

HOUSTON  
REGION



SPORTS CAR  
CLUB OF  
AMERICA

# Solo II Course Design

*version 3.2*

assembled and updated by  
Roger H. Johnson (of no sheep)  
October 1999

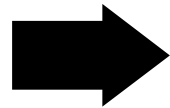


# Introduction

- Credits
  - This packet is a plagiarism of the experiences of **Karen Babb, Gregg Lee, Jim Garry, Mark Sirota, Team.Net,** and myself, **Roger H. Johnson** (of no sheep and no yellow 'Vette)
- This packet is broken up into 4 categories.  
A brief description of each of these categories follows:
  - 1.) Fundamentals** *(pages 3 - 5)*
    - This section contains things to consider about the event site and event procedures before you begin your course design
  - 2.) 10 Basic concepts** *(pages 6 - 59)*
    - Things to consider, techniques and ideas to help you create a course that everyone will like to drive
  - 3.) So you have a blank piece of paper...** *(pages 60 - 87)*
    - How to put your ideas down on paper
  - 4.) Elements, dimensions and real speed** *(pages 88 - 99)*
    - A “real world” view on the relationship of course content to size/horsepower



# Agenda



- **Fundamentals**

- 10 Basic Concepts
- So you have a blank piece of paper...
- Elements, dimensions and real speed
- Summary



# Fundamentals

avoiding all that stuff that can  
mess up a perfectly good course

- Conditions of the surface
  - Avoid sections of the pavement that are breaking up or bumpy
  - Avoid patches or treated areas
  - Beware of fluid spills sticky tar, etc.
  - Avoid drainage grates, manhole covers, or any other non-movable objects
- Course Workers
  - Safe workstation positioning
    - Workers do not have to cross one part of the course to get to down cones on another part?
    - Station not placed in the path of a predicted spin point?
  - See all of the pylons within their responsibility?
  - Pylons close enough that the workers can get to them without delaying the start or causing a red flag?



# Fundamentals

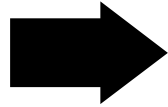
(continued)

- Multiple cars
  - If necessary, can two (or more) cars safely be on course at once?
  - Do adjacent section conflicts prevent full use of the time available?
- Start and Finish Lines
  - Have you established clear access to the start and from the finish?
  - Avoid “drag race” starts to ensure a fair start for all competitors.
    - Place a sharp turn immediately before or after the start lights
  - Provide a safe finish
    - Don’t point the finish towards nearby spectator areas
    - Allow plenty of room for a safe, non-dramatic shutdown
- Timing and Scoring
  - Can timing crew easily read the car numbers and view the entire course?
  - Is the timing equipment and crew clearly out of harms way?  
(such as a spinning vehicle)



# Agenda

- Fundamentals



- **10 Basic Concepts**

- So you have a blank piece of paper...
- Elements, dimensions and real speed
- Summary



# 10 Basic Concepts

- 1.) Be a Commercial Artist
- 2.) Use Creativity
- 3.) No Hidden Agendas
- 4.) Be Familiar with the Solo II Course Design Rules
- 5.) Make the Course Flow
- 6.) Use Elements that Favor Horsepower **and** Elements that Favor Handling
- 7.) Use Pointers and Directionals Correctly and Sparingly
- 8.) Line the Course, when possible
- 9.) Place Gates to Avoid Visual Confusion
- 10.) Walk/Drive Your Course with the Intent of Improvement



## 10 Basic Concepts

# 1.) Be a Commercial Artist

- As a course designer, you will become an artist; according to Webster, an artist is “one who professes and practices an imaginative art”
  - Believe me, imagination is required to create a course that is interesting and fun to drive - and when the course design is completed, you will feel like you have created a piece of art!
    - A **Fine Artist** is:
      - An artist whose main goal is to please themselves, and then everyone else can like it or ‘stuff it’
    - A **Commercial Artist** is:
      - An artist whose main goal is to *please the customer*, while pleasing themselves as well

Be a **Commercial Artist** - not a Fine Artist



## *10 Basic Concepts - Be a Commercial Artist*

# How does a Commercial Artist Please the Customer?

- Keep in mind, the main goal of course design is to provide the competitors with **Fair, Fun and Safe Competition.**
- After creating a course design, take copies of it to be reviewed and critiqued by your peers (never destroy the original).
  - Leave your pride at home!
  - Listen and hear to what they have to say
  - Ask them to explain the 'hows and whys' of their suggestion
  - Mark your map up with their suggestions and comments
- After the peer review, look over and analyze their comments, and then implement any that you feel improve your course design
  - Be true to your basic concept - put your own style into their suggestion if you wish; that is the reason you ask to understand the 'hows and whys'
  - Remember: The great thing about advice is that you don't have to take it - and you might actually learn or see something you had not thought about



## 10 Basic Concepts - Be a Commercial Artist

# Judging your Success

(If you're yelling at me, should I assume you didn't like it?)

- Ask the competitors about your course directly and listen to what they have to say.
  - What did they like/dislike and why?
  - Know why, so that you can create/avoid that effect again
  - Listen to their comments so that you don't become a Fine Artist, who is usually more concerned with their pride than creating a course that everyone likes to drive
  - If a favorite element is criticized every time that you use it, it most likely is a poor element; re-think it - don't force your fellow competitors to accept a particular element just because it is an "old favorite" of yours
  - Try to 'eaves drop' for comments about the course
    - This is a good way to get their "true" feelings on the matter since they are not concerned with the embarrassment of offending you
  - Don't get discouraged if some people do not like the course
    - I have never designed a course that everybody likes
    - You can usually tell from the 'why' of their comments as to whether they are whining or have a valid point
    - Remember: those who have won will like it; those that didn't tend not to...



## 10 Basic Concepts - Be a Commercial Artist

# Judging your success (continued)

- Did you receive unsolicited praise or complaints?
- Note the number of delays for course workers, course repair, etc.
- Track the number of DNFs for other than mechanical failure
  - The goal is zero:
    - acceptable is 1 in 20 on the first run, 1 in 100 there after
- Number and frequency of pylons hit
  - The goal is zero
  - Acceptable is 1 car in 10 hitting any; no more than 3 for any one car
- Keep in mind, the main goal of course design is to provide the Solo II competitors with **Fair, Fun and Safe Competition.**



## 2.) Use Creativity

- Creativity is what makes a course interesting to drive
  - What is creativity in course design?
    - Taking a usual maneuver and changing to make it more interesting - not to make it painful!
    - Setting usual maneuvers in a visually different manner
    - Including a variety and number of different types of turns and transients and a sufficient input density
    - Placing enough challenge into a course without making it “painful”
    - Utilizing the “punish/reward” or “sacrifice/gain” concept
    - Creating situations where the driver must analyze the course carefully to find the fast line(s) - so that those with the right amount of skill, aggression, experience and discipline will be rewarded
    - Use chalk lines in a variety of visually interesting and helpful ways
- Be creative and innovative but avoid the bizarre
  - When you come up with a concept that you believe to be new and creative, take a moment to analyze it. Is it so creative that it has become bizarre? If so, modify the idea or forget it, because it will not be well received by most drivers



## 10 Basic Concepts - Use Creativity

# Application of Creativity

- Include turns of varying radii and speed
  - Sweepers should come in various sizes, possibly even with changing radii
  - Don't design a course consisting primarily of 180° turns.
    - use 90°, 180°, 60°, fast 45° turns, etc.
- Provide a variety of car path directions
  - Use the various turns to send the car in directions not always perpendicular or parallel/perpendicular to the site outside perimeter or the site markings on the surface such as paint stripes or concrete squares (*see diagram on page 39*)
- Provide a variety of transients
  - Straight slaloms / offset slaloms
  - Sequences of offset gates
  - Lane changes
  - Combinations of the above
    - Challenging courses include combinations of transients that require a precise proper entry into the first part of the combination in order to drive through the entire combination quickly



## 10 Basic Concepts - Use Creativity

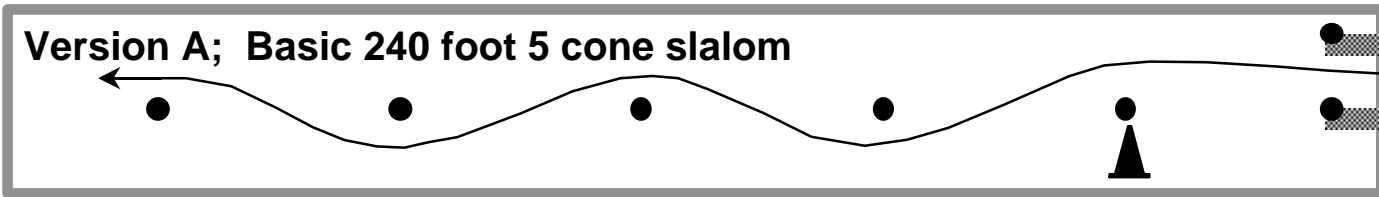
# Application of Creativity (continued)

- Provide sufficient input density
  - **Input density** is a measure of direction-changing inputs which the driver must give to the car to negotiate the course divided by the length of the course
    - A good course has 25 to 35 inputs over a distance of approximately 3/4 mile
    - A less interesting course will have only 15 to 20 inputs for the same distance
    - If input density is over 45 inputs for 3/4 mile, odds are that the design is too busy
  - Results of **too great** an input density
    - Drivers will never seem to have the time or room to set up for the next element
    - Drivers feel they are thrashing through the course, just trying to survive until the finish
  - Results of **too little** input density
    - A boring, non-challenging course to drive, where all times run are approximately the same

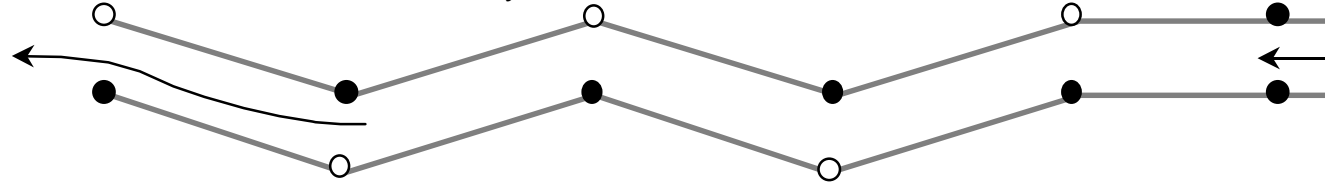


# 10 Basic Concepts - Use Creativity

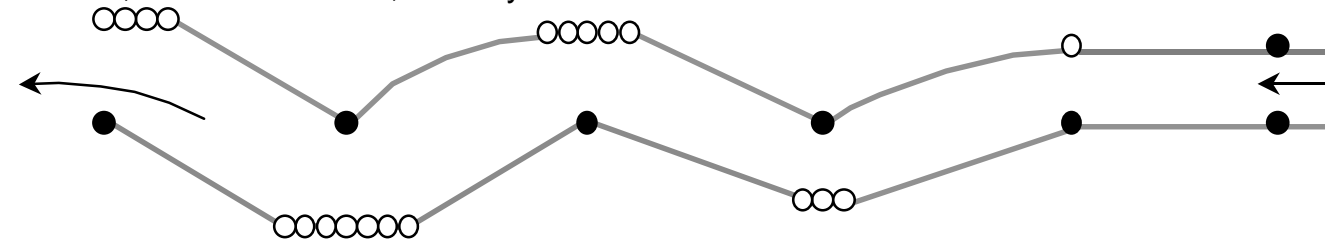
## 5 Cone Slalom



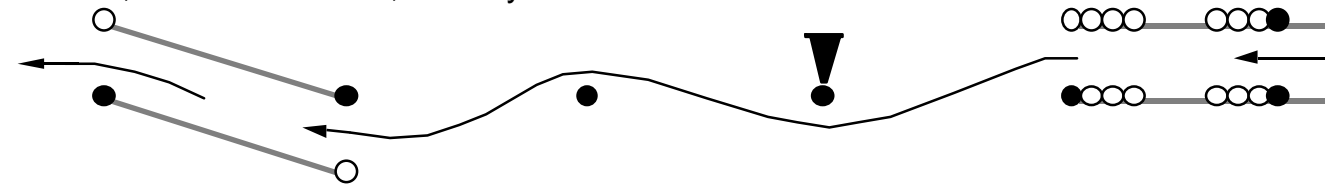
Version B; same maneuver, visually different



Version C; same maneuver, visually different



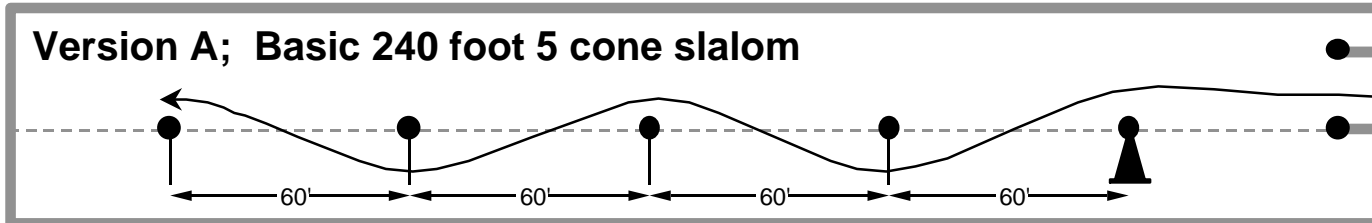
Version D; same maneuver, visually different



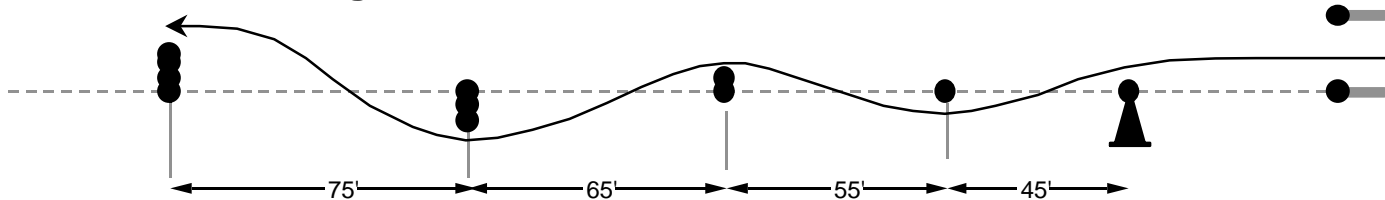
# 10 Basic Concepts - Use Creativity

## 5 Cone Slalom (continued)

**Version A; Basic 240 foot 5 cone slalom**

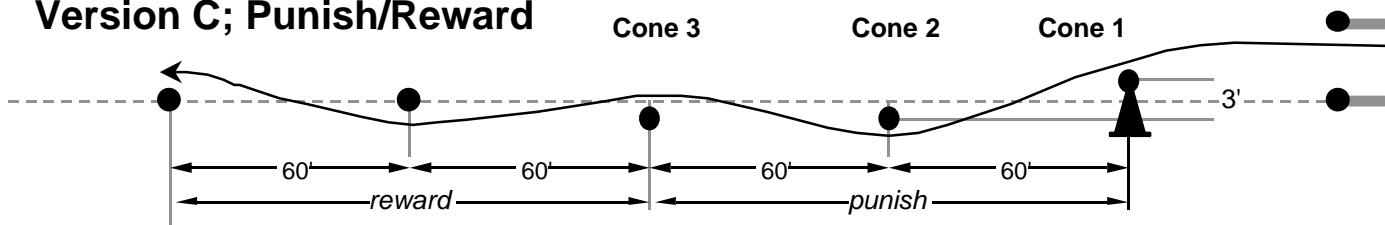


**Version B; Change for interest**



Note: Version A & B are both 240' long. Version B offsets one cone width for each gain of 10' in slalom length, resulting in a more interesting maneuver of the same nature. The increase in distance prevents the maneuver from becoming painful

**Version C; Punish/Reward**



Note: Cones 1 & 2 are offset 3' the hard way with cone 3 offset 1.5' the easy way. This opens up a "Lotus freeway" through the last 3 cones of the slalom. To make the punishment bearable, be sure to allow adequate set up area prior to the punishment, otherwise the punishment becomes painful

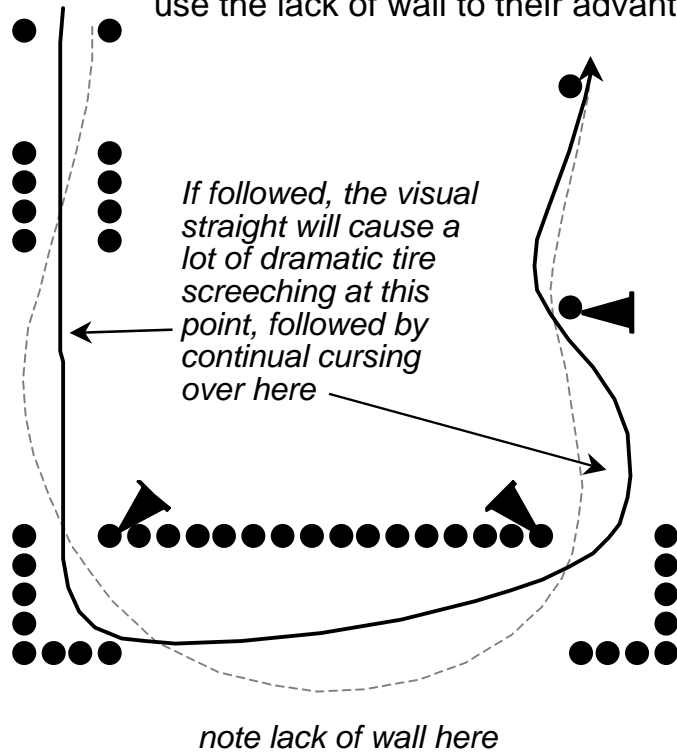
# 10 Basic Concepts - Use Creativity

## The Brainer

the intent of a "brainer" is to allow a fast line through, but give it the visual effect of a slow maneuver. This will then give the competitor a reward, or a "doggy bone" if you prefer, for figuring it out.

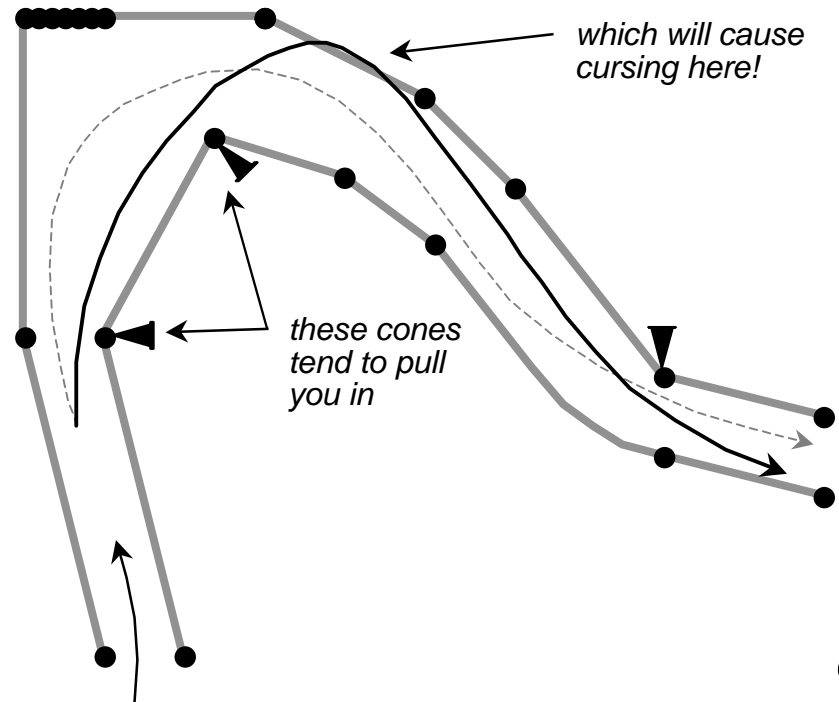
### The Brainer

The wall at the 180° will tend to make an unwary competitor square the corner out. The driver who looks carefully will round the corner out and use the lack of wall to their advantage



### The Brainer

Competitors that don't "read" the course tend to drive cone to cone. The indicated cone will tend to pull in a driver who has not thought this one out. The fast line is to stay wide to make a sweeping turn.

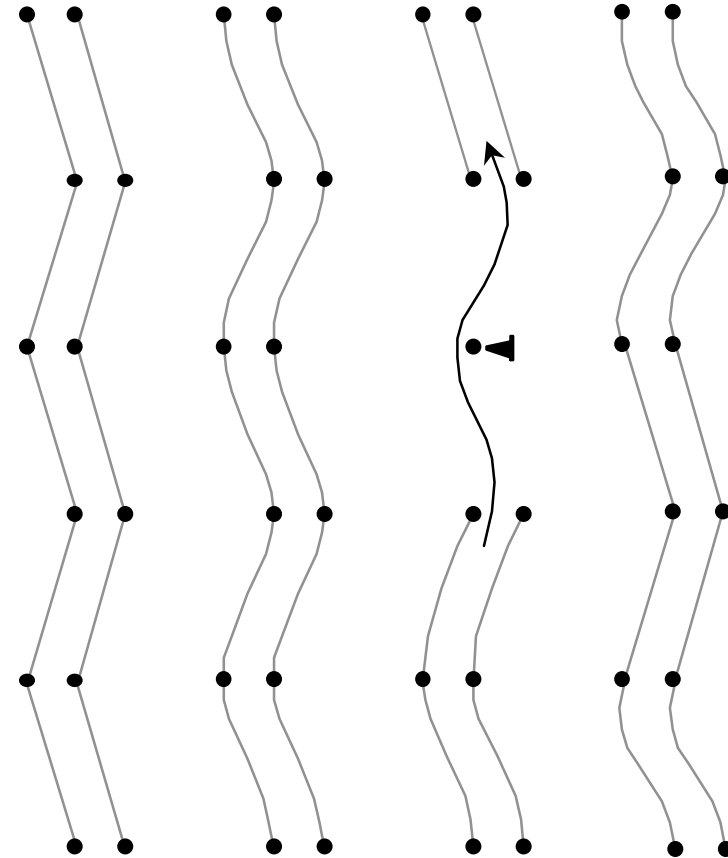
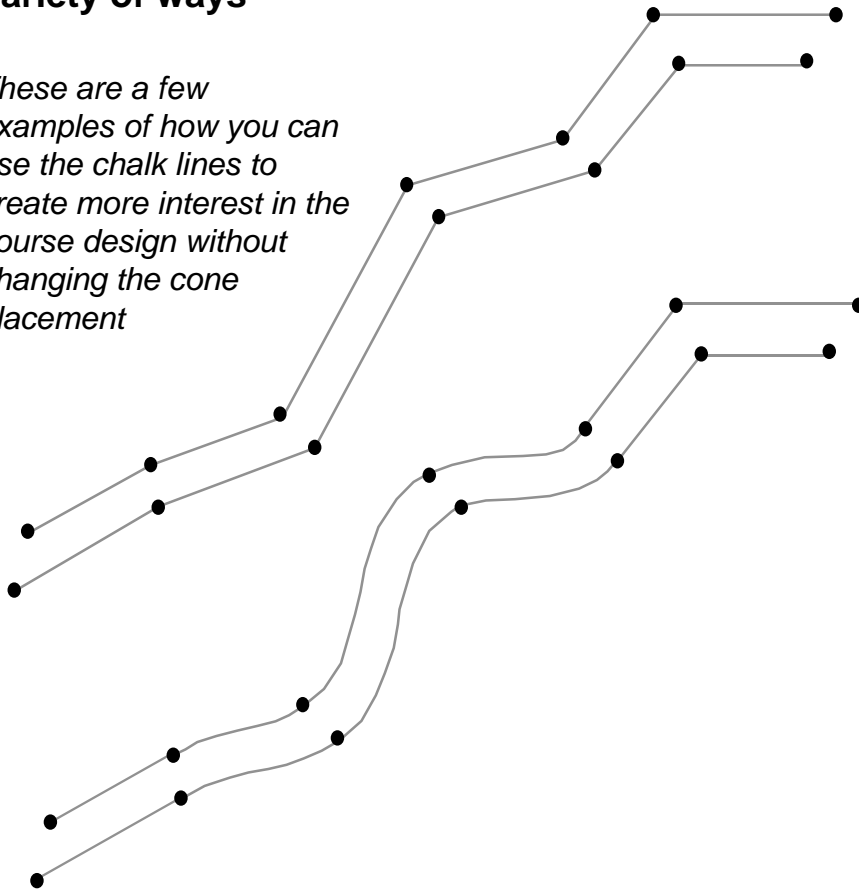


## 10 Basic Concepts - Use Creativity

# Chalk Lines

### Use the chalk lines in variety of ways

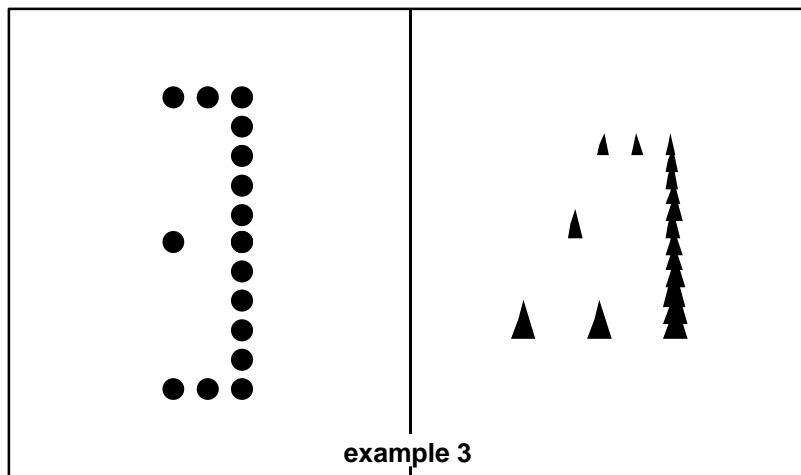
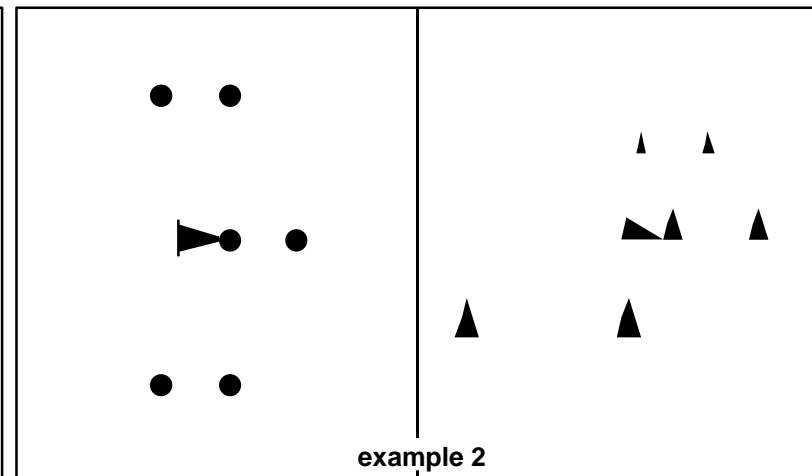
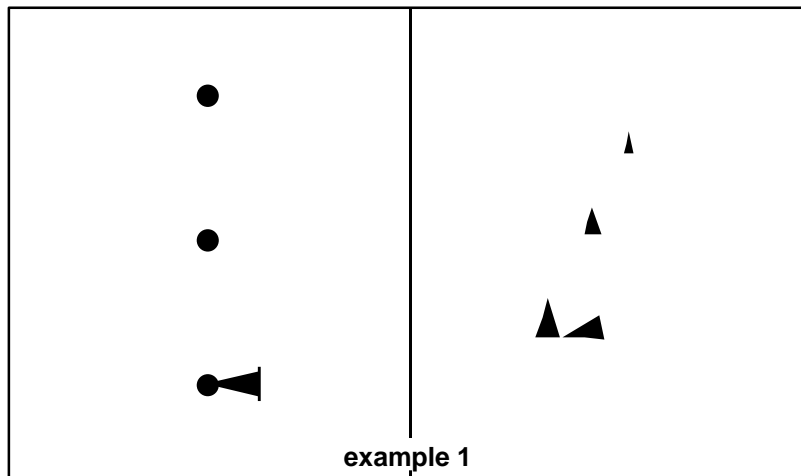
*These are a few examples of how you can use the chalk lines to create more interest in the course design without changing the cone placement*



# 10 Basic Concepts - Use Creativity

## Which is easiest to see?

All three of these are a slalom - the same maneuver. Obviously, **example 1** is easiest to see.



