VITTORIA
WHITE PAPER

vittoria

32 INCH WHEELS

DEFINING THE KEY PERFORMANCE TRAITS OF THE EMERGING TREND

KEN AVERY
SENIOR VICE PRESIDENT, PRODUCT DEVELOPMENT

EMILIANO SABETTI
PRODUCT DEVELOPMENT DIRECTOR

DENNIS CAPPELLETTI
TESTING ENGINEER

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WHILE BICYCLE TIRES HAVE GROWN EVER WIDER IN RECENT YEARS, THE NEW TREND NOW AT THE FOREFRONT OF BICYCLE MEDIA RELATES TO WHEEL DIAMETER. THAT TREND IS THE 32” WHEEL, AND WITH IT BRINGS EQUAL PARTS CLAIM AND THEORY OF INCREASED ROLLING PERFORMANCE, GRIP, AND COMFORT, PRIMARILY INTENDED FOR THE DISCIPLINES WITHIN ROAD, GRAVEL, AND MOUNTAIN (MTB) CATEGORIES.

THIS IS A SONG WE’VE HEARD BEFORE, SPECIFICALLY IN THE EARLY 2000S WITH THE TRANSITION FROM 26” TO 29” MOUNTAIN BIKE TIRES. THEN AS NOW, TOPICS RELATING TO INCREASED SPEED AND COMPLIANCE ARE MET WITH CONCERNS OF WEIGHT, FITMENT, AND THE ETERNAL QUESTION OF VALIDATION.

IN THE FOLLOWING WHITE PAPER, WE WILL SPEAK TO RECENT CONTROLLED TESTING OF 32” TIRES WITHIN THE VITTORIA LABS AND VITTORIA PARK, COMPARING THESE OUTCOMES TO OTHERWISE IDENTICAL 29” TIRES. IN DOING SO, BENEFITS AS WELL AS POTENTIAL COMPROMISES OF THE 32” WHEEL AND TIRE STANDARD ARE DEFINED, WHILE THE MOST LOGICAL INTENDED-USE CASES BECOME CLEAR.



FIGURE 1. 32" Vittoria Peyote.

INTRODUCTION

It could be argued that since the invention of the wheel, humans have continuously attempted to make it roll faster and more efficiently. In simple theory, increasing the diameter of a wheel tends to have the effect of smoothing rough rolling surfaces, while adding width typically offers greater engagement with the given surface. With the advent of pneumatic tires, the performance of both factors further increased, while the added benefit of comfort became much more apparent. While manipulating diameter and width to spread load through a broader contact patch is certainly nothing new, the debate on a superior configuration remains, whether the vehicle is a complex multi-wheel vehicle or a simple bicycle.

How these factors play into the world of cycling may appear nuanced to a non-enthusiast. After all, the wheel known as 700c (which shares the same rim bead-seat diameter as a 29" MTB wheel) has been virtually unchanged for decades, while in this time the performance minded attributes relating to the surrounding bicycle system have seen immeasurable performance advancements.

So why all the hype about going to a larger wheel, and why now?
To answer this, consider that cycling has never been more advanced than it is at this very moment. Modern cycling enthusiasts enjoy the latest in aerospace grade materials, wireless Bluetooth shifting, smart suspension, and sustainable rubber compounds, all packaged into what used to be a simple human-powered machine. Each step took immense optimization, with the World Tour and Olympic stages serving as proving grounds for these efforts.
All of it rolls on two outwardly simple wheels, which have now become the latest point of interest for potential optimization.

With this in mind, we can begin the journey to rationalize the user benefits of the 32" tire system as they relate to simple key performance indicators, comparing each to what has been a well-established standard of 29" tire systems in performance cycling.

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FIGURE 5. 29” Decathlon Ford Racing Team 2026 bike (top picture), 32" Decathlon Ford Racing Team 2027 bike (bottom picture).





