



THE ART AND SCIENCE OF HIGH PERFORMANCE DRIVING

FOREWORD

A person who finds pleasure in the act of controlling a vehicle and who demonstrates expertise, or skill behind the wheel, is a High Performance Driver. I am of the opinion that both expertise and pleasure are very important to the make up of a High Performance Driver.

The demonstration of your skills can take place under any driving condition, for although I derive an immense pleasure in driving fast cars on a racetrack, I also enjoy driving on the highway, country roads and off roads.

To be smooth and progressive with a car whatever circumstances are involved is the key to success and satisfaction behind the wheel. It is this challenge to be ever better that maintains my interest in driving; for surely the acceptance of that challenge could renew interest for a driver who perhaps has found driving to have become dull.

Not to take an interest in becoming a better driver suggests that you will never be a good one.

DEREK HANSON
Chief Instructor

1.0 THE COCKPIT

- 1.1 For the purpose of driving on the track under controlled conditions one need only concern oneself with the Tachometer, Oil Pressure and Water Temperature gauges as far as instruments are concerned.

Tachometer: Reading this instrument enables you to run the engine at peak performance, in that upward gear, shifts are made somewhere in the area of maximum power where the red line of the tachometer starts.

Learn to watch the tach so that over-revving does not take place either on downshift as well as up shifting.

Oil Pressure: If your oil pressure is low or should the oil pressure light come on, you must stop in the pits at the very first opportunity.

Temperature: If your engine temperature is above normal by some margin you should immediately reduce speed. If the condition persists then stop in the pits.

- 1.2 The next important thing to consider in the cockpit is your position relative to the controls.

Steering Wheel: Hands grip the steering wheel anywhere from 9 and 3 o'clock to 10 and 2 o'clock, firmly but without tenseness. Driving with bent elbows gives you more power and your arms will not fatigue as easily as if you were to drive with them straight.

Seating: There is no question that your ability to "feel" and respond to information transmitted by the car from the road is a function of proper seating.



Points to look for are as follows:

- (a) Buttocks should be jammed into the angle formed by the seat and the seatback.
- (b) Trunk of body erect. Your body functions better and you are more alert in this position.
- (c) Back resting firmly against seatback.
- (d) Adjustment of seat runners should be done such that the clutch can be depressed fully without stretching, for only in this position will you be able to apply maximum pressure to the brake pedal if required. The seatback should be adjusted so that either hand on the steering wheel can be run over the 12 o'clock position without shoulders leaving the seat. In that way you will not suddenly find yourself hanging on to the steering wheel to keep yourself in the seat during a cornering maneuver.

1.3 Rest, Dead or Brace pedal: This pedal is usually found to the left of the clutch, however on some cars the bulge of the left wheel-well serves the same function. By planting your left foot firmly on the dead pedal it is much easier to stay in the seat while cornering.

2.0 BASIC SKILLS

2.1 Braking: Never stamp on the brakes like a madman, because invariably it will upset the balance of the car going into the corner. Instead we want to do the following very quickly. Push the pedal relatively lightly until the pressure point is felt, only then put your weight into it.

Heel and Toe Downshifting: When slowing for a corner, we usually downshift in order that upon exit from a corner, we are in the proper gear to have the engine operating in its range of maximum torque so as to realize maximum acceleration. In order to do this smoothly we must brake and downshift simultaneously; it is therefore necessary for the right foot to operate both the brake and gas pedal simultaneously. Heel and toe is somewhat of a misnomer since it is the ball of the foot which operates both pedals in most cars

To be smooth is to match road speed and engine speed so that when the clutch is engaged in the lower gear there is neither sudden acceleration nor drag which could cause the driving wheels to lock up.

STEP 1

Approaching corner with application of brakes.

