

# Solo Course Design 2018

presented by


**Roger Johnson**  
(Roger the Real)



# Introduction

- **Credits**
  - This booklet 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)
- **Today's presentation is broken up into 5 categories**
  - A brief description of each of these categories follows

# Agenda

- **Fundamentals** 
- 10 Basic Concepts
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Summary and Questions

# Fundamentals

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

- **Make a scale map**
  - Show “known places”
    - Dimensions of parking stalls, and/or Concrete square dimensions
    - Surface Imperfections, Site access points, light poles and curbs
  - Benefits of a scale map include
    - Know where the fast/slow parts of your design are likely to be
    - Know that the finish is safe
    - Hand out maps accurately showing workers their area of responsibility
- **Then place start and finish lines**
  - Establish clear access to the start and from the finish
  - Avoid “drag race” starts to ensure a fair start for all competitors
  - Provide a safe finish
- **Timing and scoring location**
  - Ensure timing crew can easily read car numbers and view the entire course
  - Keep timing equipment and crew clearly out of harms way (i.e. a spinning vehicle)



# Fundamentals

*(continued)*

- **Consider placement of the course workers**
  - Safe workstation positioning
    - Workers do not have to cross one part of the course, nor is the station placed in the path of a predicted spin point
  - Ensure they can See all of the pylons within their responsibility
  - Keep pylons close enough so they can be placed without start delay or a red flag
- **Check out the 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
  - Add any unknowns to scale map
- **Allow for multiple cars (site and timing software allowing)**
  - Can two cars (or more) safely be on course at once?
  - Do adjacent section conflicts prevent full use of the time available?

# How to Keep Your Solo Peers from Killing You...

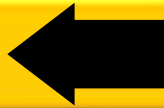


- ...**Get them lost** or make them hit cones!
- ...**include too many pylons** creating a “Sea of Pylons”
- ...**space pylons** the same or similar distance as the gate width
- ...place the next gate **out of their line of sight**
- ...**fail to line the course** (when possible)
- ...place a cone(s) thinking “**boy, will THAT one get creamed!**”

# Agenda

- Fundamentals

- 10 Basic Concepts



- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Summary and Questions

## 10 Basic Concepts

- 1.) Be a Commercial Artist
- 2.) Use Creativity
- 3.) No Hidden Agendas
- 4.) Be Familiar with the Solo 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



# 1.) Be a Commercial Artist

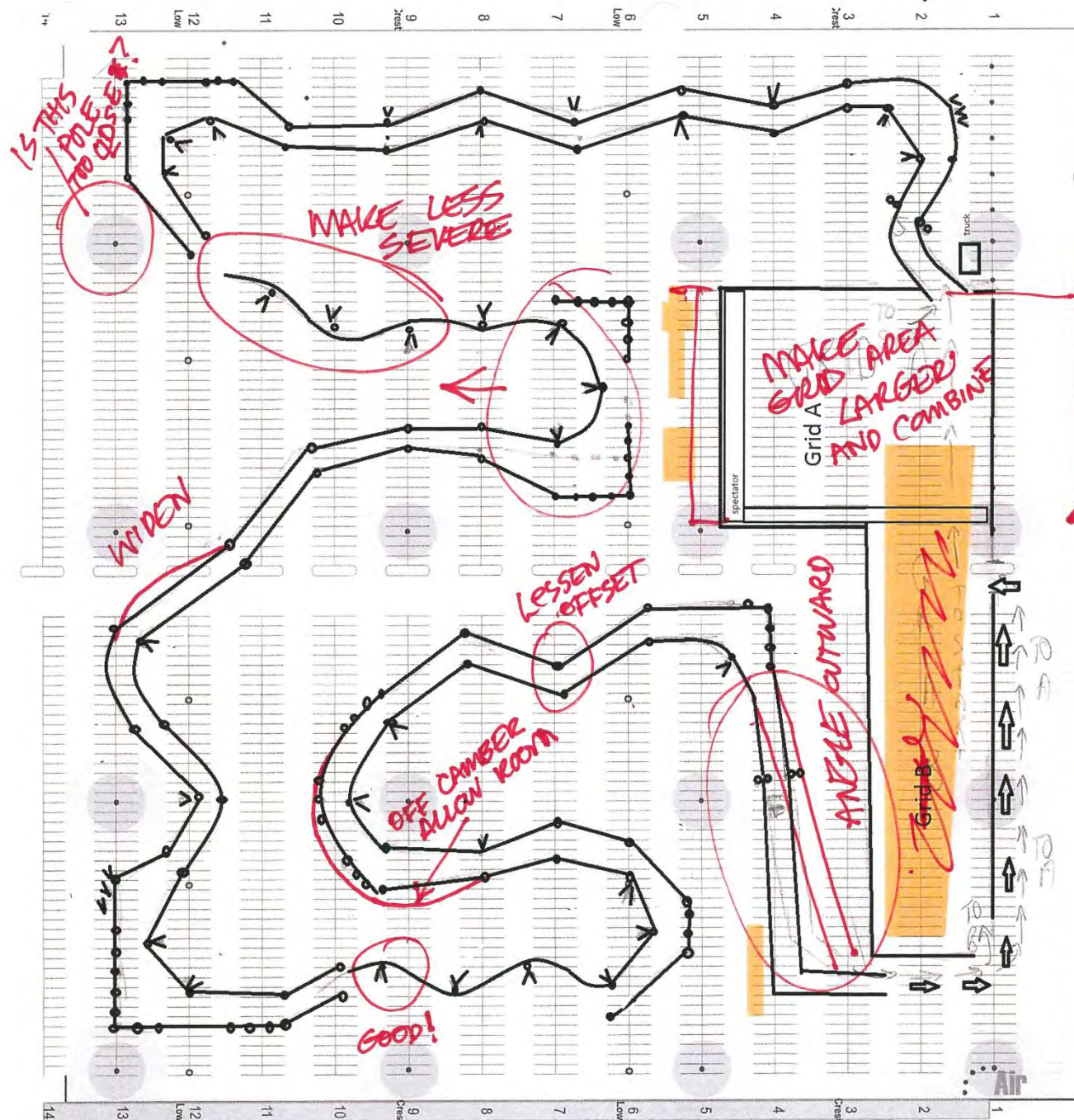
- **As a course designer, you will become an artist; according to Webster, an artist is “one who professes and practices an imaginative art”**
  - Believe me, imagination is required to create a course that is interesting and fun to drive - and when the course design is completed, you will feel like 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**



# Set yourself Up for Success

- 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



# Pits

(between course and road)

Freedom to  
USE 9' wide ALL  
11 spaces  
REMEMBERING  
9/11 on  
September 11, 2011

Bad Asphalt Sec  
Do Not

Car # \_\_\_\_\_

Class \_\_\_\_\_

Run Heat \_\_\_\_\_

Work Heat \_\_\_\_\_



# Set yourself Up for Success

*(continued)*

- **After the peer review**
  - **look over and analyze** their comments
  - Address all **safety** related comments
  - **implement** any you feel improve the design
  - **Be true to your basic concept**
    - Put **your own style** into their suggestion; that is why you got the 'hows and whys'
- **The great thing about “advice” is:**
  - **You don't have to** take their advice
  - You might **learn or see something** you had not thought about

# Judging your Success

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

- **At the event, 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 your **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 it
  - **Try to 'eaves drop' for comments about the course**
    - This gives you 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 love it; **those who have lost** tend not to...



## **Judging your success** *(continued)*

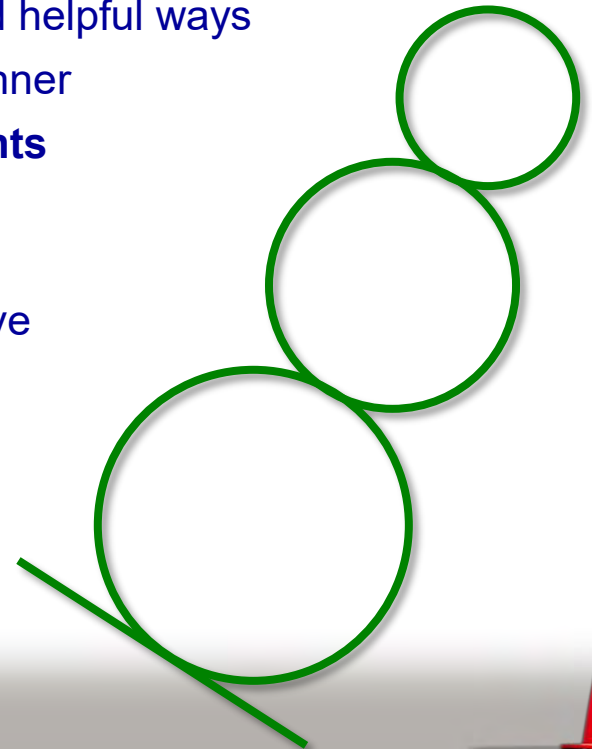
- Did you receive unsolicited praise or complaints?
- Note the number of delays for course workers, course repair, etc.
- Track the number of DNFs for other than mechanical failure
  - The goal is zero - acceptable is **1 in 20** on the first run, **1 in 100** there after
  - The number of “newbies” can affect this count
- Number and frequency of pylons hit
  - The goal is zero - acceptable is **1 car in 10** hitting any; **less than 4** for any one car
  - If almost every car is hitting “that cone”, the course will not be well received

Keep in mind, the main goal of course design is to  
provide the Solo competitors with

**Fair, Fun and Safe Competition**

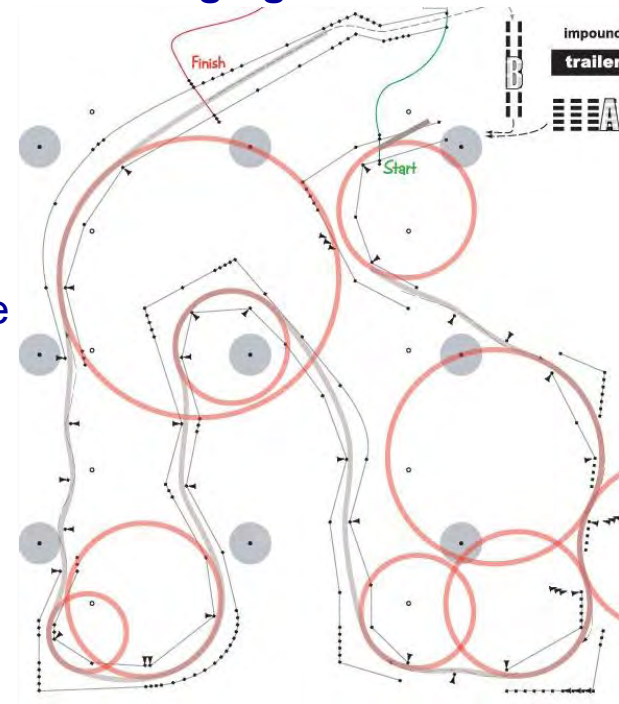
## 2.) Use Creativity

- Creativity is what makes a course interesting to drive
- What is creativity in course design?
  - **Rewarding** those with the right amount of **skill, aggression, experience** and **discipline**
  - Placing **challenge** in the design without making it “**painful**” or too much **input density**
  - Using **chalk lines** in a variety of visually interesting and helpful ways
  - Setting up an **often used maneuver** in a **different** manner
  - Including a **variety** of different **turn-types** and **transients**
- **Be creative and innovative but avoid the bizarre**
  - When you come up with a **new 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



# 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** to the site outside perimeter or the site markings on the surface such as paint stripes or concrete squares
- 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 entry** into the first part of the combination in order to drive through the entire combination quickly



# Input Density

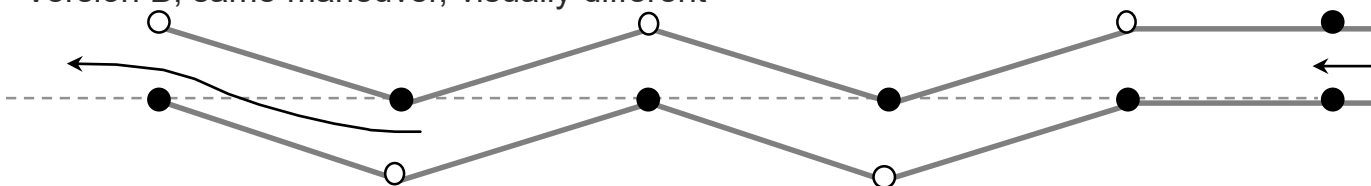
- **Input density is:**
  - Measure of direction-changing steering inputs, divided by the length of the course
  - The following is only a guideline (nothing is “black and white”)
- **Desired input density is about 20 to 35 inputs over a distance of ~ 3/4 mile**
  - Adequate time to set up between maneuvers, challenging to drive fast, drive times vary, drivers do not have trouble remembering all elements
- **A less interesting course will have only 15 to 20 inputs for ~3/4 mile**
  - Too much time between maneuvers, resulting in a boring, non-challenging, course to drive where all times are approximately the same
- **A “too busy” design will have more than 35 inputs for ~3/4 mile**
  - 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

# 5 Cone Slalom

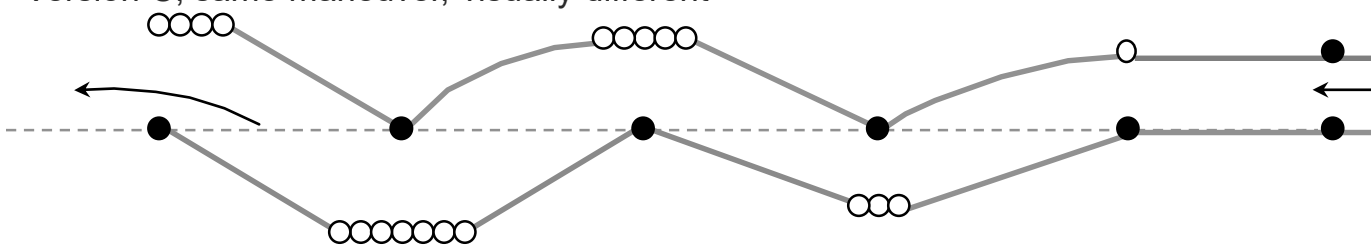
**Version A; Basic 240 foot 5 cone slalom**



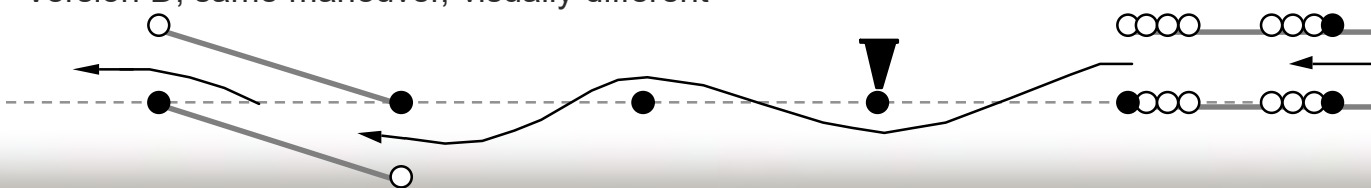
Version B; same maneuver, visually different



Version C; same maneuver, visually different



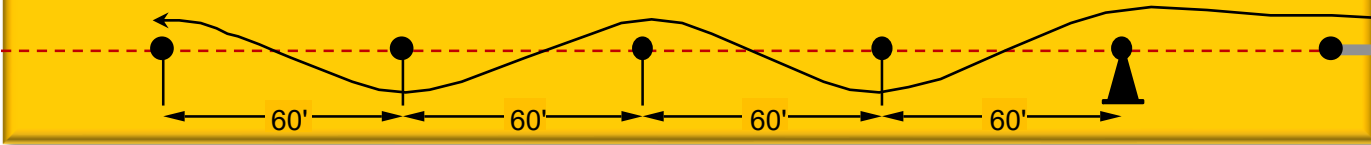
Version D; same maneuver, visually different



