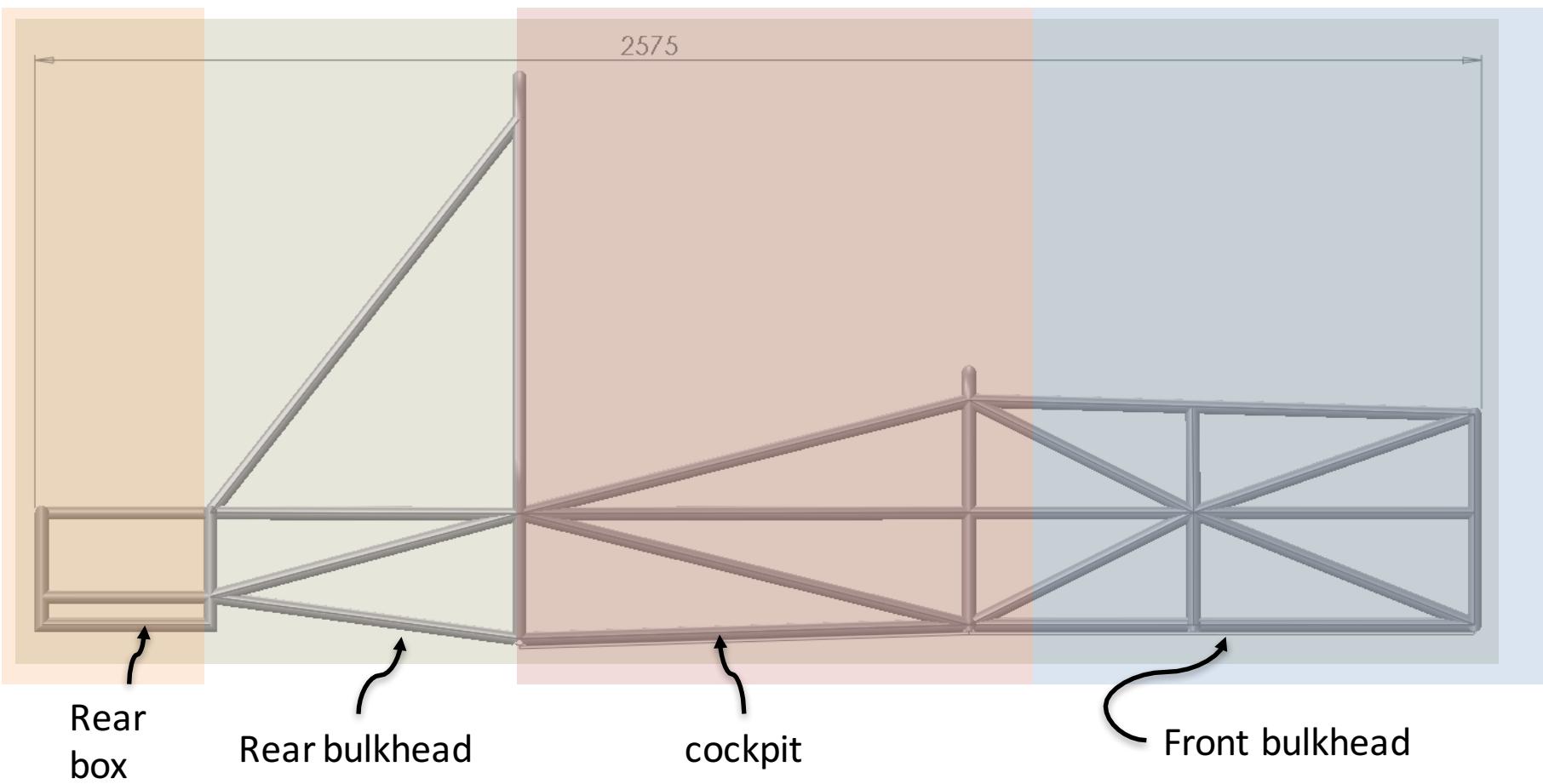
ANGLED
CENTRAL
SECTION

ANGLED
SIDE
MEMBERS



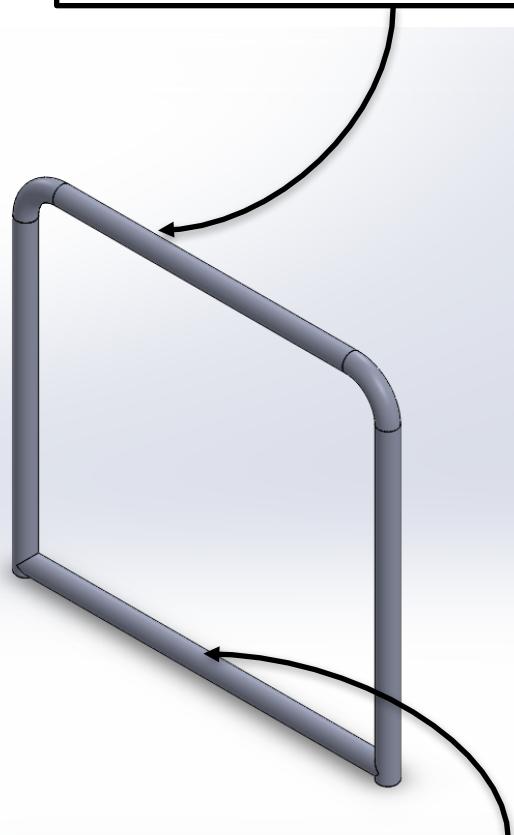


SEGMENTATION





Front roll hoop – bent one piece



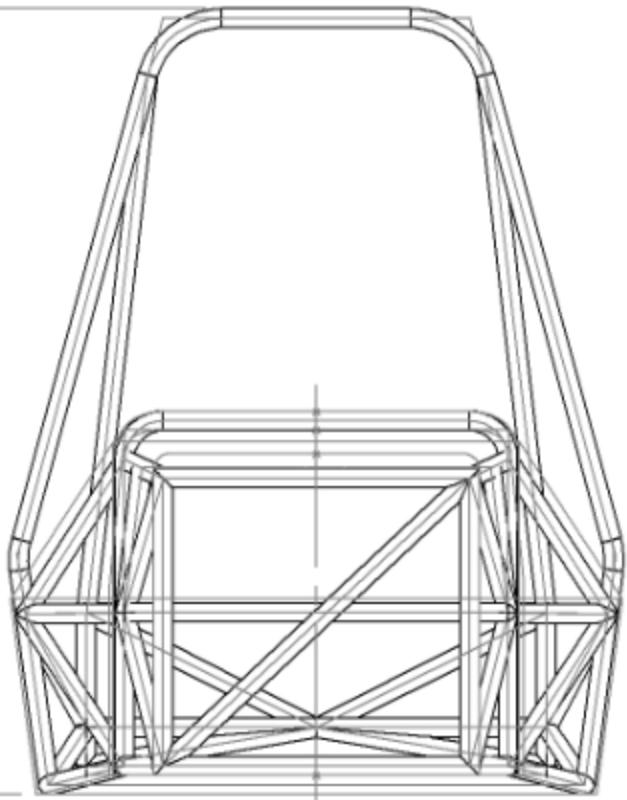
