Abstract

Rover is a vehicle for exploring the surface of a planet or moon. For, this competition, it is supposed to be designed to four non-pneumatic tires and be capable of traversing on the land of other planets.

The chassis of a rover is a skeleton structure that supports systems such as suspension, steering, and the powertrain. For this reason, the chassis of an all-terrain is designed by considering factors such as the safety of the driver, ease of manufacturing, sustainability, compactness, lightweight and ergonomics design.

The special requirements of a rover, like the need of better stability and safety is done by providing a stable chassis structure, which is the basic load bearing framework of the rover.

Some factors which must be kept in mind while designing the chassis is -

* Human ergonomics
* Manufacturing
* Strength of materials
* Factor of safety

The design and establishment process of the chassis involves various considerations, namely material selection, cross section determination, chassis design, and finite element analysis. One of the critical design decisions that enhance the reliability, safety, and performance of any vehicle structure is the material choosing.

The material selection for the chassis is **Grade 2024-T3** is the most common high-strength aluminium alloy. It is often considered aircraft quality. It has excellent fatigue resistance even though its corrosion resistance is lower than that of 6061.

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| --- | --- | --- | --- | --- | --- |
| Material Grade | Aluminium Alloy Grade 2024-T3 | Stainless Steel Grade 304 | Magnesium AZ91D-F | Aluminium 7075-O | Titanium Ti-6Al-4V(grade 5) |
| Density | 2.78g/cc | [8.00](https://www.matweb.com/tools/unitconverter.aspx?fromID=43&fromValue=8.00) g/cc | [1.81](https://www.matweb.com/tools/unitconverter.aspx?fromID=43&fromValue=1.81) g/cc | [2.81](https://www.matweb.com/tools/unitconverter.aspx?fromID=43&fromValue=2.81) g/cc | [4.43](https://www.matweb.com/tools/unitconverter.aspx?fromID=43&fromValue=4.43) g/cc |
| Poisson ratio | 0.33 | 0.29 | 0.35 | 0.33 | 0.342 |
| Elongation | 20% | 70 % | 3.0% | 17 % | 14 % |
| Shear Modulus | 4060 ksi | [11200](https://www.matweb.com/tools/unitconverter.aspx?fromID=78&fromValue=11200) ksi | [2470](https://www.matweb.com/tools/unitconverter.aspx?fromID=78&fromValue=2470) ksi | [3900](https://www.matweb.com/tools/unitconverter.aspx?fromID=78&fromValue=3900) ksi | [6380](https://www.matweb.com/tools/unitconverter.aspx?fromID=78&fromValue=6380) ksi |
| Tensile Strength | 41000 psi | [73200](https://www.matweb.com/tools/unitconverter.aspx?fromID=123&fromValue=73200) psi | [33400](https://www.matweb.com/tools/unitconverter.aspx?fromID=123&fromValue=33400) psi | [33000](https://www.matweb.com/tools/unitconverter.aspx?fromID=123&fromValue=33000) psi | [138000](https://www.matweb.com/tools/unitconverter.aspx?fromID=123&fromValue=138000) psi |

The legs of the rover, which will have the maximum load will be constructed with stainless steel AISI 4130 as it has the most tensile strength and a density of 7.85 g/cm3 which will help us in keeping the rover strong and durable to bear the weight.

Approximate weight of legs = 3.993 kg

, if the size of each leg is 50 cm and provided, we are using pipes of outer diameter 3 cm and internal diameter 2.4cm

The body of the rover will be made of Aluminium Alloy Grade 2024-T3 because it has a density of 2.78 g/cc and will consist of about 70% of the rover, helping us in making it lightweight and durable for use. 41000 psi is just enough for the body to handle the weight of the drivers and any obstacle we will face.

Approximate weight of chassis=12.8 kg

provided we are using pipes of outer diameter 3 cm and internal diameter 2.8cm.

The gearbox and mechanisms will be made of Stainless-Steel Grade 304 as it is an economically feasible option. Furthermore, it has one of the highest tensile strengths, which we require as we cannot afford for such an essential component of the rover to fail.

Approximate weight of the drivetrain = 10 kg

DESIGN-