STEP 2

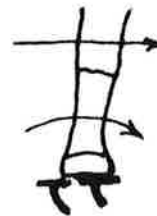
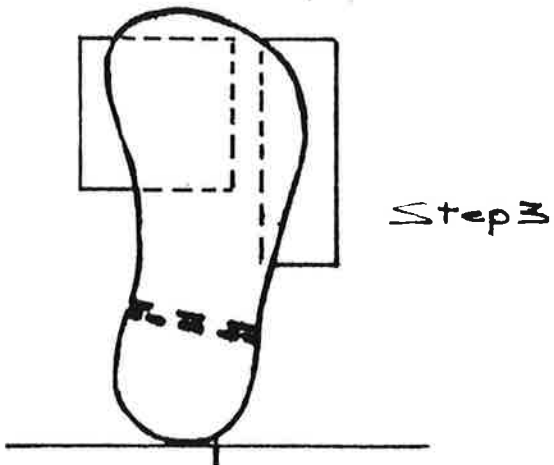
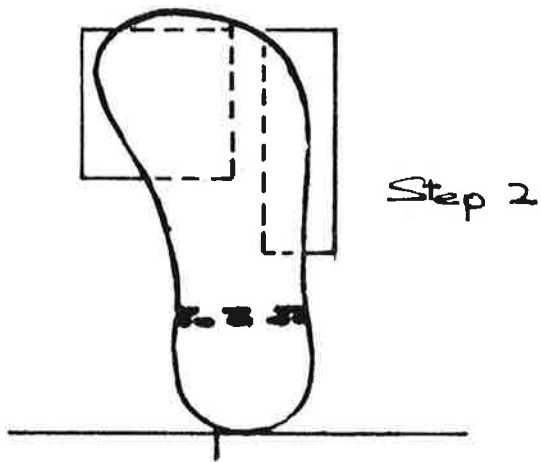
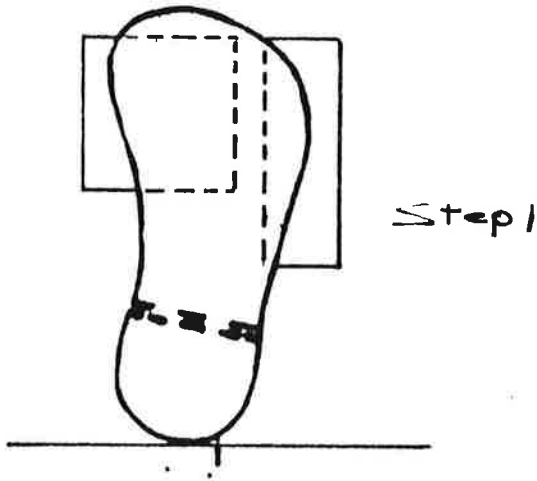
Approach the turn-in point while still maintaining pressure on brake, rotate ball of foot to blip the accelerator simultaneously de-clutching and shifting into lower gear, with next action being the immediate release of clutch.

STEP 3

Complete braking.

STEP 4

Practice, practice and more practice is the only way to perfection in heel and toe.





3.0 CAR DYNAMICS

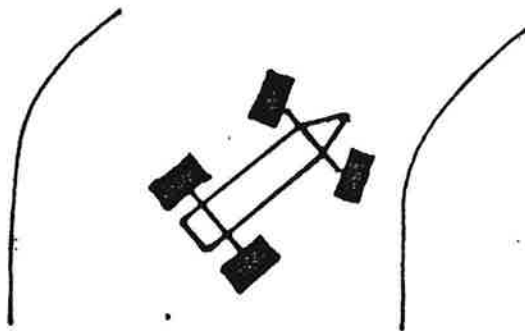
The most common problem during cornering is either too much understeer or too much oversteer; the theoretical ideal being neutral steer. Therefore the three basic attitudes a car adopts while cornering is as follows:

UNDERSTEER: The front tires lose traction before the rear, resulting in a plowing or pushing effect.

