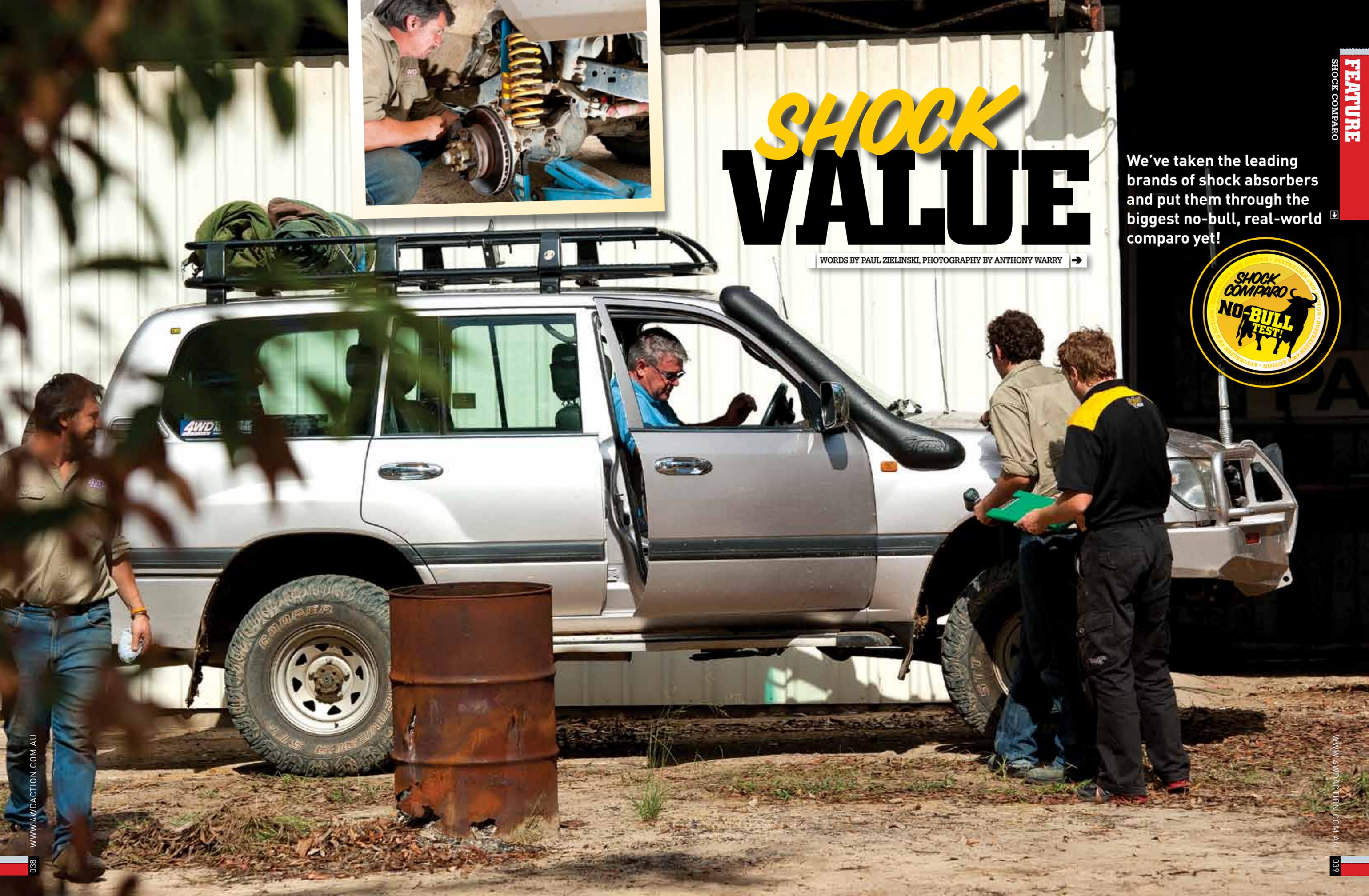


SHOCK VALUE

We've taken the leading brands of shock absorbers and put them through the biggest no-bull, real-world comparo yet!

WORDS BY PAUL ZIELINSKI, PHOTOGRAPHY BY ANTHONY WARRY →



Undoubtedly, the humble shock absorber is one of the most underrated components in a 4WD's suspension. Off-road your 4WD's suspension, in particular the shock absorbers, is under enormous forces, rapidly moving up and down. Without a set of shocks fitted, you'd be lucky to drive little more than 50m before the vehicle was overcome by an uncontrollable bounce.

With this in mind, we've undertaken a comprehensive no-bull shock absorber comparo to help you get the most out of your 4WD's set-up. This comparo focuses on real world and controlled environment testing on nine leading brands of 4WD shock absorbers to see how they stack up.

Just how well do each of the shocks handle rough terrain, both on and off-road? Do they give the driver confidence behind the wheel? Is it possible to get a great all-rounder? How bushproof are they? After all, along with the cost, these are all factors that influence our decision when we're looking to purchase a new set of shocks.

Also along for the real-world testing on this comparo, we've called on the expert driving skills of Bruce Garland. Bruce is one of only two Aussies to have competed in the Dakar Rally in his highly modified Isuzu D-Max 4WD ute. He's also racked up an impressive collection of trophies for a number of off-road rallies, including the Australian Safari.

He's definitely one man who

knows his way around a 4WD, and more importantly, how they should handle correctly. With Bruce behind the wheel of our 100 Series test vehicle, the shocks had nowhere to hide and were set to get put through their paces. To keep the testing completely objective, we had Bruce test each set of shocks without knowing what brand was fitted each time, we simply recorded his comments on the strengths and weaknesses of each shock along the way.

As if the driving leg of this comparo wasn't enough, we punished each shock on the dyno. Utilising state of the art equipment with a data replay facility, we were able to precisely rerun every bump the shock went through on our test track back on the shock dyno. Each

shock was graphed for performance before and after the run to determine if shock fade was a factor. So sit back as we tackle the biggest shock comparison test we've ever done!

> INSTALLATION TIP

When fitting a new set of twin-tube shock absorbers, it's important to cycle them through two full strokes in the upright position. Gas rises to the highest part of the shock after they have been lying down for a period of time. There's a chance gas can make its way through the foot valve and become trapped behind the head of the piston in the shock. This results in premature foaming, decreasing the shock's performance.

By cycling the shock through its stroke, any gas that may have made its way into the piston chamber is bled out, keeping it in the top of the outer tube where it belongs.



THE SHOCKS WE TESTED

- RAW 4x4 - Nitro Max
- TERRAIN TAMER - Premium Heavy Duty
- TJM - XGS Gold
- BILSTEIN - B6 Off-road
- RANCHO - RS9000 XL
- OLD MAN EMU - Nitrocharger Sport
- TOUGH DOG - Foam Cell
- THE ULTIMATE SUSPENSION - Aussie Rydler
- KONI - Heavy Track



THE TEST MULE

So we could focus solely on the performance differences in each shock, we eliminated as many variables as possible throughout the testing process. For the real-world testing in this comparo, we used the 4WD Action Toyota LandCruiser 100 Series as the test vehicle. It's the 4.5L petrol-powered auto model and has solid axles front and rear.