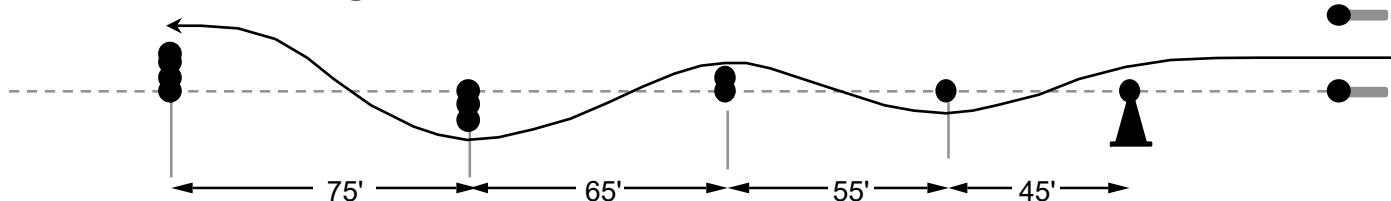


# 5 Cone Slalom (continued)

## Version A; Basic 240 foot 5 cone slalom

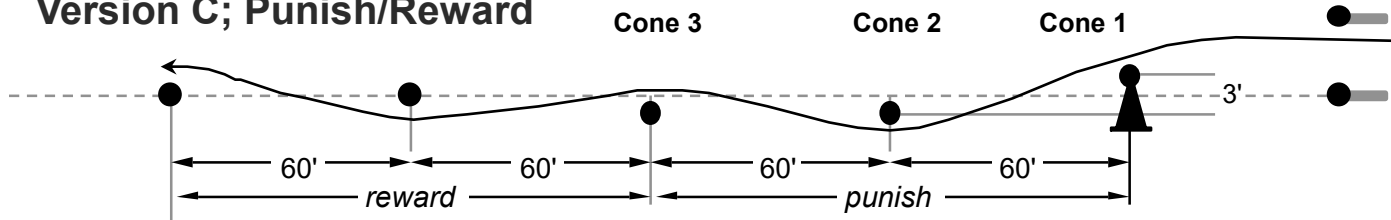


## Version B; Change for interest



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

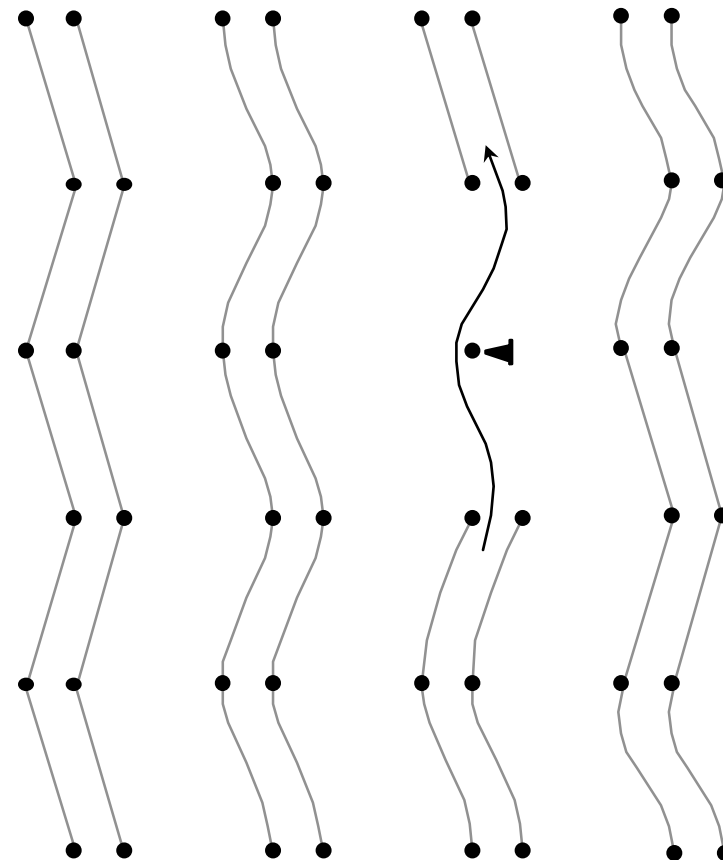
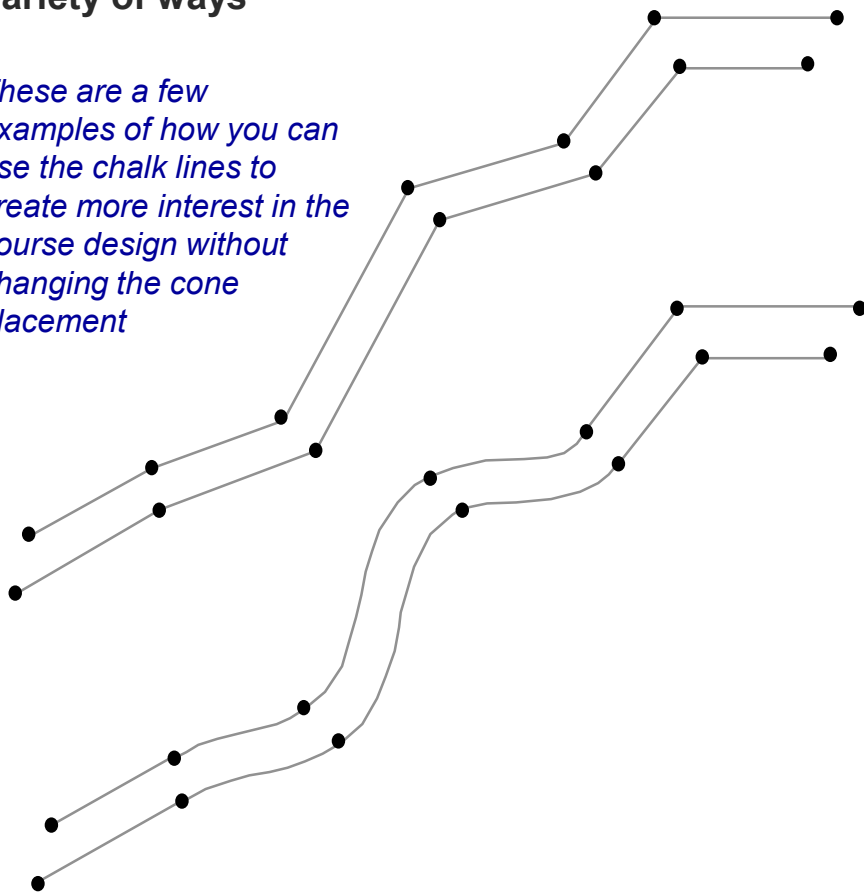


Note: Cones 1 & 2 are offset 3' the hard way with cone 3 offset 1.5' the easy way. This opens up a "Lotus freeway" through the last 3 cones of the slalom. To make the punishment bearable, be sure to allow adequate set up area prior to the punishment, otherwise the punishment becomes painful

# 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*

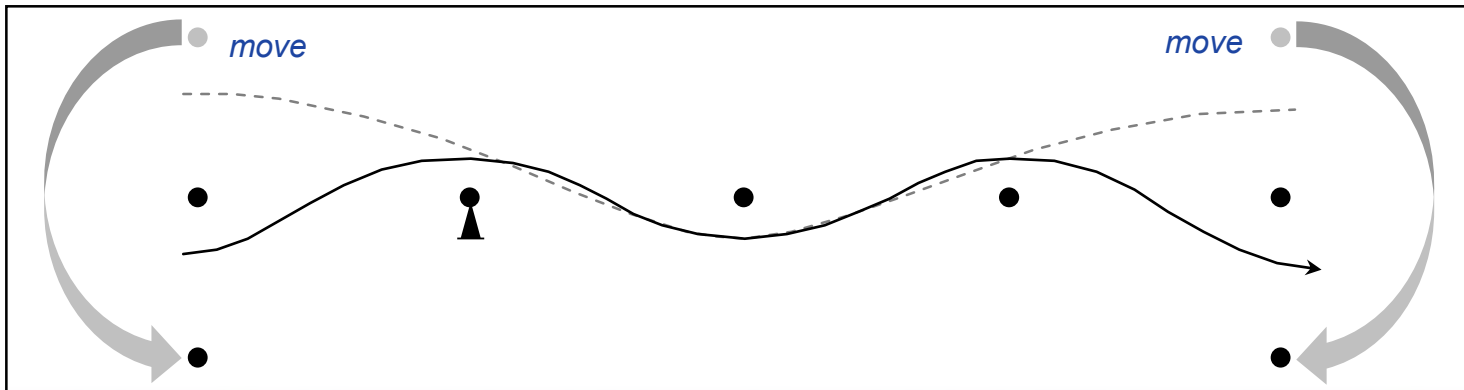
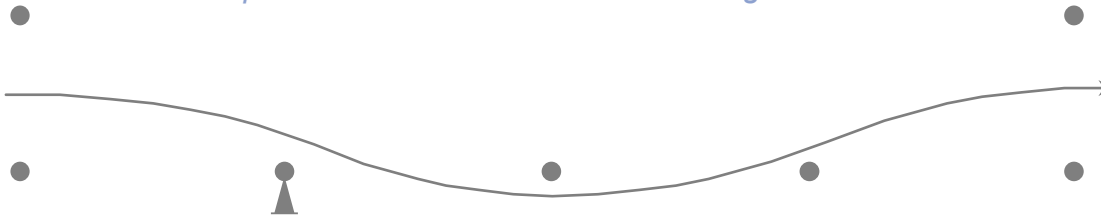


## The “Before and Afters”

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

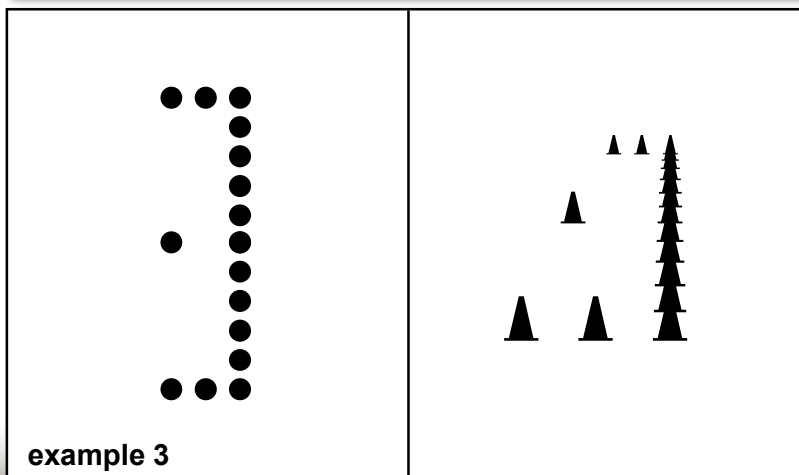
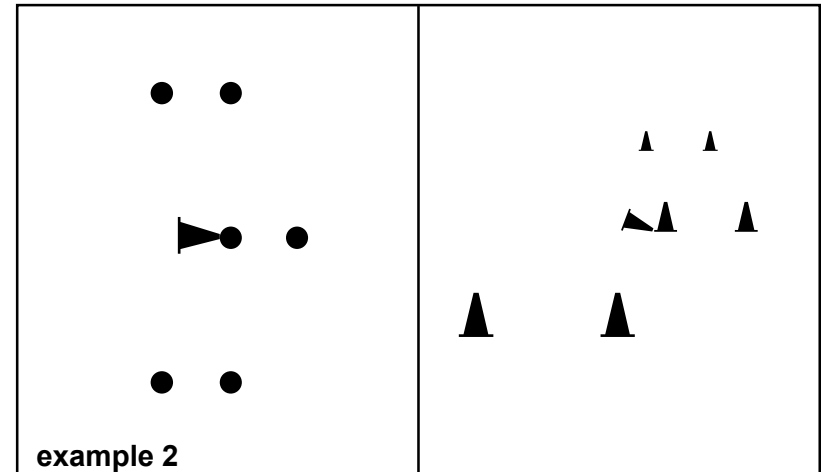
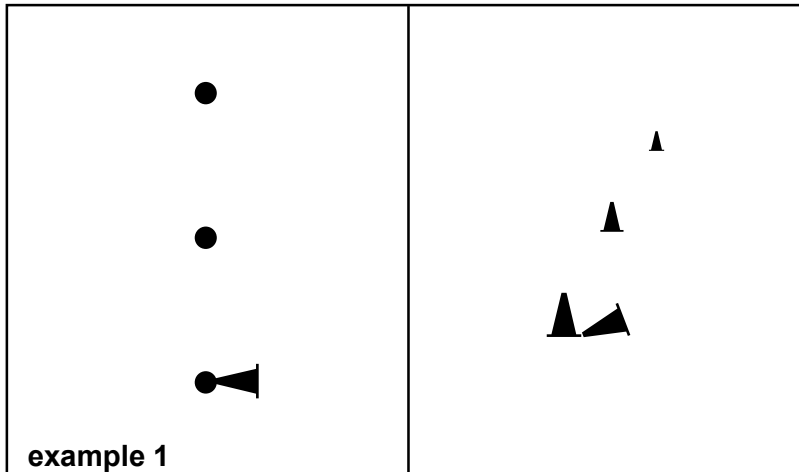
### 3 Cone Slalom

*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*



# Which is easiest to See?

All three of these are a slalom - the same maneuver; **Example 1** will be the easiest to see



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

The surrounding cones from the following maneuvers may impact the clarity of these examples as well

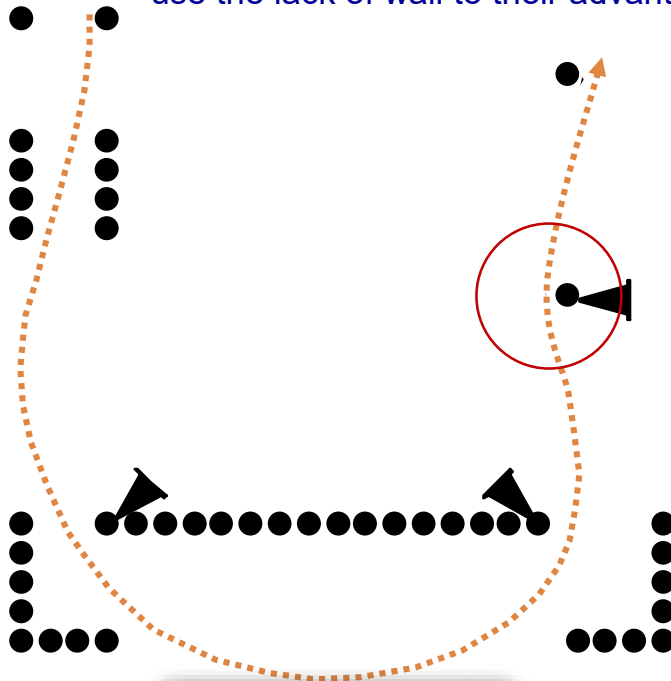
For instance, if you have several walls of cones following this slalom, example 1 would be most appropriate; and if not, examples 2 or 3 might be more appropriate

