



'94 Boing

Suspension forks have come a hell of a long way since the first Rock Shox.

BRANT RICHARDS has been bouncing about on 10 of the latest offerings.

Pics by PETER CANNING

When Paul Turner produced the first Rock Shox, at the end of the '80s, everyone laughed: motorbike forks on a bike, it'll never fly. Five years later boingy forks are everywhere, with a huge choice in what you can fit to your scooter.

We're still learning about forks – what the various features actually do, rather than what the marketing

people claim, and how to fine tune fork set-up, so let's look at some of the design and engineering issues.

How a shock works

At the heart of every suspension system is a shock absorber, a device to absorb shock from the trail to reduce the forces on the rider. However a shock absorber is made, be it from a steel spring with an oil damper, an air/oil combination or

using polymer technology with plastics or rubber, the two elements needed to ensure proper performance are springing and damping.

A spring by itself is of little use. If hit by a bump force it would compress, then rebound with the same force as it was hit, like a pogo stick. The damper reacts to the force and speed of the impact, making the load manageable for the spring.

As the goal of the suspension is

to move as much as possible, for small bumps the damper offers low resistance, but with bigger bumps, the damper slows the speed of the impact to avoid bottoming. The blow is absorbed by the damper converting the energy of the impact into heat. The spring then extends the damper back out again so it can take another hit. On this rebound stroke, some damping is employed. Without this rebound damping the suspension would be unpredictable, but with it, the suspension returns at one constant speed throughout the stroke.

Designers can change the rates of damping and springing to affect the way the shock reacts to the impact. Just as the spring can be made stiff at the beginning or end of the travel, the damping can be tuned to react to every bump, yet still cope with wheel-eaters.

Spring rate/progression

A spring can be made from many things. I've heard of steel, aluminium, titanium, elastomer rubbers, concrete (yes) and air springs. Mountain bikes (at the moment) only use springs from steel, elastomer and air. Spring rate is measured in pounds per inch (cause we're US led on this one). A 300lb/in spring takes 300lb to move it one inch. A linear spring takes 300lb to move it one inch, then another 300lb to move it another inch. A rising rate spring (like an air spring) takes more load to move the same distance as it compresses.

Air spring rate

If you have a volume of gas enclosed in a piston, say 100mm long, at a pressure of 40psi, and you compress the piston 50mm so the volume is half what it was originally, the pressure will be 80psi. If you halve the volume again, by moving it another 25mm, the pressure will be doubled again to 160psi. If you ever manage to compress the piston to the full 100mm of travel, the pressure will be infinite. This is how an air spring works, with the rate of increase of pressure increasing as the piston moves in.

The force to compress the spring (the spring rate) depends on the pressure in the fork. If you look at the graph (page 63) of the pressure in the piston as the volume is reduced, you can see the pressure really starts to build up past half initial volume. Up until half volume, the pressure increase is quite steady, but as the volume moves past half-way, it starts to build very rapidly.

An air spring in a suspension fork works identically, but here the fork doesn't have to compress all the way to infinite pressure to achieve maximum travel. Air spring forks have their 'oil height' such that at maximum travel, there's still a lot of air to compress, ensuring infinite pressure never arrives. Confusingly, the oil height isn't the height of the oil, but the depth of the air-space from the top of the fork to the oil when the stanchion is fully compressed (at max travel), so increasing the oil height means decreasing the oil in the fork.

Typically, a suspension fork has about the same oil height as the amount of travel, which means the maximum pressure in the

fork is typically twice that when in a resting state. The oil height can be used to change the riding qualities of the fork, by making the spring more linear in performance, or giving it a rising rate at the end of the stroke. By increasing the amount of oil in the fork the air space can be made smaller. This makes the fork's spring rate (resistance) build up quicker, and so the fork can be run softer initially, by putting in less air pressure, but with the increase in pressure building up at the end of the stroke, still resist bottoming. Forks with more oil height than travel will have a constant, almost linear feel, but may bottom on big hits.

Elastomer stacks

An elastomer fork uses a longer length of bumper than the total amount of compression because the elastomers can't compress to nothing. But wait! The latest developments in elastomer forks use a long bumper with a bottom out stop, which only ever compresses to around half of its potential. Sound familiar? Short stack elastomer systems bottom out by reaching a point where the elastomer can compress no more, but long-stack elastomers actually hit a bottom out stop, and reach that point without the rate rising too quickly near the end, as will happen with short stack elastomers. This will make the fork feel more consistent throughout its travel, but bottoming will occur with a positive stop.