The 'Cruiser is a typical 4WD with a number of accessories to help it along in the bush. It's fitted with steel front and rear bars, rear wheel carrier, long-range tank (180L aftermarket sub tank + 90L factory main tank). It's also fitted with a roof cage, rear cargo drawers and 285/75 R16 Copper STT tyres wrapped around a set of steel wheels.

On the suspension side of things, we had a new set of heavy-duty 2in lift King Springs that were fitted by the guys out at Wholesale Suspension in Penrith. The team also thoroughly checked over the 'Cruiser to ensure everything was in top shape prior to the testing getting underway. This way we could compare the performance of each set of shocks closely, knowing the 'Cruiser's suspension components remained consistent during the test and worn parts were not influencing the ride quality.



The test was carried out with two occupants and full fuel tanks. Lead weight bags were added to the rear drawers to bring the vehicle up close to the GVM of 3180kg

The 'Cruiser was lowered onto a set of wireless scales to measure both individual corner weights and total vehicle weight



> ADJUSTABLE SHOCKS

The adjuster on an adjustable shock changes the amount of load or hydraulic pressure that will be applied to a particular valve stack. While there are a number of different designs when it comes to adjustable shocks, most technically don't adjust the sensitivity of the piston valve. They simply allow a different amount of oil to bypass the foot valve depending on the pre-selected setting.

WHAT YOUR SHOCKS REALLY DO

No matter what springs are under your vehicle, the shocks will be working surprisingly hard to limit the effects of rough terrain back through the vehicle. While the springs ultimately support the weight of the vehicle, shocks are what control the energy from your springs as your vehicle moves over any bumps.

The shock absorber's main role is to slow down and control the movement of your vehicle as the suspension travels through its full range of movement. A good shock will be able to control wheel movement over bumps while keeping the tyre in contact with the ground, within the limits of your suspension travel that is!

At touring speeds, controlling spring movement is no easy feat. Every bump that's felt from inside the vehicle will be cushioned significantly by your springs and shocks. If the shocks aren't up to the task, you'll find most 4WDs will be dancing all over the track. Not only will worn shocks make for an uncomfortable experience for everyone on-board, but it makes travelling at any speed dangerous.

There's a fine line that shock absorber engineers balance when designing a shock to get the maximum amount of control without jeopardising comfort. Countless hours of R&D are invested by shock manufacturers to refine the shock's performance to suit each vehicle and application. It's this

balance of control and comfort that defines a good shock absorber.

BEHIND THE COLOURFUL PAINT

As with many 4WD products, there are various designs and features that set out to achieve a similar result - shocks are no exception. Within the range of shocks we had for this comparo we had a mix of mono-, twin- and triple-tube design shocks, shim, spring and needle valving, and both adjustable and fixed valving, high- and low-pressure gas charge and a variety of bush materials and hardness. Before we get too carried away with the testing leg of this comparo, let's take a close look at what all these differences really mean.



NOT ALL SHOCKS ARE CREATED EQUALLY

TUBE DESIGN

> MONO-TUBE SHOCKS

All shocks essentially have a main tube surrounding the piston and shaft, similar to the cylinder in an engine. A mono-tube shock uses this tube for the internal piston surface and has no cavity between it and the external tube that makes up the main body of the shock.

Along with a piston at the end of the shock shaft, there's a second piston that floats in the lower section of the shock. Hydraulic oil and gas are separated by this floating piston. This creates a separate chamber for the gas that prevents any mixing of gas and oil, known as aeration.

Having this single-tube design gives a mono-tube shock a little advantage when it comes to dissipating heat to the air around it. In rugged off-road conditions, the only downside to a mono-tube design is the risk of damage from debris. Any impact damage to the shock absorber will directly distort the inner tube surface and damage the piston, potentially jamming it from travelling through its full stroke.

Mono-tube shocks are regarded as high-performance shock absorbers and generally run a high gas pressure to resist fading when the shock is working hard over bumps. The Bilstein we tested in this comparo was a mono-tube design shock.



> TWIN-TUBE SHOCKS

The majority of shock absorbers on the market are twin-tube design shocks. This style of shock has an outer oil chamber surrounding the main tube. The piston works similarly to a mono-tube shock with the addition of an extra valve in the base of the shock that allows fluid to pass into the outer oil tube.

The hydraulic oil and gas are together in the same outer chamber, which once the shock starts working hard can cause some aeration or foaming. To combat this foaming effect, some manufacturers install a material barrier to limit the oil and gas blending.

Foam is a material that is most commonly used in the top section of the outer tube cavity. The foam cell is designed to capture stray gas bubbles and keep them from mixing with the oil. The Tough Dog shocks that we tested were foam cell designed twin-tube shocks. Small gas-absorbing bags, known as gas cells, are also used by some manufacturers and are designed to capture any rouge gas particles in the outer tube to keep them separate from the oil. The Raw Nitro Max shocks we tested utilise this gas cell design in its twin-tube shock.



The foam lining in the outer tube helps combat shock fade by keeping the gas and oil separate

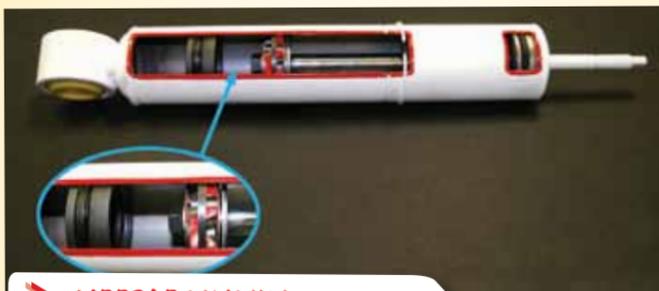


VALVING

> SHIM STACK VALVING

This style of valving is made up of small disc-shaped shims that are stacked either side of the piston. As the piston moves through its stroke, oil is forced through small ports in the piston, which push against the back of the shims. As the force moving the piston increases, the shims begin to flex, allowing the oil to pass through at a controlled speed.

The manufacturer can vary the thickness and quantity of these shim stacks to give the desired release pressure as the piston travels through the oil. This image shows the shim stack valve in a mono-tube design shock, but they are also commonly used in twin-tube shocks. Old Man Emu, TJM, Koni, Ultimate Suspension, Bilstein and Terrain Tamer all utilise the shim stack style valving.



> NEEDLE VALVING

Needle valving is quite a unique style of shock valving that is found only inside the Rancho RS9000XL. Besides the spring and disc valve arrangement on the piston, the Rancho runs a small, spring-loaded needle valve in the base of the shock as the primary method of oil control. Grooves machined along this small needle provide a track for the oil to pass through the valve's seat at a specific flow rate.

The needle valve plays a major role in the adjustment of the shock's performance, as it controls the flow of hydraulic oil circulating around the shock as it works through its stroke. The adjuster knob fitted to the base of the shock pushes against this spring-loaded needle valve, and varies the depth of the needle in its seat and determines how much of the machined grooves are exposed. The needle valve cut-away shows the variation between the softest and firmest setting and the spring-loaded needle valve itself.



