

## Driving “At the Limit”

### NNJR Track Side Class Room Series



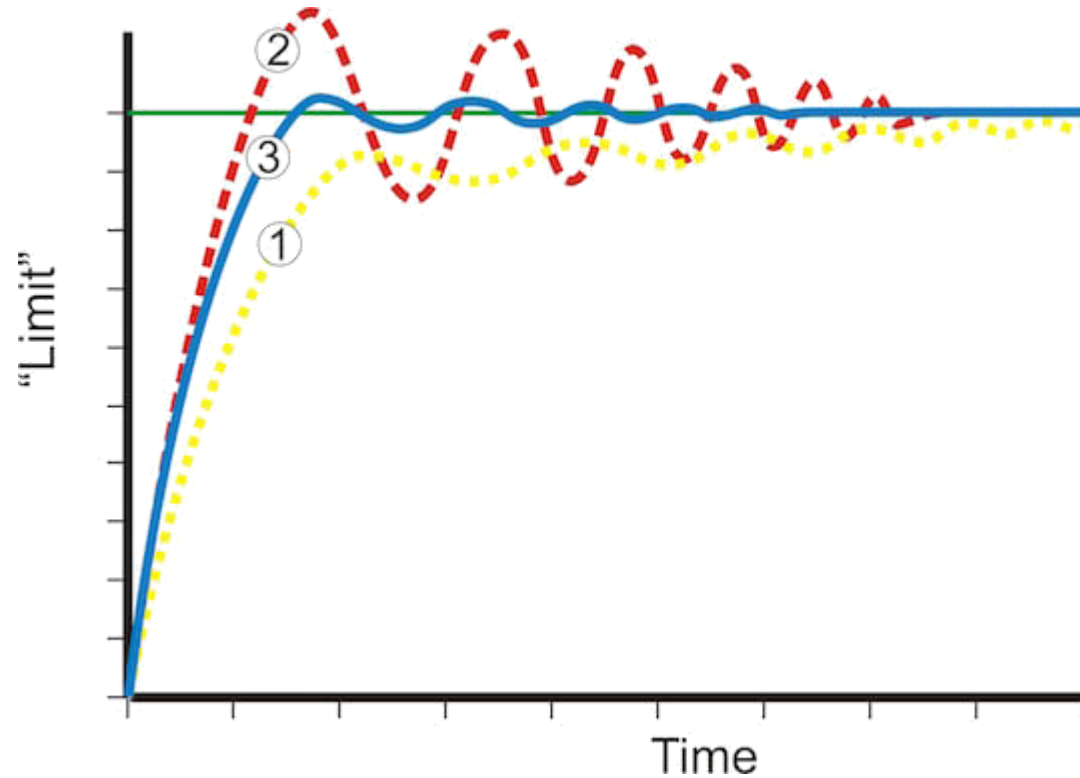
## ***Disclaimer***

*The techniques shown here have been compiled from experienced sources believed to be reliable and to represent the best current opinions on driving on track. But they are advisory only. Driving at speed at VIR, or any other track, requires skill, judgment and experience. These techniques assume the reader has high performance driving knowledge and applies them as applicable to their level of driving experience.*

*High-performance driving can be very dangerous, carries inherent risks and may result in injury or death. NNJR and PCA make no warranty, guarantee or representations as to the absolute correctness or sufficiency of any representation contained herein. Nor can it be assumed that all acceptable safety measures are contained herein or that other or additional measures may not be required under particular or exceptional conditions or circumstances.*



- What is the Limit?
  - Driver
  - Car
- How to (safely) approach the limit
  - Prerequisites
  - Techniques
  - Tips