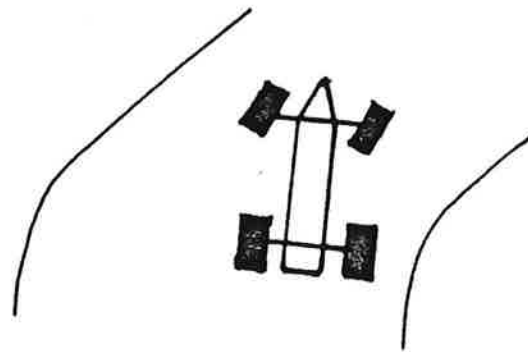
OVERSTEER: The rear tires lose traction before the front resulting in the rear sliding towards the outside of the turn and the front aimed towards the inside of the turn.

NEUTRAL STEER: The theoretical ideal, front and rear traction matched. This will only take place at a given speed on a given corner with the right combination of steering angle and throttle.

The driver can make a car neutral steer, but only if the car's suspension is set up to do so. However, it is up to the driver to come as close as possible to this ideal within the limitations of the car as a whole. Sometimes it may be prudent to induce oversteer or understeer for certain peculiar conditions.



OVERSTEER



UNDERSTEER

- 3.1 Weight Transfer: Under hard braking weight transfer takes place causing the front wheels to be heavily loaded and the rear wheels lightly loaded; the reverse occurring under acceleration. In cornering the outer wheels are heavily loaded. The heavily loaded wheels will have increased traction while the lightly loaded wheels will have reduced traction. From the foregoing it can readily be seen that the manipulation of weight transfer will have a profound effect on the cornering attitude of a car.



4.0 CORNERING

Cornering begins at the instant acceleration is interrupted and your right foot moves as fast as possible from accelerator to braking pedal. Empirically the exact braking point is worked out, and by pushing the pedal relatively lightly until the pressure point is felt, and only then put your weight on it the entire braking procedure is tightly under control.

Before the turn-in point the proper gear necessary for maximum acceleration out of the corner is selected through the heel and toe procedure.

Extend braking zone into corner; rolling off brakes as steering lock is increased, then executing weight transfer when comfortably in corner. Pass the apex, open the throttle early, exit and accelerate placing the car flush to the outside of the corner.

