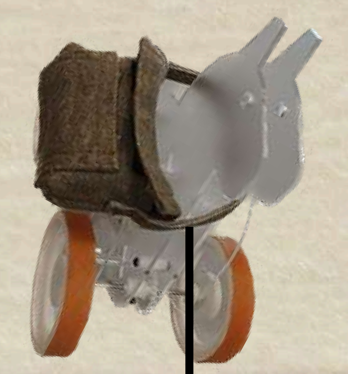
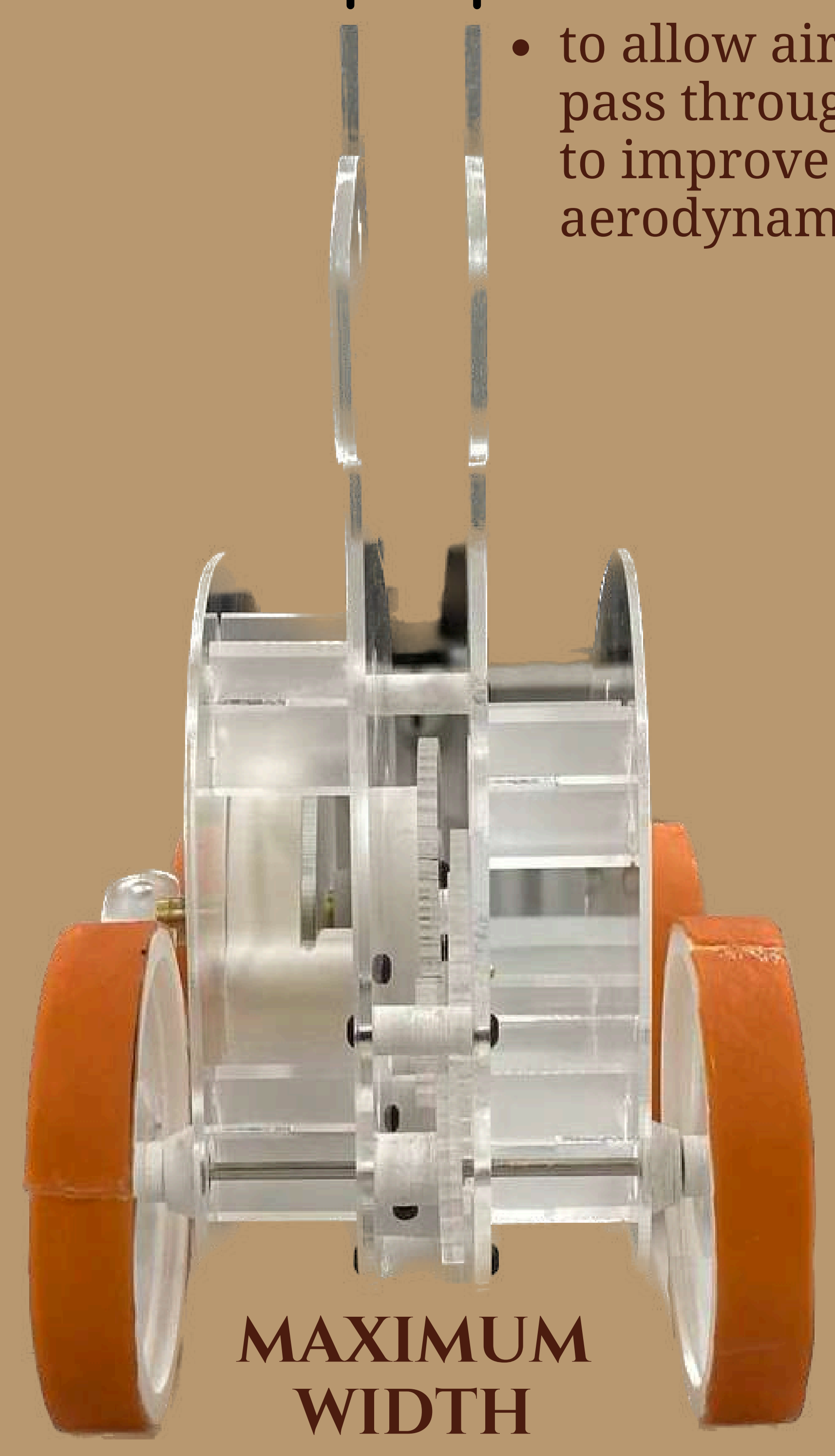
ID PHYSICS PROJECT