SECTION 1.
TESTING METHODOLOGY

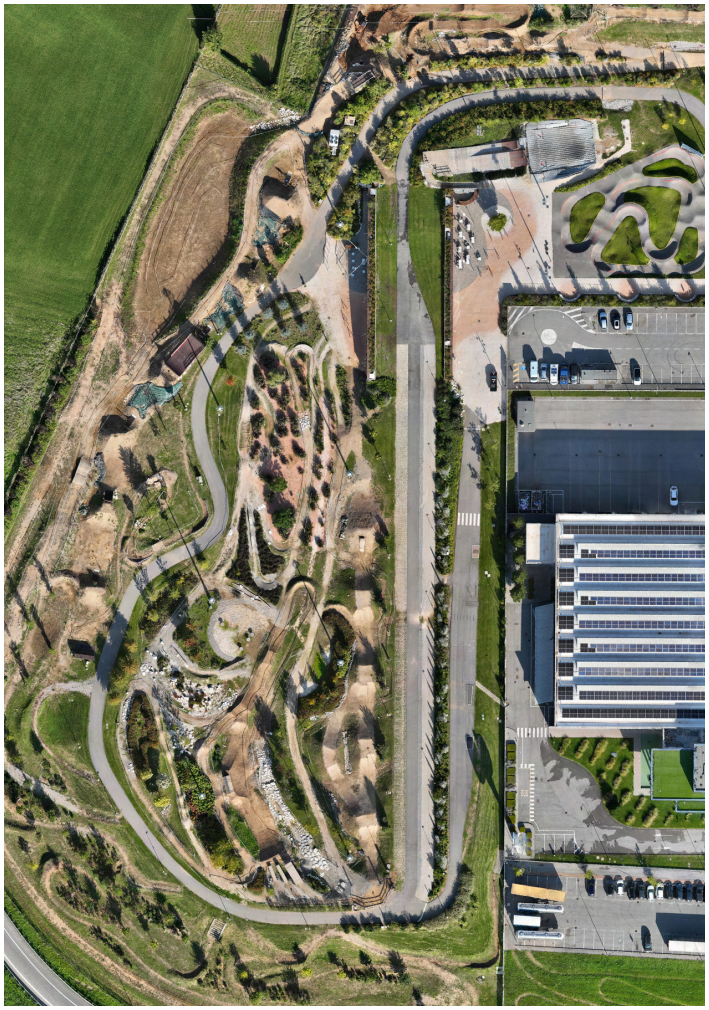


FIGURE 3. Vittoria Park.



FIGURE 4. Vittoria Labs.

Vittoria Park combined with Vittoria Labs provided the ideal backdrop for this type of testing. Both are company owned technical testing facilities, located on the campus of the Vittoria Headquarter. Vittoria Park features set outdoor testing routes for each of the related categories within this test, as well as dirt jump, pump track, MTB, and cyclocross. Each are designed with authentic use in mind, testing the limits of each tire system at the limits of both handling and efficiency. Vittoria Labs houses a family of proprietary machines which are specifically designed for replication of real-world scenarios related to performance bicycle tires. When combined, data can be cross-referenced between Park and Labs and even further replicated in the lab setting.

To better categorize the performance benefits for users, testing on both 29" and 32" tire systems was conducted across three surface types: Asphalt, Gravel, and Cobblestones.

This approach allowed for a variance in both rolling resistance and traction, in addition to more subjective factors such as bump size, along the way.

To dive deeper, each size tire system was tested across these surfaces using three separate pressure levels: 1 bar, 1.5 bar, and 2 bar. This approach allowed for a broad variance of real-world surfaces, at pressures which are commonly used in these types of scenarios by the target consumer.



FIGURE 5. Vittoria Park asphalt, gravel, and cobblestone sections.



FIGURE 6. Test bike with multiple wheel sets (32" top, 29" bottom).

To further control the data set, the same bike was used for each wheel size. As one data set was completed, just a quick wheel/tire swap was needed before moving on to the next surface and tire system size scenario. This further increases consistency as time is reduced, so conditions for each test session, as well as factors relating to bike and rider remain identical.

The asphalt test track features the smoothest surface of the three, replicating most general road uses for each product. The roughly 1km long paved loop in the Vittoria Park features rolling inclines and declines, and a series of both flat and banked corners. In this scenario, rolling performance and grip are often referred to as the most notable factors, given the consistency of the surface.

The gravel segment within the test loop features a mix of hardpack, fine loose, and mixed gravel sections, replicating a common variety of conditions riders may face when using a related product in the field.

Gravel is unique, in that it inherently demands the typical rolling and grip performance indicators, but in a more active approach. In this testing phase, treads lock into a more dynamic dirt-based surface to provide traction, in addition to the tactile grip demands of harder terrain surfaces throughout the segment.

