GENIE
Field Test Report

SPECIALIZED SCIENCE CLUB

Contents

The Specialized Science Club employs the scientific method to support the creation of evidence-based performance for riders. The following report was executed by Matt Morrison of Cass Labs on behalf of Specialized Science Club to independently test and verify performance of GENIE pneumatic spring assist (PSA) technology.

Summary

This document contains key numerical and graphical test results and in-field performance findings for **GENIE**. Test results support the hypothesis that **GENIE** delivers unique benefits to riders, including:

GENIE delivers novel “best of both worlds” performance: a softer spring in the mid-stroke for better rear wheel tracking and deep stroke bottom-out protection.

GENIE shines in terms of traction. We have been able to correlate positive qualitative feedback about control to quantitative measurements of traction performance in the field.

GENIE provides design engineers with a new ability to optimize wheel rates by fine-tuning not only the bike’s leverage rate, but also the **GENIE** spring curve.

Numerical Results Snapshot

Following is a definition of terms and a snapshot of the key numerical results of the areas tested.

Bottom Out Event Time

DEFINITION

"Bottom out event time" is the sum of all time spent with the shock fully bottomed out while riding. A "severe bottom out event" is one that lasts for longer than a tenth of a seconds, meaning you really slam into the bottom out bumper. Measured directly from potentionter data.

FINDINGS

39% fewer severe bottom-out events compared to standard spring with 0.8 volume reduction (progressive setup) when shocks are sag matched to 33% sag. Across 41 on-trail runs.

11.3% less bottom-out event time on GENIE compared to standard spring with 0.8 volume reduction (progressive setup) when shocks are sag matched to 33% sag. Across 41 on-trail runs.

81.2% less bottom-out event time on GENIE compared to standard spring with 0 volume reduction (less progressive setup) when shocks are sag matched. Across 15 runs.

Traction Loss Time

DEFINITION

"Traction loss time" is the sum of all times the rear wheel is slipping with respect to the front. It is measured by comparing front and rear wheel rotational speeds while riding.

FINDINGS

57% less traction loss time on GENIE compared to standard spring. Across 82 on-trail runs.

Traction Loss Intensity

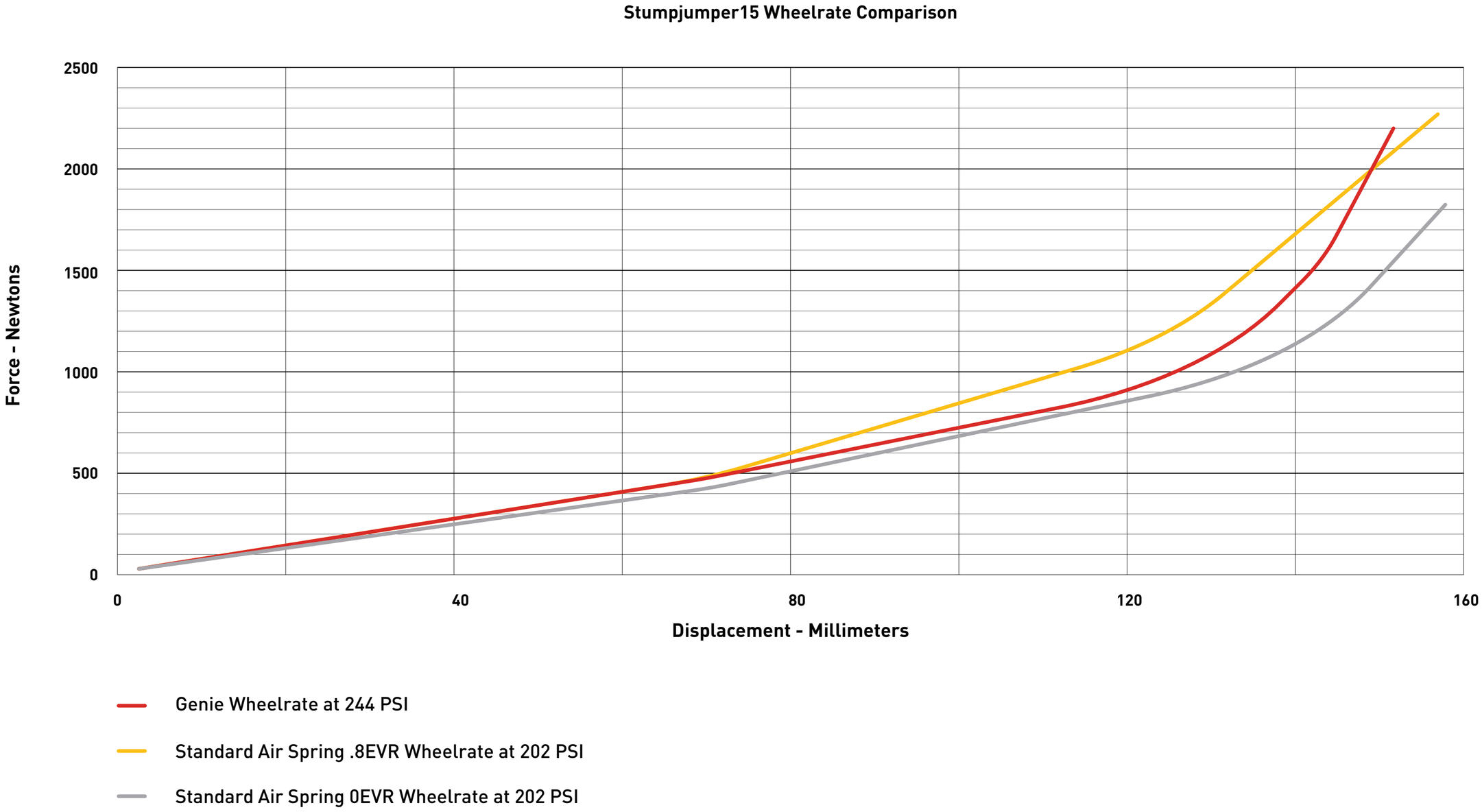
DEFINITION

"Traction loss intensity" is the difference in the front and rear wheel speed when a slip occurs. 100% means the rear wheel is locked up, and 0% means it's spinning freely.

FINDINGS

GENIE has 27% less traction loss intensity than standard spring. Across 82 on-trail runs.