THE MECHANICAL HORSE

HTTPS://YOUTU.BE/BK9YAIZLVI4

BY GROUP 8

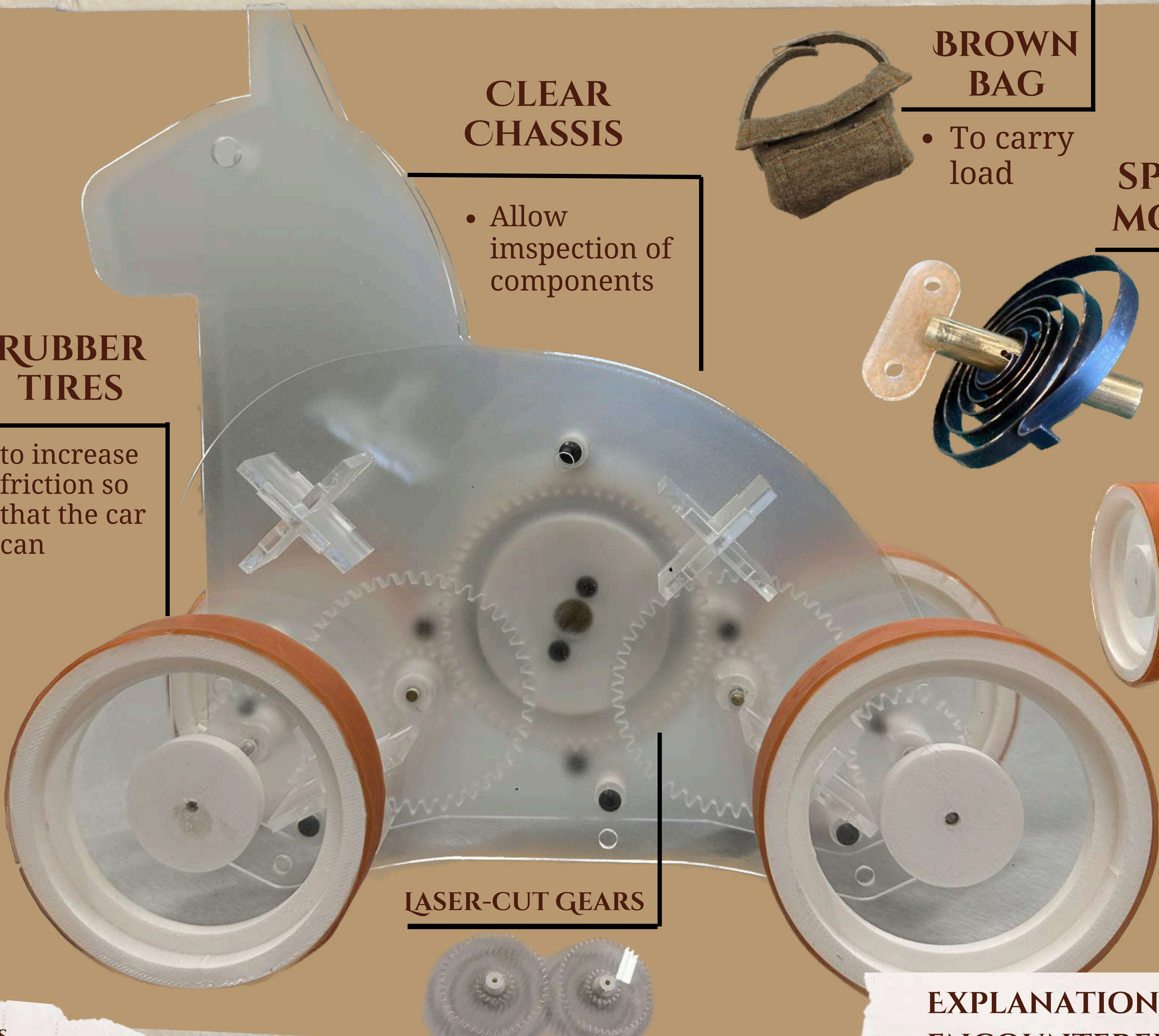




LAYERED CONSTRUCTION

- to allow air to pass through to improve aerodynamics

