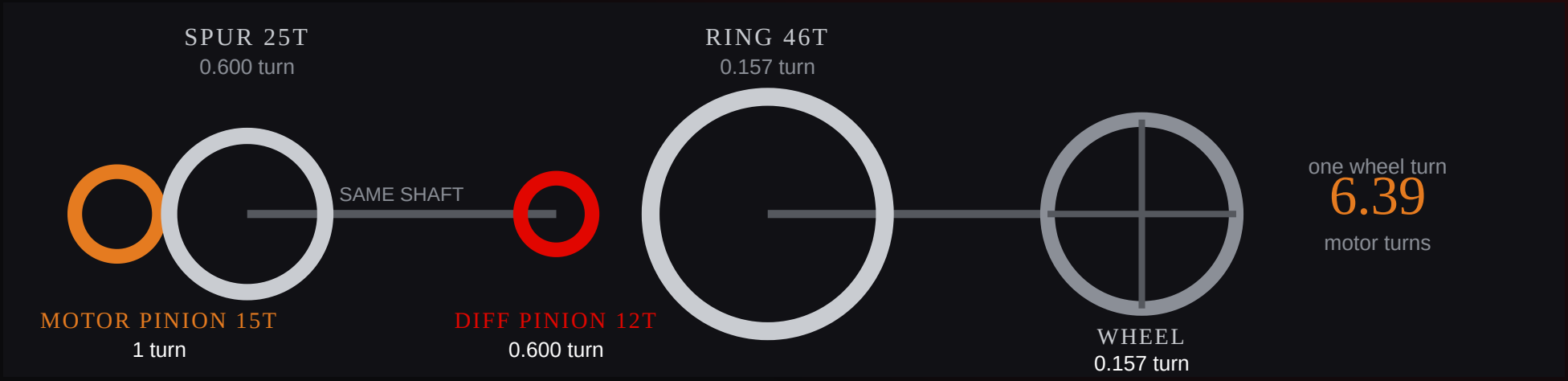
YOUR GEARS MULTIPLY

Motor pinion → spur → diff pinion → ring → wheel. Two steps, one number.



SPUR ÷ PINION
25 / 15
= 1.667 · stage one

RING ÷ DIFF PINION
46 / 12
= 3.833 · stage two, inside the diff

FINAL DRIVE
6.39 : 1
motor turns per wheel turn

Mike's example gearing. **Tire, motor and speed numbers in this guide are clearly labeled example assumptions, not measured EVUL results.** The EVUL Gearing Calculator does all of this live, with a plain-language note on every field.

WHAT EACH GEAR DOES

Small gear drives big gear = slower, stronger. Big drives small = faster, weaker.

MOTOR PINION
15T

On the motor shaft. Small. Spins the fastest of anything in the car.

SPUR
25T

Driven by the motor pinion. Bigger = slows it down, adds push.

DIFF PINION
12T

Inside the diff, on the same shaft as the spur. Turns with the spur.

RING GEAR
46T

Big gear on the diff. Turns the axles and the wheels.

MOTOR → **PINION** → **SPUR** → **DIFF PINION** → **RING** → **WHEEL**

STAGE 1 = pinion → spur · STAGE 2 = diff pinion → ring (inside the diff)

THE RULE FOR EVERY PAIR

Driven ÷ driver = that stage's ratio. 25 ÷ 15 = 1.667 means the motor turns 1.667 times for each spur turn. It does not matter which gear is "first" — only which one is being driven.

THE MISTAKE THAT COSTS PEOPLE A SEASON

Counting the stator slots instead of the rotor magnets, or the spur instead of the ring, gets you a number that looks reasonable and is completely wrong. Count teeth on the actual gear, twice.

TWO STAGES MULTIPLY

Each ring below is one full motor turn. Count the rings.

STAGE 1 motor turns per spur turn		1.67
STAGE 2 spur turns per ring turn		3.83
TOTAL motor turns per WHEEL turn		6.39

1.667 × 3.833 = 6.39 · the stages MULTIPLY, they do not add

NOT 1.667 + 3.833

Adding gives 5.5, which is **wrong**. Every spur turn already took 1.667 motor turns, and the ring needs 3.833 spur turns. So 3.833 × 1.667 = **6.39** motor turns.