Preload

Preload isn't for stiffening the suspension action, but for tuning the initial movement of the fork. All preload is doing is stopping the forks moving all the time, by pre-compressing them. If you have a 300lb/in spring, and you preload it with half an inch of movement, it means that you're going to have to hit it with 150lb before it moves at all. If that spring only has the same amount of compression as the forks have travel, then any preload is taking movement away from your suspension. With long-stack elastomers, preload can be applied without taking anything away from the fork travel, it will just affect the amount the fork sags when sitting on the bike, the ride height. In short, preload is principally used to adjust the ride height of the fork.

Sag and spring rate

As holes in the trail go down as well as up, it makes sense to have a little compression of the fork when you sit on the bike. This will alter as you move about on the bike, but I set forks with 2in travel to sag about a quarter of an inch when I'm sitting on the bike. If you're a more gentle rider, it will be worth setting the suspension up much more softly, with perhaps half an inch of sag on the bike. This will make the suspension bounce more during climbing, but it's something you can adapt to easily. Riders who don't want their fork to move at all during climbing are losing out on major benefits of suspension.

Damping

A spring alone would make a suspension

Jargon Buster

Spring rate The stiffness of the spring used in the suspension system is measured in inch-pounds. A 300lb spring rate spring takes 300lb to compress the spring 1in. Springs can be wound in many combinations to increase the stiffness as the spring compresses, or a linkage system can be used to alter the rate.

Rising rate Referring to spring rate, rising rate systems increase the stiffness of the spring as it compresses, by means of spring winding, or by a linkage system.

Stanchions The fixed piece of a suspension fork, fixed into the fork crown. Usually chrome plated and ground to provide a bearing surface.

Sliders The movable, sliding piece of a suspension fork, sliding on the bearing surface of the stanchions.

Brace A piece of formed tubing or plate which connects the two sliders together to limit independent movement.

Staged damping Variable damping rates to control how the shock works through its travel.

Stiction The reluctance of a bearing to initially move. Stick/slip occurs at the bearing surface and it takes a large force to get the slider moving, then a smaller force to continue that movement.

Progressive spring A spring that doesn't have linear characteristics. The force needed to compress the spring increases non-linearly as the extension increases.

Lengths

While a great deal of fuss is made about the change in height that a suspension fork makes to a bike, it's rapidly becoming less of a problem. If you run a regular fork with a big fat front tyre, let's look at some numbers:

Regular fork length = 15.5in
Suspension fork length = 16in
'Sag in suspension fork' = 0.25in
Change to a 1.9in tyre from a 2.2 = 0.15in
So... your new ride height will be:
16 - 0.25 - 0.15 = 15.6in, trivially higher than the old position!

Lengths for forks tested:

Rock Shox Quadra 10	15.75in
Shocktech ATC 100 Comp	16in
Manitou 3	16in
Rock Shox Mag 21	16in
Specialized Future Shock	16in
Pace RC-35 AB	16.25in
Rond Fork Elasto Pro I	16.25in
Rond Fork Hydro Pro I	16.25in
Spring VLS	16.75in

system work like a pogo stick, any bump being hit is absorbed, then the fork rebounds with the same force. It's obvious that some system must be employed to slow down the movement. Damping is the thing that does it, and is achieved by a variety of means. All of them generate heat, though, dissipating some of the energy of the bump. As a fork has two directions of travel, compression and rebound, so the fork employs two different levels of damping to control the movement on each stroke. Compression damping is the one

Rock Shox Quadra 10



Test notes

The stock bumpers hardly moved so I fitted cold-weather ones. Feels good on small stuff, but still rather hard on big stuff. Much more robust than the Mag 21, but still a little floppy torsionally, if not side-to-side or front-to-back. Short travel, but more of a cushion than real suspension.

The review:

Visually identical to last year's Quadra, the new 10 is internally far simpler (read cheaper) than last year. From what we can see, last year's Quadra is equivalent to this year's Quadra 21, though the Q21 has a bolt-on crown. What the Quadra 10 has lost is the 'friction ring', a simple damping device designed to tame the bounce of elastomer forks. The first test of a suspension fork (pushing down on it in the workshop) showed us that some softer rubbers were needed, and so, with an eye on the weather outside (4°C) we fitted cold weather elastomers.

With its characteristic shock boots, the Quadra looks like a very capable fork, and it felt good tracking across the car park. Hitting the trail showed that it was capable in the small-to-medium sized bumps, with the initial stiction of the fork meaning it wasn't at its best on the very small stuff, and rather overfaced on the large stuff. Landing a 3ft rock drop-off that I've been eyeing up for a bit, the Quadra felt firm, but my wrists came away intact and I was happy.

The fork doesn't feel much like suspension, as it blends in nicely with the rest of the bike, in looks and function, with the chrome covered up and the subtle movements feeling like an extension of the

normal components on the bike. Poetic bollocks? No. With the Quadra you feel like you've got a very big (or quite soft) front tyre on, which can still get overfaced sometimes, but does the job on a lot of bumps. Flex wasn't especially evident, though riding one-handed was more nervous than some forks I've ridden.

