International Journal of Advanced Technology and Innovative Research
www.ijatir.org
ISSN 2348–2370
Vol.07,Issue.16,
November-2015,
Pages:3218-3223

Modelling of Heavy Vehicle Chassis Frame with Finite Element Analysis

MYLAVARA PUSARATH CHANDRAPRASAD[1], B. JITHENDRA KUMAR[2], DR.T.DHARMARAJU[3]
[1]PG Scholar, Dept of Mechanical Engineering, Nova College of Engineering and Technology, A.P, India,
E-mail: rajkumar_lb@yahoo.com.
[2]HOD, Dept of Mechanical Engineering, Nova College of Engineering and Technology, A.P, India,
E-mail: phanindrareddyk@gmail.com.
[3]Professor & Principal, Adarsh College of Engineering, A.P, India.

Abstract: A vehicle without body is called Chassis. It is the main mounting for all the components including the body. So it is also called as Carrying Unit. This project was proposed to rectify the failures by changing the present design. In this project we are going to collect data by reverse engineering for the heavy duty truck having the capacity of 10 Ton. By conducting Structural analysis for the existing material structural steel and aluminum alloy material one of the composite material, for reducing the weight and stresses of the chassis. Pro/Engineer software is used for the modeling and assembly. Ansys software is used for the analysis.

Keywords: Heavy Vehicle Chassis, Finite Element Analysis.

I. INTRODUCTION

The chassis forms the main structure of the modern automobile. A large number of designs in pressed-steel frame form skeleton on which the engine, wheels, axle assemblies, transmission, steering mechanism, brakes, and suspension members are mounted. During the manufacturing process the body is flexibly bolted to the chassis. This combination of the body and frame performs a variety of functions. It absorbs the reactions from the movements of the engine and axle, receives the reaction forces of the wheels in acceleration and braking, absorbs aerodynamic wind forces and road shocks through the suspension, and absorbs the major energy of impact in the event of an accident. There has been a gradual shift in modern small car designs. There has been a trend toward combining the chassis frame and the body into a single structural element. In this grouping, the steel body shell is reinforced with braces that make it rigid enough to resist the forces that are applied to it. To achieve better noise-isolation characteristics, separate frames are used for other cars. The presence of heavier-gauge steel components in modern separate frame designs also tends to limit intrusion in accidents.

A. Introduction of Chassis Frame

Chassis is a French term and was initially used to denote the frame parts or Basic Structure of the vehicle. It is the back bone of the vehicle. A vehicle without body is called Chassis. The components of the vehicle like Power plant, Transmission System, Axles, Wheels and tier, Suspension, Controlling Systems like Braking, Steering etc., and also electrical system parts are mounted on the Chassis frame. It is the main mounting for all the components including the body. So it is also called as Carrying Unit.

B. Layout of Chassis and Its Main Components

The following main components of the Chassis are

1. Frame: it is made up of long two members called side members riveted together with the help of number of cross members.
2. Engine or Power plant: It provides the source of power
3. Clutch: It connects and disconnects the power from the engine flywheel to the transmission system.
4. Gear Box
5. U Joint
6. Propeller Shaft
7. Differential

C. Functions of the Chassis Frame

1. To carry load of the passengers or goods carried in the body.
2. To support the load of the body, engine, gear box etc,
3. To withstand the forces caused due to the sudden braking or acceleration
4. To withstand the stresses caused due to the bad road condition.
5. To withstand centrifugal force while cornering

D. Types of Chassis Frames

There are three types of frames

1. Conventional frame
2. Integral frame
3. Semi-integral frame

II. CHASSIS AND BODY STRUCTURE

The vehicle design starts up with conceptual studies to define size; number and location of undrive and drive axles, type of suspension, engine power, transmission, tire size and axle reduction ratio, cab size and auxiliary equipment. The selected configuration has to be suitable for the considered transportation tasks and should match the existing production line. Either new vehicle type is generated or a certain improvement over existing types has to be achieved. Because of the fierce competition, and advancedtechnology in engineering, manufacturing and service and strenuous work is required to be successful. Having defined the general configuration of a vehicle, let us now concentration the main structural components. The most important function of the "backbone" is supporting and distributing the loads originating from Payload including its vessels, axles with their fixtures, coupling device, drive train, truck cabin including top sleeper/windshield, inertia forces, forced deformation, special service functions like cab tilt mechanism, cargo handling, equipment a.s.o. In addition to the primary structural functions, the chassis has to incorporate accessories, optional and special equipment like hydraulics, and electrical wiring and piping systems. Altogether, space is very limited and sometimes only small cross section dimensions are usable for the main structure.

1. Chassis Parts

Different chassis parts together comprise of automobile chassis. The different types of automobile chassis parts comprise of control arm, pitman arm, ball joint, stabilizer link, tie rod end, rack end and many other auto parts.