EXTRA STAGE? MULTIPLY AGAIN

A transmission or an extra gear pair is just one more ratio in the chain: final = stage 1 × stage 2 × extra. No extra stage = 1, which changes nothing.

MIKE'S WORKED EXAMPLE

15T pinion · 25T spur · 12T diff pinion · 46T ring

1	STAGE 1 spur ÷ motor pinion	25 ÷ 15	1.667 : 1
2	DIFF ring ÷ diff pinion	46 ÷ 12	3.833 : 1
3	FINAL DRIVE stage 1 × diff	1.667 × 3.833	6.39 : 1
4	ROLLOUT tire circumference ÷ final drive	199.5 mm ÷ 6.389	31.2 MM
5	TOP SPEED (NO LOAD) kV × volts × rollout	5800 × 12.6 V × 31.2 mm	85 MPH
6	TOP SPEED (LOADED) × sag and 90% loaded kV	loaded volts · 90%	74 MPH

FINAL DRIVE
6.39:1
motor turns per wheel turn

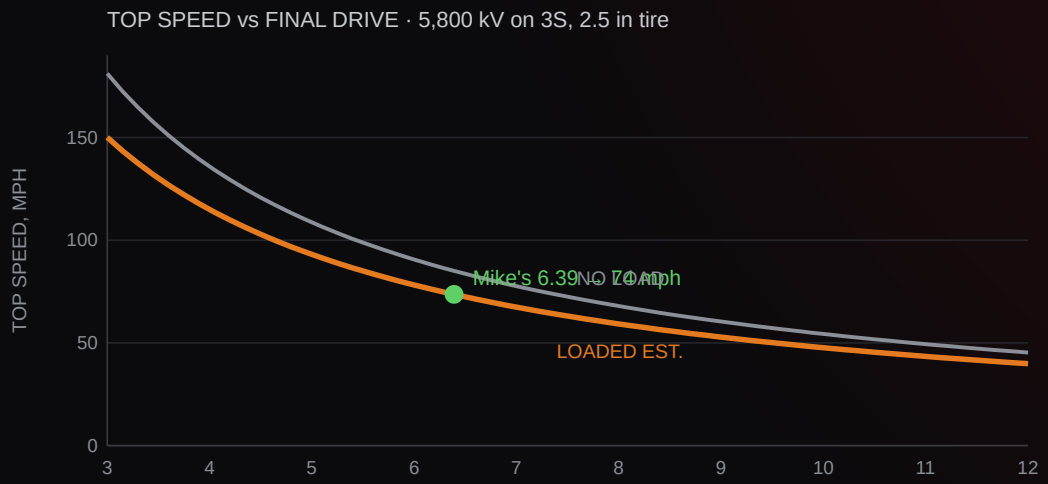
ROLLOUT / MOTOR REV
31.2 MM
1.229 in of track per motor turn

WHEEL TORQUE ×
5.75
final drive × 90% drivetrain efficiency

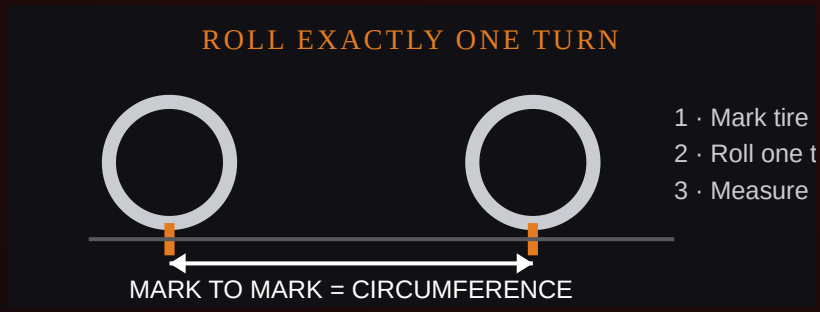
Example assumptions for steps 4–6: *2.5 in (63.5 mm) tire, no growth; Tenshock EVO2240HS 5800 kV (factory chart); 3S at 4.20 V per cell = 12.6 V; loaded speed uses the battery-guide sag model (2 lb car, 4 mΩ per cell) and 90% loaded kV. Wheel torque × = final drive × 90% drivetrain efficiency. Not measured EVUL data.*

ROLLOUT + TOP SPEED

Rollout = how far the car moves for one motor turn. Bigger rollout = taller gear = more speed, more load.