Additionally, comfort becomes an increased factor in gravel cycling (compared to the asphalt surface data set), as the tire negotiates stones and surface abnormalities throughout the rolling period.

Cobblestone adds an entirely different scenario, by providing a more controlled and consistent rough surface, which offers a sort of rhythm of impacts as the tire rolls and deforms over the edges. This demands that the tire is not only grippy and efficient in rolling, but also stable, durable, and comfortable all at once. Cobblestone sections of the Vittoria Park offer both the Flanders and Roubaix variety. While the Flanders style is often smaller and more consistently arranged, the Roubaix style exhibits a rougher and more jagged form of cobblestone surface.

To gather data, telemetry and power-meter instrumentation was affixed to the bike, and test cycles in the Park began. The measure of CRR (Coefficient of Rolling Resistance) is obtained in real use conditions by means of an in house developed procedure based on the Chung method. Different tire systems can be compared over different surface types and pressure ranges.

In simple terms, CRR is a dimensionless number that represents the amount of energy lost as a tire deforms and recovers against the road under the weight of the bike and rider.

It is calculated by dividing the rolling resistance force by the vertical load (normal force) pushing down on the tire. The lower the value means less energy is lost, equating to a faster-rolling tire.



FIGURE 7. Vittoria Park gravel terrain.



FIGURE 8. Vittoria Park cobblestones.

ROLLING RESISTANCE MEASUREMENTS

At Vittoria Park, outdoor rolling resistance measurements can be performed on different surfaces and under a range of load, inflation pressure, and speed conditions.
To isolate the effect of wheel diameter as much as possible, the comparison was carried out using a prototype frame specifically designed for 32" wheels, on which equivalent 32" and 29" wheelsets were tested. The two wheelsets used the same hubs, spoke material, rim material, rim geometry, and internal width. Likewise, equivalent tires were selected, featuring the same tread pattern, nominal section width, and material construction. This approach was intended to minimize potential sources of experimental variability unrelated to wheel diameter and therefore provide a more direct assessment of the effect of the 32" format.

The results reveal a dependence of the relative advantage of the two wheel diameters on surface characteristics and inflation pressure.

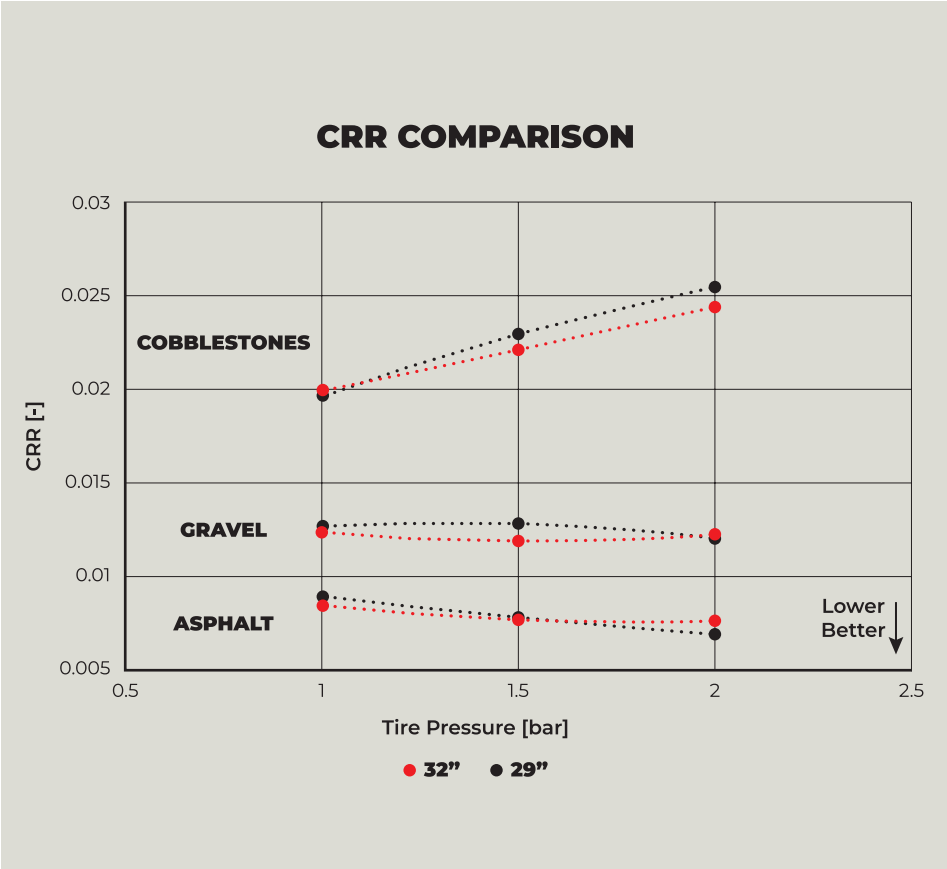


FIGURE 9. CRR comparison.