2. Chassis Improvements

As standard, most chassis are designed to meet a minimum set of requirements at a reasonable price - as such, there are usually improvements that can be made for vehicles that are going to be used for heavy duty applications and racing.

3. Material Choice

If Possible, one of the best ways to improve upon a design is to ensure that the most suitable materials are being used. Steel, for example, is available in various grades, and rebuilding a chassis using a higher grade will give strength benefits - In drag racing, the chassis of a competing vehicle must be built from a minimum grade of metal in order to run in certain classes.

Another good example of this is in tubing; the cheapest way to make tubing is to take a flat sheet of metal, roll it into shape, and then weld the seam (such tubes are referred to as electrical resistance welded, or ERW - the picture on the left shows a machine used to do this on an industrial scale). However, this seam can be a weak point, and so extruding out a tube in one (seamless) piece is preferable. Given that most of the time, a space frame chassis is built for a specialized purpose, seamless tubing will be used, this is more relevant when building additional components such as roll cages (below). Remember - as we said in the section on chassis materials, completely different materials cannot be interchanged without redesigning the structure to suit their different properties. A steel chassis rebuilt to exactly the same specifications from aluminum or titanium will be far lighter, but much more susceptible to flexing.

III. MODEL OF EXISTING CHASSIS

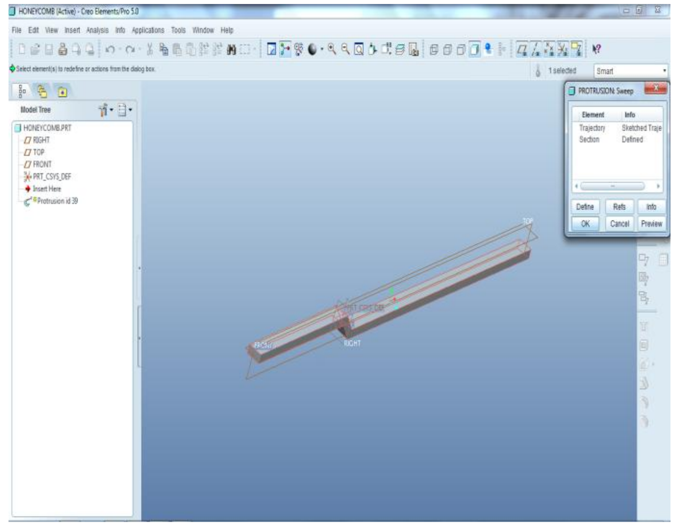


Fig1. Side Channel.

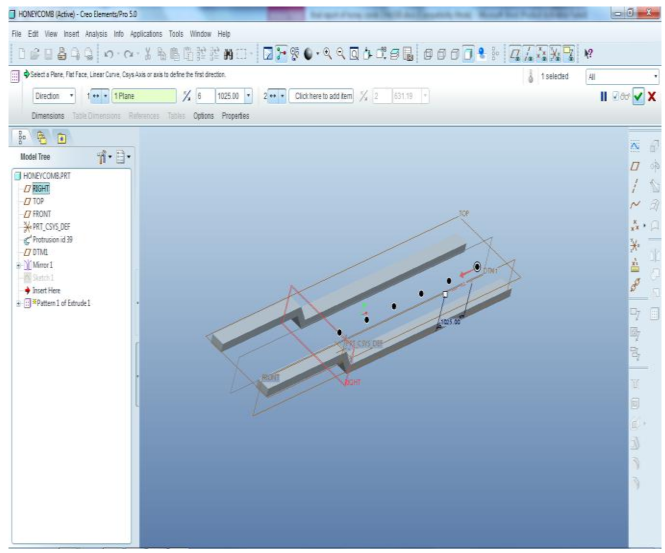


Fig2. Channel with cross members using pattern.

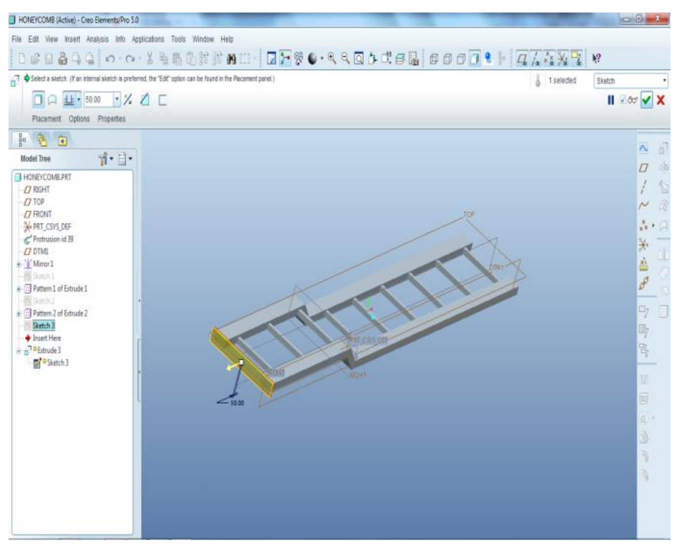


Fig3. Final model of existing chassis.