# 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

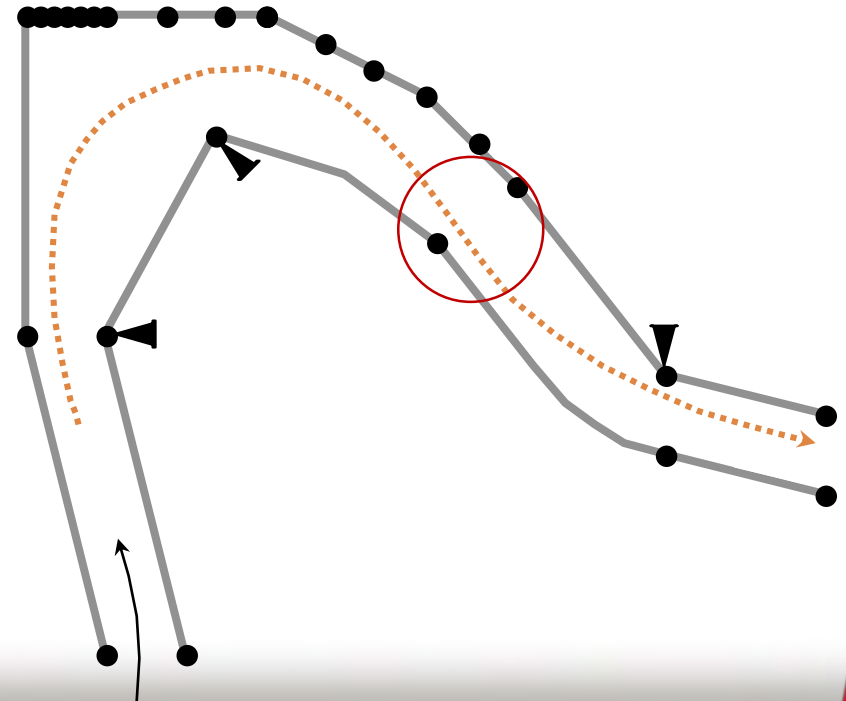
The wall at the 180° will tend to make an unwary competitor square the corner out. The driver who looks carefully will round the corner out and use the lack of wall to their advantage



*note lack of wall here*

## 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.





## 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 Event Chairman):
    - Enlist someone who is **truly interested** in designing a course
      - you will still be responsible for the design, but will have "jobbed" it 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"

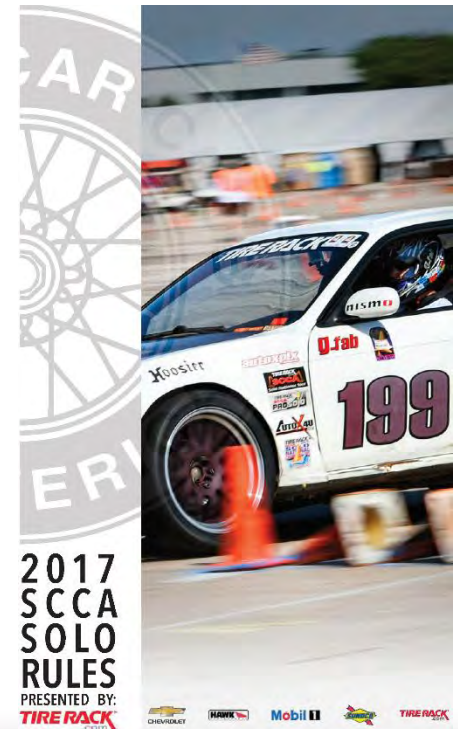


With a hidden agenda the result is a course that only a few people enjoy - or perhaps even a course that **NO ONE** will enjoy!

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

**Basic Concept 4.) refers to the rules found in Section 2.0 of your Solo rule book**

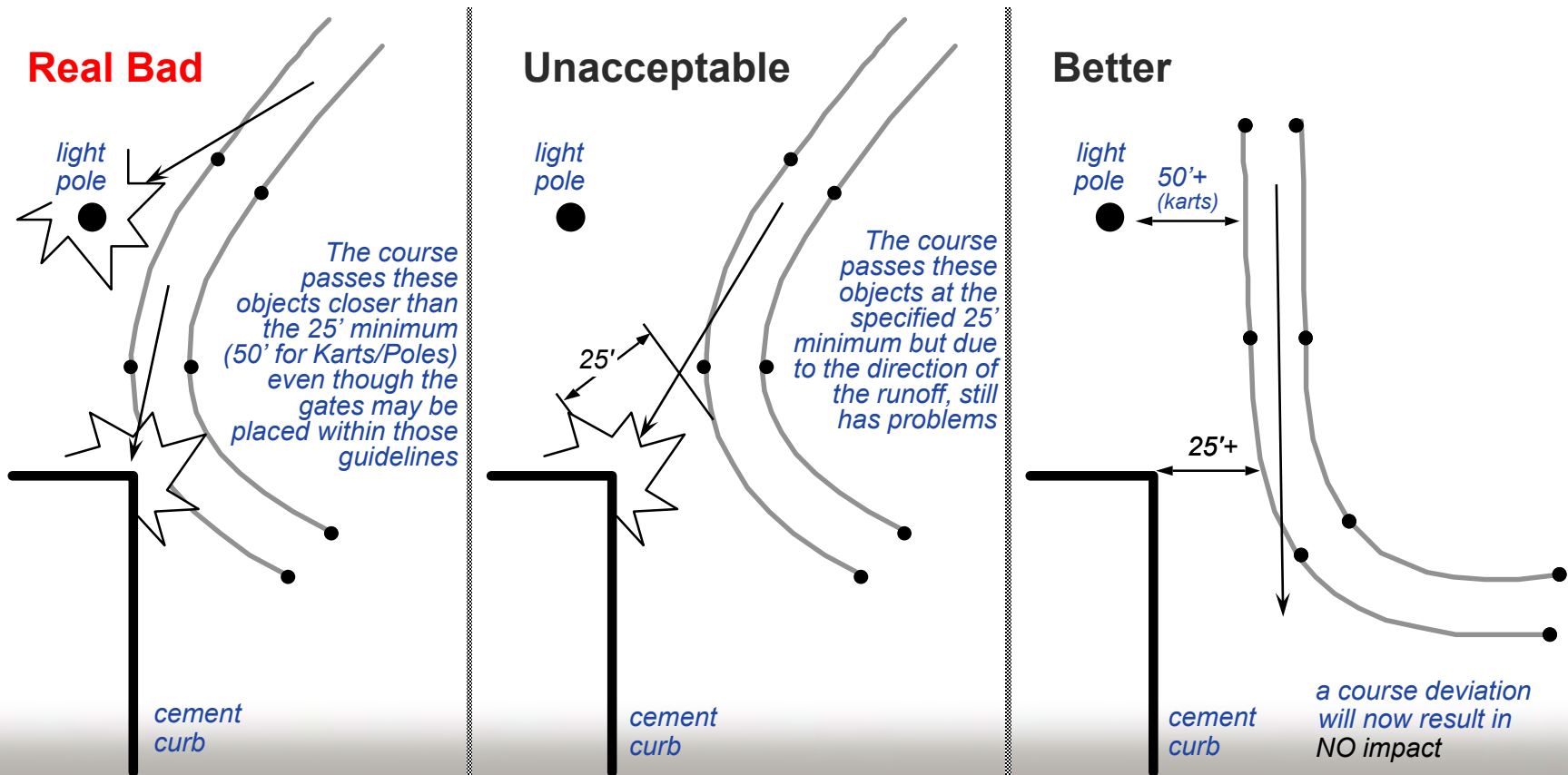
- By knowing the rules in Section 2.0, you will be able to create a design that will be a Solo type course, as well as a design that is acceptable to the Solo Safety Stewards and your peers
- The following are diagrams taken from some of the 2018 rules
  - ALL of the rules, of course, are important and should be known/understood - these are just the rules that I perceive to have the most impact on your design decisions



## 2.0 Diagrams

- 2.2.C The course boundary shall not normally pass closer than **25 feet** from solid objects  
 2.2.D **karts...** ... upright solid objects (e.g., light poles, fence posts, etc) on the site  
**within 50 ft. of the actual course.** This does not include curbs

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

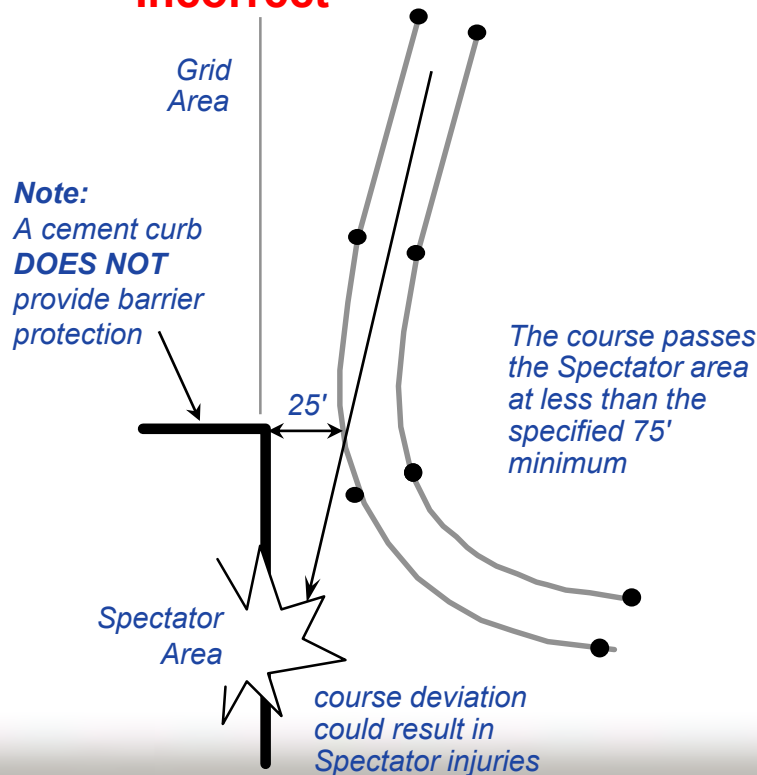


## 2.0 Diagrams (continued)

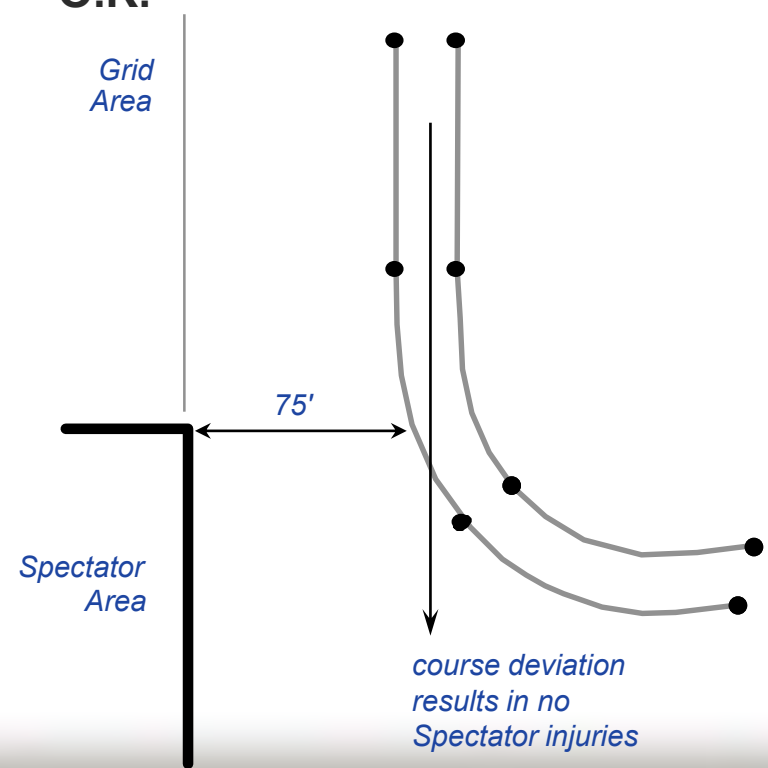
2.2.M Participants and non-participants must be kept at a safe distance... ...minimum viewing distances may not be less than **75' from the course edge in unprotected areas** (areas without adequate barrier protection such as concrete or tire walls)...

*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.**



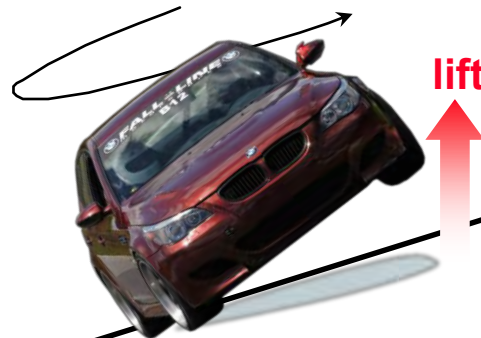
## 2.0 Diagrams (continued)

2.2.E Special caution should be applied where negative-cambered turns are used.

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

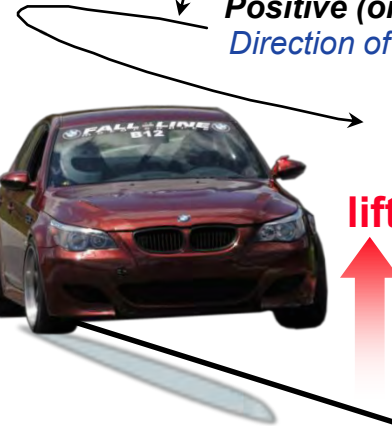
Note:  
Parking lots generally have a slight grade built into them to promote drainage of water. They usually drain away from the light poles to the sewage grates (duh...)

