DYMAG®
PERFORMANCE WHEELS

Technical Guide

DYMAG CARBON COMPOSITE AUTO WHEELS

Physical Benefits of Lightweight Wheels

OEM – Racing – Road/Aftermarket

LIGHTER | STRONGER | FASTER

CONTACT

Dymag Group Ltd
Unit 18, Bumpers Enterprise Centre
Vincients Rd
Bumpers Farm Industrial Estate
Chippenham
Wiltshire
SN14 6QA
UK

Email: info@dymag.com
Tel: +44 (0) 1249 446438
www.dymag.com

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CONTENTS


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1.0 Introduction

DYMAG® PERFORMANCE WHEELS

You're a tech savvy driver who wants to get the best driving experience out of your high performance car. The buzz in the automotive industry is all about decreasing weight whilst still stepping ahead in performance, safety and sophistication.

What's the one improvement you can make to your car that will have the biggest impact? Simply put, it's lightweight wheels and Dymag,the British company that pioneered carbon fibre wheels, has launched its latest carbon fibre composite wheel.

Among the lightest wheels on the market, Dymag's carbon car wheels are typically 40% lighter than an equivalent OEM aluminium alloy wheel of the same size.

This guide is designed to help you understand the physical benefits of lightweight carbon composite car wheels and talk you through some of the technical terminology that will help you when it comes to choosing the very best wheels that will make your car look stunning as well as give you a better all-round driving experience.

WHY GO LIGHTWEIGHT?

Dymag's carbon fibre wheel can improve the handling, performance and fuel economy of your vehicle. This is because you need more energy to move heavy objects, than to move light objects over the same distance.

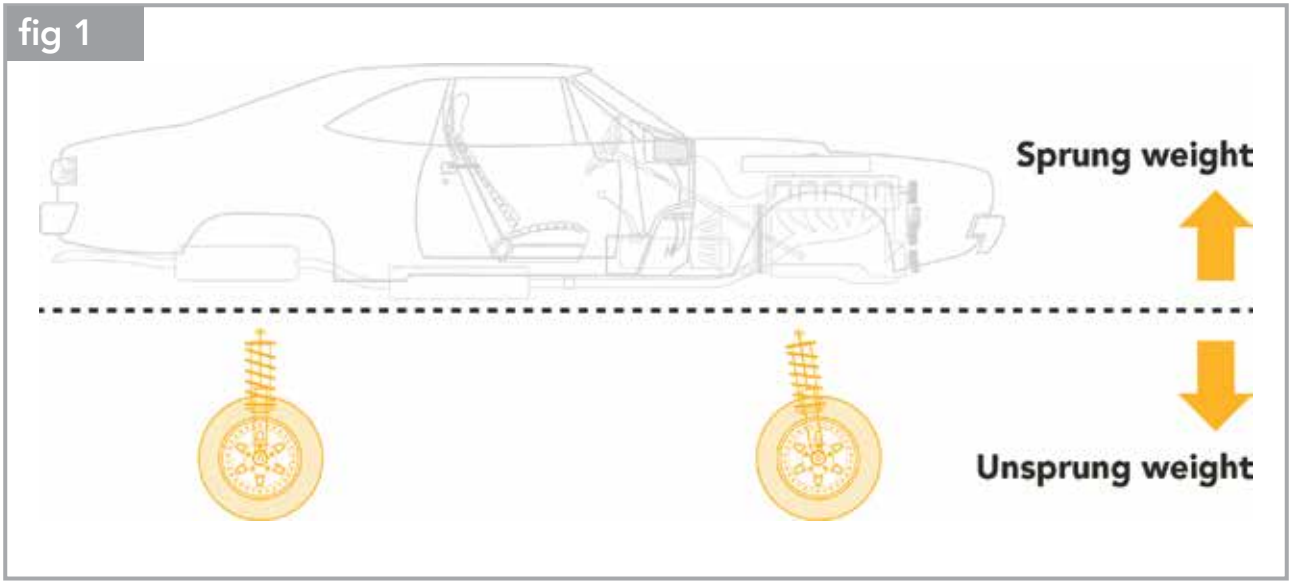
We can measure these physical benefits scientifically, but as drivers we also feel the subjective improvement in ride quality and "flickability" of lighter vehicles.

Dymag's carbon fibre wheel provides both: its unique carbon fibre composite rim and aluminium alloy spoke combination makes it significantly lighter than an OEM wheel of the same size.

UNSPRUNG WEIGHT

A car's suspension supports most of its components, including the chassis, the engine and the driver – these components are "sprung" weight. However, some car components are not supported by the suspension and are therefore "unsprung"; they include the tyres, the wheels and the brakes.