> SPRING & DISC VALVING

Spring and disc valving consists of a small, specially made coil spring that's fitted to the head of the piston. The spring holds a set pressure on a disc covering small ports in the piston head. This spring allows the disc to lift off the head of the piston, exposing the ports and allowing the flow of oil.

As the disc lifts off the piston, hydraulic oil transfers from one side of the piston to the other. The spring rate that the engineers settle on for this small spring determines how hard or soft the shock feels when it's in use. There are also factors such as port (or orifice) sizing and the grade of hydraulic oil being used that influence how much force is required to compress and expand a shock. The Tough Dog and Raw 4X4 shocks we tested used spring and disc style valving.



CONTROLLING THE BOUNCE

Shock absorbers need to be able to control suspension movement over a range of different speeds and terrains. They convert kinetic energy, or movement, from the vehicle's suspension as it reacts to bumps into thermal energy, or heat. The harder a shock works to control your 4WD's suspension, the more heat that it will generate. To be able to control your 4WD well, there are a number of factors that are calculated into the R&D process before a shock becomes suitable for a specific vehicle and the intended application.

Bump and rebound are two forms of movement that a shock absorber is subjected to. Bump (or compression) is any movement where the wheel is travelling up into the guard, closing the shock. Rebound is the term given to movement of the wheel away from the guard, opening up the shock. Rebound also factors in energy from the spring as it tries to return to its normal ride height after a bump.

How well shocks control these two movements is only half the battle a shock absorber has to face. Shocks are subject to high- and low-speed movement in both directions, which is totally independent of vehicle speed. High-speed shock movement is any sharp, rapid road condition the shock has to react to, like a tree root along the track or corrugations. The shock must be able to control the rapidly moving spring, without allowing the vehicle to skip all over the track. Low-speed shock movement occurs whenever the shock is moving slowly, like when travelling over crests and dips in the road. A shock that's too soft in low-speed control can often let the vehicle continue to bounce after a large bump.

Different styles of springs, whether coils, leaves, torsion bars or even airbags, all react in slightly different ways over bumps. For example, a coil will want to bounce freely after being compressed, whereas a leaf spring develops more resistance from the leaf-pack when returning to its original position. This sees each suspension set-up demanding a specific valving to help control the vehicle.

One shock is not interchangeable with different vehicles just because it's the same length. The amount of pressure it takes to move a shock at each of these four key movements comes down to valving design that the manufacturer settles on to suit each vehicle.

With a master like Bruce Garland at the wheel, every aspect of handling was covered



> WHY UPGRADE?

Every component on mass-produced vehicles is driven by a per unit dollar figure. Even relatively small cost reductions add up to big savings for the manufacturer when it comes to producing vehicles in such high volumes. So there's a good chance that the quality of your factory-fitted shocks won't be up to the task once the going gets tough.

It's also worth considering that the standard shocks in your fourby were designed around a bog-stock vehicle, with no accessories! Add on all the usual off-road gear that we all like to get our hands on and the shocks will be struggling to support your vehicle. Often, good-quality aftermarket shocks will be designed with the 4WDer in mind. They're built to deal with many of the terrains we travel over and are tailored to handle the extra weight.

> COMBINED SHOCK SPECS

	BILSTEIN	KONI	OME	RANCHO	RAW 4X4	TERRAIN TAMER	THE ULTIMATE SUSPENSION	TJM	TOUGH DOG
	B6 OFF-ROAD	HEAVY TRACK	NITRO CHARGER SPORT	RS9000 XL	NITRO MAX	PREMIUM HD	AUSSIE RYDER	XGS GOLD	FOAM CELL
VALVE TYPE	SHIM	SHIM	SHIM	NEEDLE	SPRING & DISC	SHIM	SHIM	SHIM	SPRING & DISC
CONSTRUCTION	MONO	TWIN	TWIN	TRIPLE	TWIN	TWIN	TWIN	TWIN	TWIN
FRONT LENGTHS - MM (CLOSED/OPEN)	365/596	363/610	355/615	375/595	368/612	365/615	370/615	363/615	360/607
FRONT STROKE - MM	231	247	260	220	244	250	245	252	247
REAR LENGTHS - MM (CLOSED/OPEN)	375/595	370/610	375/620	380/590	380/625	380/615	380/615	375/615	375/622
REAR STROKE - MM	220	240	245	210	245	235	235	240	247
BODY OUTER DIAMETER	50MM	55MM	54MM	55MM	70MM	60MM	62MM	60MM	60MM
BORE INTERNAL DIAMETER	46MM	36MM	35MM	35MM	41MM	35MM	36MM	36MM	41MM
ROD DIAMETER	14MM	15.75MM	18MM	18MM	17.5MM	16MM	18MM	18MM	17MM
GAS PRESSURE	HIGH	NILL	HIGH	LOW	LOW	HIGH	HIGH	HIGH	LOW
FLUID TYPE	SEMI-SYNTHETIC	SEMI-SYNTHETIC	SEMI-SYNTHETIC	MINERAL	SEMI-SYNTHETIC	MINERAL	SEMI-SYNTHETIC	SEMI-SYNTHETIC	SEMI-SYNTHETIC
SEAL MATERIAL	VITON	VITON	HNBR	TEFLON	VITON	VITON	VITON	VITON	VITON
BUSH MATERIAL	RUBBER	RUBBER	POLYURATHANE	POLYURATHANE	POLYURATHANE	POLYURATHANE	RUBBER	RUBBER	RUBBER
BUSH HARDNESS (TESTED USING DURAMETER)	60	70	80	83	80	87	70	75	75
DUST COVER	PLASTIC	STEEL	PLASTIC / HPBE	RUBBER	RUBBER	STEEL	RUBBER	STEEL	STEEL
WARRANTY	1YR/20,000KMS	3YR / UNLIMITED	3YR / 60,000KMS	3YRS / UNLIMITED	2YRS / UNLIMITED	3YRS / 100,000KMS	2YR / 80,000KMS	3YRS / 60,000KMS	2YRS / 40,000KMS
MADE IN	GERMANY	HOLLAND	AUSTRALIA	USA	SOUTH AMERICA	SOUTH AMERICA	AUSTRALIA	CHINA	USA
PRICE	\$220 EACH	FRONT \$274 EACH / REAR \$303	\$170 EACH	\$198 EACH	FROM \$145 EACH	\$127.35 EACH	\$135 EACH	\$169 EACH	\$160 EACH

Bruce wasn't holding back when it came time to push the shocks to their limits



OUT ON THE TRACK

Covering as many terrains as possible in close proximity was always going to be a difficult task for this comparo. To maximise the most amount of variation in terrain as we could, we locked in a week of testing at an off-road racing circuit. We pieced together a 15km off-road loop that covered the most common terrain that we all see with the hubs locked. The track we had planned took in everything from high-speed corrugations and off-camber humps to slow rocky hill climbs that really got the suspension moving.

Following the off-road track, we covered a 25km on-road section that had a mix of tight sweeping turns along with high-speed straights to gauge how the shocks impact on the

on-road handling. After all, we spend a reasonable amount of time travelling on the blacktop between tracks.