**Negative Camber Left Turn**  
*Direction of car*



*A Car tends to roll left on a right turn and right on a left turn. So, use the hill to counteract this phenomenon on a sharp turn*

**Positive (on) Camber Left Turn**  
*Direction of car*



Sewage Grate  
Area

Sewage Grate  
Area



Crest of Hill

Valley of Hill

●

Light Pole

○

Sewer Grate

Finish

Start

B

A

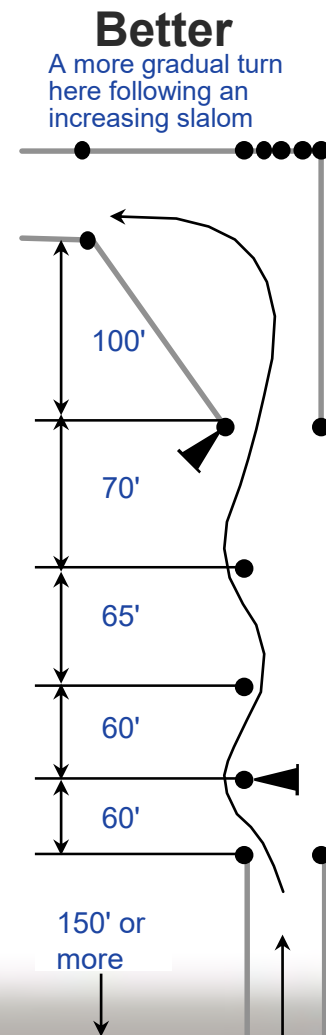
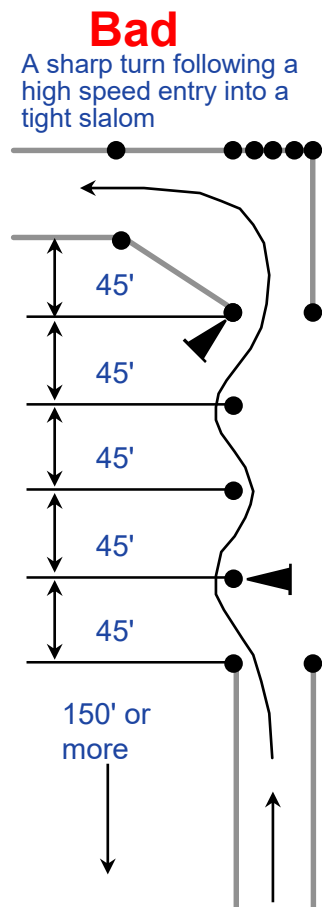
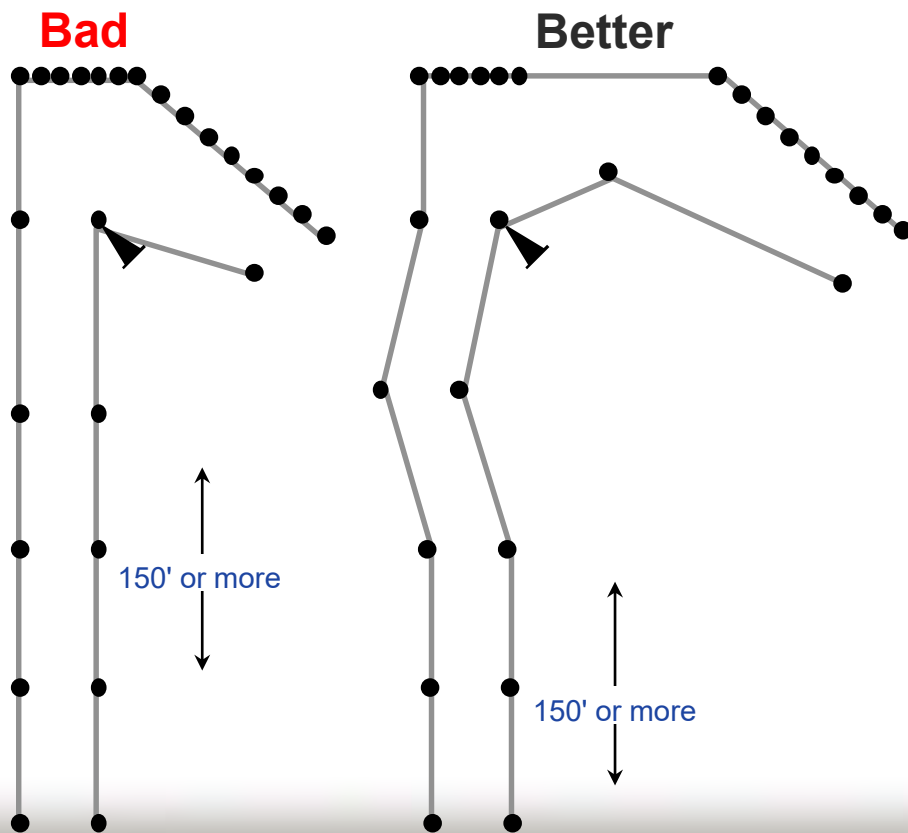
C

E

D

## 2.0 Diagrams (continued)

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

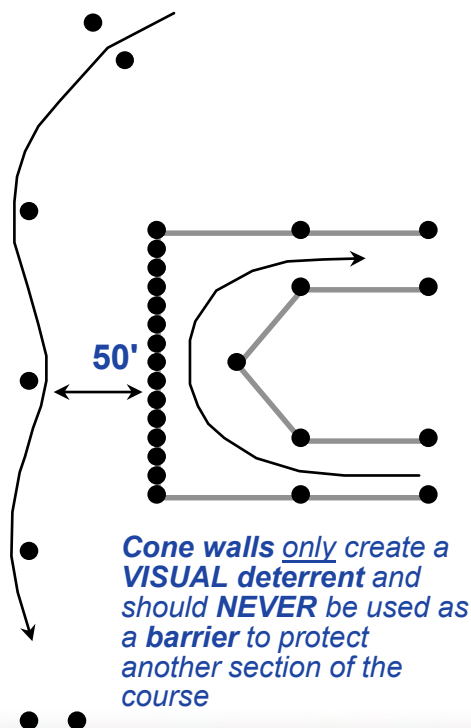


## 2.0 Diagrams (continued)

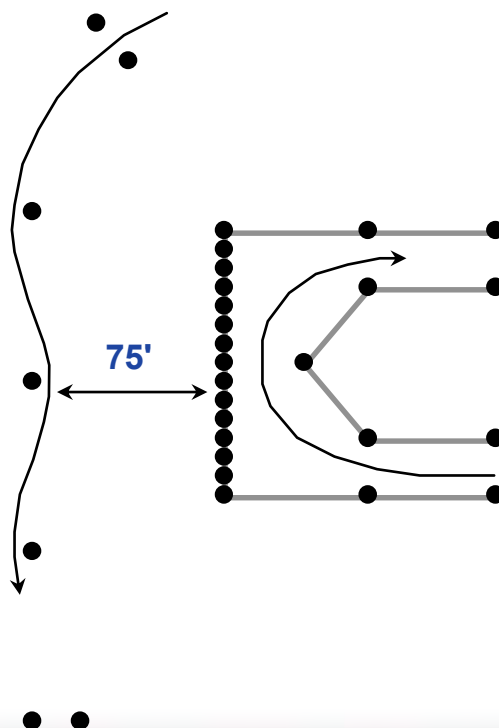
### 2.2.H Cars on course simultaneously shall not run in close proximity to each other

"Close Proximity"... The definition of this is ultimately up to the **Safety Steward**, but if you consider rule 2.2.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.

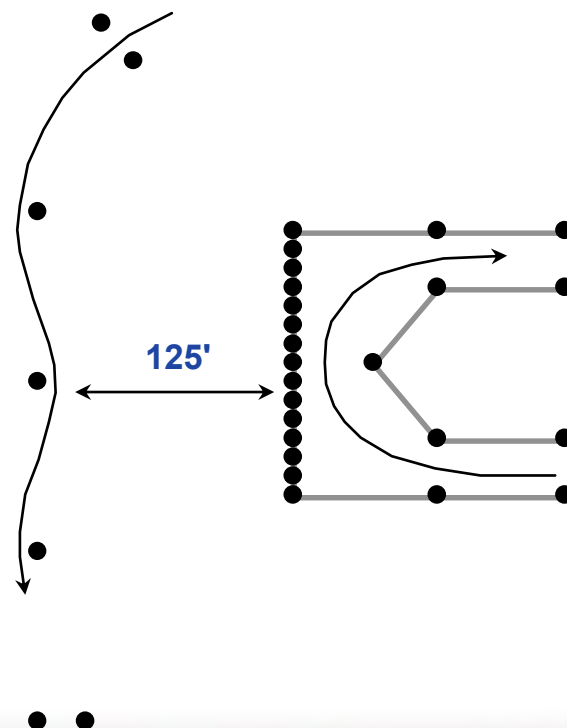
#### Unacceptable



#### Acceptable



#### Better Yet



## 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 refers to the way **adjacent sections** of a course connect to each other



## 5.) Make the Course Flow



- 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**

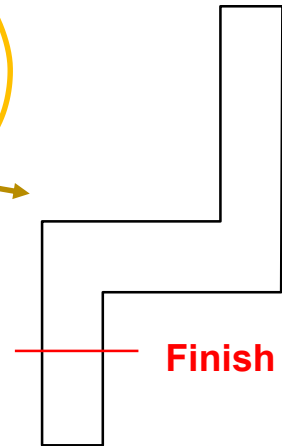
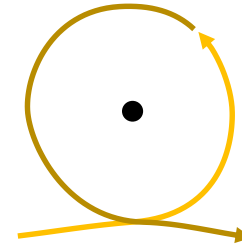
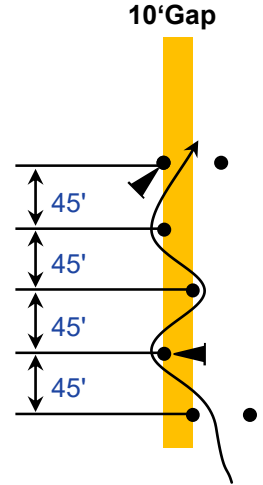


## Ways to Make Your Course Flow

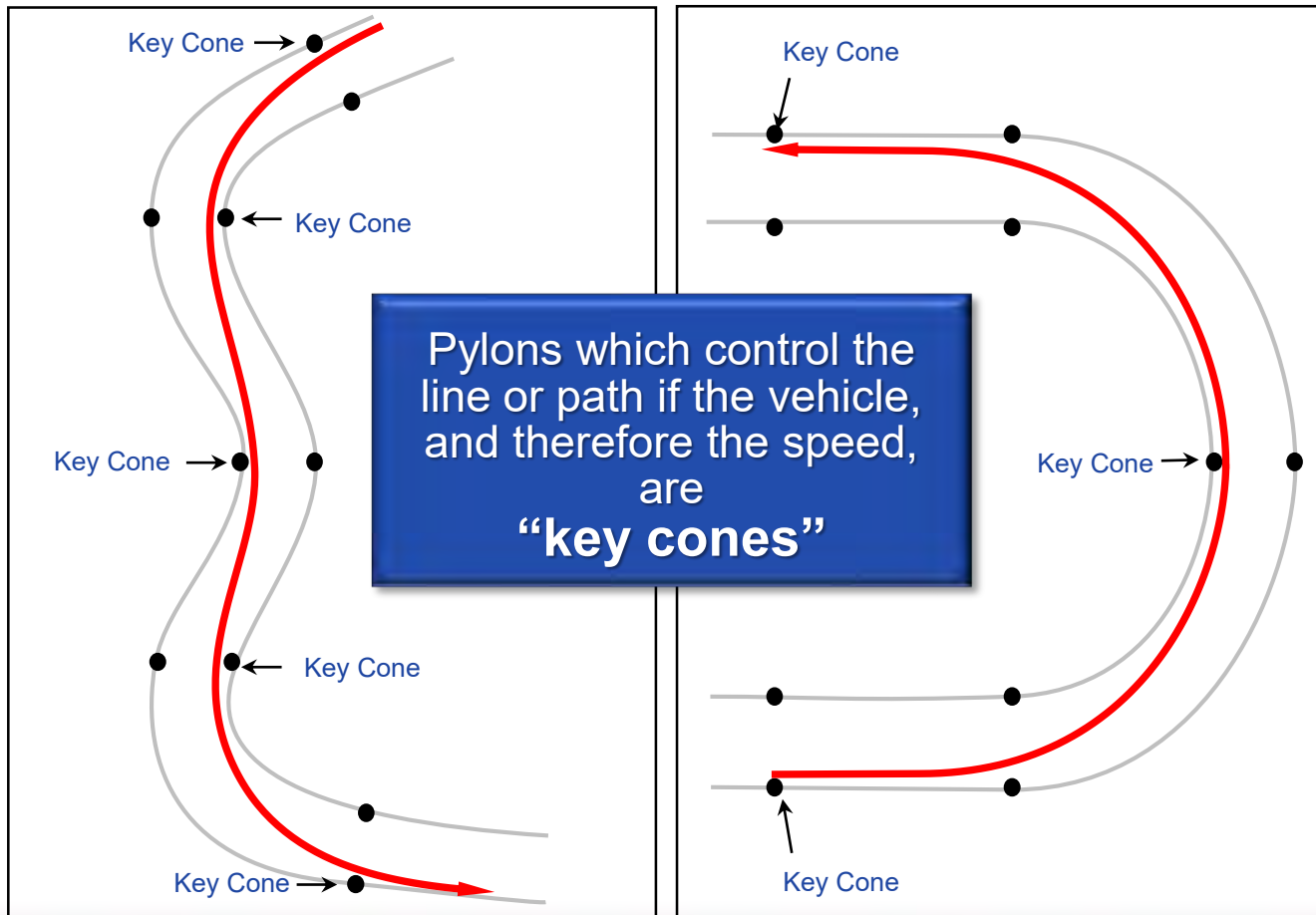
- To be able to accurately determine the flow of a course before you set it up, you must be able to first draw a **scale map** (gasp!)
  - **Visit the site before** submittal of your map to make your map accurate and to include things and land formations to avoid
- **Locate the “key cones” in your design**
  - Determine which cones control the speed and direction of the course (key cones) and **remove** any of the remaining cones that could cause confusion
- **Remove** a slalom cone in a 45' - 55' slalom
- **Allow a few more feet** of width and/or length when approaching the next maneuver
- Avoid **painful** walled-in turns
- Ensure the “next gate” is visible in your **peripheral** line of sight
- **Move** a limiting or constricting gate 1 to 10 feet left or right to open the approach up
- Do not use **painful maneuvers** to slow things down

# Maneuvers to Avoid

- **Avoid maneuvers that could make a car roll**
  - 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" (NFM) 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



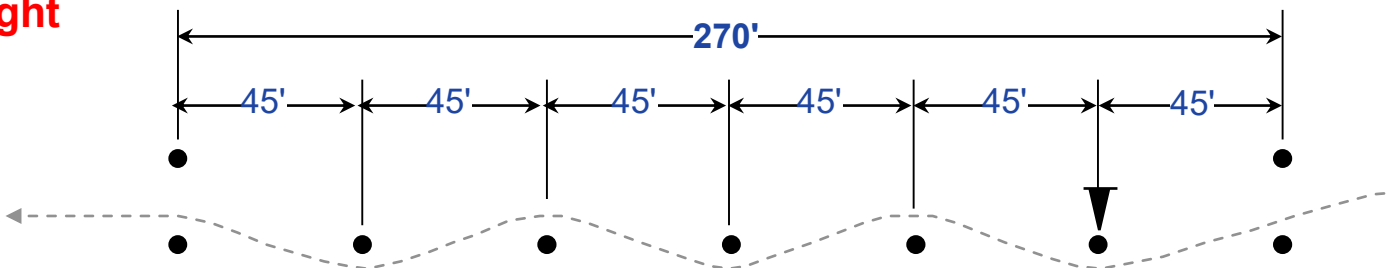
# Locating Key Cones



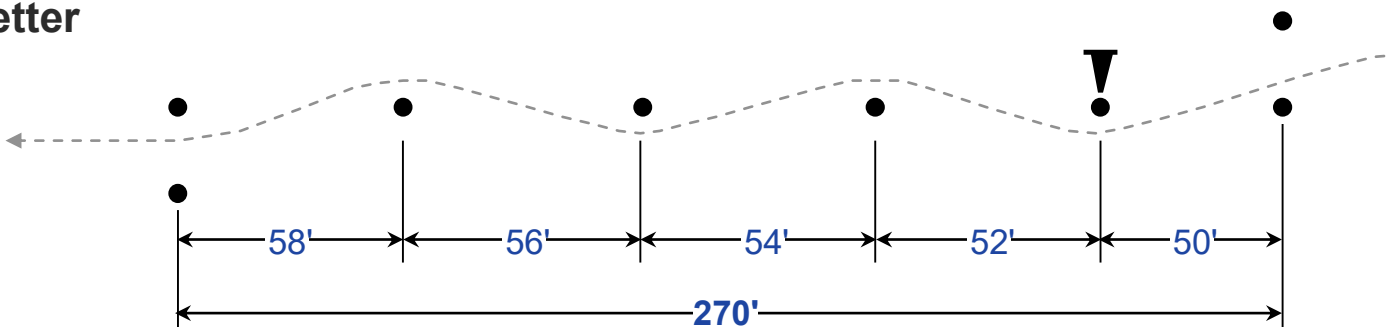
- ## Advantages of wider gates
- Choosing the **superior line** requires more skill and experience
  - **Allows** for mistakes/sloppiness with **no pylon** penalties
  - **Easier** on course **workers** and timing & scoring