TARMAC

On the smooth asphalt surface, the 32" setup shows a slight rolling-resistance advantage over the 29" configuration, particularly as inflation pressure is reduced. An additional relevant observation is the lower sensitivity of the 32" setup to changes in inflation pressure. This behavior may indicate a more favorable distribution of stresses and localized micro-slippage within the tire contact patch, which represents one of the potential advantages of a larger wheel diameter on relatively smooth surfaces.

GRAVEL

On the gravel track, designed to reproduce the characteristics of a typical “strade bianche” surface, the 32" configuration again exhibits a relatively stable CRR across the tested pressure range. The advantage over the 29" setup is particularly evident at low and intermediate pressures, where the measured difference is in the order of 5–8%. This suggests that the larger wheel diameter may provide a more consistent rolling response as tire inflation pressure is reduced on moderately irregular surfaces. To provide a better idea of what this advantage could mean for a rider, let’s consider its equivalence to about 6 to 9W for an average rider weight of 75kg and an average bike weight of 10kg.

DEEP AND WIDELY SPACED COBBLES

As surface severity increases, as in the case of deep and widely spaced cobbles, the behavior becomes more strongly dependent on inflation pressure. Under these conditions, the 32" setup shows an increasing rolling-resistance advantage as pressure rises.

This result can be interpreted as the outcome of two opposing effects. On the one hand, the larger wheel diameter provides improved obstacle rollover capability. From a purely geometrical standpoint, the rollover capability of a 32" wheel is approximately 4% greater than that of a 29" wheel when negotiating a given obstacle of 100mm.

This produces a mechanical advantage in overcoming larger surface irregularities.