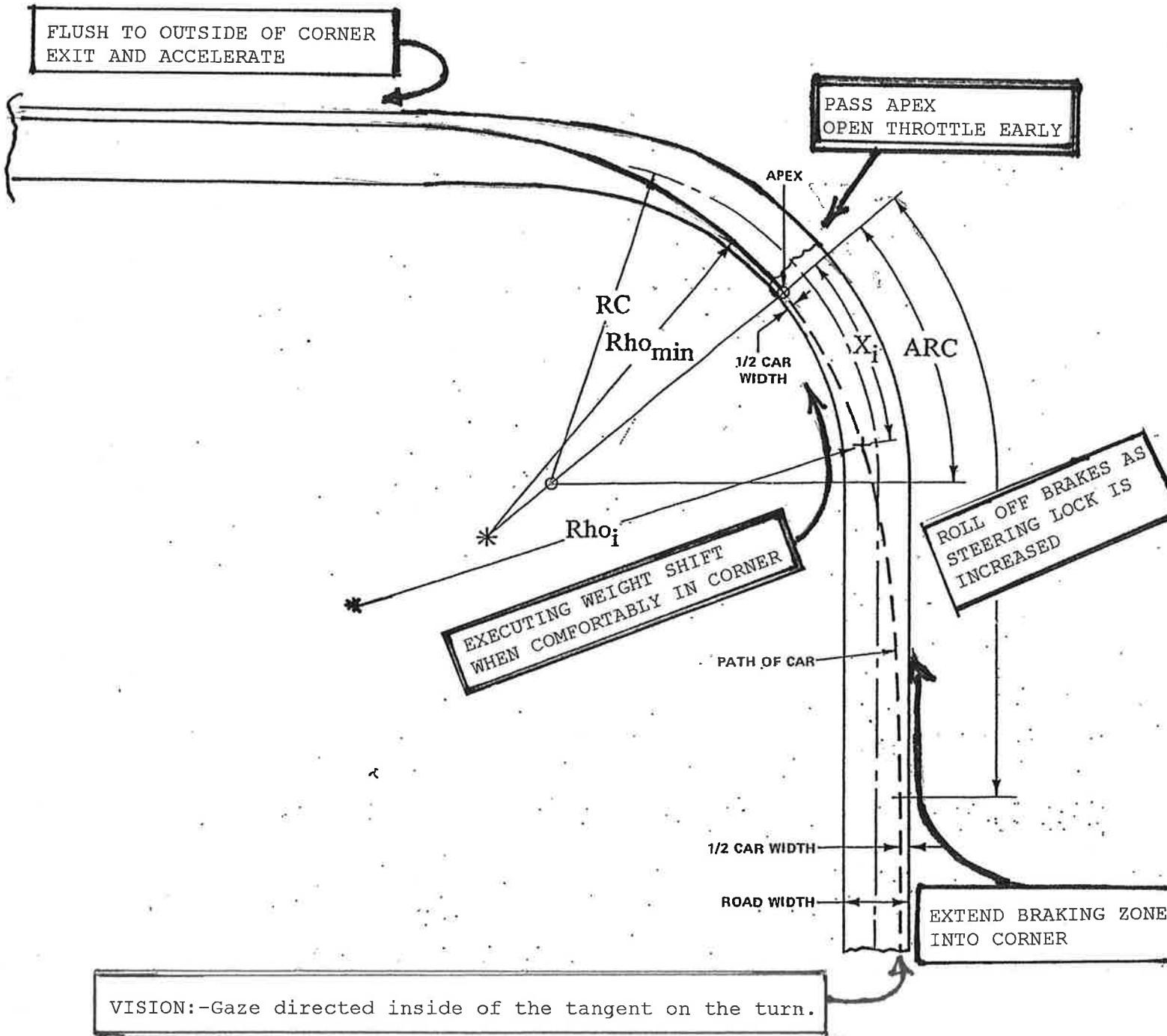
When turning, the steering wheel should not be moved too fast or abruptly otherwise cornering forces are built up too quickly on the outside front tire which can be overloaded, possibly inducing either understeer or diagonal weight transfer resulting in oversteer.

In a nutshell, the basic procedure is to brake as hard as possible, as late as possible and accelerate as soon as possible as hard as possible.

