

Numerical simulation of design parameters of suit case which can be used as a wheel chair for old age and physically disabled citizens.

Rahul Mishra^{1,*}

¹*Department of Mechanical Engineering, NSHM Knowledge Campus, Durgapur-713212, W.B., INDIA*

Abstract

Many old age and physically disabled citizens are travelling, and their family members reach station to drop them. Some of the personnel's are not able to walk at that time their family members have to ask for wheel chair or battery moved vehicle in the station and this is quiet cumbersome process and takes time. So we thought that each and every person is travelling with a suit case. So, if we can somehow with some design modifications make some arrangement so that the person who is unable to walk can sit on the suit case and the person who is there to drop him/her can slide the suit case. It will be beneficial for the old age and physically disabled citizens and also for their relatives who are there to drop them. Also the suit case which is available in the market is modified with very low cost and high durability and load carrying capacity, so that every citizen can easily purchase it. The design is tested by taking two different loads i.e. 300N and 150N. So that persons with different weights can be easily carried.

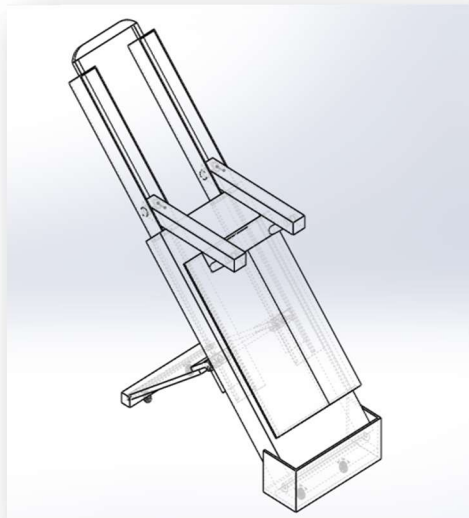
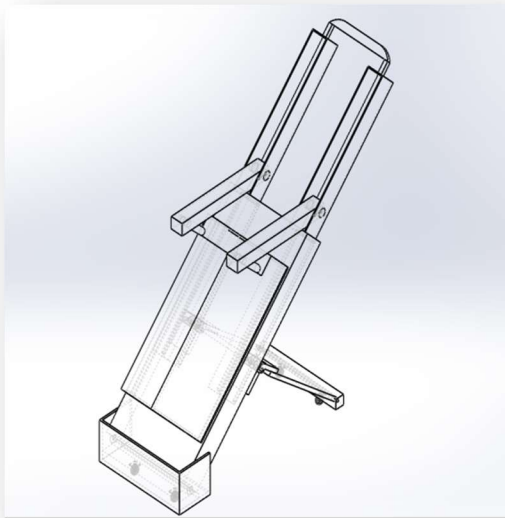
Keywords: Numerical Simulation, Shear Stress, Grid independence test, Elastic Strain, Sectional Stress, Total Deformation.

Introduction

Now a day's wheel chair for the senior citizens and the physically challenged are easily available in the railway stations and airport, but in many railway stations one has to perform lots of formalities for issuing of those wheel chairs and because of time factor involved in the stations these types of formalities creates lots of desultory. So, keeping this in mind the present research work has been carried out. Many old age and physically disabled citizens are travelling, and their family members reach station to drop them. Some of the personnel's are not able to walk at that time their family members have to ask for wheel chair or battery moved vehicle in the station and this is quiet cumbersome process and takes time. So we thought that each and every person is travelling with a suit case. So, if we can somehow with some design modifications make some arrangement so that the person who is unable to walk can sit on the suit case and the person who is there to drop him/her can slide the suit case. It will be beneficial for the old age and physically disabled citizens and also for their relatives who are there to drop them. The main objective of this invention is to help the old age and physically disabled citizens while travelling. Also the suit case which is available in the market is modified with very low cost and high durability and load carrying capacity, so that every citizen can easily purchase it.

Problem Definition

The researcher Claim that this design will serve its purpose to help the old age and physically challenged (Divyang) peoples to travel freely without any difficulty. Their family members will also get rid of carrying wheel chair and battery moved vehicles.