IV. HONEY COMB CHASSIS

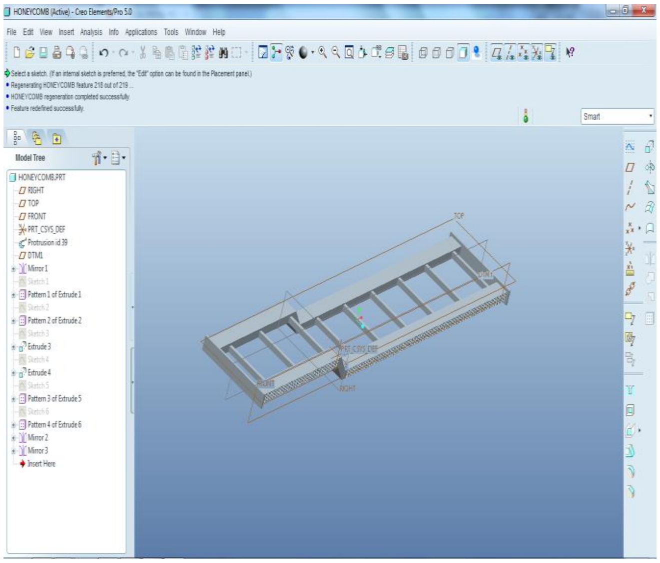


Fig4. Final model of honeycomb chassis.

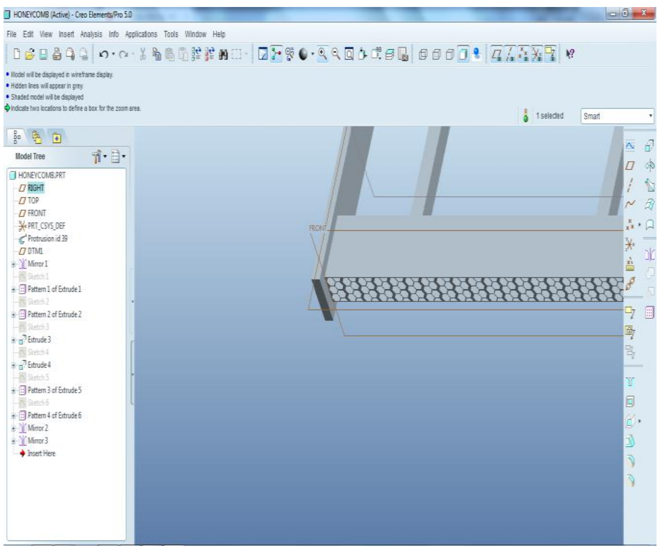
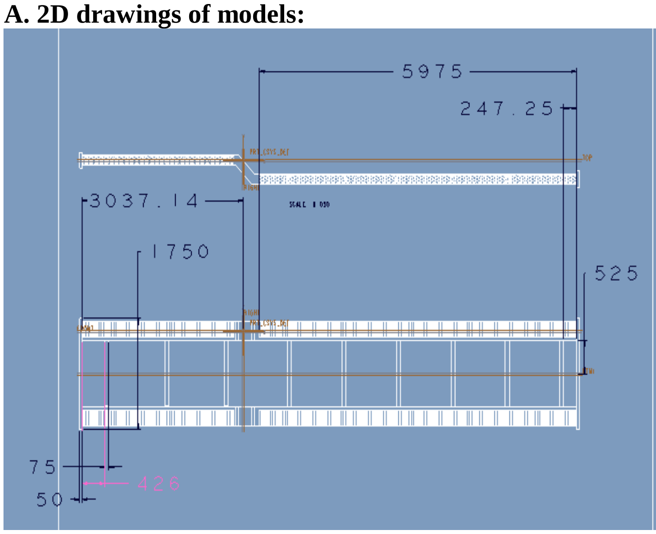


Fig5. Detail of honeycomb chassis.

A. 2D drawings of models:



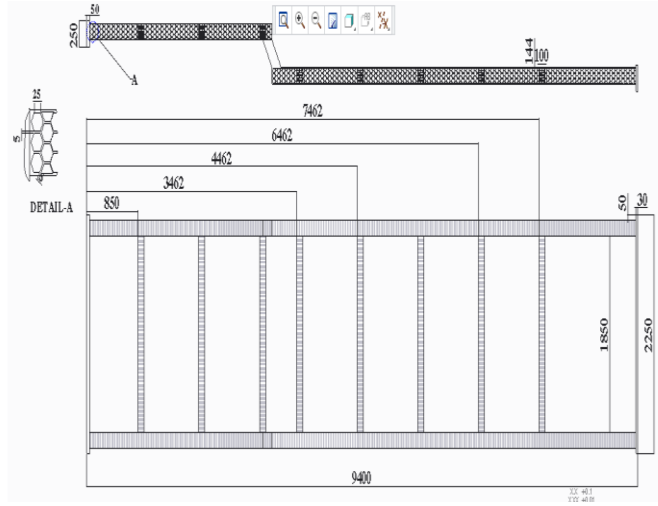


Fig 6. 2D drafting of honeycomb chassis.