MAXIMUM WIDTH



CLEAR CHASSIS

- Allow imspection of components

RUBBER TIRES

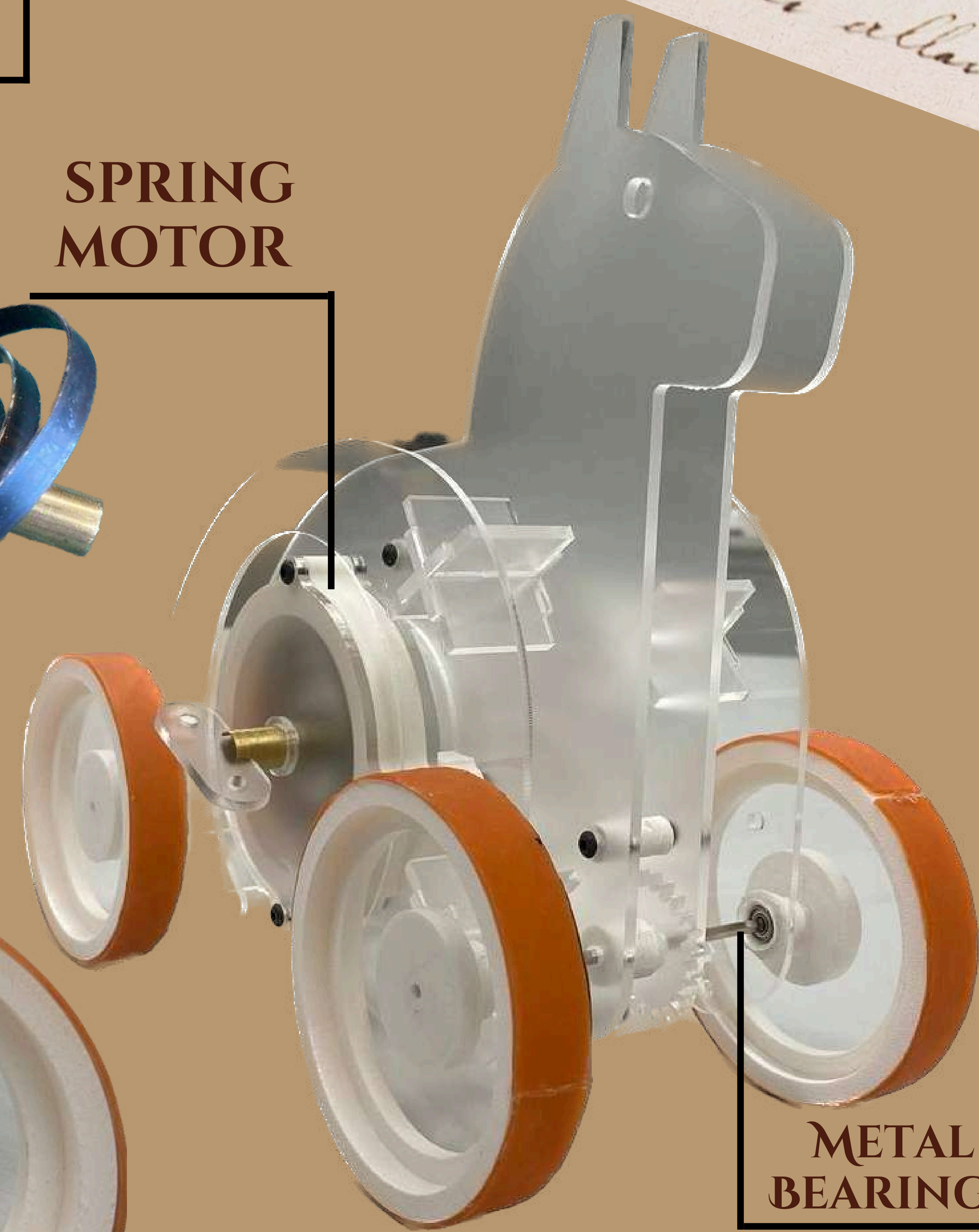
- to increase friction so that the car can

