

# MODELLING, ANALYSIS AND FABRICATION OF AN ADJUSTABLE BACK REST FOR A MOTOR VEHICLE RIDER

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**Abstract:** *The invention of automobiles is the blessing to human being from engineering and science for comfort transportation. While traveling on a two wheeler for longer distances, the rider is subjected to different seating postures depends on the condition of roads and the stresses will act on his backbone, and result in back pain and neck pain. To reduce these stresses on back bone, a new model is developed using NX CAD10.0 and load analysis is done by using three different materials they are mild steel, steel, aluminum 6061. Among these materials mild steel has better results, so it used to fabricate an adjustable back rest for a two wheeler rider.*

**Keywords —** *Back rest, NX CAD, Stress, Fabrication, Analysis, Back pain and Neck pain.*

## I.INTRODUCTION

Now a days, the usage of two wheelers is increasing day by day because of its ease of use, affordable cost and passion on it. While travelling on it there is a chance of getting back pain, neck pain etc., because it does not contain any back supporting system like in cars and busses etc. There are different types of sitting postures present based on design of vehicle, while travelling long distances due to the continuous sitting postures there is a chance of getting back pain. In olden days we have only a limited no of automobile manufacturers are available but now so many manufacturers are manufacturing these two wheelers and because of competition between them the cost of two wheelers also reduce. The main aim of this project is to provide comfort to the rider as well as co-traveller. So that they can reach the destination very safely and they can enjoy the journey. Otherwise it may effects his concentration on driving, rider may get irritation and there a chance of accident. The rider needs to assist the doctor for his recovery. So to reduce all these problems and to provide a comfort journey we need an effective design of back rest and in the economical range.

Most of the Indian bikes do not have back rests. Because the bikes used in India are having low CC bikes i.e. 120-180cc which are developed for short distance travelling. But in other countries they generally use high CC bikes for travelling long distances. For such long distance travelling bikes they used to provide back rests, music systems, GPRS, Bluetooth etc. Here the rider comfort is the main criteria not the type of vehicle and distance to travel. Generally, speaking the back rest is needed for longer distance but also needed for shorter distance for example in some cities like Hyderabad, Bangalore etc. In that heavy traffic there is a chance of getting stress on back bone.

**Karmegam Karuppiyah [1]** In this paper the author observed that in general the motor cyclists are experience symptoms of discomfort on various parts of their bodies while driving longer distances, especially at the lower back part. An experiment was conducted on different sitting postures in different time intervals. There are independent different variables were considered with and without back support. The participants were required to sit on a static two wheeler in observation room. The time duration for to sit is 2 hours and the time intervals are 15 minutes. The discomfort 'break point ' with and without back support was calculated.

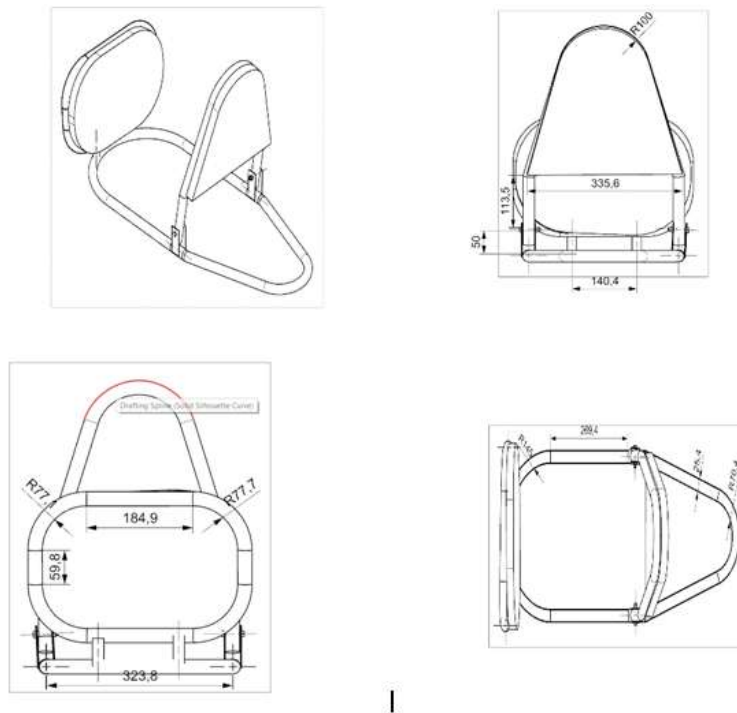
**Kadaba, M.P.; Ferguson-Pell [2]** This research shows that finite element analysis on deflection of seat cushion and as well as the human buttock when seated in it. A 6mm thin neoprane layer was considered as a shell of buttock and the human load was acting through it on seat. To replicate the behavior of skin and fat the neoprane layer was considered as viscoelastic material and the deflections of seat were calculated at various loads.