Summary

A good suspension fork for people who don't want to have to learn new skills. It's got good wheel-squish, though not terrain-hugging cushions that you can get with better systems. At its price point it works well, and is certainly a good specification on many production bikes. Recommended for beginners because of its lack of maintenance, though suitable for XC racing too.

Ratings

Suspension compression:	●●●○
Suspension rebound:	●●●○
Little stuff (0-1.5in):	●●●○
Mid stuff (1.5-3in):	●●●○
Big stuff (3in+):	●●●○
Braking:	●●●○
Steering response:	●●●○
Maintenance:	●●●○
Overall:	●●●○
Value:	●●●○

Weight: 3lb 4oz
Travel: 43mm
Price: £239
From: Caratti ☎ 0454 273733

Shocktech Carbon Race



Test notes:

Pace/Manitou look-alike, Carbon legs look good, but very RC-35-esque. Elastomer stack same as ever, like old Manitou unit. Brake bosses oversize at ends. Light. Top-out too hard, compression has hard rising rate (as you'd expect). Bouncy, bit wobbly, not too bad.

The review:

Aesthetics aren't my primary concern when testing forks, but you'd have to admit that the sliders of this fork look more than a little like RC-35s, but hey, that's no bad thing. Unless you're Pace, I guess. That aside, the rest of the fork looks quite cheap. Lots of stanchion is showing, which certainly doesn't improve the potential tracking qualities.

Hitting the trail, and hitting things hard to get a feel for the fork, we noticed another clunky top-out. Though not as bad as the Specialized fork we'd had on earlier, the clunk was annoying, but not distractingly bad. When cruising the fork seemed OK, but it was, as we expected, a little flexy through the bumps when they'd come off their end stops. This is because of a flexible brace, fixings and the lack of overlap.

Compression felt good on small hits, with the fork accommodating little bumps well. When things got bigger, it began to shy away from absorbing the hits, and started bouncing off things, with that rebound clunk becoming increasingly apparent. The travel at the end of the stroke became harder, quite quickly, typical of the short-stack elastomer

systems (and the reason why long-stack bumpers came about). For short amounts of travel it feels good, but on bigger stuff, soon gets overfaced and leaves the pilot to do the controlling.

Summary

Shocktech seem to have learnt little from their first fork, improving only the weight of the unit, rather than any performance features we can see. As a budget fork, the Shocktech worked well. Now in this higher price bracket, it seems to be out of its depth.

Ratings

Suspension compression:	●●●○
Suspension rebound:	●●●○
Little stuff (0-1.5in):	●●●○
Mid stuff (1.5-3in):	●●●○
Big stuff (3in+):	●●●○
Braking:	●●●○
Steering response:	●●●○
Maintenance:	●●●○
Overall:	●●●○
Value:	●●●○

Weight: 3lb 3oz
Travel: 47mm
Price: £289
From: TMS Systems ☎ 0420 489333

Manitou 3



Test notes:

Not Crud Catcher friendly! So easy to adjust, even on the trail. Looks excellent with the easy-to-use dials. Feels rigid, steers well. Quite bouncy in use, and the fork tends to top-out hard if you use soft elastomers with more than a little pre-load. Builds up at the end less than most other elastomer forks.

The review:

While visually the new Manitou fork may look very similar to the old models, as far as the shock absorbing system goes, there's very little similarity, apart from the elastomeric suspension medium. Instead of the previous 4in of rubber there's now over 6in of elastomer stack, all of which is easily take-out-and-put-inable on a skewer which screws neatly into the top of each stanchion. No daft long allen keys here!

The neat thing about the fork is the fact that the elastomer stack works in two distinct regions. While the fork is doing the small stuff well, it's just bouncing on the elastomers on the skewer, but as it approaches the end of its travel, another harder bottom-out bumper kicks in and does its stuff. The system works well. If you bottom the forks hard, you can actually get bounced off the ground again by the rebound force, not too cool, but set everything up well and it shouldn't happen too often.

As we mentioned in a Quick Release about these forks, early samples had bearings the wrong size which resulted in the forks having quite a bit of loose movement in them, even when just out of the box. There are various fixes for this problem, involving squashing things in vices and using electrical tape, neither of which should have to be used to fix what is just slack quality control.

In terms of rigidity and control, the fork was very inspiring. Manitous have always steered well,

and with their new super-chunky brace this one felt good. Braking was as positive as those looks would suggest, and the fork tracked well under load. Some forks feel good on full extension, but get a little flimsy when they're moving. Not the Manitou. It felt solid all the time, despite the bearing problems we mentioned at the start.

