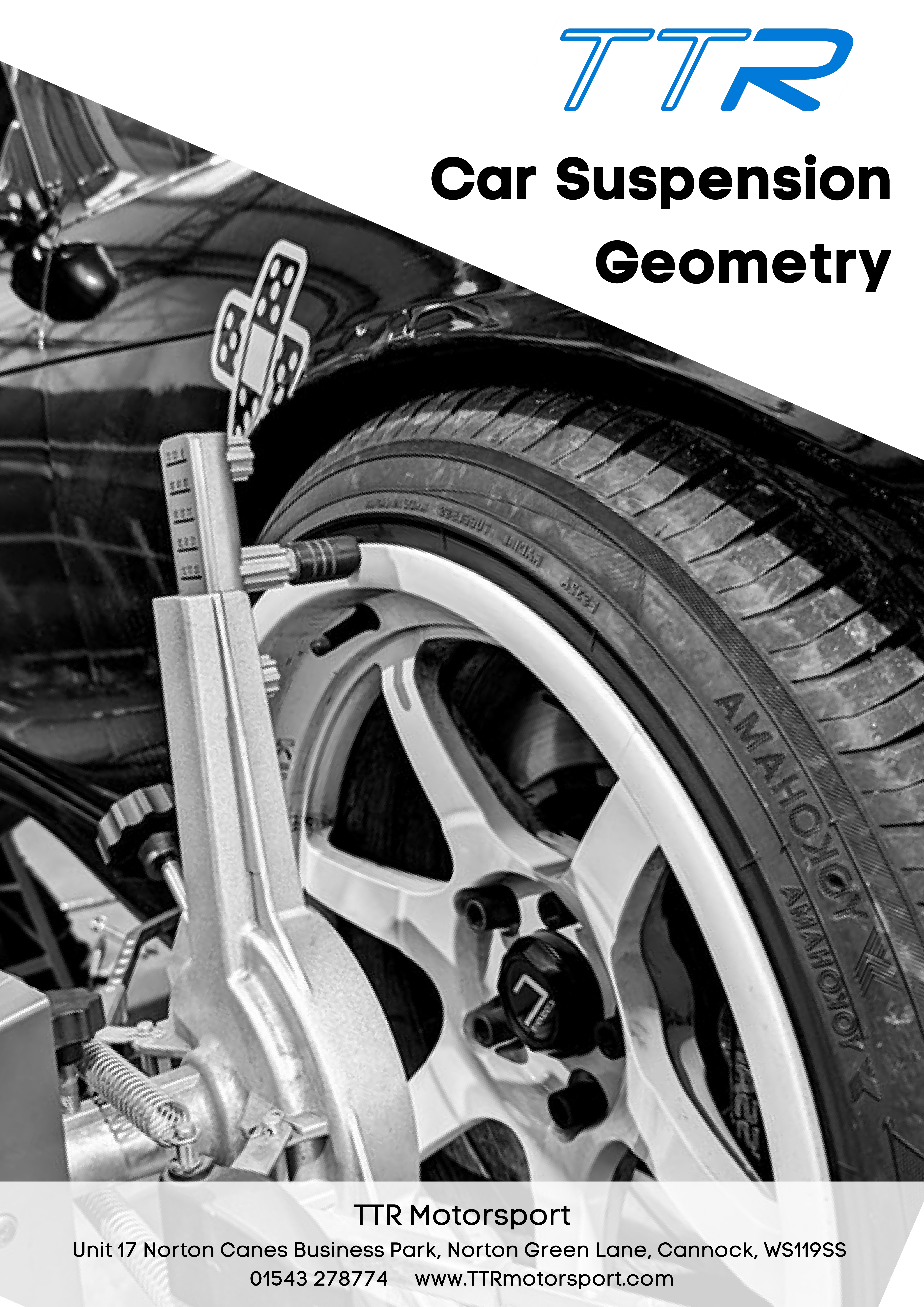




Car Suspension Geometry



TTR Motorsport

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Introduction

Welcome to the world of
Car Suspension Geometry

Suspension geometry is a crucial aspect of a car's performance and handling. It refers to the arrangement and interaction of various components that make up the suspension system.