# NNJR Driver: Limits vs. the Limit



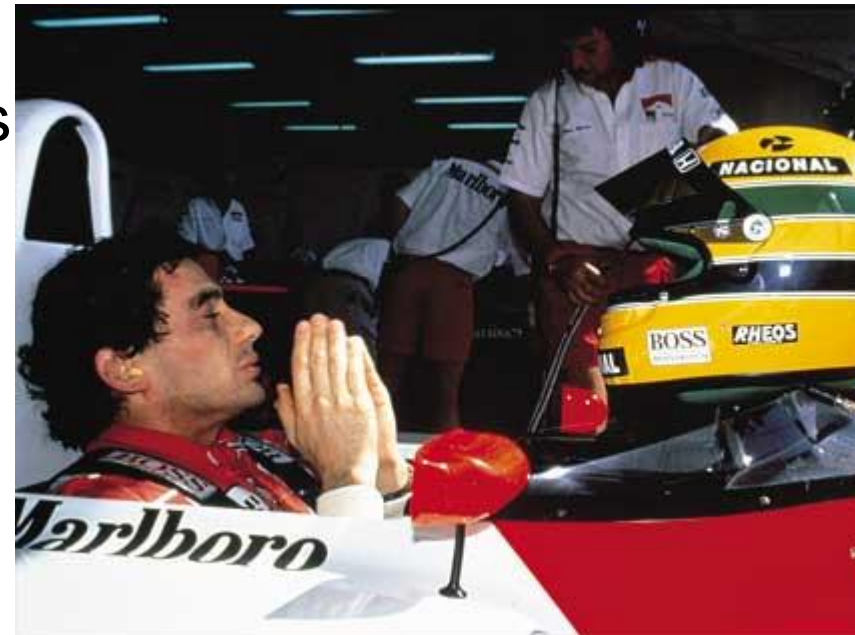
- Physical Condition
  - Uncomfortable in the car
  - Tired
  - Dehydrated
- Mental Condition
  - Distracted
  - Tired
  - Hurried
  - Focus on the wrong thing, or too many things e.g.
    - Go fast
    - Poor technique
  - Not prepared



# NNJR Driver Prerequisites



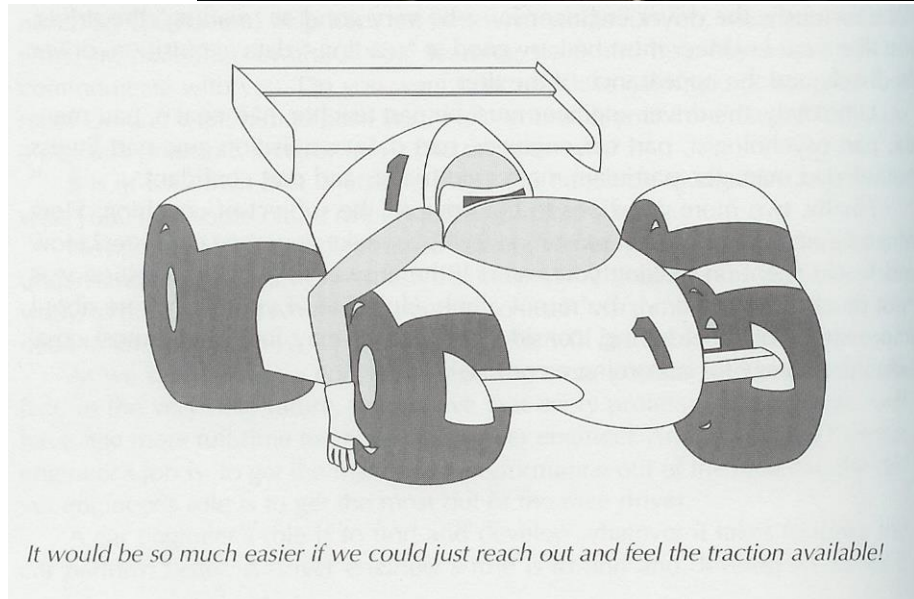
- Good physical condition
- Proper seating, control access
- Mental attitude
  - Learning mode (receptive)
- Focus
  - One technique or corner for this session
  - Use all the senses (Sensory Input Sessions)
  - Visualization



# NNJR Driver Prerequisites



- Relaxed
- Focused on one thing
  - All other driving is a consistent baseline
  - Mental image of success
- **Full sensory input**



*It would be so much easier if we could just reach out and feel the traction available!*



