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Cycle Stand Project

Abstract:

This report gives the overview of the steps taken and processes involved in the designing of cycle stand along with the final results that were obtained.

Objective:

- To design robust cycle, stand for the use of students of IIT Patna.
- The prototype should be designed keeping the following things in mind
  Cost effectiveness
  Space optimization
  Proper material selection

Motivation:

As our college is newly constructed, cycle stands are yet to be bought. We face problem in parking of cycles. I was taught design concepts like load and stress analysis, fatigue failure analysis, failure due to static and variable loading, design of mechanical elements etc.
Thus, being student of mechanical engineering, with the motivation, we decided to implement what I have learnt by some practical experience like making of a cycle stand.

Layout:

The dimensions of proposed area, i.e. in front of block 9 were measured and the results are depicted below:

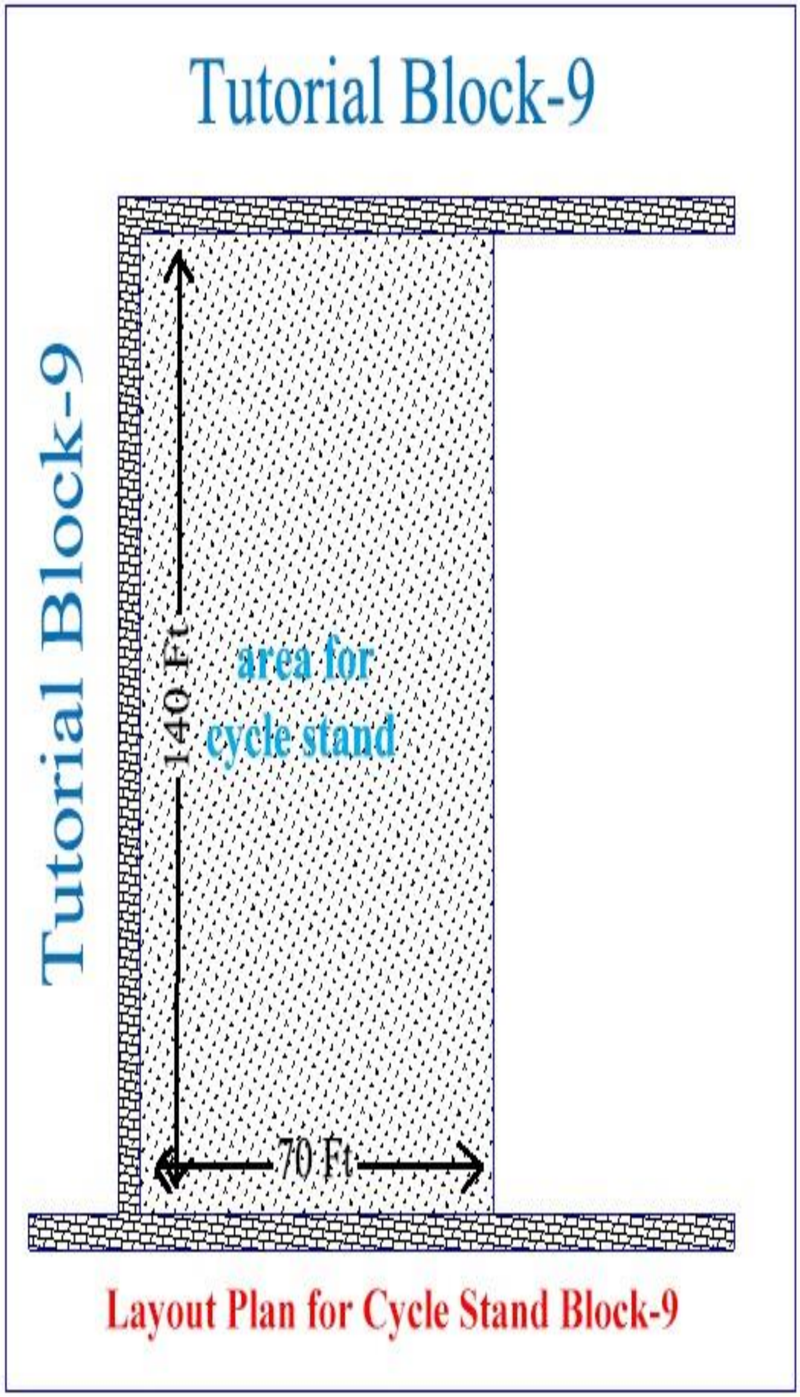


Fig 1.1 Layout plan for cycle stand

Cad Model:

To gather further information and obtain a more detailed requirement list, I had discussions with some friends facing the same problem of cycle parking. Then I compiled a list of specific requirements and constraints and came up with a basic model which was further modified using sound engineering techniques.

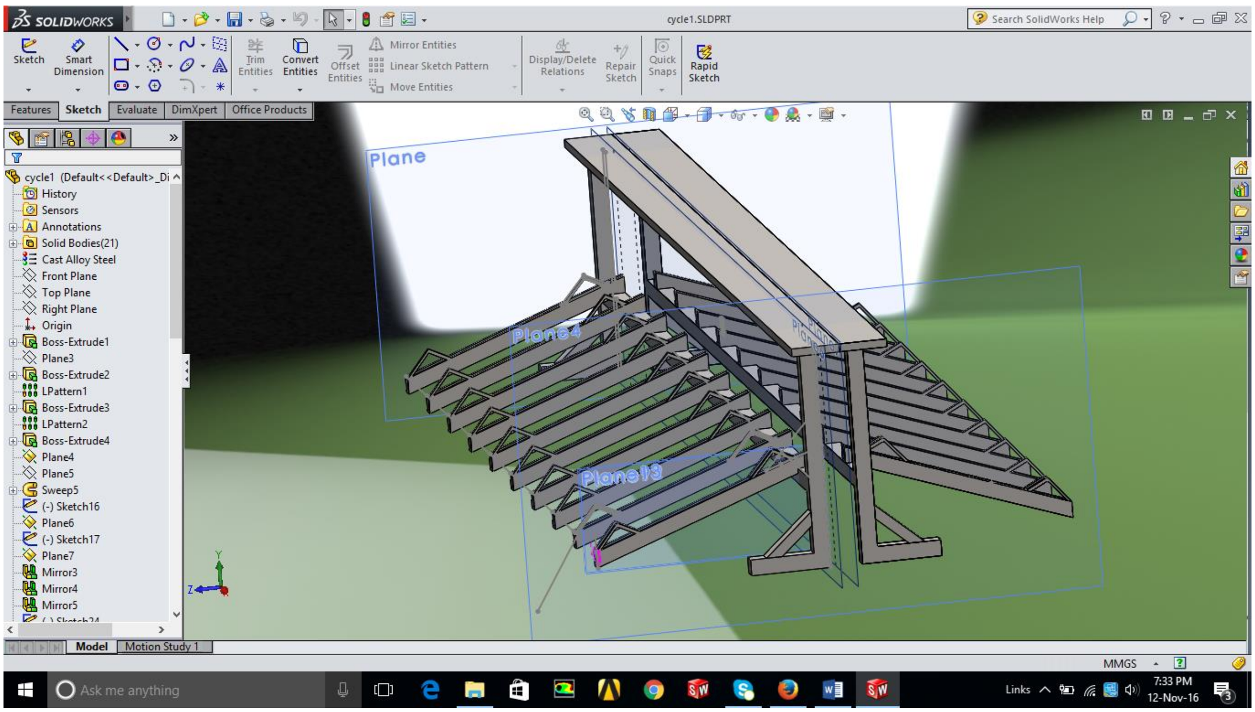


Fig.1.2 CAD model of cycle stand