Main roll hoop – bent one piece

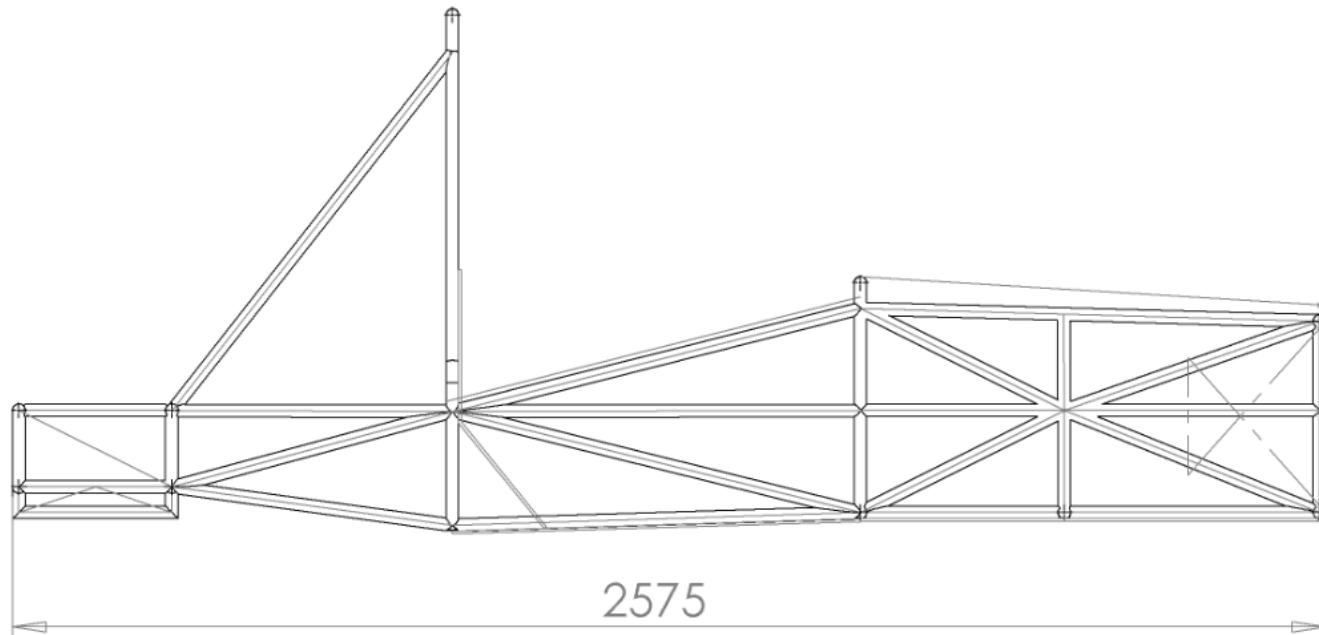


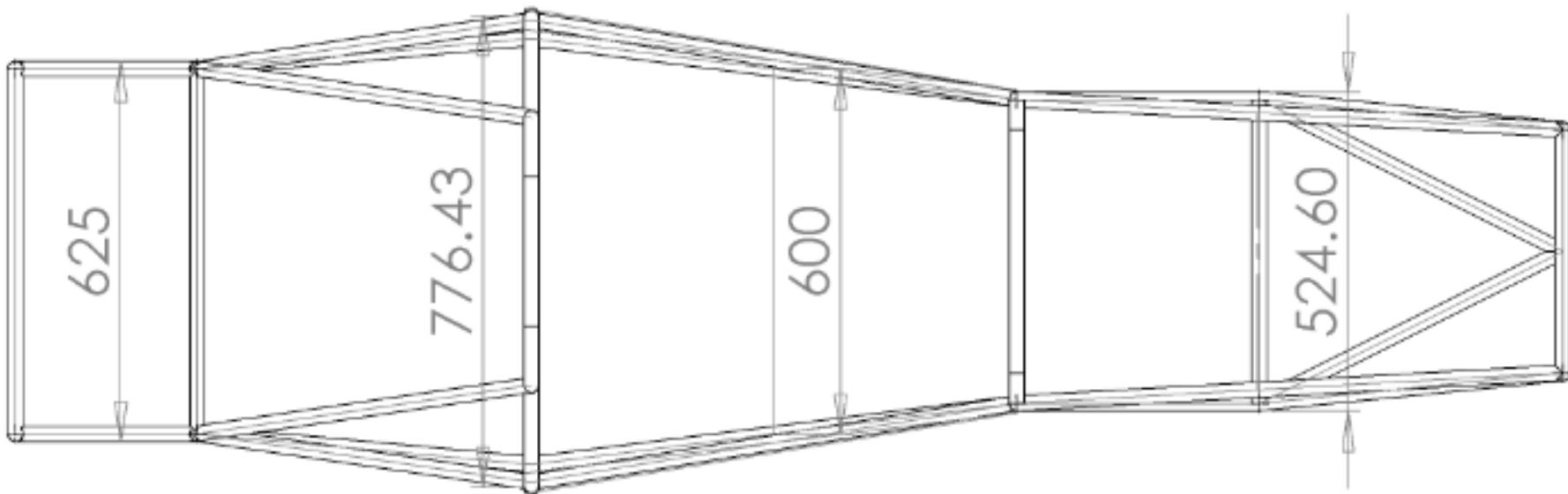
Connecting welded section



1025









Outcomes of meeting with General and Tube Engineering:

Cost of fabrication £1200 including 30% deposit

Cost of painting £60

Current funding approx. 920

Material costs approx. £300 – need to check steel pricing asap

Recommend requesting extra funds from vadeera and Dominic Martinez

Lead times

Material 2-3 days

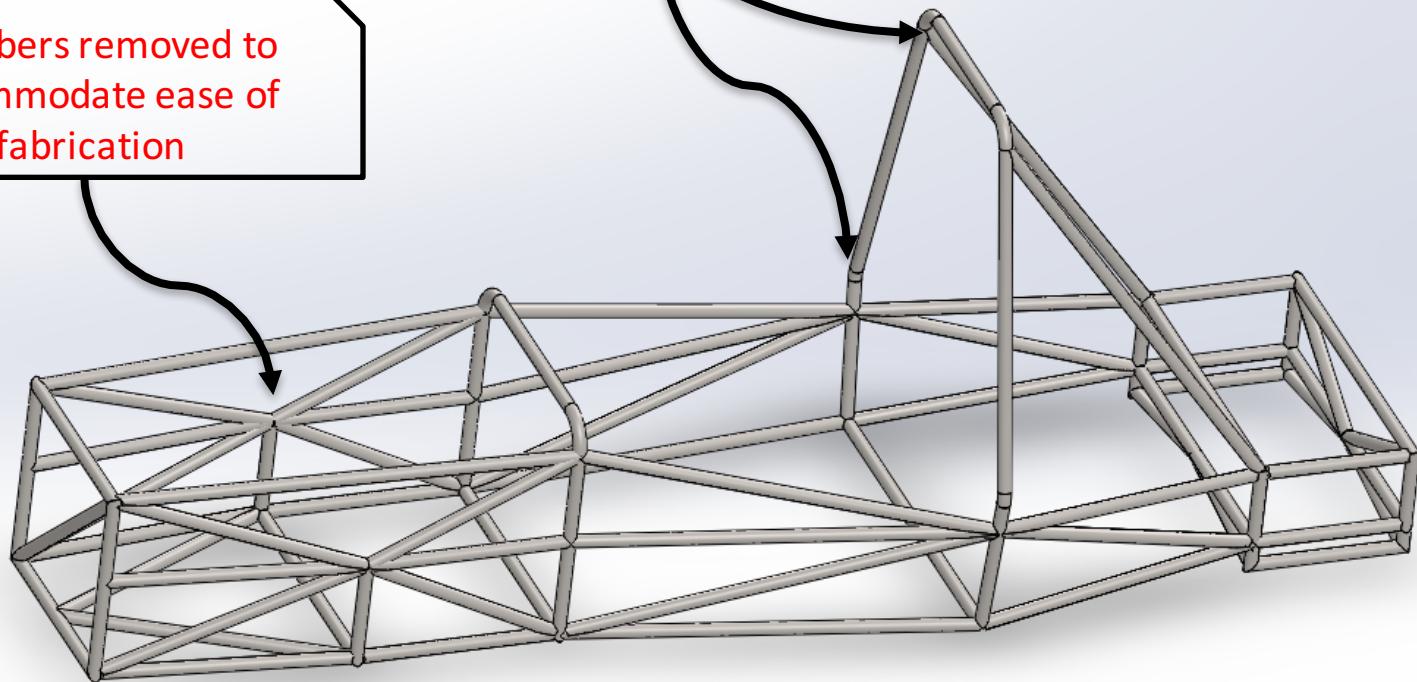
Fabrication 7 working days

Total time allotted for manufacture: 2 weeks. Deadline before July



Radii changed to 62.5mm to accommodate supplier tooling

Members removed to accommodate ease of fabrication



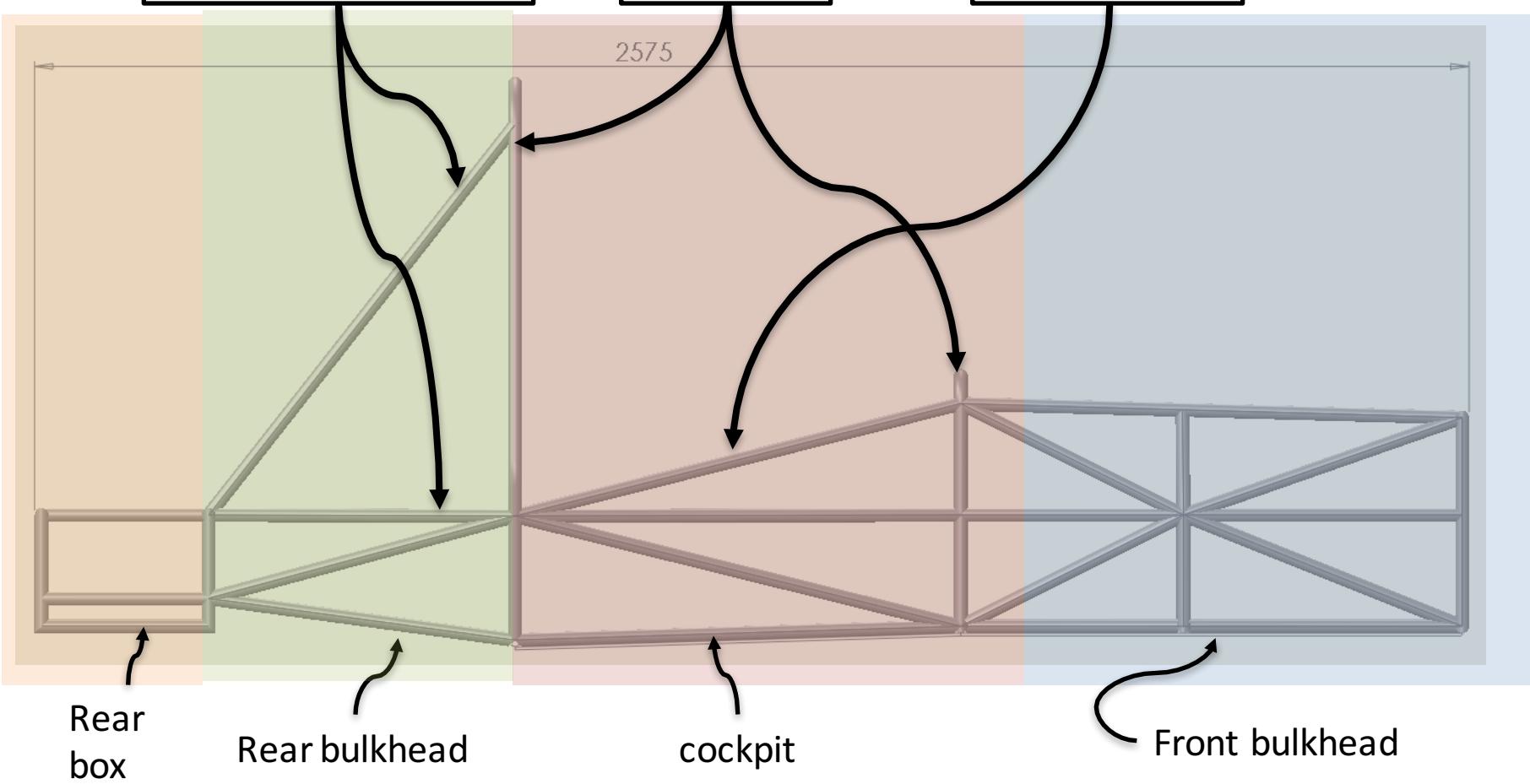
SEGMENTATION



Connecting Members

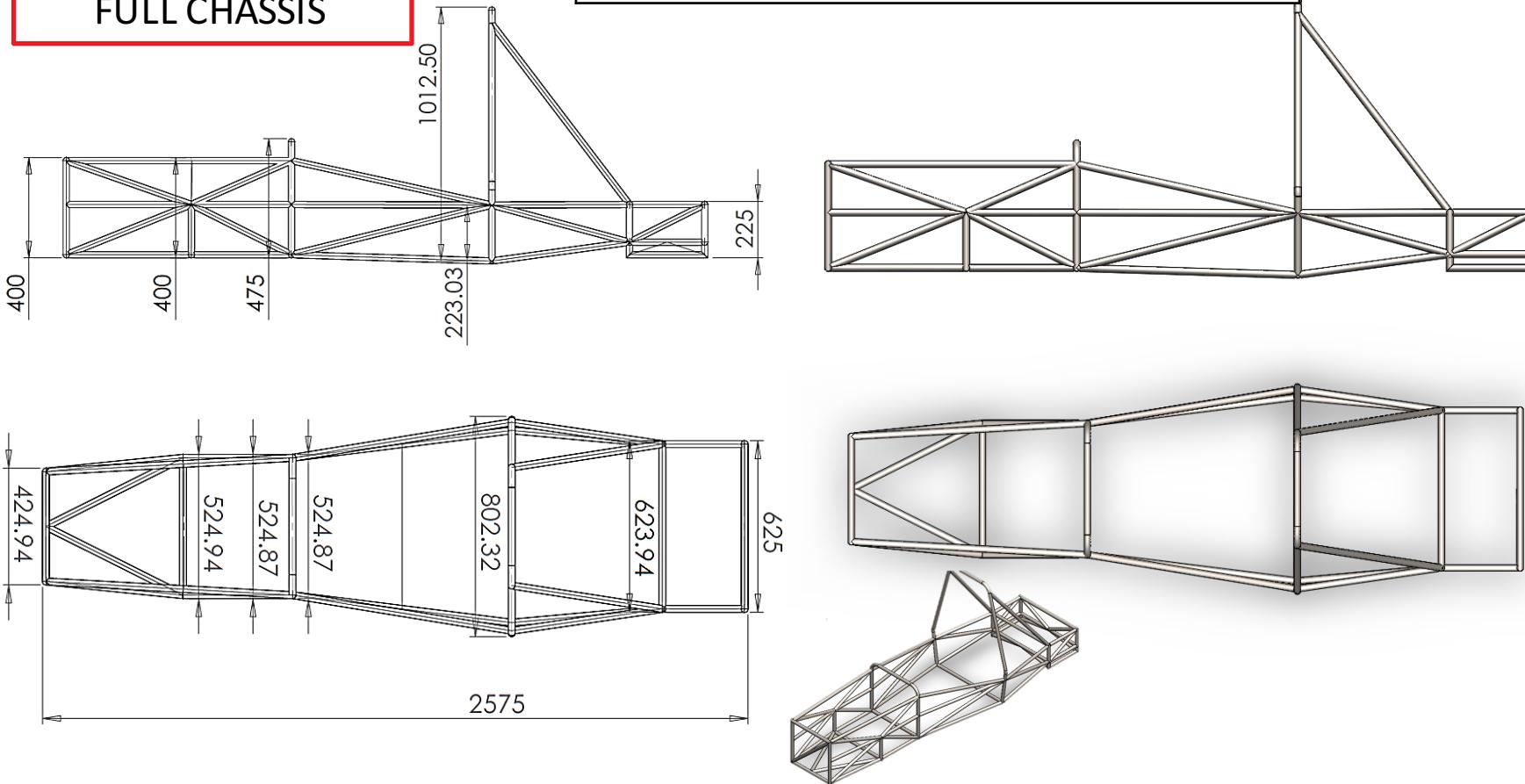
Roll Hoops

Side members



LENGTH: 2575 mm
WIDTH: 802 mm
HEIGHT: 1012.50 mm

FULL CHASSIS

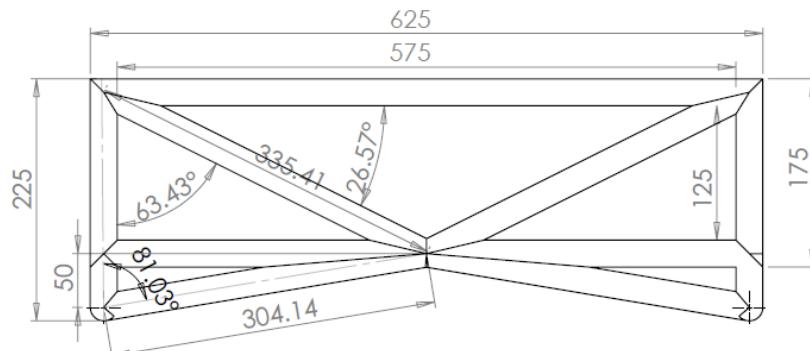
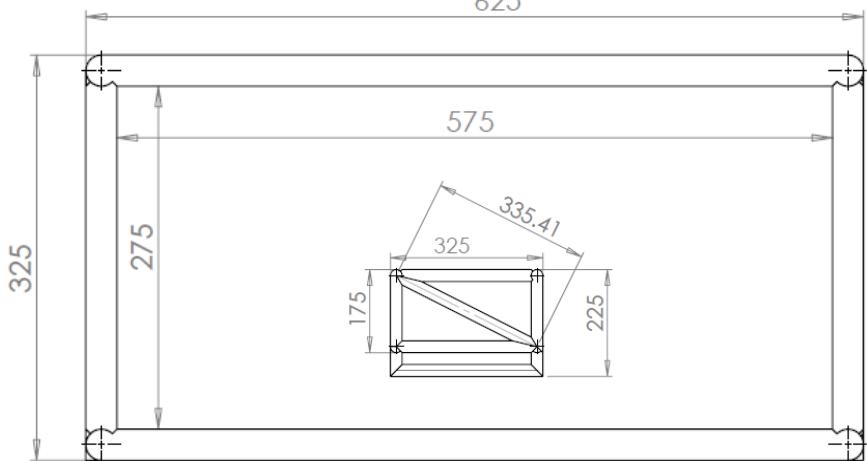


SUB ASSEMBLY	LENGTH	NUMBER OF STOCK	
		PIECES	
FRONT BULKHEAD	15	2.5	
REAR TRUSS	6	1	
SIDE MEMBERS	7	1.2	
back box	8	1.5	
Total	36	6.2 TOTAL	





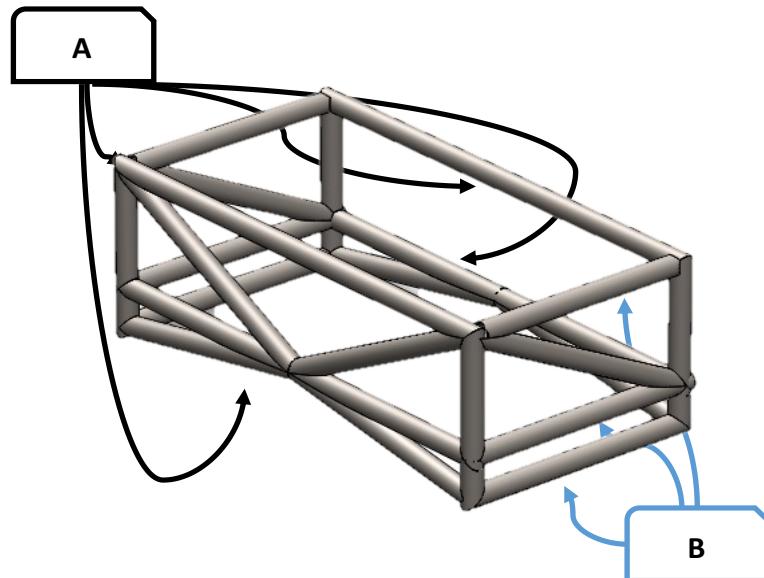
