International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Review on Design and Analysis of Trailer Mounted Water Pump Canopy

Akshay Mande[1], Dr. I.A. Khan [2]
[1]Akshay Mande, Mechanical Engineering Department & Priyadarshini College of Engineering
[2]Dr. I. A. Khan Mechanical Engineering Department & Priyadarshini College of Engineering

---***---

Abstract - The chassis of a trailer-mounted water pump canopy is a critical structural component that ensures stability, mobility, and durability of the system. This study focuses on the design and analysis of a chassis capable of supporting a water pump within a protective canopy while withstanding operational and transportation stresses. The design process involves 3D modelling using CAD software, followed by structural analysis using Finite Element Analysis (FEA) to assess stress distribution, deformation, and factor of safety under various loading conditions.

Key design considerations include load distribution, material selection, weight optimization, and dynamic performance. The chassis must accommodate the pump's weight, resist vibrations during operation, and endure road impacts during transportation. Materials such as structural steel and aluminium alloys are evaluated based on strength, corrosion resistance, and weight efficiency. Suspension and axle configurations are also analysed to ensure proper load balance and maneuverability. Additionally, the design considers factors such as ground clearance, centre of gravity, and ease of maintenance to enhance usability

Key Words: CAD Modelling, FEA Analysis, Chassis, Design of chassis, Canopy

1.INTRODUCTION

A chassis is the structural framework of a vehicle or trailer that supports its components and ensures stability, strength, and mobility. It serves as the backbone of any wheeled system, providing a rigid platform to mount essential parts such as the engine, suspension, axles, fuel tank, and body structure. In the case of a trailer-mounted water pump canopy, the chassis supports the water pump, protective canopy, and other equipment while ensuring safe transport over different terrains.

A pump is a mechanical device used to move fluids (liquids or gases) from one place to another by creating pressure or flow. It operates by converting mechanical energy (from an engine, motor, or manual force) into hydraulic energy, enabling the fluid to be transported efficiently. Pumps are widely used in industries such as agriculture, construction, firefighting, water supply, wastewater management, and industrial processing.

A canopy in vehicles refers to a protective covering or enclosure designed to shield components, cargo, or passengers from external elements such as weather, dust, debris, and theft**.** Canopies are commonly used in utility vehicles, trucks, trailers, and emergency response units to provide protection and security while maintaining accessibility and ventilation.

A trailer-mounted water pump canopy is a mobile system designed to transport and operate a water pump efficiently in various applications such as agriculture, construction, firefighting, and disaster relief. The chassis is a fundamental component of this system, providing structural support, stability, and mobility. It serves as the foundation for mounting the water pump and other essential components while ensuring safe transportation over different terrains.

The design and analysis of the chassis are crucial for ensuring durability, load-bearing capacity, and resistance to mechanical stresses. The chassis must be capable of supporting the weight of the pump, fuel tanks, and canopy while withstanding vibrations, road shocks, and towing forces. Factors such as material selection, weight optimization, structural integrity, and dynamic performance play a significant role in its overall efficiency. Structural steel and aluminium alloys are commonly used due to their high strength-to-weight ratio, corrosion resistance, and ease of fabrication.

To guarantee the unwavering quality and security of the chassis, different building methods, counting computer-aided plan (CAD) displaying and limited component investigation (FEA), are utilized. These strategies offer assistance assess push dissemination, miss happening, and calculate of security beneath diverse stacking conditions. Moreover, contemplations such as suspension plan, pivot situation, ground clearance, and center of gravity are joined to improve maneuverability and solidness

2. LITERATURE REVIEW:

Sen Zheng ‘‘Failure Analysis Of Frame Crack On A Wide-Body Mining Dump Truck’’

The wide- body mining dump truck is a type of heavy-duty, off- trace truck that's substantially used for transporting gemstone and ore in open- hole mines. Because of colorful potholes, obstacles, pitches and angles on the bumpy road, the frame of the truck is impacted by the multiform large loads from ground. After five to six months in service, cracks tend to appear in the frame of the truck, near the hinder seating of the frontal splint springs. To identify the cause of these failures and propose an approach for perfecting the design, a practical system combined with finite element analysis (FEA), as well as static and dynamic testing, was applied. FEA was used to dissect the cause of the cracking, after which the design of the frame was bettered. stationary and dynamic tests were conducted to corroborate the FEA results of the bettered frame. Analysis results indicated that the stresses are concentrated in the frame near the hinder seating of the frontal splint springs, which results in the unseasonable appearance of fatigue cracks. A result for precluding the appearance of these cracks was proposed. The bettered frame has been in service for further than twelve months in the mine and no cracks have appeared to date.