Spring Curve Recap



Compared to other "standard" air shocks on the market, GENIE allows for a lower spring rate earlier in the stroke, with a higher ramp later in the stroke. With the "softer spring" of GENIE, more travel is used to absorb the same amount of energy, resulting in a smoother ride.

Riders can tune wheel rates with what's available on the market now. To achieve a soft spring through the mid stroke, a "Standard Air Spring" shock can be set up with no volume reducers, but then you don't get the necessary ramp to prevent bottom outs. Or, the standard air-sprung shock can be set up with volume reducers to provide bottom-out protection, but then the soft spring and supple performance in the mid-stroke is lost. GENIE provides the best of both worlds, and more of each end of the spectrum.

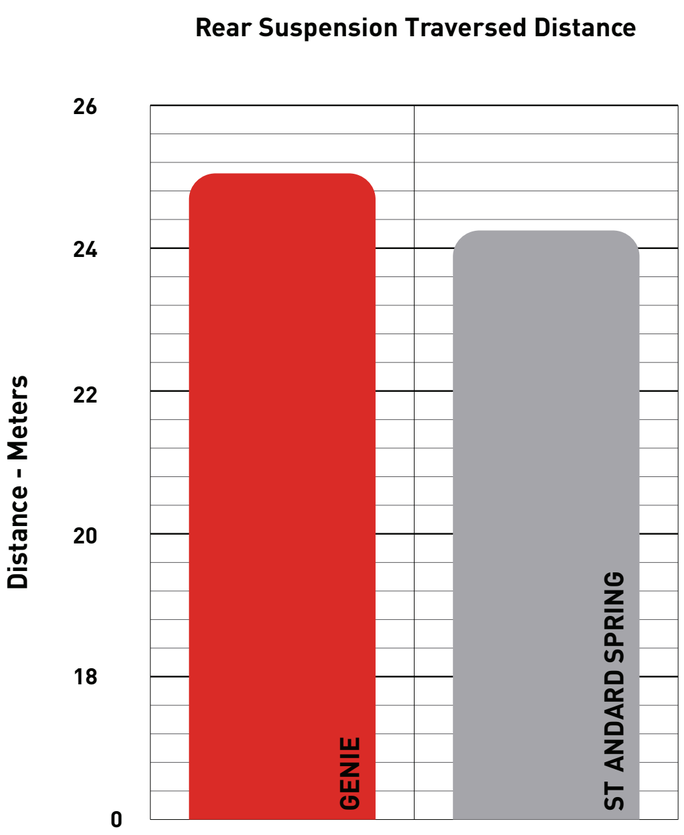
On-Trail Testing Results

Data from field testing shows greater suspension distance traversed (total cumulative travel) in the softer spring zone, which suggests that the rear wheel is better able to move over terrain and track the ground. The data also illustrates that bottom-out event frequency and total duration are both reduced due to the GENIE ramp. Following is the data of suspension distance traversed across dozens of runs on different trails with different riders.

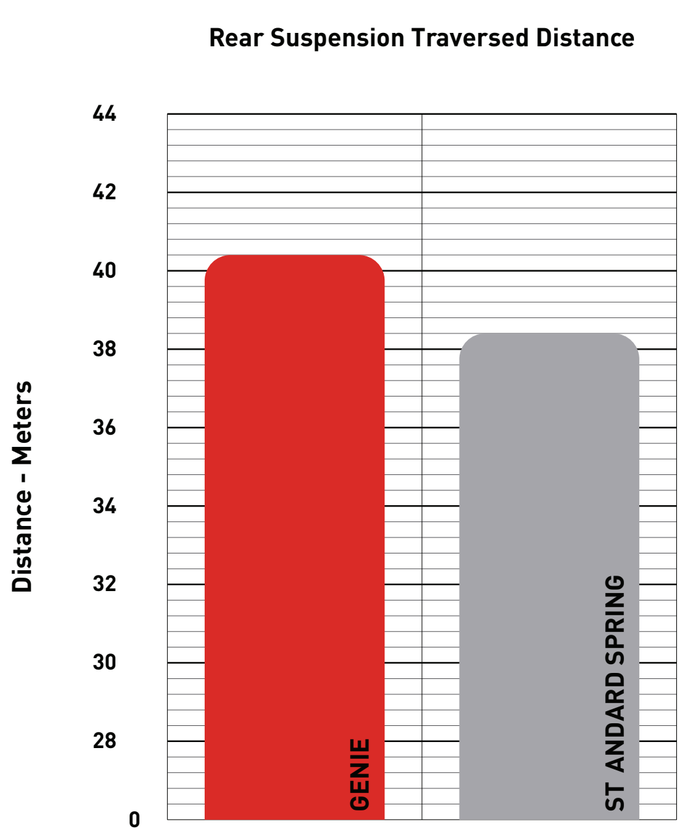
Suspension Distance Traversed

Below, we see the average distance traversed by the shock across many runs is higher on GENIE.

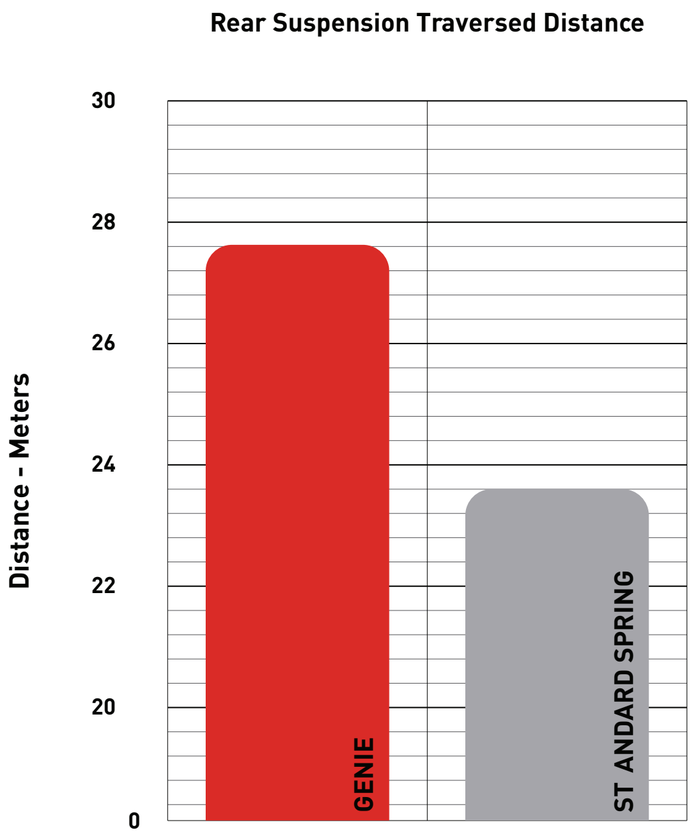
All data shows GENIE traversing more suspension distance in the field due to the softer spring.