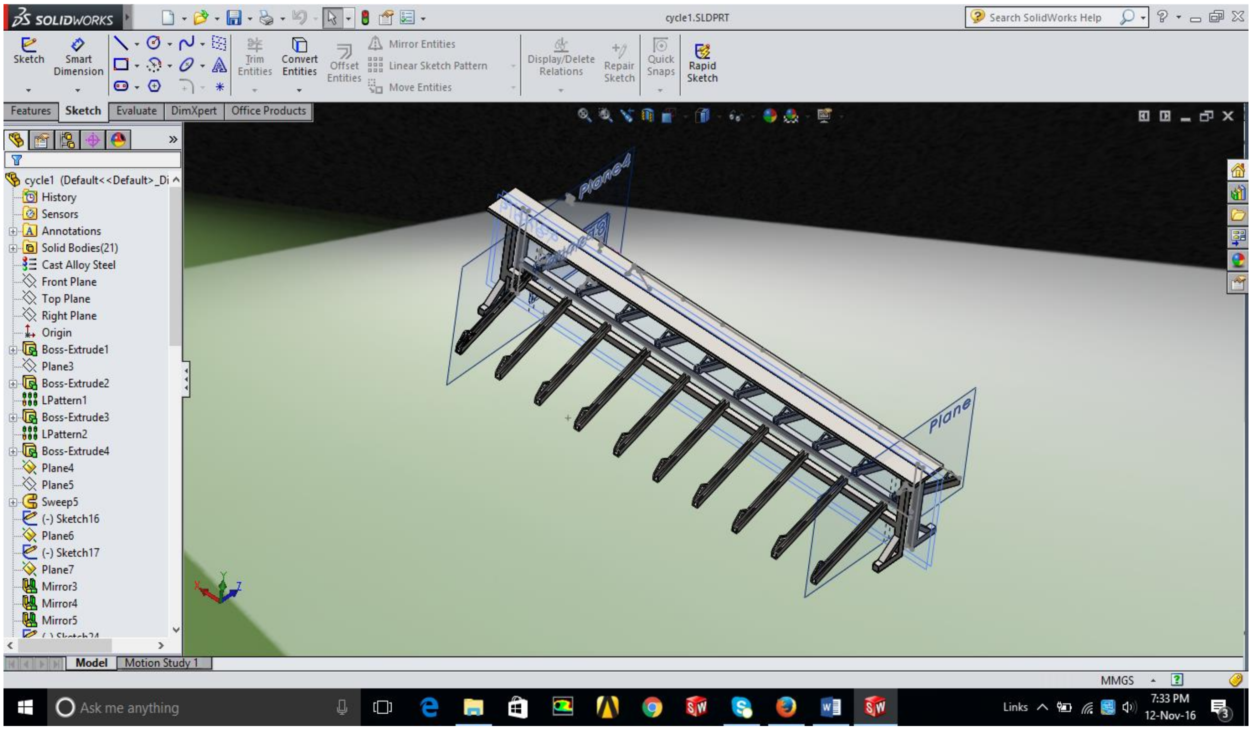


Fig.1.3 Isometric View

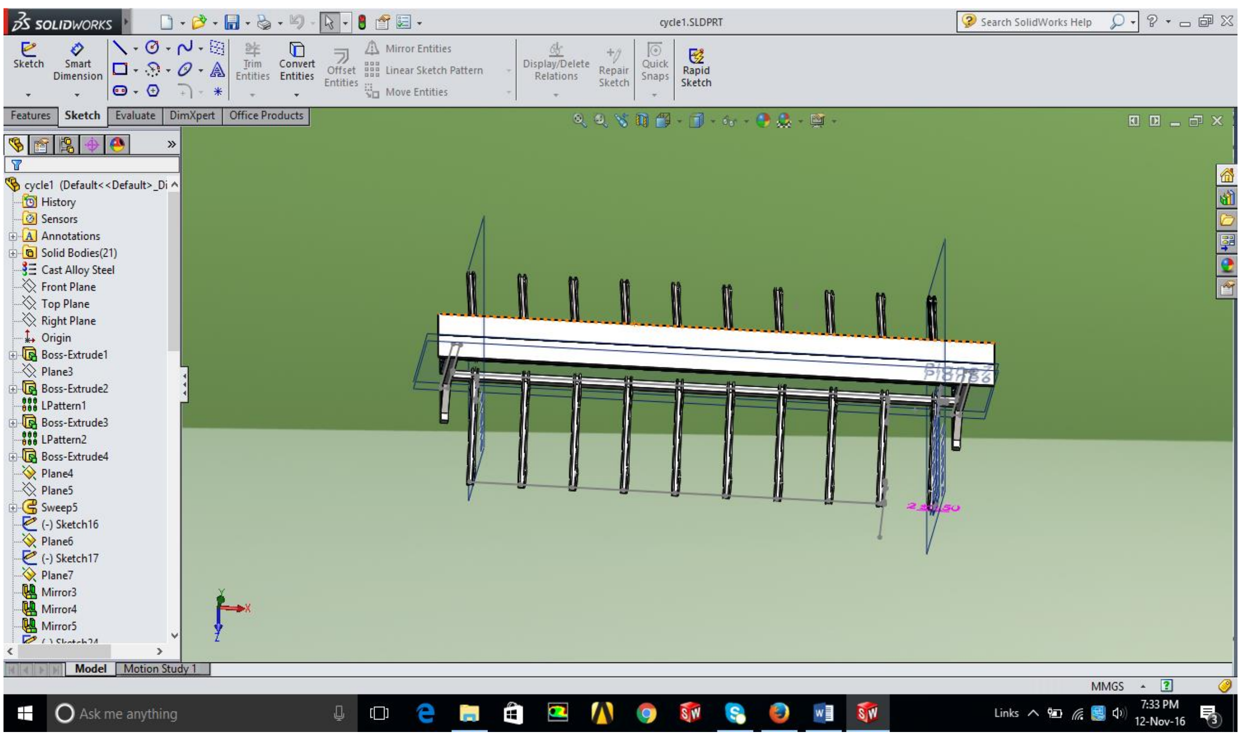


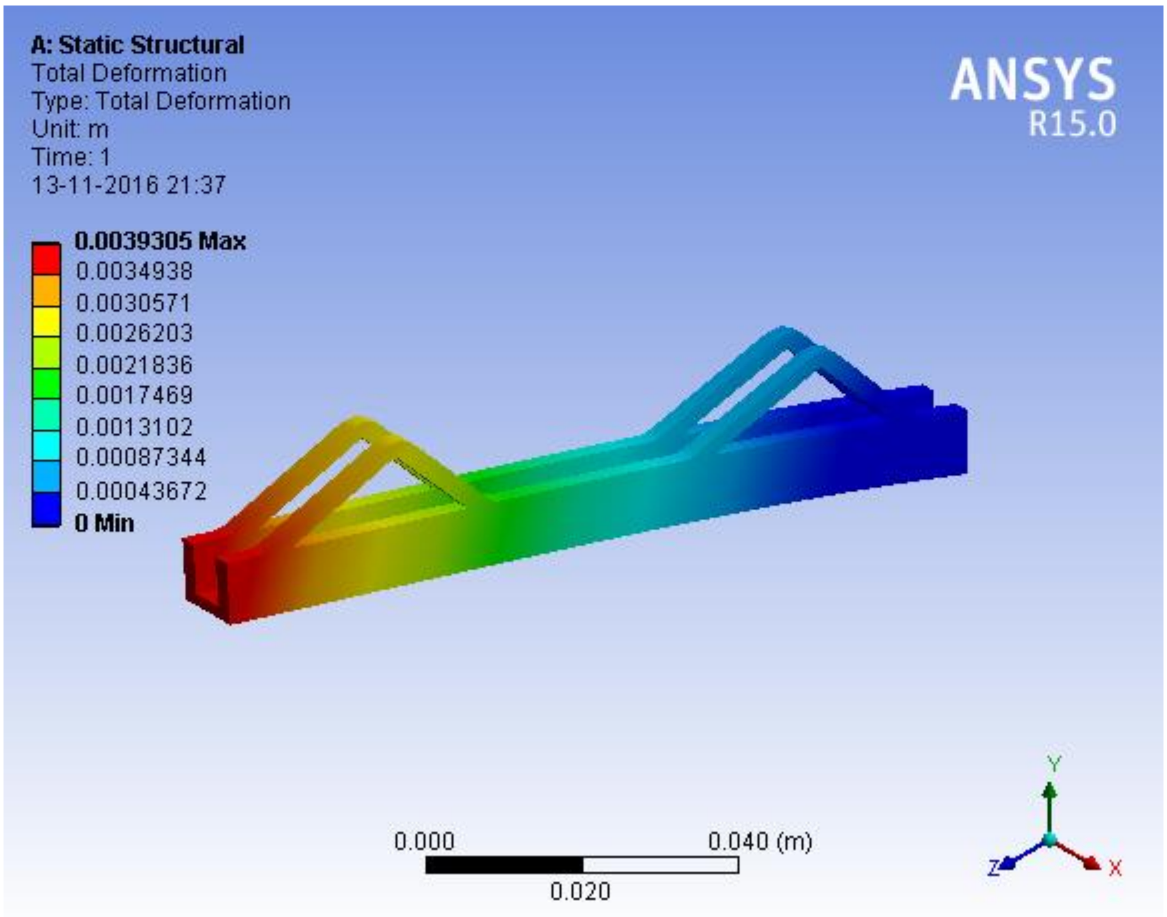
Fig.1.4 Top View

