



DETAILING DAVE WEAGLE'S DW-LINK

BY MARK JORDAN

BEFORE BUILDING BIKES AND CHAIN GUIDES, DAVE WEAGLE USED TO DESIGN TACTICAL ROBOTICS FOR THE U.S. DEPARTMENT OF DEFENSE. WEAGLE'S DAY JOB GAVE HIM A SOLID STRUCTURAL AND KINEMATICS BACKGROUND, AND AFTER GETTING INTO DOWNHILL AND DUAL SLALOM RACING, HE FOUND HIMSELF APPLYING FEA (COMPUTER AIDED STRUCTURAL ANALYSIS) TO BICYCLE FRAME STRUCTURES. FROM THERE, WEAGLE BEGAN HEAVILY ANALYZING MOUNTAIN BIKE SUSPENSION AND HAD SOME IDEAS THAT WERE SOMEWHAT RADICAL COMPARED TO WHAT EXISTED. AFTER A LOT OF REFINEMENT AND ESSENTIALLY CREATING HIS OWN TERMINOLOGY, THESE IDEAS BECAME THE BASIS FOR THE DW-LINK SUSPENSION SYSTEM.

THE PHYSICS

Here are some quick bits of information from Dave Weagle to help understand the physics of suspension:

1. Every rider has a mass. For a person seated on a bicycle, a theoretical point just in front of his/her navel represents the "center of mass."
2. Newton's Third Law of Motion states that "every action has an equal and opposite reaction." When a bicycle accelerates forward, the rider's mass is transferred rearward. Without something to counteract this mass transfer, the rear suspension on most bicycles will compress under acceleration. This mass transfer, as a reaction to acceleration, is what riders have come to know as "bob."
3. All vehicle suspensions are affected by mass movement. This goes for motorcycles, trucks and bicycles. Anti-squat is a term used to describe a suspension's resistance to mass movement during acceleration.

100% anti-squat counteracts mass movement fully. Zero percent anti-squat allows total mass transfer and subsequent suspension compression.

4. "Pedal feedback" is a result of radically changing aligned chainstay lengths (the distance from the center of the bottom bracket to the center of the rear axle) and gearing choice. The less radical of a change in



aligned chainstay length, the less pedal feedback can be felt.

5. Extra damping is not a substitute for an efficient suspension system. Less compression damping lets your suspension react to smaller imperfections on the trail and aids in traction in corners and on the climbs.
6. Linkage instant center location is critical to braking performance.

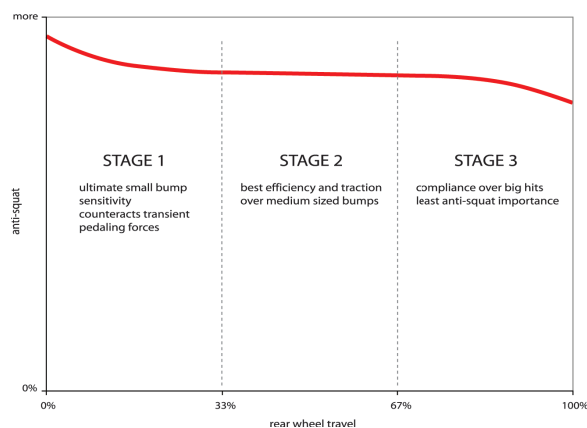
Instant center location is not a governing factor in regards to acceleration performance.

THE TECHNOLOGY

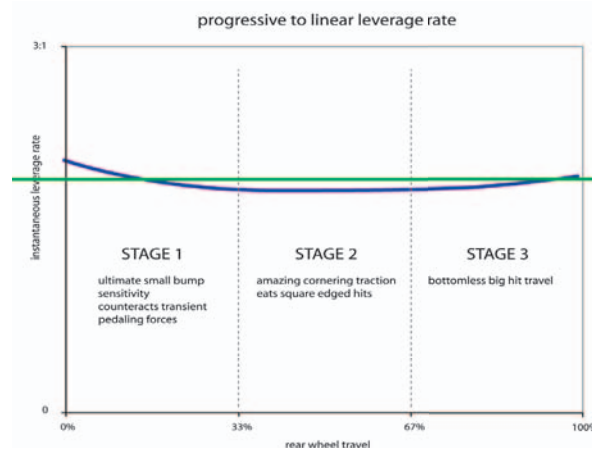
Bicycle suspensions pose incredibly challenging design problems for engineers. The dw-link is engineered to address seven aspects that are important to exceptional suspension performance.

1. **EFFICIENCY:** The dw-link features simultaneously engineered anti-squat and leverage ratio curves. These two important parameters are engineered to complement and balance each other under acceleration and when climbing.

dw-link 3-STAGE Anti-Squat Curve



2. **THREE-STAGE ANTI-SQUAT CURVE:** When a bicycle accelerates its mass is transferred rearward, following Newton's Third Law that states every action has an opposite reaction. Additionally, transient pedaling loads (like the rider's legs moving up and down) work to compress the suspension. The dw-link's anti-squat curve counteracts the transient pedaling loads and rearward mass transfer under acceleration to eliminate pedal bob, while increasing small bump sensitivity and traction.



3. **PROGRESSIVE-TO-LINEAR RATE:** The dw-link does not require a platform type damper. It has a slightly progressive-to-linear leverage rate that is engineered to work with the three-stage anti-squat curve. This approach keeps the suspension sensitive to small bumps while still retaining excellent big hit control.



4. **BRAKING:** The dw-link projects an instant center to a location just behind the front wheel. This helps the linkage achieve an excellent balance between traction and stability under hard braking.



5. **PEDAL FEEDBACK:** Pedal feedback is a combination between chainstay length change and gear effects. The dw-link has a smooth and constant positive chainstay lengthening effect to offset negative gearing effects.




6. **TRACTION:** The dw-link axle path changes to coordinate with the demands of the terrain. In the beginning of the travel, the rearward profile caters to small bump sensitivity. In the middle of the travel, the path is still rearward and becomes more vertical to work with the front

suspension for a balanced feel. At the end of the travel, the suspension has an increase in compression damping for big hit absorption.



7. **STRUCTURE:** The dw-link's low leverage ratio coupled with short links and a triangulated rear swingarm makes for a structurally superior design.

THE VERDICT

Dave Weagle licenses his patent pending dw-link design to Independent Fabrications and Ibis, but the most famous version of it is the Iron Horse Sunday downhill chassis ridden by Sam Hill. While Hill placed second at the World Championships, it is his legendary eight-second victory at the World Cup in Schladming, Austria that people still talk about. A little race domination is a good way to legitimize a design, but if you want more details then check out our Sunday test on page 62 in this mag. Iron Horse also builds 90mm, 125mm and 180mm travel dw-link bikes. 

If you need more info, go to dw-link.com and get ready to go to school.