



**Composite driveshafts can
increase torque and can help
prevent injuries**

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- Traditionally made of steel, a driveshaft transfers power from the transmission to the rear axle of the vehicle. If a steel driveshaft fails, however, it can project shrapnel in all directions and even dig into the ground, catapulting the vehicle into the air.¹
- According to a commercial manufacturer of composite auto parts, drive shafts in race cars can pose serious threat of injury and even death to the driver inside, as shrapnel can penetrate the car and rollover can increase the chance of severe injury.²
- Composite driveshafts are made of carbon and polymer fiber that is designed to break into small fiber fragments or “broom” upon failure, posing little danger.³
- Composite driveshafts are also lightweight, requiring less energy to spin, effectively increasing the amount of power that the engine can transmit to the wheels.¹
- For a typical IHRA Pro-Modified Drag Car with a driveshaft length of 36 3/8”, one composite driveshaft removed 6.6 lbs. of rotating weight over a standard 3.0” OD chrome-moly shaft without sacrificing necessary performance strength. When tested, the 53% lighter carbon fiber shaft failed at 5,417 lb.-ft. of torque—almost 20 times the normal operating torque for a production vehicle.^{4,5}



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Example of a composite driveshaft.



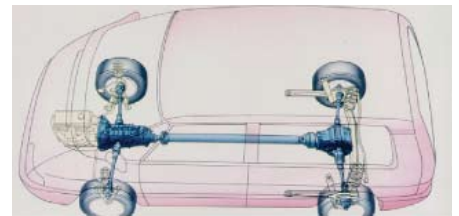
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Composite driveshafts “broom” rather than produce shrapnel, protecting drivers from injury.



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The Nissan 350Z uses a composite driveshaft for added power.



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A composite driveshaft can increase the power delivered to the wheels from the engine.

Additional Information

- According to Texas A&M University, the rule of thumb is: 17%–22% of the power generated by the engine is lost to rotating the mass of the drive train, which can be reduced by decreasing the amount of rotating mass.¹
- According to an Advanced Composites Products and Technology Inc. test, a composite driveshaft in a supercharged LT1 Camaro on a DynoJet chassis dynamometer showed a power gain at the wheels that increased as the engine made more power. At 3000 rpm, the shaft put nine additional horsepower to the ground, and at 5000 rpm when the engine was making almost twice the power, this number nearly doubled.⁶
- “I have two talented, young drivers to protect,” said Dick Anderson of Dick Anderson Racing. “Both have narrowly escaped serious injury when metal shafts broke and penetrated their cars. Last season, a bracket came loose, destroyed the torque arm and broke the [composite] shaft in two; but it never came into the car. It ‘broomed’...and no one was hurt.”³
- A composite shaft can have greater torsional flexibility (higher angle of rotation per torque load) than traditional shafts. This increased torsional flexibility absorbs impact loading (torque spikes) due to “clutch pop,” and can, according to one manufacturer, effectively increase the cycle life of all other drivetrain components connected to the shaft.⁴
- Another advantage of using a lightweight composite material is that it can be used to form a press-fit molded joint with its yokes (joints that connect the shaft to the axle), rather than using an adhesive that can axially constrain the yokes during crashes, according to “Design News for Mechanical and Design Engineers.”⁷
- According to Andrew “Pollard’s Polymer Matrix Composites in Driveline Applications”, the Renault Espace Quadra, launched in 1988, was the pioneering application for composite driveshafts in production vehicles—the composite driveshaft system weighed 5kg, compared to 10 kg for the two-piece steel alternative.⁸
- Currently, composite driveshafts used in production vehicles, including the Mitsubishi Montero, the Nissan 350Z, and the Mazda RX-8, weigh 40–50% less than comparable two-piece steel designs.⁷

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- 4 BAC Technologies Ltd. "Carbon Fiber Driveshafts." Burkett Advanced Composite Technologies Ltd. <http://www.bactechnologies.com/shafts.htm> (accessed April 21, 2006).
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Pictures

Composite Driveshaft: <http://www.acpt.com/driveshaft/safety.html>

Brooming: <http://www.acpt.com/driveshaft/safety.html>

2006 Nissan Z with Composite Driveshaft: <http://www.nissannews.com>

Driveshaft Diagram: <http://www.spinning-composites.com/images/CompositesInDriveline.PDF>

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