Both curves use Mike's motor, pack and tire; only the final drive changes. The grey line is bench rpm; the orange line is what the pack and load actually leave you.



Or: diameter × 3.1416. Measuring beats trusting the box.

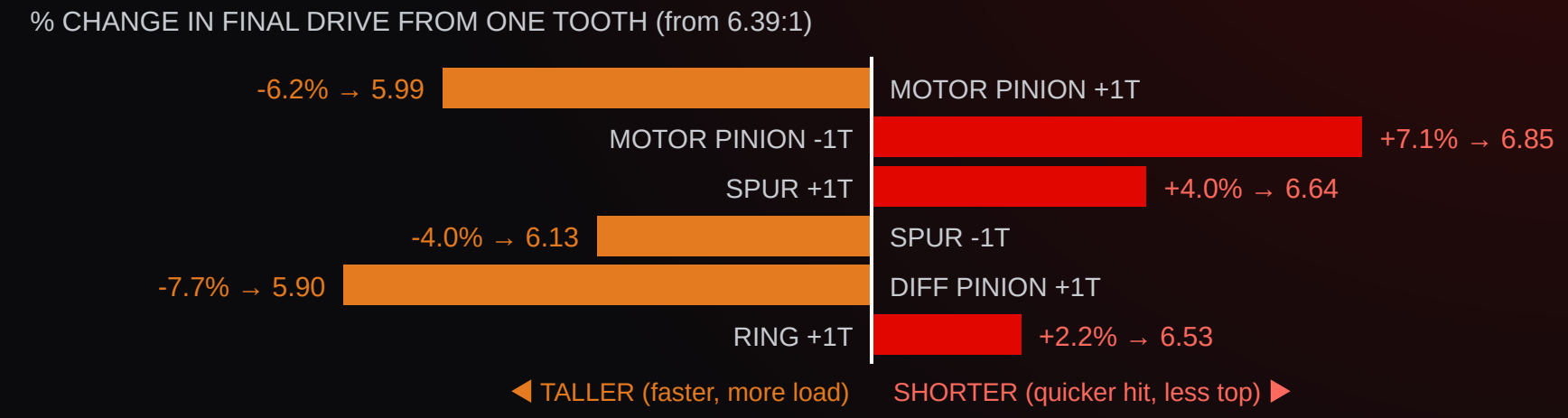
```
rollout = circumference ÷ final drive
top mph = kV × volts × rollout(in) × 60 ÷ 63,360
```

