Weston Performance.com | Car Suspension and Chasis Tuning installation and Setup

Performance Car Chasis Tuning Packages
Here at Weston performance we believe in tailoring your vehicles tuning to your specific needs.
We are aware that every customer has different demands on there vehicle so the tuning packages are more to give you an idea of what can be done to the vehicle. And not a strict guide line to follow.
We offer four basic power train, chassis/suspension transmission and braking packages for all vehicles. We believe it is best to enhance the complete vehicle and not just one area at a time

With any chassis/suspension setup it is important to look at the job you want your vehicle to do.

This could be anything form driving on public roads to rallying to circuit racing to drag and drift racing, and the vehicle would require a completely different setup for each of these areas.

However there are good compromises that can be made to create a vehicle setup that performs well in a number of areas.

Try and work out how your car is handling click here to see our cause and effect chart in the technical section

Chasis Tuning Packages
Weston chassis stage one
It is important that the vehicles chassis and suspension are working as well as possible for the car to handle well in its standard form, therefore for stage one there are various products we can offer to help improve the standard package.

Up rated Powerflex bushes.

Suspension bushes are some of the most highly stressed components fitted to a motor car. They undergo enormous strains and in the most arduous of conditions with no maintenance or lubrication. The material they are manufactured from is a rubber compound containing natural products which deteriorate with age. It becomes softer and more pliable, resisting the forces placed on it less and less. Therefore allowing more and more movement of suspension components and offering less and less control over the suspension geometry.

This in turn causes accelerated tyre wear, braking instability and poor handling. This is the single biggest reason you can instantly tell the difference driving a three year old car compared to a showroom new one. However even new cars will benefit from powerflex bushes because of their superior design they offer much more effective control of the suspension components to a much greater extent than normal rubber items.

We offer a large range of Power flex bushes.

Click here for applications list

For a vehicle suspension system to work correctly it is important that the chassis is as stiff as possible, for this reason we recommend the use of upper and lower strut braces to stiffen the chassis between suspension pickup points.

Weston chassis stage two
For stage two we would generally recommend (depending on the type and age of the vehicle) that you change the dampers. For most applications a coilover package is the best option offering the most adjustability for your money.

This would include springs and dampers, the spring seats are adjustable offering adjustable ride height and corner weight balance. As part of stage two your coilovers are fitted in our workshop where the car is set up on the flat patch where castor, camber, toe and corner weights are checked and where possible adjusted to manufacturer specifications or to match your given application (rallying, drag racing, circuit racing E.T.C.).

Weston chassis stage three
Firstly if the vehicle is still suffering adverse body roll even with the fitment of good quality dampers and springs, anti roll bars can be added to increase roll stiffness, a nice trick you can play with adjustable anti roll bars is to tension and slacken front and rear bars to change the car from under steering (front pushing on in corners) to over steering (rear end sliding round in corners).

With any chassis/suspension package the way your vehicle behaves on the road or circuit is only as good as the way it is set up and adjusted.

For stage three we liaise with you the customer to assess what it is you want from your vehicles handling behaviour and look at what components need to be changed to achieve this. Assuming that you already have good bushes and good quality shocks and springs we then change components to allow more adjustment to the Camber Castor and Toe.

These components would typically include:

Adjustable top mounts

Adjustable upper or lower rear arms

Adjustable lower front arms

Adjustable Castor rods

Weston chassis stage four
As this guide is generic covering a wide range of vehicles by stage four it gets very difficult to predict specific modifications. At this stage we are really dealing with custom work:

Movement of chassis pick up points

Fully rose jointed suspension

Please enquire with your particular requirements.

Chasis Tuning Technical
Purpose of suspension
Suspension by definition means the vehicle is riding or hanging on something with give. It has to have some flexibility and over the years a great deal of ingenuity has been expended on a wide variety of materials and methods of employing them. Mounting the axle directly to the frame of a vehicle would subject the occupants and general components to severe shocks. It is known that when a wheel strikes a bump the vertical acceleration will cause considerable shock, this is because the vehicle chassis can not move upwards quickly enough and without suspension the inertia would probably buckle the wheel (you can observe this situation when riding a unsuspended bicycle over a bump).

A spring fitted between the wheel and the vehicle chassis allows the wheel to move up and down without causing similar movement of the chassis. The spring will absorb road shocks and allow the wheel to follow the irregular contour of the road surface: for this purpose the wheel assembly should be as light as possible.