By gaining an insight into suspension geometry, you can optimise your vehicle's handling, stability, and tyre performance.

In this quick guide, we will dip into the fundamentals of suspension geometry and provide you with valuable insights to help you get started on your journey towards better car performance & handling.

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Fundamentals of Suspension Geometry

Understanding Suspension Geometry

Suspension geometry involves the positioning and alignment of key components such as control arms, bushings, tie rods, and other suspension elements.

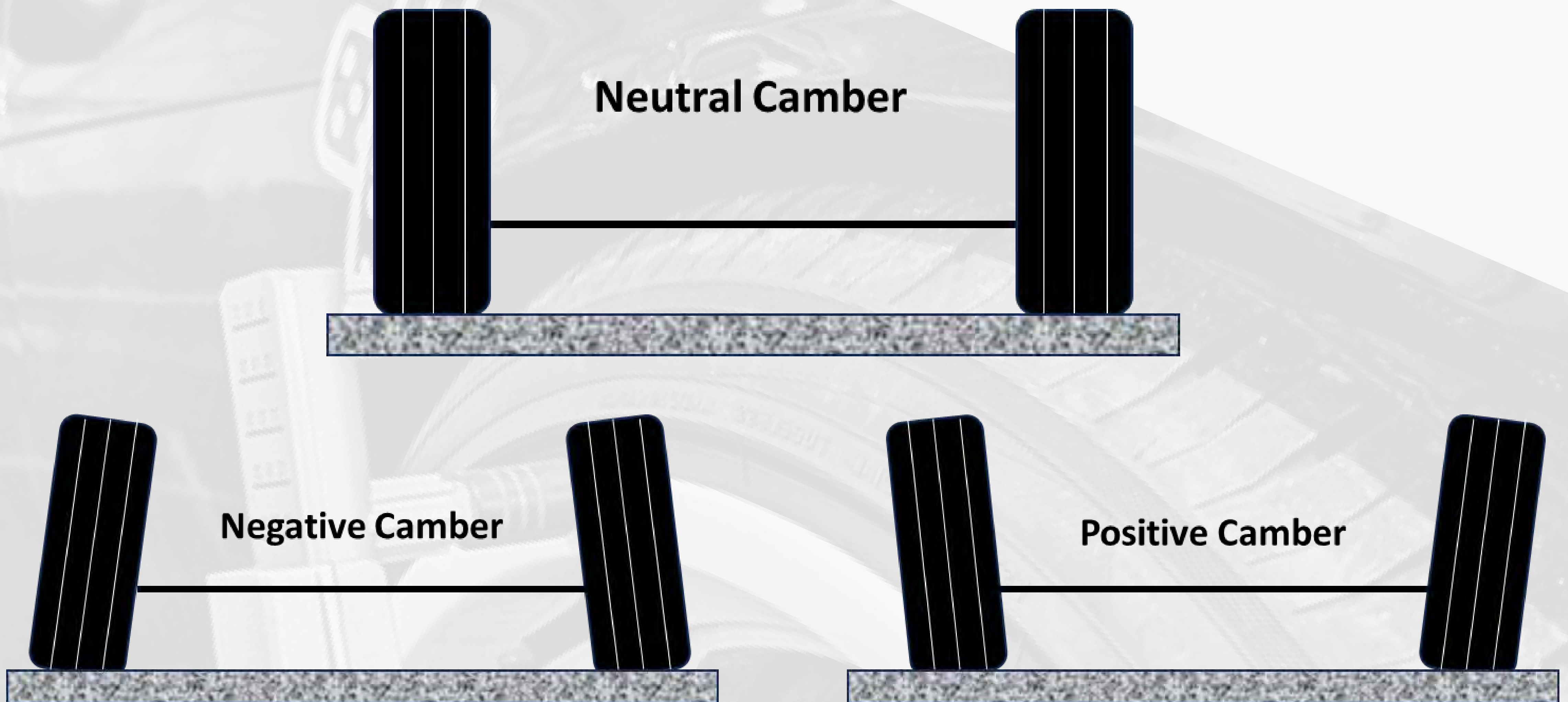
The primary goal of suspension geometry is to control wheel movement, maintain **tyre contact** with the road surface, and provide a balance between ride comfort and handling.