RIDER: A
LOCATION: SANTA CRUZ, CA
NUM RUNS: 12



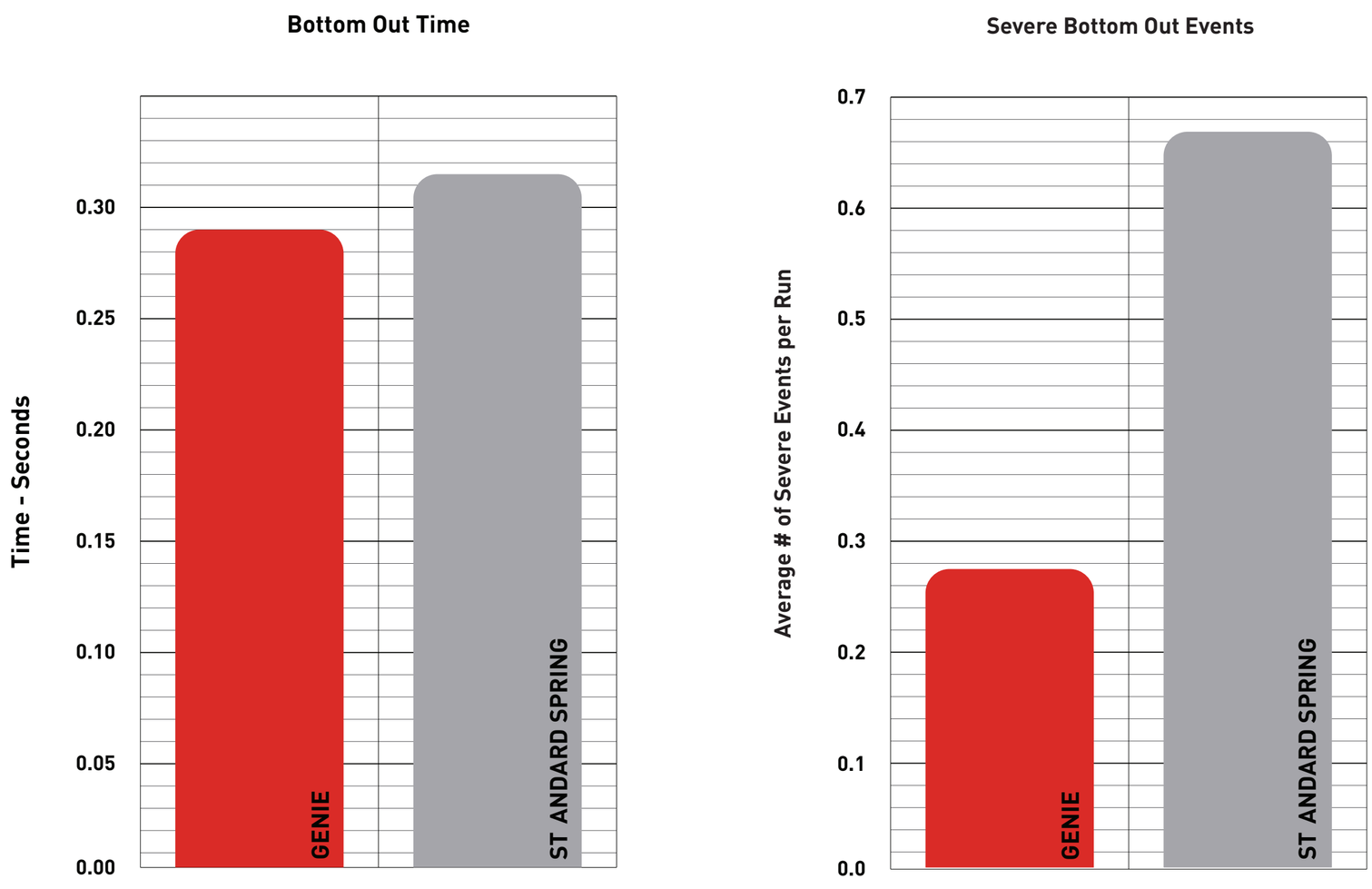
RIDER: B
LOCATION: AUBURN, CA
NUM RUNS: 15