# NNJR Getting Closer to the Limit



- Example: Braking at Turn 1
  1. Can you Heel and Toe (consistently)?
  2. What is current braking point? Speed?
    - Are they consistent? Really consistent? Indexed?
  3. Set target: e.g. 5 feet later / half a car length
  4. In the paddock, measure half a car length
  5. Merge 3 and 4, visualize
  6. On track: out lap at reduced speed, brake at new point
  7. Increase pace slightly for several laps
  8. Success: back to original pace or it's too late



Adapted from Ross Bentley: *Speed Secrets weekly 165*





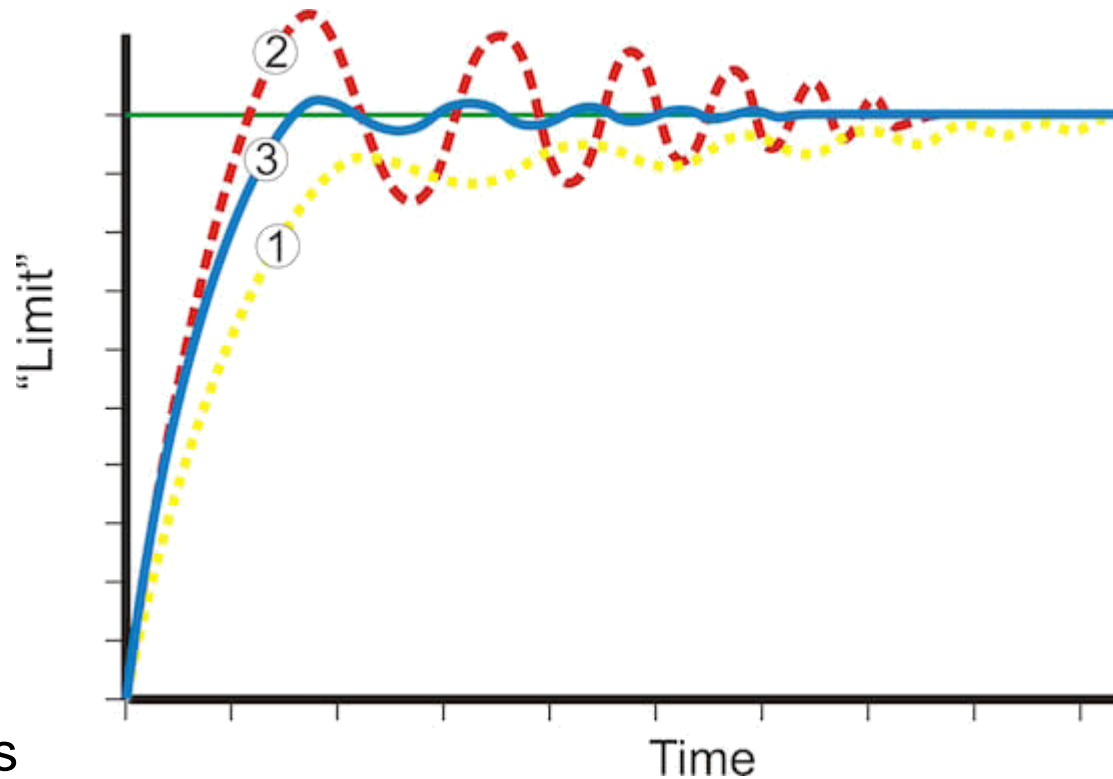
- Focus on Consistency
- Assuming the line is consistent: Braking
  - Approach speed: same every lap?
  - Braking Point: same every lap?
  - Braking Force: same every lap?
  - End of braking: same every lap?
  - Transition off the brakes: smooth?
  - Throttle application: smooth? Same every lap?
  - Consistent Heel and Toe?





- Which corner/section?
- Braking?
- Cornering?
- Accelerating?
- Transitions
  - Steering Input
  - To the Brake
  - Heel and Toe
  - Off the Brake
  - To the Gas (TAP)
  - Full Gas (FTP)
  - Others for newer drivers