By carefully adjusting suspension geometry, you can influence this tolerance by altering **camber**, **caster**, and **toe** angles.

In the following pages we will uncover each of the individual aspects of geometry and explain in brief how the components work and the effects it has on the performance & handling of your car.

Camber

Camber refers to the angle of the wheel in relation to the vertical axis when viewed from the front or rear of the vehicle.



Proper camber adjustment ensures **optimal** tyre contact with the road during cornering, maximising grip and improving cornering stability.

Camber Adjustment

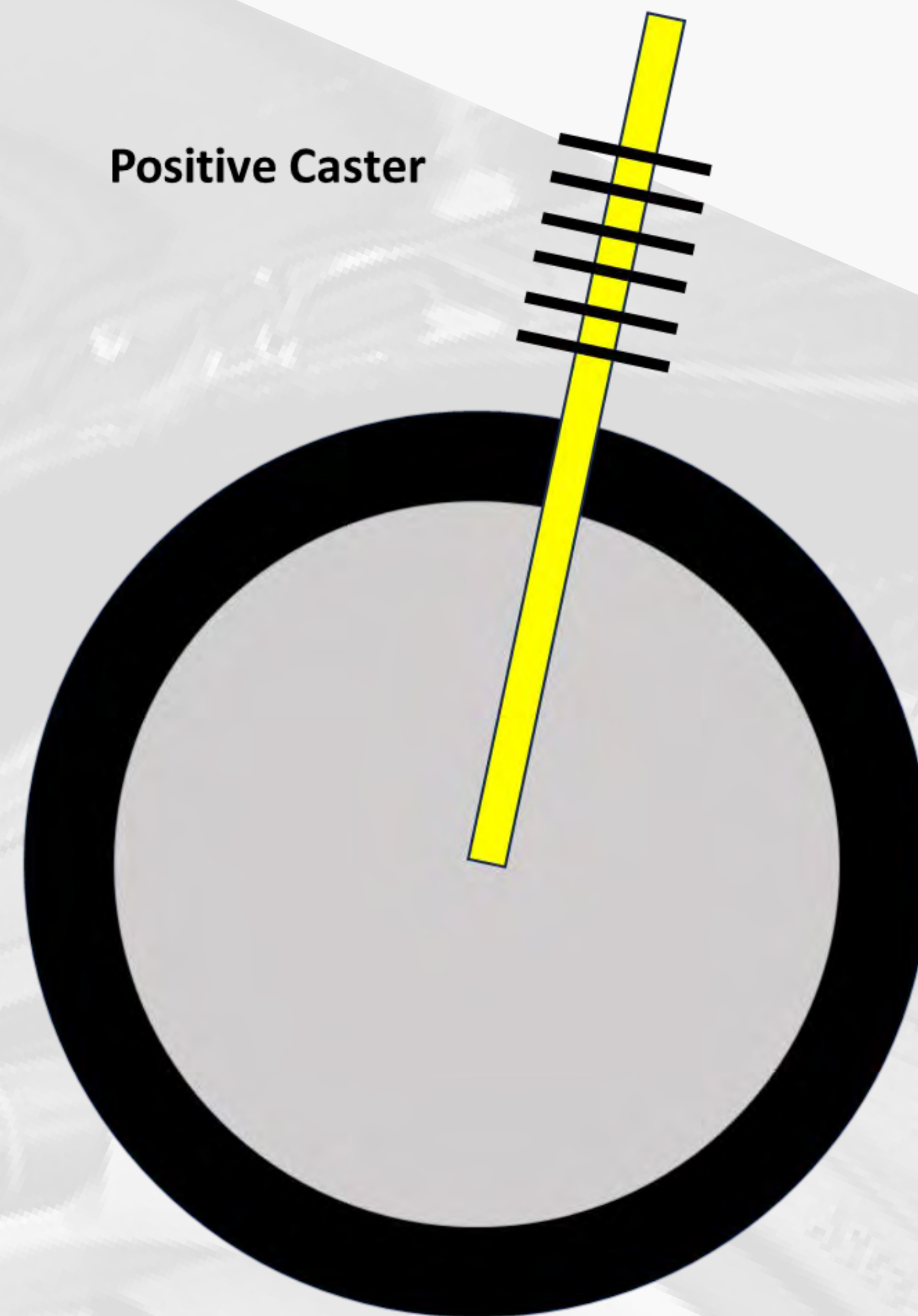
Camber can be adjusted using various methods, such as shims, adjustable control arms, or specialised suspension components.