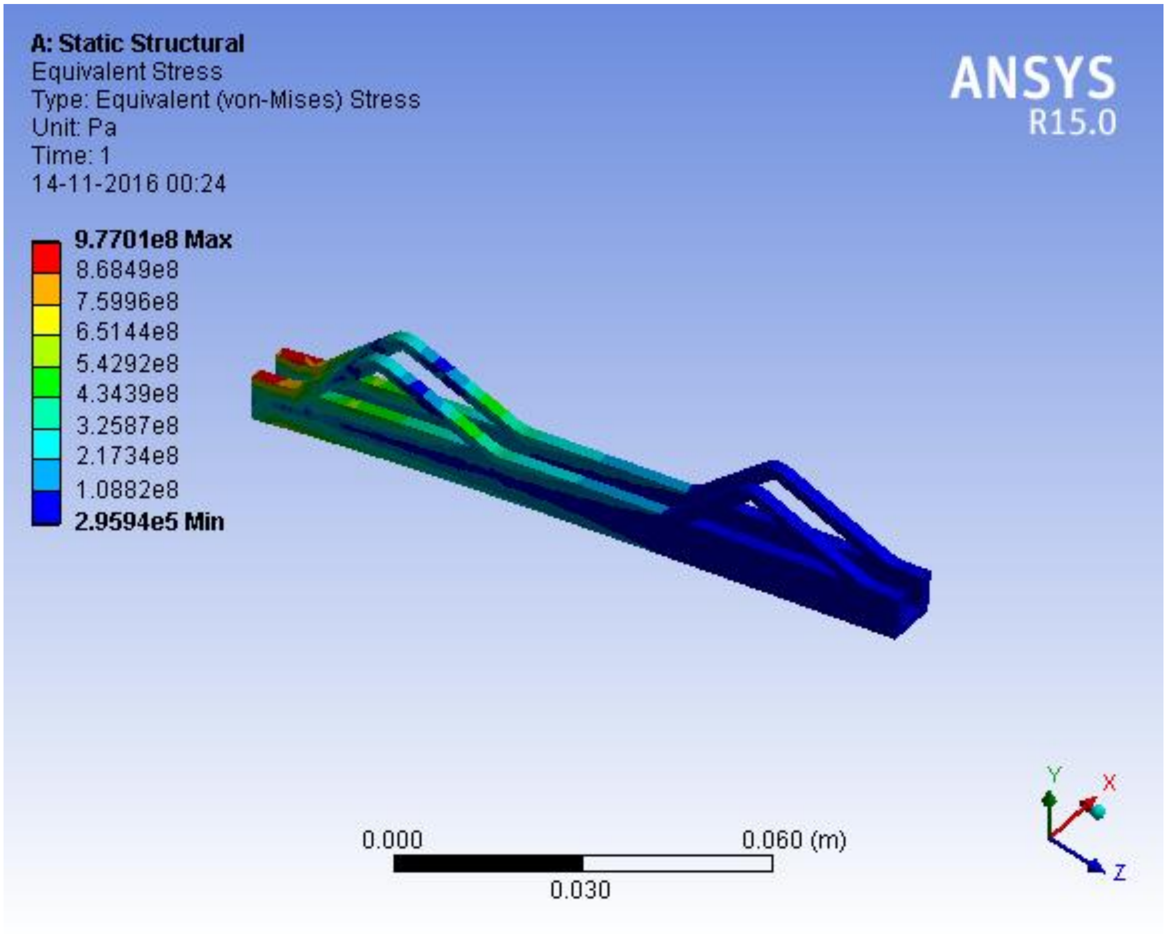
I approached my final design by considering all possible alternatives for a system & modeling them in SolidWorks to obtain a CAD model with least weight.