The analysis indicated severe stress concentration in the frame near the rear seating of the front leaf springs (RSFLS) due to unreasonable design and complex interaction loads. Key issues were the interaction between the frame and the RSFLS and the frame's design. Improvements included changing the frame section, modifying openings, and widening the RSFLS, reducing stress from 235 MPa to 43 MPa. The improved frame met strength requirements and showed no cracking after twelve months. Further research on matching coefficients and residual stresses in welds is recommended [1].

Shiva Prasad U, ‘‘Automotive Chassis Design Material Selection For Road And Race Vehicles’

The study analyzes ladder and space frame chassis designs with three materials under un-laden and laden conditions. Stress analysis shows minimal stress in the unladen case and maximum stress in the laden case. These results assist in selecting suitable materials for automotive frames.

Material selection for automotive chassis design balances production and customer needs. Ladder chassis, used for long vehicles, require high stiffness, while space frame chassis, used for high-end vehicles, prioritize weight reduction. Aluminum alloys and composites like fiberglass are used for their specific properties. Material changes affect processing operations, and lightweight designs can maintain robustness and reduce vehicle costs [2].

Mohd Azizi Muhammad Nora, “Stress Analysis of a Low Loader Chassis’’

The paper models and performs stress analysis on a 35-tonne trailer's I-beam structure using Low Alloy Steel A 710 C. Finite element modeling (FEM) and stress analysis in CATIA software showed stress and deflection locations, aligning with theoretical approximations. Safety factors were calculated, and the study aims to improve the chassis design.

The study used finite element method (FEM) to analyze stress and maximum deflection on a low loader chassis structure. Results showed that the locations of maximum stress and deflection matched theoretical predictions. The design safety factor was calculated to be 3.5. Discrepancies between theoretical (2-D) and numerical (3-D FEA) results were found. Further analysis and experimental investigations are planned to improve the model and optimize the number of I-beams for weight and cost reduction [3].

I. D. Paul, “Structural Analysis Of Truck Chassis Using Finite Element Method’’

The paper analyzes the chassis frame for structural strength using finite element method (FEM) to identify high-stress points and bending of frames. The study focuses on a ladder frame under static load conditions and uses Ansys for stress analysis. The chassis, modeled in CATIA and imported into Ansys, includes side members considered as beams for simulating attachments. The results show high stress at weld joints, which can be reduced by redesigning with cross members.

The study used finite element analysis (FEA) to accurately simulate an automotive chassis, verifying stresses with a beam model. It analyzed static loads, mounting locations, and responses. To reduce stress concentration at joints, proper joint design and additional reinforcing plates are recommended. Increasing side members and using connection plates can enhance stiffness and reduce stress, though it may increase chassis weight [4].

Mohammed Tazeem Khan, ‘’ Design & Manufacturing Of Fsae Chassis”

The report outlines the design and development process of a Formula Student racing car's chassis and bodyworks, adhering to the 2020 FORMULA SAE RULEBOOK. A Chromoly AISI-4130 mild steel space-frame chassis was designed based on structural and ergonomic analysis. Torsion analyses ensured a fail-safe design against increased forces. Finite element analysis (FEA) using ANSYS® and SIMSCALE® validated the 1-D and 3-D models, comparing results with theoretical equations. CAD modeling in SIEMENS NX-12® enabled iterations for optimal vehicle mass, component packaging, and weight distribution, prioritizing driver safety. Ergonomic principles ensured the driver's comfort based on 95th percentile male analysis.