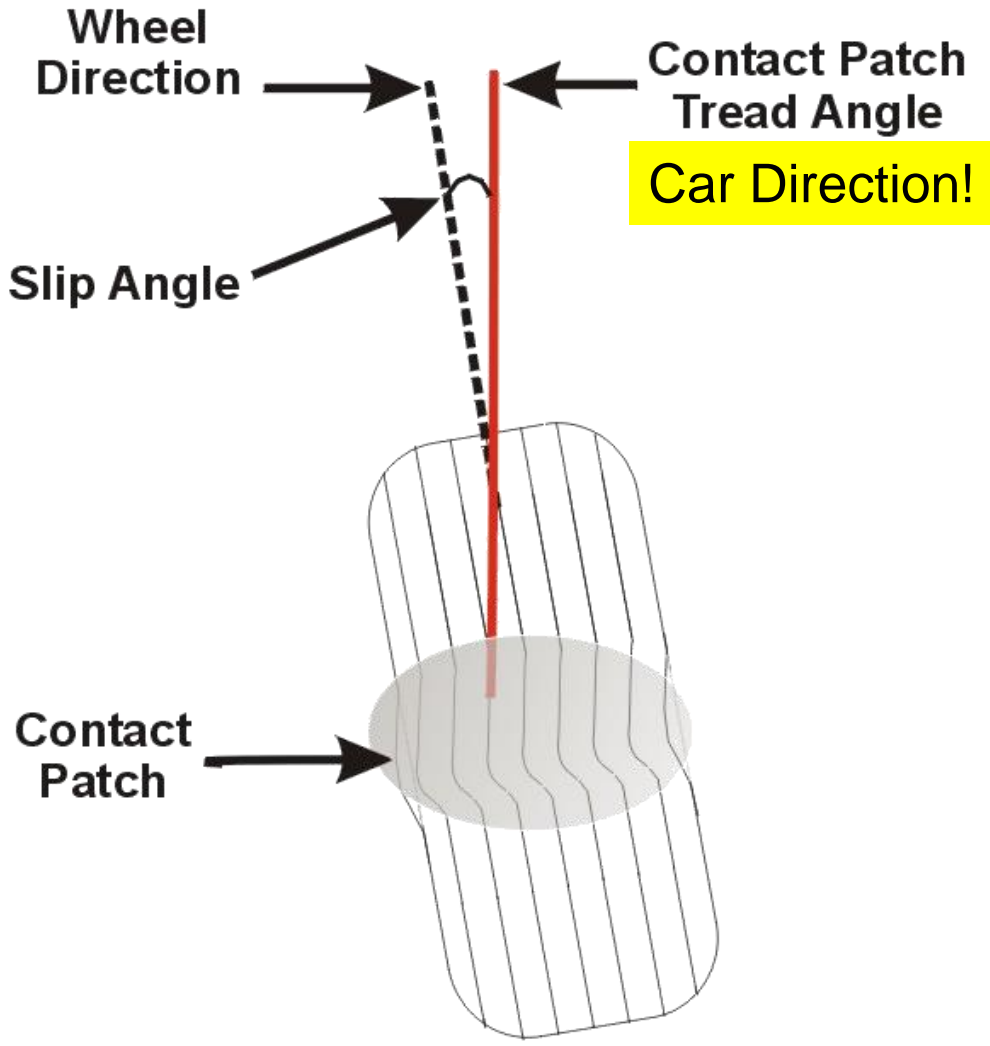
- Work on one at a time
  - Focus!