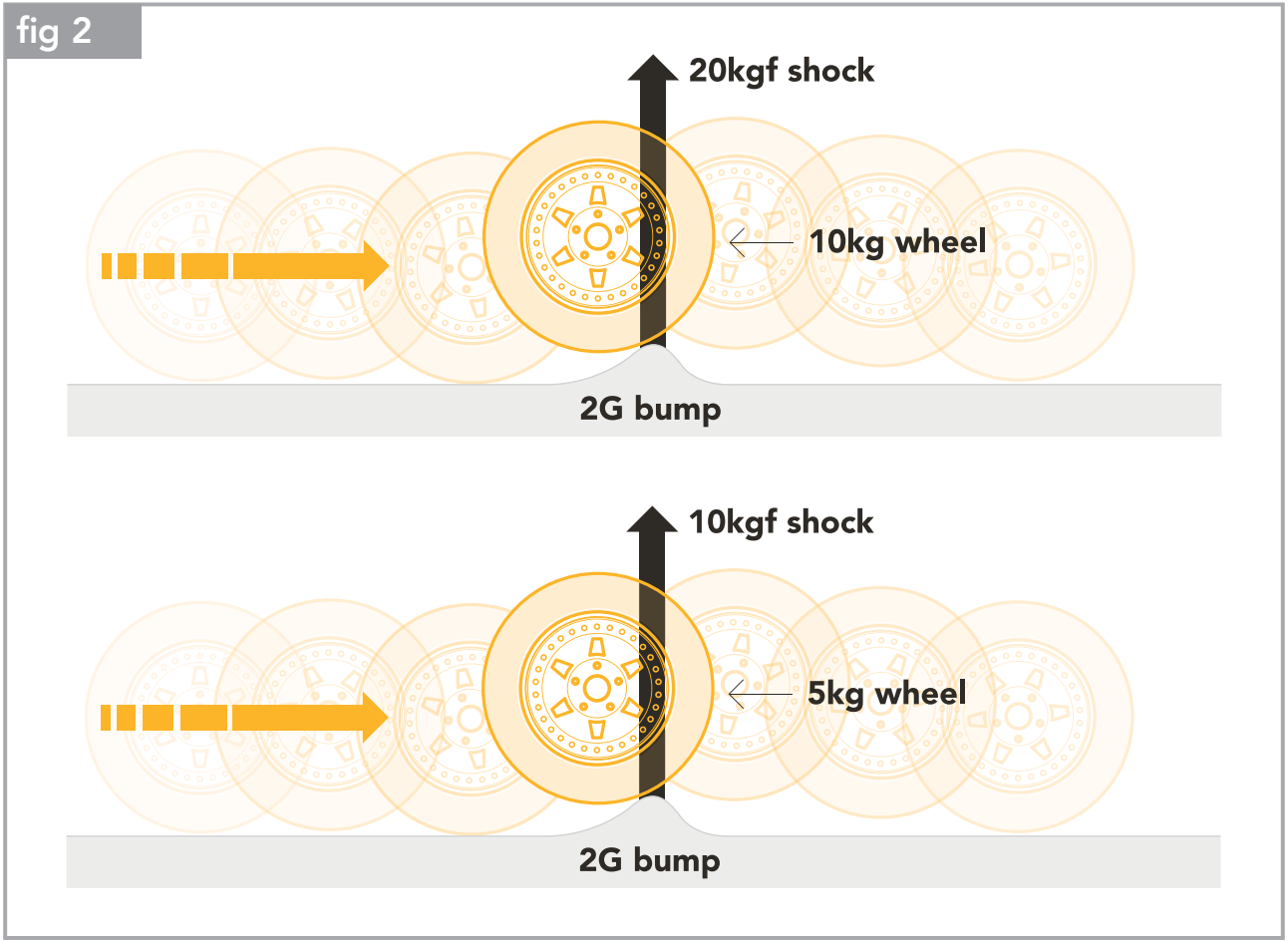
fig 1



When a car passes over a bump in the road, the driver will feel the unsprung weight being forced upwards. At high speeds this causes unpleasant vibrations—the greater the vehicle's unsprung weight, the stronger these vibrations become.

3.0 Unsprung weight

fig 2



A high unsprung weight can also lead to “bouncing” and “hopping”, where the tyres temporarily lose contact with an uneven road – which is potentially dangerous. You can significantly improve on this problem by installing Dymag’s lightweight wheels – just look how much weight you could save!