REAR BULKHEAD /BACKBOX



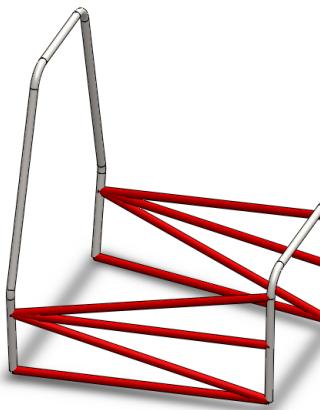
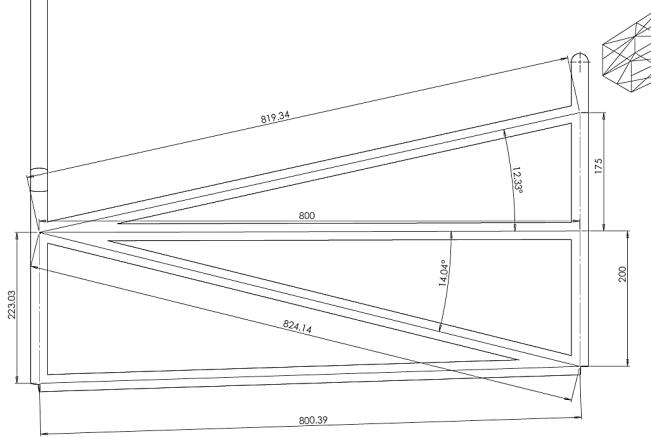
solidworks				
ITEM NO.	QTY.	LENGTH	Label	sub total
1	2	282.32		564.64
2	4	175		700
3	4	625		2500
4	2	335.41		670.82
5	1	314.14		314.14
6	1	335.41		335.41
7	2	62.5		125
8	2	325		650
9	1	304.14		304.14
10	1	304.14		304.14
11	1	304.14		304.14
12	1	62.5		62.5
13	1	62.5		62.5
14	1	304.14		304.14
15	1	2.08		2.08
16	1	312.5		312.5
17	1	303.66		303.66
total		7819.81		

self assessment				
ITEM NO.	QTY.	LENGTH	Label	sub total
1	4	625	A	2500
2	6	325	B	1950
3	4	225		900
4	4	305		1220
5	4	336		1344
total				7914
				7.914

stock used 8
% of stock 19.0%



SIDE MEMBERS

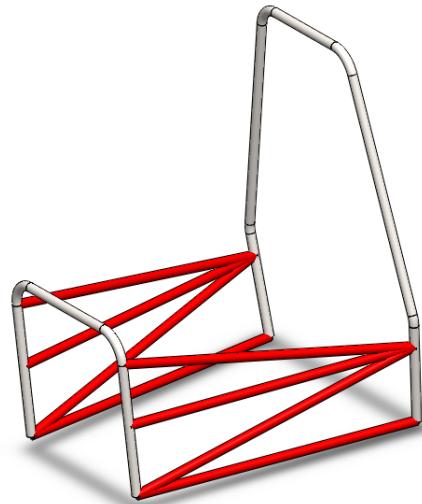


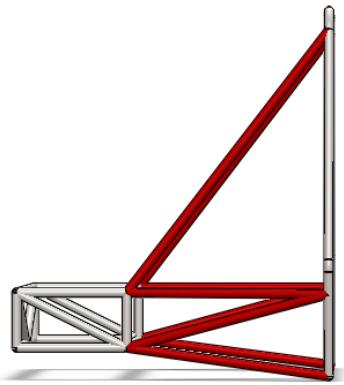
SIDE MEMBERS

SOLIDWORKS

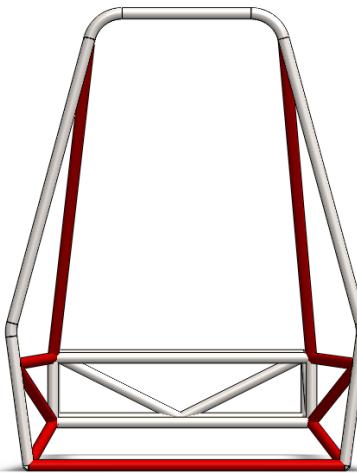
self assessment

ITEM NO.	QTY.	LENGTH	SUB TOTAL	
1	2	820	1640	
2	2	800	1600	
3	2	825	1650	
4	2	802	1604	
TOAL	6494			
	6.494			
stock used	7			
% of stock	17%			