The design and development of the FSAE chassis, from initial research and rules constraints to manufacturing, followed best practices, including using T-shaped fixtures for bending resistance and selecting appropriate welding and filler materials. The developed chassis adheres to FSAE guidelines and is ready for national and international competitions [5].

Ranjith Kumar V, ‘’ Design And Analysis Of Truck Chassis’’

The automotive chassis is crucial for supporting the vehicle's body and parts, and must withstand various stresses while providing adequate bending stiffness for better handling. Key design criteria include maximum stress, equivalent stress, and deflection. This report focuses on optimizing the chassis design within these constraints using finite element techniques.

The study compares heavy vehicle chassis materials—St eel, Aluminum, and Epoxy—regarding weight, stiffness, and strength under a 15-ton load. Results show that Stainless Steel offers high strength and is more economical compared to conventional materials, despite similar stress levels and varied strain values among the materials [6].

Rohan Y Garud, ‘’ Structural Analysis Of Automotive Chassis, Design Modification And Optimization’’

The chassis of an automobile supports various components and must withstand shocks, twists, vibrations, and stresses. The paper reviews research on chassis design, focusing on maximum stress, deflection, and critical regions under loading. Simulation techniques were used for design optimization to reduce weight, improve material utilization, and find suitable cross sections. Web height and thickness were adjusted to observe their impact on weight.

From the optimization carried out on the chassis, it can be concluded that 8 mm thick Advanced High Strength Steel chassis shows better result as compared to original 5 mm thick steel chassis. Also from weight reduction point of view, change in geometry topology was carried by changing Box section to T section for cross members [7].

Sangar,‘’R.,Design And Amp; Impact Analysis Of Automobile Chassis/Frame’’

The impact performance of a vehicle chassis is influenced by the materials used, with AISI 4130 and AISI 1018 being the two most common materials. AISI 4130 offers high strength and toughness, while AISI 1018 provides a balance of strength, ductility, and formability. Choosing between the two materials depends on specific application needs [8].

Aguiar, J. B. De, “Truck Chassis Design And Analysis, Científica”

The paper focuses on redesigning medium-sized truck chassis to enhance load capacity, utilizing a ladder-type model. It employs finite element analysis to evaluate static and dynamic loads, ensuring structural integrity through geometric and material considerations under hyperstatic conditions.

The paper highlights the significance of chassis redesign in enhancing load capacity, the application of finite element analysis for structural evaluation, and the identification of critical sections that require attention in the design process. These findings contribute to the ongoing efforts to improve the performance and safety of medium-sized commercial trucks [9].

Sudhakar, K, ‘’ Study Of Dynamic Load Behaviour And Rollover Resistance Of Truck Chassis And Optimization’’

The paper focuses on the design and optimization of truck chassis, emphasizing the importance of bending and torsion stiffness. It employs Finite Element Analysis for various load cases and includes experimental validation to ensure performance while reducing weight through topology optimization.

This paper concludes that adequate bending and torsion stiffness are critical for the design of truck chassis. Insufficient stiffness can lead to various issues, including NVH (Noise, Vibration, and Harshness), compromised ride handling, and reduced safety and reliability. Therefore, ensuring sufficient stiffness is mandatory for optimal chassis performance [10].

Pavankalyan, S, ‘’ Design And Analysis Of Truck Chassis’’

The paper focuses on the design and analysis of truck chassis, specifically the Eicher E2 TATA model, evaluating materials like AISI 4130 Steel and AISI A304 Alloy Stainless Steel using various cross-sections (C, I, Rectangular Hollow) for optimal performance.

The study concludes that the C cross-section is the most effective design for the chassis. This design not only provides economic effectiveness but also supports high payloads while ensuring vehicle safety under extreme loading conditions. The C cross-section is preferred for its balance of weight and strength, which is essential for fuel efficiency and structural integrity [11].