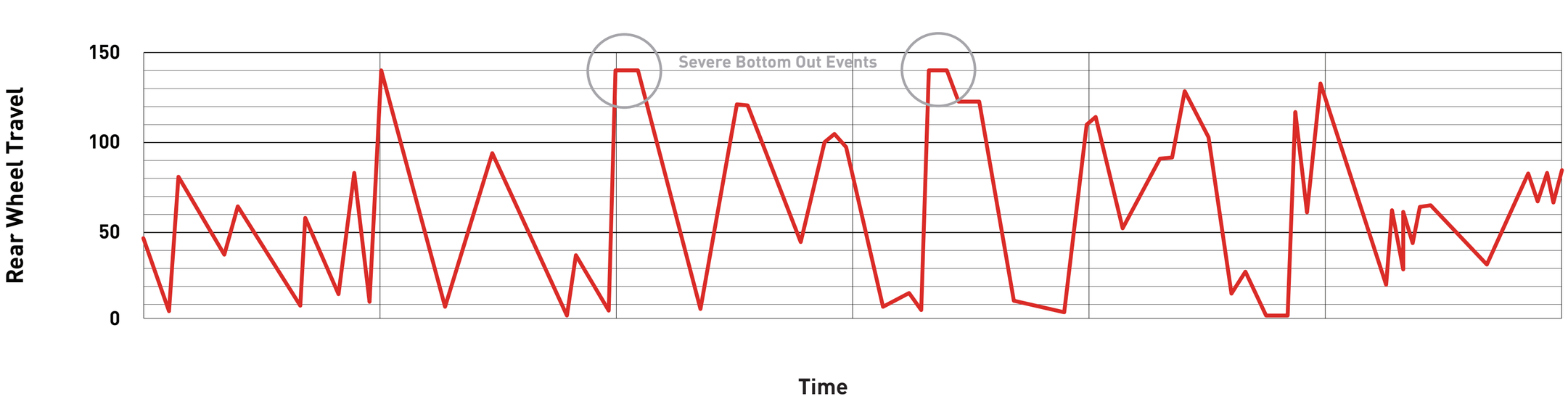


RIDER: C
LOCATION: AUBURN, CA
NUM RUNS: 14

Bottom Out Protection

Below, we see two plots: on the left is the average time per run spent at the bottom out, and the plot on the right is the average number of events per run that are classified as “severe” bottom-out events (i.e., the bottom out lasts for at least a tenth of a second). Bottom outs are not necessarily bad if we just barely kiss the bumper—but when we slam into it, that hurts control, product longevity, and rider comfort. This is why we collected the “severe bottom out event” counter and total time. We see this trend across different tests, trail locations, and riders. For example, below is some rear-wheel travel data we measured on the trail. You can see the first bottom-out event is just barely hitting bottom and then coming back down, but the later two events hit bottom out more severely, as we can see by the plateau at full bump. These are the more severe events we want to try to avoid.



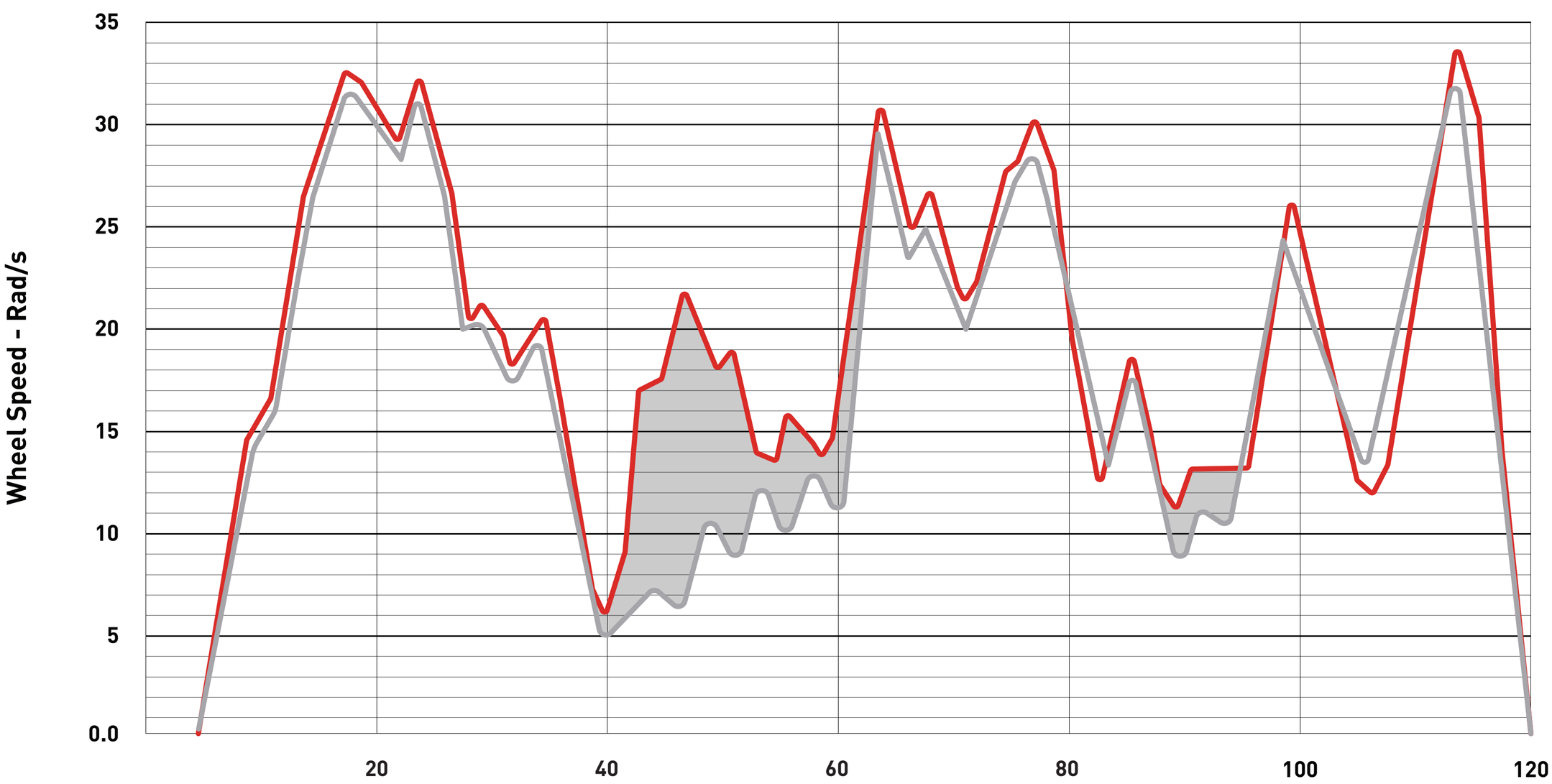


Traction

The effectively softer spring of the GENIE shock's mid-stroke allows the rear wheel to track better over trail inputs, which we suspected may yield better traction. And this trend is exactly what we see in the field. We compute traction loss time and intensity by comparing front and rear wheel speed data.

The plot below shows front and rear wheel speed data from a trail ride (red and gray lines). The shaded areas between the curves represent traction loss events (the rear wheel speed dropping significantly below front wheel speed).