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UNSPRUNG WEIGHT REDUCTION:

23kg

BMW F80 M3
unsprung weight reduced by 23kg

10.5kg

NISSAN GTR
unsprung weight reduced by 10.5kg

7.8kg

AUDI R8
unsprung weight reduced by 7.8kg

WHEEL WEIGHT REDUCTION:

38%

BMW F80 M3
wheel weight reduced by 38%

22%

NISSAN GTR
wheel weight reduced by 22%

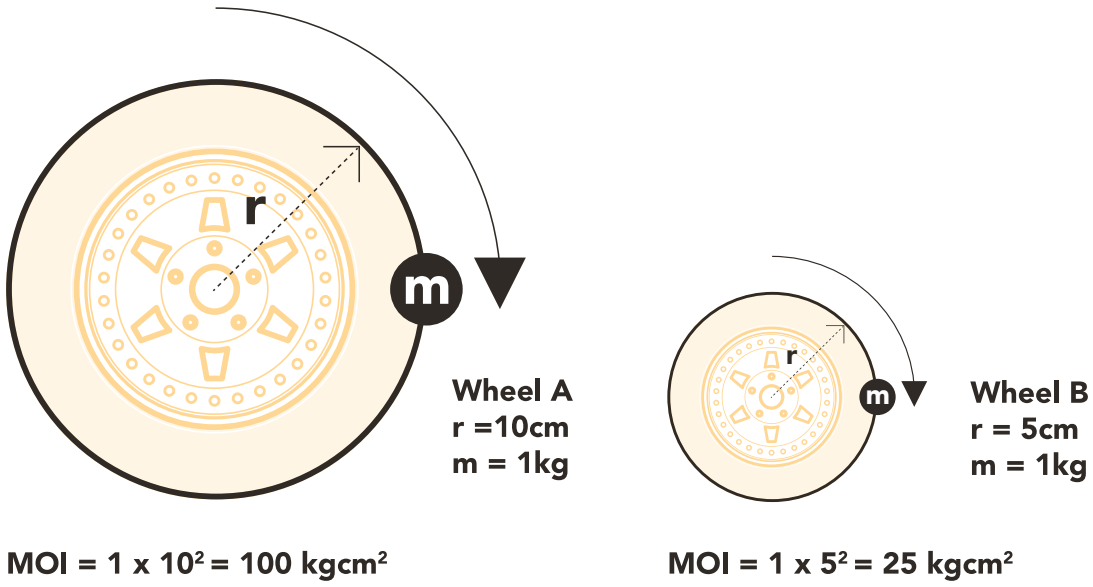
17%

AUDI R8
wheel weight reduced by 17%

MOMENT OF INERTIA

Moment of Inertia (MOI) is a measure of how easily an object spins or stops spinning – a high MOI means that an object is difficult to spin. Spinning objects are unusual: the energy you need to start or stop spinning an object (accelerating or braking) increases as the square of the object's radius (distance from centre to the edge). In figure 3 there are two wheels of equal weight but different sizes. The equation for the MOI is $I=mr^2$ where the MOI (I) is equal to the weight (m) times the radius (r) squared.

fig 3

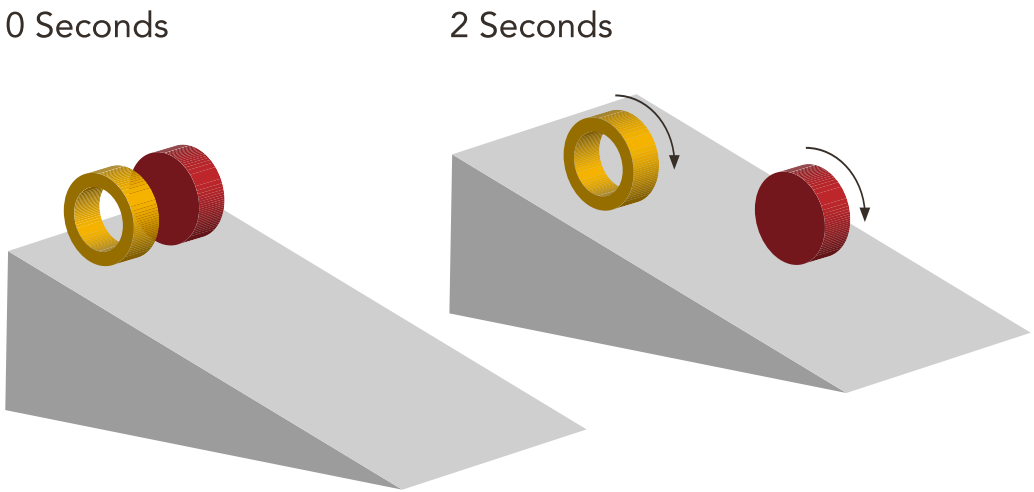


The important point of this equation is that the radius influences the MOI *significantly* more than the weight – if you divide the radius by two you will divide the MOI by *four*. This effect is extreme for larger changes: if you divided the radius by ten you would divide the MOI by one *hundred!!!*

A car wheel is the same: if you reduce the weight of the wheel at the radius *(the rim*), you reduce the MOI of the wheel *more* than if you had removed the *same amount* of weight at the hub. Dymag's wheel replaces a typical, heavy metal rim with a lightweight carbon fibre rim – it therefore has a lower MOI than conventional OEM wheels.