Road cars often require slightly negative camber for improved cornering **grip**, while track and race cars may benefit from more **aggressive** negative camber settings.

Achieving the correct camber balance for your specific needs is essential for maximising tyre performance and **overall handling**.

Caster

Impact on steering feel and stability.



Caster angle is the forward or rearward tilt of the steering axis when viewed from the side of the vehicle.

It influences steering feel, self-centering behaviour, and high-speed stability.

More positive caster angle **enhances straight-line stability**, but excessive caster can make steering effort heavier.

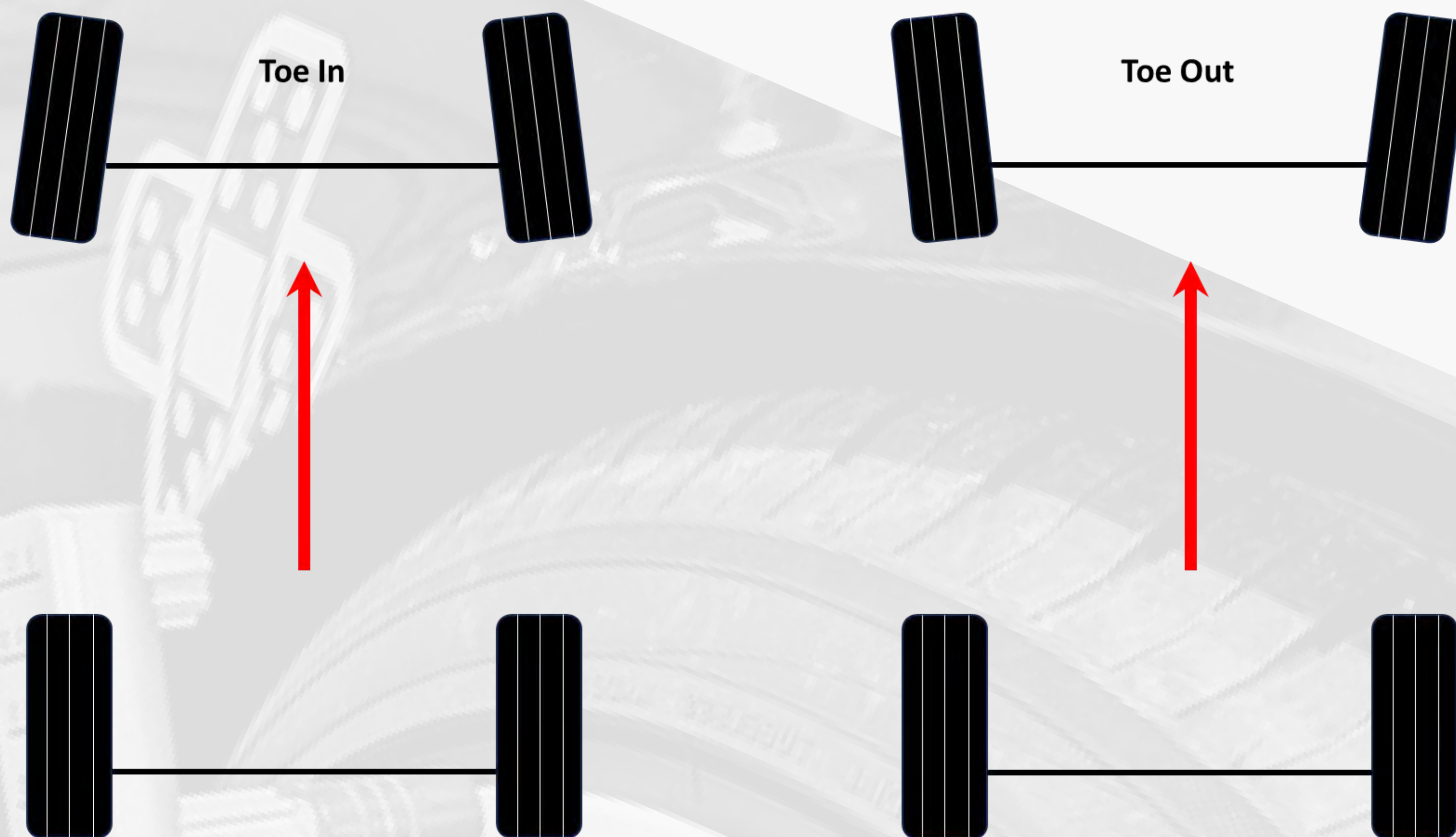
Caster angle adjustments can be made using caster plates, eccentric bolts, or adjustable control arms / bushings.