Traction Loss Events Example



Traction

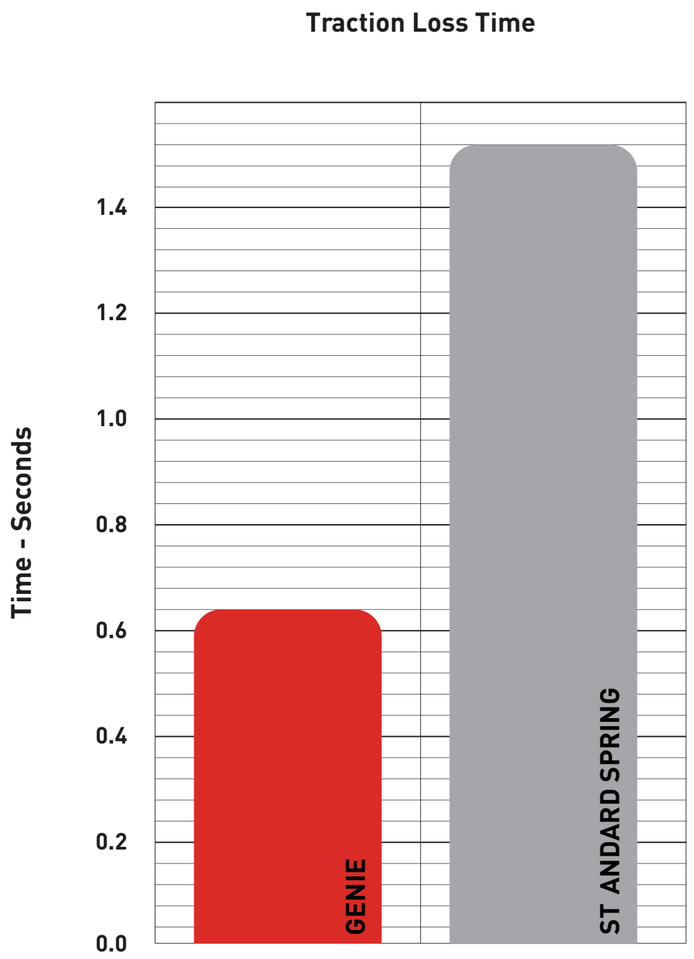
GENIE maintains rear wheel traction better than a standard air-sprung shock. Lower traction loss times and traction loss intensity values are better!

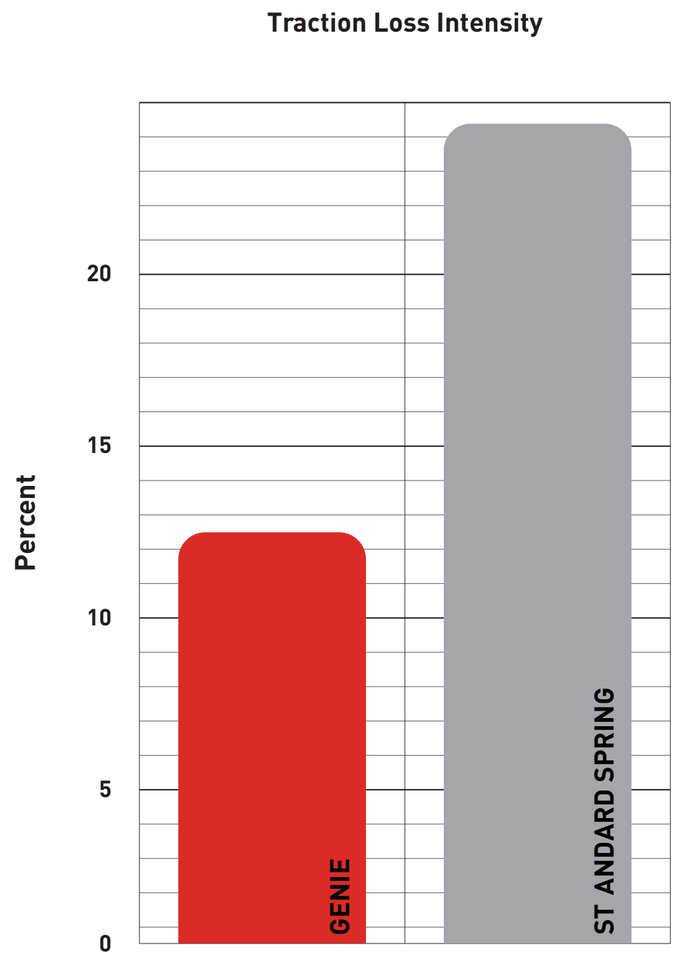
Results below from dozens of runs on different trails with different riders:

RIDER:
A

LOCATION:
SANTA CRUZ, CA

NUM RUNS:
17

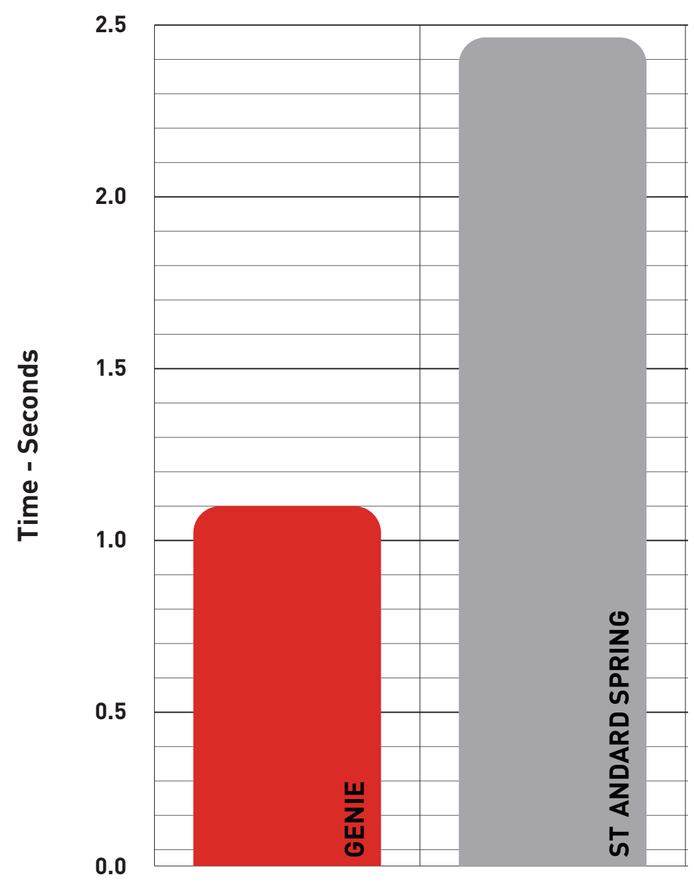


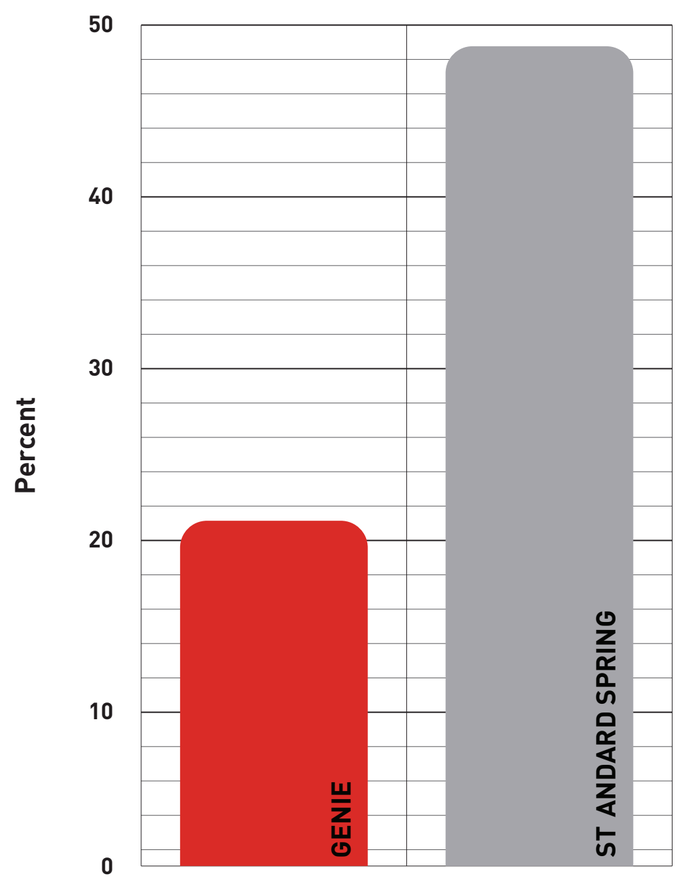


RIDER:
B

LOCATION:
SANTA CRUZ, CA

NUM RUNS:
15



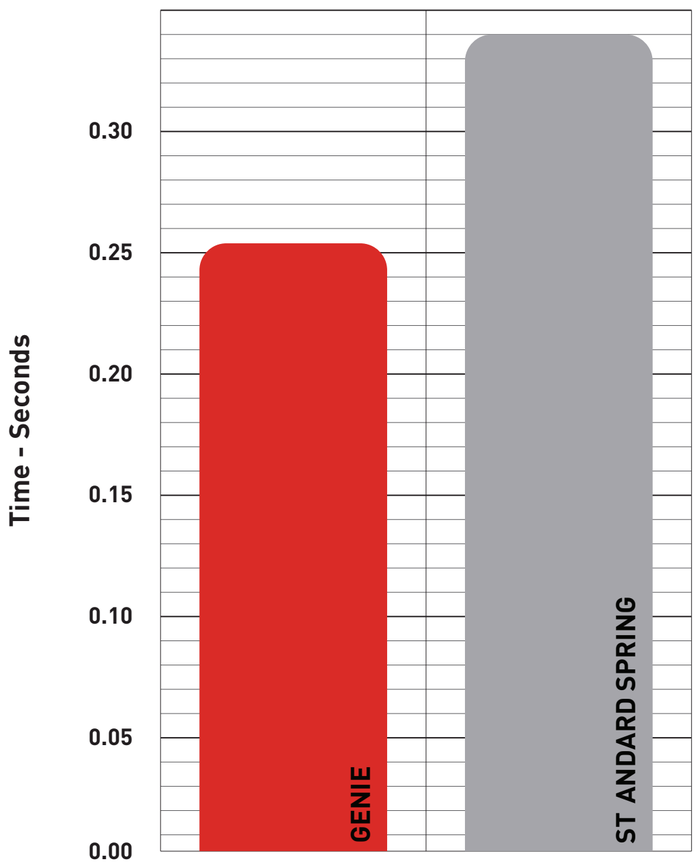


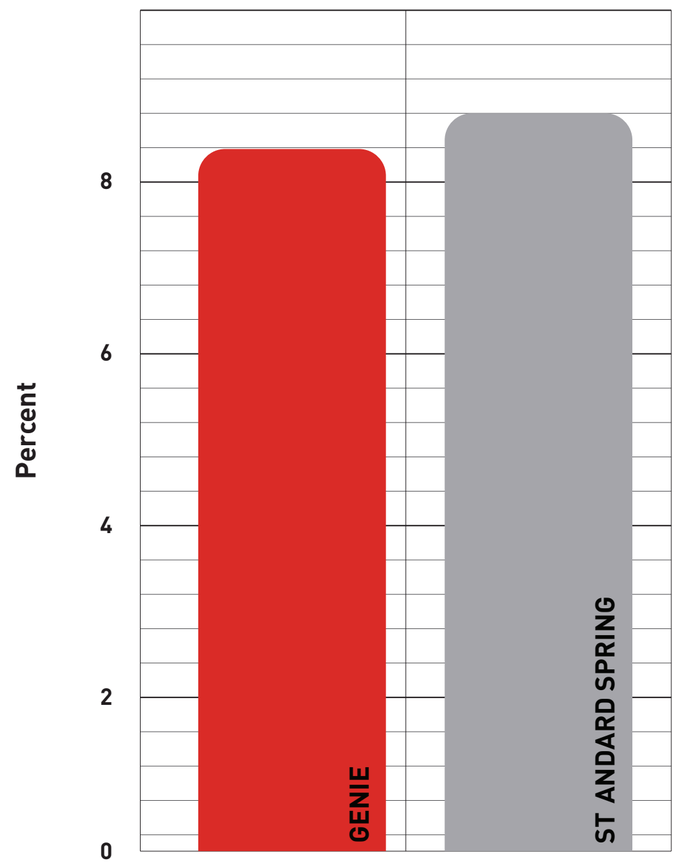
Traction

RIDER:
A

LOCATION:
AUBURN, CA

NUM RUNS:
15

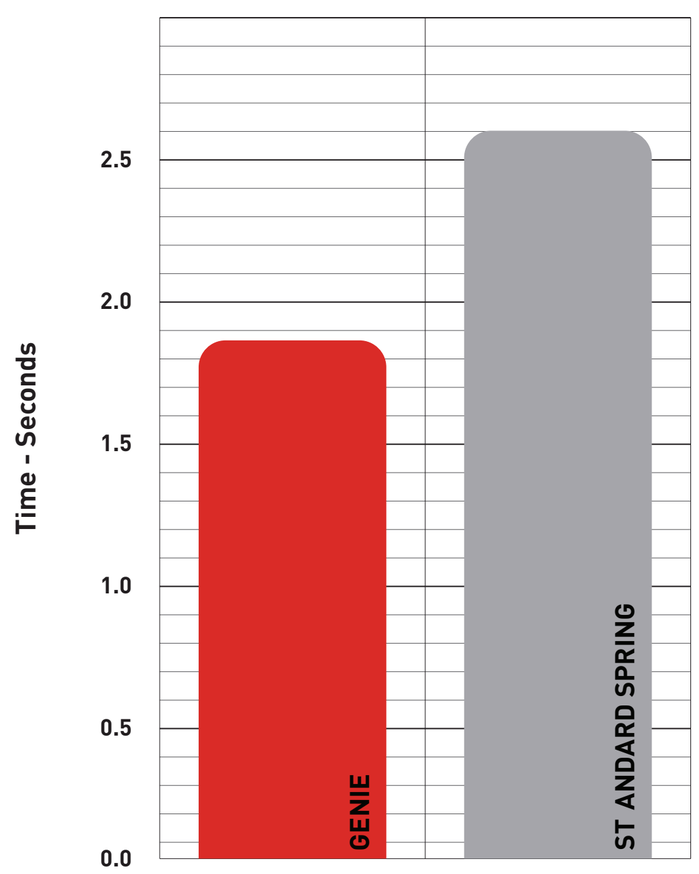


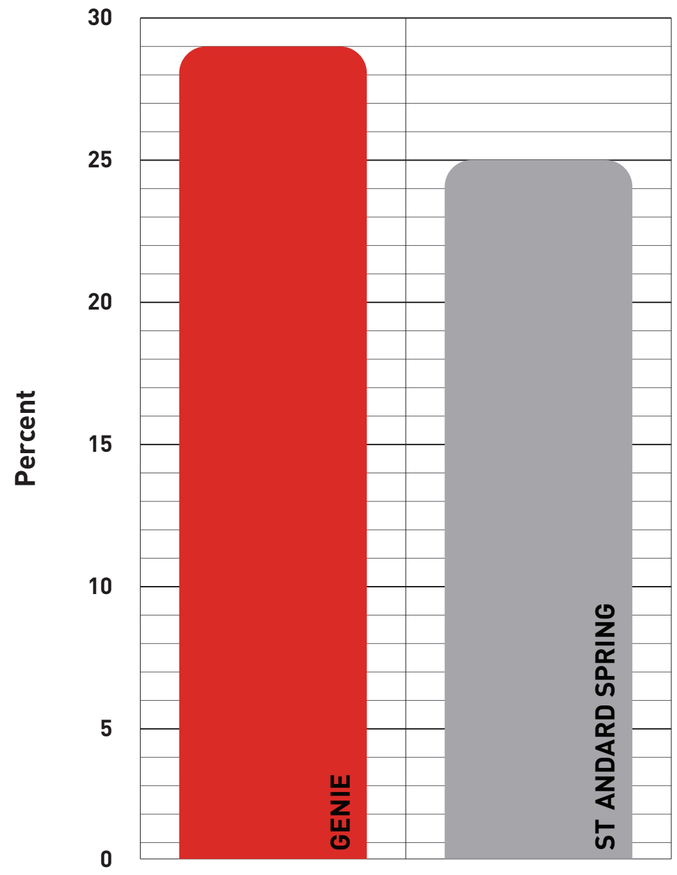


RIDER:
B

LOCATION:
SANTA CRUZ, CA

NUM RUNS:
12



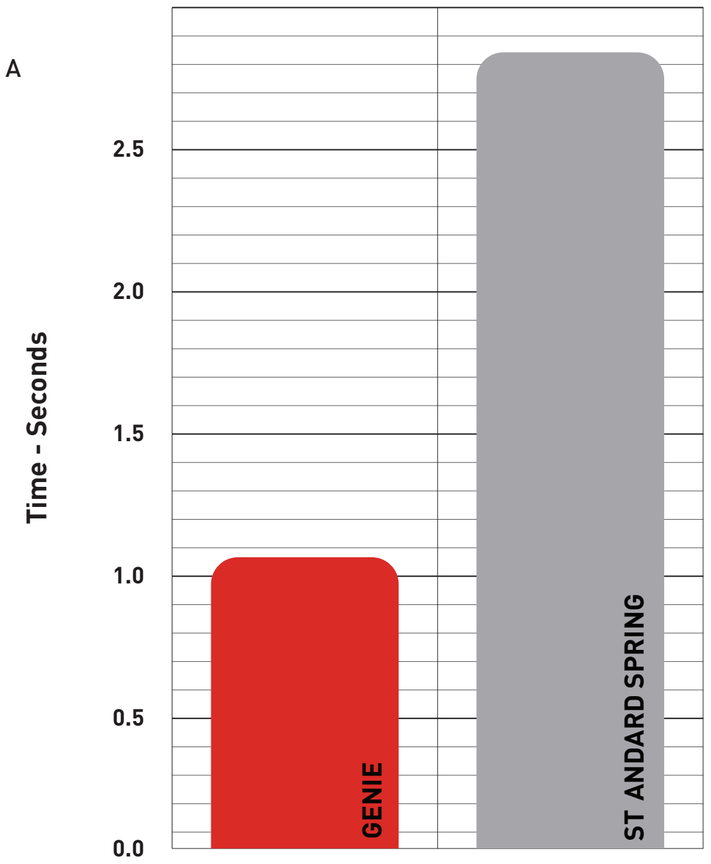


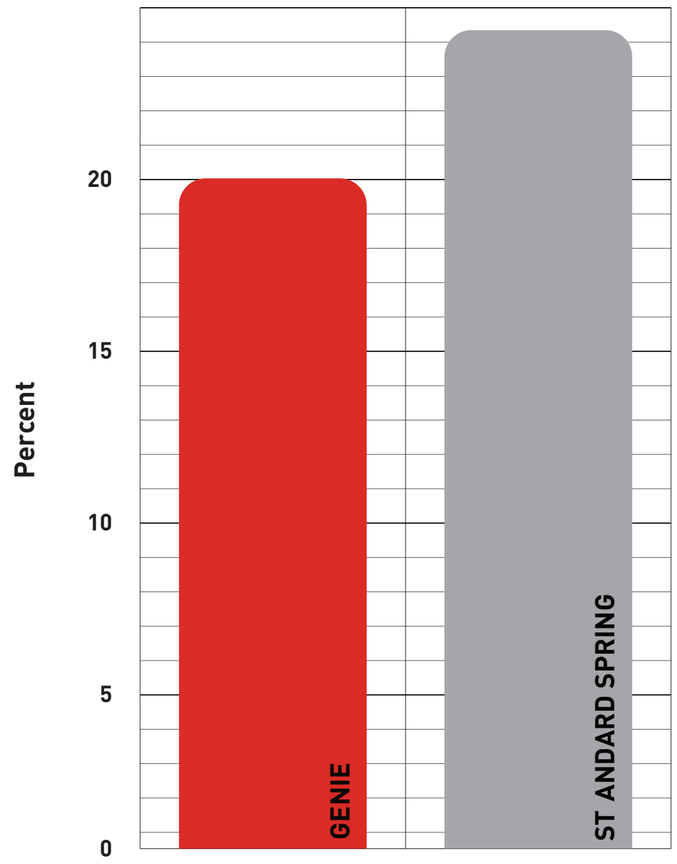