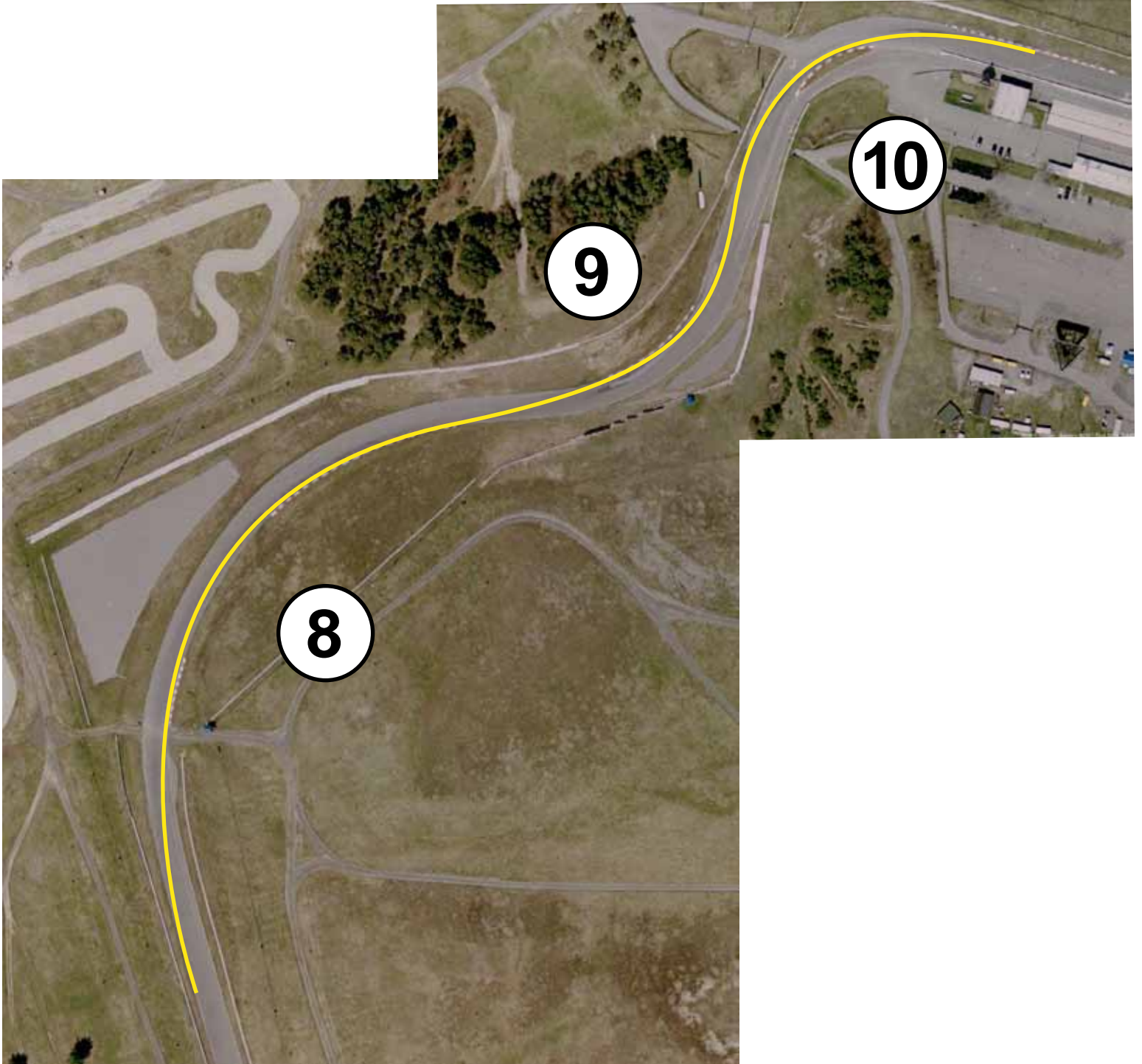
In a rear wheel drive car acceleration can begin somewhat sooner than a front wheel drive due to weight transfer increasing traction on the driven wheels of the rear wheel drive car. On the other hand the front wheel drive cars can be driven harder into the corner by virtue of their weight distribution and the front driven wheels.

As is the case with most front wheel drive cars, understeering can be a problem on slow corners. Therefore, the technique is to go in fast, approach and pass the apex on a light throttle, and only apply power when the corner starts opening up. It is a technique that needs nurturing, for most people find that there is a temptation to apply great globs of throttle rear of the apex. It is not unlike driving a moderately powerful rear wheel drive car on the circuit for the first time. You corner everywhere on full opposite lock, until you discover that a sideways "spectacular" is not the quickest way.

- 4.1 However advanced driving is not concerned with anyone corner, but rather with linking sequential corners in a smooth fashion. This skill maintains the car's momentum-reduces the number of unnecessary inputs and contributes to a flow pattern.