Kumar, V. V, ‘’ Design & Analysis Of Automobile Chassis’’

In this composition, the main ideal of the design is how to develop the prototype of Heavy Duty Lattice with two different types of sections(C&I) of heavy- duty vehicle using CAD tool CREO 2.0

The primary goal of the project is to develop a prototype for a Heavy Duty Chassis. This chassis will be designed using two different types of sections, specifically C and I sections, which are common shapes used in heavy-duty vehicles. The design process utilizes a computer-aided design (CAD) tool called CREO 2.0 [12].

JATIN RAJPAL, ‘’Finite Element Analysis And Optimization Of An Automobile Chassis’’

The paper bargains with the auxiliary investigation of vehicle outline of EICHER E2 11.10 Also and plan alteration of outline cross-section to decrease weight of the chassis. Advance, a consider of rolling over impact, toppling and National Interstate Activity Security Organization (NHTSA) is done and the rolling over list of the car is decreased utilizing the same decreased weight. Auxiliary Investigation of the outline with diminished rolling over record is done to check for disappointment. A chassis component have a place to the category of security components, subsequently it must never fail. The chassis serves as a system for supporting the body and distinctive parts of the vehicle. Moreover, the reality of the rolling over of a car is to be taken into thought. In this manner, chassis ought to be unbending sufficient to withstand the stun, bend, vibration and other stresses. Along with quality, an critical thought in chassis plan is to have satisfactory twisting firmness for way better dealing with characteristics. So, most extreme stretch, most extreme equilateral stretch and diversion are imperative criteria for the plan of the chassis 13].

A.Hari Kumar, ‘’ Design & Analysis Of Automobile Chassis’’

The objective of paper is to discover out best fabric and most reasonable cross-section for an Eicher E2 TATA Truck step chassis with the limitations of greatest shear stretch, comparable stretch and diversion of the chassis beneath most extreme stack condition. In display the Step chassis which are employments for making buses and trucks are C and I cross segment sort, which are made of Steel combination (Austenitic). In India number of travelers travel in the transport is not uniform, abundance travelers are voyaging in the buses every day due to which there are continuously conceivable outcomes of being failure/fracture in the chassis/frame. Subsequently Chassis with tall quality cross area is required to minimize the disappointments counting figure of security in plan. In the display work, we have taken higher quality as the primary issue, so the measurements of an existing vehicle chassis of a TATA Eicher E2 (Show no.11.10) Truck is taken for investigation with materials to be specific ASTM A710 Steel, ASTM A302 Amalgam Steel and Aluminum Combination 6063-T6 subjected to the same stack. The diverse vehicle chassis have been modeled by considering three distinctive cross-sections specifically C, I and Rectangular Box (Empty) sort cross areas. The issue to be managed for this thesis work is to Plan and Analyze utilizing reasonable CAE computer program for stepping stool chassis. The report is the work performed towards the optimization of the vehicle chassis with imperatives of firmness and quality. The modeling is done utilizing Catia, and examination is done utilizing Ansys. The overhangs of the chassis are calculated for the stresses and avoidances logically are compared with the comes about gotten with the investigation software.

In the display work, step sort chassis outline for TATA Turbo Truck was analyzed utilizing ANSYS 14.5 program. From the comes about, it is watched that the Rectangular Box area is having more quality than C and I Cross-section sort of Step Chassis. The Rectangular Box Cross-section Stepping stool Chassis is having slightest diversion i.e., 2.96 mm and slightest Von Mises push and Most extreme Shear push i.e., 54.31MPa & 5.98MPa separately for Aluminum Amalgam 6063-T6 in all the three sorts of chassis of distinctive cross area. Limited component examination is viably utilized for tending to the conceptualization and

definition for the plan stages. Based on the investigation comes about of the show work, the taking after conclusions can be drawn [14].

D.Srinivasa Rao, ‘’ Design And Analysis Of A Truck Chassis Frame Using Catia And Ansys’’

The grid plan, in common, is a complex strategy and to arrive at a result which yields a great execution is a repetitive assignment. Since the cross section has a complex figure and filling designs, there's no well characterized coherent method to dismember the cross section. So the numerical framework of examination is embraced, in which ‘Limited Component fashion' is the most broadly habituated framework [15].