Coil Spring
The coil spring has many virtues, it is light, compact, inexpensive, variable in length, rate and diameter, friction free and there is a mass of knowledge concerning its manufacture and use. The spring is usually made from high quality round steel bar with an extremely accurate outside diameter. Heated, the rod can then be wound into equal coils, tapered, given varied diameter on the coils all to achieve different results in use. Final heat treatment gives it extreme resistance against failure or deformation in use.

This spring is often used in conjunction with independent suspension, front and rear, although the absence of interpolate friction has prompted some manufacturers to use it at the rear with a dead axle. Coil and torsion bar spring are superior to leaf spring as regards to energy storage (energy storage in a given weight of spring). The rate of the spring is governed by the length and diameter of the wire and the number of active coils.

Coil springs are used on literally millions of road cars and race cars, on road cars they are mainly used on the front in McPherson strut designs and on the rear with a Dead axle or rear trailing arms, on sporty models they may be used in

conjunction with a rear anti roll bar to prevent body roll.

On race cars they are used in many different configurations the main one being the double wishbone design and adaptations of this.

Purpose of a damper
When a wheel strikes a bump energy is given to the spring, which is deflected. When the bump is passed, rebound or release of the energy will take place, and will carry the spring past the normal position to set up an oscillating motion. This action is similar to the action of a pendulum – a freely suspended pendulum will oscillate for a considerable time after being struck.

In order to give a comfortable ride, some device must be fitted to absorb the energy stored in the spring and so reduce the number of oscillations occurring between the initial bump and the return of the spring to the rest position. This is the duty performed by the damper.

Some suspension/chassis tuning terms explained
Castor
Caster is the side view of the Kingpin axis. It is the inclination of a line drawn through the ball joints. Usually the line slants toward the front of the vehicle. This also relates to stability.

Camber
Camber is the inclination of the tyres from vertical, as viewed from the front of the tyre. Camber is measured relative to the ground, not relative to the chassis. Positive camber means the top of the tyre is leaning away from the chassis, negative camber means the top of the tyre is leaning towards the chassis.

Kingpin inclination
The kingpin axis is the line drawn through the upper ball joints, as viewed from the front. A positive kingpin axis is inclined toward the tyre at ground level. The lower ball joint is closer to the tyre than the upper ball joint when the Kingpin axis is positive.

Most vehicles have a positive kingpin axis in order to provide a cantering effect in steering. With a positive Kingpin axis the chassis is at its lowest point when the steering is straight forward. Thus the chassis seeks to return to zero steer after steering movements.

Centre of gravity
The point at which the whole vehicle would always stay perfectly balanced whether on its side, nose or even upside down. This is Difficult to locate precisely but close estimates are practical.

Spring rate
The load necessary to deflect any spring by a given distance, Lbs/in or Newton’s/mm.

Wheel rate
This is spring rate as seen by the wheel after the suspension leverage effects.

Sprung weight
This consists of parts of the vehicle supported by the springs. Generally taken as gross weight, less un-sprung weight.

Un-sprung weight
This is normally taken as wheels, tyres, hubs, outboard brakes E.T.C. plus half the weight of any of the linkages, outboard coils/dampers.

Roll centre
The roll centre is an invisible moving point about which a vehicle is considered to rotate in a corner. This is easy to plot in a static situation, but far from easy once the vehicle is moving.

Weight transfer
Lateral weight transfer is caused by cornering forces which transfer weight across the car towards the outside of the turn direction and away from the inside of the turn direction. The transfer of weight increases the vertical load to the outer tyres by subtracting some of the vertical load from the inner tyres.

Normally vertical load is good for tyres as it increases grip available for cornering. In the case of increased vertical load caused by transfer, however, the physics of the tyre performance ensure that amount of lateral grip added to the outside tyres is less than the amount of lateral grip removed from the inside tyres. Thus, the overall effect is a loss of lateral grip just when you need it most.

One way to increase cornering performance then is to minimise lateral weight transfer and so reduce that portion of the vertical load that is transferred from one side of the car to the other.

In this situation it is only these cornering induced transfer loads that we want to reduce and not any net additional vertical load gain from aero down force. Aero down force adds vertical load roughly equally to each side of the car and this increases the amount of lateral grip available from the tyres. It is important to understand net grip gains from down force via aero effects versus the net grip losses from load transfer during cornering.

The cause of the cornering that leads to the loss of grip is, that the track turns away from the straight and the car must turn with it and follow the road around the corner.

On the majority of the world race circuits you have to turn a full 360 degrees more in one direction than the other to arrive back at the start line. In doing so the car is naturally forced to undergo more undesirable lateral load transfer in one direction than in the other. If all the turns were to the left it would be possible to reduce the amount of lateral load transfer by the simple means of pre shifting the cars static weight distribution in the same direction, in other words to counter the left turn induced lateral load transfer you would start out with more of the cars weight already shifted towards the left hand side of the car.