# NNJR Slip Angles



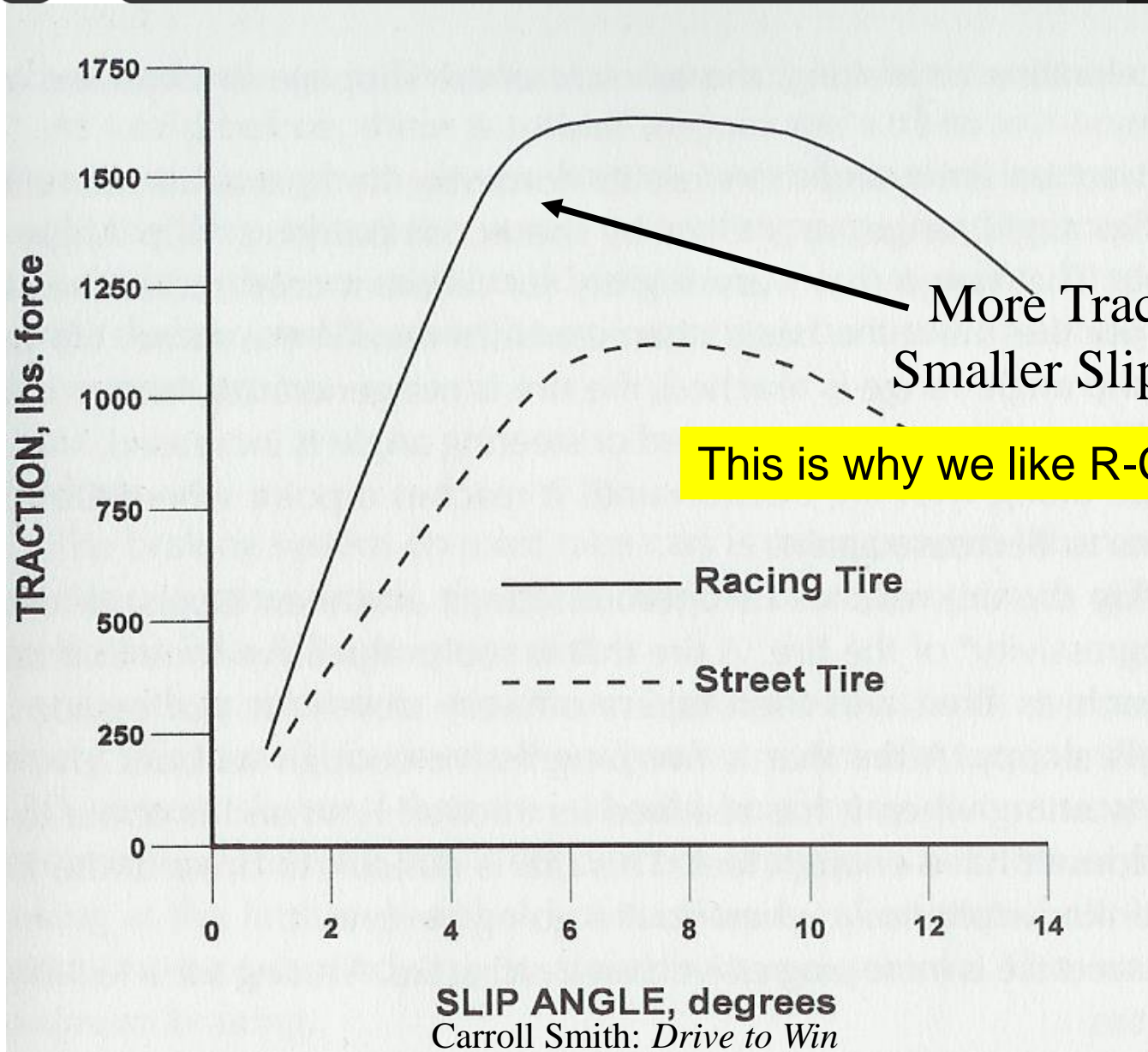
- Definition



Wheel Turning Left



# NNJR Tire Variations



This is why we like R-Comp Tires!