Positive caster enhances straight-line stability and improves steering self-centering.

Depending on the application, the desired caster angle may vary, and it is crucial to find the optimal setting that **balances stability and steering feel** as well as its effects on camber.

Toe

Effects on Tyre Wear & Vehicle Stability



Toe refers to the angle formed between the centreline of the vehicle and the direction that the tyres point.

Toe-in means the front edges of the tyres are closer together, while **toe-out** means they are farther apart.

Toe adjustment affects tyre wear, straight-line stability, and responsiveness during cornering.

Toe can be adjusted using tie rods, eccentric bolts, or other adjustable components.

Proper toe alignment minimises tyre scrubbing and **uneven wear**, improves straight-line stability, and enhances responsiveness during cornering.

Depending on the intended use, slight toe-in or toe-out settings can be employed to achieve the desired handling characteristics.

Ride Height

Distance between the ground and the vehicle chassis



Adjusting ride height affects weight distribution, aerodynamics, and **overall handling**.

Determining the ideal ride height depends on various factors, including the vehicle type (coupe, sports car, SUV, etc.)

Intended use (road, track, off-road), and the design of the suspension system will all have an impact on the ride height required.

It is **essential** to consider these factors and work with knowledgeable professionals to find the right balance between **aesthetics, performance**, and practicality when adjusting ride height.