V.RESULTS

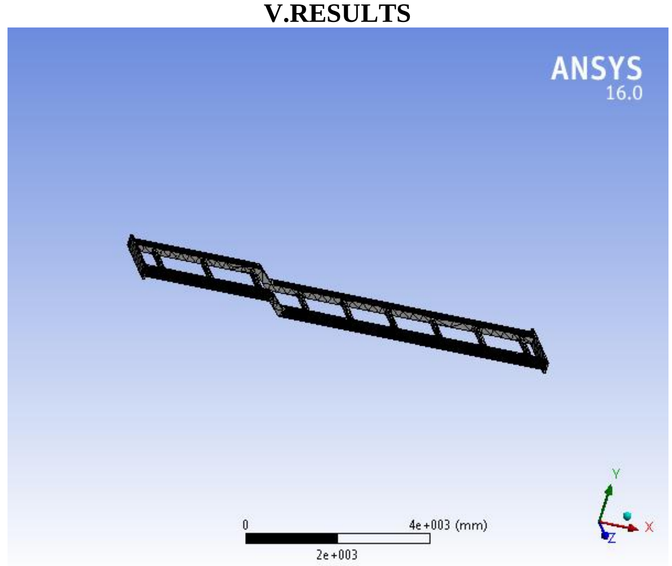


Fig7. Mesh.

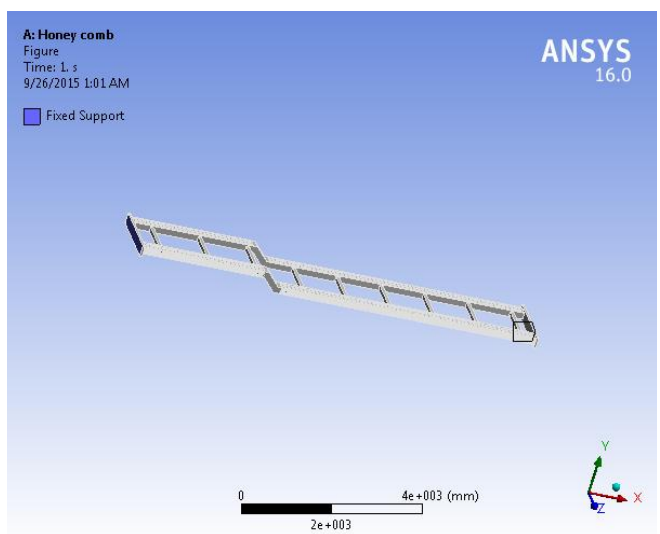


Fig8. Static Structural (A5) Fixed Support.

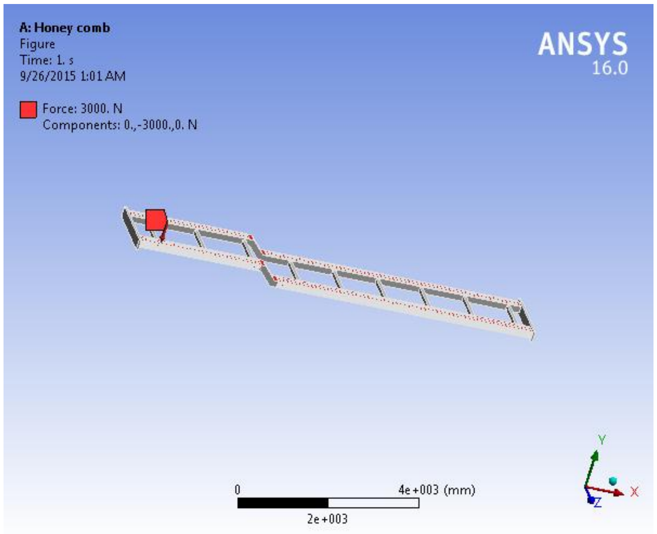


Fig9. Static Structural (A5) Force.