Description of the Invention

The whole frame of the suit case is made by Wrought Aluminum Alloy of 2024-T6 grade in order to reduce the weight of the suit case structure and also to increase the durability of the assembly of the suit case and the Hinges and Wheels are made up of Grey cast Iron of 40 grade in order to with stand the compressive strength due to weight of the person and also the grey cast iron is cheaper.

The Medium Size Suit case available in the market can be easily inserted in the bag which is designed in our structural assembly.

1. Back-Base:- The two back side wheels are mounted on the back base and it is attached with the back plate. The back base is to be used only when the suit case assembly is to be converted into wheel chair mode.
[Description of Invention\Back_base.PDF](#)
2. Back-Plate:- This back plate supports the back base and two back side wheels and it is also attached to the hinge assembly of the back side of the suit case bag assembly. The back plate is to be used only when the suit case assembly is to be converted into wheel chair mode.
[Description of Invention\Back_plate.PDF](#)
3. Bag:- It is a bucket like hollow structure to carry medium size suit case which is available in the market.
[Description of Invention\bag.PDF](#)
4. Front Base:- The front two wheels of the suit case and bag assembly are attached to the front base assembly. It also serves the purpose of foot rest for the person sitting on the slide-2.
[Description of Invention\Front_base.PDF](#)
5. Handle:- It is used to provide comfortable motion to the suitcase.
[Description of Invention\handle.PDF](#)
6. Hinge Assembly:- It is the most critical part of the suit case cum wheel chair assembly, because it carries the maximum load. So, the utmost care is taken while designing it and in turn it is made up of Grey cast iron in order to withstand the heavy compressive load.
[Description of Invention\hinge_assembly.PDF](#)
7. Model-1:- It shows all front view dimensions.
[Description of Invention\Model-1.PDF](#)
8. Model-2:- It shows all side view dimensions.
[Description of Invention\Model-2.PDF](#)
9. Main Part:- It is also an important part because the slider rod assembly inserts in it which is in turn connected with the handle. This main part assembly is in the back side of the bag assembly. And the Hinge assembly is also attached to it.
[Description of Invention>Main_part.PDF](#)
10. Slide-1:- The use of slide-1 is to provide optimum height to the handle so that the person who is carrying the suit case cum wheel chair assembly feels comfortable in doing so and with minimum effort. Also it gets locked automatically after attaining that optimum height.
[Description of Invention\Slide1.PDF](#)

11. Slide-2:- It is the seat of our wheel chair assembly. The Slide-2 assembly also has grooves for attaching nylon net like material used in the wheel chair for sitting, which is to be attached in the applied groove and a person can sit over there. When the slide-1 attains that optimum height, only then slide-2 will get opened. Also the slide-2 will out from inside the slide-1.

[Description of Invention\Slide2.PDF](#)

12. Slide-3:- Slide-3 will come out from inside slide-2 and as and when the slide-2 becomes horizontal then the slide-3 will get locked inside the slot provided in the bag assembly, in order to hold the load of the person sitting on the slide-2.

[Description of Invention\Slide3.PDF](#)

13. Wheel:- The assembly consist of 4 wheels made up of Grey Cast Iron. 2 wheels are attached on the front base assembly and the other 2 wheels are attached on the back base assembly.

[Description of Invention\wheel.PDF](#)