Corner Weighting

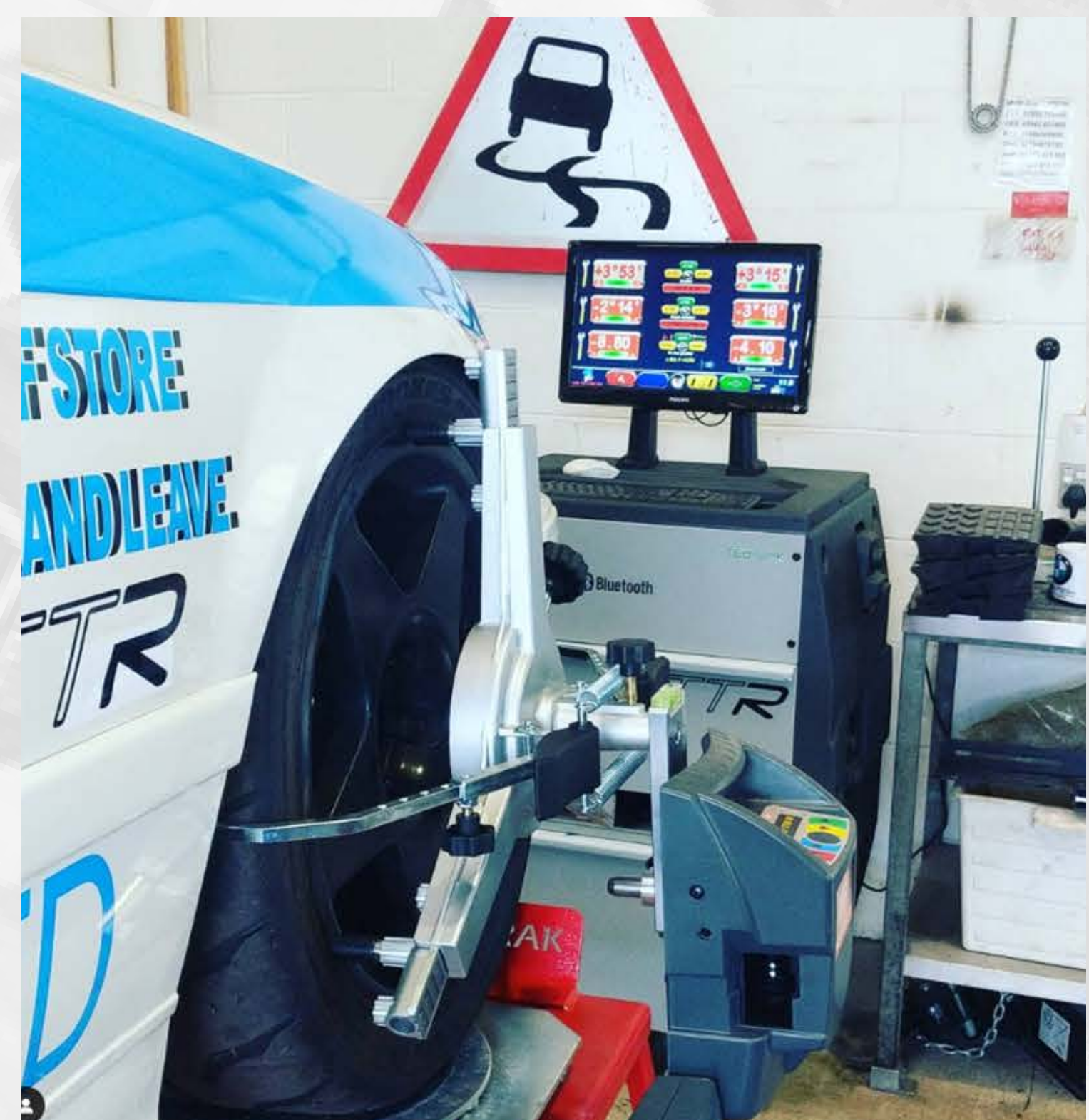
Adjusting the weight distribution on each corner



Corner weighting involves measuring and adjusting the weight distribution on each corner of the vehicle.

Proper corner weighting optimises balance, enhances grip, and improves overall handling performance.

It is recommended to consult a professional who will utilise specialised equipment to achieve accurate and precise corner weighting.



Suspension Alignment

Also known as Wheel Alignment Geometry or Geo

Suspension geometry, also known as wheel alignment, ensures that the wheels are set to the manufacturer-specified angles that they recommend for a balance of safety, handling, tyre wear & fuel economy.