The object of the dedicated off-road test track was to replicate the same conditions for every shock. This way we could directly compare how each set of shocks handled specific sections and obstacles on the track. Being the only vehicle on the track, we were able to follow the same wheel tracks for each test without being interrupted by any other vehicles.

Two loops of the dedicated off-road test track were covered for each set of shocks, with the top four performers refitted for a shootout. The first loop of the track was taken at a general touring pace. We set a target time of 10 minutes to keep the

speed of each run consistent. The aim was to travel at the pace an owner would drive after just purchasing their new 4WD.

On the second loop, we asked Bruce to step it up a notch, taking a slightly quicker pace. This second run aimed to push the shocks to their limits and replicated a slightly more demanding driving style. This run had a target time set of eight minutes.

Both loops were driven back to back with individual shock temperatures noted after each run. From these on- and off-road tests, we were able to establish the different characteristics each shock had and the overall influence on the body language of the truck, which we'll outline in the rundown of each brand.

HOW WE TESTED THEM



REAL-WORLD TESTING

Many 4WDers will have an idea of what their preferred level of comfort is. What can't be denied is the feedback from the driver's seat from a shock that is able to give good control on and off the road. The key to a good shock is a balance of control and comfort that ultimately creates a safer 4WD.

With this in mind, we set out to push each shock through a series of driving tests that would most certainly expose both the strengths and weaknesses of each shock. During the week of real-world testing, the ambient temperature was the only variable outside of our control. We must have had the weather gods on our side for this comparo, as the average daily temperature only varied from 22°C to 26°C from the start to the finish.

To keep testing as objectively as possible, Bruce was kept aside



Steep descents



High- and low-speed corrugations



Tight rutted turns



Off-camber crests

as Wayne Murphy from Mad Fab installed each set of shocks. This way each real-world test was done as a 'blind' test, eliminating any prior expectations from the results. With the dedicated test track, Bruce behind the wheel and myself riding shotgun, we were able to build one of the most consistent back-to-back shock tests yet!

We've put the results together under the rundown on each shock later in the article. So for now, let's take a look at the test track and run through what each shock had to deal with once they were fitted to the 'Cruiser.



Mud-covered ruts



Fast sweeping bends

CONTROLLED ENVIRONMENT TESTING

SHOCK DYNO TESTING

The real-world testing brought out significant differences in each shock's performance that were noticeable from inside the vehicle. To top off this comparo, we wanted to see how each shock was really affected by the heat generated during the off-road leg of our test.

To do this, we tracked down a state-of-the-art shock dyno that was able to capture and replay the exact terrain we used for our off-road test track. By hooking up a displacement sensor to one of the shocks during the real-world testing, we were able to record the two off-road loops. The first touring pace loop of the track, as well as the slightly quicker second loop, were recorded back to back. The data we collected was then able to be replayed on the dyno once we were back in the workshop.

A rear shock from each brand was loaded on the dyno one after the other and run through a standard cold performance test to gauge the base values for the shock. The dyno then

replayed the first off-road loop, followed by the quicker second off-road loop back to back.

Once the punishment from the two off-road loops had finished, we re-ran the standard performance test to establish if the shock had degraded once it was hot. It's one thing being inside a vehicle in harsh off-road conditions, but seeing what the shocks are subjected to back on the dyno is enough to give any self-respecting 4WDer cold shivers.

WHAT TO LOOK FOR

When you're looking over the performance graphs, there are a few things to look out for. During the performance test, the dyno cycles the shock over a set stroke at nine different speeds – from 0.05m/s (meters per second) to 1m/s. The columns along the bottom of each graph represent each of the nine test speeds, 0.05m/s, 0.1m/s 0.2m/s and so on. Their measured forces are displayed as a dot on the graph above each column. The top half of

the graph shows the rebound forces and the lower half shows the compression forces. Blue correspond to the cold performance test and red is for its hot test.

As a general rule, you will see low forces in the 0.05m/s to 0.2m/s range so the shock remains compliant during low-speed rock crawling situations. From 0.25m/s onwards, the forces will progressively ramp up to control the vehicle at touring speeds. The compression forces are always lower than the rebound, as rebound has to control the spring's urge to return back to its original height after a bump in the road.

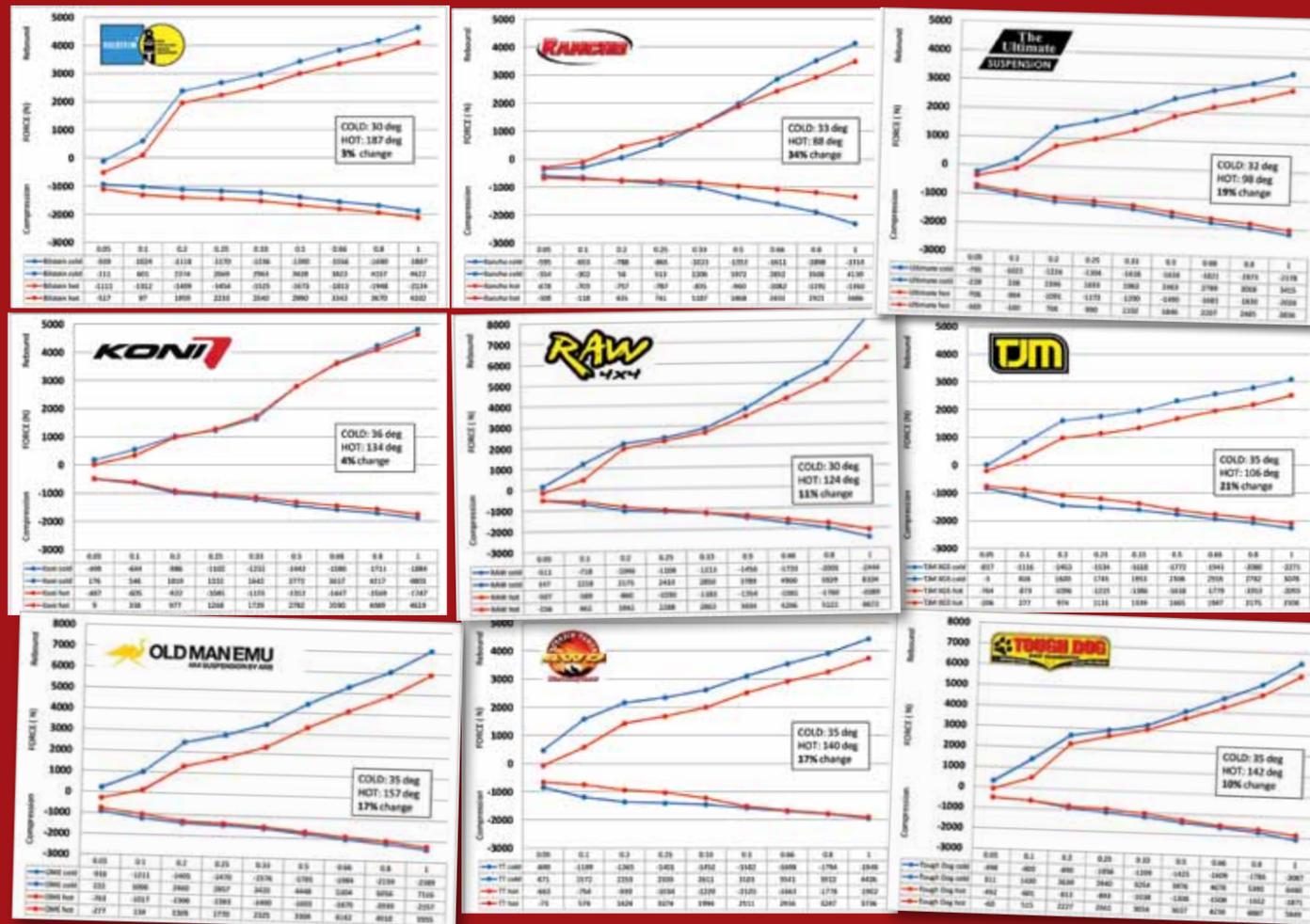
We've also measured shock temperatures at the completion of the cold and hot performance test. While the difference is displayed as a percentage of change from start to finish, things such as oil volume, twin or mono-tube design and how firm the valving is tuned all influence how heat will affect the shock.