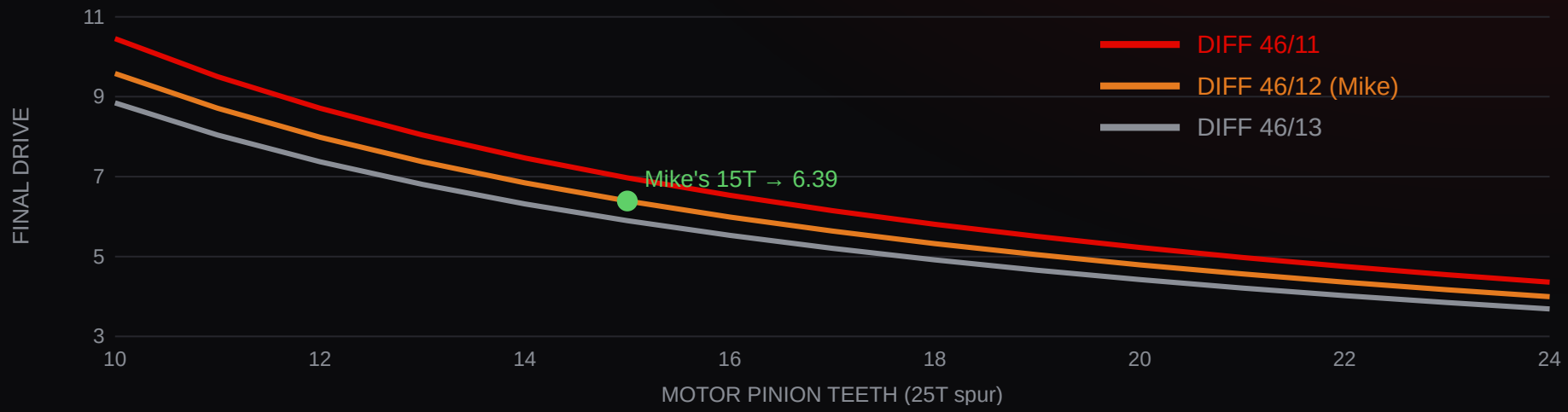
+0% GROWTH	+3% GROWTH	+6% GROWTH	+10% GROWTH
73.6 mph	75.8 mph	78.0 mph	80.9 mph

*Drag tires **grow** at speed. Growth makes the tire act taller: same gears, more top speed, more load. Growth % values are **examples**; measure yours. In Mike's example, **+1 mm of circumference ≈ +0.37 mph**.*

PINION VS SPUR VS DIFF

Small gears make big jumps. Big gears make fine steps.





FINE TUNE = SPUR

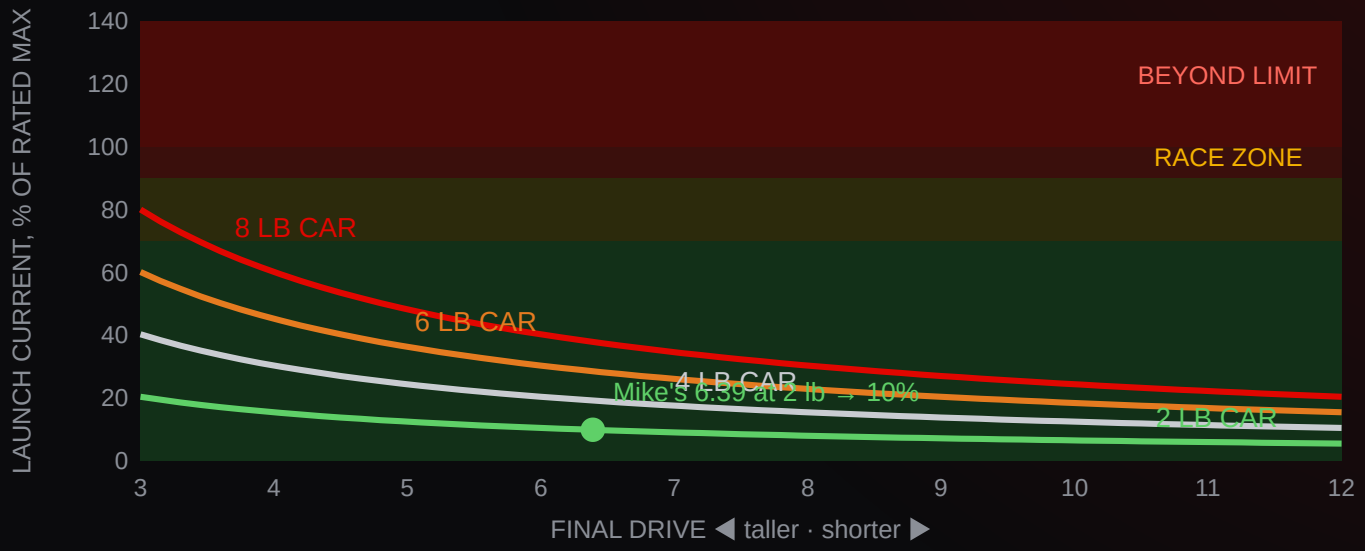
One spur tooth ≈ 4% here. Use the spur — or the tire — to make small adjustments without upsetting anything else.