You must also consider if the inclusion of your “creative” cone placement has reduced the clarity of the course significantly.

In this case, the surrounding cones from the following maneuvers may impact the clarity of these examples as well. For instance, if you have several walls of cones just following this slalom, example 1 would be most appropriate. If there were not, examples 2 or 3 might be appropriate.



## 10 Basic Concepts

### 3.) No Hidden Agendas

- You should not accept a course design job for any reason other than a desire to design a course
  - If you are not really interested in the design of it, chances are that you will not create a good course
  - If you have gotten the responsibility 'by default' (i.e the responsibility comes with being Event Chairman), try to enlist someone who is truly interested in designing a course - you will still be ultimately responsible for the design, but will have "jobbed" it out to a more qualified/interested party
  - Avoid designing the course on the premise of favoring your car, while penalizing others
    - Example; Camaro versus Miata
      - Camaro: 1000' straight, 180° turn, and a 1000' straight
      - Miata: 45' offset slaloms connected with 30' radius "sweepers"
- With a hidden agenda the result is a course that only a few people enjoy - or perhaps even a course that **NO ONE** will enjoy!



## 10 Basic Concepts

# 4.) Be Familiar with the Solo II Course Design Rules

**Basic Concept 4.) deals with the Solo II Course Design Rules found in Section 2.0 of your Solo II rule book.**

- The obvious advantage to knowing the rules in Section 2.0 is that you will be more likely to create a design that will be considered a Solo II type course, as well as a course that is acceptable to the assigned Safety Stewards and your competing peers
- The following are some quotes from those rules. ALL of the rules, of course, are important and should be known/understood. These are just the rules that I perceive to have the most impact on your design decisions.
  - 2.0 Solo II courses should be open enough to allow good competition between larger and smaller cars and should not emphasize high speed, power to weight ratio, extreme maneuverability or visual acuity...
  - 2.1.A ...speeds on straight stretches should not normally exceed the low 60's (mph) for the fastest Stock and Street Prepared category cars. The fastest portions of the course shall be those most remote from the spectators and property. Turns should not normally allow speeds in excess of 45 mph in unprepared cars...



## 10 Basic Concepts - Solo II Course Design Rules Familiarity

# Thus Quoth the Rule Book...

- The following are some quotes... (continued)
  - 2.1B The course as laid out shall be on a paved surface which contains no dangerous holes, loose gravel, gratings, oily spots, or other hazardous features. Dips that could get a car airborne shall not be included
  - 2.1.C The course boundary shall not normally pass closer than 25 feet from solid objects.  
*(see diagram on page 24)*
  - 2.1.D ...authority to disapprove a course or site for karts only, when there are upright solid objects (e.g. light poles, fence posts, etc) on site within 50 feet of the course. This does not include curbs... *(same intent as diagrams on page 24)*
  - 2.1.M Participants and non-participants must be kept at a safe distance...  
...minimum viewing distances may not be less than 75' from the course edge in unprotected areas (areas without adequate barrier protection such as concrete or tire walls)...  
*(see diagram on page 25)*
  - 2.1.E Negative cambered turns will be avoided if at all possible.  
*(see diagram on page 26)*
  - 2.1.F A long straight (over 150') should not terminate in an extremely sharp turn...  
*(see diagram on page 27)*



# 10 Basic Concepts - Solo II Course Design Rules Familiarity

## Thus Quoth the Rule Book

### Some More...

- The following are some quotes... (continued)
  - 2.1.H Cars on course simultaneously shall not run in close proximity to each other  
*(see diagram on page 28)*
  - 2.1.I All portions of the course shall be visible to at least one Course Marshal who can communicate through signals or by electronic means with the starting line
  - 2.1.K Entrance and exit lanes shall enter the course at separate points, though they may be close together...
  - 2.2.B The course shall be at least 15 feet wide and single file slalom markers shall be at least 45 feet apart. Any series of course markers which are generally in a line and have the effect of a slalom are considered to be a slalom...  
*(see diagrams on pages 15 and 19)*
  - 2.2.C A Solo II Event, other than a gimmick event in which time is not the only consideration, shall be a test of driving skill, not memory
  - 2.2.E Cars should leave a gate/turn headed generally in the direction of the next gate/turn *(see diagram on page 39)*

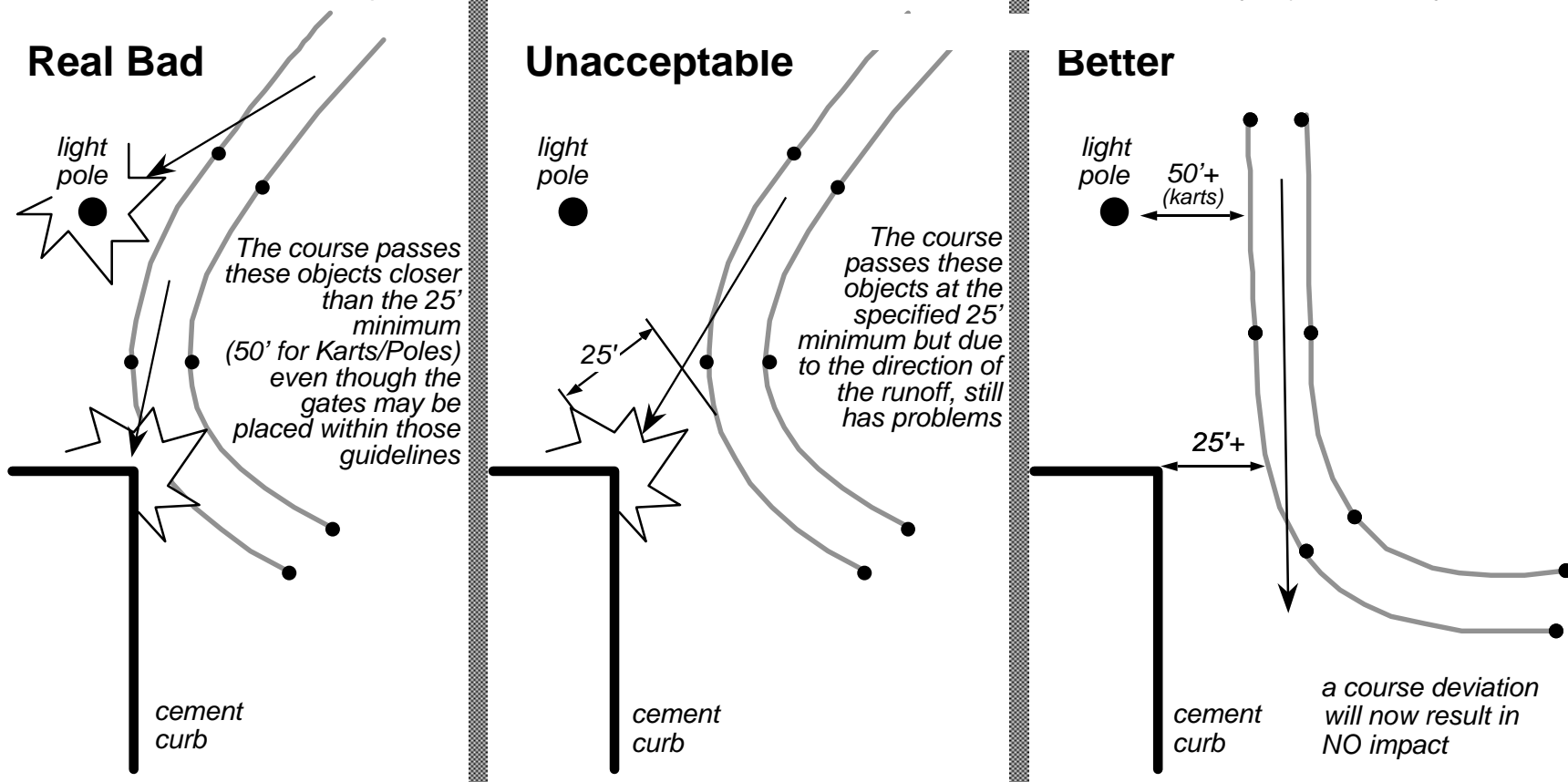


# 10 Basic Concepts - Solo II Course Design Rules Familiarity

## 2.0 Diagrams

- 2.1.C The course boundary shall not normally pass closer than 25 feet from solid objects
- 2.1.D karts... upright solid objects on site within 50 feet of the course.  
This does not include curbs

The "better" example shown here is considered minimum. Greater distances from Stationary objects is always better





# 10 Basic Concepts - Solo II Course Design Rules Familiarity

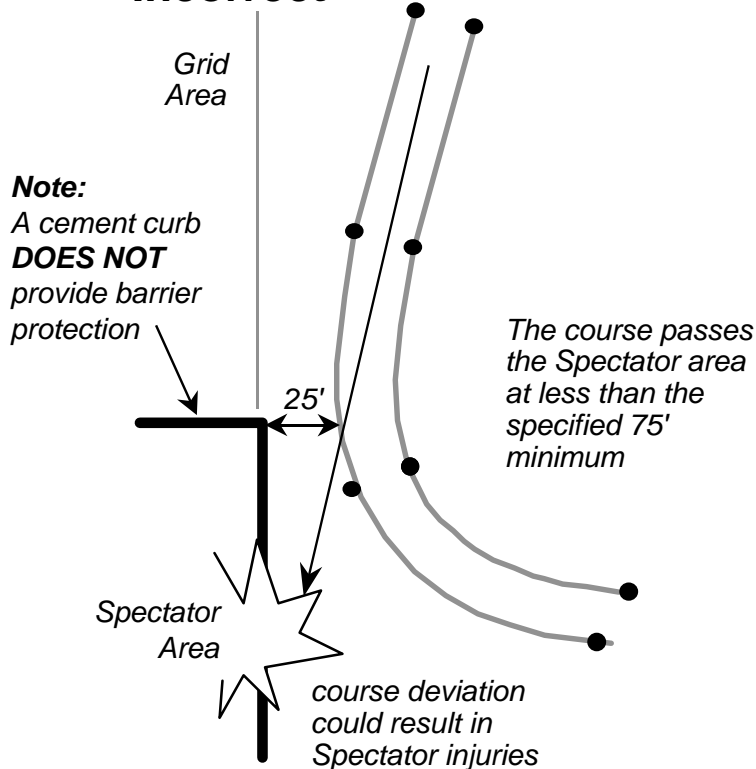
## 2.0 Diagrams

(continued)

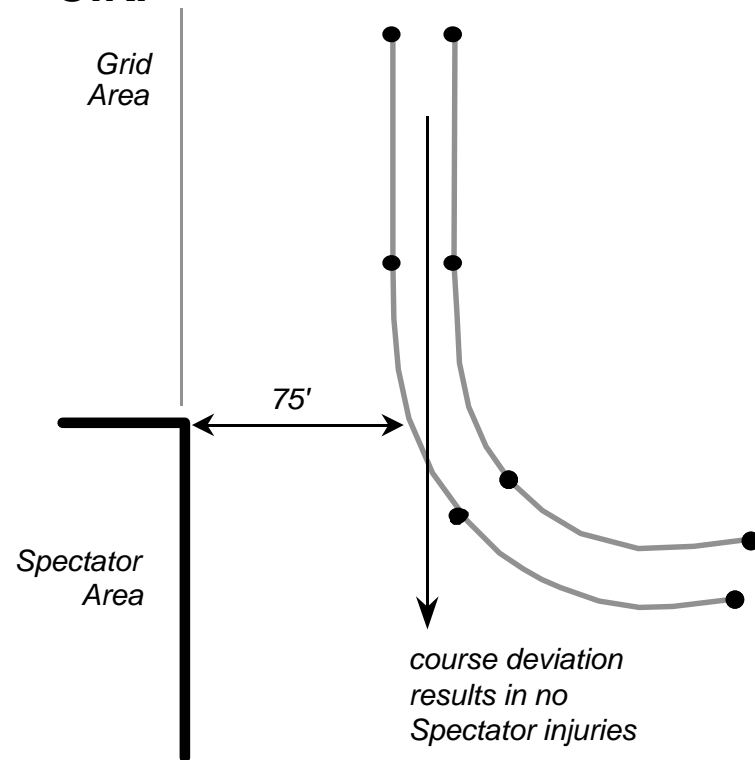
2.1.M Participants and non-participants must be kept at a safe distance... ..minimum viewing distances may not be less than 75' from the course edge in unprotected areas (areas without adequate barrier protection such as concrete or tire walls)...

*The preferred example shown here is considered minimum. Greater distances from Spectator Areas are always better. Fast course sections should never aim directly at spectator areas without very large runoff distances*

### Incorrect



### O.K.



# 10 Basic Concepts - Solo II Course Design Rules Familiarity

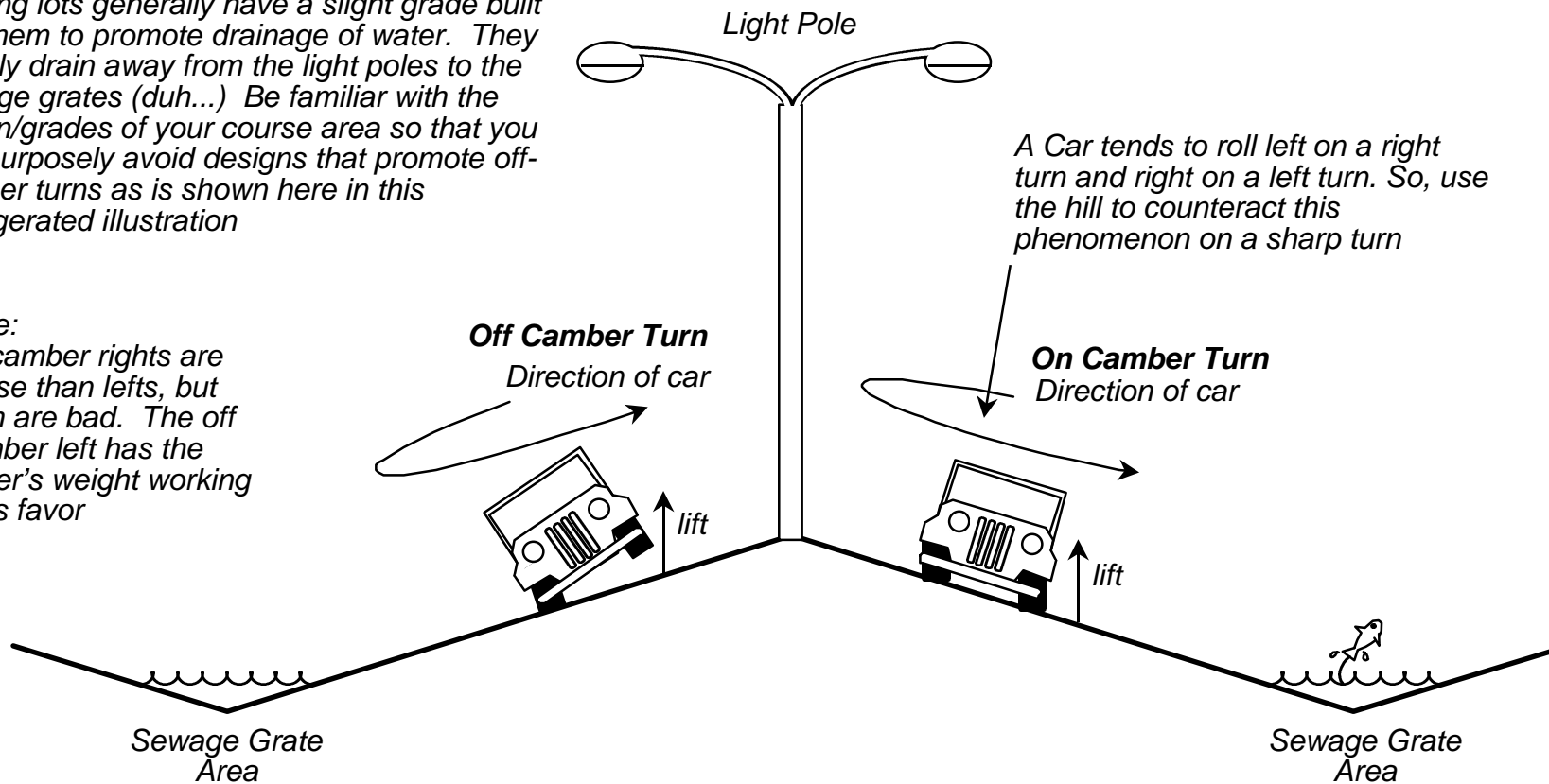
## 2.0 Diagrams

(continued)

### 2.1.E Negative cambered turns will be avoided if at all possible

*Parking lots generally have a slight grade built into them to promote drainage of water. They usually drain away from the light poles to the sewage grates (duh...) Be familiar with the terrain/grades of your course area so that you can purposely avoid designs that promote off-camber turns as is shown here in this exaggerated illustration*

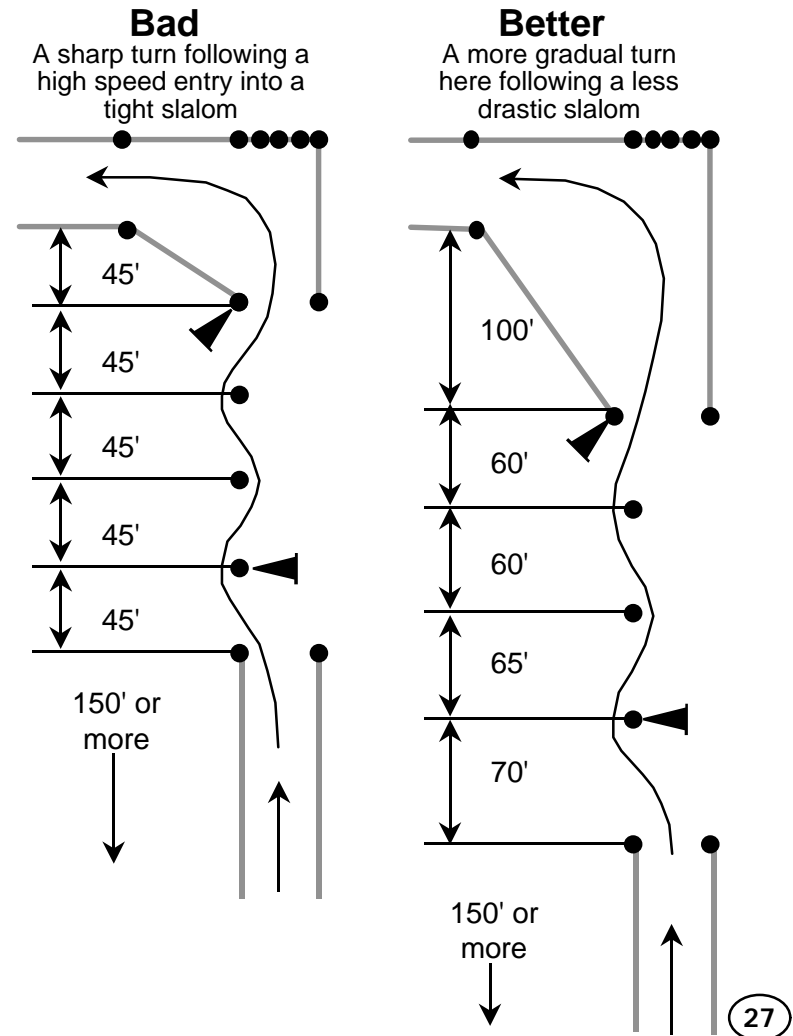
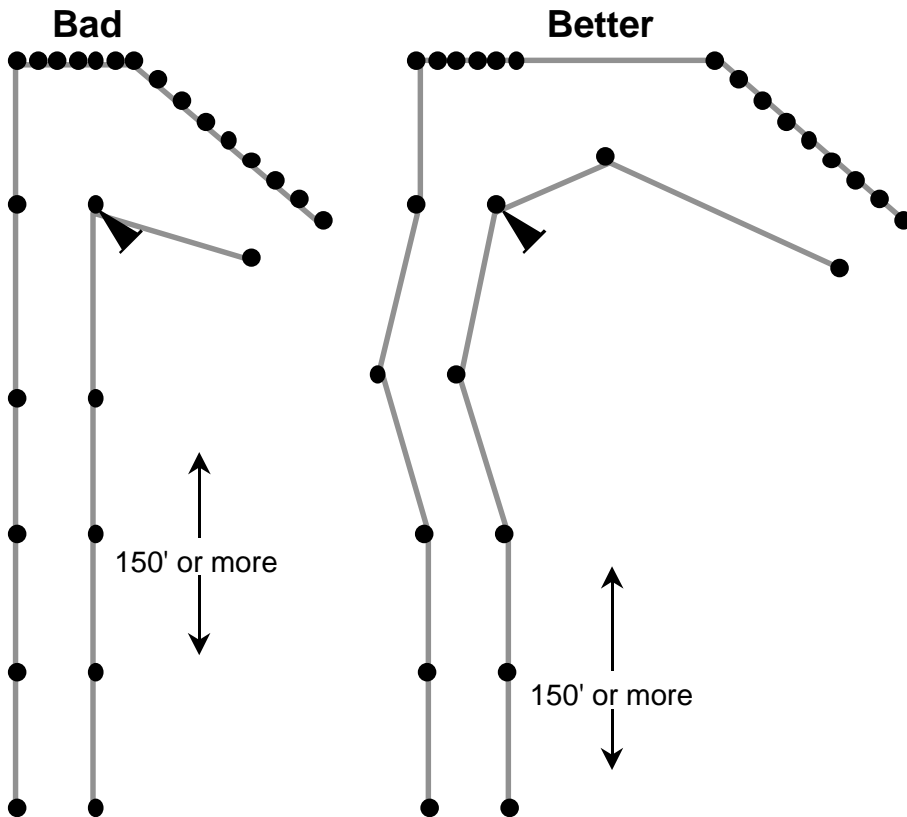
*Note: off camber rights are worse than lefts, but both are bad. The off camber left has the driver's weight working in its favor*



# 10 Basic Concepts - Solo II Course Design Rules Familiarity

## 2.0 Diagrams (continued)

2.1.F A long straight (over 150') should not terminate in an extremely sharp turn...



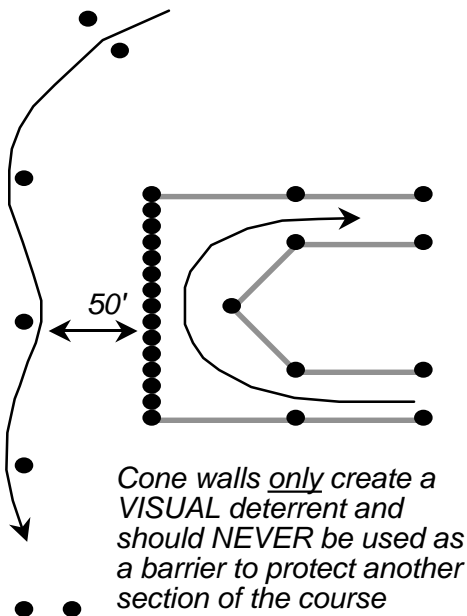
# 10 Basic Concepts - Solo II Course Design Rules Familiarity

## 2.0 Diagrams (continued)

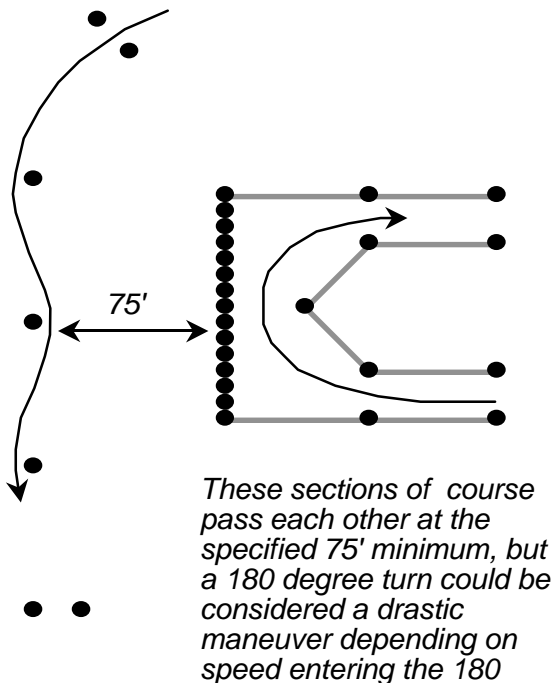
### 2.1.H Cars on course simultaneously shall not run in close proximity to each other

"Close Proximity"... The definition of this is ultimately up to the Safety Steward, but if you consider rule 2.1.L, the absolute minimum would be 75'. Obviously, the more drastic the maneuver, the more space that should be allotted. The whole idea of this rule is to keep 2 competitors from colliding in the event of one (or both) of them losing control or getting lost on course.

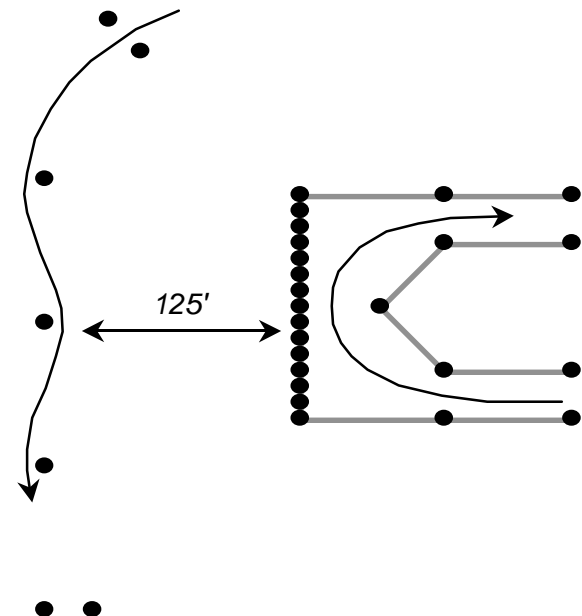
#### Unacceptable



#### Better



#### Better Yet





## 10 Basic Concepts

# 5.) Make the Course Flow

**“There’s no such thing as a car that can turn on a dime...” K. C. Babb**

- It’s not necessary to get into third gear in order to have a fun course
  - The level of “fun” will more likely be determined by the flow of the course instead of the highest attained speed
  - If you feel like you’ve gone fast without violating the speed paradigms, then your design is a success
- So, then what is the “Flow of the Course”?
  - The flow generally refers to the manner adjacent sections of a course connect to each other.
  - Envision a river flowing down a riverbed. Even when the water is moving rapidly and encounters an object, it will find a way to flow around the object smoothly. Your course should have the same characteristics. If a car cannot be maneuvered through the obstacles smoothly, the course does not flow.