M D Vijayakumar, ‘’ Finite Element Analysis Of Automotive Truck Chassis’’

The transportation diligence at present world play a principal part in field of current marketable frugality and developed countries. The operation of exchanges is intensively adding to carry the loads and accoutrements. To enterprise a truck lattice numerous features to be considered including material selection, packaging, strength- to- weight rate, stiffness. This paper substantially reviews on utmost exploration workshop and focuses on stress study of the truck lattice using four Finite Element Analysis (FEA) videlicet ANSYS. The result of this exploration paper gives the experimenter immediate result on ultramodern and present developments in truck lattice field using FEA.

Model enquiry and stationary mechanical study were carried out on the truck's Tata 407 staircase. From the below results for sword and carbon fiber the maximum shear stress, maximum equal stress and relegation is equal to that of sword. The weight of the product in the machine assiduity is a major factor for design and the stress values of carbon fiber are within respectable limits. Carbon fiber is thus suitable as a lattice material for vehicles due to its high strength and light weight. For the same cargo-carrying capacity, carbon filaments are better than sword for erecting graduation frames, as this reduces the lattice frame by 80 and increases the severity of the lattice frame. To conclude, by fabulous FEM software we can optimize the frame weight and conclude that it's suitable for lattice construction [16].

Harshal V, ‘’ Design Improvement In Heavy Vehicle Truck Chassis’’

The chassis of a vehicle is its main structure, supporting various components and the payload. It needs to be strong and stiff to withstand shocks, twists, vibrations, and stresses from activities like braking and uneven road conditions. The research suggests there is potential to improve the chassis design by altering factors like stress, deformation, and weight through varying cross-sections and materials.The study conducts structural analysis of a heavy vehicle chassis under maximum load and dynamic analysis of a modified chassis to check for failure due to resonance. It uses dimensions of the TATA 2518TC truck chassis and considers two main cross-sections: "C" section with Structural Steel ST37 and "I" section with AISI-4130 material.

The existing “C” section chassis is replaced with an “I” section chassis, and modifications are made by decreasing the height, thickness, and cross-section of the chassis, resulting in a potential weight reduction of 10%.A comparison between the “C” and “I” section chassis shows that the “I” section chassis, made from AISI-4130 material, exhibits greater strength and less deformation (3.6800 mm) and stress than the existing “C” section chassis. Therefore,

the “I” section is deemed suitable for heavy trucks. The dynamic analysis of the “I” section chassis reveals that its natural frequencies do not match the truck's operating frequency of 60Hz. This means there is no risk of resonance and failure for the “I” section chassis [17].

1a. Satyanand, ‘’ Design And Optimization Of Truck Chassis Frame’’

The chassis of an automobile includes the engine, frame, tires, suspension, and driveline. The frame provides necessary support to vehicle parts and must be strong enough to resist impact loads, twists, vibrations, and bending stresses. In designing a chassis frame, both bending and torsional stiffnesses are crucial factors. Research indicates that while the “C” section chassis offers good bending stiffness, it lacks in torsional stiffness. The aim of the present research is to enhance the stiffness of a truck chassis frame by combining different cross-sections to make it more resistant to bending and torsional stresses while maintaining mass constraints. for modeling, the Eicher PRO 6025 truck with a “C” sectioned frame is considered. Commonly proposed cross-sections for frames include C, I, BOX, and TUBULAR. Most torsional loads from road irregularities act on cross members, so it is assumed that modifying the cross sections of transverse members with the proposed sections will optimize the chassis frame, improving both bending and torsional stiffnesses. The chassis frame of the Eicher PRO 6025 is modeled using Pro-E software and analyzed with Ansys 15.0, applying a load of 306,562 N. Stress and deformations are calculated using both analytical and simulation methods. Linear static analysis is used to determine the stress distribution and deformation pattern under two loading conditions: truck components loading and asymmetrical loading. The maximum stress occurs at the chassis and suspension joints, while the maximum translation occurs at the rear end of the frame. The current "C"-sectioned frame experiences a bending stress of 143.78 MPa and a total deformation of 2.20 mm, with a mass of 825.82 kg. The optimized "C-TUBE" section frame shows improved results, with a bending stress of 113.79 MPa, total deformation of 1.795 mm, and a reduced mass of 757.41 kg. Simulation results indicate that optimizing the chassis weight and combining different cross-sections significantly impact strength, ride comfort, handling, stability, and preventing vehicle rollover during quick maneuvers. The bending stiffness and torsional stiffness for the current "C"-sectioned frame are 139.34 MN/m and 8.24 KNm/deg, respectively. In contrast, the optimized "C-TUBE" section frame has improved bending stiffness of 170.78 MN/m and torsional stiffness of 14.56 KNm/deg. Thus, the "C-TUBE" section provides better results, with additional stiffness, load-bearing capacity, improved handling characteristics, and overall vehicle performance [18].