BIG JUMP = PINION / DIFF

One pinion tooth ≈ 6%; one diff-pinion tooth ≈ 8%. Change these when you want a real move, not a trim.

132 FT GEARING TIPS

Taller gear (lower number) = more load. Heavier car = more load.



GOOD
under 70% of rating

CAUTION
70–90%

RACE ZONE
90–100%, on purpose

BEYOND
past the rating

Same gears, heavier car: the line climbs into the red. Example: EVO2240HS 5800 kV, 3S, 60 mph in 2.5 s, 2.5 in tire, calculator launch model.

TALLER = MORE TOP, MORE LOAD	Lower final drive = more rollout and top speed, but the motor works harder off the line. In 132 ft you rarely need all the top speed.
SHORTER = HARDER HIT, LESS TOP	Higher final drive launches harder but runs out of rpm sooner. If top speed is under your trap speed, it's too short.
THE PACK PAYS FOR IT	More load = more amps = more sag. Put this final drive into the EVUL Battery Sizing Calculator and check sag against your floor.
TINY PINIONS	Very small pinions (under about 12T) have weak teeth and mesh poorly. Under about 9T is flagged as unworkable in the calculator (example thresholds).

APPENDIX · THE MATH, STEP BY STEP

```
01  STAGE 1 = spur ÷ motor pinion
    25 ÷ 15 = 1.6667

02  DIFF RATIO = ring ÷ diff pinion
    46 ÷ 12 = 3.8333

03  FINAL DRIVE = stage 1 × diff × extra stage
    1.6667 × 3.8333 × 1 = 6.3889
    = motor turns per wheel turn

04  CIRCUMFERENCE = π × diameter
    at speed = circumference × (1 + growth)
    π × 63.5 mm = 199.49 mm

05  ROLLOUT PER MOTOR REV = circumference ÷ final drive
    199.49 ÷ 6.3889 = 31.23 mm (1.229 in)

06  TOP SPEED (mph) = kV × volts × rollout(in) × 60 ÷ 63,360
    5800 × 12.6 × 1.2293 × 60 ÷ 63,360 = 85.1 mph no load
    km/h = mph × 1.609

07  WHEEL TORQUE = motor torque × final drive × drivetrain eff.
    torque multiplier = 6.3889 × 0.90 = 5.75
    tractive force = wheel torque ÷ tire radius

08  Kt ≈ 9.549 ÷ kV  (N·m per amp)
    est. max torque = Kt × rated max amps
    9.549 ÷ 5800 × 350 A = 0.576 N·m

09  LAUNCH TORQUE NEEDED
    = mass × (trap ÷ ET) × tire radius ÷ (final drive × eff.)
    2 lb car, 60 mph in 2.5 s: 0.0537 N·m at the motor
    launch amps = torque ÷ Kt + no-load amps

10  % OF RATING = demand ÷ rated max × 100
    good under 70 · caution 70–90 · race zone 90–100
    beyond limit over 100 (example thresholds)
```

WHAT CHANGES WHAT

One **spur** tooth ≈ 4% · fine tune
One **motor pinion** tooth ≈ 6% · big move
One **diff pinion** tooth ≈ 8% · biggest move
One **ring** tooth ≈ 2% · finest of all
+1 mm of tire circumference ≈ +0.37 mph

WHAT IS ESTIMATED

Loaded kV allowance (90%), drivetrain efficiency (90%), tire growth, no-load current and the rating thresholds are all example assumptions. The gear arithmetic itself is exact; everything downstream of the motor is a model.

COMPANION TOOLS

EVUL Gearing Calculator — every field has a plain-language note, and it shows what each single tooth would do
Battery Sizing Calculator — put this final drive in and check sag
Start Here — if a word here lost you, start from what went wrong instead

This guide gives physics-based estimates, not guarantees. Real results depend on traction, track, setup and parts. Confirm every setup with a logged pass.