## Remove a Slalom Cone

**Tight**



**Better**

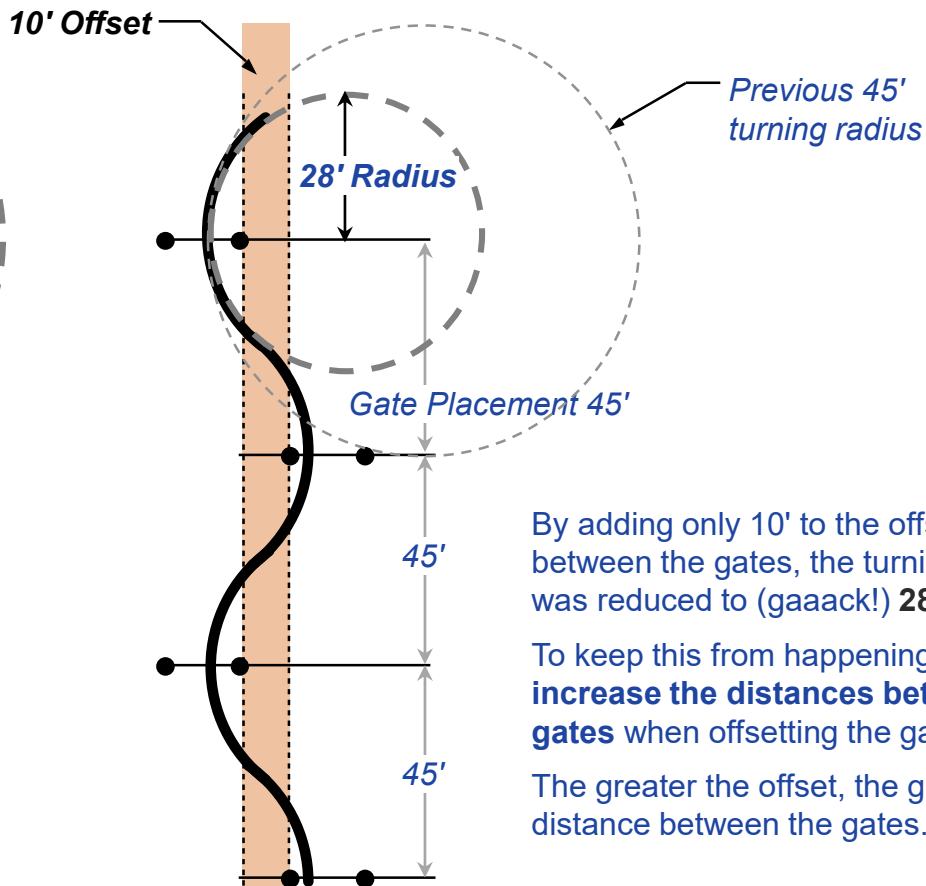
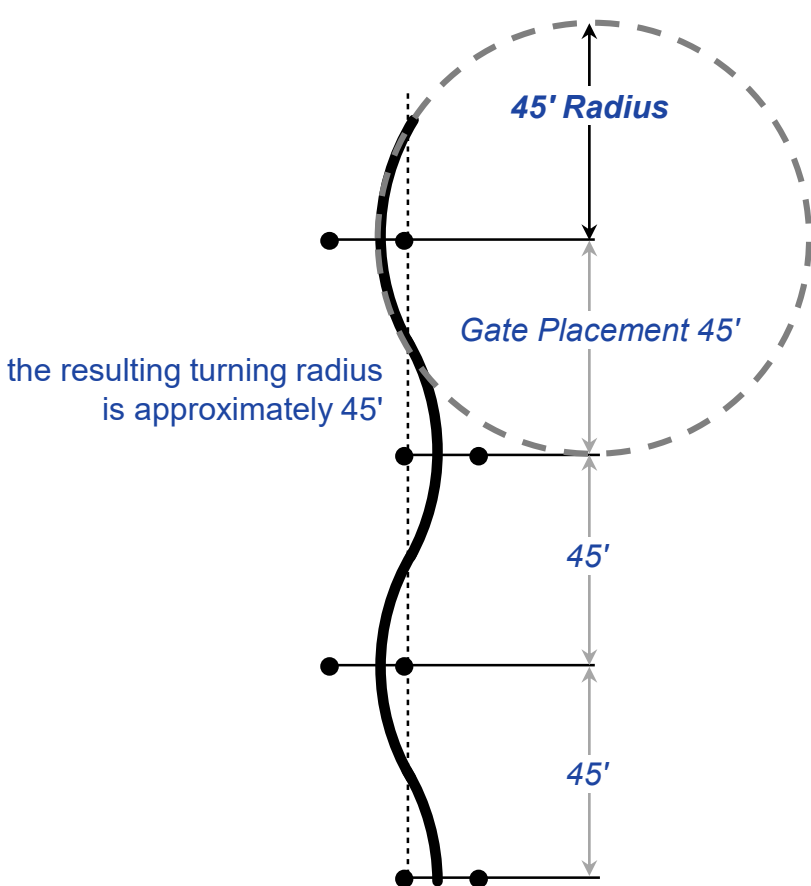


- By **removing** only **one cone** in this 270 foot slalom, you are able to open up the slalom to a more reasonable spacing of 54 feet. This is not a “wide open” slalom and definitely flows better than the example on top. You can also make the slalom a **gradually increasing** allowing the more astute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



# Lock to Lock Turns

## No lock to lock turns



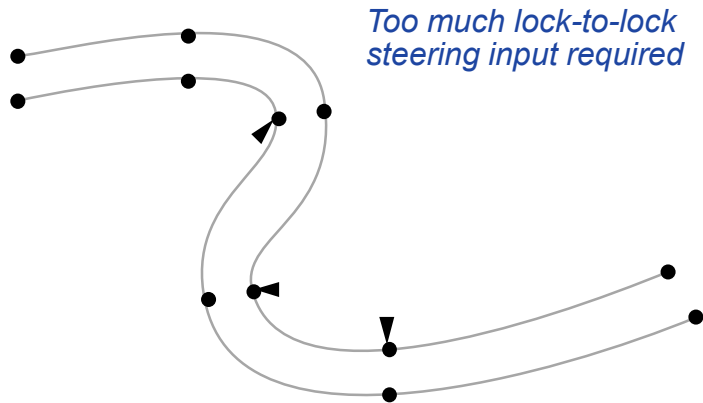
By adding only 10' to the offset between the gates, the turning radius was reduced to (gaaack!) **28 feet!**

To keep this from happening, **increase the distances between the gates** when offsetting the gates.

The greater the offset, the greater the distance between the gates.

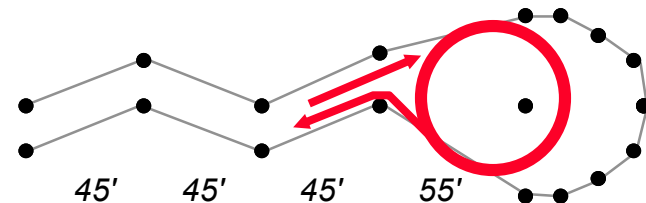
# Lock to Lock Turns (continued)

**not fun**

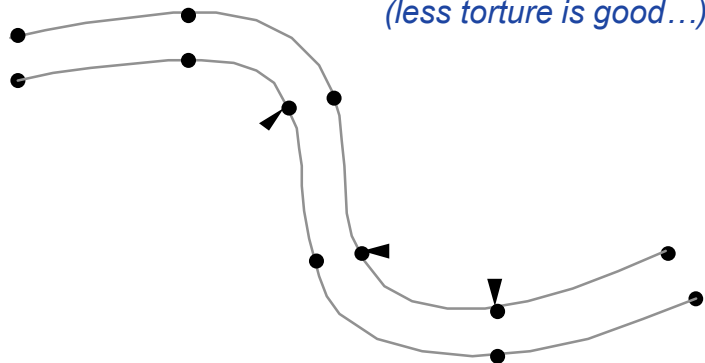


**painful**

Generally, avoid 180° turns. If required by lot shape, don't make lock to lock steering inputs just before entering the 180°

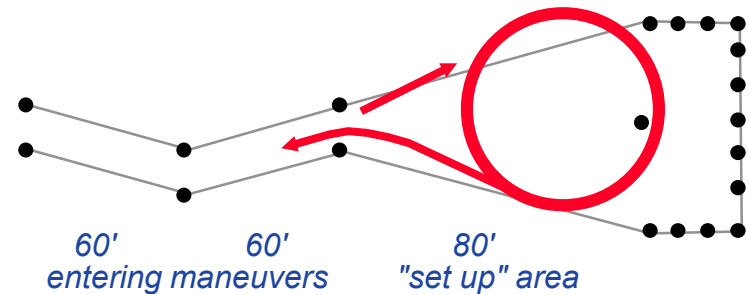


**better**



**better**

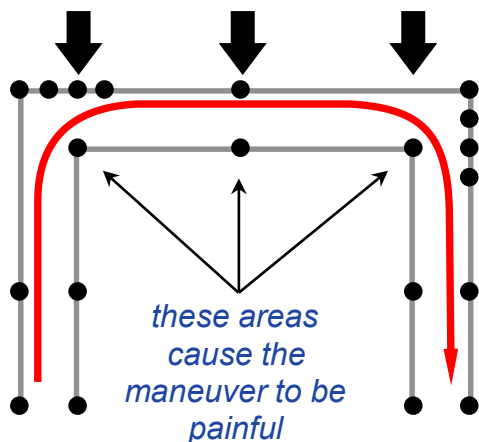
- Open up the entering maneuvers
- Allow plenty of setup area to enter/exit a 180° turn



# Avoid “Painful” Walled in Turns

## Painful

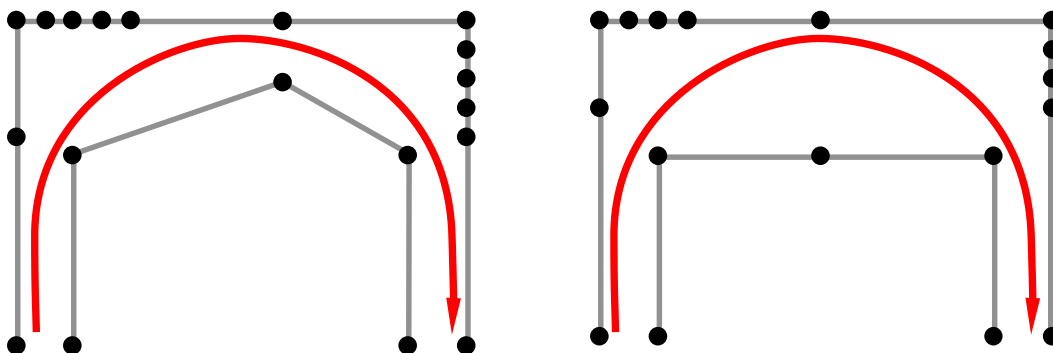
Narrow, walled in sharp turns



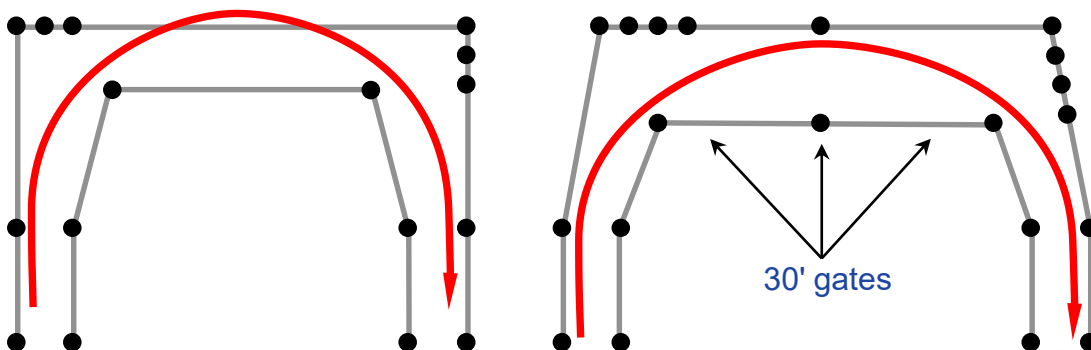
The placement of the wall  
forces the turn to be made up  
of **2 or more painful turns**  
instead of a flowing turn

## Better

*solutions keeping the same flavor as the original*



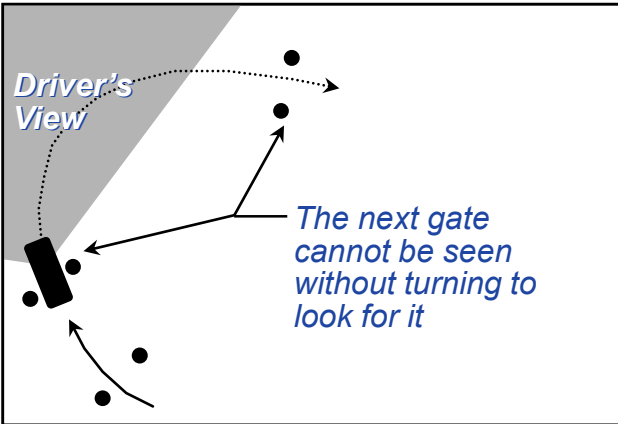
**1 flowing turn...**



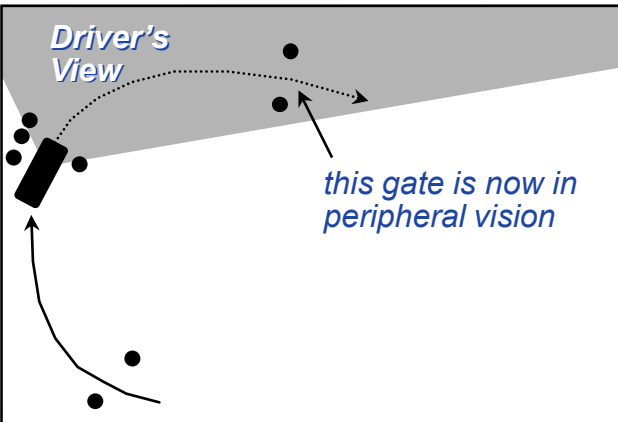
18' gates

# Line of Sight and Gate Positioning

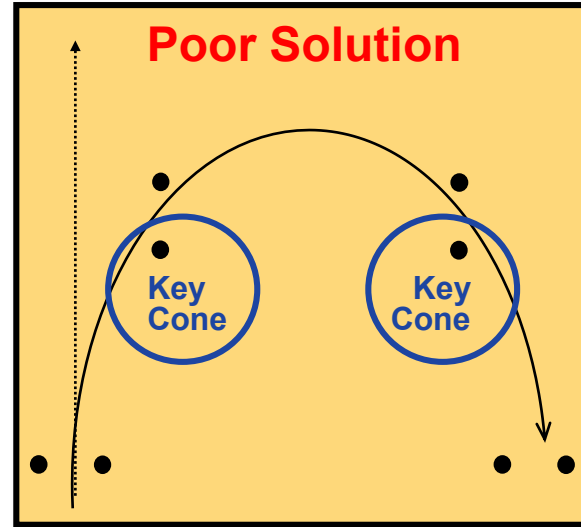
**Bad**



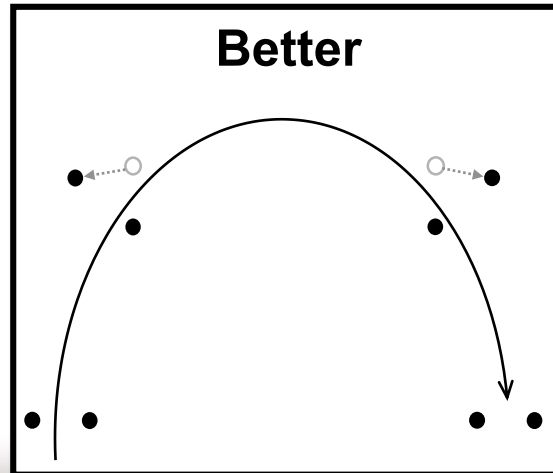
**Better**



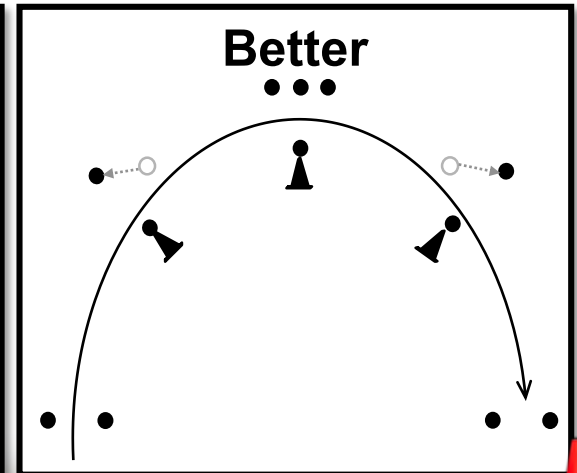
**Poor Solution**



**Better**



**Better**



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

- Use **both types of elements** is to create an “equalizer” course
  - This would be one where a **2015 Camaro SS 1LE** would have no advantage over a **2008 Mercedes C300**, which in 2018 are both in FStreet
  - By doing so, you will have a much greater chance of **pleasing the majority** of the drivers in attendance
- **First decide what favors horsepower and what favors handling**
  - Then evenly apply those kinds of maneuvers in your design
  - In a over simplified explanation:

### horsepower

---

straights (duh...)  
long spaced slaloms and 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.