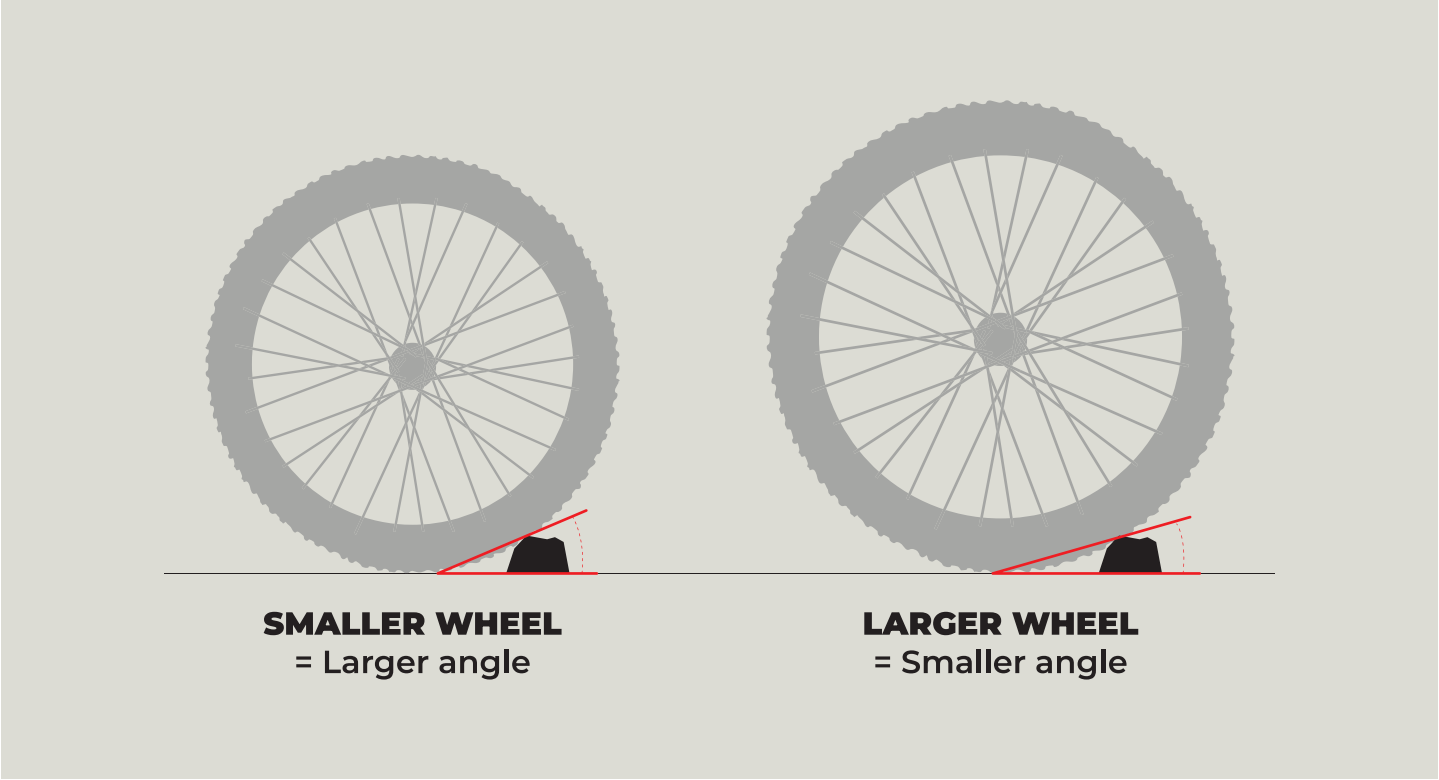


FIGURE 10. 29'' vs 32'' impact angle.

On the other hand, the complete 32" wheel system has a higher unsprung mass, due to the larger and heavier rim, spokes, and tire.

The increased unsprung mass (in this specific configuration measured in +5%) can result in higher rebound and associated tire and wheel deformation when the wheel interacts with severe surface irregularities.

As inflation pressure increases, both wheel diameters tend to exhibit greater bouncing and reduced ability to conform to the surface. However, under these conditions, the improved rollover capability of the 32" wheel progressively outweighs the negative effect associated with its higher unsprung mass, resulting in a measurable rolling-resistance advantage.

It should also be noted that the experimental configuration introduces a potential bias in favor of the 29" wheel. Specifically, the 29" wheelset was mounted on a frame designed for 32" wheels, resulting in a lower overall center of gravity and potentially reduced pitch and roll inertia. These effects can influence the dynamic response of the bicycle and may partially compensate for the inherent rollover advantage of the larger wheel.

Conversely, mounting a 29" wheelset on a frame designed for 32" wheels is not representative of an optimized 29" configuration and introduces several geometrical and functional limitations, including reduced ground clearance and an increased likelihood of pedal-to-ground contact, as well as potential changes in steering stability. Therefore, the results obtained in this test should be regarded as a conservative estimate of the potential difference between optimized 32" and 29" configurations. If the two wheel sizes had instead been tested on dedicated 32" and 29" frames, respectively, with equivalent materials, main features, and key technical characteristics, the difference in rolling performance could reasonably be expected to be greater and more in favour of 32".

Bottom line: considering the results obtained at 1.5 bar, which was identified during the test as the most favorable pressure from a riding-quality perspective, the 32" configuration exhibits improved rolling performance on all three tested surfaces.

On the same surfaces used to quantify the rolling resistance under real outdoor conditions, it is possible to measure the vibration transmission from the ground to the rider. To this aim, a set of accelerometers has been mounted on the frame and on the fork, to analyze the differences in the output vibration under the same surface input, as a result of the different wheel diameters.

The assessment of riding comfort did not reveal appreciable differences between the 32" and 29" configurations on either tarmac or gravel.

On tarmac, this can be attributed primarily to the relatively low amplitude of the surface-induced vibrations. The roughness of the asphalt is largely attenuated by the combined damping properties of the tire and wheel system, together with the air volume of a modern mountain bike tire. Under these conditions, the potential advantages associated with the larger wheel diameter are therefore less pronounced.

On gravel, several effects appear to counterbalance each other. The larger diameter provides improved rollover capability when negotiating surface irregularities, which tends to improve the dynamic response of the wheel. At the same time, however, the larger wheel has a longer contact patch, potentially increasing the area over which surface-induced vibrations are transmitted to the wheel, while the higher unsprung mass of the 32" system can contribute to greater dynamic loads and rebound. The combined effect of these mechanisms results in no appreciable difference in perceived riding comfort under the tested gravel conditions.

