

Q3- Wishbone Design for IGVC 2026

Ig Fishbone is Stronger

Part A: Material Selection for Wishbone Design

Required Material Properties

Before selecting a metal for the wishbone, the following properties must be evaluated:

- **Strength:** Ability to withstand static and dynamic loads without failure.
- **Stiffness (Young's Modulus):** Ensures minimal deformation under load to maintain suspension geometry.
- **Density:** Lower density reduces unsprung mass and improves vehicle dynamics.
- **Corrosion Resistance:** Protects against environmental damage in outdoor conditions.
- **Manufacturability:** Ease of machining, welding, and forming.
- **Cost and Availability:** Material should be affordable and easily sourced.
- **Impact Toughness:** Ability to absorb shocks without brittle failure.

Commonly Available Metals for Robotics Applications

Based on availability and performance requirements, the following metals are considered suitable for the wishbone design:

- Aluminium 6061-T6
- Aluminium 7075-T6
- Aluminium 2024-T3
- Titanium Alloy (Ti-6Al-4V)
- Chromoly Steel (AISI 4130)
- Magnesium Alloy (AZ31)

Advantages and Disadvantages of Candidate Materials

Aluminium 6061-T6

Advantages:

- Good strength-to-weight ratio.
- Excellent corrosion resistance.
- Easy to machine and weld.
- Low cost and widely available.

Disadvantages:

- Lower strength compared to high-grade aluminum and titanium.
- Moderate fatigue performance.

Aluminium 7075-T6

Advantages:

- Very high strength comparable to steel.
- Lightweight.
- Excellent stiffness.

Disadvantages:

- Poor weldability.
- More expensive than 6061.
- Slightly lower corrosion resistance.

Material Comparison Table

Material	Density (kg/m ³)	Yield Strength (MPa)	Corrosion Resistance	Cost
Al 6061-T6	2700	275	High	Low
Al 7075-T6	2810	503	Medium	Medium
Al 2024-T3	2780	324	Low	Medium
Ti-6Al-4V	4430	880	Very High	Very High
AISI 4130	7850	435	Low	Low
Mg AZ31	1770	200	Low	Medium

Table 1: Comparison of candidate materials for wishbone design

Conclusion

For the IGVC 2026 robot wishbone, Aluminium 7075-T6 emerges as a strong candidate due to its high strength-to-weight ratio, making it suitable for handling BLDC motor-induced loads while minimizing unsprung mass. Titanium provides superior performance but is not cost-effective for student competitions. Aluminium 6061 remains a reliable backup option due to its excellent manufacturability and low cost.

Thus, the material selection process balances strength, weight, durability, cost, and manufacturability to ensure optimal performance of the suspension system.