Standard Wheel Alignment:

A basic alignment that focuses on adjusting the wheel angles to ensure they are within the manufacturer's tolerances. It aims to improve tyre wear, rolling resistance, straight-line stability & safety.

Full Suspension Geometry Setup:

A **comprehensive** evaluation and adjustment of the suspension system, including wheel angles and suspension component alignment. It optimises dynamic behaviour, traction, and handling characteristics. Requires specialised expertise and equipment for fine-tuning performance.

Suspension Upgrades

Upgrading suspension components

The **best upgrades** for improving a car's suspension performance include:

Performance Coil-over Suspension: Adjustable ride height, damping, and spring rates for better control and customisation.

Anti-Roll Bars (Sway Bars): Stiffer bars reduce body roll, improve stability, and enhance traction.

Performance Shocks/Struts: Upgraded damping control for improved road contact, stability, and handling.

Adjustable Control Arms: Precise alignment adjustments for optimising suspension geometry and enhancing handling.

Polyurethane Bushings: Replacing rubber bushings with polyurethane reduces deflection, improving control and responsiveness.

Performance Alignment: Professional alignment tailored to your preferences and requirements improve handling & stability.

Consider factors such as your vehicle's make and model, intended use, and **personal preferences** when selecting upgrades.

Track Geometry Optimising A Track Setup

Track driving requires a different suspension setup compared to road driving.

Adjustments such as increased negative camber, optimised toe settings, and firmer suspension tuning can enhance grip and reduce body roll.



Experimentation and fine-tuning based on track conditions and driving preferences along with analytical data are key to finding the optimal suspension geometry for track use.

Race Geometry

Optimising A Race Setup

Racing demands an even more precise suspension setup tailored to specific race requirements.

Advanced techniques like suspension kinematics analysis, roll centre adjustments, Tyre temperature data and dynamic weight transfer optimisation can provide a competitive edge.



Professional race teams often rely on extensive data analysis and expert knowledge to fine-tune suspension geometry for maximum performance.

Maintenance & Inspections

Regular inspections of suspension components ensure their proper functioning and longevity.

Look for signs of wear, damage, leaks, or loose connections in control arms, bushings, and other suspension parts.

Regular maintenance, such as greasing joints and replacing worn-out components, is crucial for maintaining optimal suspension geometry.

Suspension-related issues can **manifest** as uneven tyre wear, excessive body roll, or poor handling.

Common problems may include misaligned suspension geometry, worn-out bushings, or damaged components.

A systematic approach involving inspection, diagnosis, and appropriate **corrective measures** can help resolve suspension-related problems.



Conclusion

By gaining a **solid understanding** of the fundamentals of suspension geometry and implementing proper setup and adjustments, you will optimise your car's handling, stability, and overall driving experience.

By delving into the principles of suspension geometry and comprehending the synergy between components, such as control arms, bushings, tie rods, and more, you can achieve a finely tuned suspension system that **enhances** your car's performance.

Properly adjusting key parameters like camber, caster, and toe by even fractions of a degree can **significantly impact** tyre contact with the road, cornering grip, straight-line stability, and overall responsiveness.

By finding the right balance in suspension geometry, you can improve grip, reduce understeer or oversteer tendencies, and enjoy a more precise and **enjoyable driving experience**.

Remember, suspension geometry is not just a technical concept – it's a gateway to unlocking **the full potential** of your vehicle. By mastering the fundamentals and employing the principles discussed in this guide, you can take control of your car's performance, elevate your driving skills, and experience the **exhilaration of optimised suspension geometry**.

Embrace the journey of exploring suspension geometry, continue to expand your knowledge, and never hesitate to seek professional assistance when needed.

With the proper setup and adjustments, you can transform your car into a precision-handling machine that brings joy and excitement to **every drive**.

Looking For More?

Understanding geometry is no mean feat but putting it into action is even more complex.

