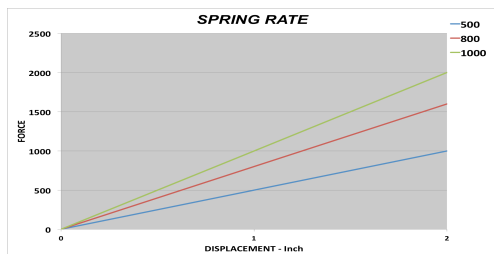


SPRING: THEORY

- Displacement sensitive – lb./inch
- Wheel rate based on suspension geometry
- Springs control tire load and distribution
- Springs store energy and need shocks to control the release of that energy

SPRING RATES

- Linear rate



SPRING: ADJUSTMENT DIRECTION

- All depends on grip level – Velcro or skating rink?
- Try softer for grip as first change
- Stiffer if car rolls over and gives up
- Stiffer springs for better transition - crisper
- Softer springs for bumps and curbs
- Softer rear springs for better traction
- Stiffer front springs for better entry stability
- Always think how car is moving and what you need

SPRING RUBBER

- Goes in coils of spring and increases spring rate when compressed
- Many different rates and types



SPRING RUBBER

- Allows you to quickly change the spring rate without removing the springs
- Very inexpensive
- Easy to get (link later in presentation)
- Estimated rate increase...

Conversion	5.71	ID	NOTES
N/mm	lbf/in		
97	553	100-2	
107	613	100-2	1 White Rubber
119	681	100-2	2 White Rubber
112	639	100-2	1 Yellow Rubber
129	735	100-2	2 Yellow Rubber
150	859	160-2	
167	953	160-2	1 White Rubber
185	1057	160-2	2 White Rubber
174	993	160-2	1 Yellow Rubber
200	1142	160-2	2 Yellow Rubber

BUMP RUBBER

- Goes on shock shaft and increases spring rate when compressed
- Many different rates and types



PACKERS

Packers: plastic shim to control when bump rubber starts to compress



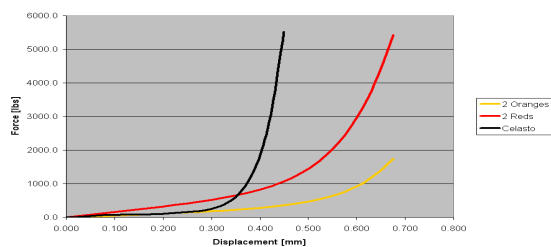
PACKER & BUMP RUBBER: THEORY

- Can be used if can't change springs due to rules or cost
- Easy way to stiffen one end of the car
- Very inexpensive
- Different than a spring or spring rubber change
 - Can time when bump rubber comes into play with packer
 - Spring rate different than a coil spring change

BUMP RUBBER RATES

- Not linear like a spring

Bump Rubber Compare



HOW TO SET UP A BUMP RUBBER/PACKER PACKAGE

- Try to get a rate graph of the bump rubber
- Pick something relatively linear if possible to start
- Estimate shock travel
 - Data system if possible
 - Tie wraps on shock shaft
 - Video camera
- Install bump rubber and enough packers to give some engagement
- Go run and feel the car – add packers until you feel the change in stiffness
- Tune like you would springs

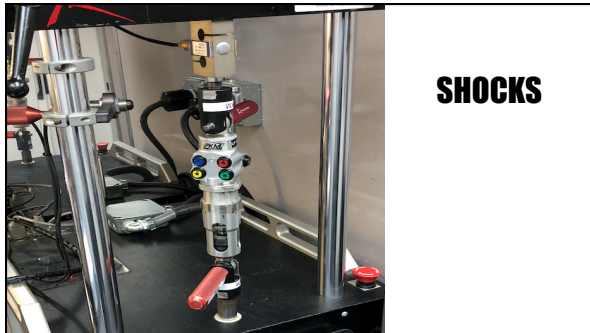
BUMP RUBBER/PACKER ADJUSTMENT DIRECTION

- Need less movement – close packer gap (more packers)
- Need stiffer – close gap or stiffer bump rubber
- Pitch on brakes too much – close gap on front
- Push off corner – close gap in the rear, less squat
- Roll too much – close gap
- Flat slide (skating rink) – open gap or softer bump rubber
- Not crisp on direction change – close gap front
- Rain? Don't do a thing – not enough lateral load generated to get to bump rubber