Result and Discussion

1. Stress

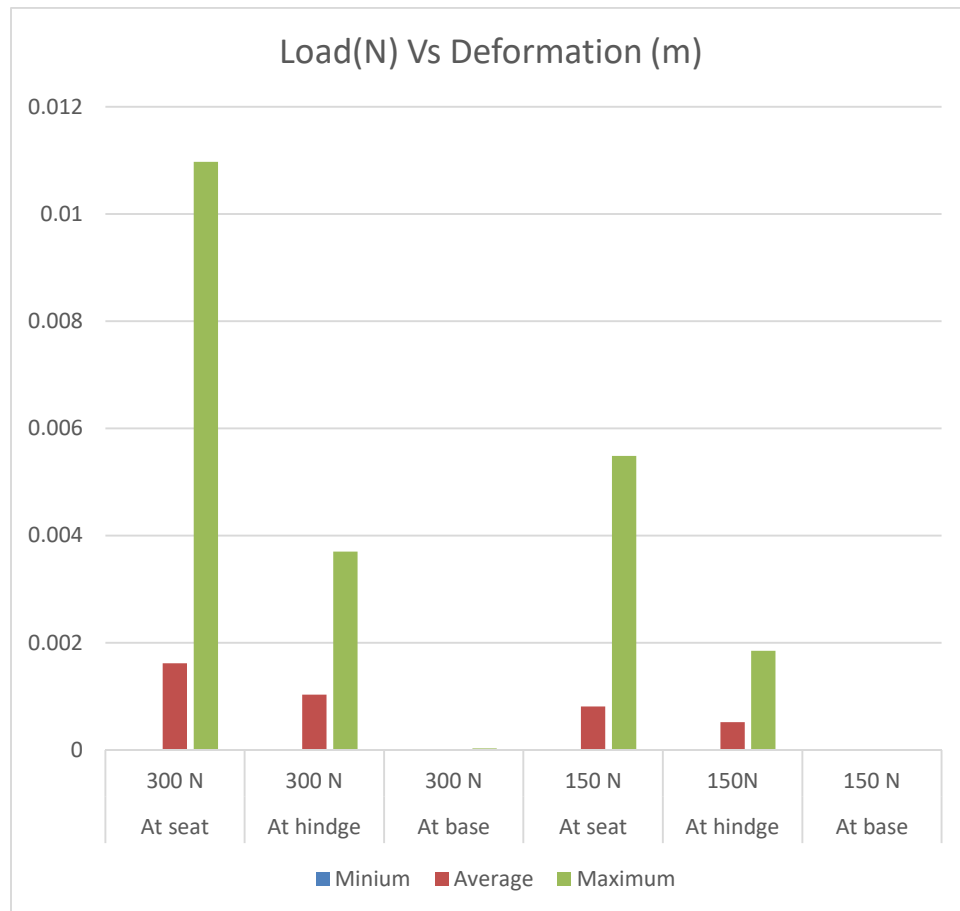
Position	Surface Area (A)	Load	Minium (Pa)	Average (Pa)	Maximum (Pa)
At seat	2179.73 square centimeters (for two pannel =A*2)	300 N	0	1.58E+06	9.39E+08
At hinge	1044.08 square centimeters (for two hindge =A*2)	300 N	0.00E+00	9.65E+05	2.40E+08

At base	Front =7696.08 square centimeters Back=1312.34 square centimeters	300 N	6.99E-03	4.05E+05	8.98E+07
At seat	2179.73 square centimeters (for two pannel =A*2)	150N	0	7.89E+05	4.70E+08
At hinge	1044.08 square centimeters (for two hinde =A*2)	150 N	0.00E+00	4.82E+05	1.20E+08
At base	Front =7696.08 square centimeters Back=1312.34 square centimeters	150 N	3.50E-03	2.03E+05	4.49E+07

2. Total Deformation

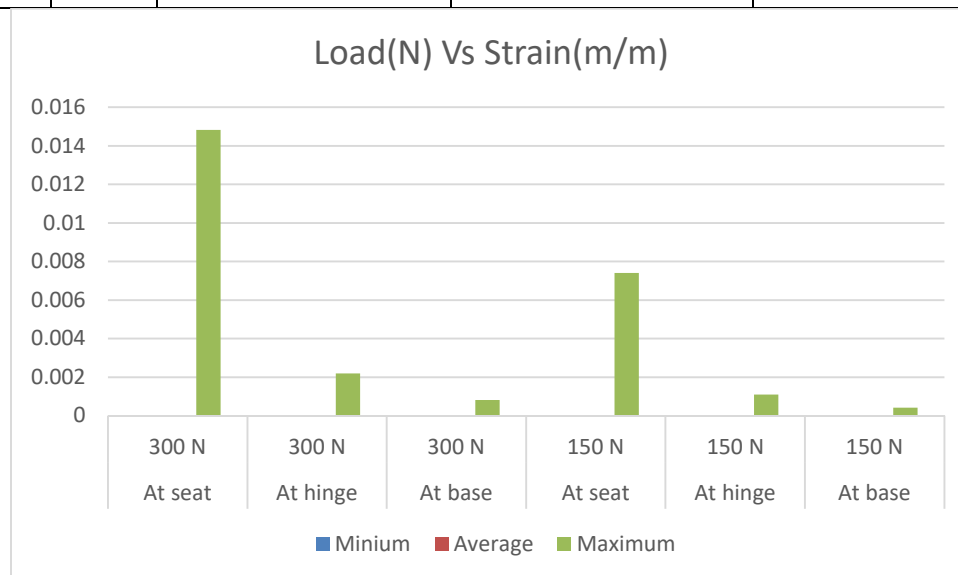
Total deformation				
Position	Load	Minium (m)	Average (m)	Maximum (m)
At seat	300 N	0	1.62E-03	1.10E-02
At hinge	300 N	0	1.04E-03	3.70E-03