Summary

The Manitou 3 is a noticeable improvement on the last generation of Manitou fork. It felt to be the fastest fork that we rode cross-country. It has a very 'alive' feel that some riders, especially riders new to suspension, may not like. The long-bumpers haven't solved all the problems; the fork still seems to come to an abrupt but squishy halt at the end of the stroke. It's very smooth through small stuff, a little bouncy on mid-sized rocks and feels great on the big hits. Just watch those bottom outs. All in all though, I loved it and found myself doing dafter and dafter things on it. Recommended.

Ratings

Suspension compression:	●●●●●
Suspension rebound:	●●●●●
Little stuff (0-1.5in):	●●●●●
Mid stuff (1.5-3in):	●●●●●
Big stuff (3in+):	●●●●●
Braking:	●●●●●
Steering response:	●●●●●
Maintenance:	●●●●●
Overall:	●●●●●
Value:	●●●●●

Weight: 2lb 15oz
Travel: 50mm
Price: £367
From: ATB Sales ☎ 0424 753566

Specialized FS



Test notes:

Yuck! Ever ridden with your QR not tightened properly? Top-out clunk abounds. Dialling in some extra damping slows it a little, but not much, and then it's a little too hard in both directions. Feels OK on the compression, and some of the rebound is OK, but it's the clank-clank top-out that drives you nuts.

The review:

I've never ridden a Specialized suspension fork before, but I'd heard good things about them through the years. Enthusiastically hitting the trail with the fork, we were initially very disappointed as it felt good when hitting the bumps, but coming out the other side the clunk felt through the bar because of top-out – and heard above the other trail noise – was distracting, annoying and made handling tricky.

Dialling in a little more damping slowed the compression and rebound strokes, and while the top-out was still present, it was nowhere near as bad. We like a fork to have a fast action, but the part of the damping range that lets you have a fast stroke makes the fork top out. Oh well... In compression and rebound in this new position the fork felt quite good. A little too much damping in both directions for our tastes, but not bad by any means.

As for the performance of the rest of the fork, it worked well. Action was smooth, with no slop and a sturdy feeling from the steel legs (rather than the aluminium on the similar RS Mag 21). They weren't

as sturdy in use as the Manitous, and brake rub was present, but not a huge problem.

Summary

Specialized should fix the top-out problem, and then there might be hope of the fork doing everything for everyone, with fast compression and rebound for those that want it, with more damping for the heavier crowd. As it is, it's a good off-market fork, with a little glitch that can annoy lighter riders. It can be tuned with oil and revalving and is a most excellent value air/oil fork.

Ratings

Suspension compression:	●●●●●
Suspension rebound:	●●●●●
Little stuff (0-1.5in):	●●●●●
Mid stuff (1.5-3in):	●●●●●
Big stuff (3in+):	●●●●●
Braking:	●●●●●
Steering response:	●●●●●
Maintenance:	●●●●●
Overall:	●●●●●
Value:	●●●●●

Weight: 3lb 5oz
Travel: 46mm
Price: £249
From: SBC UK ☎ 0372 740084

Test notes:

Very solid feel – no brake rub at all. Certainly very smooth. Can be tuned with 12 clickers on the top of the stanchion. Good compression and rebound feel too. A very chunky machined construction all from 7075 aluminium. Very 'factory' looking. Funny pump.

The review:

Straight out of the box, the fork felt smooth, and the compression test (the forks... you remember) showed us the lack of flex in the fork. Apparently the bearings in the Rond Fork are a one-piece unit, so they can't suffer from the misalignment or slop which can plague other systems. As a result, when I was honking up the trail along the river, trying to catch up with my dog, I noticed something lacking from the bike. No brake rub! I listened more closely, and I still couldn't hear anything. Amazing, and very impressive.

Uniquely, as far as we know, anyway, the Rond Fork features a rebound and compression damping 'brake' on the first 6mm of the stroke. It lets the fork lock out on smooth trail, but any hard movement knocks it off, and then the fork floats as normal. During the testing of our fork, it felt a little rough, but we're told it does wear in after about 10-20 hours of riding.

At stock the fork has 7.5 weight oil, which makes it very durable, and the valving is such that the fork is tuneable from super-smooth to fully-locked-out with the clickers. Rond Fork recommend a switch to 5W oil for experienced riders who want a fast suspension action, but only for riders who are prepared to maintain their forks regularly.

In use the fork was very smooth, and the differences between the first and last clicker settings was much appreciated. This fork was easy to dial in to exactly the setting you wanted. Consequently this fork was tuned to as near perfect as we could get.

Rond Hydro Pro 1

Summary

We rode the fork with both 7.5W and 5W oil and came away very impressed with both situations. We performed the 5W setting, but realise that not everyone would want as fast a fork as we're used to, especially if you're coming from a rigid background. Tracking and control were excellent, and the fork is superb value.

