"MAGIC SETUP"

- GET a rear sway bar from a 65 Pontiac GTO
- Bend the arms at a 12.6 degree angle in the X plane and 46.8 degrees in the Y plane
- Heat treat it in a carburizing oven for 3 hours to achieve a Rockwell hardness of 75 to 80
- Machine a 6mm radius notch, 2mm deep in the bend where the arm meets the main bar using a 7mm ball end mill in a Bridgeport

"MAGIC SETUP" - Part 2

- Let the bar sit outside under a pine tree from April 29th to July 11th and be sure its covered in tree sap
- On July 12th wrap the bar with 1.5mm green vinyl for all but the last 10mm
- Put the whole unit in the trunk and duck tape it to the floor
- Go run and see if it handles better

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"MAGIC SETUP"... THE RESULT

- The car had less understeer and he went faster
- Perfect! So now we know how to solve a oversteer problem and all we need is a solution for understeer and this webinar is over
- Have a great racing season and thanks for listening

WHAT JUST HAPPENED?

- Our car went faster – good!
- Why did we go faster?
- Was it the bends?
- The heat treat?
- The notches?
- The tree sap?
- NO. We went faster because we changed the weight distribution
- We could have thrown a concrete block in the trunk & done the same thing

THERE IS NO MAGIC SETUP!

- I cannot tell you what shocks, springs, bars, tires to run on your car to make it handle great
- Heck, I can't even do that on the LMP2 car I run!
- We need to know what's causing the handling
- Then figure out what we can change on OUR car…
- With OUR tools we own…
- Using OUR personal skills…
- And in OUR budget
- Let's GET SMARTER!

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THE 51% DISCLAMER

- Rules of thumb will be given
- Each situation is different – track, car, experience level, etc.
- Try my suggested direction first, if unsure
- No hard and fast rules on direction of a change
- If anyone read the latest Speed Secrets Weekly, you have a head start on this

It all depends on how much GRIP you have

EVALUATING GRIP

THE MOST IMPORTANT THING TO ADJUSTING YOUR CAR'S HANDLING

HIGH GRIP vs. LOW GRIP

ICE SKATING RINK

Be easy on the tire

VELCRO

Push hard on the tire

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TYPES OF GRIP

- Tire grip
  - Race tire compounds
  - Street tire compounds
- Track grip
  - Temp
  - Weather
  - Surface
- Aerodynamic grip
- Suspension grip
  - Production cars
  - Race cars

THINGS WE CAN CHANGE

- Tire Pressures
- Alignment
- Anti-roll Bars
- Springs
- Bump Rubbers & Packers
- Shocks
- Aero

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TIRE PRESSURE: THEORY

- Provides the core structure to the tire
  - Safety
- Supports the tread
  - Goal to keep tread on road
- Effects stability of side wall
  - Driver can feel this
- Changes spring rate
  - Smaller feel to driver, but very important
- Changes footprint
  - Very small change

TOOLS FOR TIRES

- Source of dry air
  - Nitrogen
  - Air dryer – simple and cheap
    (www.mcmaster.com/#air-compressor-dryers/=yvjrmj)
- Tire pressure gauge
  - Reads to 0.1 accuracy
  - Bleed valve
- IR temp gauge
  - Track and air temp
  - Basic tire temp
- Needle pyrometer
  - Tire temps of tread
- Camera phone
  - Pictures of your tread
- Note-taking system

STREET/PERFORMANCE TIRE CHARACTERISTICS

- Low grip in general
- Needs tread support – more pressure
- Tall sidewall needs support – more pressure
- Soft construction = low spring rate
- Hard compound
- Low heat dissipation – thick tread

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STREET/PERFORMANCE TIRE: ADJUSTMENT DIRECTION

- Skating rink thinking
- Is it sliding right away – be easier on tire
  - Lower pressure = softer
- Rolling over then sliding – Needs support
  - More pressure – support
- Must focus on tire feel and evaluate what's happening
  - Adjust pressure to suit

RACE TIRE CHARACTERISTICS

- High grip in general
- Good tread support
- Good sidewall construction
- Higher spring rate
- Softer compounds available
- Good heat dissipation – thin tread

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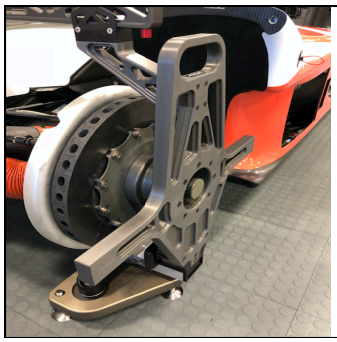
RACE TIRE: ADJUSTMENT DIRECTION

- Velcro thinking
- Slow transitions – needs support
  - More pressure
- Need grip and can support it
  - More pressure on that end
- Hotter track temp
  - Lower pressure – grip down
- Key is to feel the tire and grip level



CHASSIS ALIGNMENT

RIDE HEIGHT – Part 1

- Lower is better – always, always
  - As long as we are not karting
  - As long as we are not hitting the ground
  - As long as we are not closing the diffuser
- Change balance of car
  - Changes CG of end adjusted
    - More rake makes it looser
    - Has to do with roll centers and overturning moments & LLTD (Lateral Load Transfer Distribution)