At base	300 N	0.00E+00	7.73E-06	3.21E-05
At seat	150 N	0	8.10E-04	5.49E-03
At hinge	150N	0.00E+00	5.18E-04	1.85E-03
At base	150 N	0.00E+00	3.87E-06	1.60E-05

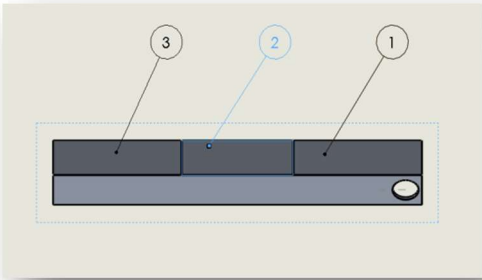
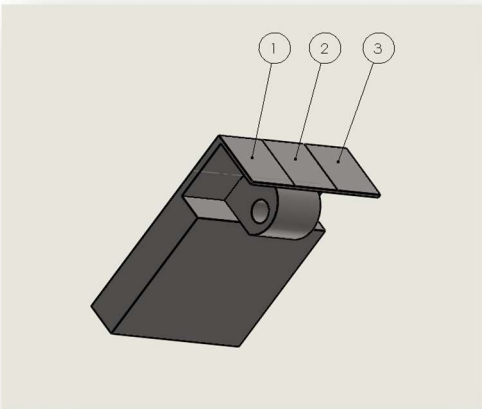