Monika S.Agrawal, ‘’ Finite Element Analysis Of Truck Chassis Frame’’

Chassis is one of the critical portion that utilized in car industry. it is a unbending structure that shapes a skeleton to hold all the major parts together. Chassis outlines are made of “steel section” so that they are solid sufficient to withstand the stack and stun. Chassis must be light in weight to diminish dead weight on the vehicles. Major challenge in today’s vehicle vehicle industry is to overcome the expanding requests for higher execution, lower weight in arrange to fulfill fuel economy necessities, and longer life of components, all this at a sensible fetched and in a brief period of time. The consider is to create comes about to correct issues related with structures of a commercial vehicle such as quality, firmness and weakness properties along with push, twisting minute and vibrations. This can be accomplished by inactive and energetic examination, combining existing hypothetical information and progressed expository strategies. Plan of a Chassis is carried by utilizing CATIA .And limited component examination will be carried out by utilizing ANSYS This ponder effectively accomplished its essential objectives. Key Points: 1. Static Analysis: o Identified exceedingly focused regions of the truck chassis due to connected load. o Analytical shear stretch was found to be 13.33% less than FEA values. 2. Modal Analysis: o Determined add up to misshapening of the truck chassis outline at distinctive recurrence ranges. o Frequency extend for Modular Examination (Free-Free Condition): 16.89 Hz to 46.316 Hz. o Frequency extend for Modular Examination (with connected stack): 13.886 Hz to 43.828 Hz. o Both recurrence ranges drop inside 10 to 50 Hz, guaranteeing the plan dodges reverberation amid working conditions. 3. Design Improvements: o Reducing the tallness of the cross-member by 8.6% driven to an 8.72% lessening in chassis weight. In substance, this think about gives significant bits of knowledge into optimizing truck chassis plan for security and efficiency [19].

3. CONCLUSIONS

During literature review it is found that very few literatures are available on chassis of trailer mounted water pump canopy and material selection of chassis. No one had done any work related to design and analysis and material selection of chassis of trailer mounted water pump canopy. In this research work same is done. This will going to help for designing the chassis of chassis of trailer mounted water pump canopy.

4. REFERENCES

[1] Sen Zhenga, Kai Chenga, Jixin Wanga,⇑, Qingde Liaob, Xiaoguang Liuc, Weiwei. Liua Failure analysis of frame crack on a wide-body mining dump truck. www.elsevier.com/locate/engfailanal

[2] Shiva Prasad U, Athota Rathan Babu, Bandu Sairaju, Saikrishna Amirishetty, Deepak D. Automotive Chassis Design Material Selection for Road and Race Vehicles. Journal of Mechanical Engineering Research and Developments ISSN: 1024-1752 CODEN: JERDFO Vol. 43, No. 3, pp. 274-282 Published Year 2020.