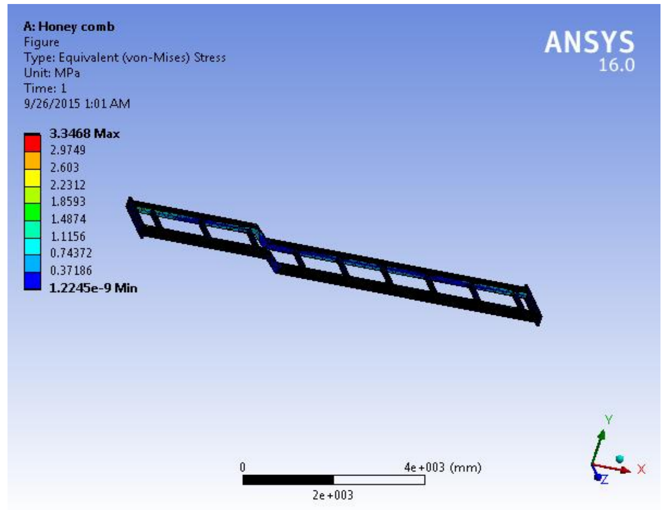


Fig12. Static Structural (A5) Solution (A6) Equivalent Stress.

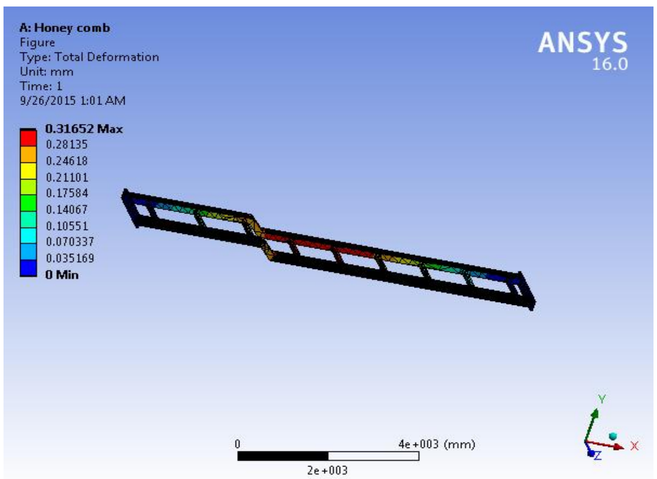


Fig10. Static Structural (A5) Solution (A6) Total Deformation.

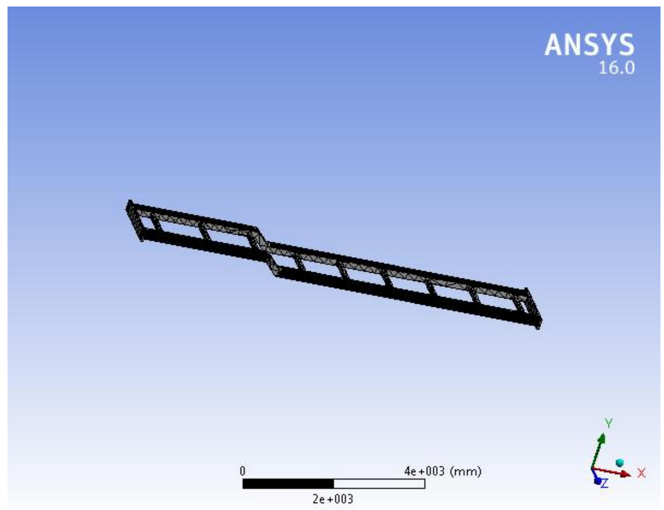


Fig13. Model (A4) Mesh.

