



Review Paper on Fabrication of Chassis for Electric Utility Vehicle

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Abstract

This project is focused on the fabrication of a lightweight and robust chassis for an electric utility vehicle (EUV) to support sustainable transportation solutions. The chassis is the structural core of the vehicle, intended to house electric powertrain components, batteries, and other subsystems with safety, stability, and performance in mind. Material choice, structural analysis, and fabrication methods were carefully weighed to obtain an optimal balance between weight and strength. Computer-aided design (CAD) and Fusion 360 tools were used for modeling, followed by fabrication using mild steel due to its favorable mechanical properties and cost-effectiveness. The resulting chassis design appropriately satisfies the functional and structural needs for an EUV and provides a basis for vehicle and further integration development. The research enhances the expanding landscape of electric mobility by advancing a cost-effective and dependable platform for utility electric vehicles.

Key Words: Electric Utility vehicle, Chassis Design, Performance, Material Selection, Light Weight, Performance, computer aided design, fusion 360, Electric power train, Battery integration, Safety, Fabrication technique.

1. INTRODUCTION

The chassis is the fundamental structural framework of any vehicle, being the one on which all other assemblies are supported. It provides the necessary strength, stiffness, and support to resist the weight of the vehicle body, passengers, and mechanical components and to accommodate any dynamic loads imparted during operation. In motor vehicle engineering, the chassis is a critical assembly in ensuring stability, handling, and general safety. For electric vehicles, the chassis design is even more critical due to the unique location of components such as battery packs, electric motors, and power electronics. Unlike conventional internal combustion

vehicles, EV chassis must carry heavy battery systems without sacrificing structural integrity and minimizing

weight to enhance efficiency and range. A well-designed chassis not only responds to the functional requirements of the vehicle but also goes a long way in framing the performance, longevity, and efficiency of the vehicle. As such, the production of a suitable chassis is a key step in the development of an electric utility vehicle, balancing the principles of mechanical engineering with today's sustainability goals

2. LITERATURE REVIEW

[1] Narayanan (2022): focused on the design optimization of an electric vehicle (EV) chassis using Finite Element Method (FEM). The project involved creating a CAD model of the chassis and analyzing it under various load conditions. FEM was used to identify stress points and areas for structural improvement. The goal was to reduce weight while maintaining strength and safety. The study supports efficient and reliable EV chassis design through simulation-driven development.

[2] Kumar and Dhingra (2015): worked on the design and fabrication of a go-kart chassis using Finite Element Analysis (FEA). The chassis was modeled using CAD software and tested under simulated load conditions. FEA helped identify stress distribution and deformation zones. The project aimed to optimize strength while minimizing material usage. The study demonstrates how simulation enhances design efficiency before actual fabrication.

[3] Kumar and Mishra (2017): This focused on designing a vehicle chassis and analyzing its crashworthiness using computer-aided engineering tools. The chassis model was created using CAD and tested through Finite Element Analysis (FEA). The study evaluated the structure's ability to absorb impact



energy during collisions. Results helped identify weak zones and improve safety features. The project supports safer and more durable chassis design in modern vehicles.

[4] Chau and Wong (2002): This studied power management strategies in hybrid electric vehicles (HEVs). The project focused on optimizing energy flow between the internal combustion engine, electric motor, and battery system. Various control strategies were analyzed to improve fuel efficiency and reduce emissions. Simulation models were used to evaluate performance under different driving conditions. The study provides insights applicable to electric vehicle power systems and chassis integration.

[5] Yadav (2014): He explores the fundamentals of vehicle dynamics and control in automotive systems. The study covers key areas such as suspension design, steering geometry, braking, and stability. It emphasizes how these factors influence handling, comfort, and safety. The work also discusses control systems that enhance vehicle performance during different driving conditions. These concepts are crucial for designing stable and responsive electric vehicle chassis systems.

[6] Tarun & Raju (2018): This study focuses on selecting suitable lightweight materials and fabrication techniques for electric vehicle (EV) chassis frames. The authors compare materials like aluminium alloys, carbon Fiber, and high-strength steel based on strength-to-weight ratio, cost, and manufacturability. The project aims to reduce overall vehicle weight without compromising structural integrity. Emphasis is placed on welding and joining methods suitable for EV applications. The study supports efficient chassis design for enhanced EV performance and range.