SOURCE FOR BUMP RUBBERS, PACKERS & SPRING RUBBERS

- REsuspension.com



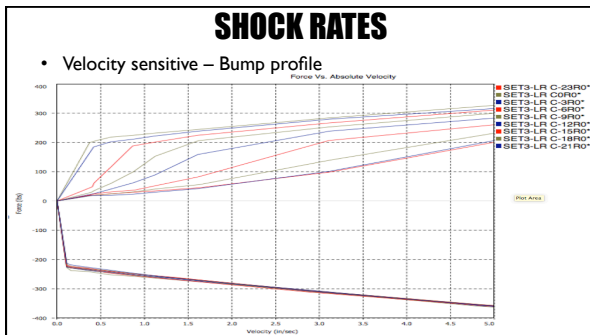


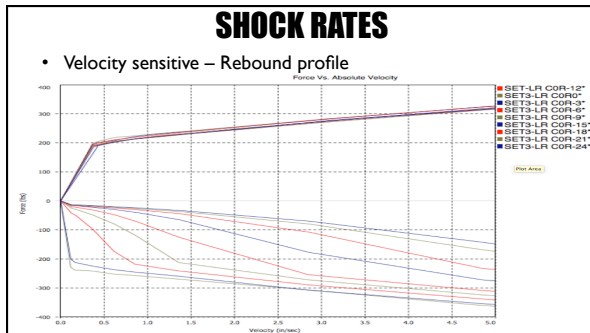
SHOCKS: THEORY

- A complete webinar in itself
- Download this book - \$2.99
 - <https://speedsecrets.com/product/shocks-for-drivers/>
- Bump
- Rebound
- Shock speed vs. Car speed
- Timing device
- Not like a spring or bump rubber
- Need profile to understand how to adjust

SHOCK RATES

- Velocity sensitive – Bump profile





- ### SHOCKS: ADJUSTMENT DIRECTION
- First think like a spring – but remember it's NOT at all like a spring
 - Controlling MOVEMENT and speed of that movement, not weight transfer amount, but how weight gets there and how fast
 - Roll too much – more rebound, like an anti-roll bar
 - Pitch too much – more front bump and rear rebound – hold it flat
 - Bad in bumps - softer bump first – high speed if possible
 - Need power down traction – softer rear bump and softer front rebound, let it squat
 - Think what's happening and how you can use shock to control it
 - Scratching surface – get the book – it's the bargain of the century



AERO: THEORY

- Balance is key. More important than total down force or drag
- Center of pressure (CoP) sets balance - % front
- If you're going over 40 MPH, you have an aero car
- Drag and downforce go up with the square of the speed – 2x faster = 4x drag and downforce
- Don't need wings and splitters to adjust your aero balance. Rake, tabs, flaps
- The front 1/3 of the car most important for drag
- Frontal area big factor in drag

AERO: ADJUSTMENT DIRECTION - PART 1

- Pick a turn that is your aero balance test turn
- Balance first, drag and downforce 2nd
- Add balanced downforce first, reduce drag next
 - Unless you're at Le Mans or Daytona
 - Or you have low power car
- Add downforce as efficiently as possible – L/D
 - Under-wing car – go lower
 - Gurneys
 - Wing flap
 - Splitter extensions

AERO: ADJUSTMENT DIRECTION – PART 2

- More rake moves CoP forward
 - Most powerful in flat bottom car that's low
 - Still helps in GT car
- Front wing change has little drag impact – use for balance change
- Springs and shocks effect aero balance dynamically
- More rear wing helps braking and stability – parachute effect
- Use simple add-on parts

THE "S" FLAP

- Very efficient downforce improvement, like a Gurney for the wheel arch



SPLITTER & EXTENSIONS

- All about area for slow air to act on



DIVEPLANES

- Blunt force and NOT very draggy





RAIN: THEORY

- Most important thing is have a good driver
- Everything else pales in comparison
- Always practice in the rain if you can
- It's simple – you're in skating rink conditions
 - Be easy on the tire loading
 - Nothing to press the tire into
- Hard to get heat in the tire
- Tire compound softer than dry tire
- Rain tire is a pump

RAIN: ADJUSTMENT DIRECTION

- | | |
|--|--|
| <ul style="list-style-type: none"> • Softer everything <ul style="list-style-type: none"> – Springs – Shocks – Roll bars • Generate tire temp <ul style="list-style-type: none"> – More toe – More camber • Increase tire pressure 4psi over dry tire to start | <ul style="list-style-type: none"> • Brake bias to the rear 1% or more • Same downforce or LESS! <ul style="list-style-type: none"> – Depends on situation <ul style="list-style-type: none"> • Starting position • Rain rate • Raise car if hard rain and flat bottom |
|--|--|

FINAL THOUGHTS

- At the end of this presentation are some slides to ponder...
- When you download the presentation you will want to check them out... sort of a hidden nugget
- Most are from the best race engineer you've never heard of:
Steve Johnson



**THE MOST IMPORTANT
THING IS...**

HAVE FUN!



Best way to contact me for questions is my Facebook page, or on Twitter or Instagram:

www.facebook.com/AutoRacingTechTips

@JVBRAUN

NEXT?

**5 Ways to
Drive Faster**

SPEED SECRETS


Webinar

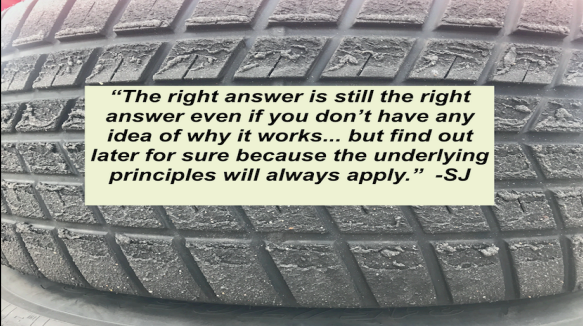
June 5, 2018

www.SpeedSecrets.com/5-Ways-Drive-Faster

Registration is open now

"The laws of physics don't change
when you cross state lines" - SJ





*"The right answer is still the right
answer even if you don't have any
idea of why it works... but find out
later for sure because the underlying
principles will always apply." -SJ*