## 10 Basic Concepts - Make the Course Flow

# Ways to Make Your Course Flow

- Visit the site before submittal of your map to make your map accurate and to include things and land formations to avoid
- To be able to accurately determine the flow of a course before you set it up, you must be able to first **draw a scale map** (gasp!). From this map, you will then be able to apply the following suggestions on paper
- Locate the “key cones” in your design (*see diagram on page 33*)
  - These are the cones that determine the actual path of the car
    - If it **is** a key cone, its removal would change the path of the vehicle running the course
    - If it **is not** a key cone, the removal of that cone would not change the path of the vehicle, but could confuse the driver...
    - There is a common misconception that the wider the gate, the faster the course. This is not necessarily so. Since the key cones determine the path of the vehicle, the gate width becomes a secondary limiting factor (*see diagram on page 34*)
- Once the key cones have been identified, look to see if varying gate width or key cone placement can be used to aid in the flow of the course



## 10 Basic Concepts - Make the Course Flow

# Ways to Make Your Course Flow

(continued)

- Determine which cones control the speed and direction of the course (key cones) and remove any of the remaining cones that could cause confusion  
*(see diagrams on pages 33 and 34)*
- Remove a slalom cone in a 45' - 55' slalom *(see diagram on page 35)*
- Allow a few more feet of width and/or length when approaching the next maneuver *(see diagram on page 36)*
- Avoid painful walled-in turns *(see diagram on page 37)*
- Ensure the “next gate” is visible in your peripheral line of sight  
*(see diagram on page 38)*
- Move a limiting or constricting gate 1 to 10 feet left or right to open the approach up. Be careful; movement as little as 1 foot can make more of a difference than you might imagine. The approach from the previous maneuver and/or the exit to the next maneuver will determine the impact of this move.
- Do not use *painful* maneuvers to slow things down *(see diagrams on pages 38 and 40)*
  - A 300' straight into a 45' slalom **IS** painful - shorten the straight or lengthen the slalom
  - Allow a minimum of a 45' radius in your turns  
*(most cars have a 30-35' minimum turning radius)*
  - Allow the driver ample room to choose a favorable line
  - No lock-to-lock turns



## 10 Basic Concepts - Make the Course Flow

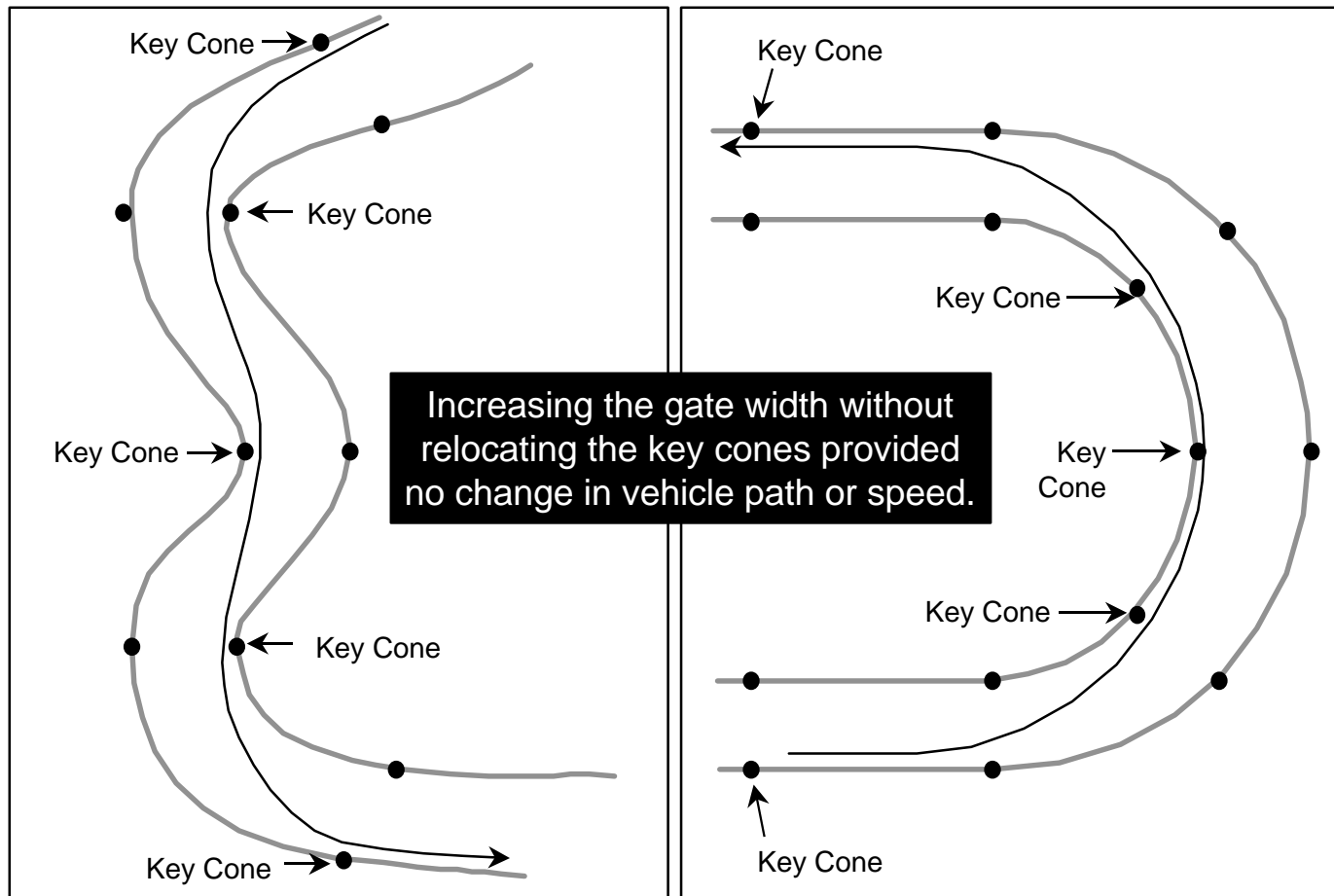
# Maneuvers to Avoid

- Avoid maneuvers that could make a car roll (*see diagrams on pages 26 and 27*)
  - Don't use significantly off camber turns, especially right turns
  - Don't use decreasing radius right turns - especially sharp ones
  - Avoid "one-two" hard corrections following a fast section as can be found in a decreasing slalom
- There are also a few "No Fun Maneuvers" (NFMs) that I would recommend avoiding if possible
  - Any maneuver that requires a 1st gear down shift
  - 360 degree pivot turns - or also known as a spin cone
  - Narrow, walled in sharp turns
  - Gates or Slaloms with severe offsets and short spacing (45' spacing; 10' offset)
  - Two 90 degree walled in turns (shaped like a "Z") just before the finish lights (which is O.K. for a start - but no way to finish!)
  - Hitting the brakes hard just before the lights





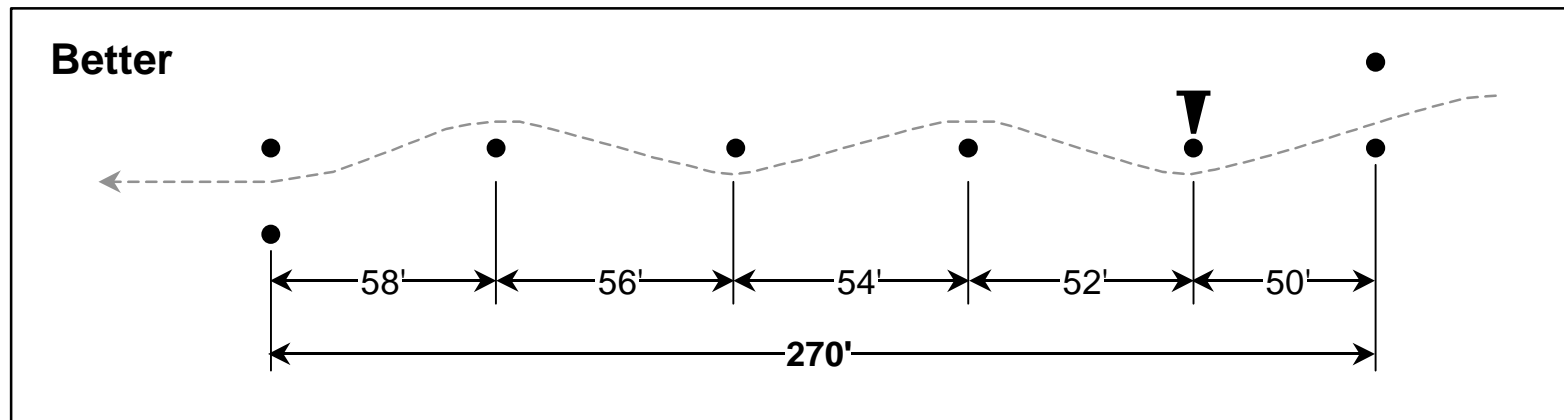
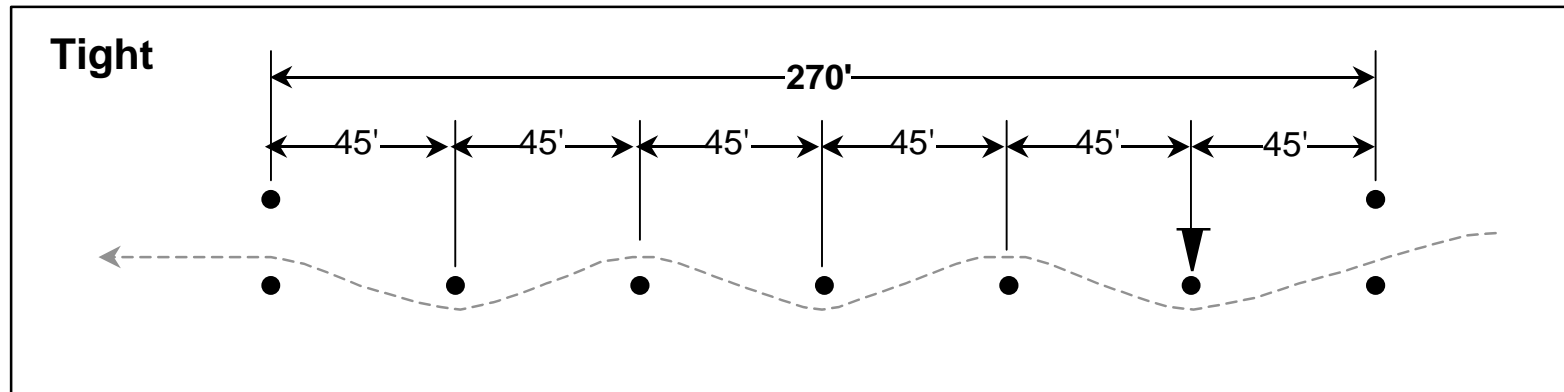
# Gate Width versus Speed



## Advantages of wider gates

- Choosing the superior line requires more skill and experience
- Allows for mistakes/sloppiness with no pylon penalties
- Easier on course workers and timing & scoring

# Remove a Slalom Cone

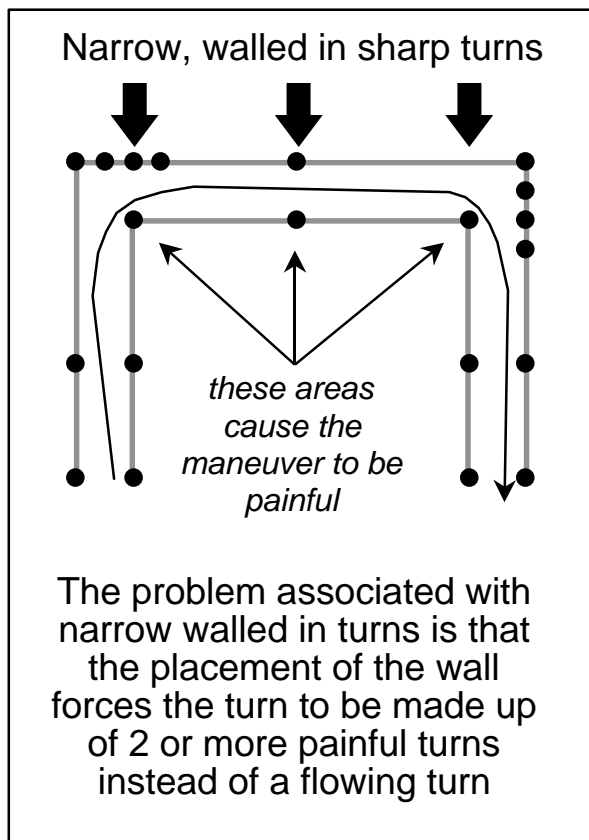


- By removing only one cone in this 270 foot slalom, you are able to open up the slalom to a more reasonable spacing of 54 feet. This is not a “wide open” slalom and definitely flows better than the example on top. You can also make the slalom a gradually increasing allowing the more astute course walkers the chance to pick up on a feature that not everyone will realize



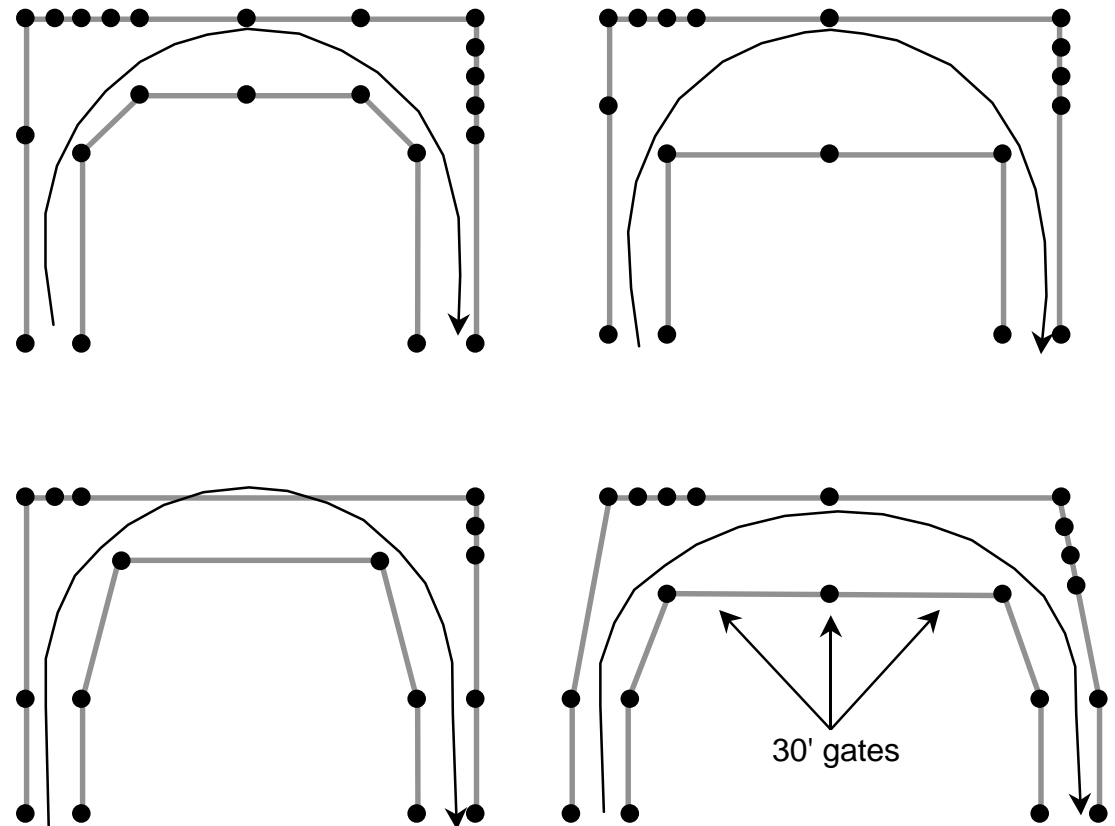
# Avoid "Painful" Walled in Turns

## Painful



## Better

*solutions keeping the same flavor as the original*

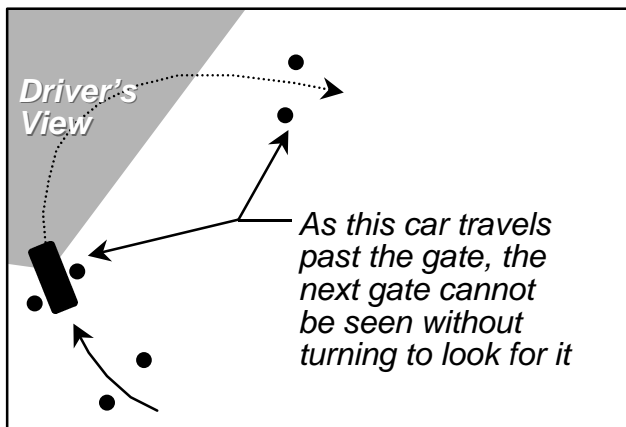




# 10 Basic Concepts - Make the Course Flow

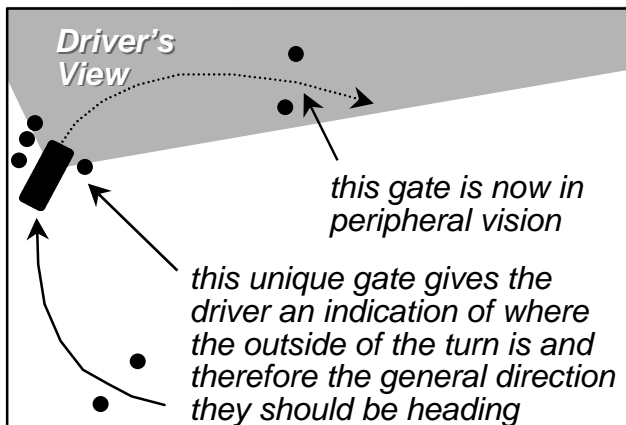
## Line of Sight and 90 Degree Turns

**Bad**



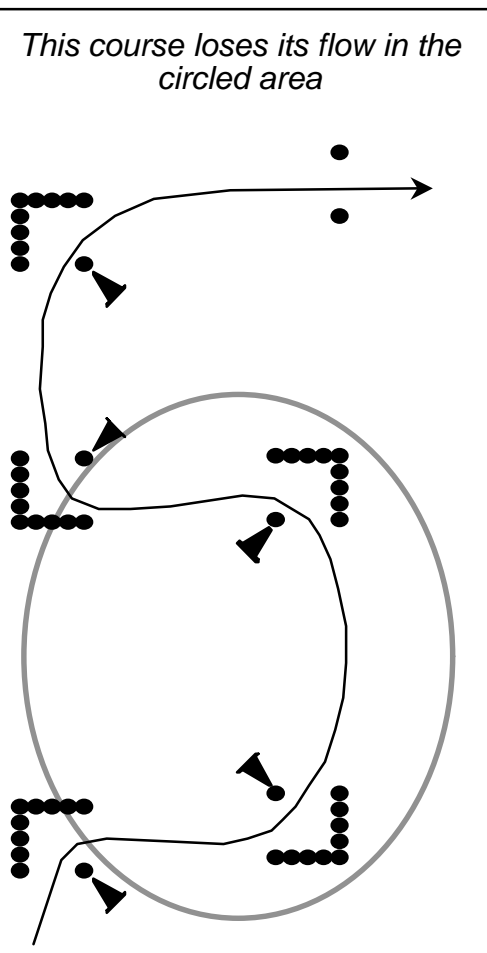
**Better**

Make the next gate visible in the driver's line of sight



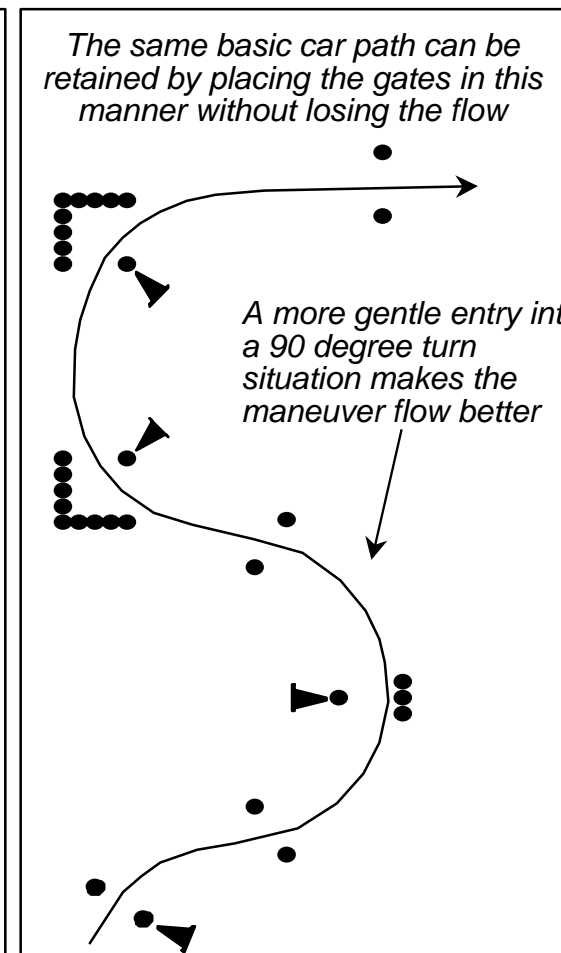
**Bad**

Improper use of 90 degree turns will quickly inhibit the flow of the course



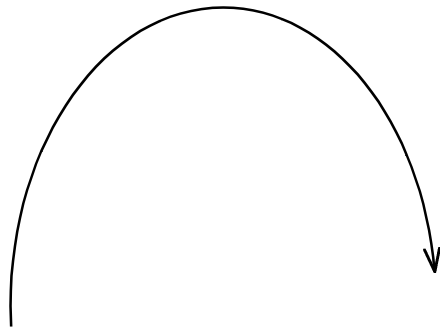
**Better**

The same basic car path can be retained by placing the gates in this manner without losing the flow



# Does gate positioning suggest which direction to go?

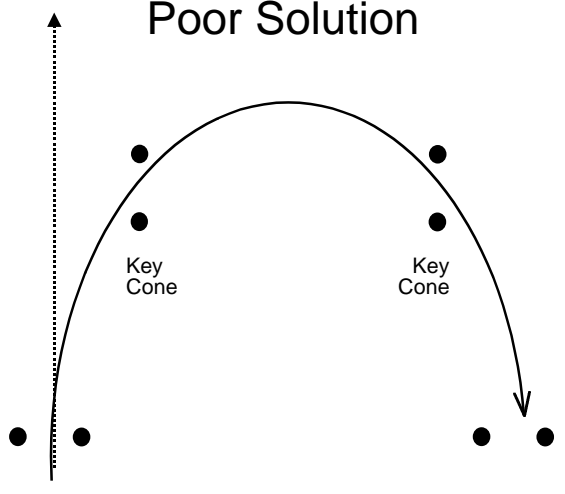
## The Basic Maneuver



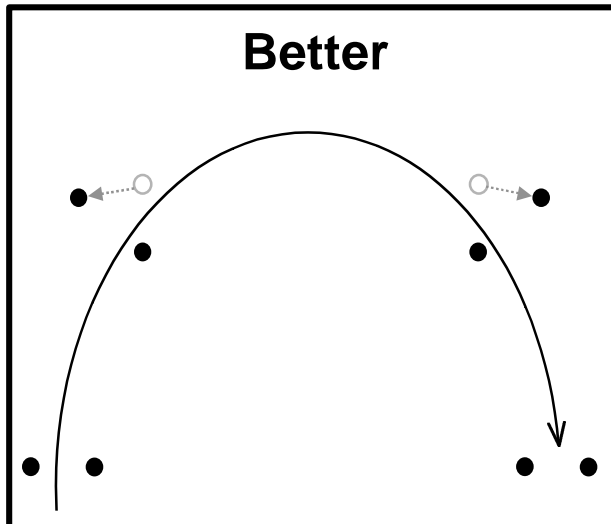
The "poor solution" shown below is a typical mistake new course designers make. This effect occurs when every gate or visual is placed perpendicular to the course edges, such as when the parking spaces are used as guidelines for gate placement. Unless your course is a box, this can be confusing. (and who wants to drive a box?)

The "poor solution" (lower left) gate placement satisfies the criteria discussed on the previous page, but it is still confusing to drive. Although the next gate is in the line of sight, the gate angle does not necessarily draw the driver in that direction - there is nothing about the gate placement that would keep the novice driver from going straight. Determine which are NOT key cones, and move those cones to lead the driver in the direction you desire as the following 2 "better" examples do. The "trick" is to place the gate perpendicular to the intended path of the car and ignore any parking space lines or concrete squares when determining the angle of the gate.

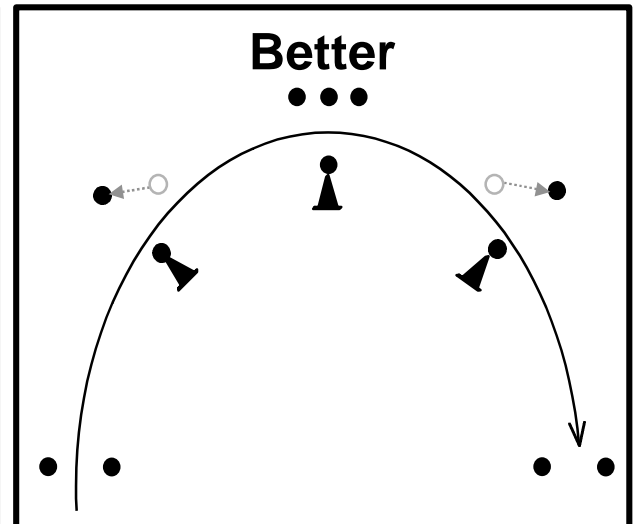
### Poor Solution



### Better

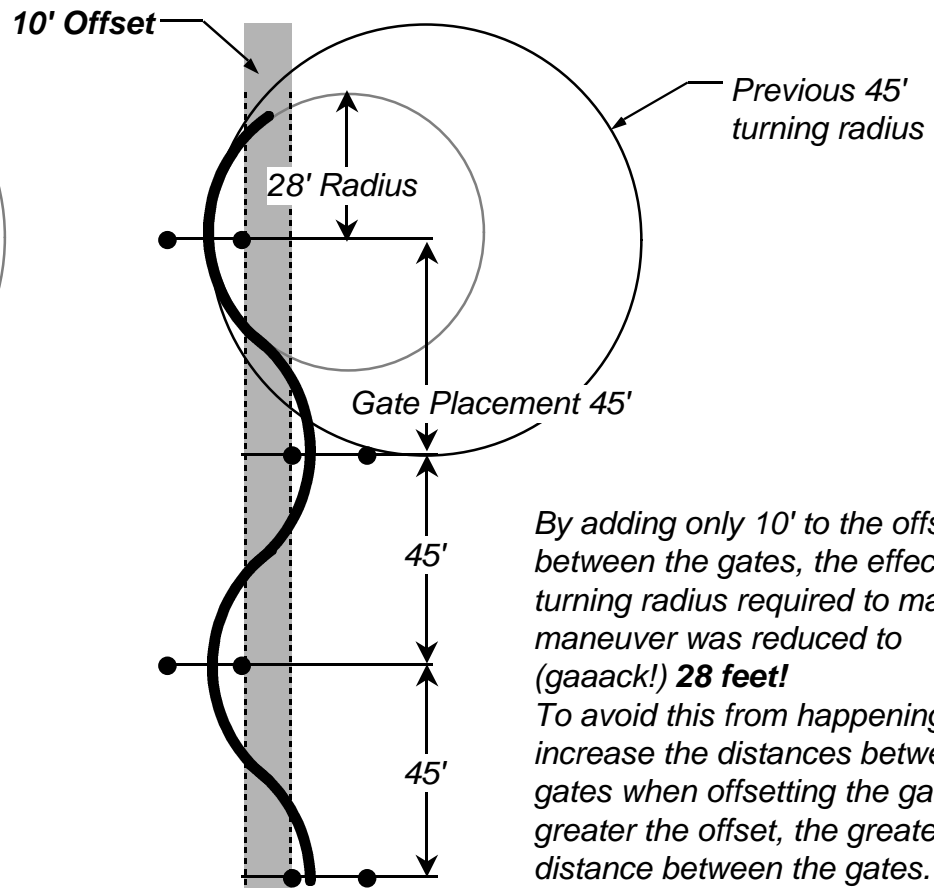
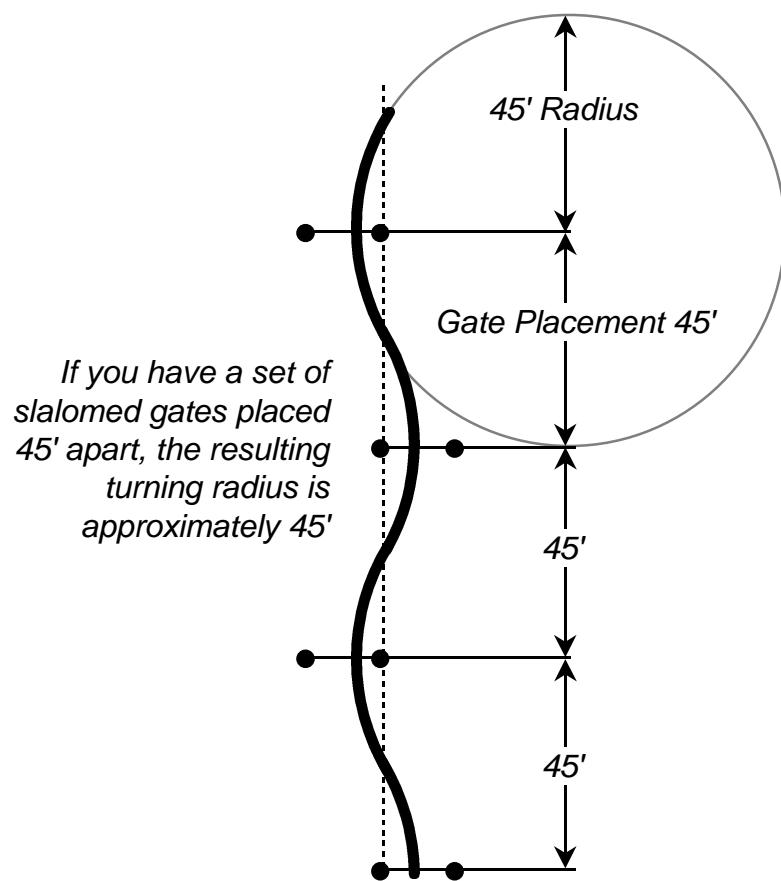


### Better



# Lock to Lock Turns

## No lock to lock turns



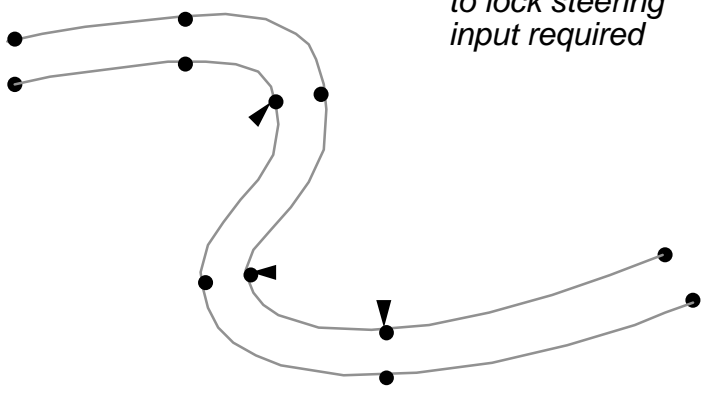
By adding only 10' to the offset between the gates, the effective turning radius required to make the maneuver was reduced to (gaaack!) **28 feet!**  
To avoid this from happening, increase the distances between the gates when offsetting the gates. The greater the offset, the greater the distance between the gates.

