

**DYMAG**<sup>®</sup>  
PERFORMANCE RACING WHEELS



## Technical Guide

# The Performance Benefits of Lightweight Motorcycle Wheels

OEM – Racing – Road/Aftermarket



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## The Dymag Pedigree

- Dymag is 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.
- As a Dymag customer you're in good company. We've supplied wheels for the motorcycle racing elite – Barry Sheene, Eddie Lawson, Michael Dunlop, Joey Dunlop, John McGuinness and Troy Bayliss to name a few past and present champions, as well as a some well-known F1 and Indycar champions...Ayrton Senna, Nigel Mansell, Alain Prost...
- Our safety and reliability record is unparalleled, with thousands of car and motorcycle carbon-fibre wheels manufactured since 1995.



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

Simply put, there is no other modification that gives such an instant boost in motorcycle handling and performance as lightweight wheels.

Dymag, the British company that pioneered carbon fibre motorcycle wheels, leads the market with a comprehensive range of carbon, magnesium and aluminium wheels that are some of the lightest and strongest on the market. All tested and certified for road use.

Designed with the benefit of 30 years of lightweight wheel technology, our stylish, ultra-light - and ultra strong Dymag motorcycle wheels will transform your bike's handling and performance.

Motorcycle racers understand that the primary technical attributes of a Dymag lightweight racing wheel are the dramatic reductions in *unsprung mass*, *moment of inertia* and *gyroscopic torque*, as well as stiffness.

This guide is designed to help you understand the physical benefits of lightweight bike 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 bike look stunning as well as give you a better all-round riding experience.

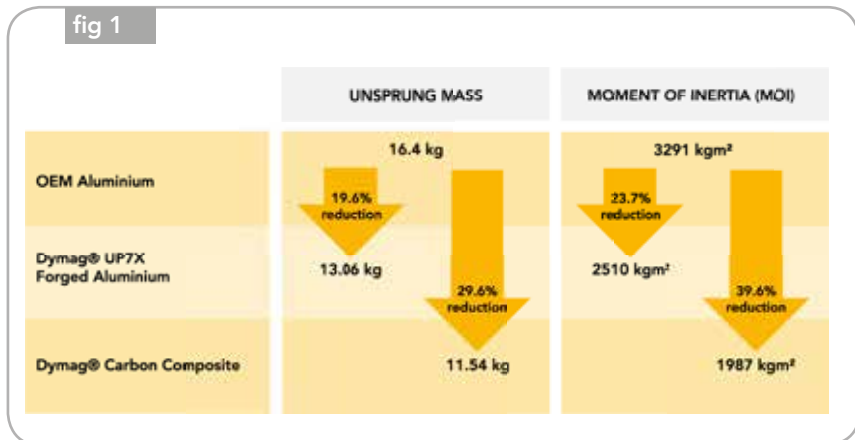
# Why is lightweight better?



Dymag's lightweight motorcycle wheels can improve the handling, performance and fuel economy of your bike. 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 riders, we also feel the subjective improvement in ride quality and "flickability" of lighter bikes.

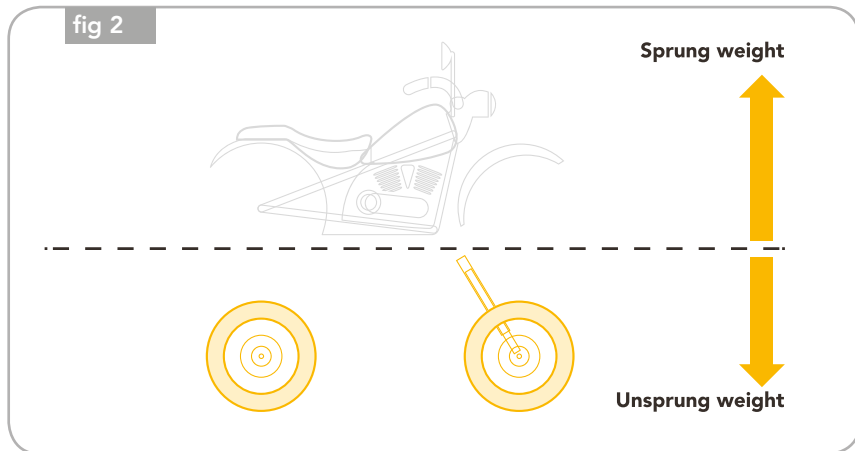
For example, look at the impact on the BMW S1000RR fitted with a set of "Dymags" compared to the OEM supplied wheels. There is a significant improvement when switching to forged aluminium wheels and even greater benefits when trading up to the ultimate – our carbon fibre CA5s:



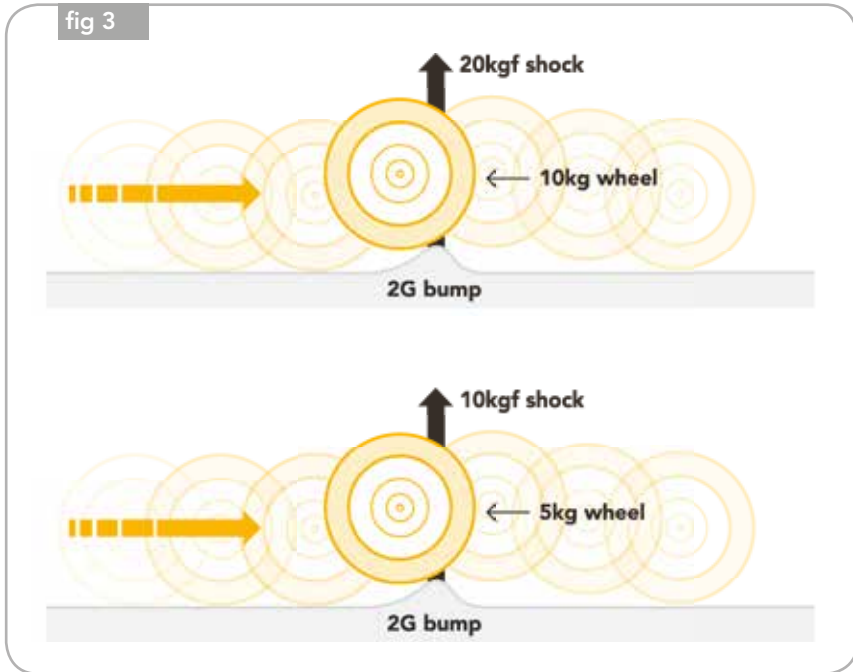
# What does this all mean?

## Unsprung Weight

A bike's suspension supports most of its components, including the chassis, the engine and the rider – these components are known as "sprung" weight. However, some bike components are not supported by the suspension and are therefore "unsprung"; they include the swingarm, fork lowers, brakes, tyres and wheels.



When a bike passes over a bump in the road, the rider will feel the unsprung weight being forced upwards. At high speeds this causes unpleasant vibrations - the *greater* the bike's unsprung weight, the stronger these vibrations become.

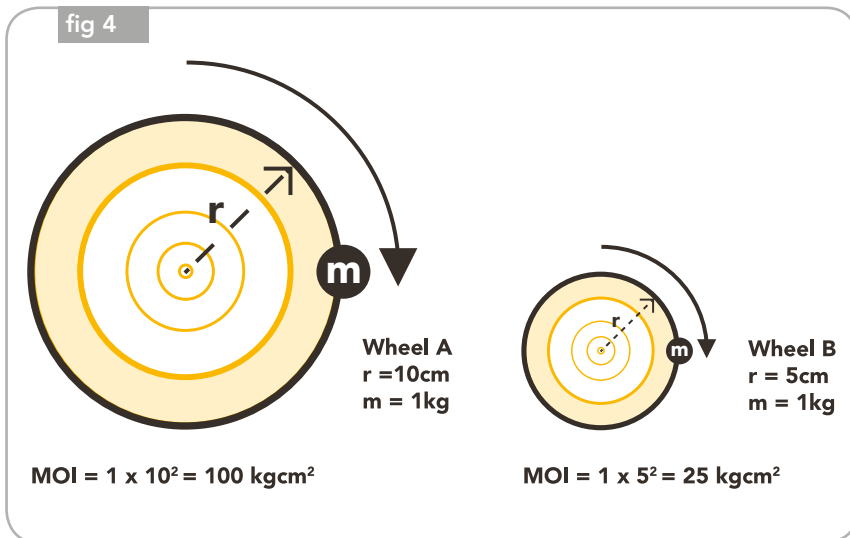


A high unsprung weight can also lead to “bouncing” and “hopping”, where the tyres temporarily lose contact with an uneven road, causing the bike to buck around – which is potentially dangerous.

You can significantly improve on this problem by installing Dymag’s lightweight wheels – just look how much weight you could save!