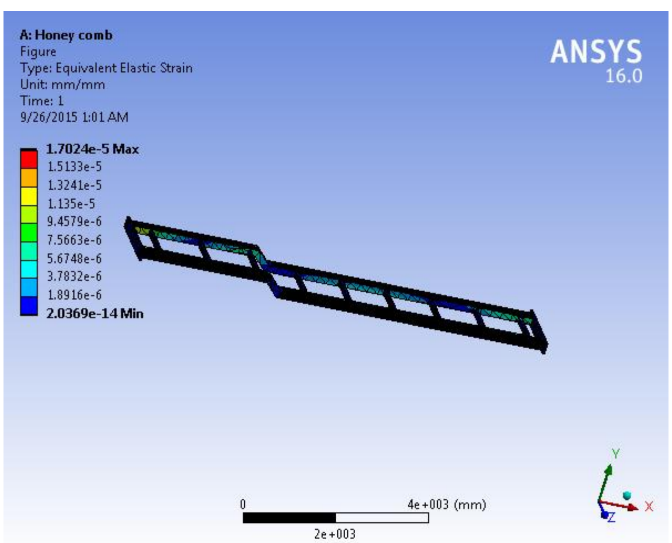


Fig11. Static Structural (A5) Solution (A6) Equivalent Elastic Strain

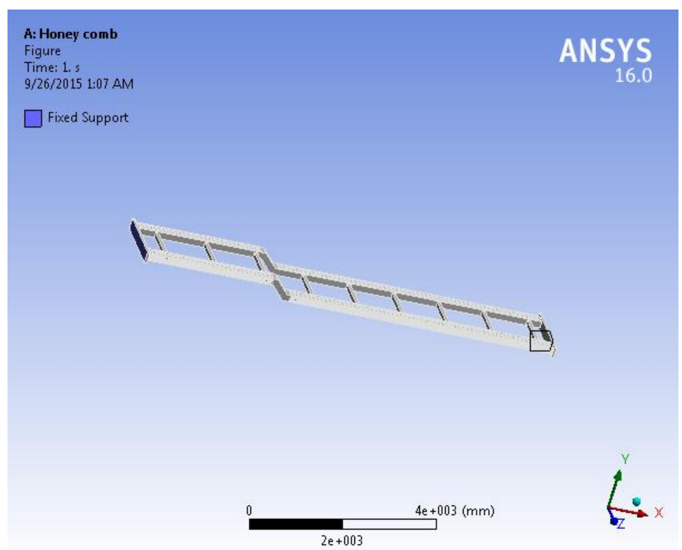


Fig14. Static Structural (A5) Fixed Support.

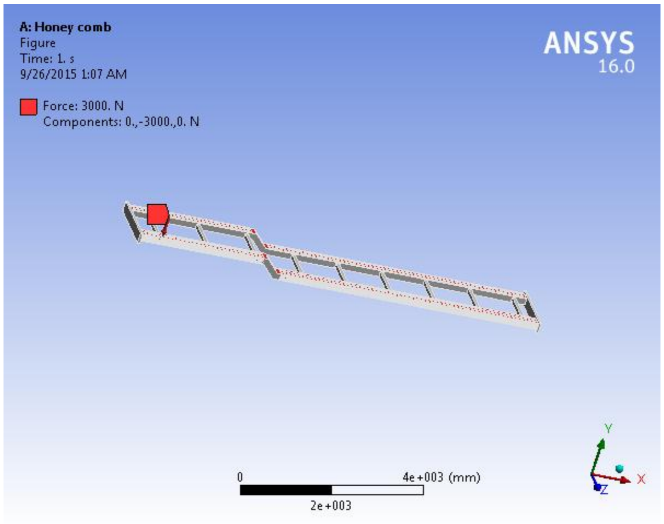


Fig15. Static Structural (A5) Force.

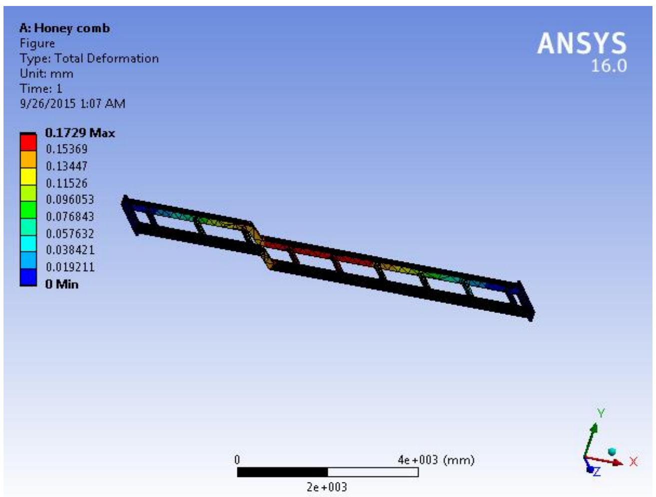


Fig16. Static Structural (A5) Solution (A6) Total Deformation.

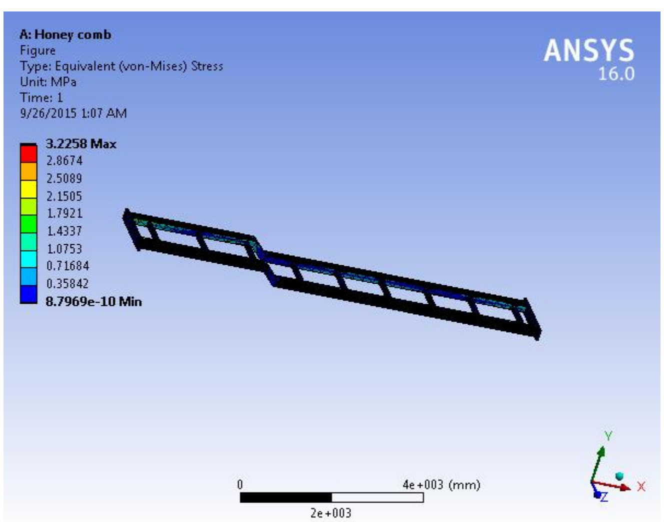


Fig17. Static Structural (A5) Solution (A6) Equivalent Stress.