# 10 Basic Concepts - Make the Course Flow

## Lock to Lock Turns (continued)

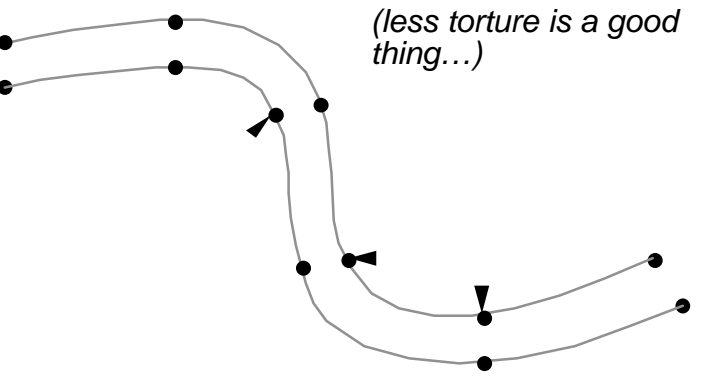
**not fun**

*Too much lock to lock steering input required*



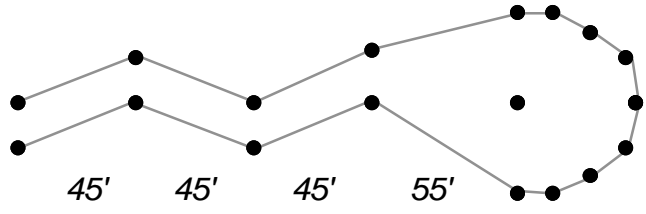
**better**

*Same driving skills tested with less torture (less torture is a good thing...)*



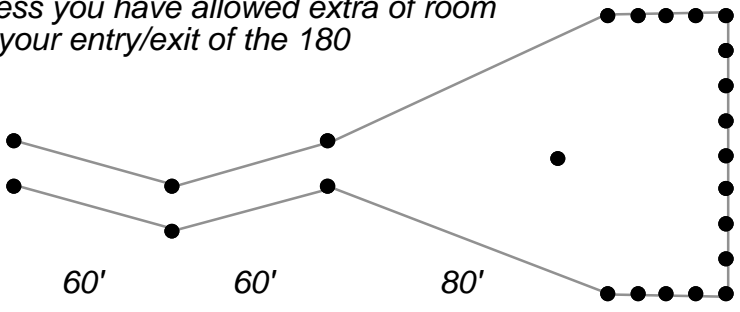
**painful**

*Generally, avoid 180° turns. The shape of some lots require a 180° turn, however, so don't make them painful with lock to lock steering inputs just before entering the 180*



**better**

- Open up the entering maneuvers
- Allow plenty of setup room to enter a 180° turn. Align your entry/exit gate centered to the 180 cone, unless you have allowed extra of room for your entry/exit of the 180



60' 60' 80'

entering maneuvers "set up" area



## 6.) Use Elements that Favor Horsepower and Elements that Favor Handling

- The reason for using both types of elements is to create an “equalizer” course. This would be one where a Miata would have no advantage over a 944 which are found in the same class. By doing so, you will have a much greater chance of pleasing the majority of the drivers in attendance. Then again, if you are designing a course for the Mustang club...
- The first thing to decide is what favors horsepower and what favors handling. You then can evenly apply those kinds of maneuvers in your design.
- In a over simplified explanation,
  - **Horsepower** is advantageous where a car with a high power/weight ratio can stand on the gas, or any maneuver that requires standing on the gas following completion of the maneuver (such as a sharp turn onto a straight)
  - **Handling** is advantageous in a situation where a nimble but under-powered car will be able to maintain speed, but a less nimble and more powerful car will not (such as slaloms and offset gates)



# 10 Basic Concepts - Horsepower and Handling

## General Categories of Horsepower and Handling

### horsepower

---

straights (duh...)  
 large radius sweeping turns  
 sharp turns (90 degree or more)  
 maneuvers connected with straights  
 open maneuvers  
 etc.

### handling

---

short to medium spaced slaloms  
 small radius sweeping turns  
 chicane/lane changes  
 successive maneuvers  
 tight maneuvers  
 etc.

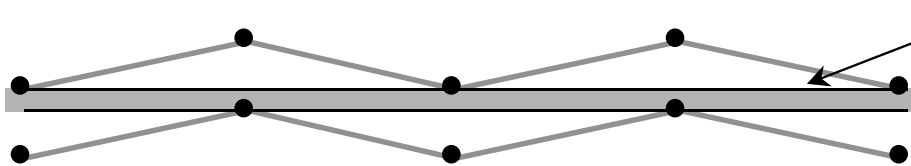
- Straight:
  - Is any area where full acceleration can be utilized, and is not necessarily the classic definition of the shortest distance between two points
    - Minimize the “classic” straight lengths utilized on the course and try to use sweepers and increasing slaloms
    - A slalom spaced greater than 100’ can be considered a straight
- Large radius Sweeping Turns - Any turn over 100’ radius:
  - These turns allow a moderate amount of acceleration and a fairly high limit of speed
- Small radius Sweeping Turn - Any turn between a 30’ and 60’ radius:
  - These turns offer minimal acceleration and a fairly low limit of speed

## 10 Basic Concepts - Horsepower and Handling

# Utilize "the Gap" to Help Control Speed

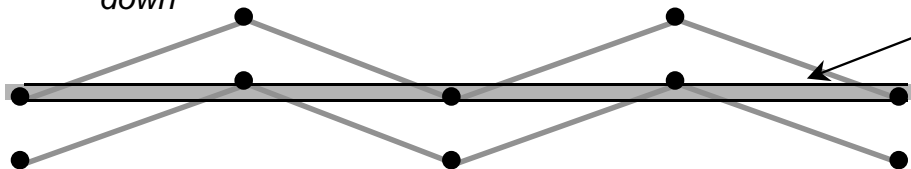
Use either easy or difficult maneuvers to speed up or slow down a course without disrupting the flow.

**Version "A"**  
Speed things up



By increasing this gap, you will effectively increase the speed of the maneuver. A small increase (e.g. one foot) will have a surprisingly large effect

**Version "B"**  
Slowing things down



By increasing this overlap, you will effectively decrease the speed of the maneuver. A small increase here will also have a surprisingly large effect

As was mentioned earlier, it is very important to draw scale map. This enables you to figure out where the fast/slow parts really are. Otherwise your course design will just be a fantasy in your mind until the day of the event. Placing it on paper allows you the freedom to actually design your course rather than depending on luck or chance.



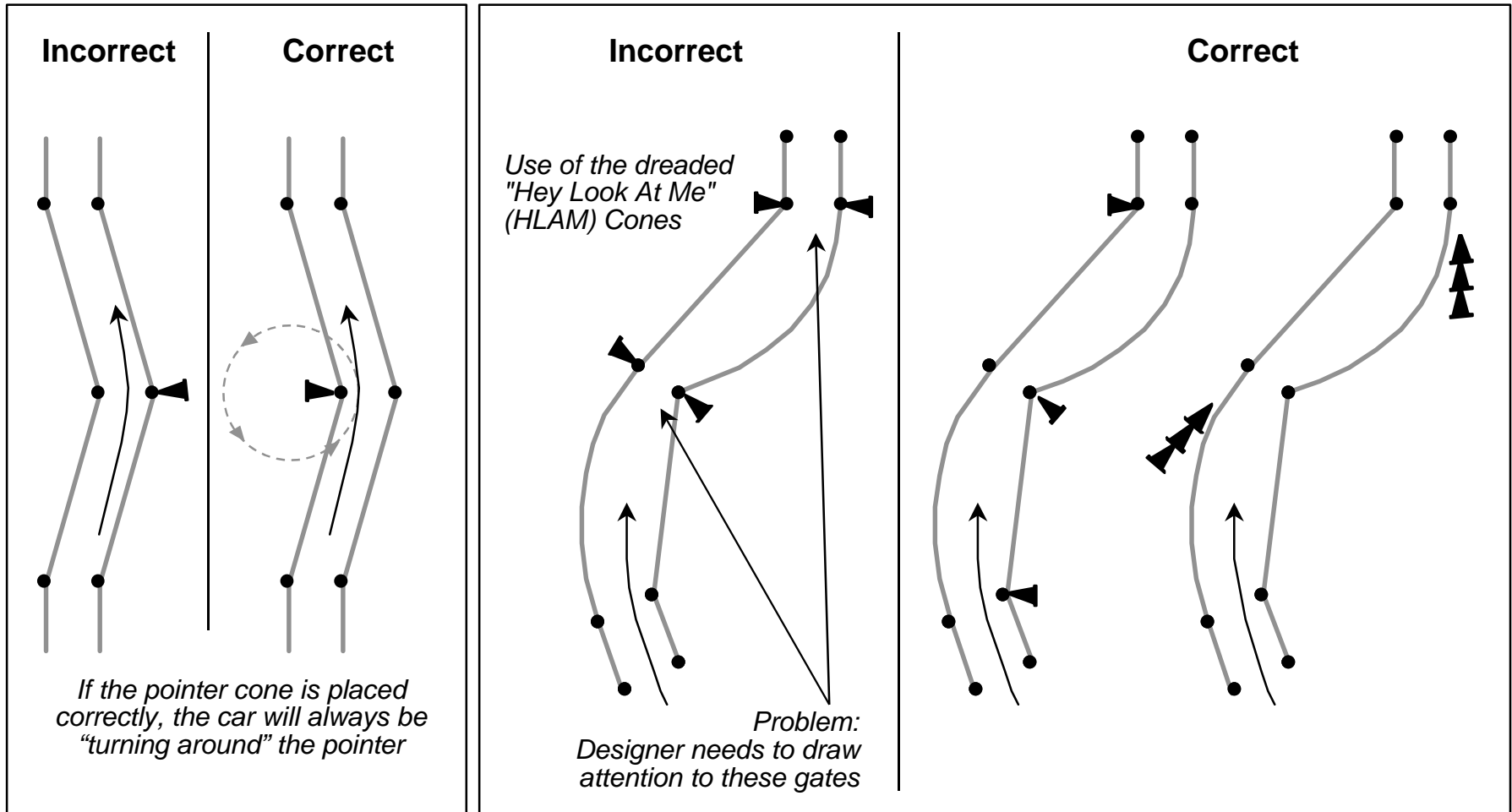
## 7.) Use Pointers and Directionals Correctly and Sparingly

- Pointers
  - A single lay down cone at the base of a standing cone
    - The purpose of a pointer cone is ONLY to indicate the inside of a turn (usually near the apex) - use them sparingly
    - Your car will always turn around a pointer when you negotiate the course if it is placed correctly
    - Do not use "Hey-Look At Me" (HLAM) cones - pointer cones on both sides of a gate (see diagram on page 46)
      - These can be confused with a down cone that a worker has not noticed
      - HLAM cones can make an experienced driver turn the wrong way since pointer cones are supposed to be on the inside of a turn
- Directionals
  - A series of lay down cones (3 or more) to guide the driver's to the left or right
    - The "big secret" to effective use of these is choosing a set number of cones (such as 3) and always use that amount when placing directionals on the course
    - This creates a recognizable pattern anytime a driver sees 3 lay down cones, telling them that it is a directional set and not some cones the course workers missed while telling a good joke

With pointers and directionals, "less is more"

10 Basic Concepts

# Correct Use of Directionals and Pointers Cones





## 8.) Line the Course

*Note: If the site prohibits the lining of a course, please skip to rule 9. If your course is at a location that does allow course lining, please read on.*

- Line the course whenever possible because it makes it much easier for the inexperienced driver to make it through the course with out a DNF
- The course should NOT be line dependent
  - If it rains the course must still be able to be seen and negotiated successfully if all of the lines are washed away
  - This is accomplished by paying close attention to basic concept #5
- The lining of the course is intended to be a visual aid in basic course negotiation and not an indication of the correct line to drive
  - Care should be taken to avoid the “correct line” from passing over the chalk lines; and should this not be considered, “open wheel” drivers will complain - rightfully so!
  - Lines should not be so far outside the cones as to fall outside of the driver’s easy field of vision; 1 foot or less is a good guideline to use when lining outside of the cones
- What to use (in order of preference)
  - Flour: non-caustic, easy to get, bright on pavement, smells like a Bakery!
  - Marble Dust: non-caustic, hard to get, not bright on pavement
  - Fertilizer: Caustic, easy to get, not bright on pavement, promotes weed growth in cracks
  - Lime: Extremely caustic, Easy to buy, bright on pavement



## 9.) Place Gates to Avoid Visual Confusion

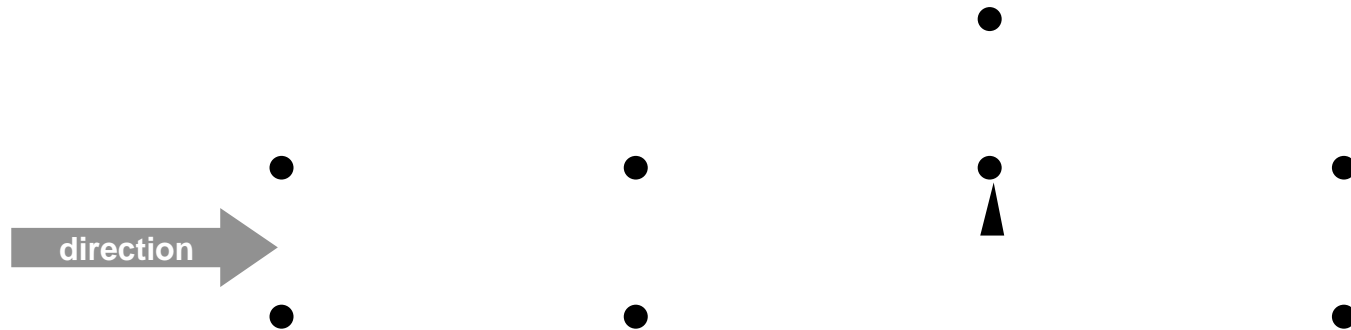
- Do not place cones or gates at intervals similar to the width of gates being used
  - For example, do not place gates going around a sweeping turn 25' or 15' apart if all of your gates are 20' wide (*see diagram on page 54*)
  - This creates a visual nightmare called “Cone Hell” since, at speed, all openings appear to be about the same size. *Arrrrgh!!! Which is gap and which is gate?*
- Make all cone walls dense enough so that at any angle, the gaps between them cannot be construed as a gate (*see diagram on page 49*)
- When entering a “box” or walled in turn, place the cones that appear in the approach path closer together and more frequently - creating a wall in the driver’s line of sight (*see diagram on page 57*)

# Gate Spacing "Rule of Thumb"

## Gated Courses

*Ratio of gate width to gate spacing should be 1 to 3 or greater.*

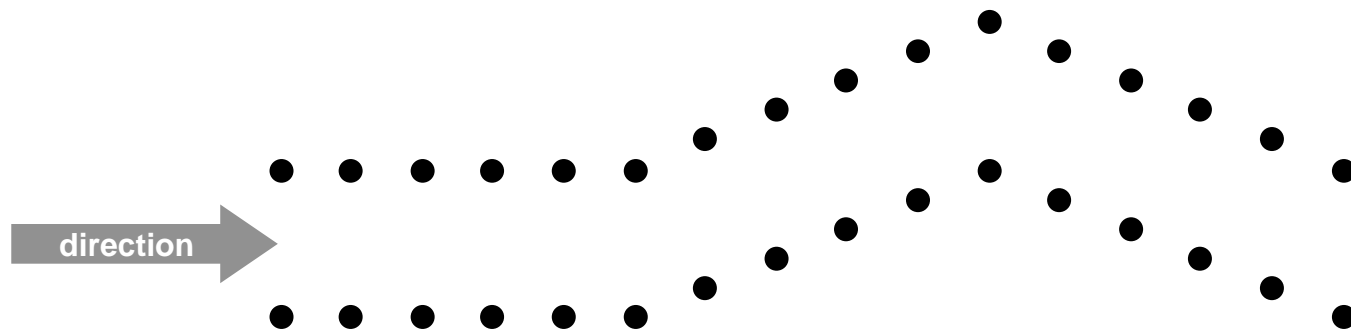
*For example, if your gate width is 20 feet the distance between gates would be 60 feet or greater*



## Miniature Road Courses

*Ratio of gate width to gate spacing should be 2 to 1 or less.*

*For example, if your gate width is 20 feet, the distance between gates would be 10 feet or less*

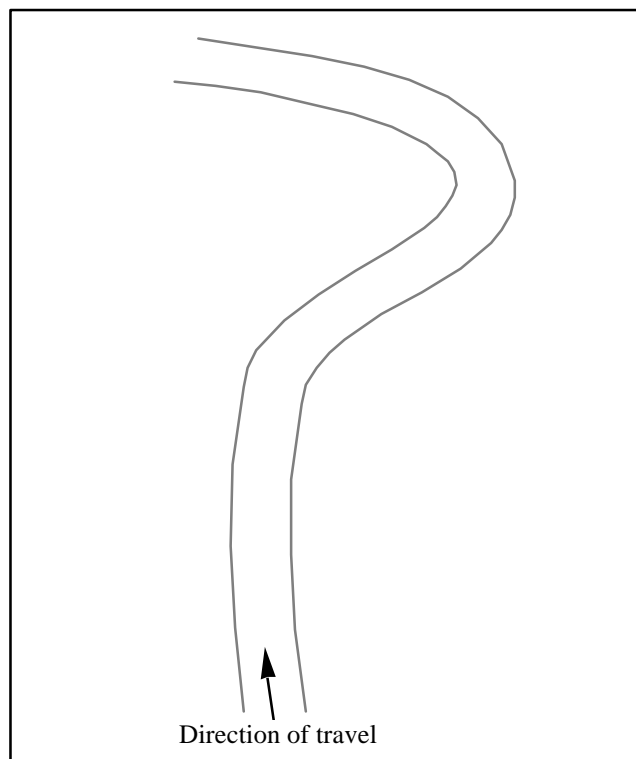




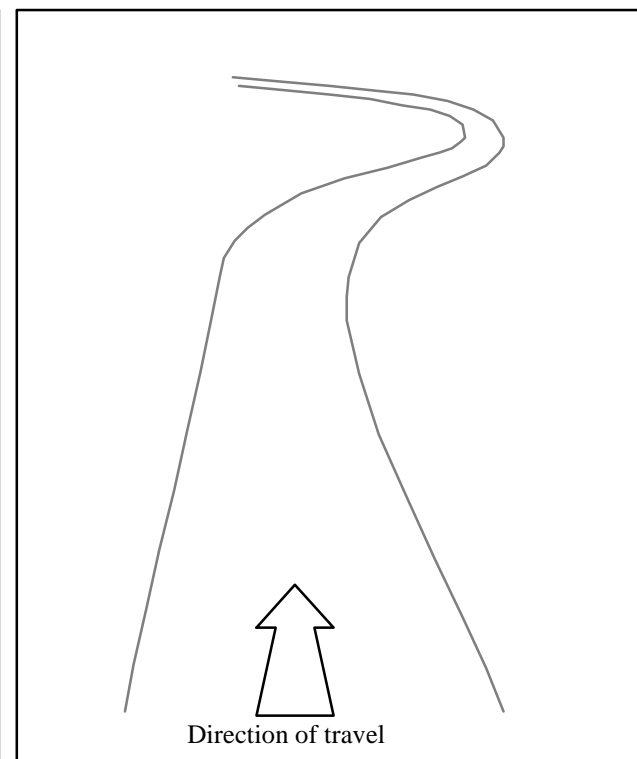
# Plan and Perspective views

- The following examples show a plan view and a perspective view of certain situations so that you can better visualize the cone configuration being indicated. What you see below is the basic path that the next 3 examples are going to take.

**Plan View**



**Perspective View**



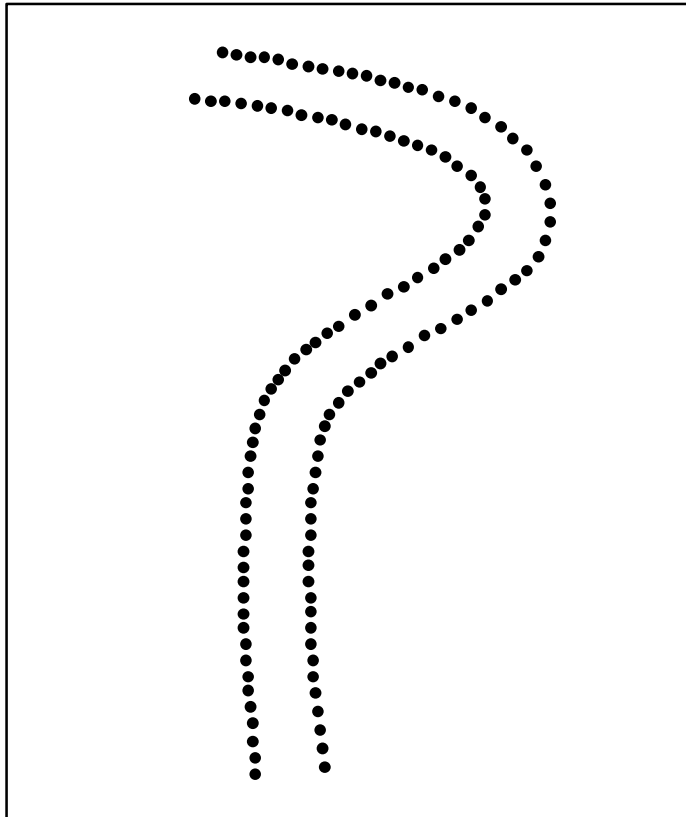




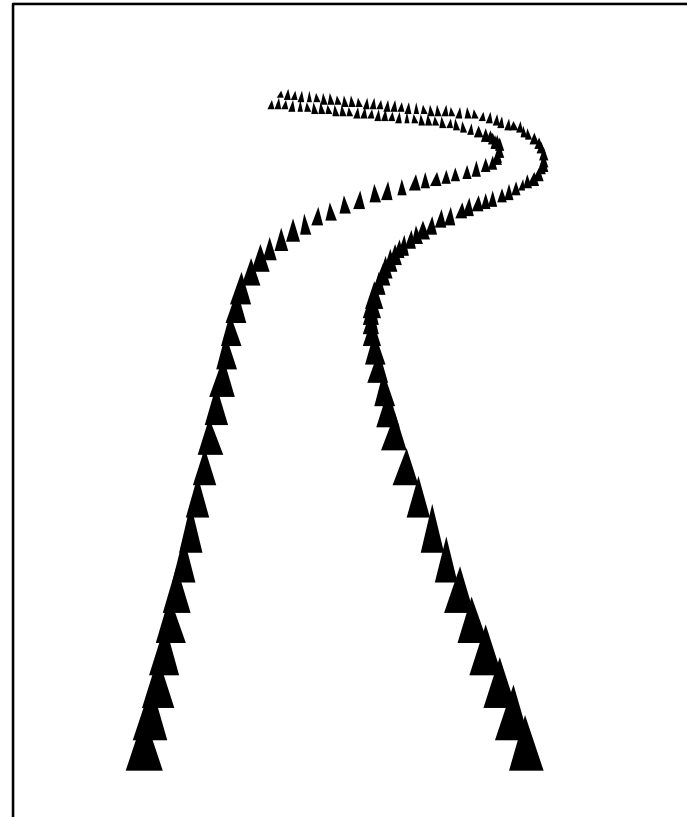
# Wall - o - Cones or Miniature Road Course (MRC)

- This is an example of the proper use of the miniature road course technique. The pathway for this is also quite clear and easy to follow