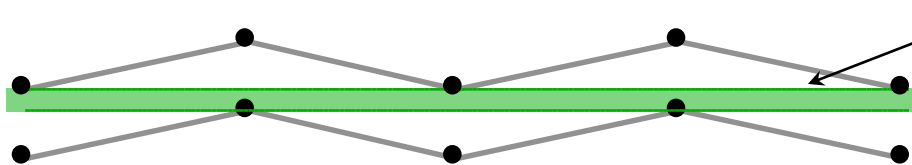
- **A straight is any area where full acceleration can be utilized, and is not just the classic definition of the shortest distance between two points**
  - A slalom spaced greater than 100' can be considered a straight



# Utilize “the Gap” to Help Control Speed

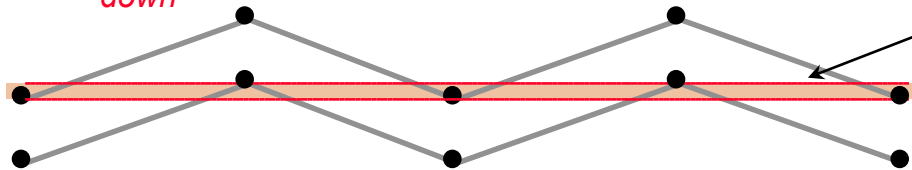
Use either easy or difficult maneuvers to speed up or slow down a course without disrupting the flow

**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*



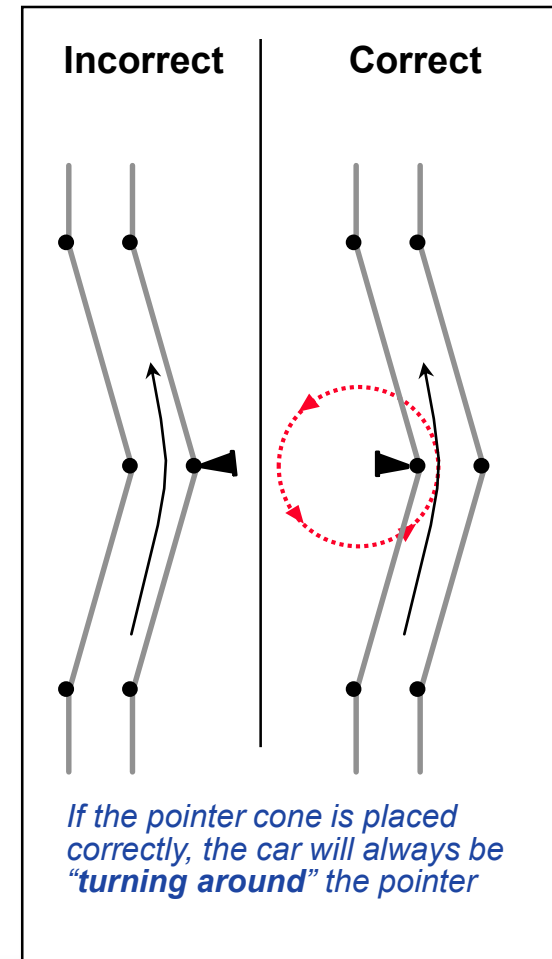
By increasing this **overlap**, you will effectively **decrease the speed** of the maneuver. A small increase here will also have a surprisingly large effect

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
  - Your car will **always turn around a pointer** if it is placed correctly

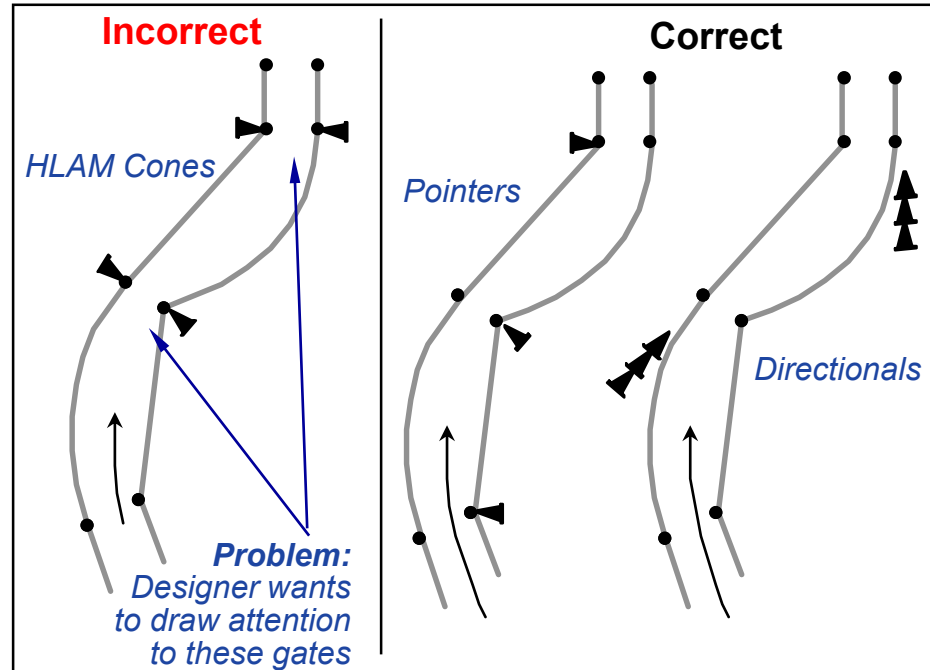


# Directional Cones

## • Directionals



- A series of 3 or more lay down cones to guide the driver to the left or right
- Choose a set number of cones (such as 3 or more) and always use that amount when placing them on the course
  - Creates a recognizable pattern
  - Driver will see it as a directional set and not a downed cone next to a pointer



## • DO NOT use HLAM\* cones – pointers on both sides of a gate



- Can be confused with a down cone that a worker has not noticed
- HLAM cones can make a driver turn the wrong way
  - Pointer cones are supposed to be on the inside of a turn

\* HLAM = Hey - Look At Me

## 8.) Line the Course

- **Line the course whenever possible**
  - It helps the inexperienced driver to make it through the course with out a DNF
  - Lessens the chance for a “cross-over”, into an oncoming car
- **The course should NOT be line dependent**
  - The course still must be driven successfully if the **lines are “rained” away**
  - This is accomplished by paying close attention to **basic concept #5**
- **The lining of the course is a visual aid in basic course negotiation: 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 vision
- **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
  - **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
  - 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
- When entering a “box” or walled in turn, place the cones that appear in the approach path closer together and more frequently - creating a **dense wall in the driver's line of sight**

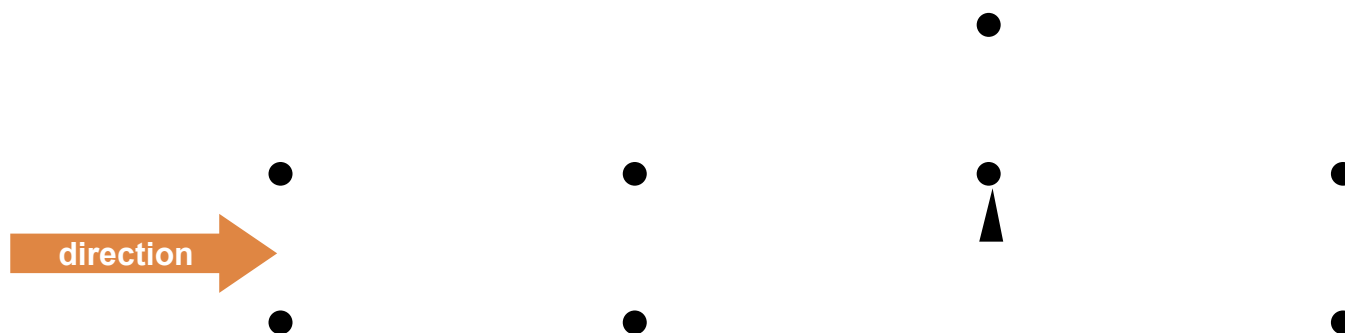


# Gate Spacing “Rule of Thumb”

## Gated Courses

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

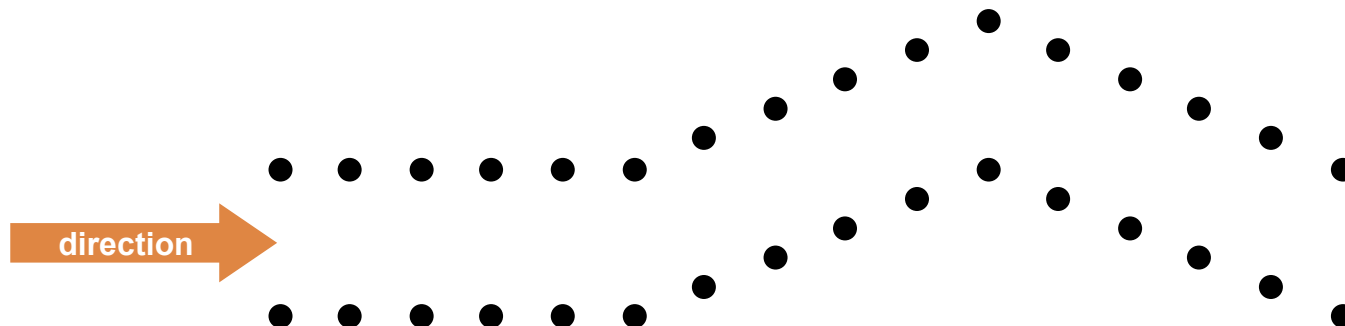
*For example, if your gate width is 20 feet the distance between gates would be 60 feet or greater*



## Miniature Road Courses

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

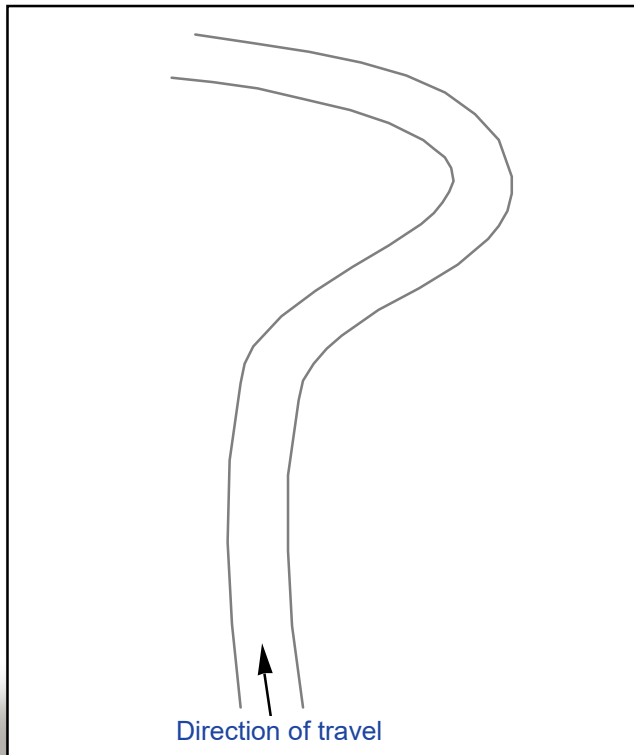
*For example, if your gate width is 20 feet, the distance between gates would be 10 feet or less*