> WHAT IS SHOCK FADE?

Shock fade is a term given to the soft feeling a shock can develop after being punished over long stretches of harsh terrain. Not all shocks are created equally, and some will be affected by fade more than others.

Shock fade begins to occur as the gas starts to overheat and tiny bubbles become mixed in with the hydraulic oil inside the shock. Once these tiny bubbles make their way to the piston chamber, they start to pass through the valving much more easily compared to the hydraulic oil. This reduces the shock's ability to control rapid suspension movement. It generally gives a soft, uncontrolled feeling back to the driver that's often noticed as excessive bounce over bumps.

If you notice this happening to your vehicle, it's best to stop for a break to give the shocks some time to cool down. Once you get back home, get them checked, as it might be time to upgrade.



THERE'S NO EXCUSE FOR A POOR-HANDLING 4WD



The maximum temperature was measured at the start and finish of each dyno run. The temps were slightly higher compared to the real-world testing where the shock is exposed to airflow when the vehicle is moving

Each shock was installed on a state-of-the-art data replay dyno and put through its paces

A displacement sensor was fitted alongside the shock to measure and record the exact movements of the shock during the off-road test track. The data was later replayed for each shock back on the dyno

HOW THEY STACKED UP

Just before we get stuck into the individual rundown on each shock, here is a quick snapshot of just what's gone into the heart of each shock.

BILSTEIN – B6 OFF-ROAD

Bilstein is no stranger in the world of high-performance shocks, and while you might find yourself paying a little more initially for each corner, the rewards are clearly evident. A strong performing mono-tube shock that is fully rebuildable.

The Bilstein B6 Off-roads held their own over practically every terrain we could throw at them. They provided great feedback and control for the driver. The slight trade-off for that precise control is that we did find the ride to be one of the firmest out of all the shocks tested, but it was still acceptable from inside the vehicle. The firm ride is only a small price to pay for the direct control for the driver.



Being a mono-tube, Bilstein offer an additional stone guard to help protect the vulnerable lower section of the shock

PRICE: \$220 each
MADE IN: Germany
WARRANTY: One year/20,000km



BRUCE'S OPINION

Braking and steering inputs proved responsive with this shock fitted. There was very minimal pitching and diving as I pushed the 'Cruiser hard on the second loop. Both off-road and particularly on-road characteristics were also improved, giving a great deal of confidence back to the driver at touring speeds.

Overall, this shock is a great driver's shock if you can deal with a slightly firmer ride.

KONI – HEAVY TRACK

The Koni Heavy Track shocks have the benefit of being adjustable. The main purpose of the adjustability is to compensate for wear as the shock, along with the rest of the suspension, gets a few years under its belt. The shock must be removed and compressed to carry out the adjustment.

While Koni originally tune the shocks to match the vehicle when it's set on the lowest setting, adjustments can still be made to suit personal applications. A cam

engages with the foot valve in the base of the shock when it's fully compressed. By turning the body and shaft clockwise, it adjusts the valve and stiffens the rebound forces of the shock. It can change the feel of the shock up to a maximum of 100% stiffer than its softest setting.

We tested the Koni Heavy Tracks on a setting of one and a half turns from soft, as per Koni's recommendation. It was matched well to the 'Cruiser with its extra gear and heavier springs.

BRUCE'S OPINION

These shocks gave a slightly firm but direct ride back through the vehicle. While they were a little firmer than most off-road, they still remained comfortable over the bumps and managed to control both bump and rebound confidently in situations that left other shocks wondering.

As a trade-off to the slightly firmer ride, you develop some very favourable handling characteristics from behind the wheel. From my point of view, the steering inputs were very direct and allowed for good feedback to the driver. They proved to give a very predictable ride both on and off-road.



PRICE: \$170 each
MADE IN: Australia
WARRANTY: Three years/60,000km



PRICE: Front: \$274 each/Rear: \$303 each
MADE IN: Holland
WARRANTY: Three years/unlimited kilometres

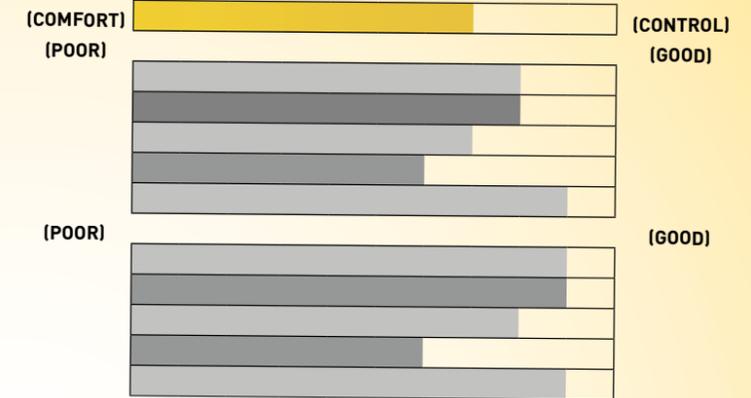


> SHOCK NAME: BILSTEIN

PERFORMANCE SCALE:

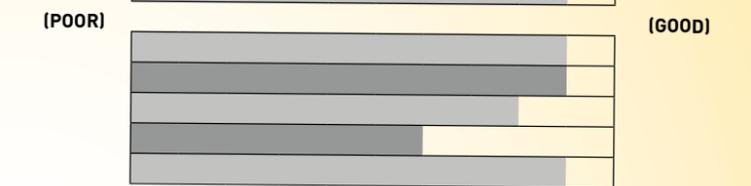
OFF-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL OFF-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)



ON-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL ON-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)



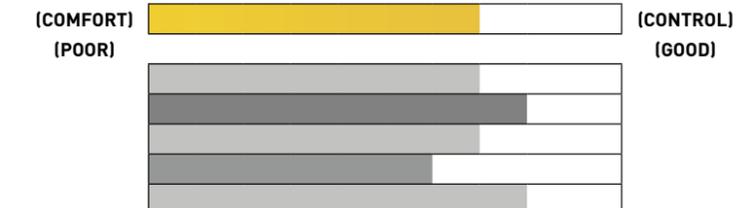
HIGHEST OFF-ROAD SHOCK TEMPERATURE 135°C
HIGHEST ON-ROAD SHOCK TEMPERATURE 60°C

> SHOCK NAME: KONI

PERFORMANCE SCALE:

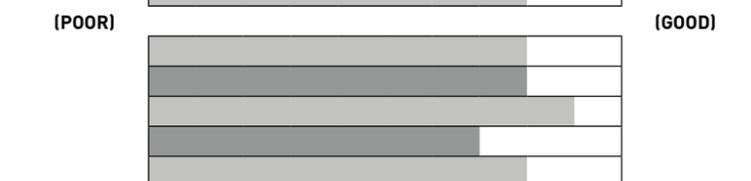
OFF-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL OFF-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)



ON-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL ON-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)



HIGHEST OFF-ROAD SHOCK TEMPERATURE 97°C
HIGHEST ON-ROAD SHOCK TEMPERATURE 41°C

> SHOCK NAME: OLD MAN EMU

OLD MAN EMU – NITROCHARGER SPORT

The Old Man Emu Nitrocharger Sport shock was a strong performer in both the real-world testing and on the dyno. It's great to see products that have been 100% designed and manufactured in Australia giving the offshore gear a run for its money.

The stone guard on the OME shocks is made of lightweight

plastic and would help to deaden the sound of stone impacts from under the vehicle. We did notice by the end of our testing that the stone guards had begun to slightly rub on the sides of the shock body. Although superficial, over time this may lead to a small amount of rubbing through the painted surface.

BRUCE'S OPINION

These shocks held up superbly over the first and second off-road test, maintaining a consistent feel from inside the vehicle over every terrain. The ride was noticeably stiffer than most other shocks, but this is always going to be a trade-

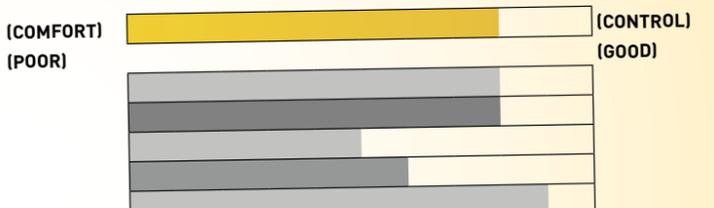
off for a high level of control on the track.

On-road, they were one of the most direct and responsive sets of shocks in the test. They showed terrific on-road manners, especially as weight shifted in the transition between left and right bends at speed.

PERFORMANCE SCALE:

OFF-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL OFF-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)



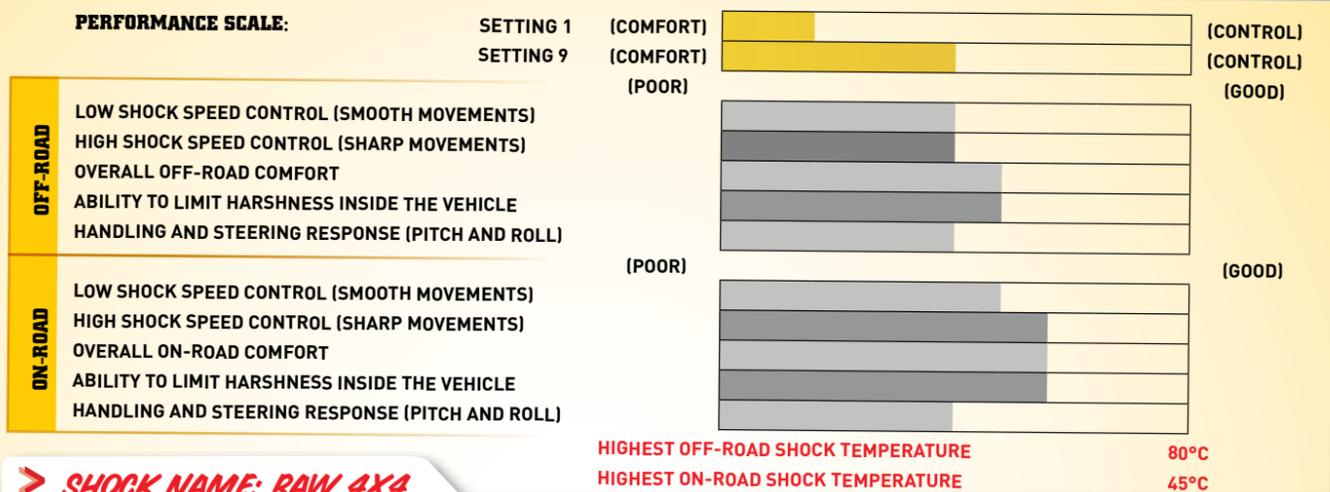
ON-ROAD

LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)
HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)
OVERALL ON-ROAD COMFORT
ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE
HANDLING AND STEERING RESPONSE (PITCH AND ROLL)

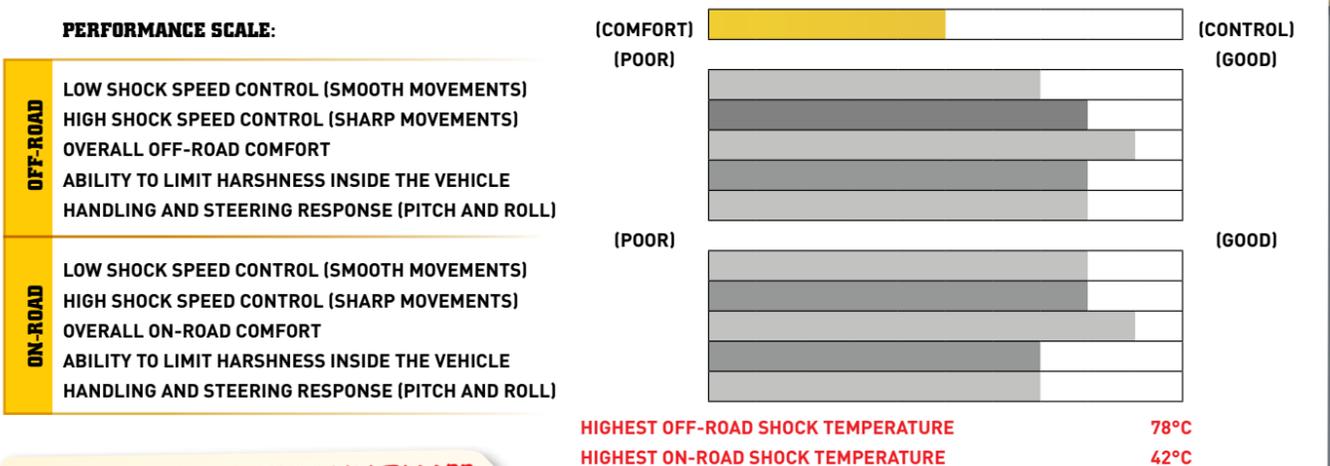


HIGHEST OFF-ROAD SHOCK TEMPERATURE 100°C
HIGHEST ON-ROAD SHOCK TEMPERATURE 46°C

> SHOCK NAME: RANCHO



> SHOCK NAME: RAW 4X4



> SHOCK NAME: TERRAIN TAMER

TERRAIN TAMER – PREMIUM HEAVY DUTY

While the Terrain Tamer shocks were a little on the softer side of the shocks we tested, it did leave you with a comfortable ride from inside the vehicle. All in all, they're a great budget shock that is up to the task. Coming in as the most affordable shock in the test, they definitely proved their worth amongst the some

of the dearer shocks in both the real world and controlled environment testing.