[3] Mohd Azizi Muhammad Nora,b*, Helmi Rashida, Wan Mohd Faizul Wan Mahyuddinb, Mohd Azuan Mohd Azlanc, Jamaluddin Mahmuda. Stress Analysis of a Low Loader Chassis. International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012)

[4] I. D. PAUL, S. M. SARANGE, G. P. BHOLE AND J. R. CHAUDHARI. STRUCTURAL ANALYSIS OF TRUCK CHASSIS USING FINITE ELEMENT METHOD. International J.of Multidispl.Research & Advcs. in Engg.(IJMRAE), ISSN 0975-7074, Vol. 4, No. I (January 2012), pp. 85-98

[5] Mohammed Tazeem Khan. DESIGN & MANUFACTURING OF FSAE CHASSIS. International Research Journal of Modernization in Engineering Technology and Science. Volume:03/Issue:02/February - 2021 Impact Factor- 5.354 www.irjmets.com

[6] Ranjith Kumar V ,Dharani Dharan R ,Pradeep Kannan S S ,Balaji N DESIGN AND ANALYSIS OF TRUCK CHASSIS. International Journal of Research and Analytical Reviews (IJRAR) www.ijrar.org © 2019 IJRAR May 2019, Volume 6, Issue 2

[7] Rohan Y Garud, Shahid C Tamboli, Dr. Anand Pandey.Structural Analysis of Automotive Chassis,

Design Modification and Optimization. International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 11 (2018) pp. 9887-9892 © Research India Publications. http://www.ripublication.com

[8] Sangar, R., Design & Impact Analysis of Automobile Chassis/Frame, Indian Scientific Journal Of Research In Engineering And Management, vol. 08, no. 05, pp. 1–5, May 29, 2024. DOI: 10.55041/ijsrem35003

[9] Aguiar, J. B. de and Aguiar, J. M. D., Truck Chassis Design and Analysis, Científica, June 1, 2022. DOI: 10.46842/ipn.cien.v26n1a07.

[10] Sudhakar, K., Jagtap, K. R., & Korade, D. N. (2021). Study of dynamic load behaviour and rollover resistance of truck chassis and optimization. Journal of Emerging Technologies and Innovative Research, 8(8). https://www.jetir.org/view?paper=JETIR2108495.

[11] Dabair, M., & Pavankalyan, S. (2020). Design and analysis of truck chassis.04(12),550–553. https://doi.org/10.33564/IJEAST.2020.V04I12.099.

[12] Kumar, V. V., & Rao, K. S. (2016). Design & Analysis of Automobile Chassis. International Journal of Research, 3(14), 4339–4346. https://journals.pen2print.org/index.php/ijr/article/download/5831/5650

[13] JATIN RAJPAL, RUCHA S. BHIRUD, ANCHAL K. SINGH, AJAY V. HOTKAR, Finite Element Analysis and Optimization of an Automobile Chassis. Jatin Rajpal* et al. (IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH Volume No.3, Issue No.3, April - May 2015, 2075 – 2082.

[14] A.HARI KUMAR, V.DEEPANJALI DESIGN & ANALYSIS OF AUTOMOBILE CHASSIS. International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 5, Issue 1, January 2016

[15] D.Srinivasa Rao, V.V.Narayana Reddy, M.Rama Krishna,V.Sarath Chandra Varma. DESIGN AND ANALYSIS OF A TRUCK CHASSIS FRAME USING CATIA AND ANSYS. International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-3, Issue-8, August 2017 ISSN: 2395-3470 www.ijseas.com

[16M D Vijayakumar , C Ramesh Kannan , S Manivannan, J Vairamuthu, Samuel Tilahun and P M Bupathi Ram. Finite Element Analysis of Automotive Truck Chassis. IOP Conf. Series: Materials Science and Engineering 988 (2020) 012114 IOP Publishing doi:10.1088/1757-899X/988/1/012114

[17] Harshal V. Pachgade1, Dr. Dinesh N. Kamble, Amol Birajdar. Design Improvement In Heavy Vehicle Truck Chassis. Journal of Advanced Engineering Research ISSN: 2393-8447 Volume 8, Issue 1, 2021, pp.63-70

[18] A. Satyanand, Dr. K. Hemachandra Reddy. Design And Optimization Of Truck Chassis Frame. International Journal for Research in Engineering Application & Management (IJREAM) ISSN : 2454-9150 Vol-04, Issue-05, Aug 2018.

[19] Monika S.Agrawal. Finite Element Analysis of Truck Chassis Frame. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 02 Issue: 03 | June-2015 www.irjet.net p-ISSN: 2395-0072