Traction

RIDER:
A

LOCATION:
GRASS VALLEY, CA

NUM RUNS:
12

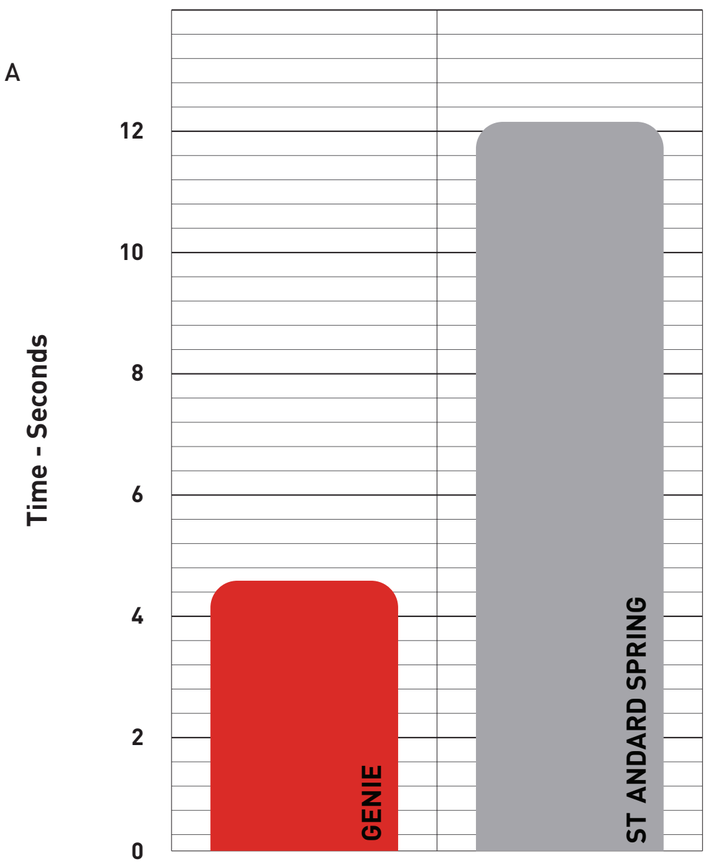


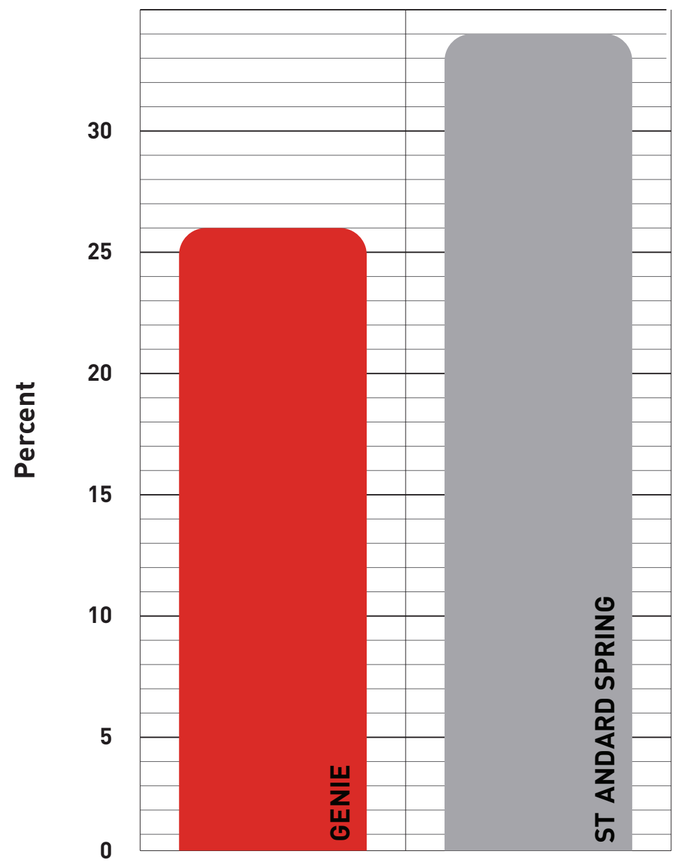


RIDER:
B

LOCATION:
GRASS VALLEY, CA

NUM RUNS:
11





Standard Spring without Volume Reduction

Returning to bottom out, we tested a standard spring with no volume reduction. To achieve a "softer spring" feel with what is currently on the market, one could set up a standard spring with no volume reduction (as shown on page 5). While no air-sprung shock on the market can be set up like GENIE, one could try to get a softer feeling mid-stroke by removing all the volume reducers from a standard air-sprung shock. This would yield a softer mid-stroke feel, but provide no bottom out protection! We tested with the GENIE and a standard spring with 0 VR to see for ourselves, and the results left little room for doubt. This test illustrates that GENIE gets us in that sweet spot that a standard spring can't hit. We get the soft spring feel in the stroke but still get bottom-out protection deeper into the travel.

Bottom Out Analysis: Austin TDS