Plan View



Perspective View

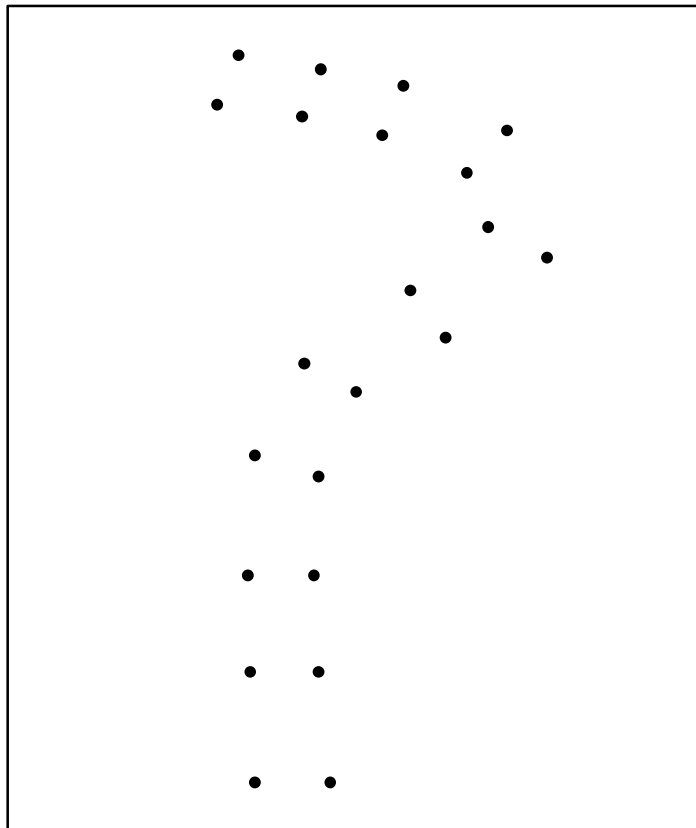


## 10 Basic Concepts - Avoid Visual Confusion

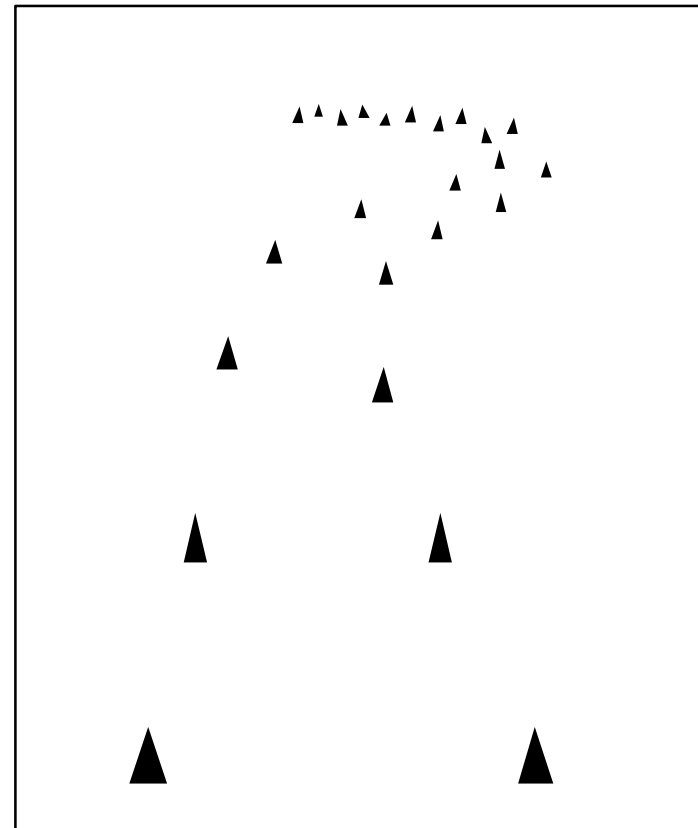
# the Dreaded "Sea of Pylons"

The dreaded sea of pylons shown here is the result of using spacing of gates similar to the gate width. As seen in the perspective view, the curve in the distance becomes vague and difficult to follow. When at speed, this effect is worsened since your mind has less time to process what is placed before it

Plan View



Perspective View

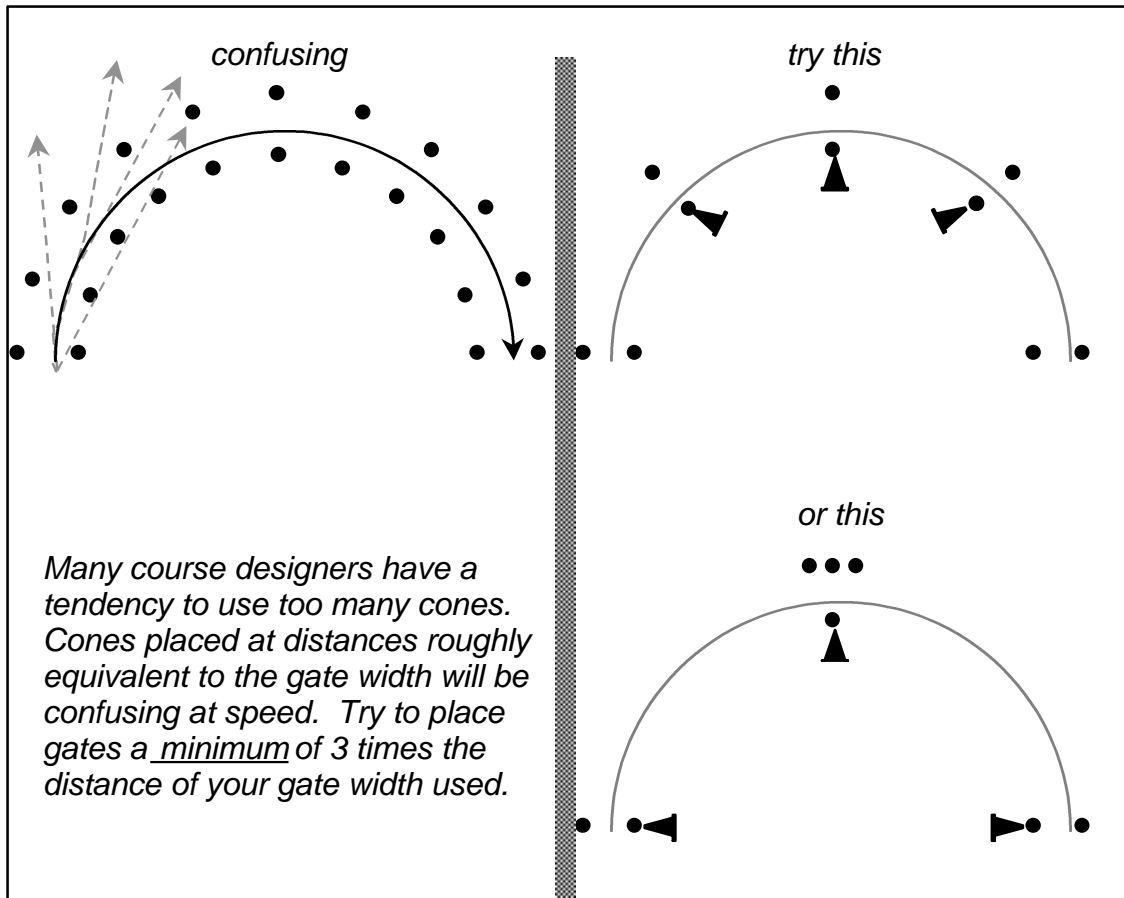




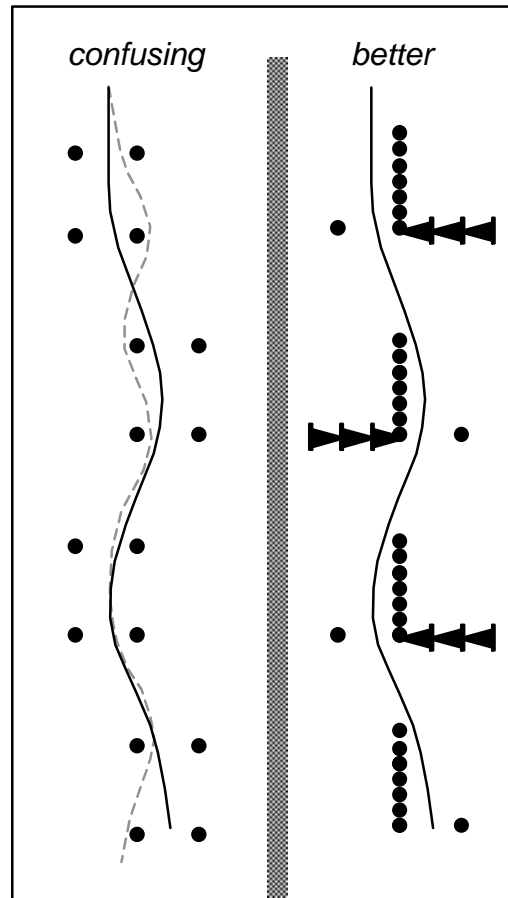
# More Examples of "Cone Hell"

Other examples that demonstrate the importance of gate spacing

**Sweeper** (see page 54)



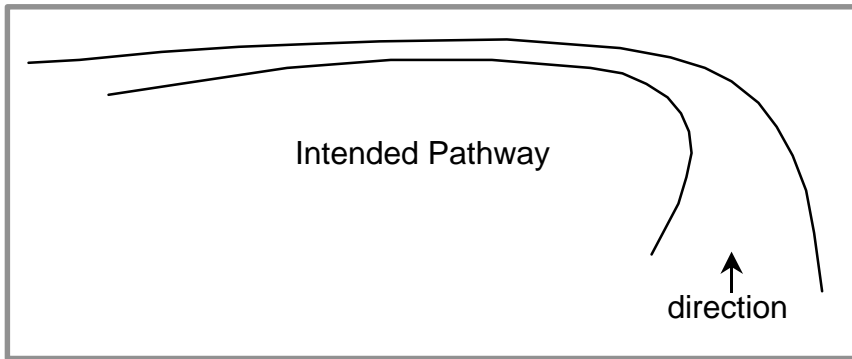
**Lane Change** (see page 55)





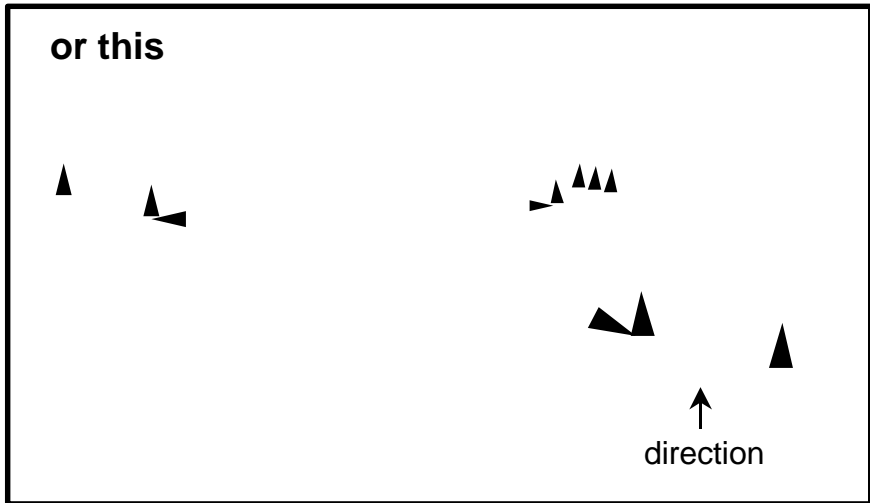
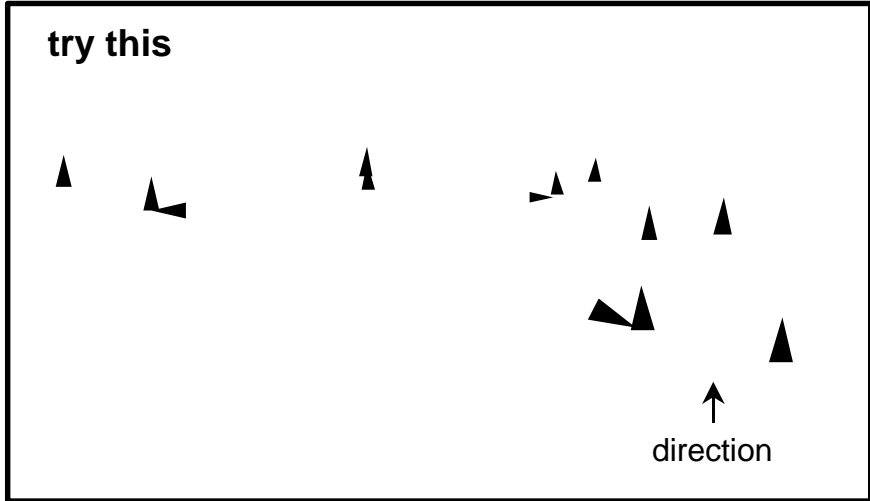
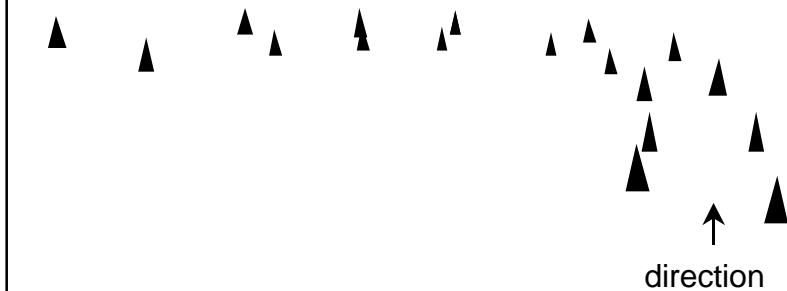
# 10 Basic Concepts - Avoid Visual Confusion

## Sweeper - Perspective View



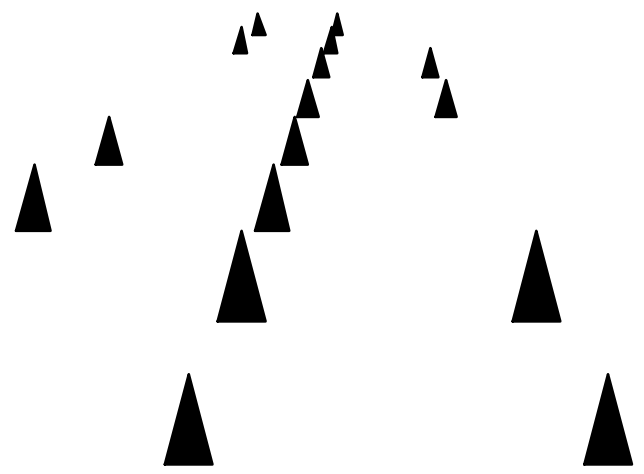
**could be confusing**

*Placing cones at similar intervals as gate width causes this effect which can be confusing at speed*

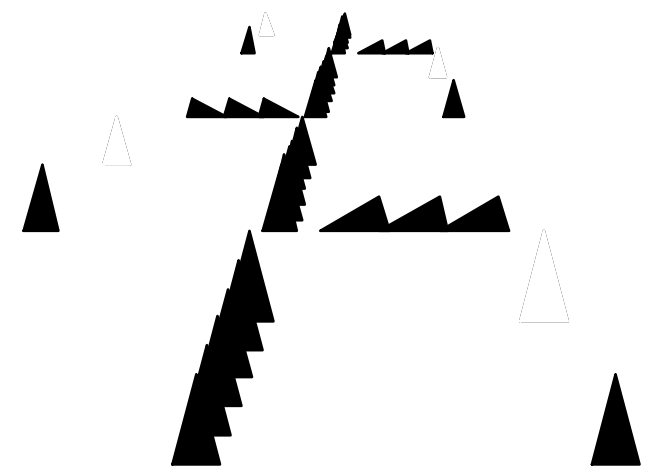


# Lane Change - Perspective View

sea of cones



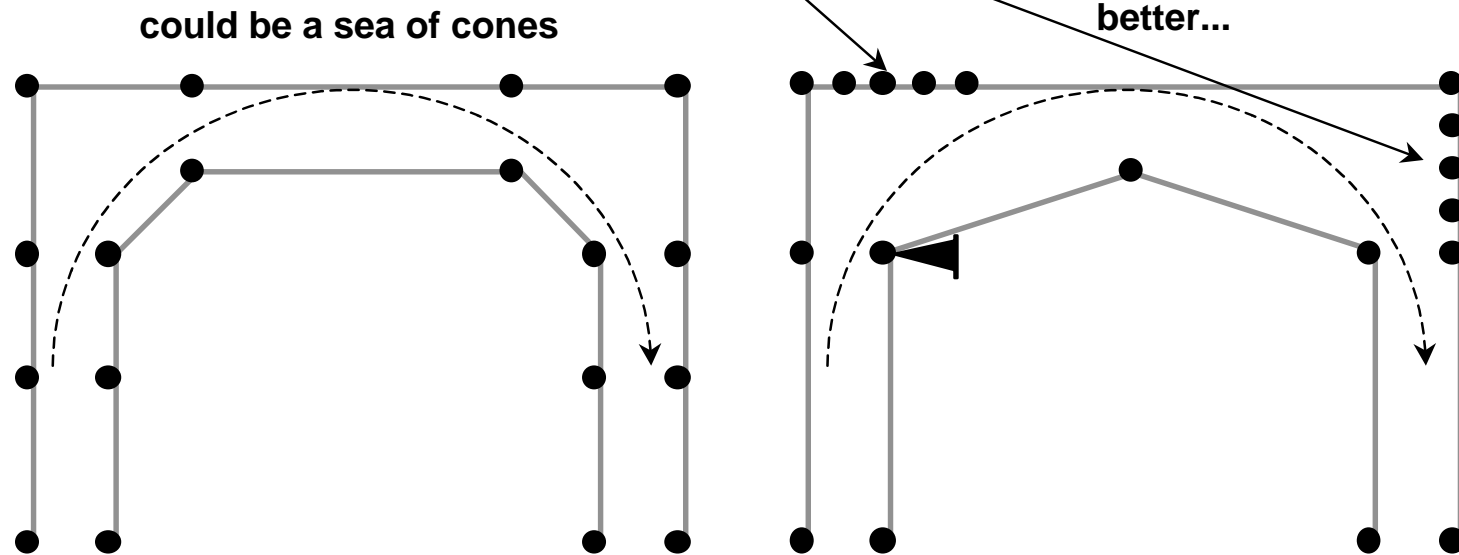
better



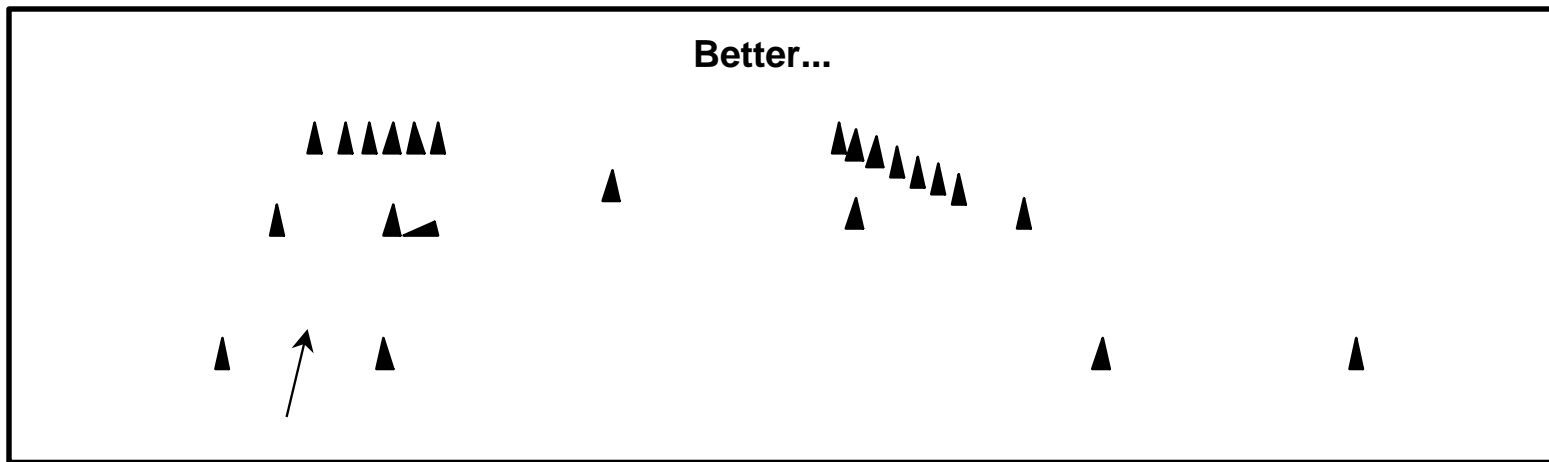
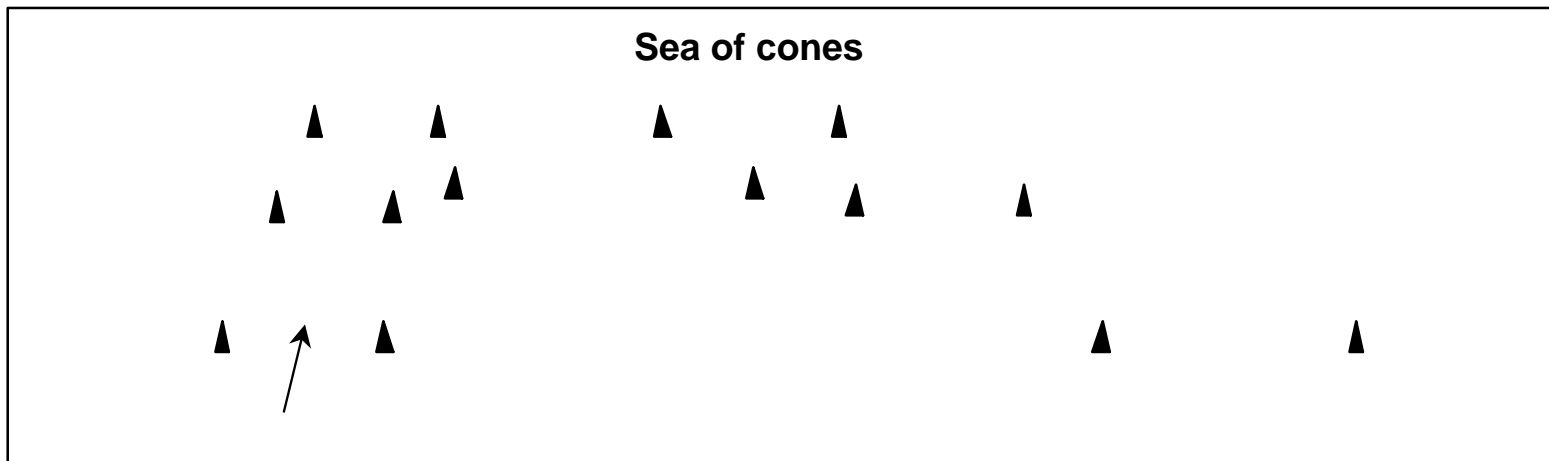


# Box Turns

When entering a “box” or walled in turn  
place the cones that appear in the approach path  
closer together and more frequently (see diagram on page 57)



# Box Turns - Perspective View





# 10.) Walk & Drive your course with the Intent of Improvement

- **Always** walk and drive your course after its initial set-up with the intent of changing it to improve the flow - I have never drawn a course, set it up and not changed at least one thing
  - Keep the **basic concept** of what your maneuver was, but improve it to make it more fun
    - Maybe it was too tight, or too fast, or visually hard to see
    - What ever the shortcoming, this is the perfect time to fix it
- Take an experienced course designer and Safety Steward with you
  - You are there when they have a suggestion
  - You are able to control the types of changes the Safety Steward makes (to maintain the basic concept of the maneuver)
  - You can discuss/analyze any of the suggestions the experienced course designer comes up with
- When not a competitor, DRIVE the course to find its shortcomings
  - If you are a competitor, designate a non-competitor whose Solo II course design opinions you trust to drive the course
  - Make your design changes based on the inputs received from your walk through, the Safety Steward, experienced course designer and your drive through

Be a Commercial Artist, NOT a Fine Artist



# Agenda

- Fundamentals
- 10 Basic Concepts
- **So you have a blank piece of paper...**
- Elements, dimensions and real speed
- Summary



# So You Have a Blank Piece of Paper

- This section contains a method to use that will enable you to put your ideas and the 10 basic concepts you've just gone over down on a piece of paper. I have found that at times, a blank piece of paper can be *extremely intimidating*. So, the following section will hopefully alleviate that problem and make this task easier for you as it has for me.



## *So You Have a Blank Piece of Paper* Before You Start Your Glorious Creation

- Make the job easier and improve your chances of success
  - Acquire or make a reasonable scale map of the event site that contains the following information:
    - The *accurate* overall shape and size of the course area
    - Map scale information
      - Dimensions of parking stalls
      - Concrete square dimensions
    - Locations of:
      - Surface problems (grates, holes, oil, etc.)
      - Immovable objects (light poles, buildings, curbs, planters, trees, etc.)
      - Boundary features (fences, sidewalks streets, etc.)
      - Entrance and Exits
      - Elevation changes and/or sloped sections  
(*such as at drainage grates - see diagram on page 26*)

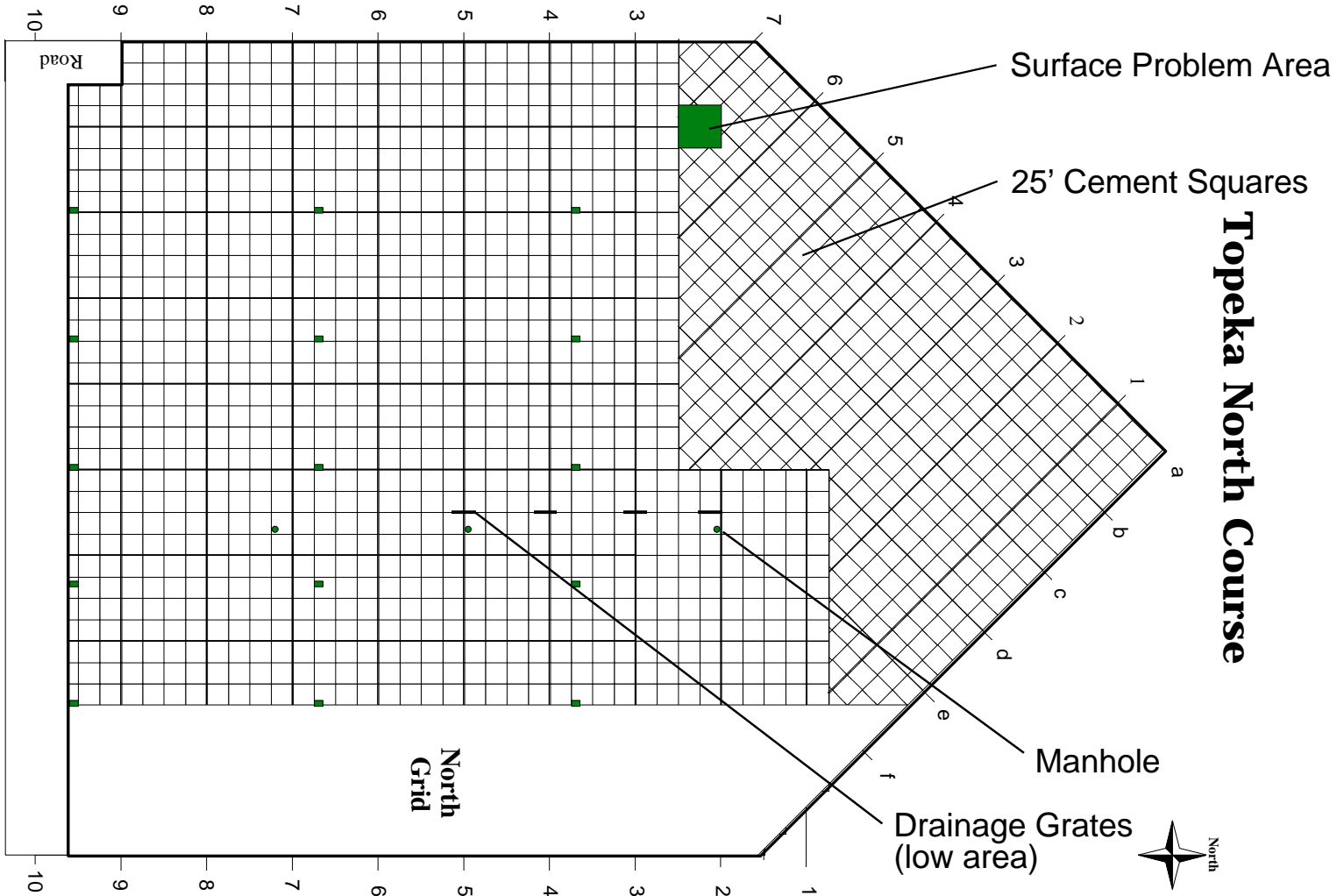


*So You Have a Blank Piece of Paper*  
**Before You Start  
Your Glorious Creation**  
(continued)

- Address logistics involving non-course features on your map as well
  - Competitor entrance(s) and waiver patrol points
  - Pit areas
  - Grid
  - Run-out for the finish
  - Required boundary buffers for spectator areas  
*(see diagrams on pages 22 and 25)*
  - Registration location
  - Technical inspection location
  - Timing vehicle/trailer/tent positioning
  - Number of cones available
- the following page has an example of a Map that I created for the 1995 Solo II Nationals North Course Area at Forbes Field in Topeka



# So You Have a Blank Piece of Paper Scale Map of the Topeka North Course Area





*So You Have a Blank Piece of Paper*

# Design Goals

- Consider the course attributes that meet good design goals
  - It follows the ten basic concepts
  - It is easy to find
    - The general route makes sense
    - It can be walked the first time without a course map by an experienced driver
    - It can even be driven by experienced drivers without a walk-through
  - It is easy to remember
    - The sections connect well and make good sense
    - The style and visual clues are consistent and clear
    - Its directional flow leads drivers along the correct path
  - It is hard to drive “right”
    - Lines, discipline, calculated aggression and car control are all critical to having a good competition run
    - Sloppy runs result in slow times
    - Novices are noticeably slower than the experienced drivers in similar cars
- All of these things will provide “Fair, Fun and Safe Competition”



*So You Have a Blank Piece of Paper*  
**How to Keep Your Solo II Peers  
from Killing You...**

## Do Not

Get them Lost!