SLIP ANGLE, degrees  
Carroll Smith: *Drive to Win*



# NNJR Tire / Slip Angle Limit



THE SLIP ANGLE vs LATERAL FORCE CURVE  
DIVIDED INTO ENVELOPES OF DRIVER EXPERTISE

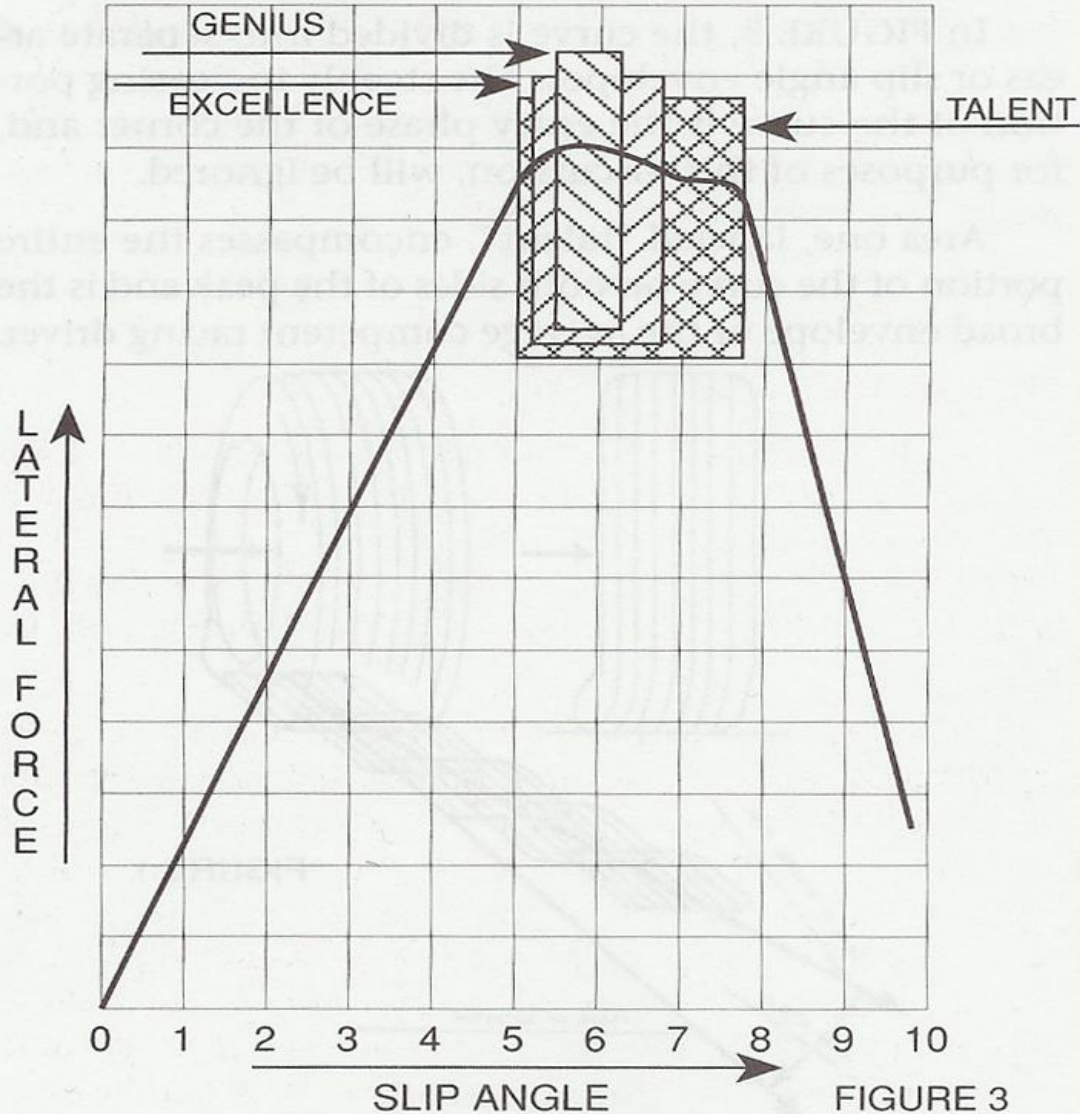


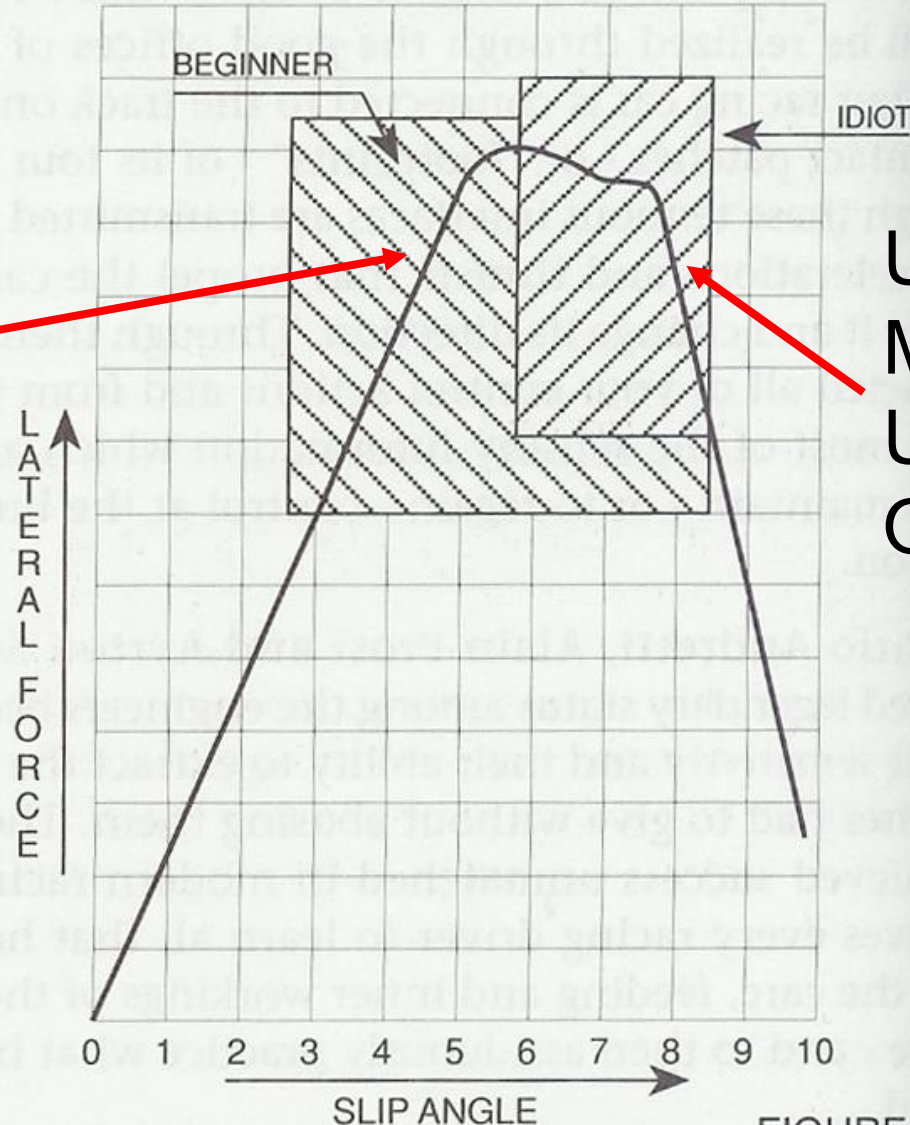
FIGURE 3

Carroll Smith: *Drive to Win*

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BEGINNERS AND IDIOTS SLIP ANGLE ENVELOPES



Even, controllable, predictable

Unpredictable, Massive Understeer &/or Oversteer

Carroll Smith: *Drive to Win*

FIGURE 4



# Getting Closer to the Limit: Cornering



1. Pick a “safe” corner (!?!)
  - Not South Bend!
2. Is current driving very consistent? Indexed: +/- 100 rpm
3. What is current entry speed/rpm? Exit speed/rpm?
4. What is the current “line”?
  - End of braking? Throttle application point? Full throttle point?
5. Mid-corner: what do tires sound like? Feel like?
  - Are all of these consistent?
6. Visualize: 5’ earlier TAP or +3% cornering force
7. On track: reduced pace, try earlier TAP, FTP
8. Cornering force: remember slip angle graph!
  - Cornering best learned at AX, skid pad
9. Biggest improvement from earlier TAP and/or FTP
  - May require slightly slower early corner pace





- Focus on Consistency
- Cornering:
  - See Braking Slide!
  - Focus on end of braking
    - Same place every lap?
    - Same speed every lap?
  - Is turn-in the same every lap?
  - Learn to index
    - Measure RPM or Speed at fixed reference point before and/or after a corner



# NNJR Summary: Driving at the Limit



- Starts with the driver
  - Solid, very consistent, baseline
  - Focus on one item
  - Well developed “seat of the pants”
- Getting closer to the limit
  - Small steps
  - Start with visualization (e.g. brake half car length later)
  - Practice at lower speed
  - Gradually increase speed (indexing)
  - Solidify a new baseline
- Understand the physics
  - They set the car/tire limits