**Mr. Swapnil R. Mathurkar [3]** In this paper the research shows different sitting postures of two wheeler riders and the various stress concentration points of human body during riding. The resign of seat was done in such way that it provides comfort to the lower back of two wheeler rider and protect from the vibrations, jerks during riding. The analysis was done and deflections, maximum and normal stresses are found by considering different loading conditions.

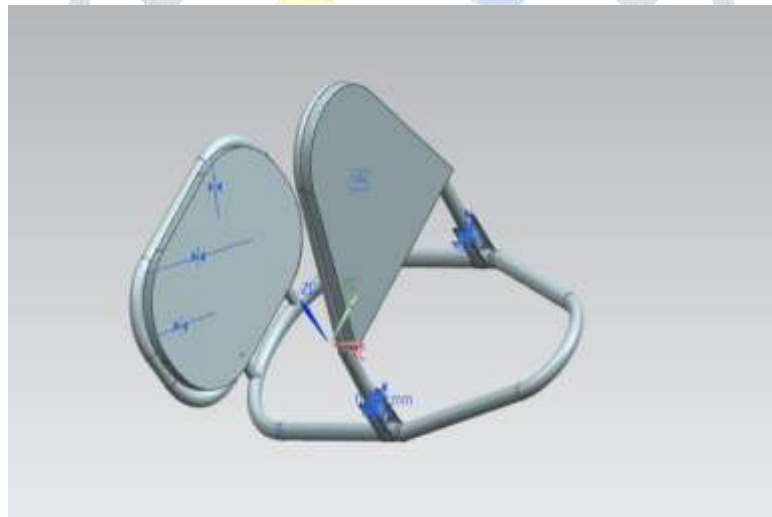
## II.METHODOLOGY

### MODELLING OF BACK REST USING NX CAD:

The measurements of computing and last as on base of anthropometric qualities information and from investigation of Honda Activa 125 two wheeler. The modeling of back rest is done by using soft were NXCAD 10.0. In modeling process the dimensions of the back rest are taken as shown in figure [1]. In order to develop the two dimensional model the sketch tool is used. This two dimensional sketch is converted as three dimensional solid model by using the tools sweep along guide and extrude. The final model consists of several parts so that each part is developed individually and then assembled by using assembly constraints.

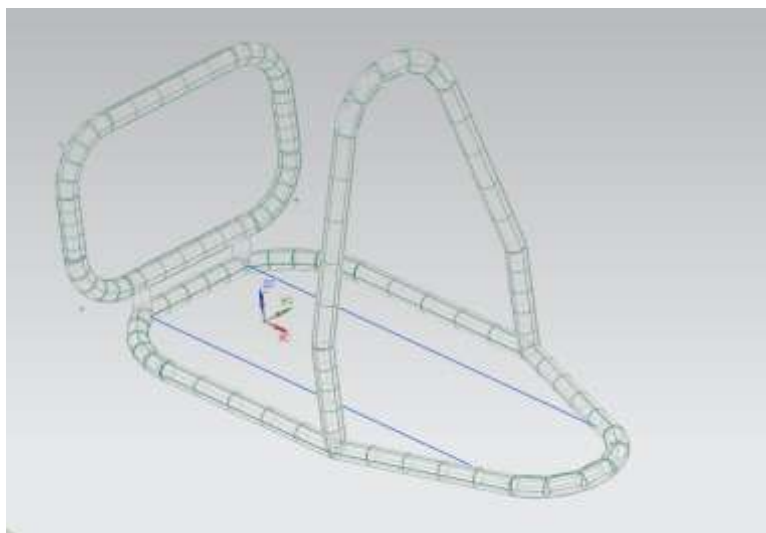
**DRAFTING:****Fig.1. Drafting of Back rest****THE THREE DIMENSIONAL MODEL OF BACK REST:**

The individual parts of the back rest are modeled and then by assembling those parts the three dimensional design of back rest is developed in software NXCAD 10.0. In assembling process import the individual parts and make a bond between the parts. The Assembly Navigator is positioned on crown of the Part Navigator bar Resources on the left of the screen. The navigator shows various things that form the assembly, including part hierarchy, the part name, information regarding the part such as either the component is read only, the position, which let, knows either the part is arrested the DOF by using assembly constraint tools are under mating condition, and the reference one.