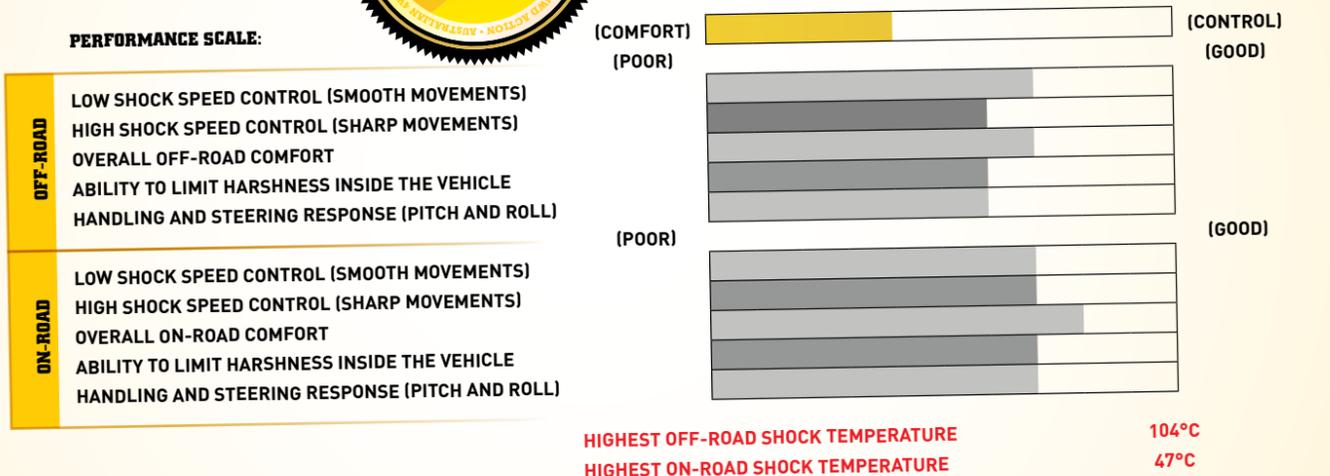


BRUCE'S OPINION

These shocks gave fairly even feedback over the various terrains we covered in the off-road test track. Off-road, the shocks allowed the vehicle to develop a slight wallow when weight was transferred from side to side over off-camber crests, which did upset the

handling slightly more than others in the test.

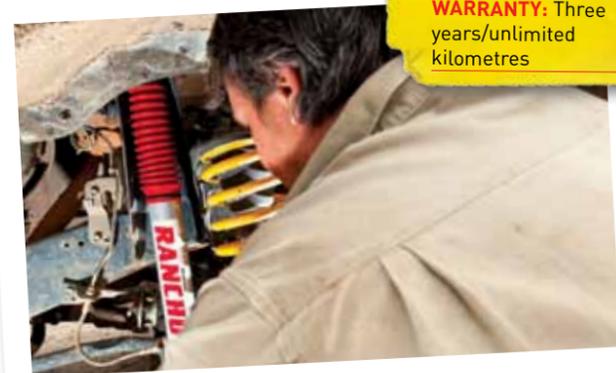
For one of the softer-feeling shocks in the test, they had good on-road manners and were more than capable of controlling the 'Cruiser at touring speeds.



RANCHO – RS9000XL



PRICE: \$198 each
MADE IN: USA
WARRANTY: Three years/unlimited kilometres



Being an externally adjustable shock comes with the benefit of tuning the shock's performance to suit a wide range of driving conditions. For our off-road test, we started Bruce off with the lowest setting of one, but soon found it to be way too soft to control the big 'Cruiser. After a quick pause, Wayne adjusted them to their maximum stiffness setting of nine so we could continue with the test.

The Rancho uses a unique valving set-up, which incorporates a triple-tube design body. The valving is controlled by a spring-loaded needle in the foot of the shock. This needle valve is directly behind the adjuster knob and controls the flow rate of oil transferred around the shock.

BRUCE'S OPINION

Surprisingly, even when Wayne adjusted these shocks set to their firmest setting, they still allowed a significant amount of body movement, particularly when weight shifted from side to side when changing directions between corners and under braking.

Being on the soft side, it did take away some driver confidence at touring speeds, on and off-road. This shock would be best suited to low speed off-road work and may well be more at home on a lighter vehicle.

THE BALANCE OF CONTROL AND COMFORT DEFINES A GOOD SHOCK ABSORBER!

RAW 4X4 – NITRO MAX

The Raw 4X4 Nitro Max is one massive shock. With its large bore size of 41mm and the fat 70mm body, the big shock took on the rough terrain off-road with ease. Along with the large body, the Raw 4X4 shock uses a unique gas cell inside the outer body to help it deal with the punishment that comes with extended off-road driving.

The large body of the shocks was a snug fit in the front suspension and did touch a small bracket for the ABS wiring on each side. It did mark the body after the shock was initially fitted, but after adjusting this bracket to free up some extra clearance, it was smooth sailing.

The bushes fitted to the pin end of the shock are one of the largest outer diameter bushes out of the shocks tested. The flat washers that were provided to capture the bush on the pin end of the front shocks did flex slightly by the end of our testing. This was put down to the washer thickness being slightly undersize in the shocks we had received for the test.



PRICE: From \$145 each
MADE IN: South America
WARRANTY: Two years/unlimited kilometres



BRUCE'S OPINION

This set of shocks did well to control the vehicle, always maintaining a high level of comfort and grip on the track. From inside the vehicle, it always felt comfortable as the shocks soaked up the tough sections of our test track. Over smooth large bumps, they did allow the 'Cruiser develop slightly more rebound compared to others in the test. Overall, these are a well-balanced shock.

> SHOCK NAME: THE ULTIMATE SUSPENSION

PERFORMANCE SCALE:

OFF-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL OFF-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	
ON-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL ON-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	

HIGHEST OFF-ROAD SHOCK TEMPERATURE: 88°C
HIGHEST ON-ROAD SHOCK TEMPERATURE: 48°C

> SHOCK NAME: TJM - XGS GOLD

PERFORMANCE SCALE:

OFF-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL OFF-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	
ON-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL ON-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	

HIGHEST OFF-ROAD SHOCK TEMPERATURE: 86°C
HIGHEST ON-ROAD SHOCK TEMPERATURE: 42°C

> SHOCK NAME: TOUGH DOG

TOUGH DOG - FOAM CELL

The Tough Dog Foam Cell came in with the longest stroke out of the rear shocks we tested. It was also the equal-first largest bore size at 41mm, and the only shock to utilise the foam cell design. They were one of the only shocks to have a secondary stone guard skin on the vulnerable lower section of the rear shocks.

A combination of great value for money and outstanding

performance helped the Tough Dog Foam Cell take the crown of Best Shock Overall amongst some serious competition.