On the more severe cobblestone surface, however, the 32" configuration provides a slight improvement in riding

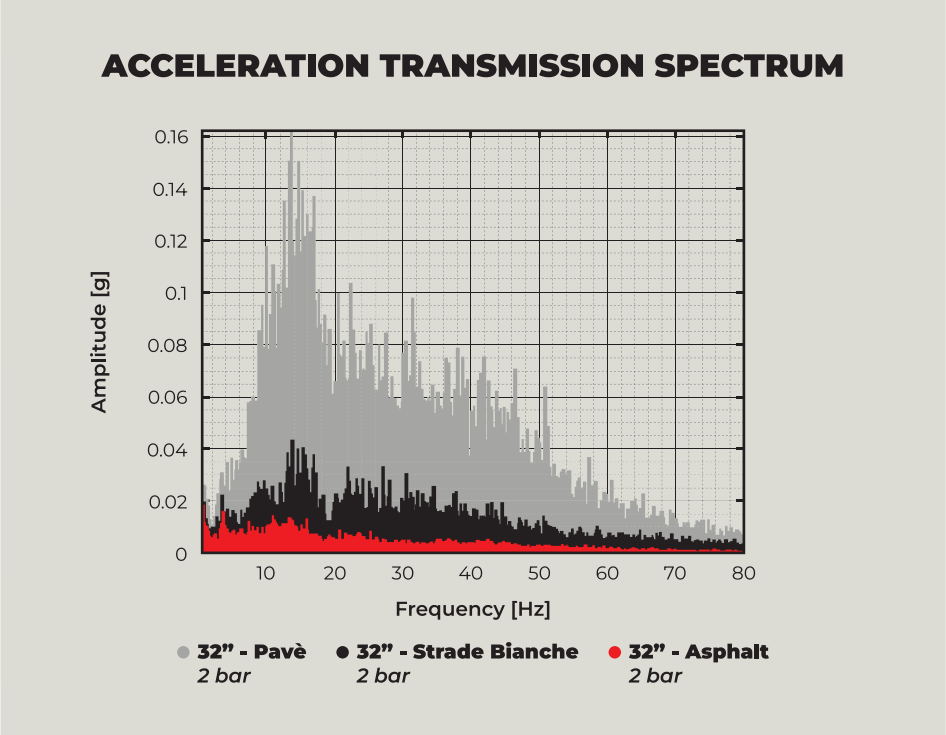


FIGURE 11. Frame vibration spectrum over different surfaces.

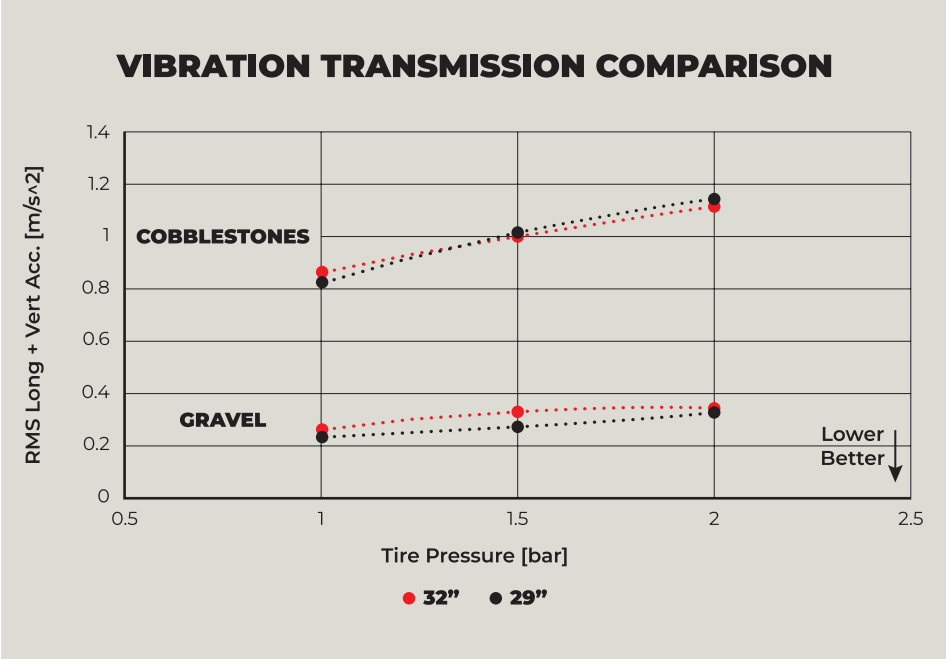


FIGURE 12. Vibration absorption comparison.

comfort compared with the 29" set-up, particularly at inflation pressures of 1.5 and 2.0 bar. Under these conditions, the improved rollover capability of the larger wheel appears to become more relevant, allowing the wheel to negotiate the larger and more widely spaced obstacles with reduced vertical displacement and impact severity.