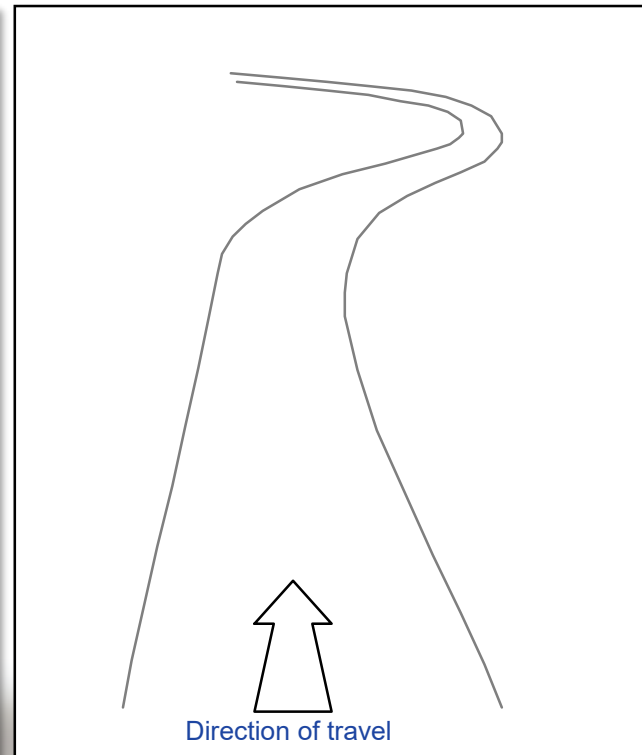
## Plan and Perspective views

- 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**



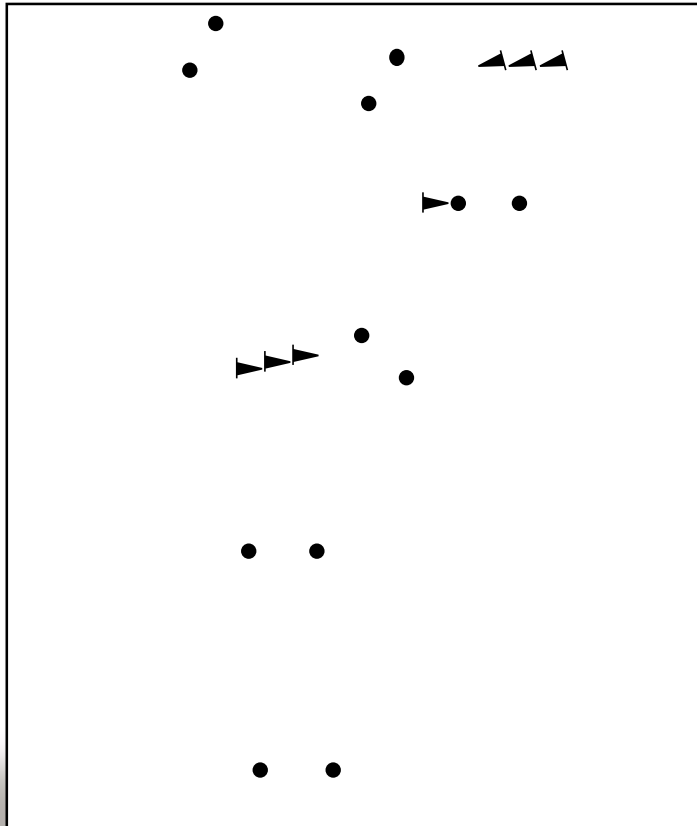
**Perspective View**



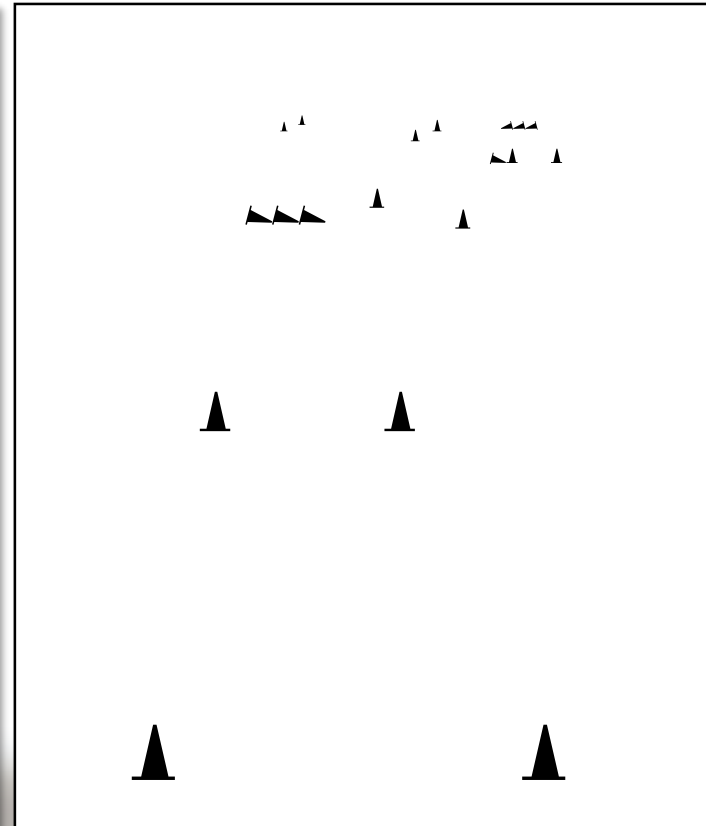
# Gates and Pointers

- This is an example of proper use of gates and pointers. The pathway is quite clear and easy to follow

**Plan View**



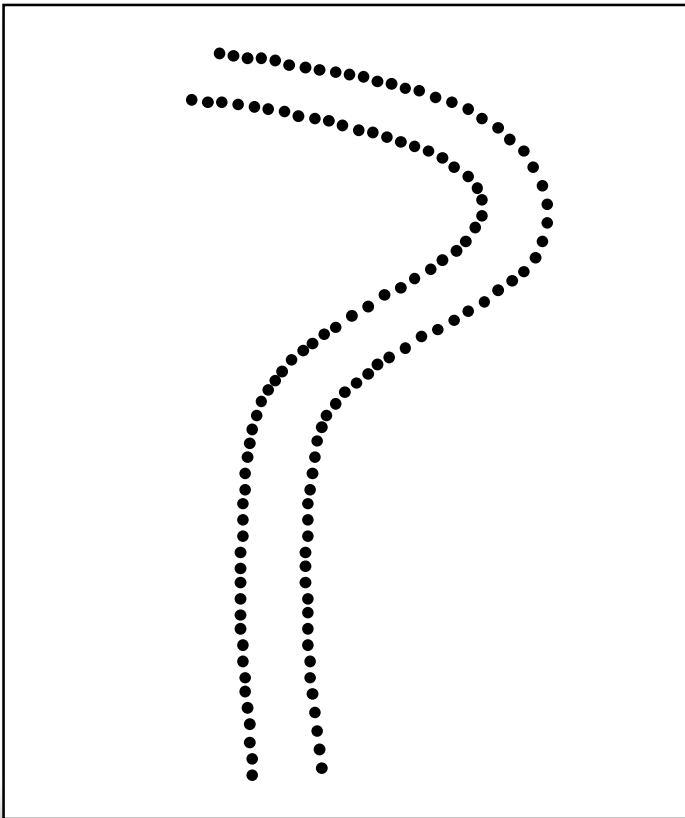
**Perspective View**



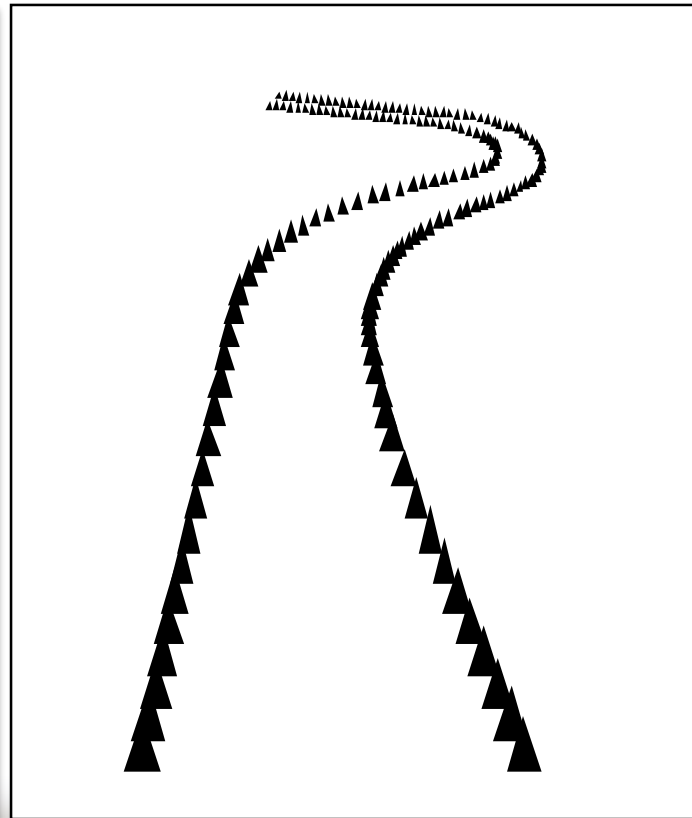
# Wall-o-Cones or Miniature Road Course (MRC)

- 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**



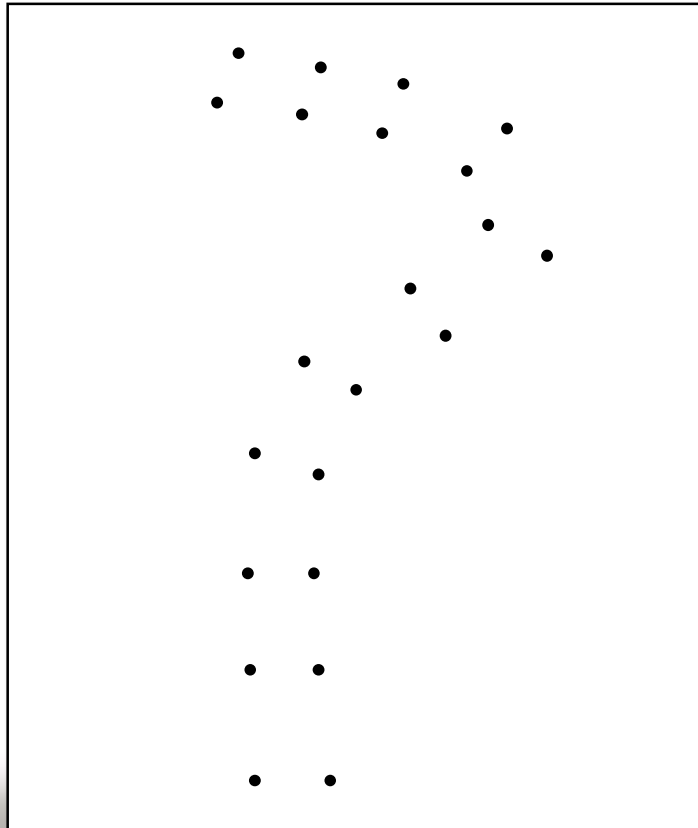
**Perspective View**



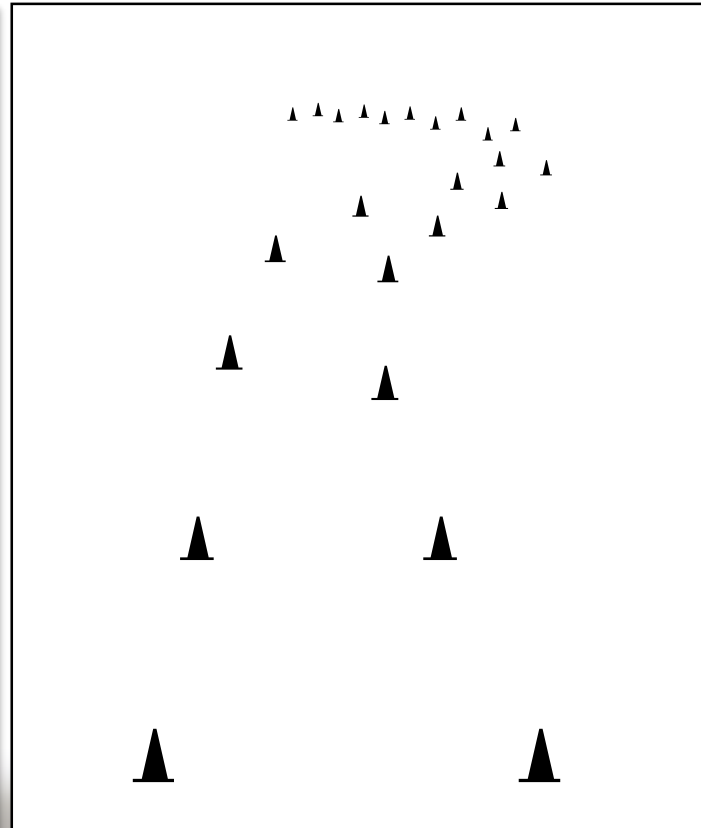
## the Dreaded “Sea of Pylons”

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**

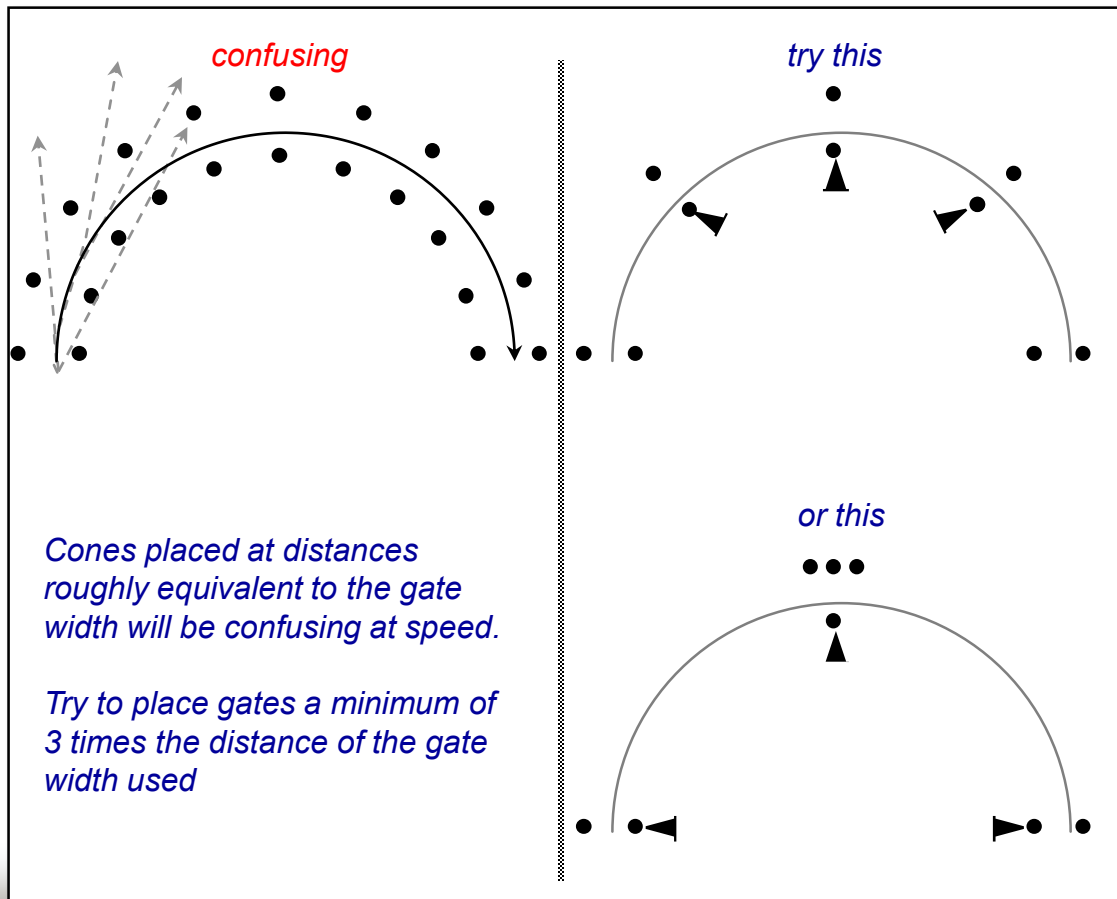




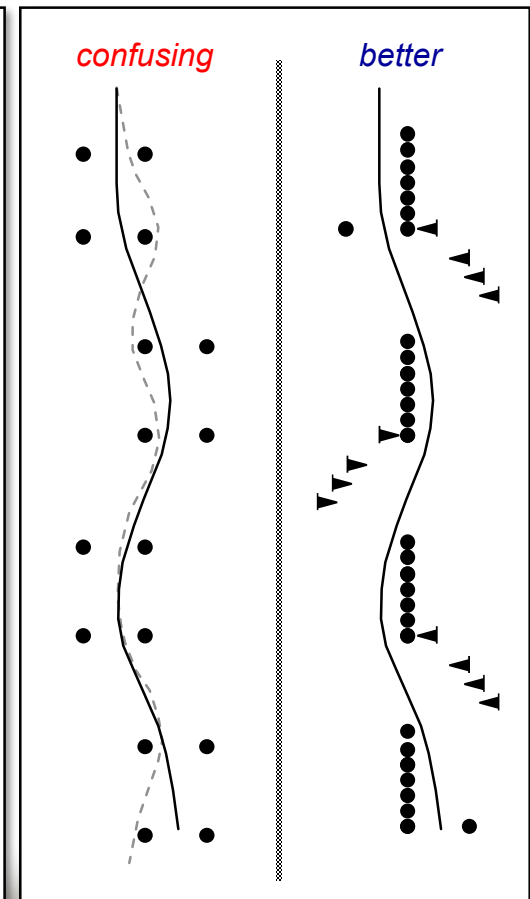
# More Examples of “Cone Hell”