# 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.



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!*

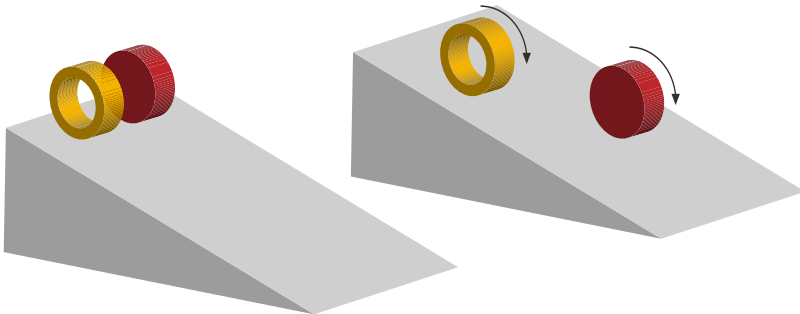
A motorcycle wheel is the same: if you reduce the weight of the wheel at the radius (the rim), you reduce the MOI of the wheel more than if you had removed the same amount of weight at the hub. Dymag's wheel replaces a typical heavy metal rim with a lightweight carbon fibre, magnesium or aluminium rim,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

Wheels with low MOI 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 bike's acceleration and braking performance because of its *lightweight rim*.

fig 5

0 Seconds

2 Seconds

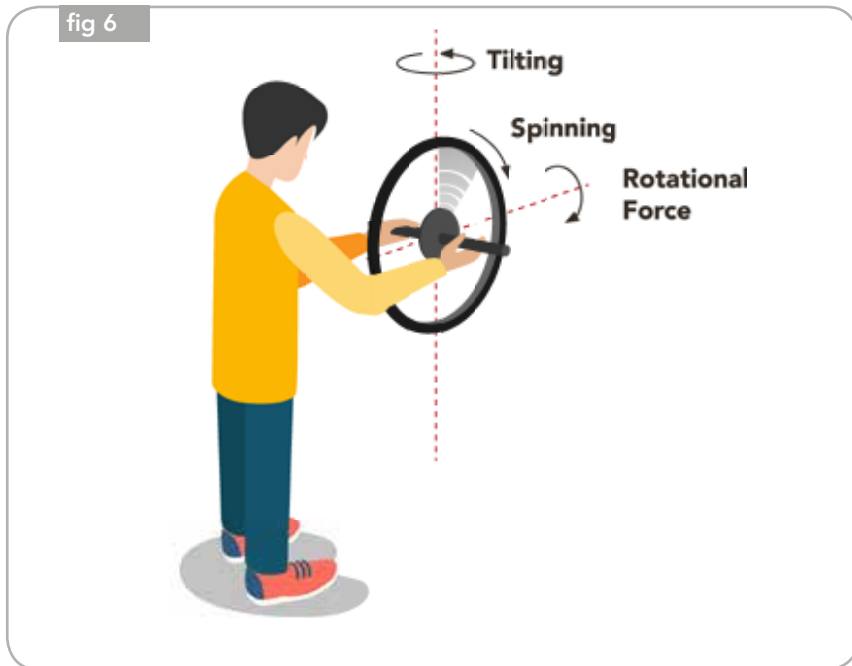




## Gyroscopic Torque

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.*



The equation for this rotational force is  $T = I\omega\dot{\theta}$  where the rotational force ( $T$ ) equals the wheel's MOI ( $I$ ) times the wheel's spinning speed ( $\omega$ ) times the speed with which you are trying to tilt the wheel ( $\dot{\theta}$ ). 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.*

On a bike the rider is constantly trying to tilt the spinning front wheels through the bike's steering mechanism. The rotational force which these wheels exert on the rider drops significantly if the bike's wheels have a low MOI. Dymag's lightweight motorcycle wheels will *reduce the forces that are constantly going into your bike's steering mechanism* – the result is that your bike handles more responsively and precisely.



## CA5

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These stylish ultra-light and ultra-strong one-piece Dymag Carbon 5 Spoke motorcycle wheels will transform your bike's handling and performance.



## UP7X

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The new Ultra Pro UP7X range of custom motorcycle wheels are the lightest aluminium wheels Dymag has ever developed. Ridden by champions worldwide they are fully certified for legal road use.



## CH3

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The Classic CH3 Range are the World's original three spoke Magnesium motorcycle wheels as used by Eddie Lawson.



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