Wheels with low MOI will will *accelerate or brake more quickly*. If you roll two cylinders of equal weight and diameter down a slope then the one with a lower MOI will reach the bottom first. You can see this in figure 4; the hollow cylinder has a higher MOI than the solid cylinder, because most of its weight is concentrated at the rim. Dymag's carbon fibre wheel will greatly improve your car's *acceleration* and *braking* performance because of its *lightweight rim*.

fig 4

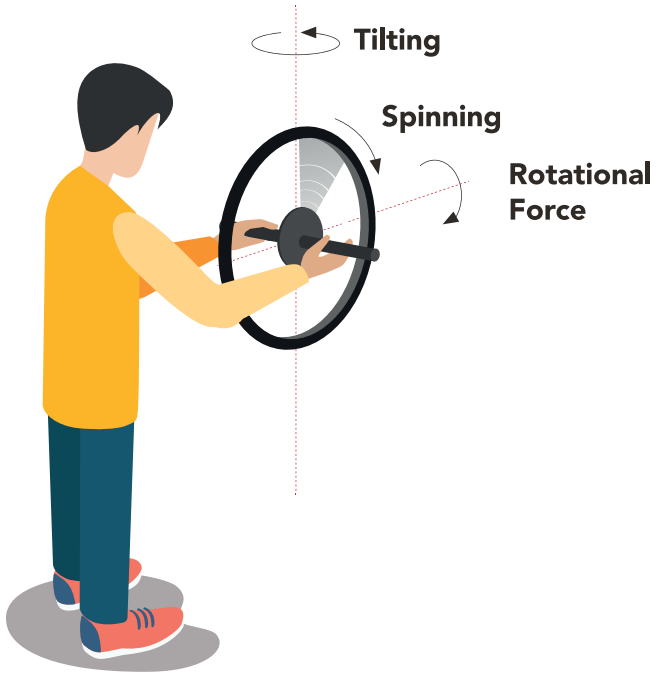


GYROSCOPIC TORQUE

Spinning objects are unusual in another way too. If they are constrained and you tilt them, *they will react with a rotational force against their constraints.*

You can (carefully) try this yourself with a bike wheel. If you hold the wheel on its axle while it is spinning and you try to tilt the wheel, you will feel that it *pushes back and pivots into a different direction.*

fig 5



The equation for this rotational force is is $T=Iw\Omega$ where the rotational force *(T)* equals the wheel's MOI *(I)* times the wheel's spinning speed *(w)* times the speed with which you are trying to tilt the wheel *(Ω)*. Importantly, the rotational force with which the wheel resists your tilting *depends* on the MOI. *A wheel with a low* MOI *will therefore exert a lower rotational force as you try to tilt it.*

In a car the driver is contantly trying to tilt the spinning front wheels through the car's steering mechanism. The rotational force which these wheels exert on the driver drops significantly if the car's wheels have a low MOI. Dymag's carbon fibre wheel will *reduce the forces that are going into your car's steering mechanism* – the result is that your car handles more responsively and precisely.

THE DYMAG PEDIGREE

We're a British performance wheel brand that has led the way in wheel design and technology for more than four decades.

We were the first company in the world to manufacture carbon fibre wheels for both high performance cars and motorcycles certified for both road and racing use.

The Dymag team developed the world's first roadworthy hybrid carbon composite wheels.

As a Dymag customer you're in good company. We've supplied wheels for the sporting elite – Ayrton Senna, Nigel Mansell, Alain Prost, Barry Sheene and Eddie Lawson to name a few!

Our safety and reliability record is unparalleled. Over 1,000 car and motorcycle carbon-fibre wheels manufactured with no major incidents.

www.dymag.com

Your local dealer:

Unit 18, Bumpers Enterprise Centre,
Vincients Road,
Bumpers Farm Industrial Estate,
Chippenham,
Wiltshire
SN14 6QA. UK

Email: info@dymag.com Tel: +44 (0) 1249 446438

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