Analysis:

Firstly, loads, supports and constraints were determined.

Force of 1000 N is applied on the base of the support frame considering bicycle is fallen at a certain velocity over it.





The model was then analyzed using ANSYS. Based on the factor of safety obtained from first iteration, proper material selection was done considering market availability and relative cost price

Material Selection:
Stainless Steel (1018)

Reason for choosing stainless steel:

1. Stainless steel has high value of tensile and yield strength.
2. No danger of rusting.
3. Cost is relatively less as compared to chromyl steel which has comparable strength.

Chemical Composition:

Element	Content

Carbon, C	0.14 - 0.20 %
Iron, Fe	98.81 - 99.26 % (as remainder)
Manganese, Mn	0.60 - 0.90 %
Phosphorous, P	≤ 0.040 %
Sulfur, S	≤ 0.050 %

Physical Properties:

Physical Properties	Metric	Imperial
Density	7.87 g/cc	0.284 lb/in^3

Mechanical Properties:

Mechanical Properties	Metric	Imperial
Hardness, Brinell	126	126
Hardness, Knoop (Converted from Brinell hardness)	145	145
Hardness, Rockwell B (Converted from Brinell hardness)	71	71
Hardness, Vickers (Converted from Brinell hardness)	131	131
Tensile Strength, Ultimate	440 MPa	63800 psi
Tensile Strength, Yield	370 MPa	53700 psi
Elongation at Break (In 50 mm)	15.0 %	15.0 %
Reduction of Area	40.0 %	40.0 %
Modulus of Elasticity (Typical for steel)	205 GPa	29700 ksi
Bulk Modulus (Typical for steel)	140 GPa	20300 ksi
Poisson’s Ratio (Typical For Steel)	0.290	0.290
Machinability (Based on AISI 1212 steel. as 100% machinability)	70 %	70 %
Shear Modulus (Typical for steel)	80.0 GPa	11600 ksi

Electrical Properties:

Electrical Properties	Metric	English	Comments
Electrical resistivity @0°C (32°F)	0.0000159 Ω-cm	0.0000159 Ω-cm	annealed condition
@100 °C/ 212 °F	0.0000219 Ω-cm	0.0000219 Ω-cm	annealed condition

COST REPORT

S. No.	Process and Material	Unit Cost	Total Cost(Rs)
1.	Stainless Steel	150 per kg	60,000
2.	Bricks	3 per brick	6,000
3.	Cement	245 per Bag	7,350
4.	Labour Cost + (Welding, Grinding, Bending)	500 per day	5,000
5.	**Grand Total**		**78,350**

Based on analysis results, the model was modified and retested and a design was finalized.

Conclusion:

The project provided an insight into how real-life problems can be solved with the use of some mechanical engineering fundamentals. It gave me a platform to apply the concepts learnt in class and helped a lot in bridging the gap between classroom learning and practical application.