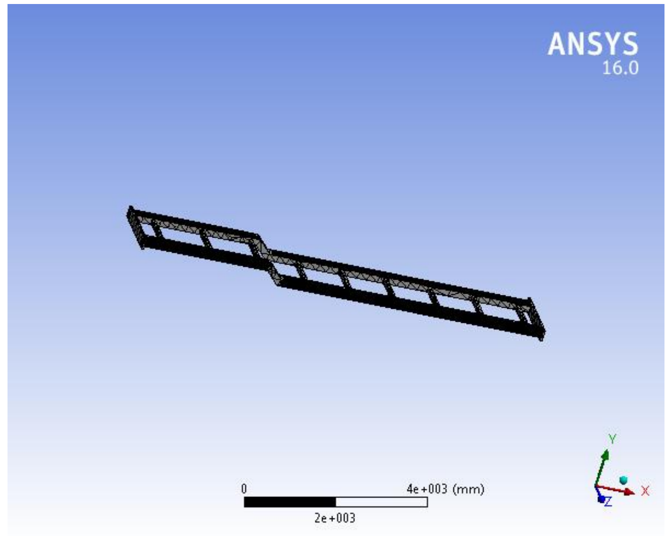


Fig18. MeshAl SiC.

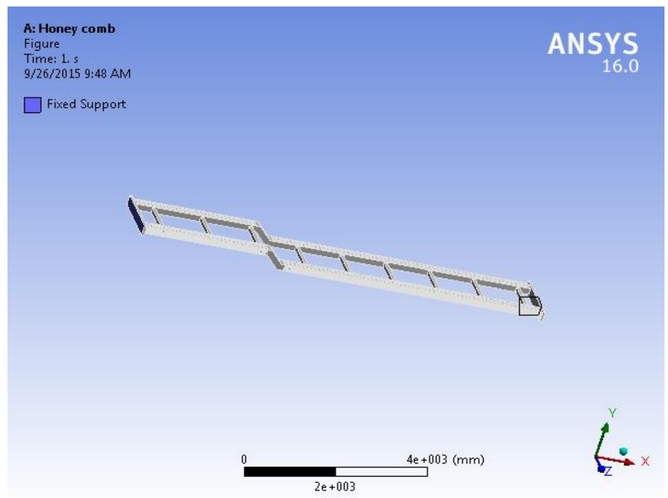


Fig19. Static Structural (A5) Fixed Support.

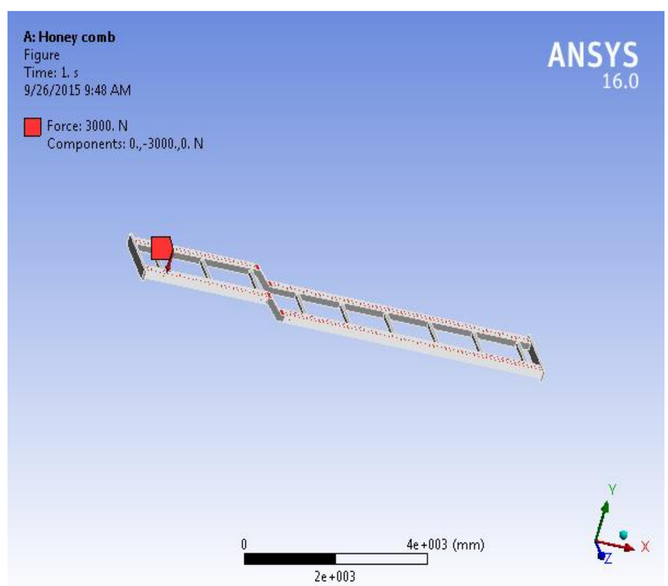


Fig20. Static Structural (A5) Force.