It should also be considered that, for an equivalent tire construction and nominal section width, a 32" × 2.4" tire provides approximately 10% greater air volume than the corresponding 29" × 2.4" tire. This additional air volume provides the possibility of operating the tire at a correspondingly lower inflation pressure while maintaining comparable support and resistance to bottoming-out. The resulting reduction in inflation pressure can improve riding comfort and increase the tire contact area, while maintaining, or in some conditions even improving, rolling performance. This combination of increased air volume, lower achievable inflation pressure, and larger wheel diameter therefore represents an important potential advantage of the 32" format.

Rather than requiring a direct trade-off between rolling efficiency and comfort, the larger tire volume can allow both characteristics to be improved simultaneously, particularly when riding on moderately rough and highly irregular surfaces.

GRIP PERFORMANCE

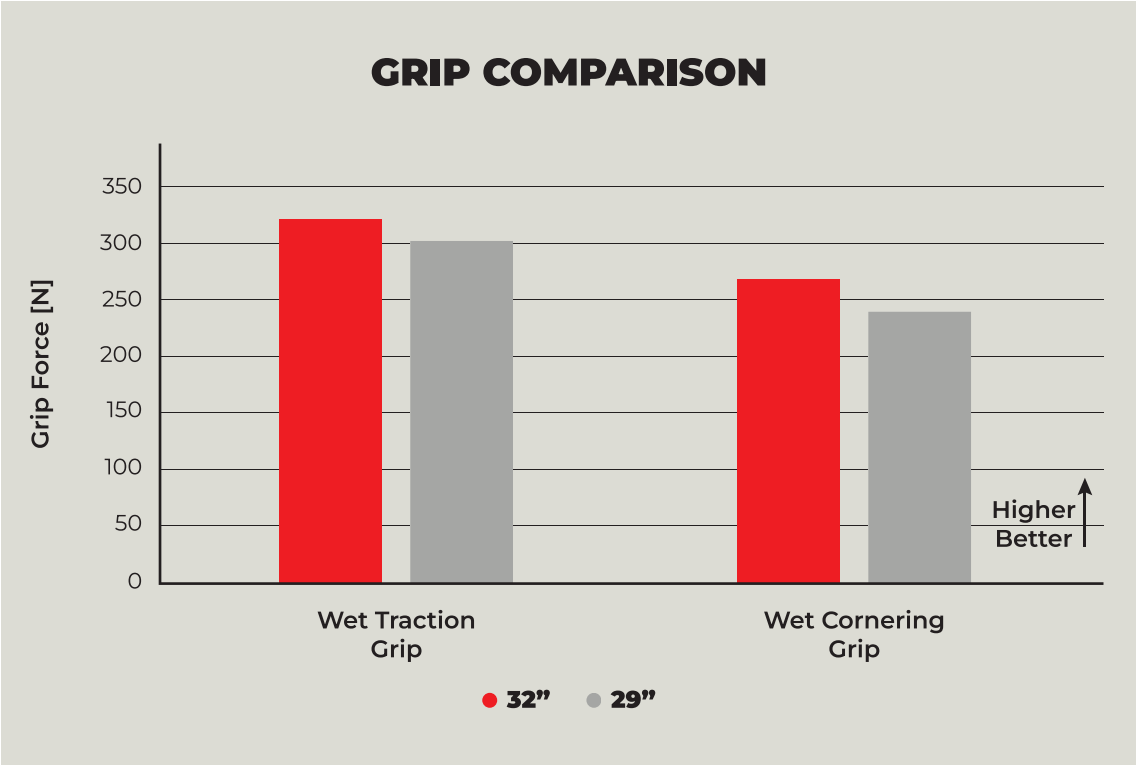


FIGURE 13. Grip comparison.