LASER-CUT GEARS

BROWN BAG

- To carry load

SPRING MOTOR



METAL BEARINGS

- to reduce friction

DESIGN FEATURES AND ENGINEERING CONSIDERATIONS OF THE PROTOTYPE, EXISTING ISSUES AND PROPOSALS FOR IMPROVEMENTS.

Design features + engineering considerations:

1. The vehicle was meticulously engineered with a strong emphasis on dimensional accuracy to guarantee a consistent and unwavering trajectory during its operation.
2. A deliberate focus was placed on the ease of disassembly, ensuring rapid and efficient modifications, particularly concerning the intricate gear system
3. The car's clear design allows for easy component visibility, aiding in fault detection and troubleshooting.
4. The hollow design reduces weight and drag by enabling smoother airflow through the car. This aerodynamically streamlined design fosters smoother airflow through the vehicle, thereby optimizing speed and operational efficiency.

Existing issues :

- Acrylic is brittle causing some parts to crack

Solution:

- Use less brittle materials like ply wood

EXPLANATION OF KEY PHYSICS CONCEPTS FOR THE DESIGN OF THE TOY CAR TO MEET THE CHALLENGES.

1. The car's design prioritized a lower center of mass (COM) to enhance stability and handling.
2. To optimize the car's traction, extensive material comparisons were conducted to identify those with superior friction coefficients, ensuring optimal traction across diverse surfaces.
3. Additionally, in ensuring the efficient transfer of energy from the motor to the wheels, a meticulous gear design was employed. This design aimed to maximize the effective transmission of torque to the gears, leveraging on acrylic's non-compressible nature. By minimizing energy loss attributable solely to friction (which manifests as heat and sound) through cutting the gears precisely, it optimizes the car's overall energy utilization and performance efficiency.

EXPLANATION OF MAJOR ENGINEERING PROBLEMS ENCOUNTERED IN EARLIER DESIGN

Problems faced:

1. *Designing the car to have enough torque*
2. *Designing the car to be stable*

Overcoming the challenges:

- *For torque*

Our group effectively utilized a spring of an initially unknown spring constant and an arbitrary gear ratio of 1:6 to create the car.
To measure the torque generated by the spring motor, we ingeniously employed a weighing scale to gauge the moments produced.
This enabled us to calculate the torque, allowing for a precise comparison against the necessary torque requirements and make adjustments to the gear ratio if necessary.

- *Enhancing stability*

Our group decided on placing the vital and weighty components, such as motors and gears, closer to the car's bottom to ensure that the car have a lower center of mass.
This intentional positioning is especially effective even if the car appears visually tall.
Despite its height, the components contributing to this verticality are lightweight, exerting minimal influence on the car's center of mass.
Moreover, maximizing the width within the specified requirements further contributes to stability.
A wider base inherently augments stability by offering a broader foundation, reducing the likelihood of tipping or swaying during operation.
By optimizing both the vertical distribution of weight and the horizontal width, our approach prioritizes stability without compromising the car's visual design, demonstrating a thoughtful balance between functionality and aesthetics.