But we have you covered. If you are looking to get your car set up by professionals, maybe even want to analyse the data or experience the set-up for yourself why not choose one of our options below?

Precision Package - £479

- **Full Suspension Setup:** Our expert team will meticulously set up your car's suspension, including ride heights, corner weights, and suspension geometry.
- **Professional Expertise:** Benefit from the knowledge and experience of our skilled technicians to ensure optimal performance and handling
- **Drop-off Convenience:** Simply bring your car to our workshop, and we'll take care of the rest, providing you with a fully tuned suspension setup.
- **Report** print out on Before & After Settings.

*"The suspension setup and tuning they did on our Mazda MX5 Mk 4 was fantastic. The car was smooth on road, and very competent on circuits in the UK and EU in both dry and wet conditions. The confidence it inspired was amazing, and allowed us to really push the car knowing it was setup correctly".
Katia & David - MX5*

Enhanced Package - £979

- **Full Suspension Setup:** Our expert team will meticulously set up your car's suspension, including ride heights, corner weights, and suspension geometry.
- **Professional Expertise:** Benefit from the knowledge and experience of our skilled technicians to ensure optimal performance and handling.
- **Drop-off Convenience:** Simply bring your car to our workshop, and we'll take care of the rest, providing you with a fully tuned suspension setup.
- **Consultation:** Upon collection and after a test drive, Engage in detailed one-on-one consultation with our expert. Gain insights into how your car suspension works, explore the progression path for performance enhancements, discuss potential upgrades, and analyse the initial setup and its impact on the end result.
- **Added Expertise:** Expand your understanding of suspension geometry, techniques, and the performance potential of your car through this personalised consultation session.

"Track Toys Racing has been our "go-to" for road and track support and maintenance for over 10 years. They are always amazing at customer service, work done, explaining what they are doing and what to expect, and the improvement to our cars both on road and circuit has been amazing."

Dave - Porsche



Elite Experience - £1479

- **Exclusive 1-2-1 Suspension Geometry Workshop:**

Join our expert in a half-day workshop where you can observe, learn, and interact as your car's suspension setup is fine-tuned. Ask questions, gain hands-on knowledge, and witness the transformation of your car's handling and performance under the guidance of our in-house professional.

- **Comprehensive Learning Journey:** Combine the benefits of a tailored suspension setup, expert consultation, and immersive workshop experience. This package offers the pinnacle of customisation, knowledge, and personalised attention.

- **Full Suspension Setup:** Our expert team will meticulously set up your car's suspension, including ride heights, corner weights, and suspension geometry.

- **Professional Expertise:** Benefit from the knowledge and experience of our skilled technicians to ensure optimal performance and handling.

- **Ultimate transferable knowledge** & learning journey, take the information you have learnt to enhance all future decisions from your next car to options for upgrades.

- **Lunch** will be included and also give you the chance to digest your newfound knowledge and understanding. Chat with our team to answer any final questions you may have. Discuss the data and how the changes that have been made to your car will transform your car's handling, grip and optimum performance.

- **Exclusive gifts** to take away, including a TTR trophy, 'Your Track Day Guide' Book (co-written by our in-house expert) Workbook for all important notes and data. Pictures of your experience & more.



Note: Our packages are designed to cater to different levels of involvement and budget, providing you with flexibility and choices.

Each tier adds significant value and expertise, ensuring that you get the most out of your investment in improving your car's suspension performance.

Group Bookings

If you have a club or group of friends that would like to take advantage of our 'elite package' this is something we can offer, just get in touch with one of the team with your requirements and we will create a bespoke package for your group.

Spaces are **strictly limited** due to busy racing schedules so pre-booking is **essential**.

We only offer a maximum of 4 workshops per Month

Have your car details to hand

Call Our Team Now on

01543 278774

Or

Submit your details via our website & One of our team will get back to you with available dates.

www.TTRmotorsport.com/Workshop