With the weight so moved the car would still suffer lateral weight transfer during left hand turns but this would have the effect of moving the weight back towards the centre of the car. Thus the lateral grip loss caused by load transfer to the outside of the car would be reduced, enabling a higher cornering speed.

Chassis Common Problems.

Car has harsh ride qualities, much sliding and wheel patter

Car will not absorb road surface irregularities but crashes over them.
This car is over damped. Dampers are too hard

Wheels do not return quickly to roads surface after displacement; inside wheel in a corner may be pulled off the road by the damper

The car may ‘jack down’ over bumps or in long corners causing loss of tyre compliance.
Too much rebound damping

Harsh reaction to road surface irregularities

Car slides rather than sticking
Too much bump force Too much bump damping

Car’s reaction to lateral and longitudinal load transfer too harsh
Too much low piston speed bump damping

Car’s reaction to minor road surface iregulations too harsh
Too much high piston speed bump damping

Car’s reaction to major bumps can be violent
Low speed bump damping too harsh.

Car floats a lot in ride and oscillates after bumps
Too little shock All round soft suspension

Car dives and squats a lot
Low spring rates

Car rolls quickly and may tend to fall over onto the outside front tyre during corner entry and onto the outside rear during corner exit

Car is generally sloppy and unresponsive
Too little damping

Car oscillates after bumps
Too little rebound force

Initial turn in reaction soft and sloppy

Excessive and quick roll, dive and squat
Too little bump force

Suspension may bottom over largest bumps on the track, resulting in momentary loss of tyre compliance and excessive instantaneous loads on suspension and chassis
Too little high piston speed bump force

Car is generally sloppy in response to lateral and longitudinal load transfers and driver steering inputs
Too little low piston speed bump force

Car darts over bumps, under the brakes and during corner entry

Car wont point into corners
Front toe-in – too much

Car wanders under braking and may be somewhat unstable in a straight line, especially in response to one wheel or diagonal bumps and wind gusts

May point into corners and then refuses to take set
Front toe-out – too much

Rear feels light and unstable on corner entry

Car slides through corner rather than rolling freely
Rear toe-in – too much

Power-on oversteer during corner exit
Rear toe-in – too little

Power oversteer during exit or in a straight line

Straight line instability
Rear toe-out

Excessive physical steering effort accompanied by too much self-return action
Front wheel caster – too much

Car too sensitive to steering

Too little steering feel and feedback
Front wheel caster – too little

Steering effort harder in one direction than in the other

Car pulls towards wheel with less caster
Front wheel caster - uneven

Inside of tyre excessively hot or wearing too rapidly. At the front this will show up as reduced braking capability and at the rear as reduced acceleration capability
Camber – too much negative

Outside of tyre will be hot and wearing. This should never be and is almost always caused at the rear by running too much static positive camber in an effort to prevent excessive negative under the influence of the wing at high speed. Will cause corner exit oversteer and reduce tractive capacity. If extreme, may cause corner entrance instability. At the front it is usually caused by excessive chassis roll or by insufficient roll camber compensation in the suspension linkage and will cause understeer after the car has pointed into the corner<
Camber – too much positive

Car darts over bumps and understeers on corner entry
Bump steer front – too much toe-in in bump

Car wanders under braking and may dart over one wheel bumps or in response to wind gusts

Understeer after initial turn in
Bump steer front – too much toe-out in bump

Same as static toe-out but less effect
Bump steer rear – any toe-out in bump

Roll axis too far out of parallel with mass centroid axis leading to non-linear generation of chassis roll and lateral load transfer; the tendency will be toward too much load transfer at the rear, which will cause oversteer
Rear roll centre too low – or front too high

Opposite of above, tending toward corner entry understeer and three wheeled motoring on corner exit
Front roll centre too low – or rear too high

Car tends to trip over its front feet during slow and medium speed corner entry

evidenced by lots of understeer. Quick fix is to increase front ride and roll resistance and to raise front roll centre
Front track too narrow in relation to rear

Harsh ride; excessive wheel patter, sliding and wheel spin

High temperature reading at centre of tyre
Too much tyre pressure

Soft and mushy response

High tyre temperatures, with dip at centre of tread

Reduced footprint area and reduced traction
Too little tyre pressure

Gradually increasing understeer
Front tyres ‘Going Off’

Gradually increasing oversteer
Rear tyres ‘Going Off’

Drags inside rear, which reduces corner entry understeer

Increases corner exit oversteer
Inside rear tyre larger diameter than outside (reverse stagger)