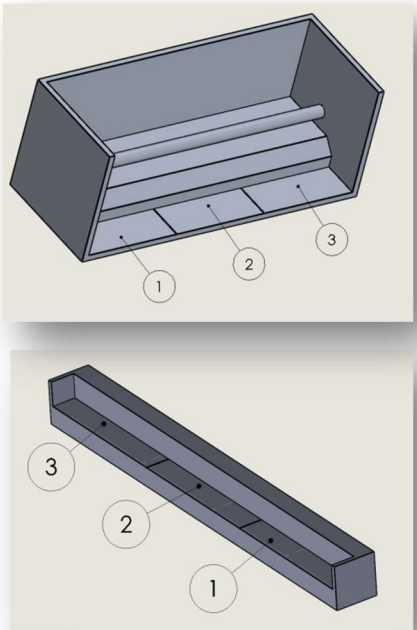
3. Elastic Strain

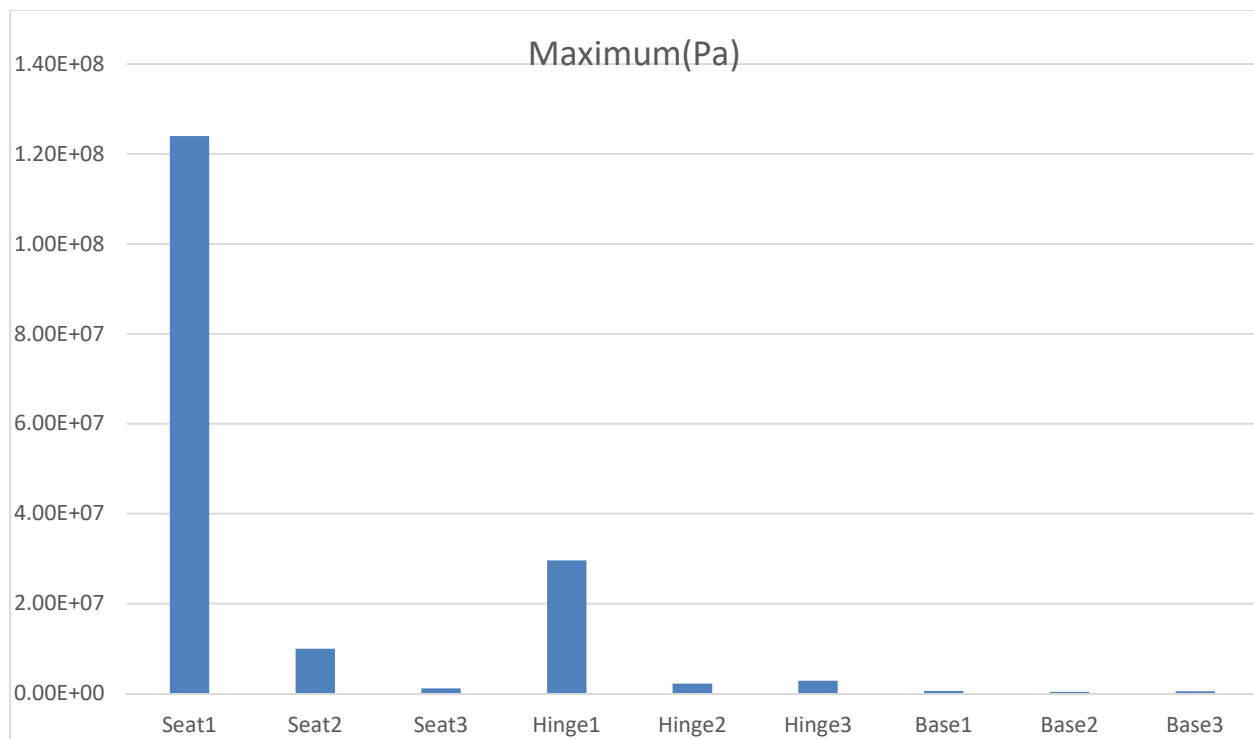
Elastic Strain				
Position	Load	Minium (m/m)	Average (m/m)	Maximum (m/m)
At seat	300 N	0	2.06E-05	1.48E-02
At hinge	300 N	0	1.19E-05	2.19E-03
At base	300 N	4.11E-13	4.53E-06	8.16E-04
At seat	150 N	0	1.03E-05	7.41E-03
At hinge	150 N	0.00E+00	5.93E-06	1.10E-03
At base	150 N	2.06E-13	2.26E-06	4.08E-04



4. Sectional Stress

Sectional Stress (300N)			
Index	Sectional Area	Surface Area	Maximum(Pa)
Seat1		2729.23 square centimeters	1.24E+08
Seat2			9.96E+06
Seat3			1.12E+06
Hinge1		732.53 square centimeters	2.96E+07
Hinge2			2.24E+06
Hinge3			2.88E+06

<p>Base1</p>		<p>Front=5824.34 square centimeters Back= 1105.74 square centimeters</p>	<p>5.66E+05</p>
<p>Base2</p>			<p>4.04E+05</p>
<p>Base3</p>			<p>5.18E+05</p>



Conclusion and Future Scope

1. The wheel chair cum suit case assembly will serve the purpose of old age citizens and physically challenged persons.
2. The present design will be beneficial for their family members as well, those who are along with the senior citizens and physically challenged to drop them in the station.
3. The time required to convert the suit case assembly in to the wheel chair assembly is also very less as compared to that of completing all the formalities in the station for issuing a wheel chair and again returning it back to the officials.
4. The whole assembly is portable enough to be carried easily along with, also it can be inserted inside the birth of the railway seats.
5. As per the use of the individuals and their family member's the advancement in the design and its research and development will be highly appreciated in the future course of action.

References

1. Completely indigenous design so no reference required.