[7] Anitha & Senthilkumar (2019): This project involves designing an electric car chassis frame and evaluating its performance using Finite Element Analysis (FEA). The study assesses stress distribution, deformation, and safety factors under various loading conditions. CAD modeling and simulation tools were used to optimize the frame design. Results help identify weak points and guide structural improvements. The work supports safer, more efficient EV chassis development.

[8] Goel and Kaushik (2021): This focused on developing a chassis specifically for compact urban electric vehicles (EVs). The study emphasized lightweight design, space optimization, and structural

integrity suitable for city driving conditions. CAD modeling and simulation tools were used to validate the chassis under urban load scenarios. The chassis was designed to support battery placement and enhance maneuverability. This project highlights the importance of compact, efficient design for urban EV applications.

[9] Mohan and Kuttappan (2020): This explored various welding techniques used in aluminium chassis fabrication for electric vehicles (EVs). The study compared methods like TIG welding, MIG welding, and friction stir welding in terms of strength, heat input, and joint quality. Aluminium lightweight properties were emphasized alongside the challenges it poses during welding. The goal was to identify the most effective technique for durable and efficient chassis construction. This work aids in improving the reliability and manufacturability of EV chassis systems.

[10] Reif and Dietsche (2014): This provides an in-depth overview of chassis design, covering fundamentals, driving dynamics, components, and mechatronics. The study delves into the integration of mechanical and electronic systems, highlighting how they impact vehicle stability and performance. The authors also address the evolution of chassis design, incorporating advanced materials and technologies. This work serves as a comprehensive guide to understanding the complex interactions within modern vehicle chassis. It is highly relevant to the development of efficient and dynamic chassis for electric vehicles (EVs).

[11] Sharma and Patel (2018): This conducted a comparative analysis of mild steel and aluminium alloy for chassis fabrication. The study evaluated the two materials based on properties such as strength, weight, cost, and ease of manufacturing. Mild steel was found to offer greater strength but at the cost of increased weight, while aluminium alloys provided lighter



chassis structures with adequate strength. The authors also discussed the impact of material choice on vehicle performance, especially in terms of fuel efficiency and handling. This research is valuable for optimizing material selection in the design of electric vehicle chassis.

[12] Lienkamp (2012): This explored innovative chassis concepts for electric cars, focusing on lightweight structures, modular designs, and energy-efficient solutions. The study examined how the unique requirements of electric vehicles (EVs), such as battery integration and powertrain efficiency, influence chassis design. New concepts like the integration of electric motors within the wheels and optimized frame geometries were discussed. The research aimed to improve the overall performance, safety, and cost-effectiveness of EVs through innovative chassis technologies. This work provides insights into advanced chassis solutions specifically tailored for the evolving electric vehicle market.

[13] Hu, Li, and Peng (2012): This conducted a comparative study on equivalent circuit models for lithium-ion (Li-ion) batteries, focusing on how these models can accurately represent battery behaviour under various operating conditions. The study analysed different models based on parameters like battery voltage, capacity, and efficiency. The authors evaluated the trade-offs between model complexity and accuracy in predicting battery performance. This research is crucial for optimizing battery management systems in electric vehicles (EVs) by improving the accuracy of battery state predictions. Their findings are applicable to the development of more efficient power management systems for EV chassis designs.

3. CONCLUSIONS

The Chassis Fabrication of the electric utility vehicle chassis is a crucial step in producing a stable and efficient EV platform. Through the selective choice in material selection, accurate engineering design, and high standards of fabrication processes, the chassis meets the required standards in strength, durability, and weight optimization. It provides a robust structural

foundation that can support the electric drivetrain, battery pack, and other critical components with safety and stability. The structure of this chassis not only leads to improved vehicle performance but also meets sustainability goals by enabling a cleaner mode of transportation. The achievement of this phase paves the way for electrical and mechanical system integration, bringing the project nearer to full vehicle assembly and testing.

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