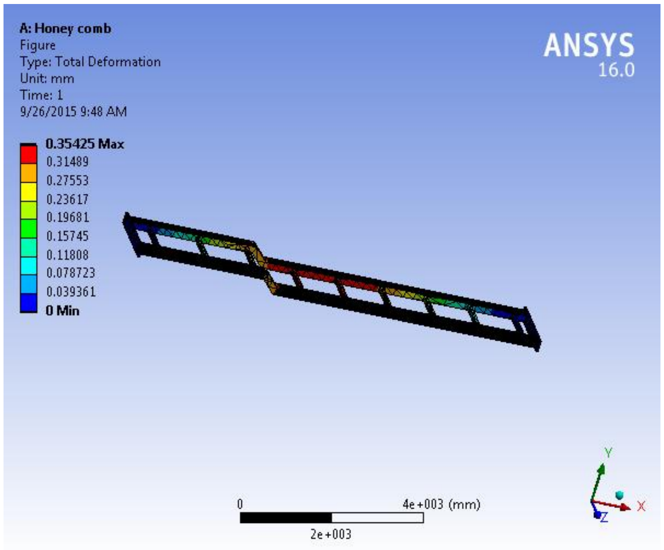


Fig21. Static Structural (A5) Solution (A6) Total Deformation

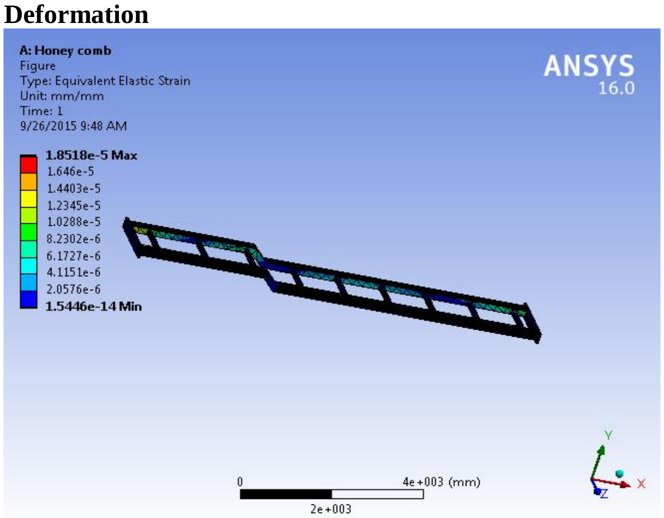


Fig22. Static Structural (A5) Solution (A6) Equivalent Elastic Strain.

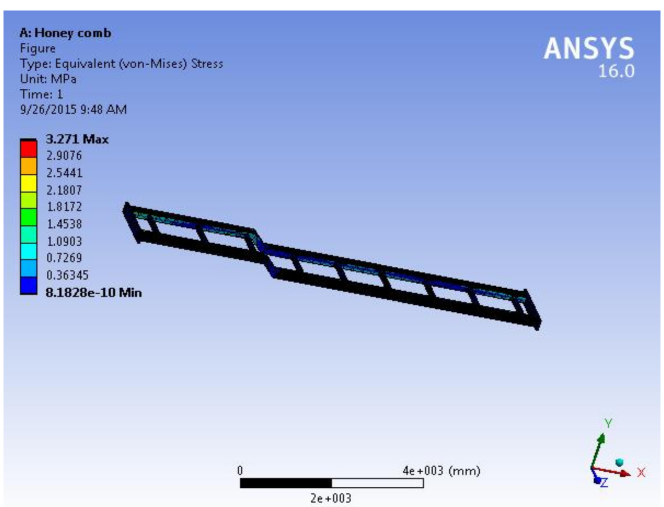


Fig23. Static Structural (A5) Solution (A6) Equivalent Stress.

VI. CONCLUSION

This paper works present's/work's on "structural optimization of chassis and implementation of composite materials in heavy vehicle chassis to reduce the weight without reducing structure quality". As per the problem description weight is the major part which effect on millage and cost of the chassis. First literature survey and data collection was done to understand the rectification method and material selection. In the next step 3D models of chassis regular and Honey comb is prepared in Pro-E for further study is Ansys. As per analytical results Honey comb structure chassis along with S2–Glass (CRPF) is the best choice. By using S2-Glass along with honey comb structure weight is reduced up to 75% and quality is improved by 87 % .So better to us above suggested model & material.S2-Glass chassis manufacturing is very easy while compared with Mild steel.

VII. REFERENCES

[1] Manpreetsinghbajwa, 2yatin raturi, 3amit joshi.
[2] hemantkumarnayak, 2nagendra prasad, 3 deepty verma,4tulsi bisht.
[3]thanneruraghukrishnaprasad, gouthamsolasa, nariganani sd satyadeep, g.sureshbabu.
[4] hirakpatel, khushbuc. panchal, chetan s. jadav.
[5] hemant b.patil1, sharad d.kachave2, eknath r.deore3 1(p.g.student mechanical, s.sv.p.s.b.s.d.c.o.engg, dhule north maharashtra university, india) 2(mechanical, s.sv.p.s.b.s. d.c.o.engg, dhule north maharashtra university, india) 3(head of mechanical, s.sv.p.s.b.s.d.c.o.engg, dhule north maharashtra university, india).
[6] prajwalkumar m. p1, vivek muralidharan2, g. madhusudhana3.
[7] havalkamal asker1, thakersalih dawood1 and arkanfawzi said2.
[8] mukeshkumar r. galolia, 2 prof. j. m. patel.
[9] sairamkotari 1, v.gopinath2.
[10] mohdazizimuhammadnora,b*, helmirashida, wan mohdfaizul wan. mahyuddinbmohdazuanmohdazlanc, jama luddinmahmuda.
[11] alirezaarabsolghar*, zeinabarsalanloo.
[12] e.bhaskar 1, t.muneiah 2, ch.venkata rajesh3.
[13] haiping du, weihua li, nongzhang, du, h., li, w. &zhang.