- DO NOT put in lots of extra meaningless pylons just to disguise the course
- DO NOT space pylons the same or similar distance as the gate width
- DO NOT forget to line the course

## Do Not

Make them hit (and pick up) lots of pylons!!

- DO NOT place a cone(s) with the only intent of “boy, will THAT one get creamed!”
- AVOID the effect known as the “Sea of Pylons”

HOUSTON  
REGION



SPORTS CAR  
CLUB OF  
AMERICA

*So You Have a Blank Piece of Paper*  
**How to Keep Your Solo II Peers  
from Killing You...**  
(continued)

- Visit the site ahead of time
- Draw the course to scale (or as close as possible) and include:
  - Worker positions
  - Start and Finish
  - Grid
  - Paddock
- Let some other non-emotionally involved person review your course
- Set up early
- Walk the course while pretending some other idiot designed it
  - Look for visually confusing areas
  - Add pointers or adjust pylons as needed
  - Remove pylons as needed
- Have someone else walk the course and adjust according to their comments as necessary
- Then, line the course



## *So You Have a Blank Piece of Paper Getting Started (Finally...) Position the Finish*

- Position the finish area first
  - Things to think about
    - Runoff area
    - Exit from the course area (tightly defined)
    - Return route to grid
    - Location of lights
      - To provide good timing stop location
      - To avoid impact by badly controlled cars
      - Separation limited by equipment capability
    - What type of finish?
      - flying finish
      - finish after turn
      - etc.
    - Avoid maneuvers which encourage control loss or requires heavy application of the brakes just before the lights
    - Try to ensure that the projected timing vehicle location will have a clear view of the finishing cars



# Position the Start

- Position the start area next
  - Things to think about
    - Staging line
    - Access from the grid
    - Location of the start/finish lights
      - Provide a logical timing start location
      - Separation of the timing lights limited by equipment capability, not the course's edge
    - What kind of start?
      - 90°
      - Drag strip
      - short approach
      - etc.
    - Try to ensure that the projected timing vehicle location will have a clear view of the starting (and finishing) cars



*So You Have a Blank Piece of Paper*  
**Sketch General Routes  
Through the Site**

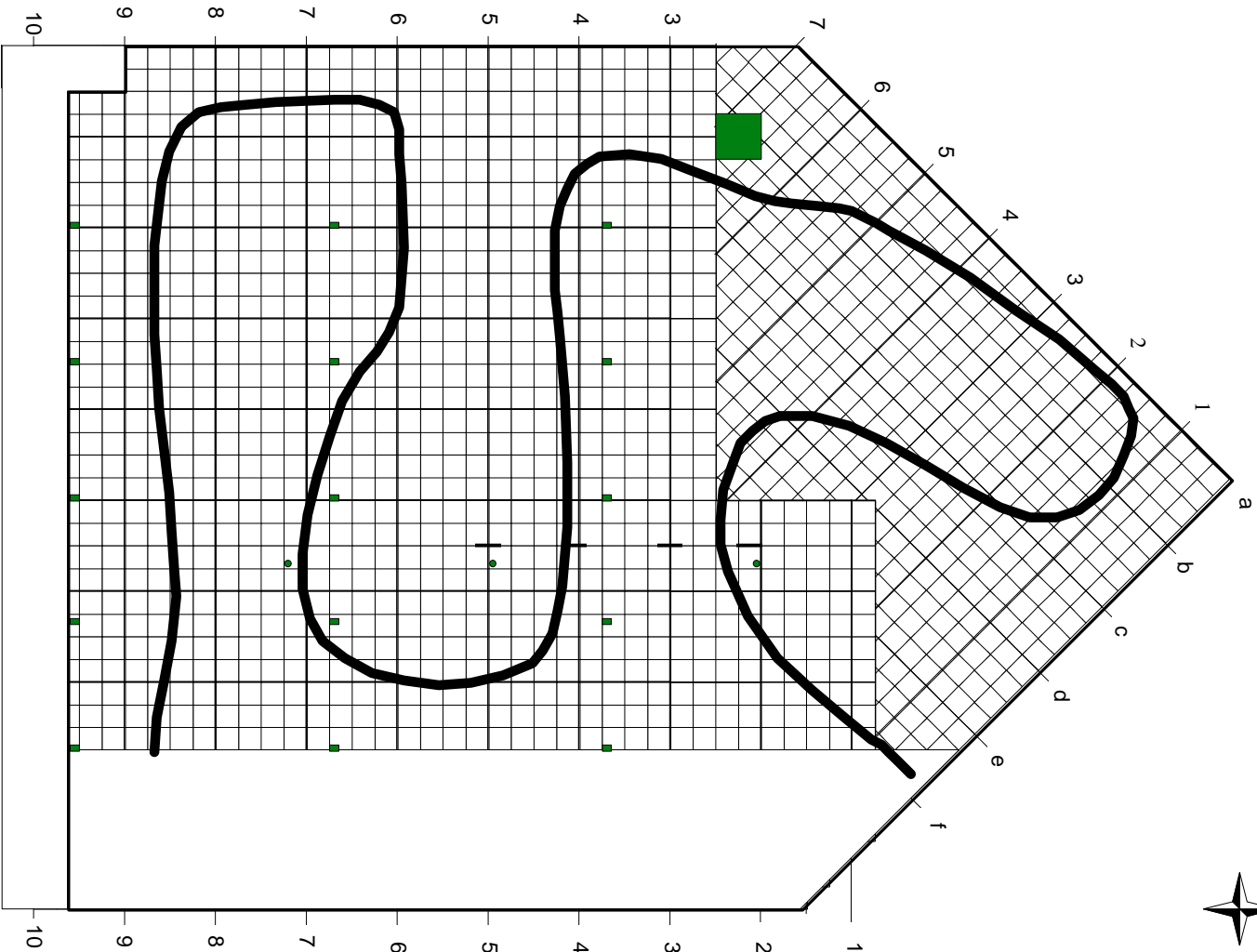
- Determine number and directions of turns
- Consider the location of the straightish sections
- Anticipate possible course worker station positions
- Keep in mind distance to boundaries and immovable objects
- Allow for multiple cars on course if necessary
  - Avoid crossovers
  - Provide separation between adjacent sections
- Provide a variety of different types of maneuvers
  - Make a list of the desired items for the course
  - Decide which portions of that route lend themselves to each of the listed elements
- Do several general sketches - there is no single “right” route
- Pick the ones that seem the best and fill them in
  - Adjust turn radii and shapes
  - Add transients where applicable
  - Ensure a diversity of elements
- Decide what your presentation format is and be consistent
  - Gate style (line or unlined)
  - Walled style (lined or unlined)
  - A combination thereof



*So You Have a Blank Piece of Paper*

# Example of a sketch

## Topeka North Course





# Finalizing the Design

- Add projected cone locations
  - Think about visual cues and clear markings  
(see pages 47 - 58)
    - Don't assume that the white chalk line will help guide the drivers
      - Rain or wind may eradicate those lines during an event
    - Consider approach speeds to allow for driver error  
(see diagram on page 27)
    - Create patterns by repeating cone formations
      - Pointers on apexes
      - Four cone walls on outside of turns
      - Consistent gate widths, etc.
  - Avoid Excess cones where not required for a desired visual
  - Prioritize key cones  
(see diagrams on pages 33 and 34)
  - Allow room for adjustment in all directions; no course should be expected to be set up on site exactly as it was drawn on the map
    - 10' minimum movement allowance of individual cones, gates or even entire sections

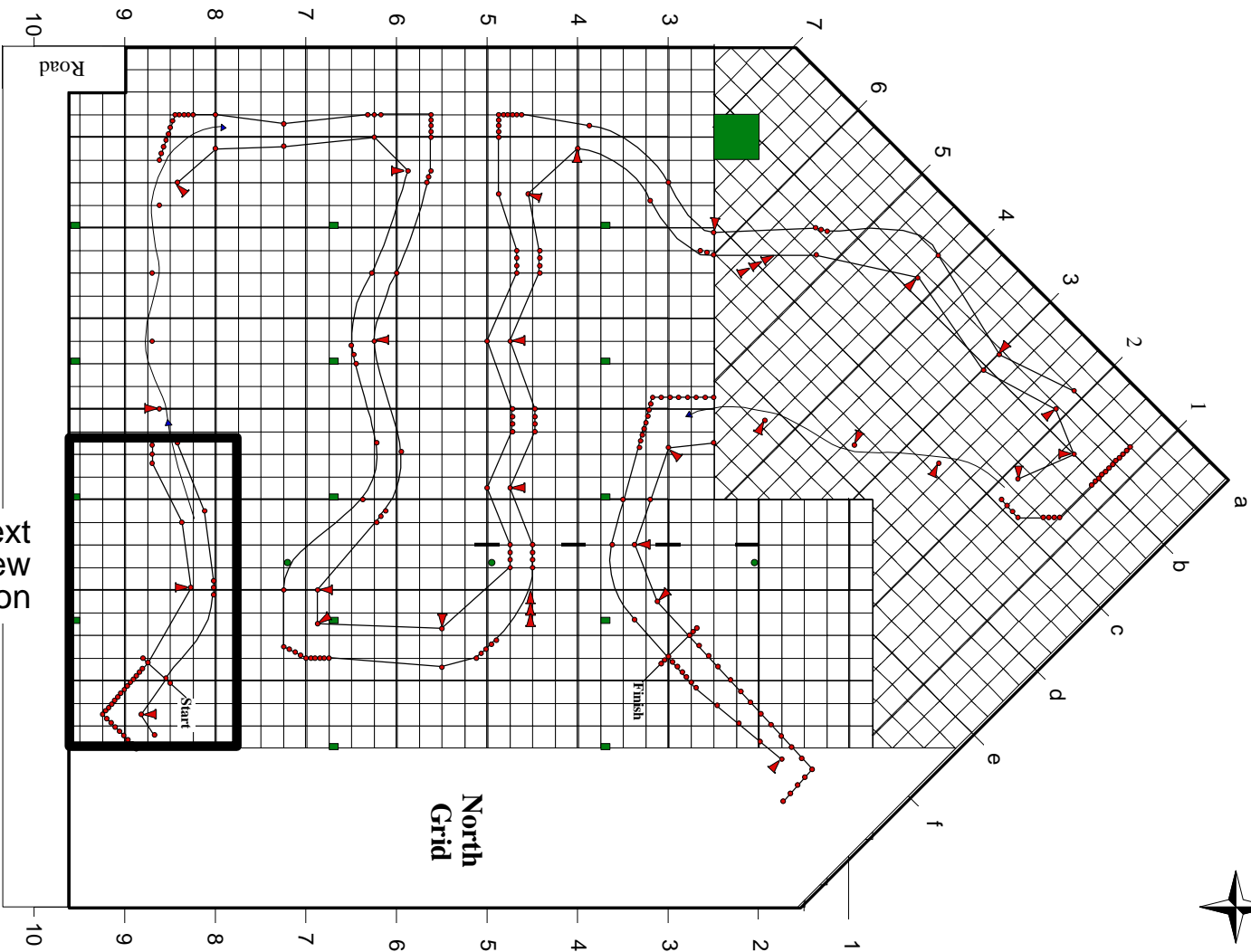


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# Finalized Design Example

## Topeka North Course

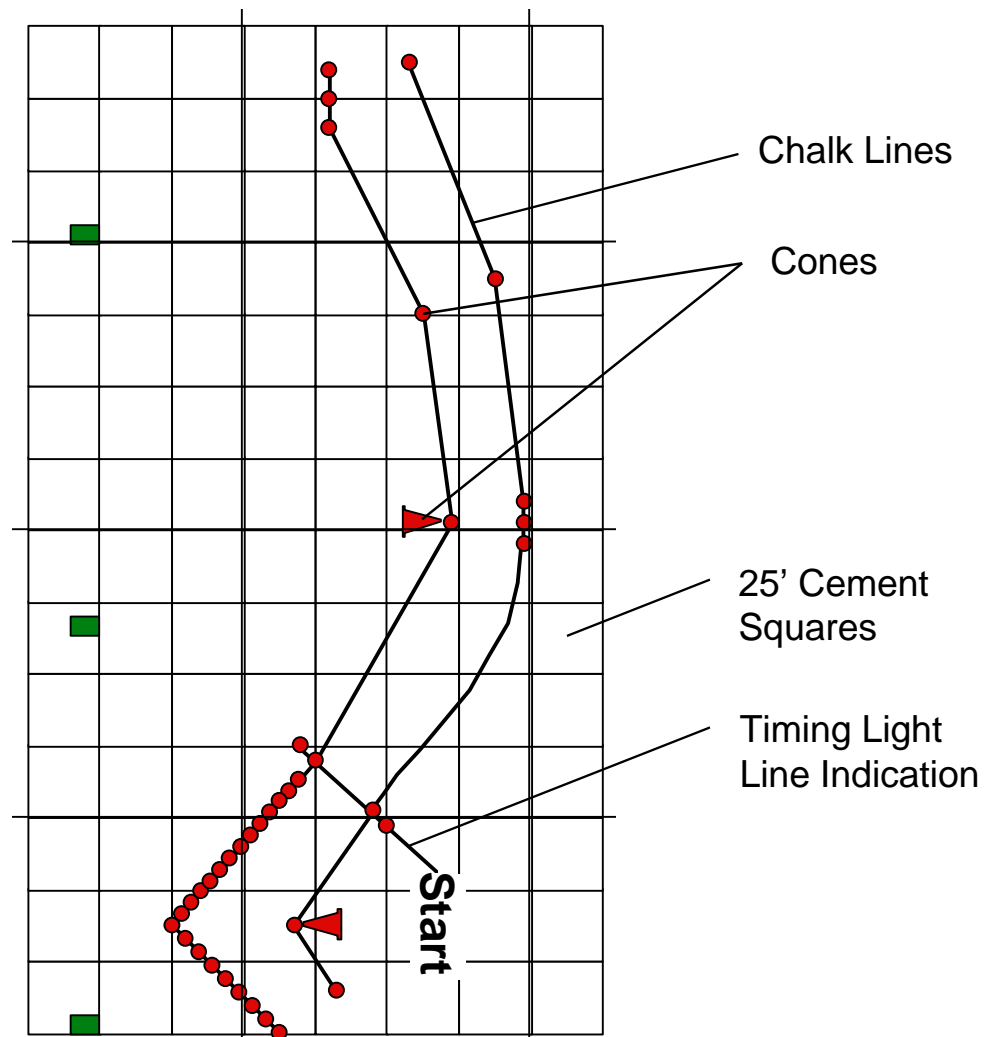


See next page to view this section



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# Section from Finalized Design



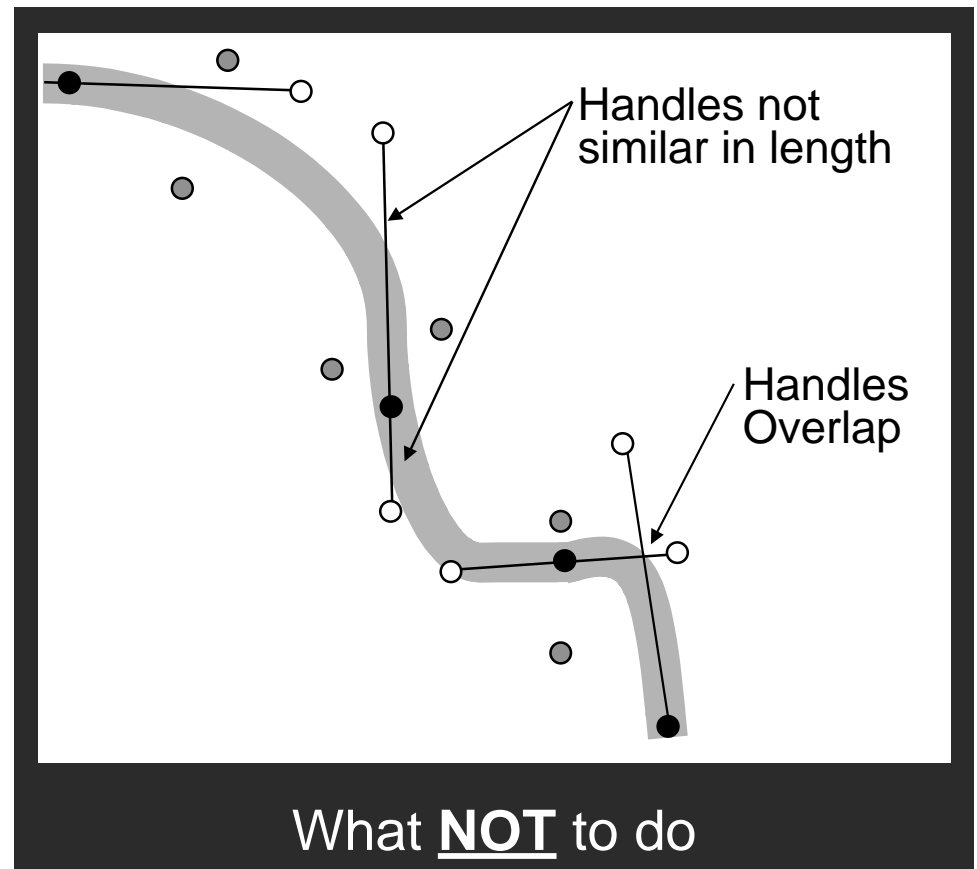
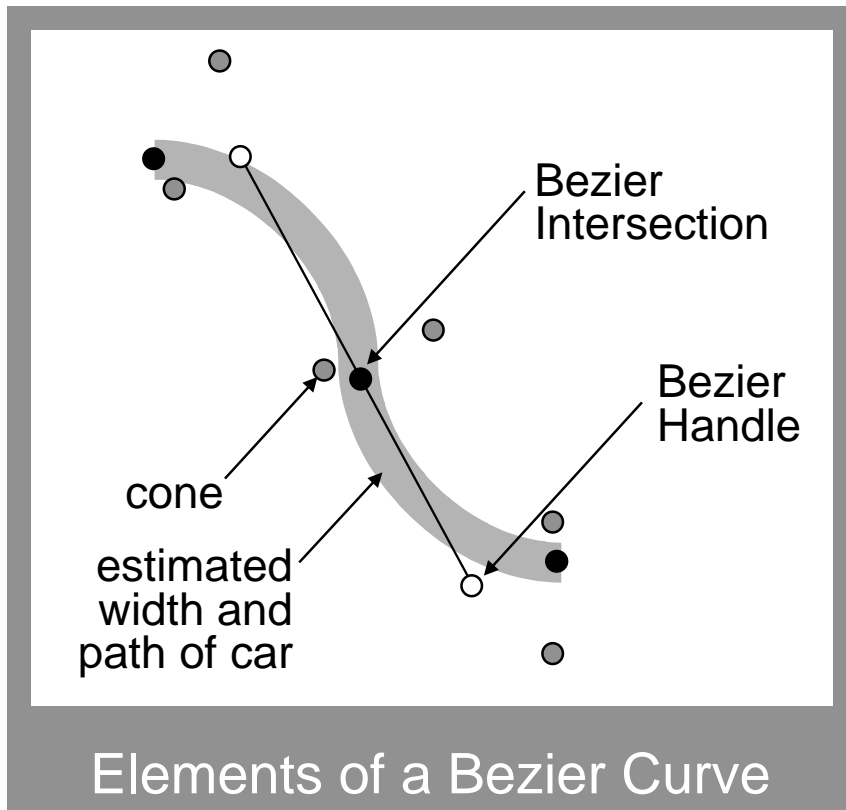


*So You Have a Blank Piece of Paper*

# Computer Analysis of the Design

- The following assumes that you have access to a fairly powerful computer with a current Graphics program that utilizes bezier curves and lines such as Adobe Illustrator, Deneba Canvas, Corel Draw, etc.
  - When you input your design into a computer to scale, you can analyze how well the course flows by plotting the probable path of a car (*see diagrams on page 76*)
    - Create a probable path of the car using a bezier curve the approximate width of a car
      - Most cars are about 6 feet wide
      - Place your bezier intersections at probable apex points
    - Adjust the bezier curves to create the fastest (shortest) path through the course without clipping any cones
      - Strive to have the line as smooth as possible
      - Make your bezier handles similar in length
      - Do not have bezier handles overlap each other

# Computer Analysis of the Design (continued)





## Worker stations

- Now add the projected course worker stations and projected coverage area
  - Keep coverage distances around 50 yards or less if possible
  - Position near solid objects if possible/available
    - light pole
    - tree
    - planter, etc.
  - Locate workers on the inside of a turn rather than the outside
  - Anticipate possible directions that a car may spin and avoid those areas
  - Prioritize closeness to the cones likely to be hit
    - slalom cones
    - tight apexes
    - outside walls at ends of significant straights, etc.
  - Try to ensure that workers do not have to cross another area of the course to get to a down cone in their coverage area

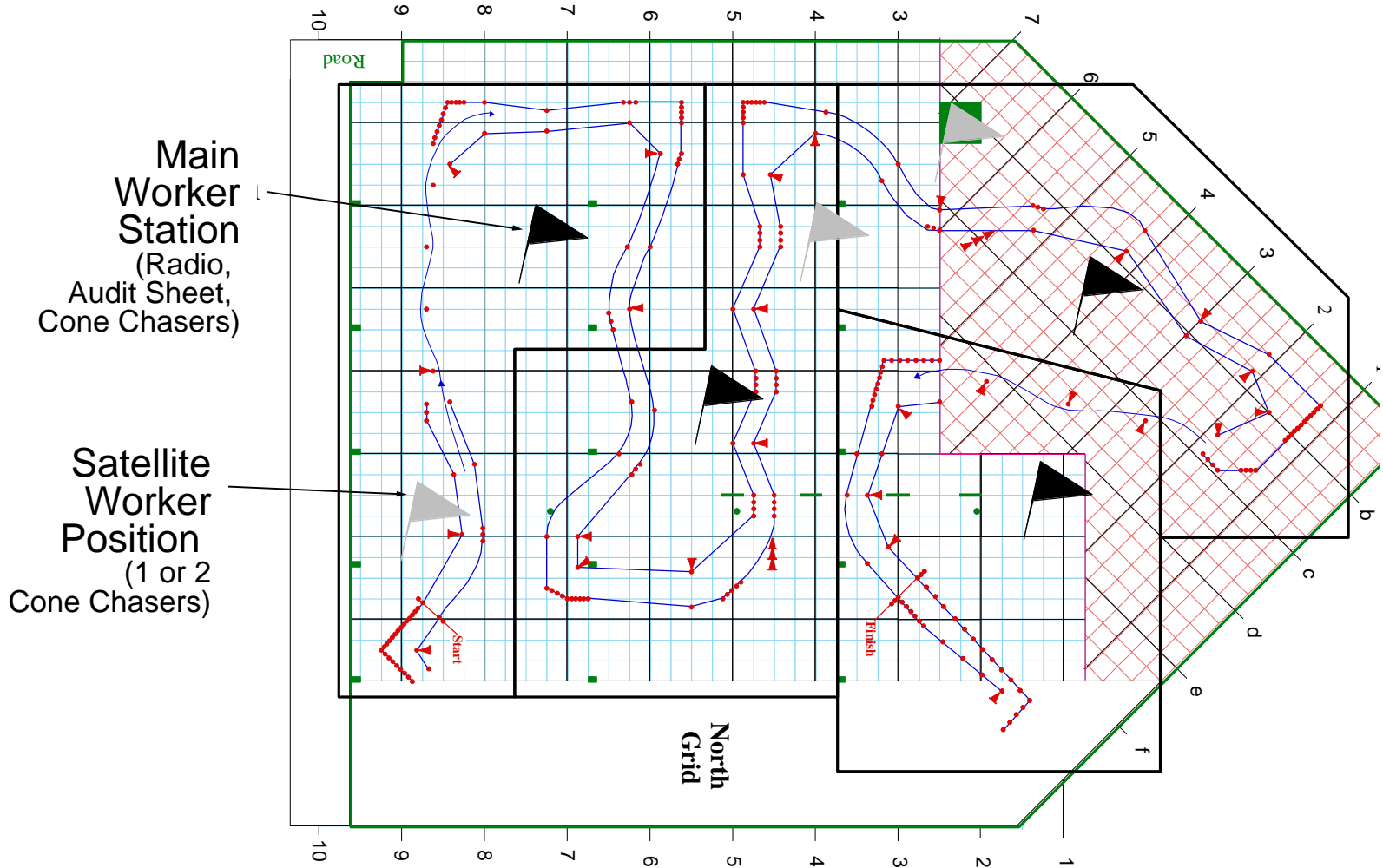
HOUSTON  
REGION



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CLUB OF  
AMERICA

*So You Have a Blank Piece of Paper*

# Worker Station Placement



Main  
Worker  
Station  
(Radio,  
Audit Sheet,  
Cone Chasers)

Satellite  
Worker  
Position  
(1 or 2  
Cone Chasers)

**Topeka North Course 1995**





## Course Set Up at the Event Site

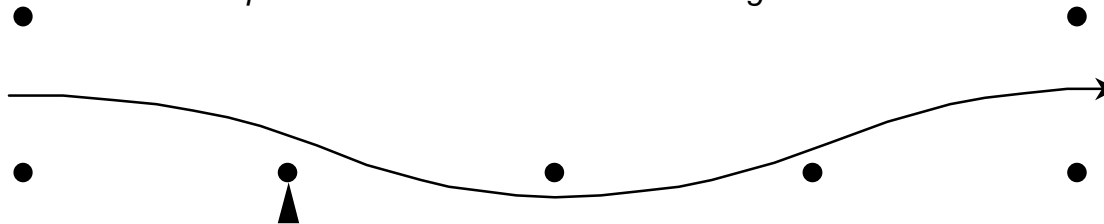
- Things are not always what they seem - or - I could have sworn they'd have to lift there!
  - It is rare to be able to say that the entire design worked the way it was intended
    - Page 72 shows a course I designed in which the first section turned out to be flat out from the start until the first 90° turn - not what I expected at all!
  - Sometimes it is difficult to spot poor sections on paper but easy to see once the pylons are in place
    - A good designer will exhibit flexibility and make on-site adjustments to allow the course to flow properly (*see diagrams on pages 80 and 81*)
      - Maps, such as the ones included in this booklet, usually have cones in them that are approximately 3-5 feet in diameter - which makes it impossible to be totally accurate
      - Because of this, some course elements which appear to reduce speed on paper may in fact be wide open, as I found out from my example above
      - The converse is true too - some elements which appear to be moderately open will be difficult and tight to drive
- So make adjustments at the event site, make note of your errors and your current and future course designs will benefit

# The "Before and Afters"

Placement of the gate "before and after" the start and finish of a slalom is critical as to the amount of turns that the slalom actually becomes.