PERFORMANCE SCALE:

OFF-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL OFF-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	
ON-ROAD	LOW SHOCK SPEED CONTROL (SMOOTH MOVEMENTS)	[Progress bar]	
	HIGH SHOCK SPEED CONTROL (SHARP MOVEMENTS)	[Progress bar]	
	OVERALL ON-ROAD COMFORT	[Progress bar]	
	ABILITY TO LIMIT HARSHNESS INSIDE THE VEHICLE	[Progress bar]	
	HANDLING AND STEERING RESPONSE (PITCH AND ROLL)	[Progress bar]	

HIGHEST OFF-ROAD SHOCK TEMPERATURE: 91°C
HIGHEST ON-ROAD SHOCK TEMPERATURE: 37°C

THE ULTIMATE SUSPENSION - AUSSIE RYDER

The Ultimate Suspension shocks did really well over the slow-speed bumps. They gave a comfortable ride from inside the vehicle while still giving confidence to the driver as they reacted to the terrain. They also have the benefit of being rebuildable for great long-term value.

In fact, in most cases the shock can be rebuilt for as little as \$60. The warranty period of two years or 80,000km has a slightly different twist - it's whatever comes last! So for example, if you find you're only covering 20,000km per year, then the warranty will cover you for four years.

BRUCE'S OPINION

These shocks worked well with the vehicle, giving a nice controlled balance without being too firm. At slow speeds off-road, these shocks really worked a treat soaking up the terrain slightly more than others.

On some of the quicker sections of the track, a small trade-off to the softer ride was as the shocks began to move faster through their stroke, they did allow the 'Cruiser to pitch and roll a little more than the others when they faced off-camber crests.

If you don't mind a softer feel from inside the vehicle, then these shocks would serve you well.



TJM - XGS GOLD LIMITED EDITION

BRUCE'S OPINION

From the moment we drove out from the fitting bay, I knew there was something impressive underneath the 'Cruiser. They gave the 'Cruiser almost unmatched pitch balance front to rear that controlled the vehicle superbly where other shocks were simply unsettled. They were able to soak up the uneven ground with ease without ever letting the vehicle skip across the track.

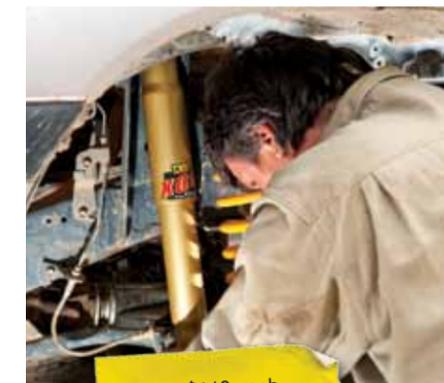
They gave a satisfying amount of confidence to the driver and always stayed predictable even across the roughest sections of the track. The balance of comfort inside the vehicle and driver control was ideal. Soft enough to soak up the rough stuff, while remaining stiff enough to give you plenty of confidence behind the wheel.

On the outside, the TJM XGS shocks have all the right ingredients for a tough, bush-ready shock. Steel stone guards, compliant rubber bushes and a generously sized outer body. They also have a built-in hydraulic bumpstop that assists with preventing shock damage on full compression. Needless to say, your vehicle should always make contact with independent bumpstops before relying on the shock alone to limit up-travel.

BRUCE'S OPINION

This set of shocks is by far one of the softest-feeling shocks over the bumps. In the driver's seat, the shocks didn't inspire confidence when you asked them to control the weight of the 'Cruiser along the track.

If you're looking for a particularly softer ride, these shocks would suit your style. Out of the variety of terrains we pushed them through, they were most at home over the low speed off-road tracks.



THE VERDICT

Whether it's driving to the limits on tough off-road tracks or long-distance touring that gets you going, your shocks will need to be up to the task. Without a good set of shocks under vehicle, you could be risking your tyres leaving the ground unnecessarily. Not only will this result in a loss of traction, but it can be downright dangerous when you're travelling at speed. A lot of factors that we all regard as good suspension characteristics rest on the shoulders of our shock absorbers. So, it pays to give them some attention before we come undone on the track.

The back to back, real world and controlled environment testing in this comparo brought out some interesting differences between the shocks. The shocks had nowhere to hide with Bruce Garland behind the wheel. The variation in characteristics we picked up between the shocks are things the average 4WDer would feel from inside the vehicle, either as a driver or passenger.

Given that every 4WDer has a preference to the way a vehicle feels behind the wheel, it was one of our most difficult comparos to rate. With price, on- and off-road performance and long-term durability in mind, we were able to crown the Tough Dog 41mm Bore Foam Cell as the Best Overall Shock, but it did have some pretty serious competition along the way.

Koni, Old Man Emu, Bilstein and Raw 4X4 were all wrestling with Tough Dog for the top spot. The superb handling characteristics of the Bilstein helped it come away as the Best Handling Shock, while the Terrain Tamer Premium Heavy Duty shock took out the Most Affordable Shock.

Ultimately, we've aimed to highlight each shock's strengths and weaknesses to help you decide what best suits your driving style.

WE WOULD ALSO LIKE TO THANK:

Wayne 'Wayno' Murphy from Mad Fab for his handiwork on the spanners throwing in each set of shocks for this comparo. **You can contact Wayno on 0404 586 139 if you're looking for any custom 4WD fabrication.**

The team out at Wholesale Suspension in Penrith for their help fitting the springs and giving the 'Cruiser a complete check over prior to our testing. **Check them out at www.wholesalesuspension.com.au or on (02) 4721 2112.**

King Springs for supplying a set of 2in lift springs that perfectly suit the 'Cruiser with all its extra gear. **For your nearest King Springs dealer call (07) 5539 6700 or head to their website at www.kingsprings.com.**

And last but not least, a special thanks to Bruce Garland for taking some time out of his busy schedule to come away for this comparo. **You can follow Garland Motorsport as the team prepare their race-bred D-Max at www.isuzumotorsports.com.**

AFTER-SALES SUPPORT

When choosing your shock absorbers, always consider the after-sales service that's on offer by the company. If a shock fails, chances are it's likely to happen out in the bush where you're a long way from home. Having the support of a manufacturer that can offer an Australia-wide network of distributors is a definite bonus to keep in mind.

FOR MORE INFO

BILSTEIN

SYDNEY SHOCK ABSORBERS

W: www.bilstein.com.au

PH: (02) 9557 5930

KONI

TOPERFORMANCE

W: www.topperformance.com.au

PH: (03) 9873 1722

OLD MAN EMU

ARB 4X4 ACCESSORIES

W: www.arb.com.au

PH: (03) 9761 6622

RANCHO

4WD 1

W: www.4wd1.com

PH: (02) 9634 2238

THE ULTIMATE SUSPENSION

W: www.ultimatesuspension.com.au

PH: (02) 9618 7674

TJM

W: www.tjm.com.au

PH: (07) 3865 9999

TOUGH DOG

4 WAY SUSPENSION

W: www.4waysuspension.com.au

PH: (02) 9672 8899

RAW 4X4

W: www.raw4x4.com.au

PH: (02) 4949 0000

TERRAIN TAMER

TERRAIN TAMER 4WD PARTS

W: www.terraintamer.com

PH: 1300 888 444