Ratings

Suspension compression:	●●●●○
Suspension rebound:	●●●●○
Little stuff (0-1.5in):	●●●●○
Mid stuff (1.5-3in):	●●●●○
Big stuff (3in+):	●●●●○
Braking:	●●●●○
Steering response:	●●●●○
Maintenance:	●●●●○
Overall:	●●●●○
Value:	●●●●○

Weight: 3lb 5oz
Travel: 56mm
Price: £329
From: KAW Ltd ☎ 0902 753636

**Test notes:**

Same super sturdy performance as the Hydro Pro. No surprises there then. The elastomers are from the same factory as the Pace ones apparently. Rising rate seems to raise its head. Bulletproof construction.

The review:

This budget fork from the Dutch suspension manufacturer features the same construction (exactly) as the more expensive hydraulic model. Indeed the bearings, stanchions and the sliders of the Elasto Pro are identical to the hydraulic model, to the extent that this is the only fork we know of where the buyer can purchase an elastomer model and send the fork back to the factory to have the hydraulic parts fitted at a later date! Remarkable, as Mr Coleman would say.

The Elasto Pro has a 120mm elastomer stack contained in the upper part of the stanchion. The fork compresses the elastomers by means of a piston coming through a bearing in the bottom of the stanchion. Preload is adjustable through clickers on the top of each stanchion. The elastomers themselves vary in size a lot. In the bottom of the fork are two small diameter elastomers, with the two upper ones being larger 'star' profile. They can all be swapped and changed with the tools provided.

The closed cell elastomers that are fitted feel much 'deadier' than the solid elastomers used in the Manitou and Quadra forks, but that's no bad thing. The fork is far less bouncy in use than the others, and feels closer to a hydraulic fork than many elastomer units. The rebound damping is well controlled, for an elastomer at least.

Rond Elasto Pro 1

Summary

As a short-travel elastomer fork it's not bad, but it's not into the Manitou area of cushy comfort. It'd be a good race fork, but it's a little heavy. Certainly good for a low-maintenance, hard-core, recreational fork, and as it's upgradable you can always put the new parts into it when you get used to suspension. Worth considering if you want to upgrade.

Ratings

Suspension compression:	●●●●○
Suspension rebound:	●●●●○
Little stuff (0-1.5in):	●●●●○
Mid stuff (1.5-3in):	●●●●○
Big stuff (3in+):	●●●●○
Braking:	●●●●○
Steering response:	●●●●○
Maintenance:	●●●●○
Overall:	●●●●○
Value:	●●●●○

Weight: 3lb 5oz
Travel: 48mm
Price: £269
From: KAW Ltd ☎ 0902 753636



Marzocchi 500

Test notes:

Impressive. Zero stiction makes it work all the time and it never bottoms. Works well on big and little stuff. Bit wobbly at times and can't tuck in corners. Flexible lower blade design. Great weight. Dinky adjusters on sliders, easy to see and to tune. Four clicks isn't enough. Not huge variations. Perhaps six clicks with more adjustment. No pump supplied.

The review:

While Marzocchi have been in the motorcycle fork business for 30 years, they've only been producing mountain bike forks for the last four years. Their initial units suffered from excess weight and flexibility. The introduction of the 500s has been fairly quiet because they look quite similar to last year's top-line 400s. However, the internals of the new fork are redesigned, but share several features with last year's fork.

Action on the trail was impressive straight out of the box, and though the fork initially seemed to have a little stiction on the initial stroke (though just as much as anything else), after a couple of miles, all traces of it vanished. Marzocchi have worked long and hard on the bearings, seals and oil on the forks, and the result is a fork that works far more smoothly than air/oil forks have in the past. In previous years, we've said that elastomers are for little bumps and air/oil for big ones, but here's an air/oil fork that does both things brilliantly.

Steering stiffness, while improved over previous years, isn't as good as other units. Though there is absolutely no slopiness in the fork action, wander and tuck do occur, mainly manifesting themselves at low speed. The culprit for this lack of stiffness is the lower slider design, which is a flattened section. It provides little lateral stiffness when compared to the round section of the other forks. This is the area of

the fork that supports the dropouts, and we've seen in previous tests that this area contributes most to torsional stiffness. For 1995 we understand Marzocchi will be beefing up their forks in several areas. But that doesn't help us this year. Despite this, the fork does feel good under braking.

Summary

This is the first pair of Zokes to impress us properly, though they still have a few problems to solve, especially with regard to torsional stiffness. That aside (and it's a big aside), the actual suspension action of the fork is fantastic, working really well. There's no reason why next year they shouldn't have it all sorted in one go, but for now, this is the best fork I've found in suspension action.