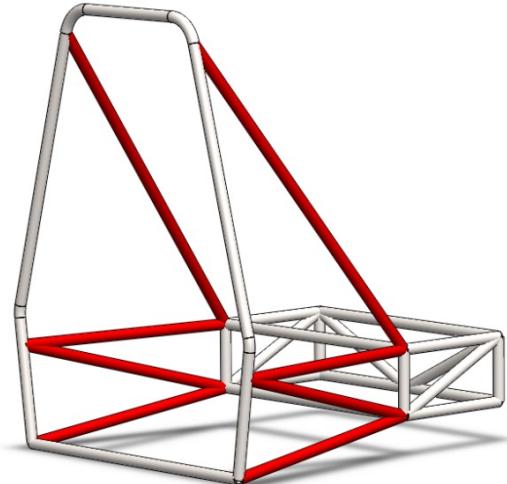
REAR TRUSS



REAR TRUSS				
SOLIDWORKS				
ITEM NO.	QTY.	DESCRIPTION	LENGTH	SUB TOTAL
1	2		909.73	1819.46
2	2		555.75	1111.5
3	2		575.13	1150.26
4	2		557.34	1114.68
5	1		700	700
TOTAL	5895.9			

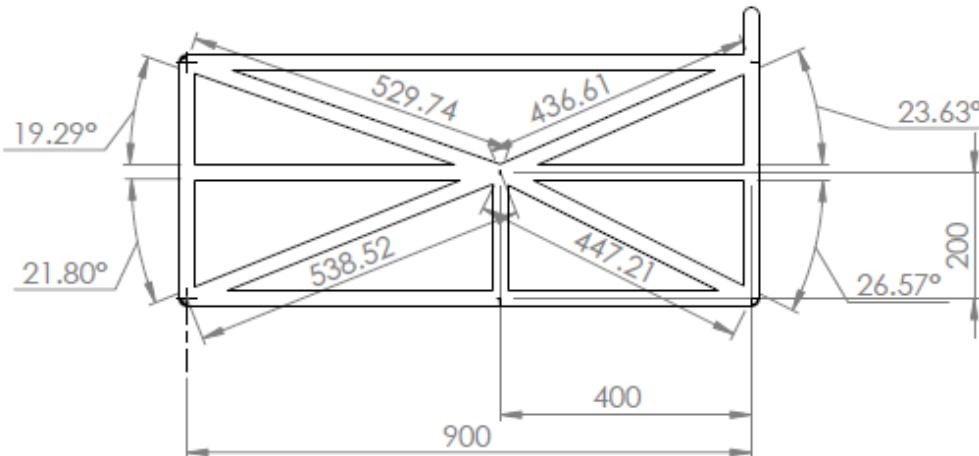
self assesment				
ITEM NO.	QTY.	LENGTH	SUB TOTAL	
1	2	550	1100	
2	2	570	1140	
3	2	560	1120	
4	2	910	1820	
5	1	700	700	
TOTAL	5880			
	5.88			

stock used	6
% of stock	14%





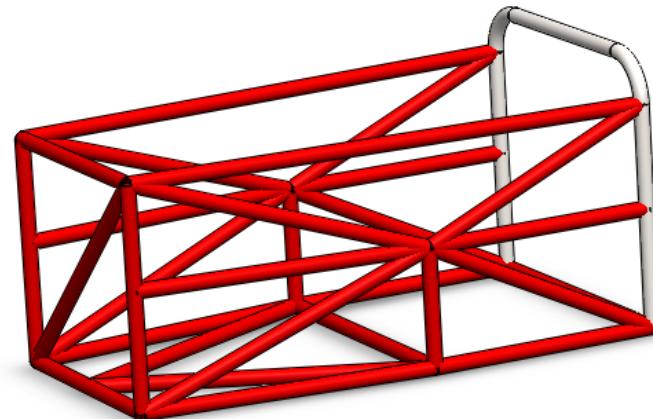
FRONT BULKHEAD



FRONT BULKHEAD				
SOLIDWORKS				
ITEM NO.	QTY.	DESCRIPTION	LENGTH	SUB TOTAL
1	2		901.39	1802.78
2	2		436.61	873.22
3	2		500	1000
4	2		532.09	1064.18
5	4		502.49	2009.96
6	2		540.83	1081.66
7	2		375	750
8	2		559.02	1118.04
9	6		400	2400
10	1		548.29	548.29
11	2		200	400
12	2		447.21	894.42
TOTAL	13942.6			
	13.9426			

ROUNDED UP				
ITEM NO.	QTY.	DESCRIPTION	LENGTH	SUB TOTAL
1	2		910	1820
2	2		440	880
3	2		500	1000
4	2		540	1080
5	4		505	2020
6	2		542	1084
7	2		375	750
8	2		560	1120
9	6		400	2400
10	1		550	550
11	2		200	400
12	2		550	1100
TOTAL	14204			
	14.204			

stock used	15
% of stock	36%





Steel cut optimisation

SUB ASSEMBLY	NUMBER OF STOCK	
	LENGTH	PIECES
FRONT BULKHEAD	15	2.5
REAR TRUSS	6	1
SIDE MEMBERS	7	1.2
back box	8	1.5
Total	36	6.2 TOTAL

tube 1	5590
tube 2	5974
tube 3	5805
tube 4	5879
tube 5	5927
tube 6	4917
total	34092

Solution using 6 bins:

Bin(sum=5990, items=[910, 910, 910, 910, 825, 825, 700])

Bin(sum=5974, items=[820, 820, 802, 802, 800, 800, 625, 505])

Bin(sum=5805, items=[625, 625, 625, 570, 570, 560, 560, 560, 560, 550])

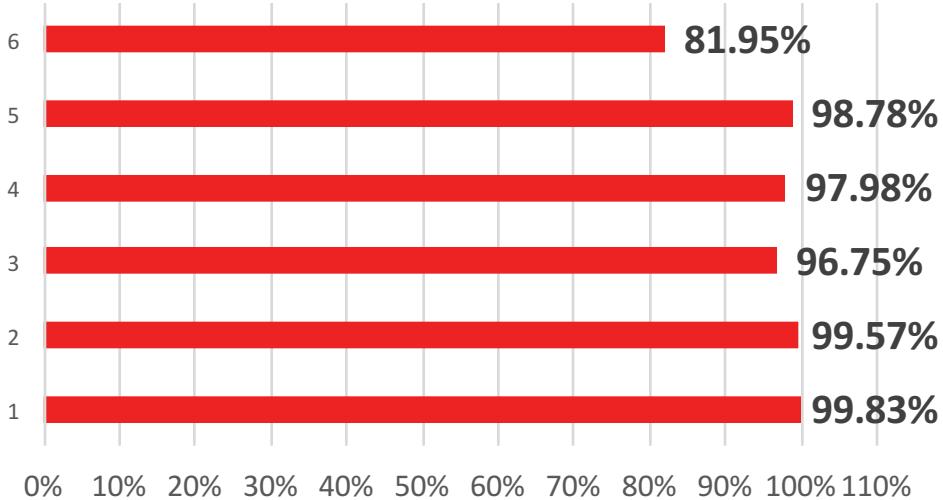
Bin(sum=5879, items=[550, 550, 550, 550, 542, 542, 540, 540, 505, 505, 505])

Bin(sum=5927, items=[500, 500, 440, 440, 400, 400, 400, 400, 400, 375, 375, 336, 336, 225])

Bin(sum=4917, items=[336, 336, 325, 325, 325, 325, 325, 325, 305, 305, 305, 305, 225, 225, 225, 200, 200])



Steel Stock Cut Efficiency



This graph shows the utilization of 6, 6 meter long pieces of stock steel profile, illustrating with no errors it is possible to produce the chassis in 6, 6 meter pieces or 36 meters of stock (actual used length is: 34.492 meters).