**Fig.2. 3D Model of Back rest****THE ANALYSIS OF BACK REST:**

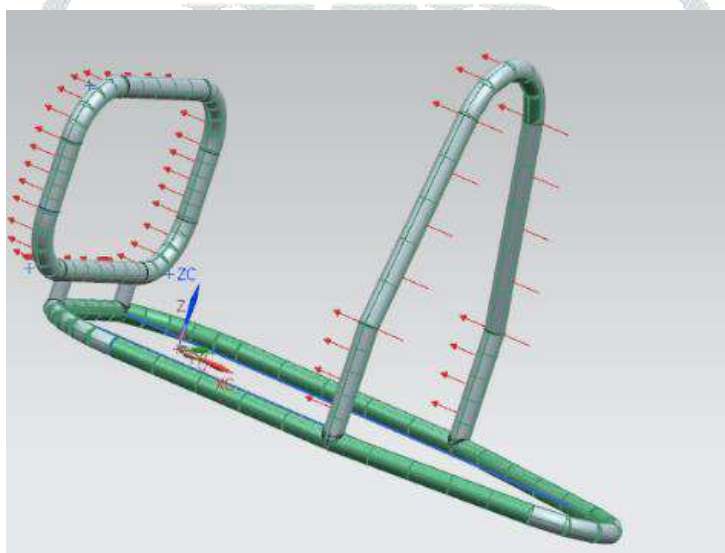
The analysis of back rest is done by using NASTRON solver in software NXCAD10.0. The analysis is done for three materials they are mild steel, steel, aluminum6061 at loads 100N to 800N with a difference of 100N. The stresses and displacements for various loads are shown in table [1]. In meshing the fixed and supporting elements are considered as one dimensional tube elements and the meshing is one dimensional meshing. The boundary conditions are applied in such a way that the frame which is at the periphery of the seat is fixed one and load are acting on the frame of back rest not on the cushion part.

**MESHING:**



**Fig.3. Wired Mesh of Solid Model**

**Loads applying on back rest:**



**Fig.4. load applied on the back rest**

**RESULTS:**

LOAD(N)	MILD STEEL		STEEL		ALUMINUM	
	Displacement (mm)	Stress N/mm <sup>2</sup>	Displacement (mm)	Stress N/mm <sup>2</sup>	Displacement (mm)	Stress N/mm <sup>2</sup>
100	1.776	42.39	1.802	42.37	5.411	42.46
200	3.552	84.79	3.603	84.73	10.823	84.93
300	5.328	127.18	5.405	127.10	16.23	127.39
400	7.104	169.58	7.206	169.47	21.65	161.86
500	8.880	211.97	9.007	211.8	27.06	212.632
600	10.658	254.37	10.809	254.20	32.47	254.79

700	12.432	296.76	12.615	269.57	37.88	297.25
800	14.21	339.16	13.925	338.93	43.29	339.21

**Table1. Load Vs Displacement and STRESS variation for 3 different materials**

### III.PROCEDURE

Fabrication is nothing but creating a real time component from the developed model. The dimensions of the model were shown in the fig. There are four different steps taken place they are bending, cutting, drilling and welding. The manual pipe bending process was used to bend the pipe. Two different pulleys were used, those are 23cm and 32.5 cm. One side of the pipe hold into the clamp and load applied at another side of the pipe. Then the pipe bent into required shape and dimensions. The additional part of the pipe can be removed by using portable cutter. The front back rest is an adjustable one as well as foldable one and the rare back rest is a fixed one. Hand drill was used to make holes at required portions and 12m.m diameter of the drill bit was used. The total set up was welded by using a portable arc welding machine. The specifications of machine are voltage 250V, current 110A.

### IV.FABRICATED MODEL:



**Fig.4. Fabricated Model**

### APPLICATIONS:

The model is suitable for two wheelers.

### V. CONCLUSION

In this project modeling, NX NASTRAN analysis and fabrication techniques are effectively integrated in order to create an effective model to reduce the hazardous impacts developed on human body. Now a days in metropolitan cities like Hyderabad and Bangalore etc. the traffic is very high so that the travelling time increases. Due to the continuous sitting postures on two wheelers the lower back of the body is subjected to high stresses so that the Back rest provides a protective mechanism which develops postural stability and integrity for the motorcyclist's spinal column system, specially the lower back bone. Therefore, this back rest supporting system has capable to providing an ideal posture and increases the comfort ability of motorcyclist's rider while riding process. The cushion support will give extreme comfort to the rider and pillion rider. It is absolutely suitable for middle aged people. The analysis is done by considering the three different materials they are steel, mild steel and aluminum. The applying loads are 100N to 800N with a difference of 100N. By comparing the results of displacements and stresses mild steel has better properties.

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