Combination Corner



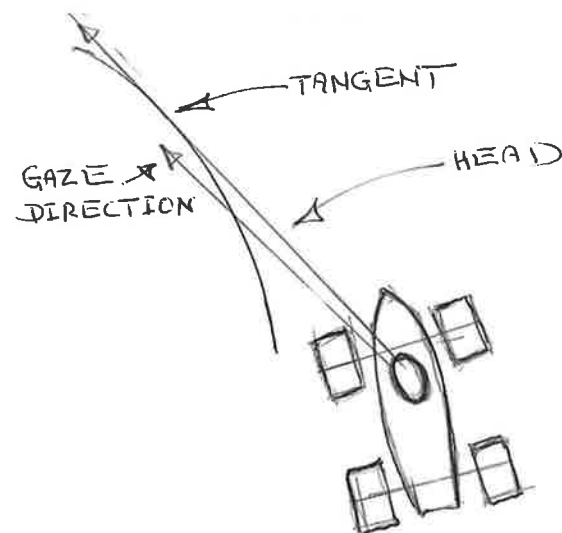
corners 8,9,10 at Mosport International Raceway



5.0 OCULAR DRIVING TECHNIQUES

This makes everything you have been taught possible.

- 5.1 Ocular Driving Technique is the key to foresight and competent driving. We constantly depend on our eyes for accurate and early information for car control. Such that a slide will be detected early so that little effort will be needed to correct it. Responding to direct information from your eyes are the hands and feet.
We have to make the best possible use of our “visual angle”. We therefore have to centre our visual angle to the inside of the tangent on the inside of the turn and enlarge it as much as possible. We have to use the natural gift of our eyes, our field of vision, with which we can look at a point and get at the same time, a good and wider vision of the area that proceeds and follows it. Your eyes are the source of a high percentage of your sensory input when driving a car. We often say we have a seat of pants feeling, but really it is our eyes and our inner ear telling us what is going on.
- 5.2 Before getting to the turn in point, shift head and eyes just to the inside of the tangent on the inside of the turn, which will be the area of the Apex. Your speed and position relative to that Apex will tell you when to begin the turn. Before clipping the Apex of the corner, shift your head and eyes to the outside of the turn and pick up the exit.
- 5.3 The Quiet Eye is defined final fixation of tracking gaze that is located on a specific object or location in the visuomotor work space within 3 degrees of visual angle (or less) for a minimum of 100ms, prior to the first “movement”.
Simple: Your hands and feet are controlled by your brain, which gets valuable information about what to do from your eyes. Your brain needs to organize more than 100 billion neurons. These neural networks are informed by your gaze and control your hands, arms and feet as you drive. The networks will stay organized for a short period of time. A window of opportunity opens that must be used when it is at its most optimal. THIS IS THE QUIET EYE PERIOD.
- 5.4 STEERING WITH THE HEAD-Close coupling between head and eye is the normal pattern.
- 5.5 It is the steering intention that determines head and eye direction.
- 5.6 Head moves-the car rotates soon after (approximately an average just over 1 second later).





Glossary

APEX

The point on the inside edge of a corner which the car's inside front wheel should touch or clip.

UNDERSTEER

The front tires lose traction before the rear.

OVERSTEER

The rear tires lose traction before the front.

NEUTRAL STEER

The front and rear tires' traction are evenly matched.

HEEL AND TOE

To operate brake and gas pedal simultaneously to accomplish a smooth downshift of the gears.

TRACTION

The ability of a car to adhere to a road surface. Same as adhesion.

REFERENCES:

1. Land MF, Benjamin WT: The visual strategy of a racing driver
2. Vickers JN: Perception Cognition and Decision Training, The Quiet Eye in Action

Group Exercises



- Group A** 2nd session each day late passing
2 Car Team - giving and taking late passing signals - up to corner entry 1,2,3,4 and 8
- Group B** 2nd session each day for first 10 minutes
2 Car Team - giving and taking late passing signals - up to corner entry 1,2,3,4 and 8
- Group C** 2nd and 3rd session on Day 1 for first 10 minutes of session giving and taking passing signals repeatedly in designated passing zone between turns 10-1, 3-4 and 5c-8
- Passing** Signal point by hand. Drivers window all the way down. In the case of rain, turn signals may be used.