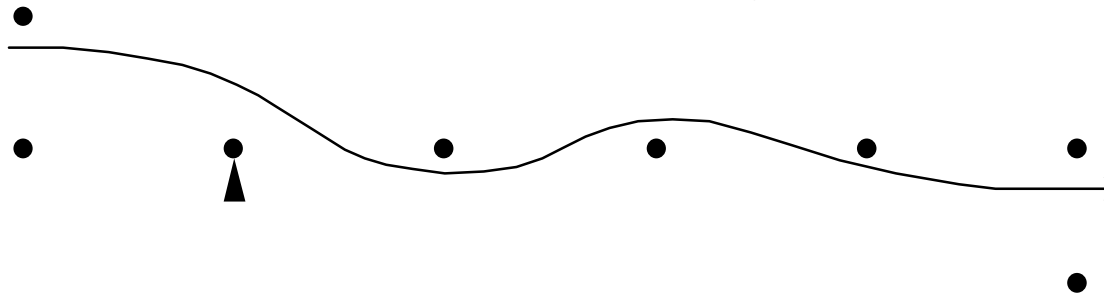
## 3 Cone Slalom

*The intent of a three cone slalom is usually to make 3 turns. As you can see from this example, this slalom has become 1 turn due to the placement of the "before and after" gates*



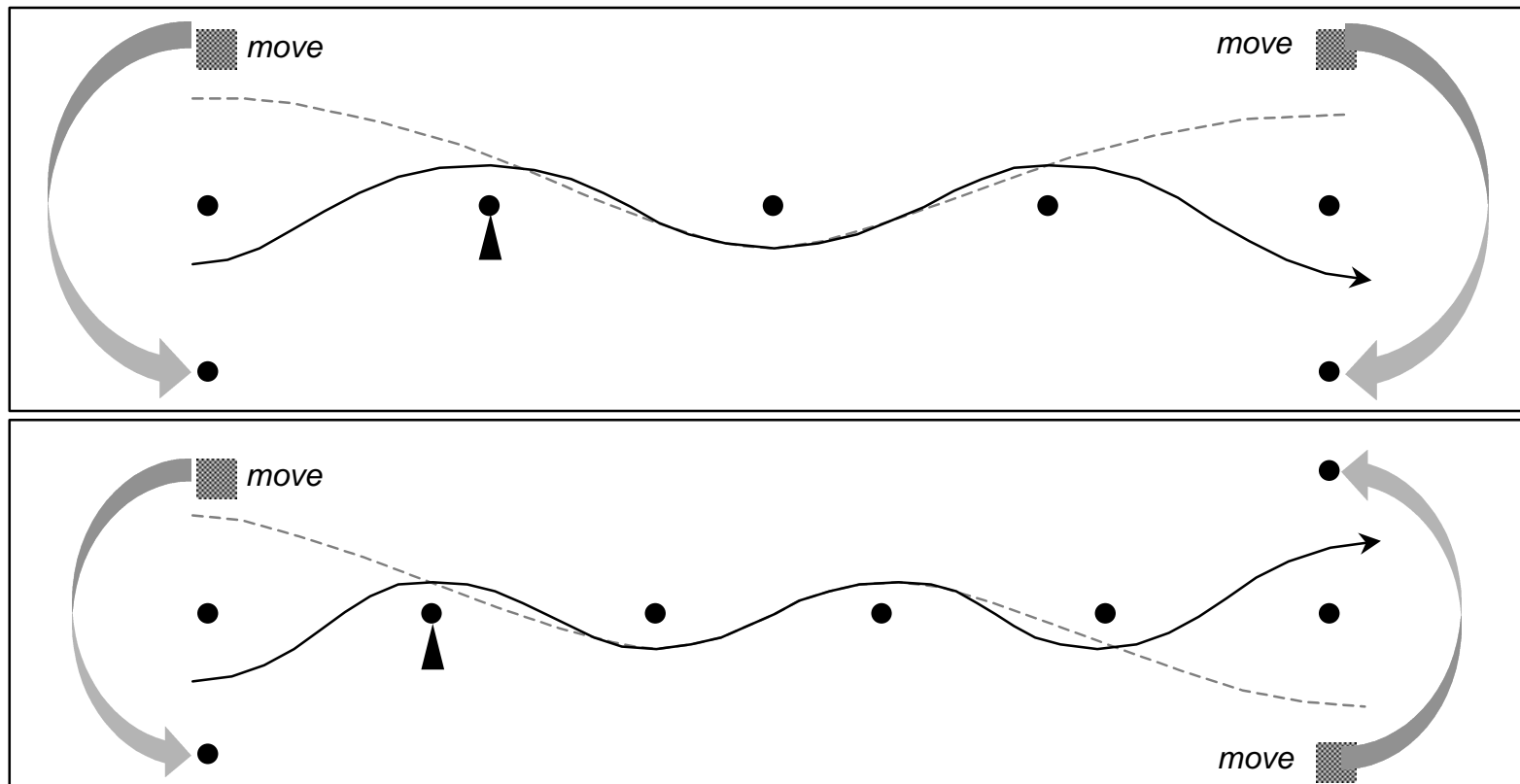
## 4 Cone Slalom

*The intent of a four cone slalom is usually to make 4 turns. As you can see from this example, this slalom has become 2 turns due to the placement of the "before and after" gates*



## *So You Have a Blank Piece of Paper* Tweak the "Before and Afters" at the Event Site

Note that the three cone slalom now has 3 turns and the Four cone slalom has 4 turns. By tweaking the placement of these two gates at the event site, you can increase/decrease the severity of a slalom just by moving either or both of these gates a few feet to get the flow you want.

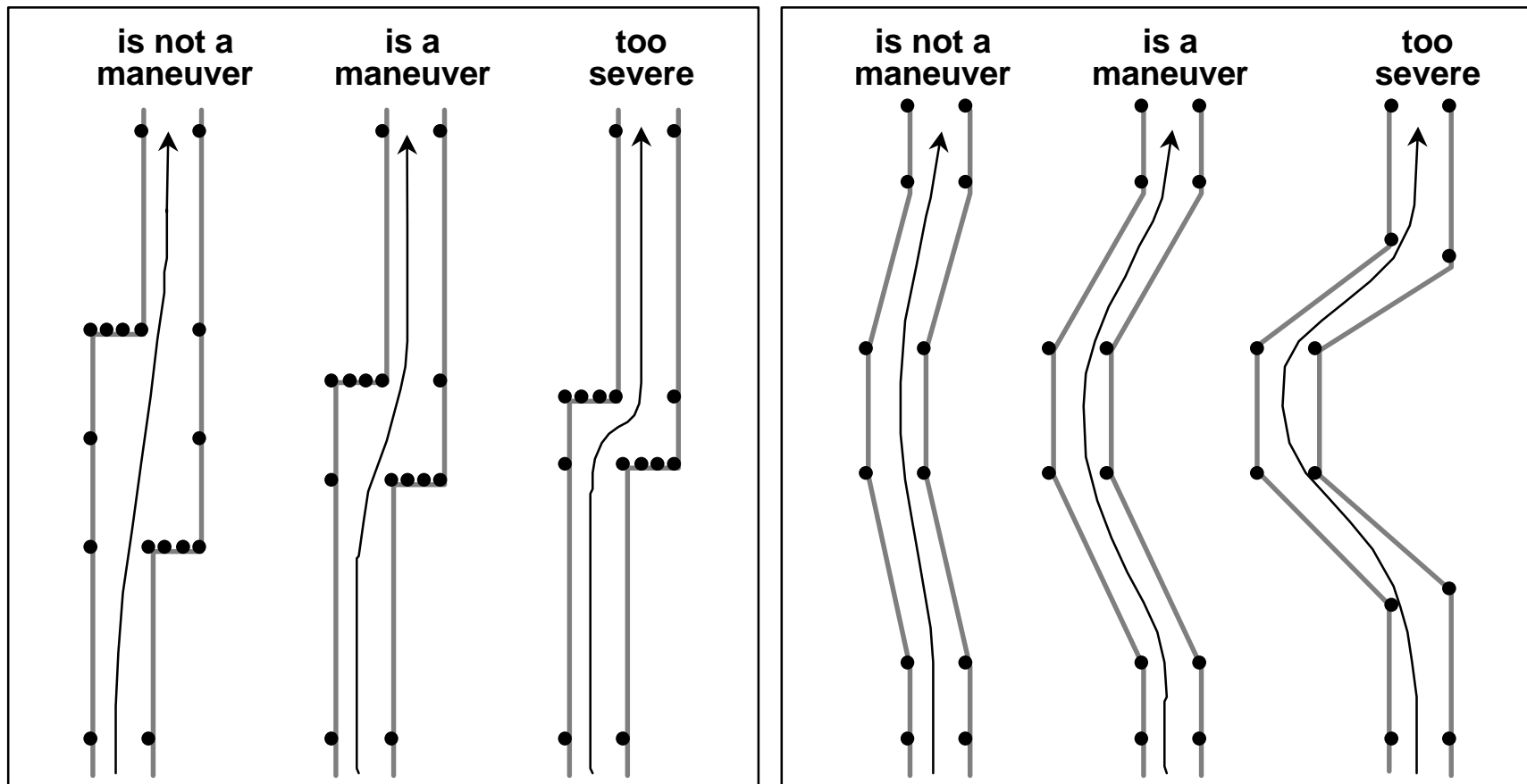




*So You Have a Blank Piece of Paper*

# When a Maneuver isn't...

While setting up your course, check to see that all maneuvers are indeed maneuvers. Also ensure that they are not more severe than you intended



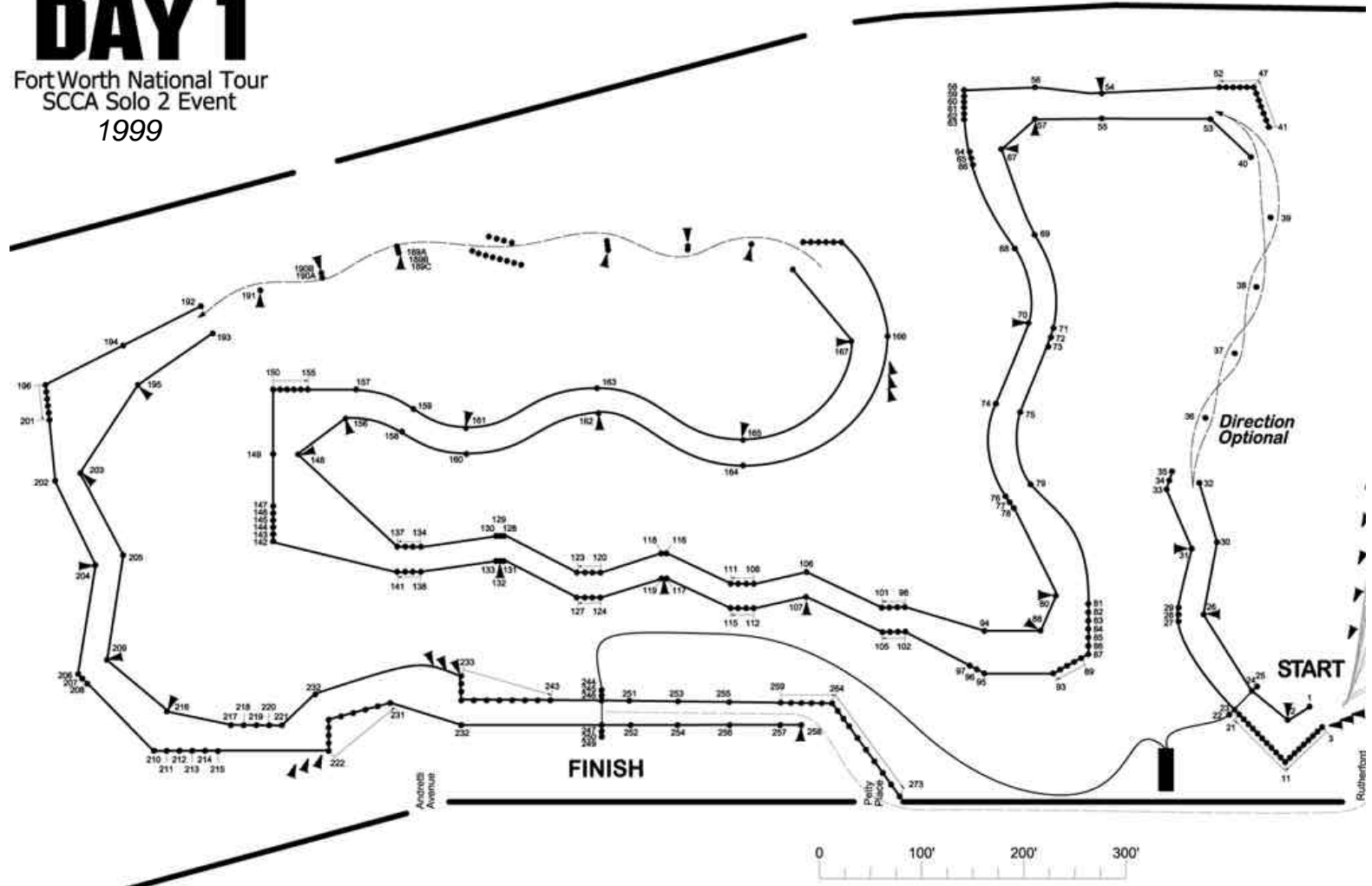


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# So You Have a Blank Piece of Paper Successful Course Designs I have designed in the past

## DAY 1

Fort Worth National Tour  
SCCA Solo 2 Event  
1999



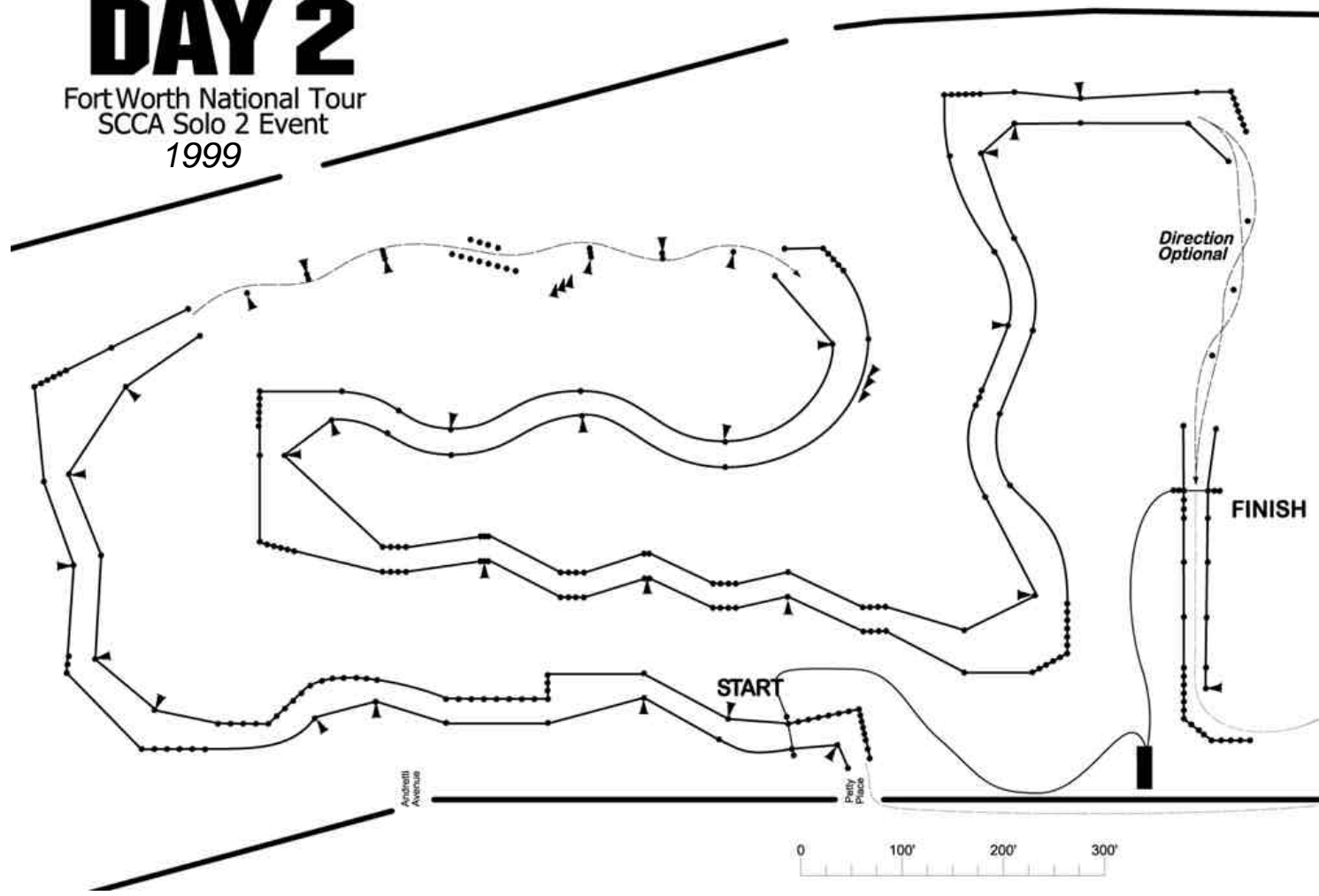


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# So You Have a Blank Piece of Paper Successful Course Designs I have designed in the past

## DAY 2

Fort Worth National Tour  
SCCA Solo 2 Event  
1999





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# So You Have a Blank Piece of Paper Successful Course Designs I have designed in the past

The Houston Region SCCA presents

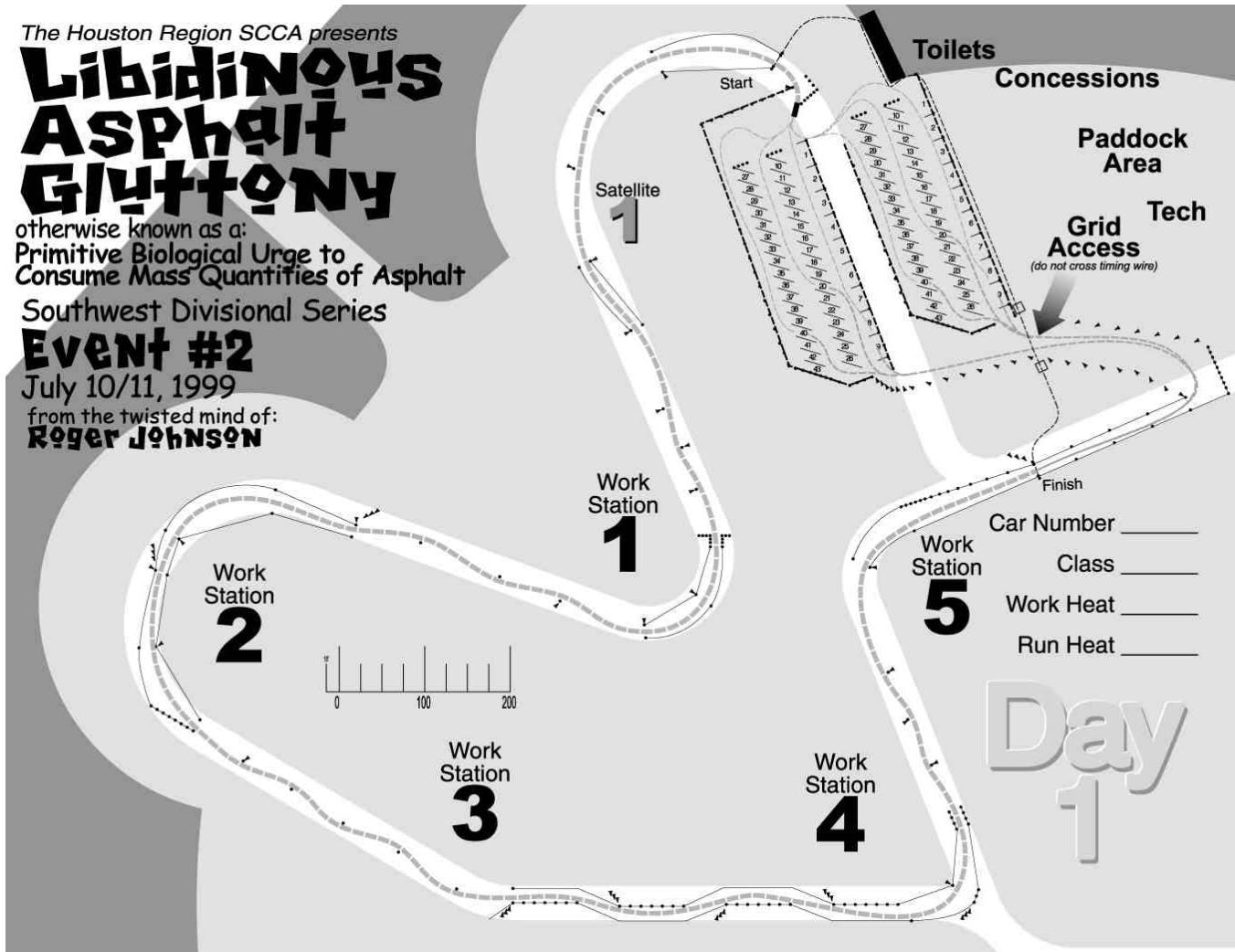
## LIBIDINOUS ASPHALT GUTTONY

otherwise known as a:  
Primitive Biological Urge to  
Consume Mass Quantities of Asphalt  
Southwest Divisional Series

### EVENT #2

July 10/11, 1999

from the twisted mind of:  
**ROGER JOHNSON**





SPORTS CAR CLUB OF AMERICA

# So You Have a Blank Piece of Paper Successful Course Designs I have designed in the past

The Houston Region SCCA presents

## LIBIDINOUS ASPHALT GUTTONY

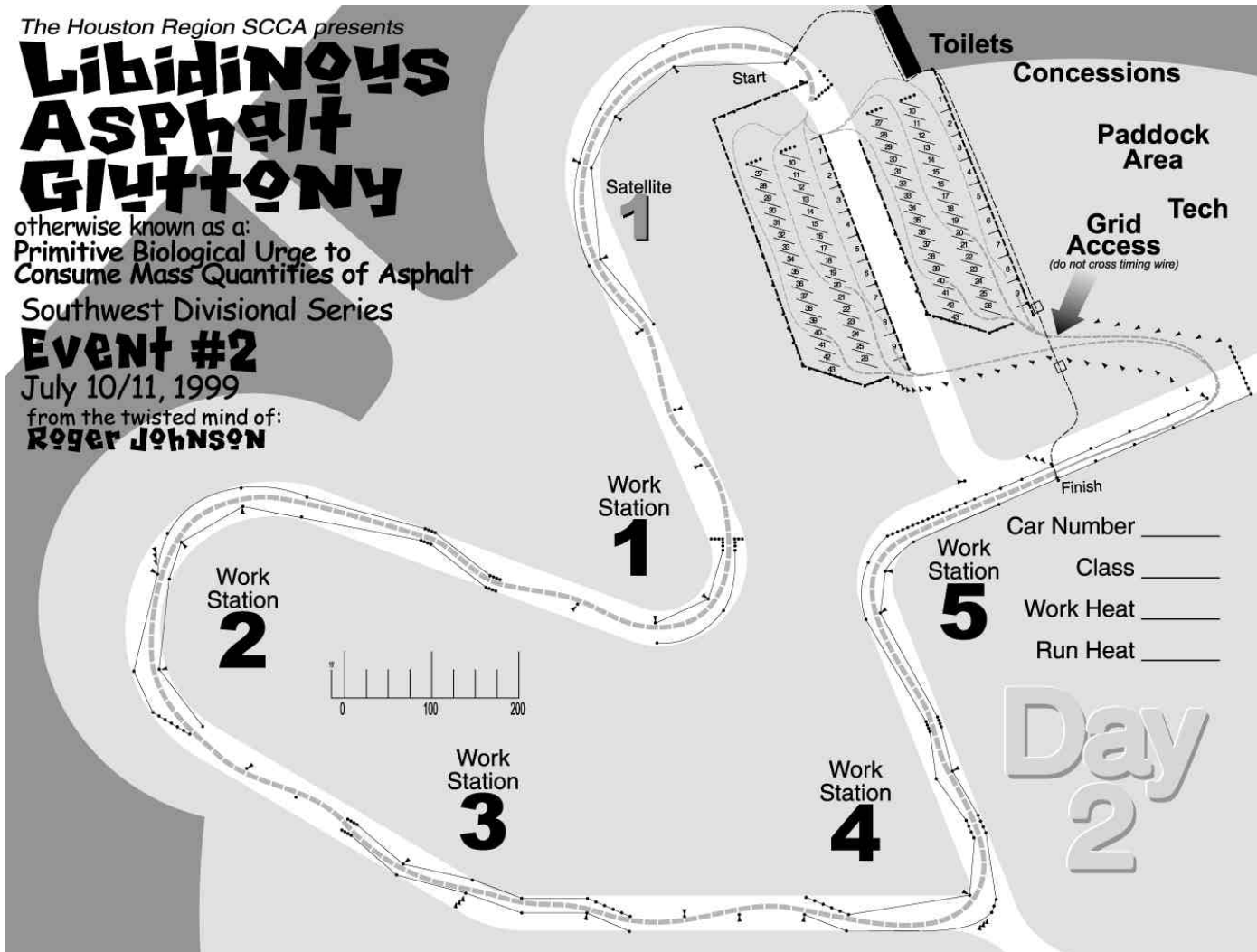
otherwise known as a:  
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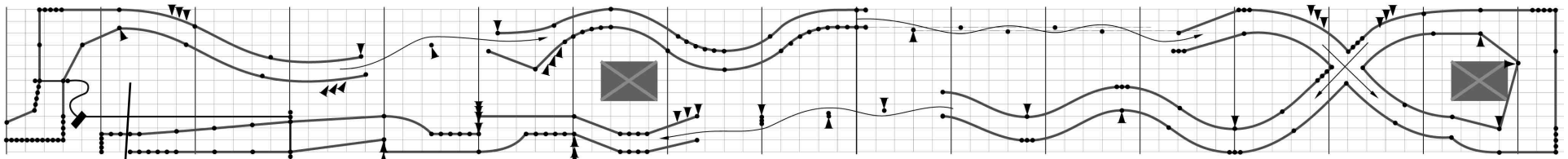


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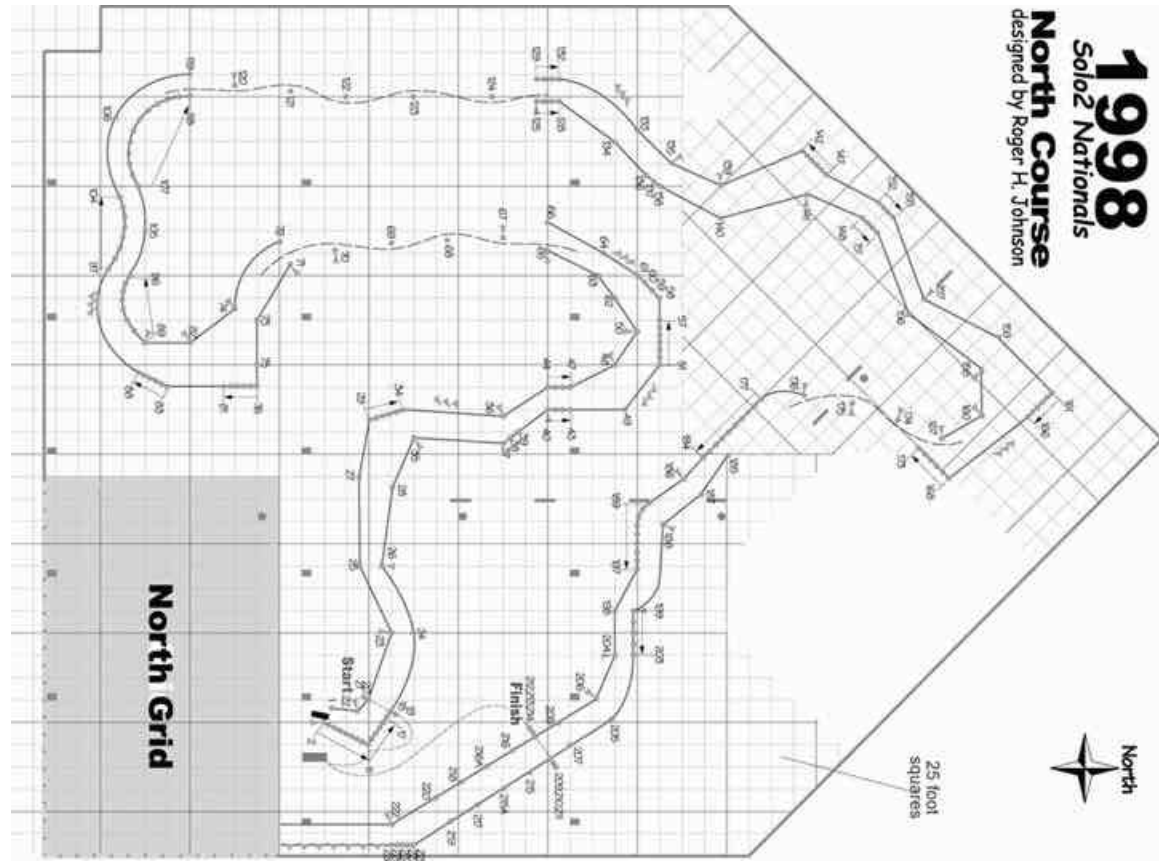


SPORTS CAR  
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AMERICA

# So You Have a Blank Piece of Paper Successful Course Designs I have designed in the past



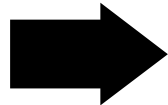
12.5 x 15 grid  
(cement Squares)





# Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a blank piece of paper...