Ratings

Suspension compression:	●●●●●
Suspension rebound:	●●●●●
Little stuff (0-1.5in):	●●●●●
Mid stuff (1.5-3in):	●●●●●
Big stuff (3in+):	●●●●●
Braking:	●●●●●
Steering response:	●●●●●
Maintenance:	●●●●●
Overall:	●●●●●
Value:	●●●●●

Weight: 3lb 6oz
Travel: 52mm
Price: £349
From: Cycosis ☎ 0256 332248

Rock Shox Mag 21

Test notes:

Arggh! Aluminium stanchions, and they're 1in. Seems to have quite a bit of stiction. Quite noticeable rising rate, more than the other air/oil forks, certainly on the bouncing-up-and-down test. Clickers are sharp to the touch but OK with gloves. There's movement in the fork out of the box, and feels like you've got a loose headset - not good. Rock Shox have come a long way from the RS1 and the Mag 20. Rubber caps fell out after half a mile.

The review:

The aluminium stanchions are the new addition to the breed, and come in the year when Easton also manufactured stanchions (albeit in a larger diameter) for the Manitou forks.

On the trail, the Rock Shox felt good, but not faultless. My main complaint was to do with the slight looseness from the bearings that, though not disruptive, wasn't a lot of fun either. This looseness seemed to be in all the forks that we wobbled on our travels, so it wasn't an isolated case. At low speeds, especially on steep climbs, you could feel a clicking as the fork travelled independently, but again, things like this don't really harm performance, just annoy.

In terms of suspending the rider, the fork worked well, though the spring rate seemed to rise quite steeply at the end of the stroke. We still achieved full travel, though, and didn't feel a harsh stop; the stock damping was a little heavy for this rider. Early hydraulic forks actually sounded like they had a metal-to-metal clunk at the end of their travel, but this is (thankfully) no longer evident.

We found the lateral stiffness to be rather lacking when landing off a big drop on an adverse camber, and

also felt that the front-to-rear flexibility of the fork was very lacking, something we haven't felt in a suspension fork for quite a while. I was certain of it being present and several other riders had noticed it too. When cornering, descending and braking hard, the fork tends to load up backwards, feeling a lot like skinny 1in steel forks, springing forwards at the worst moment.

Summary

It's a funny fork, the Mag 21, coming between the three positions of race fork, recreational fork and downhill fork. If you want suspension, and want to follow the masses, then you won't go far wrong with the Rock Shox. The wobbly bearings don't enrage it to us, and the flex is niggling and verging on the troublesome. Rock Shox seem to go in two-year cycles, and this seems to be their off year.

Ratings

Suspension compression:	●●●●●
Suspension rebound:	●●●●●
Little stuff (0-1.5in):	●●●●●
Mid stuff (1.5-3in):	●●●●●
Big stuff (3in+):	●●●●●
Braking:	●●●●●
Steering response:	●●●●●
Maintenance:	●●●●●
Overall:	●●●●●
Value:	●●●●●

Weight: 3lb 2oz
Travel: 46mm
Price: £389
From: Caratti ☎ 0454 273733

Pace RC-35



Test notes:

Good on small bumps. Seemed to tack less, always a feature I'd thought of as relating to geometry, but I guess it's to do with lateral stiffness as well. They just don't leap under you like the old Pace units did. One-handed riding was fine in the bumpy stuff. Excellent tracking. Rocker much improved from previous years. No problem with setting up at all. Not as good mud room. Mid-sized hits feel very harsh.

The review:

In their third incarnation, the 35s now feature a machined aluminium brace, still around the back of the fork blades, and actually more flexible than the previous tubular steel unit... so the question is why?

While the last unit was stiffer and stronger than the new model (not that strength is of great importance), the way it fixed to the sliders, by means of aluminium alloy bolts, meant that the whole unit ended up being more flexible than the newly gland-on aluminium brace. Only as good as the weakest link theory, and it seems to work. The new units track better and work well at stopping lateral and torsional flex, as well as independent leg movement which could occur on last year's forks when they started to get grumpy. Much has been written about the new grease, and it's just as good as everyone says.

On the trail, the newly improved seals, grease, elastomers and top-out cores make a fork that works smoothly. While the fork is super-supple on small bumps, far more so than any other Pace fork we've ridden, and accommodating on big ones, mid-sized bumps seem to suffer from the problem of over-damping on compression. This seemed to be a dichotomy. How could the forks be feeling good on big and small hits, but not on mid-sized ones? We're not sure, but we could feel that the very big hits have the edges taken off, while the mid-sized smacks seem to come

faster than the fork can cope with, making it noticeably stiff. Why do the big hits feel good? Well, any reduction in impact from a big hit feels good.