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RIDE HEIGHT – Part 2

- Aero car – Tunnels or flat bottom
  - Changes CoP
    - More rake balance to front
    - Lower makes more grip
    - 1mm can be big deal

RIDE HEIGHT: ADJUSTMENT DIRECTION

- Lower is better
- Rake makes it turn better, but looser in
- Less rake makes entry stable
- A flat car in roll is better for an aero car
  - Tilt
  - Stiffer springs
  - Stiffer bars

CAMBER: THEORY

- Every tire has a best camber for the vertical load, lateral load, temp, and slip angle it's being run at
  - We don't know what that is
  - Find that with "sweeps" in testing
- Tire data is usually not available or something we can understand

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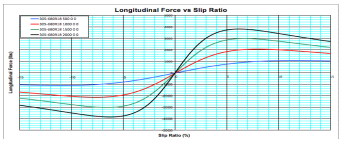
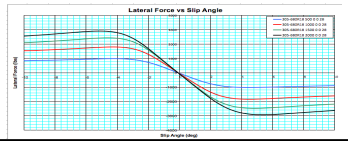
TIRE DATA SAMPLE





CAMBER: ADJUSTMENT DIRECTION

- More camber gives grip – 51% rule
  - Also heat
  - Also wear
  - Also worse braking
  - Also tire gives up sooner
- Less camber helps straight line stuff
  - Power-down traction
  - Braking

TOE - THEORY

- Modern radial & slip angle
  - Angle between where tire is going and where wheel is going
  - Optimum slip angle for max grip
  - Toe helps put tire at optimum slip angle
- More grip = more slip angle we can generate
- Less grip = smaller slip angles

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TOE - FRONT

- Front Toe-out
  - Depends on Ackerman
  - Depends on tire type
  - Depends on grip
  - Try more toe-out for increased turn-in & grip
  - Do "toe sweep" if possible - may be surprised

TOE - REAR

- Rear Toe-in
  - Think snow ski effect
  - Adds stability on brakes
  - Tightens up car center off
  - Add more rear toe-in for stability and secure rear end
  - Do "toe sweep" if possible - may be surprised

TOE: ADJUSTMENT DIRECTION

- FRONT
  - More toe-out helps turn in
  - Less toe-out helps stability on entry
  - More toe increases heat – could be good or bad
- REAR
  - More toe-in helps entry stability
  - More toe-in increases heat – could be good or bad
  - More toe can cause drag, small effect

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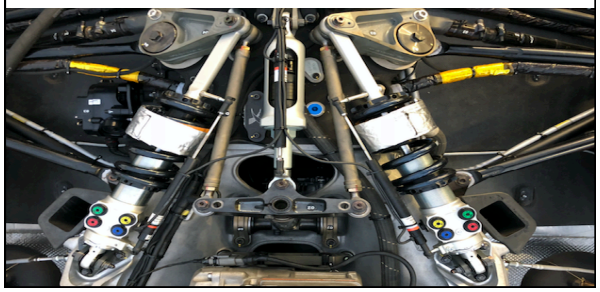
ANTI-ROLL BARS



ANTI-ROLL BAR: THEORY

- Twists bar when outside wheel goes up and tries to make inside wheel go up
- If bar was infinitely stiff the car would not roll at all
- Stiffer bars make the car feel stiffer in roll, harder to roll
- Stiffer bars load the tire harder – think about your grip level

ANTI-ROLL BAR: ADJUSTMENT DIRECTION

- Stiffer bars reduce roll on that end
  - Good for aero cars
  - Good for better transition
  - Good for high grip tracks
- Softer bars are easier on the tire
  - Good for low grip tracks – rain
  - Can make car "fall over" & be nervous to drive
- Softer bars are better in the bumps/curbs
  - Especially cross bumps (i.e., Sebring)
- Remove rear bar or go softer for better power down traction

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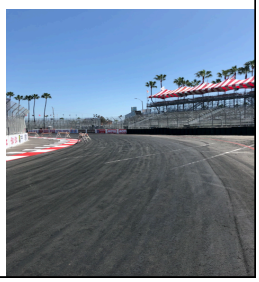
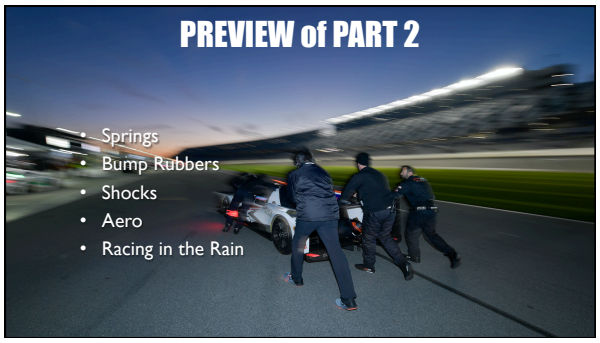
REVIEW of PART 1

- Evaluate your grip level first
- Feel the car and what it is doing
  - Instant slide – low grip
  - Grips, rolls over then slides – good grip
- Try to feel difference between what tire is doing and what car is doing
- Need to know if we should be easier on the tire or more aggressive



PREVIEW of PART 2



- Springs
- Bump Rubbers
- Shocks
- Aero
- Racing in the Rain

QUESTIONS?

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