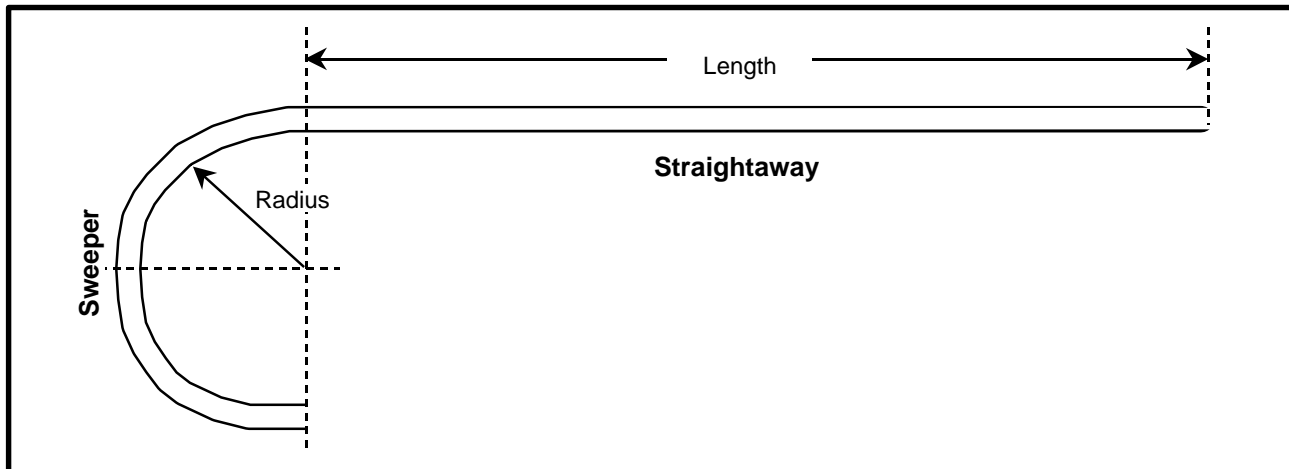


- **Elements, dimensions and real speed**

- Summary

# Element Dimensions and Real Speed

- This section of the book will address is how you, as a course designer, can relate course content and size to how fast the competitors cars might actually go
    - You “Techno-Weenies” (TW) are gonna love this
    - If you are not a TW, this section is still important to understand. It has a real life example as to why you must make your courses “equalizer courses” as outlined in the 6th basic concept (see pages 42 - 44)
- 
- This section will address:
    - Sweeper speeds
      - Radius of a turn
      - Cornering G’s of a car
    - Straightway speeds
      - Length of straight
      - Acceleration times



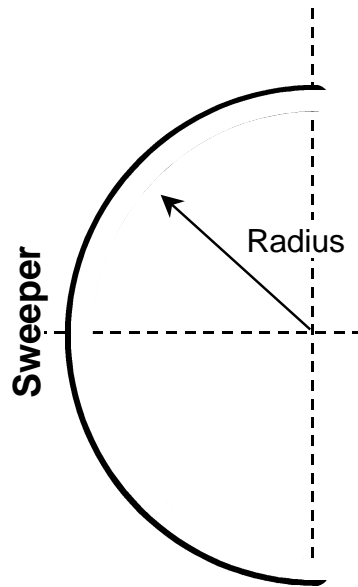


# Disclaimers

- All calculations shown in this section are based on Car magazine road test data.
- The variables include:
  - Type of surface used for testing
  - Type and size of the tires on the car
  - Preparation level of the car
    - shocks
    - alignments
    - bushings, etc.
  - Abilities of the test driver
- Approximations are inherent in the methods used
  - Sweepers are not usually constant radius arcs
  - Straightways often are not perfectly straight
- What makes a quick autocross car is not just pulling high G's and acceleration

# Sweeper Speeds

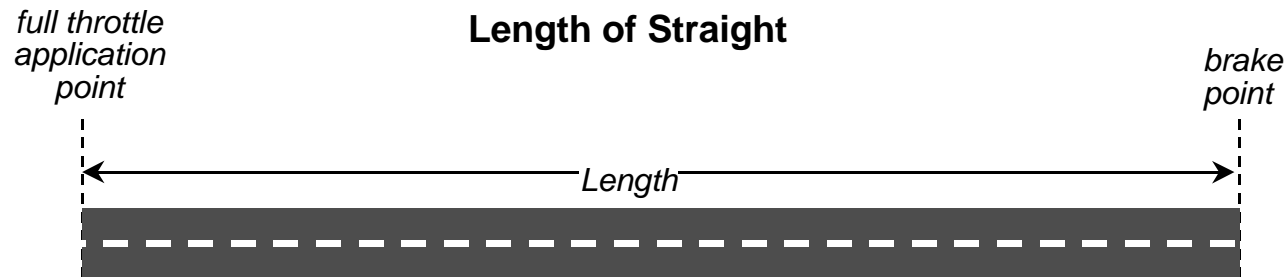
- The relationship of the radius of the turn and the cornering G's is shown in the table below:



		Miles per hour		
		Radius 50'	Radius 75'	Radius 100'
<b>G Force</b>	0.90	25.9	31.7	36.6
	0.85	25.1	30.8	35.6
	<b>0.84</b> ( '93 Camaro)	<b>25.0</b>	<b>30.6</b>	<b>35.3</b>
	<b>0.82</b> ( '93 Sentra)	<b>24.7</b>	<b>30.2</b>	<b>34.9</b>
	0.80	24.4	29.9	34.5



# Straightway Speeds

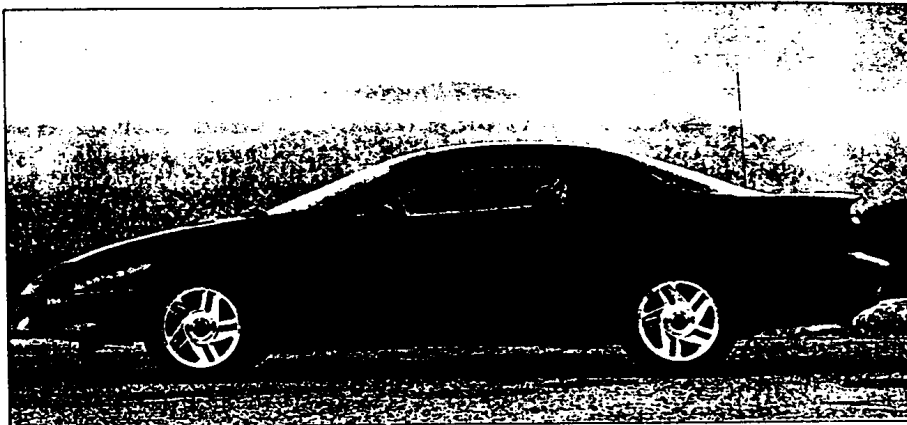


- Acceleration times
  - Magazine test data (*see diagrams on pages 93 and 95*) usually include times for:
    - 0 - 30 mph
    - 0 - 40 mph
    - 0 - 50 mph
    - 0 - 60 mph
    - 0 - 70 mph
  - Calculation of distance covered is based on the area beneath the curve on a plot of velocity versus time (*see diagrams on pages 94 and 96*)



# Camaro Specifications

## TECH DATA



'93 Chevrolet Camaro Z28

### GENERAL

Make and model.....Chevrolet Camaro Z28  
 Manufacturer.....Chevrolet Division,  
 General Motors Corp., Detroit, Mich.  
 Location of final assembly plant.....St. Therese,  
 Quebec, Canada  
 Body style.....2-door, 4-passenger  
 Drivetrain layout.....Front engine, rear drive  
 Base price.....\$17,195 (est.)  
 .....\$19,812 (est.)  
 .....Dodge Daytona IROC R/T,  
 Talon TS

### CHASSIS

Suspension  
 Front.....Upper and lower control arms,  
 coil springs, anti-roll bar  
 Rear.....Solid axle, multilink with trailing arms  
 and track bar, coil springs, anti-roll bar  
 Steering  
 Type.....Rack and pinion  
 Ratio.....14.4:1  
 Turns, lock to lock.....2.3  
 Turning circle.....39.0  
 Brakes  
 Front, type/dia., in.....Vented discs/10.9  
 Rear, type/dia., in.....Vented discs/11.4  
 Tires.....Standard  
 Wheel and tires  
 Wheel, in.....  
 Tire, in.....  
 Tire, type.....

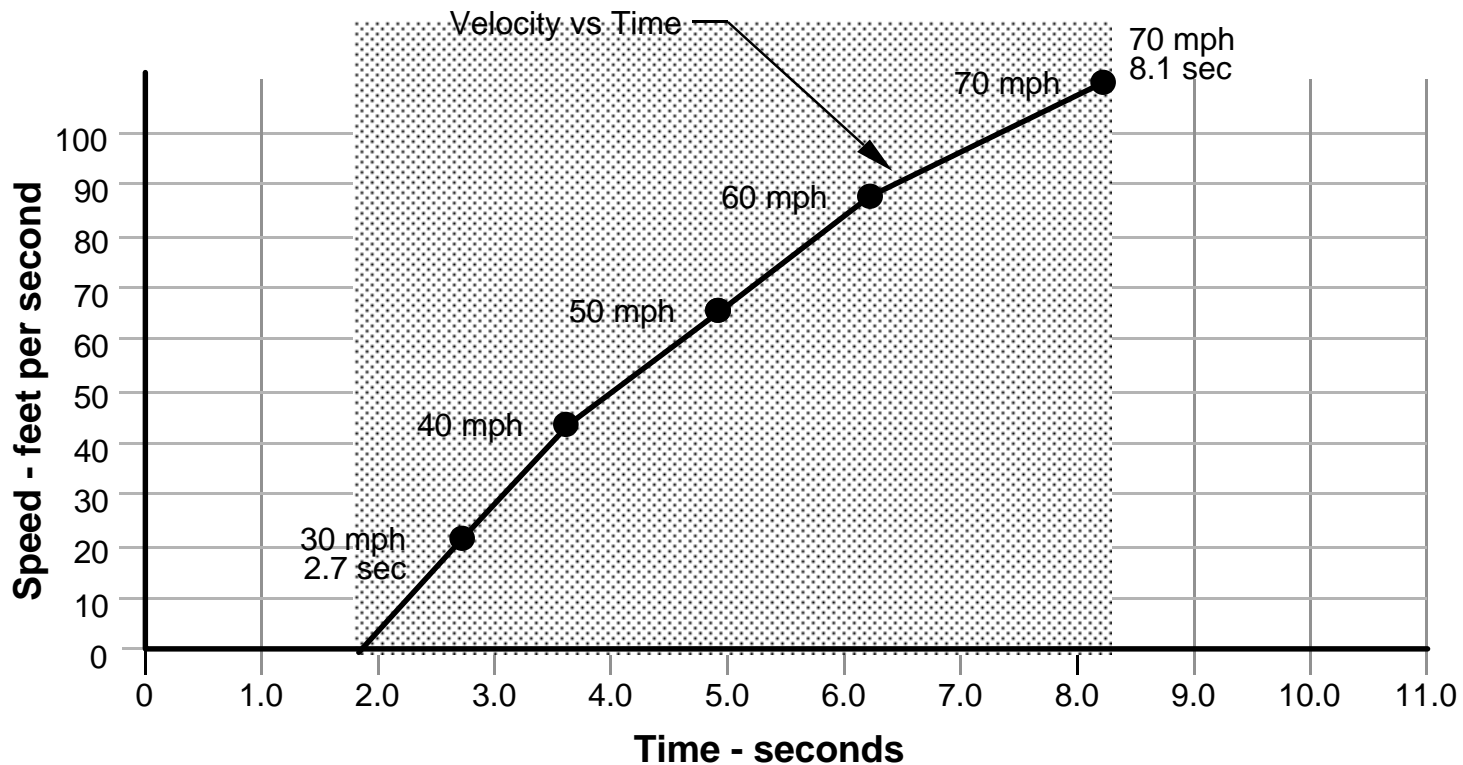
## PERFORMANCE AND TEST DATA

Acceleration, sec	
0-30 mph .....	2.7
0-40 mph .....	3.6
0-50 mph .....	4.9
0-60 mph .....	6.2
0-70 mph .....	8.2
0-80 mph .....	10.0
0-90 .....	12.7
Standing quarter mile	
sec @ mph .....	14.7 @ 96.9
Braking, ft	
30-0 mph .....	31
60-0 mph .....	110
Handling	
Lateral acceleration, g .....	0.84
Speed through 600-ft slalom, mph .....	63.6
Speedometer error, mph	
Indicated	Actual
30 .....	30
40 .....	40
50 .....	50
60 .....	60
Interior noise, dBA	
Idling in neutral .....	62
Steady 60 mph in top gear .....	75



# Element Dimensions and Real Speed

## Camaro Velocity vs. Time



*Under full acceleration from 30 to 70mph, the Camaro will travel 426.25 feet in 5.5 seconds*

HOUSTON REGION



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Element Dimensions and Real Speed

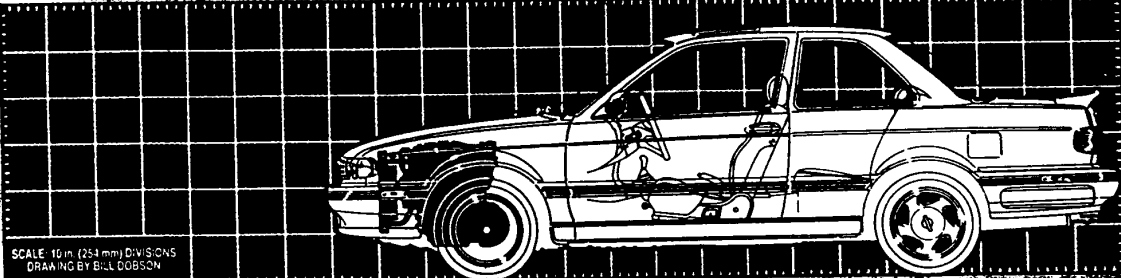
# Sentra Specifications

## NISSAN SENTRA SE-R

**PRICE**  
 List price, all POE ..... \$11,370  
 Price as tested ..... ~~est \$14,290~~  
 Price as tested includes std equip. (AM/FM stereo/cassette, elect. side mirrors, air cond (\$950), power sunroof (\$900), ABS (\$700), CD player (est. \$450), Call emissions \$711, power locking wheel \$50)

**IMPORTER**

0-60 mph ..... 8.1 sec  
 0-¼ mi ..... 16.2 sec  
 Top speed ..... est 125 mph  
 Skidpad ..... 0.82g  
 Slalom ..... 60.2 mph  
 Brake rating ..... very good



SCALE: 10 in (254 mm) DIVISIONS  
 DRAWING BY BILL DOBSON

**ENGINE**  
 Type ..... aluminum head, 4-cyl, 16-valve  
 Displacement ..... 122 cu in./1998 cc  
 Bore x stroke ..... 3.39 x 3.39 in./86.0 x 86.0 mm  
 Compression ratio ..... 9.5:1

**DRIVETRAIN**  
 Transmission ..... 5-speed manual  
 Gear ..... Overall ratio (Rpm) Mph  
 1st ..... 3.10:1 ..... 7.63:1 ..... (7500) 38  
 2nd ..... 1.83:1 ..... 7.63:1 ..... (7500) 63  
 3rd ..... 1.29:1 ..... 5.37:1 ..... (7500) 90  
 4th ..... 1.00:1 ..... 4.07:1 ..... (7500) 119  
 5th ..... 0.76:1 ..... 3.16:1 ..... est (6150) 125  
 Reverse ..... 4.18:1  
 Final drive ratio ..... 2.950

**ACCELERATION**  
 Time to speed ..... Seconds  
 0-30 mph ..... 2.7  
 0-40 mph ..... 3.4  
 0-50 mph ..... 5.9  
 0-60 mph ..... 8.1  
 0-70 mph ..... 10.8  
 0-80 mph ..... 13.6  
 0-90 mph ..... 17.6  
 Time to distance  
 0-100 ft ..... 3.3  
 0-500 ft ..... 8.7  
 0-1320 ft (¼ mi) ..... 16.2

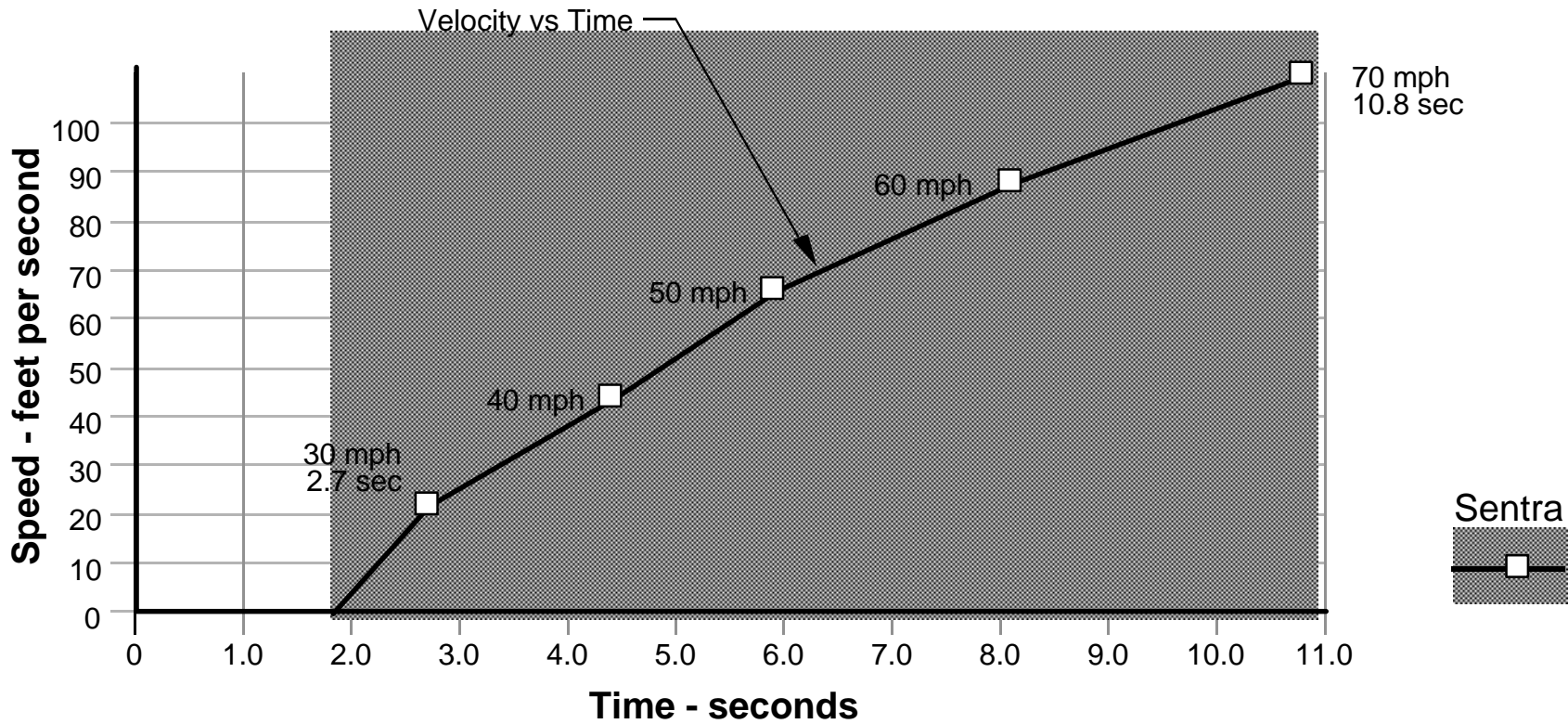
**ACCOMMODATIONS**

**BRAKING**



Element Dimensions and Real Speed

# Sentra Velocity vs. Time

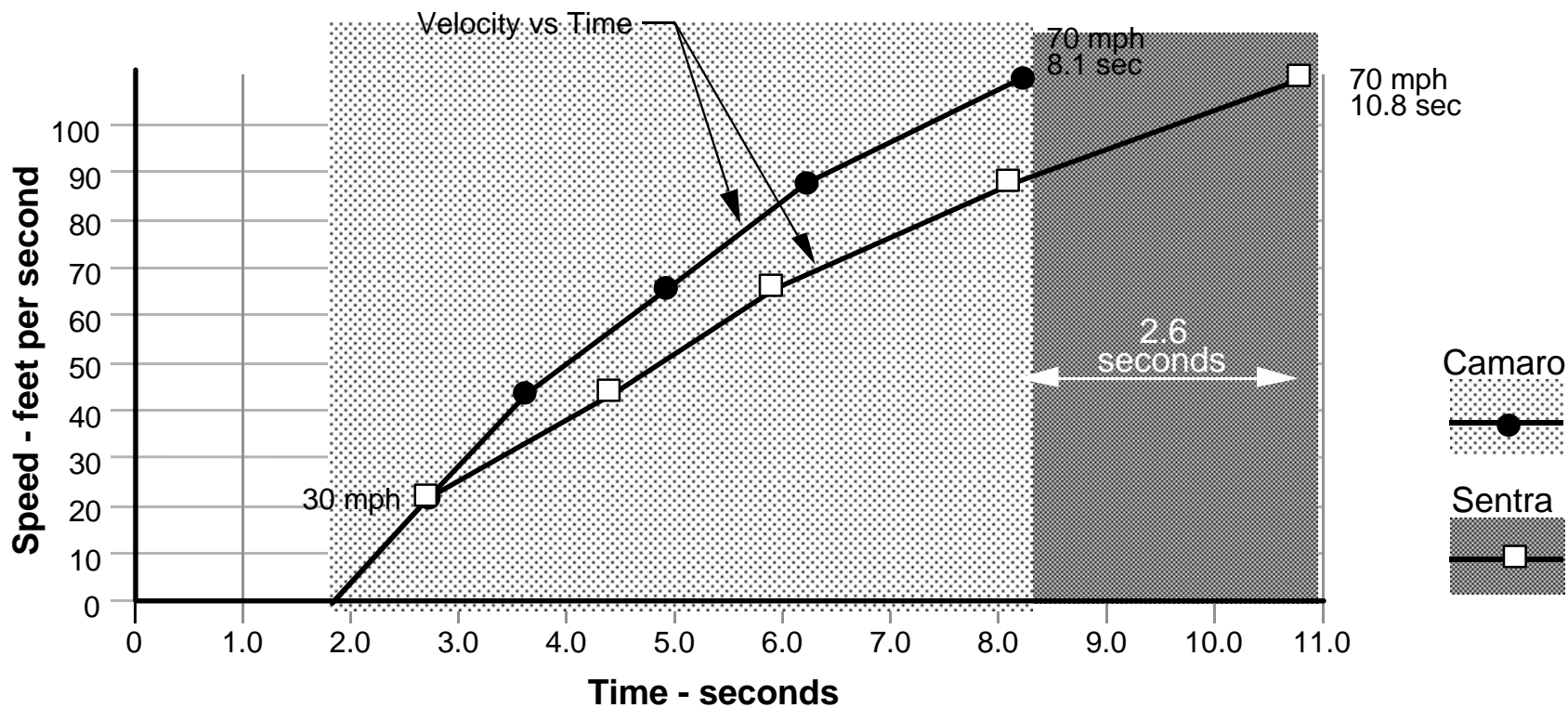


Under full acceleration from 30 to 70mph, the Sentra will travel 627.75 feet in 8.1 seconds



# Element Dimensions and Real Speed

## Camaro and Sentra Velocity vs. Time



The Sentra would have to travel 2.6 seconds longer and 201.5 feet farther than the Camaro to reach 70 mph



# How a Straight Gives Time to Power

- How much effect can a big straight have on the competition?
  - Compare the transit times already known
    - Camaro:
      - 30 - 70 in 5.5 seconds; 426 feet
    - Sentra:
      - 30 - 70 in 8.1seconds; 628 feet
      - Also reaches 351 feet in 5.5 seconds (Camaro = 426 feet in 5.5 seconds)
      - Finally reaches 426 feet in 6.35 seconds (which the Camaro did .85 seconds quicker)
  - O.K. - so what does that mean?
    - The time advantage for the Camaro over a 426 foot straight section is about 0.85 seconds, or a total distance of 75 feet
  - How could the Sentra make up that difference?
    - Either a secret nitrous container or go faster in the turns
      - To go faster in the turn, it needs a higher entry speed into the straight by 9.2 mph, so it would need to pull about 71% more G's in the sweeper
      - **Hey folks - That's 1.43 G's - and that ain't gonna happen!**



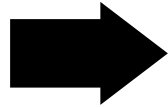
# Why Do We Care?

- How a straight gives time to power
  - O.K. - The Camaro (F Stock) is not classed with the Sentra (D Stock) but classes in Solo II do contain mixtures of cars! For example:
    - (In 1998) D Street Prepared:
      - Fiat X1/9
        - 1,935 pounds / 105 horsepower = 18.33 lbs/hp
      - Mazda RX-3
        - 2,040 pounds / 170 horsepower = 12.00 lbs/hp
    - That is a 52.75% difference between cars in the same class
  - So what does that have to do with a Camaro/Sentra comparison?
    - Sentra
      - 2,600 pounds / 140 horsepower = 18.60 lbs/hp
    - Camaro
      - 3373 pounds / 275 horsepower = 12.30 lbs/hp
    - That is a 51% difference between the cars in our example
    - The horsepower to weight ratio disparity is approximately the same as the Fiat and the Mazda in DSP



# Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a blank piece of paper...
- Elements, dimensions and real speed



- **Summary**



# Summary

- If you have made it this far without falling asleep or giving up, you are to be congratulated - or at least, you qualify as a course designing data hound...
- Seriously, there is enough information here that you cannot possibly digest it all in one read through. I encourage you to keep this booklet and refer to it when designing Solo II type courses.
- I'd like to reiterate that this is a compilation of the experiences of Karen Babb, Gregg Lee, Jim Garry, Team.Net and myself, Roger H. Johnson. I would like to thank the others for their ideas in the creation of this booklet. Hopefully I have not let my personal opinions overshadow any "truths".
- Remember, the more courses you design and set up, the better your courses will be

---

*Please feel free to contact me with any questions you may have.  
I can be reached as listed below:*

Home of the Criminally Insane  
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**Pearland, Texas 77581**  
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