The big improvement over the previously excellent handling is in sharp, low speed corners. The old Pace fork, along with every other on the market, seemed to tuck slightly, a feature I'd always thought was a function of steering geometry. This new fork doesn't tuck anywhere near as much as the old fork, and is far, far better than most other forks out there. Much improved performance.

Summary

The fork tracks, corners and steers better than anything else out there, but the suspension action is beginning to show shortcomings. It seems to be an elastomer problem, as there is no huge difference in the internals from previous years. Still recommended for an easy, low-maintenance, ride-all-year fork. Excellent race fork at a low weight point. Lacking in mid-sized bump capacity.

Ratings

Suspension compression:	●●●●○
Suspension rebound:	●●●●○
Little stuff (0-1.5in):	●●●●○
Mid stuff (1.5-3in):	●●●●○
Big stuff (3in+):	●●●●○
Braking:	●●●●●
Steering response:	●●●●○
Maintenance:	●●●●○
Overall:	●●●●○
Value:	●●●●○

Weight: 3lb 1oz
Travel: 50mm
Price: £359
From: Pace = 0751 432929

VLS Spring Fork



Test notes:

Yikes! How much travel? The tyre's miles away from the crown and still buzzes. Feels clumsy (sticky) and floppy at low speed. Feels great at very high speed. Eats the big stuff up. Too much for front suspension only? How d'ya tune this thing? Got tyre buzz no matter how high I put the crown. 67mm of travel!

The review:

The only things I'd heard about the Spring Forks was what importers Offroad Performance Direct had told me. Apparently they'd done quite well at the Worlds, the company who build them were one of those motorcycle outfits, and they had lots of travel. They certainly looked the part with big sliders, chunky adjustable dropouts, and a big thick brace. Looks aside, they booted on easily to our Orange E2 test bike. First ride out was interesting. Descending from the car park to the singlet track, the fork worked fine, but on the small stuff the fork wasn't great, and its flexible feel didn't make me enjoy it. But all that changed when you started hitting things hard – up to a point.

While more travel would be equated with better travel, when you've got nothing on the back wheel to absorb the blows, long travel units can get you into heap-big-trouble. The front wheel cruises over the big rocks, and then "thunk!" the rear wheel kicks you up the arse. If you're landing from airmail though, even on a front suspension-only bike, the long travel can be appreciated, giving super-plush landings.

For whatever reason, we were impressed with the braking performance of the Spring Fork. Whether it was because its long travel hugged the trail under braking, or the fact that the brace seemed stiffer than most, it stopped well. Top marks.

One feature of the VLS fork is its Variable Length. This allows you to change the height of the

fork by moving the stanchions in the crown. We tried this, but the fork has so much travel that it bottoms with a buzz. Not good. The ride was quite loose, as the extra length means it's not good as a short-travel fork from a flexibility point of view. If you're going to use this unit, it's best on a rear suspension bike, like an RTS or Pro-Flex, something that takes the sting out of the rear end.

Summary

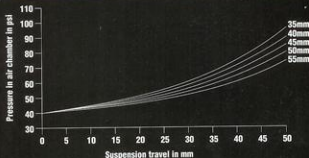
We liked the Spring Fork as far as it went. I wouldn't rate it highly for a cross-country race fork, but for a control unit it's very good. You're losing steering control, so it's harder to go around the rocks, but with this fork you can go straight through them! Providing it's used where the emphasis on the terrain is downward, and the rocks come big and fast, the VLS fork is good, but it's not for everyone.

Ratings

Suspension compression:	●●●●○
Suspension rebound:	●●●●○
Little stuff (0-1.5in):	●●●●○
Mid stuff (1.5-3in):	●●●●○
Big stuff (3in+):	●●●●○
Braking:	●●●●○
Steering response:	●●●●○
Maintenance:	●●●●○
Overall:	●●●●○
Value:	●●●●○

Weight: 4lb 0.5oz
Travel: 67mm
Price: £349
From: Offroad Performance Direct
= 081-851 0624

Effect of oil height on spring rate



You hear a lot about the rising rate action of an air spring, but here are the actual graphs to show you what's happening. Here the curves are shown for air-space, or 'oil heights' from 35mm to 55mm; 55mm is the most linear and 35mm the most progressive. The spring rate changes proportionally to the pressure in the shock.

that needs to be the most adjustable in use, as it determines how the fork absorbs the hit. In a hydraulic fork, the oil is forced through small holes and gaps into the stanchion, which slows the movement of the fork down, absorbing the impact. Rebound damping is the reverse action, where the oil is dragged back through the holes, to allow the fork to return to its normal position at a controlled speed.

Elastomer forks can suffer problems from uncontrolled rebound, but canny manufacturers, such as Pace, use long-travel top-out cores which slow the fork down progressively, rather than just hitting an end-stop. Another approach is the simple but effective friction ring as used on Rock Shox Quadra 21s.

