Quantitative Drivetrain

Bert Baker
Baker Drivetrain

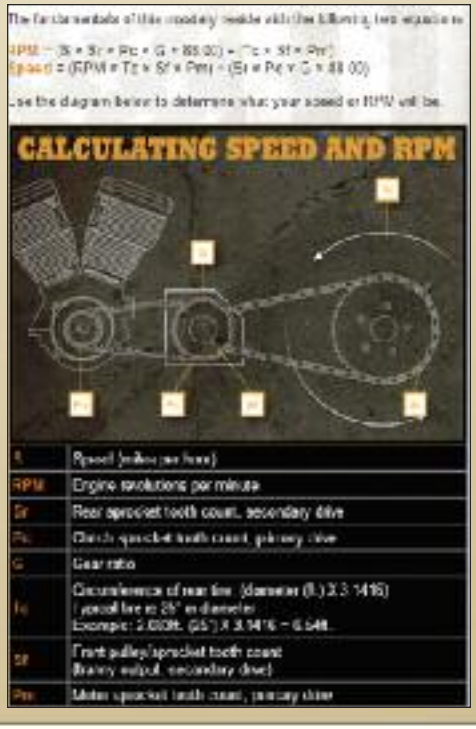
To understand the effects on performance of changing the primary and secondary drive ratios is to understand the origin of Baker Drivetrain, which was born out of the theft of my first Harley in Daytona 1995. Having your bike stolen is way worse than drinking too much tequila and eating that little worm in the bottom of the bottle.

To determine the final-drive ratio in a Harley, multiply the primary reduction by the secondary reduction. This is the equivalent of an axle ratio in a rear-wheel-drive car. For this reason, I call the product of the primary and secondary ratios the "axle ratio" in motorcycles. The personality of any motor can be dramatically altered with changes to the axle ratio, too. For instance, a mild motor with a numerical increase in the axle ratio can be "woken up" to feel like it has a higher lift camshaft and some head flow work. Conversely, a hot rod motor can be put to sleep by selecting the wrong ratio.

To digress a moment, with the insurance proceeds in hand from my motorcycle that got stolen, I scratch-built my first custom, using a 103" long block S&S motor. At the time, that was the biggest and baddest off-the-shelf long block money could buy. Behind the spawn-of-the-devil motor sat a ubiquitous 5-speed transmission. The drivetrain was configured with a 2.94:1 axle ratio by using a 61-tooth rear pulley. Because this motor had a 5" stroke that generated piston speeds beyond that of a Formula 1 engine, I felt any axle ratio could be used. In my mind, the overabundance of torque would just power its way though any axle ratio, so I bequeathed it with a lazy axle ratio that would yield a comfortable low cruising RPM void of vibration to minimize monkey butt and sleepy hands. After all, it was a rigid-mount Softail—and there ain't anything "soft" about an Evo Softail. So I assembled the bike before paint, and after an abbreviated break-in, it was time to see what she had. If it were an adult movie reviewed by *Hustler* magazine, it would have received a half-erect rating. She was a dog with fleas (or crabs)! The performance was a great disappointment! The cruising RPM was nice and it did not vibrate all that much on the highway, but it accelerated with the same glacial speed as the stock 80" engine it replaced.

That winter, spurred by the disappointing performance, I decided to do what any hot rod car guy would do; I put a performance axle in it! Using a 70-tooth rear pulley, axle ratio jumped from 2.94 to 3.37:1, giving the motor, effectively, 15% more leverage. The bike finished, we headed to Bike Week 1996 with a really good chain lock this time. In Florida I got the bike out on some back roads and twisted the throttle; I was blown away. It was a completely different motor; this thing was a rocket. It danced through the first three gears like a 125 motocrosser at WFO. I was fully erect and *Hustler* magazine would be proud. Little did I know the gods of engineering-compromise were waiting around the corner, laughing. Not wanting to go back to the cold Michigan winter in March, we migrated further south to Miami. Easing down I-95 I noticed a tingling feeling in my hands and feet. I also got a wicked case of monkey butt. The gods of engineering-compromise had just given me my first diploma. That is, I got the performance I desired by increasing axle ratio but I paid the price for it—high resultant cruising RPM and crappy fuel economy. I got 22 MPG at 80 MPH; not good for extended distances. I rode around for the rest of the summer but I got to thinking…

So I asked myself, "Self, what if this bike had another gear?" A 6th gear ratio with a 15% reduction (over 5th) would get my cruising RPM back like the days when I had the 61 rear pulley. On paper, a 6-speed transmission would give me the best of both worlds. That is, a comfortable cruising RPM and sane fuel economy with strong performance in the lower gears. It sounded like a cool concept to me, but nobody made a 6-speed for American bikes. Having manual transmission design experience from my days at GM, I viewed this as a call to arms. I did not believe in fate, but in this case all the dots kind of lined up and pointed me in a direction to design a few 6-speed prototypes.



The first prototype ran in August 1997 without a hitch. I spent that autumn riding around with my drunken buddy Schmidt sampling beverages at Michigan's finest taverns. I had starter and wet-sump issues, but the prototype transmission ran and validated the "best of both worlds" theory. Baker Drivetrain was now in gear, and we've been rolling since! IW