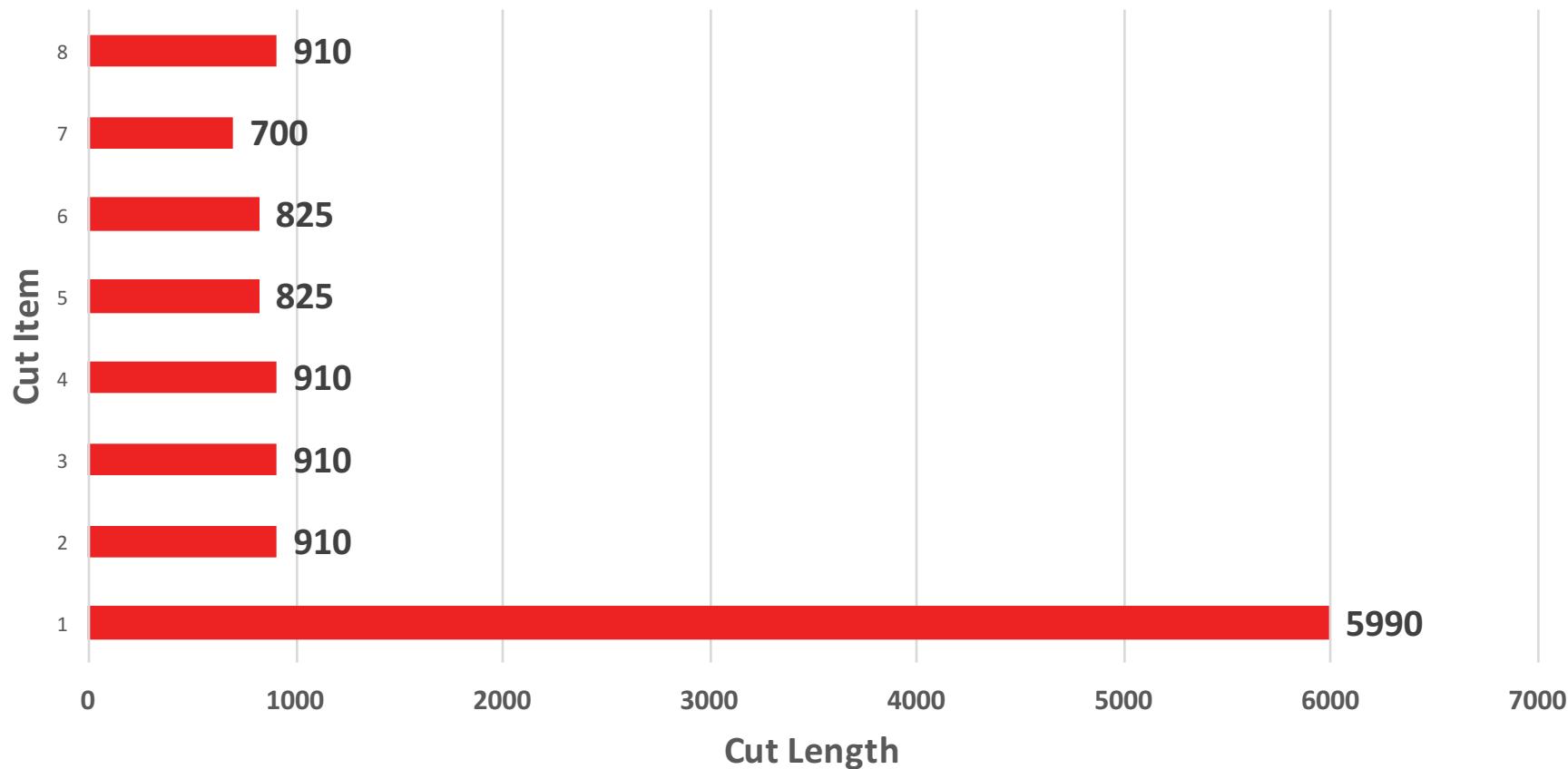
Sub Assembly	Length	Number of Stock Pieces
FRONT BULKHEAD	15	2.5
REAR TRUSS	6	1
SIDE MEMBERS	7	1.2
back box	8	1.5
Total	36	6.2 TOTAL

By comparison the calculations featuring a rough rounded up method show 36 meters across 6.2 pieces of stock. It will likely be more awkward than this.