Weight and seal!

Oils come in different weights, or viscosities. By swapping oil weights, the damping of a fork can be altered. Motor oil is typically 20W, but suspension oil is a little thinner than that, at 8W. The thinner the oil, the quicker it degrades through contamination, heating and susceptibility to breakdown from cavitation. Rock Shox have dropped the stock out-of-the-box weight of their oil down to 5W this year, a pretty low value to start with. This means that any tuning that needs to be done must be re-valving, rather than dropping the oil weight down to 2.5W which would be very susceptible to rapid breakdown. Rond Forks use 7.5W oil which is a good point to start. They also recommend altering the damping of the fork by re-valving, rather than by switching the oil for a less durable type.

Lateral & torsional flex

In any system, if you introduce pivots, links and other sliding beasts, flex occurs. Suspension fork bearings are not only easy to move up and down the stanchions, but also don't mind twisting from side to side. Braces, suspension hubs and skewers have all been developed to limit this movement but it's a problem. All suspension forks flex laterally and torsionally, far more than a rigid fork would, but it's unlikely that any developments will increase this. Suspension forks are improving with redesigns, but it's a matter of looking at the whole system of fork, hub and attachments to increase the stiffness of the front end.

A good check for fork flexiness is to turn the wheel at 90 degrees to the frame, put on the front brake, and try to compress the suspension. If the fork feels clicky, if one leg compresses before the other, then this shows flex in the system. It's a good check to see the effects of flex your-

self, on your own fork, or ones that aren't covered in this test.

Atmospheric effects

I've heard a lot about the effects of cold weather on various types of forks. During this test, there has been a radical difference in weather, from hot days to really cold. The effects of cold weather on elastomer forks is pronounced, but hydraulic ones also suffer. With elastomer units, the cold causes the elastomer to become quite noticeably stiffer, some only reaching half their recommended travel. Hydraulic forks suffer not because of the temperature affecting the air, but more, we suspect, because of the temperature increasing the viscosity of the oil. As it takes a really radical set of whoops to warm up a pair of shocks, things never improved...

The bikes used

All the forks were fitted to my own Pace RC-200, which has an Aheadset system to make fork changes easy, or to an Orange Elite 2. Despite coming from different sides of the planet, the Pace and the Orange are actually fairly similar in construction, and so once I'd specced the Orange out with my own choice of accessory components, fitted the same tyres to the front of both bikes, we were in business. Both bikes have aluminium frames, similar geometry and rode similarly, though the Orange seemed a little harsher in the rear. The tyre on the front of the bikes was an IRC Yeti FRO, a tyre that I'd had around for a while but which was an instant hit when fitted.

How we tested them

All the forks were fitted to either the Orange or the Pace and ridden hard. Every fork had at least six hours' riding on it, which in no way represents the lifetime of any product, but gave us a very good idea of how it worked. It was also long enough to show us things that could become problems later. The forks were rid-

What would we ride?

And so it's crunch time. What gets the golden votes?

Each area of riding needs different suspension qualities, so here's what we'd recommend for the following areas:

- **HARDCORE** – For super suspension action, tuneability and high strength: Rond Hydro Pro, Manitou 3, Marzocchi XC-500
- **CROSS-COUNTRY** – For light weight, easy maintenance, good shock absorption: Pace RC-35, Rock Shox Mag 21, Marzocchi XC-500
- **DOWNHILL** – For long travel, high strength, tuneability: Spring VLS, Rond Fork Hydro Pro I, Manitou 3
- **BEGINNER** – For minimal skills needed for maintenance and technique: Rock Shox Quadra

den on the same general terrain, my daily loop, and all of them rode the same downhill. I came to know how each fork rode from riding the same trails, and if I came back from a ride feeling worse or better than normal, this showed something more major, reinforcing our opinions gathered on the bumps.

Hubs were non-suspension and the skewers were fastened tightly. I rode all the forks myself, and then called around the various MBUK and MTB Pro people I trust on these subjects; so additional input and confirmation of results were from Paul Smith, Steve Worland, Justin Loretz and John Stevenson – thanks. ☉

Fork Weights

All weights for a fork with 1in x 190mm Aheadset steerer. Steel steerer tube weighs around 10z/in

Manitou 3	2lb 15oz
Pace	3lb 10z
Rock Shox Mag 21	3lb 20z
Shocktech Comp	3lb 30z
Rock Shox Quadra	3lb 40z
Rond Hydro Pro I	3lb 50z
Specialized FS	3lb 50z
Marzocchi XC-500	3lb 60z
Rond Elasto Pro I	3lb 70z
Spring VLS	4lb 0.5oz