The effect of wheel diameter on tire grip was also investigated through laboratory testing at Vittoria Labs, under controlled indoor conditions and using equivalent 32" and 29" tire configurations. For sake of simplicity and for the purpose of this paper, the result is reported for a hard irregular surface made of aluminum, representative of a gravel profile.

The results show a measurable improvement in grip for the 32" configuration in both wet traction and wet cornering conditions. Compared with the equivalent 29" setup, the 32" tire achieved approximately 7% higher wet traction grip and 12% higher wet cornering grip.

The greater improvement observed in cornering conditions is particularly relevant, as it suggests that the benefits of the larger wheel diameter extend beyond straight-line traction. The increased contact area associated with the larger tire volume, together with the ability to operate at lower inflation pressures, can contribute to maintaining a larger and more consistent tire–road contact patch. This can increase the available grip, particularly when the tire is subjected to combined vertical and lateral loads during cornering.

These results are consistent with the rolling-resistance and riding-comfort measurements presented above, indicating that the larger wheel format can provide benefits not only in terms of obstacle rollover and rolling efficiency, but also in terms of tire–road interaction. The measured increase in wet grip is particularly significant because it was obtained under controlled laboratory conditions, where the effect of wheel diameter could be evaluated while minimizing other potential sources of variability.



FIGURE 14. "Tim", Grip Tester at Vittoria Labs.

SECTION 2.
DEFINING KEY BENEFITS, APPLICATIONS, AND COMPATIBILITY

While raw data can give direction on what to expect from each tire system, in the end, the value proposition for each system centers around what it does (and in some cases what it doesn't do) for the end user.

So often, performance minded riders focus on what may be "faster", without considering the broader context of what that may mean. A system which rolls faster, but may limit a rider's ability to handle the bicycle in certain scenarios will likely not be the overall fastest option in net terms. Therefore, considering the overall experience of the 32" tire system vs the 29" tire system is often where the ideal application becomes apparent.

To begin, it's important to remember than 32" tires and wheels are not compatible with a 29" bicycle frame and fork. In this context, it is very much an either/or proposition, and a decision that must be made at time of purchasing a complete bike, rather than an upgrade type of consideration.

Secondly, larger diameter tires and wheels use more material. While the weight difference is small when considering higher end equipment, it's worth considering that this material is placed further from the rotational axis of the hub. This means that if you are a rider who prioritizes acceleration, you will likely be better served with the smaller diameter option of 29" when comparing the two.



FIGURE 13. Side-by-side comparison between 29" and 32" wheels.

Third, a certain percentage of the population of riders simply won't be tall enough to reasonably fit on a 32" wheeled bicycle. In this case, no amount of performance gain will matter. While product managers and frame designers offer creative solutions to allow for size small frames which accept 32" wheels, factors such as toe-overlap, stand-over, and weight distribution come into play, effecting handling, especially in technical off-road applications.

This will be especially difficult when rear suspension systems are also included as a factor, as room must be accounted for both wheel travel as well as linkages and shocks, in an already cramped space. Of those frames which do utilize suspension, less suspension travel will need to be specified in order to also contain fit and clearance limitations, which further reduces the benefit of the 32" platform in the first place.

In applications where extreme technical handling is less of a factor, such as road and gravel, the larger 32" wheel is a more plausible solution for a wider range of enthusiasts seeking to lower the CRR of their tire system. This of course assumes that the rider can physically fit the larger 32" platform frame, as we've previously mentioned.



FIGURE 16. Testing of a 32" set-up at Vittoria Park.

CONCLUSION

In the world of performance cycling, marginal gains are often all that are available.

Bicycles have become so efficient, it is ever more challenging to create products which provide advantages in an absolute sense.

In many ways, 32" wheels are no different.

While our testing shows consistent advantages in terms of CRR, the challenges of rider fitment, suspension clearance, weight, and acceleration are all points of consideration which remain.

Dissecting each application within a range of applicable pressures gives us a clearer view of where the boundaries of benefits can be found. When choosing between a 29" and 32" platform, the data in the preceding pages gives a clear and unbiased understanding of what to expect in terms of performance differences and gives direction on which may serve a rider best based on application.

Ultimately the decision is up to the rider, and that is part of what makes this sport both beautiful and individualistic. In the end, having fun along the way is the end goal, so while performance can be measured and justified, choosing between 29" and 32" tire systems is about more than just speed alone.



FIGURE 17. Decathlon Ford Van Rysel RCR-XC 32".