Stock 1

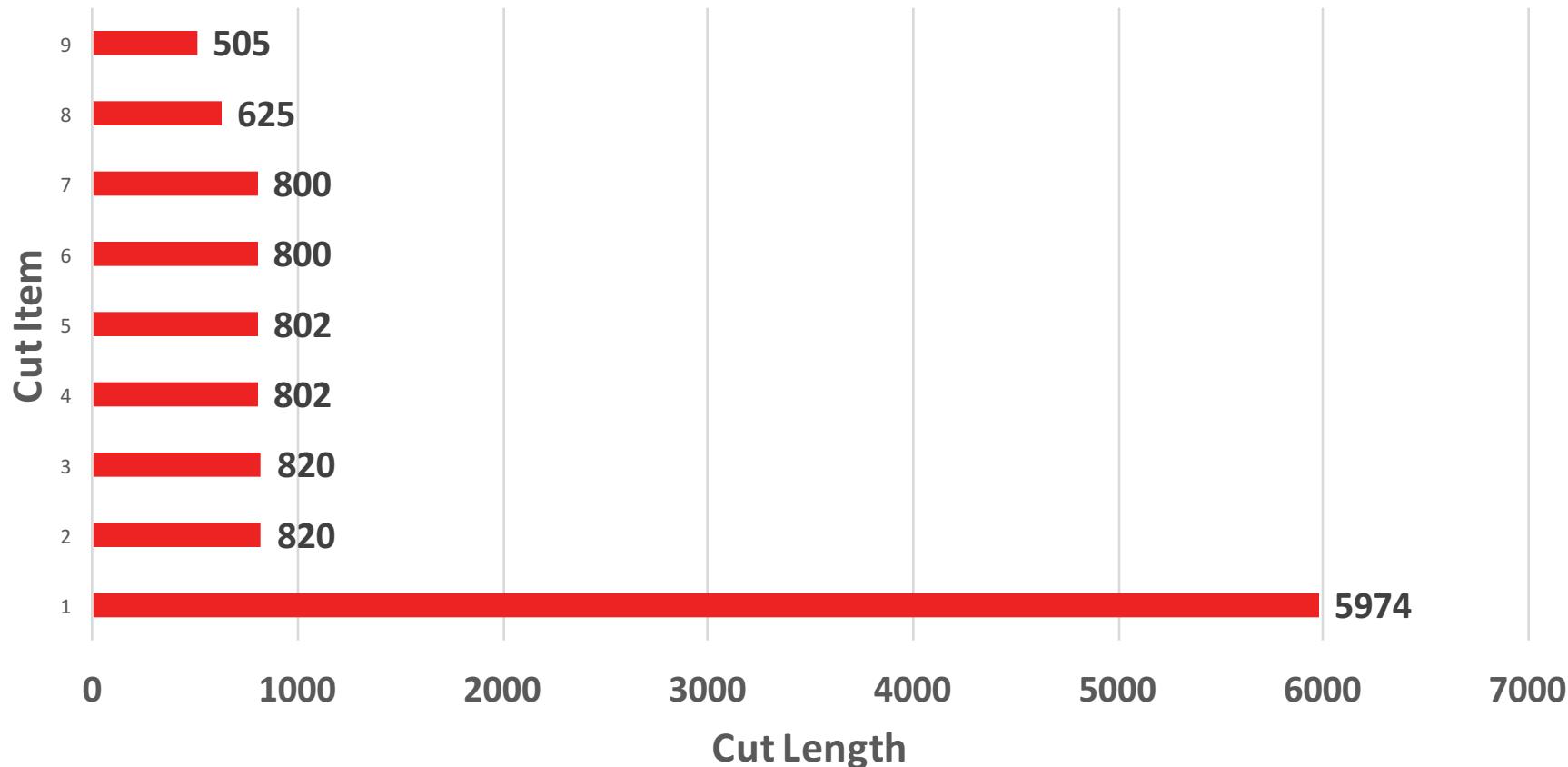
Stock 1 Utilization





Stock 2

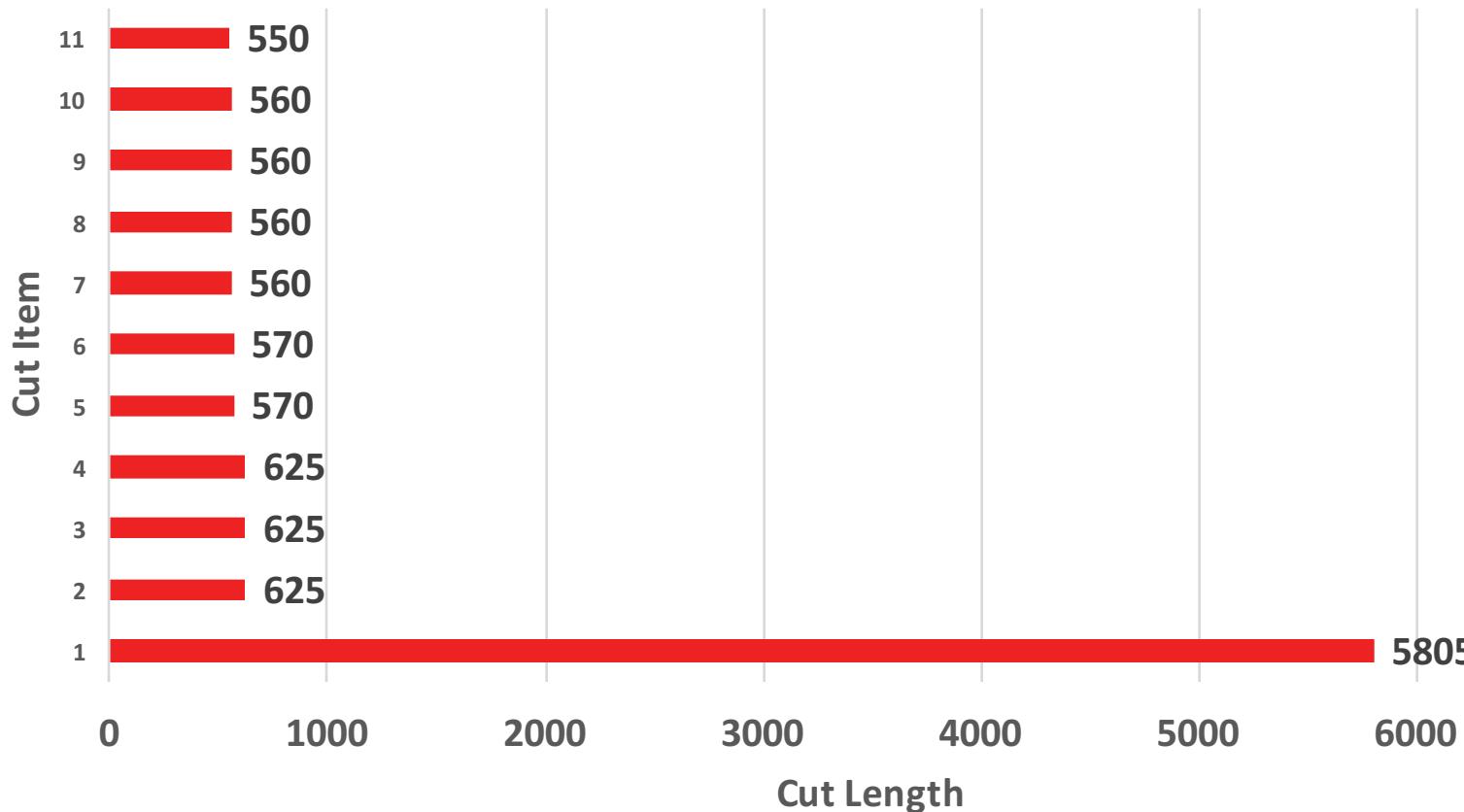
Stock 2 Utilization





Stock 3

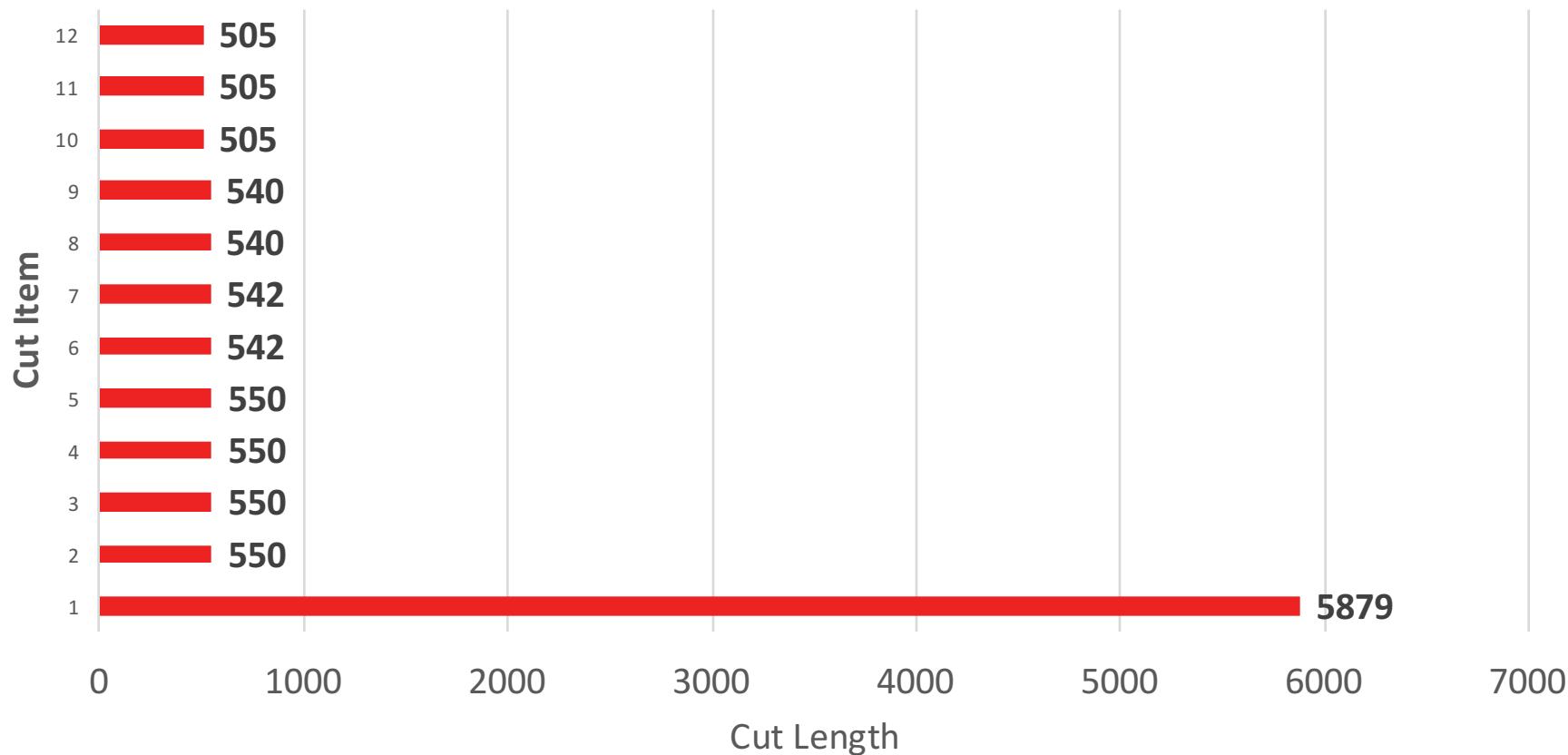
Stock 3





Stock 4

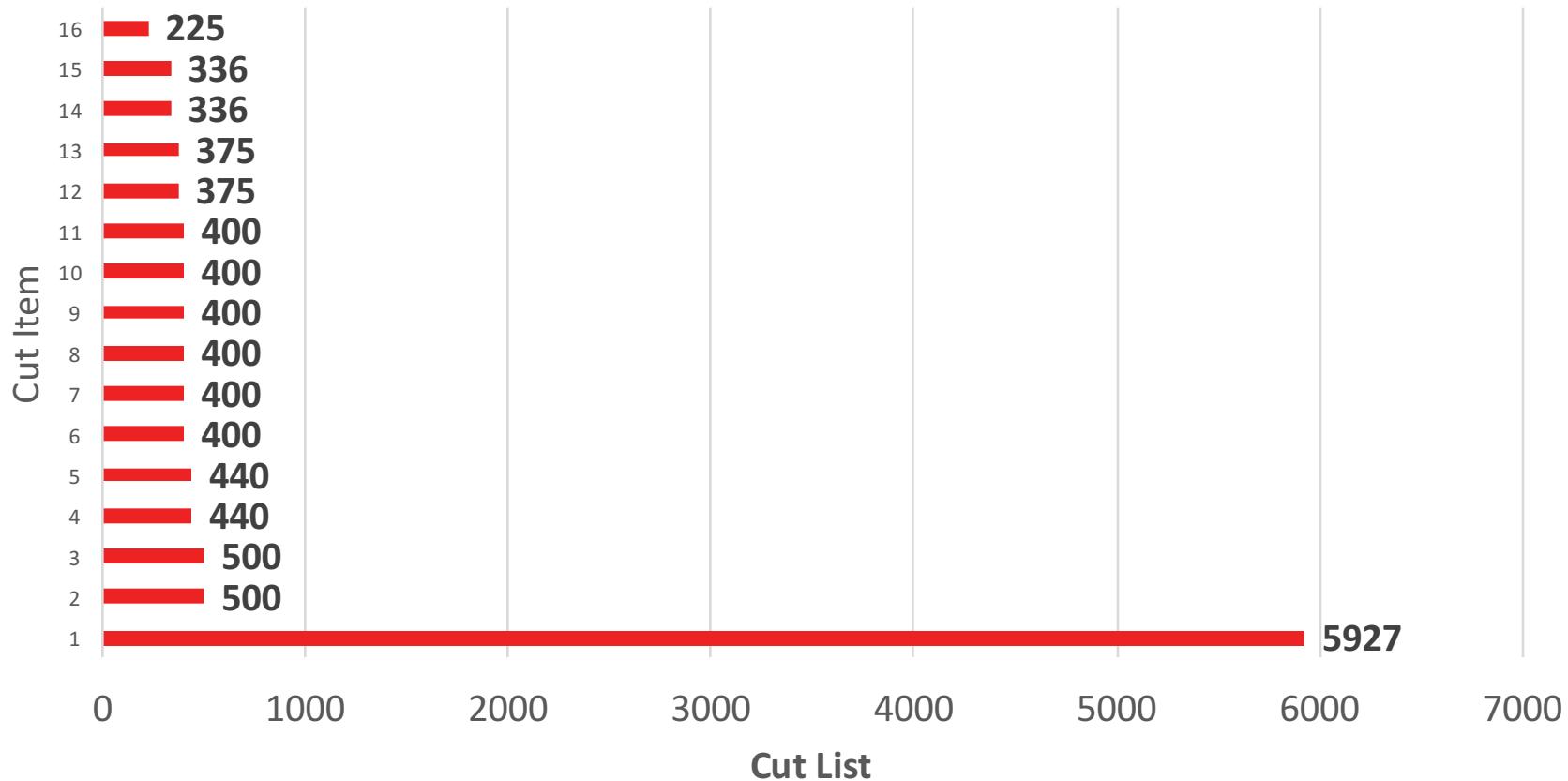
Stock 4





Stock 5

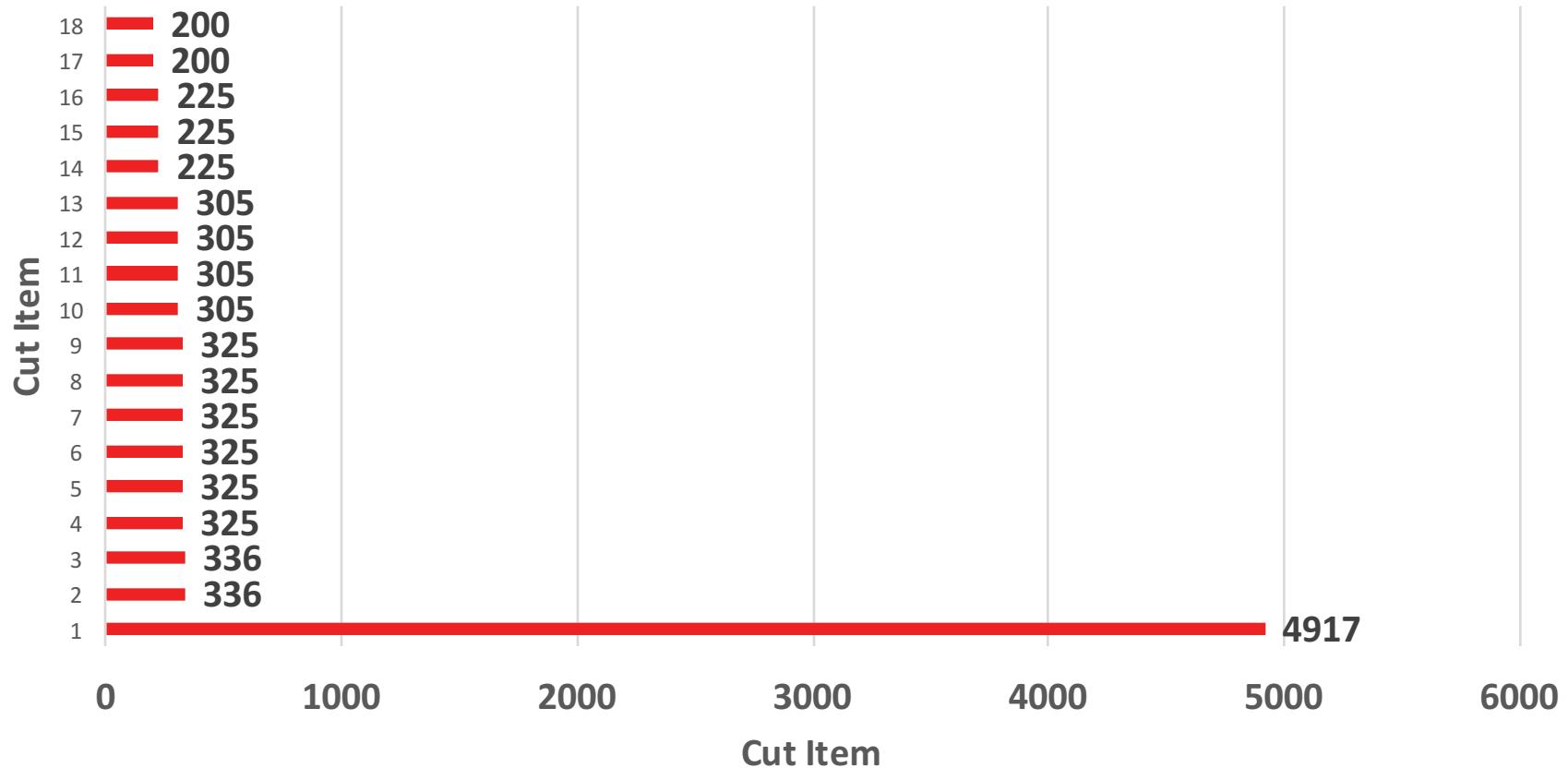
Stock 5





Stock 6

Stock 6





```
→ steel_opt git:(master) python steel_opt.py
Please enter your stock length in mm: 1000
How many do you have? 30
Stock Length is: 1000
Total Stock Length is: 30000
Please enter your cut length in mm: 450
How many do you have? 15
Total Stock Length available is: 30000
Current Length is: 6750 mm
do you have more to add? y/n?: n
There is potentially enough stock, optimisation possible
[450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450]
List with sum 6750 requires at least 7 bins
Solution using 8 bins:
Bin(sum=900, items=[450, 450])
Bin(sum=450, items=[450])
```