Other examples that demonstrate the importance of gate spacing

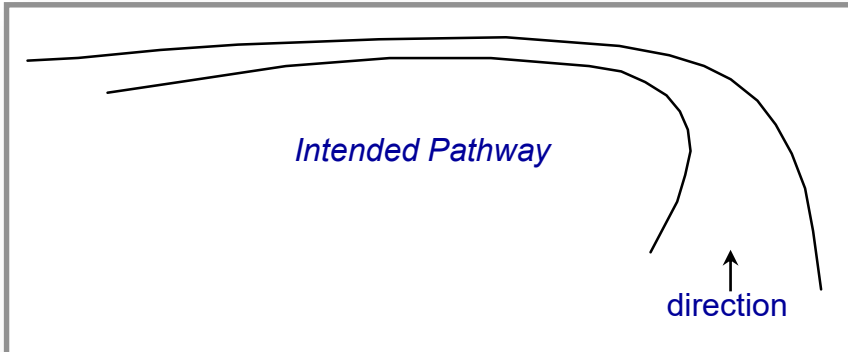
## Sweeper



## Lane Change

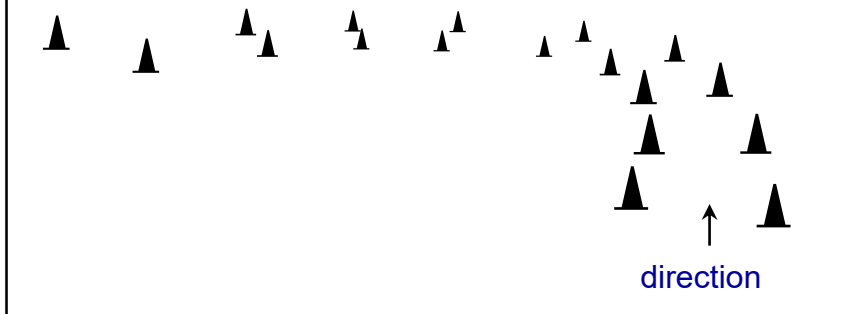


# Sweeper - Perspective View

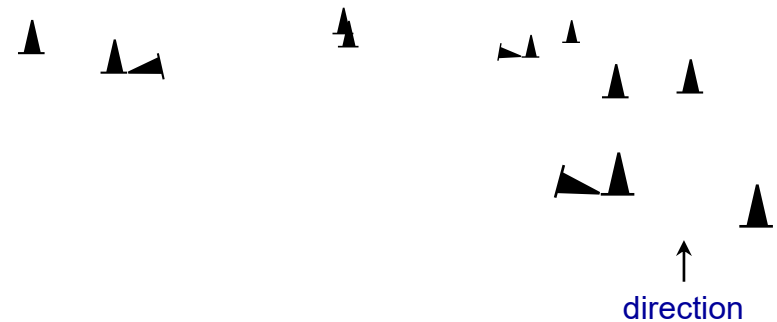


**could be confusing**

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



**try this**

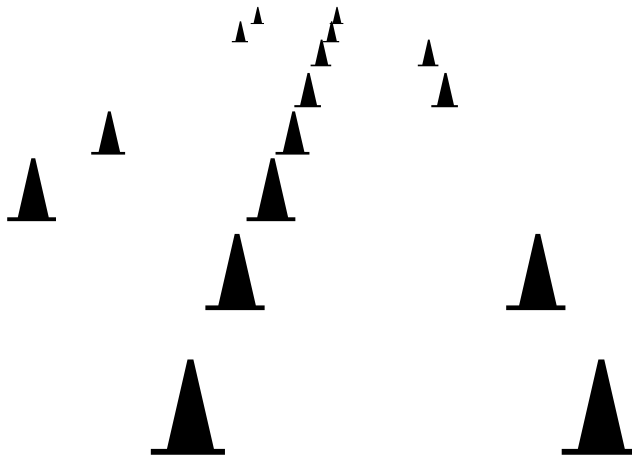


**or this**

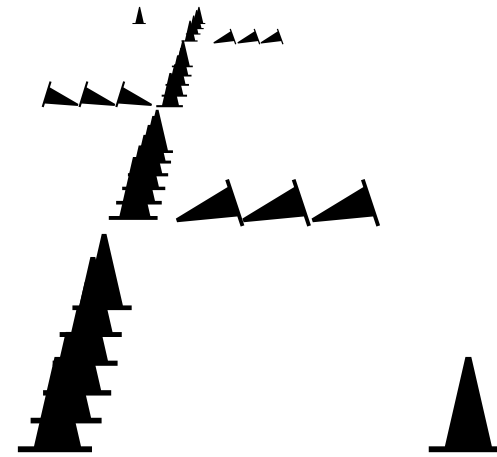


# Lane Change Perspective View

sea of cones

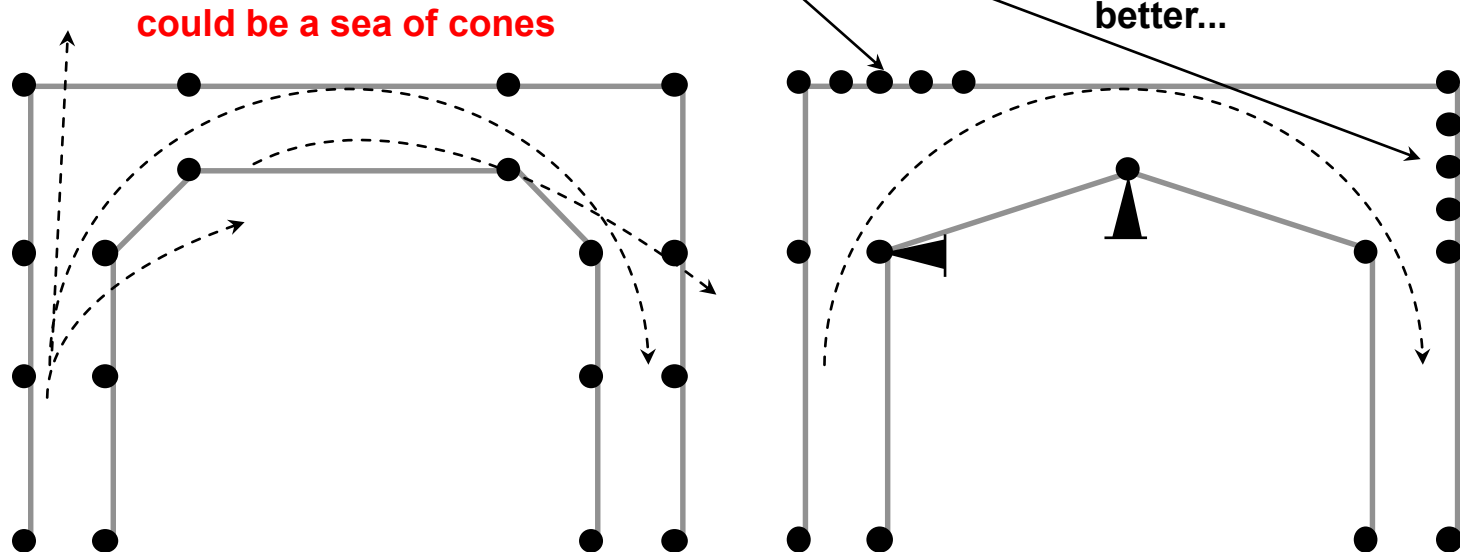


better



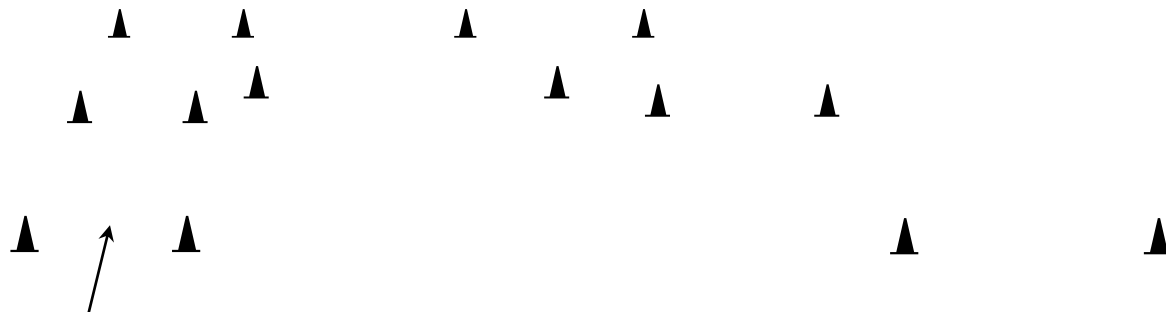
## Box Turns

When entering a “box” or walled in turn  
place the cones that appear in the approach path  
closer together and more frequently

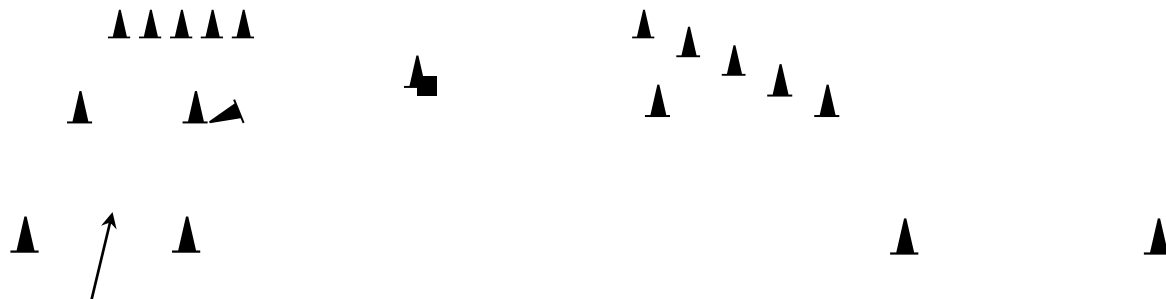


# Box Turns Perspective View

Sea of cones



Better...





## 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 your maneuver, 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 course design opinions you trust to **drive the course** - and not Aunt Ethel (unless she is an AutoXer)
  - Make your **design changes based on** the inputs received from the above

***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 and Questions



# So You Have a Blank Piece of Paper (DOH!! what now???)

- These techniques 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
  - The following section will hopefully **alleviate that problem** and make this task easier for you as it has for me



# 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 anomalies (**grates**, **holes**, **oil**, etc.); **Immovable objects** (light poles, buildings, curbs, trees, etc.); **Boundary** features (fences, sidewalks streets, etc.); **Entrance** and **Exits**; **Elevation** changes or sloped sections
- Address location/logistics of all non-course features on your map as well
  - Site entrance(s)
  - Waiver patrol points
  - Pit areas
  - Grid
  - Spectator areas
  - Registration
  - Technical inspection
  - Number of cones
  - Timing vehicle/trailer/tent
  - Finish placement/run-out

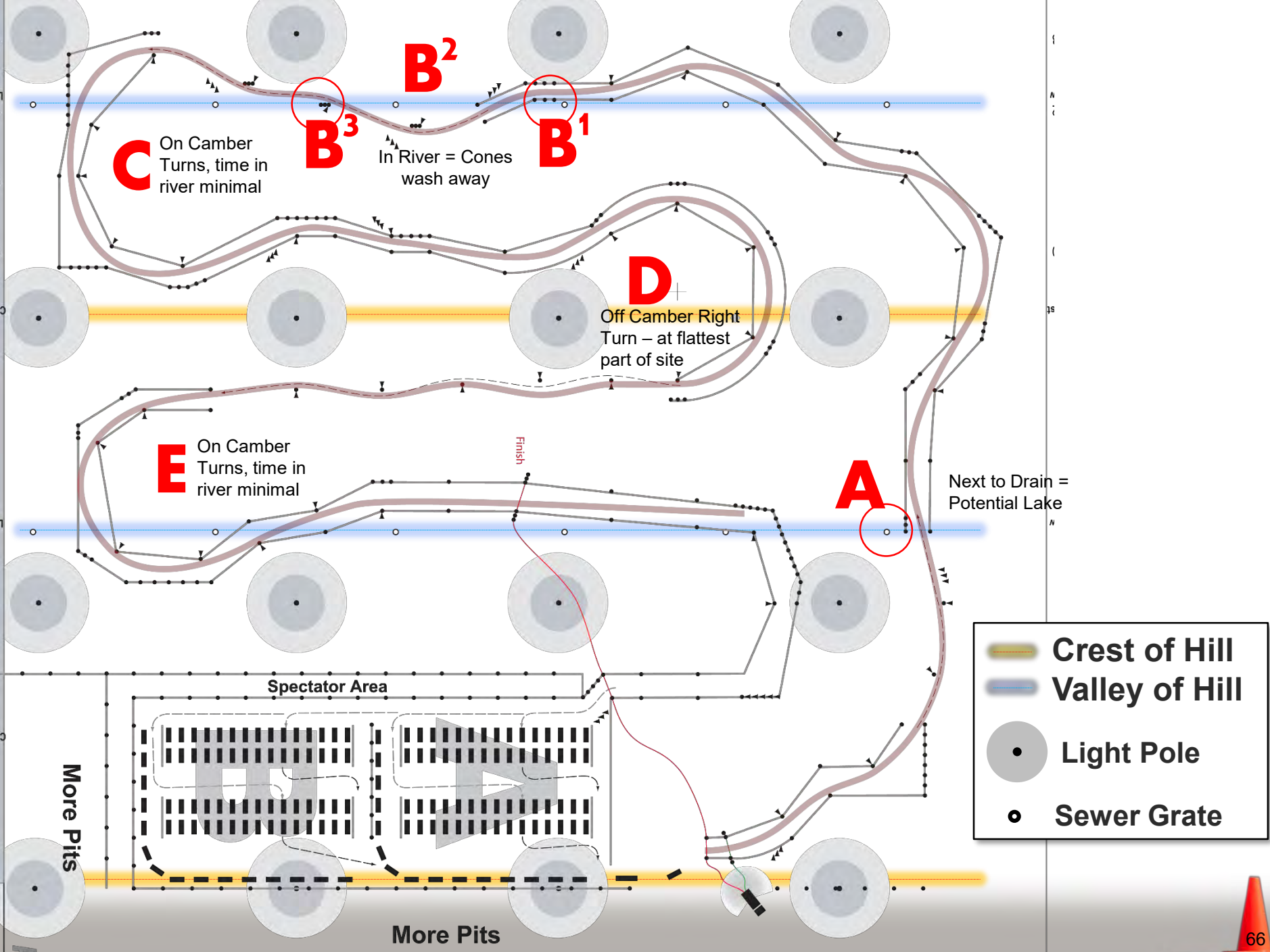
## Off Camber Surfaces, Bumpy Lots/Changing Surfaces **Why We Care**

- Any category beyond Stock can have major issues
  - **Even some Stock cars** can be broken by these things
- Ground clearance
  - Damage to **bodywork/aero**, to **engine**, to **frame**, etc.
- Suspension travel
  - **Bottoming out** is not only bad for driving but can break things and in a worst case lead to a rollover
- Getting airborne
  - Powered wheel spins uncontrolled, then can **break axles/diffs/trannies** when it comes back down
- Hard on driver
  - Think **AM, BM, CM, FM, FJr**, etc.
- Loss of control potential is larger (spins happen easier)



## **Off Camber Surfaces, Bumpy Lots/Changing Surfaces What We Care About**

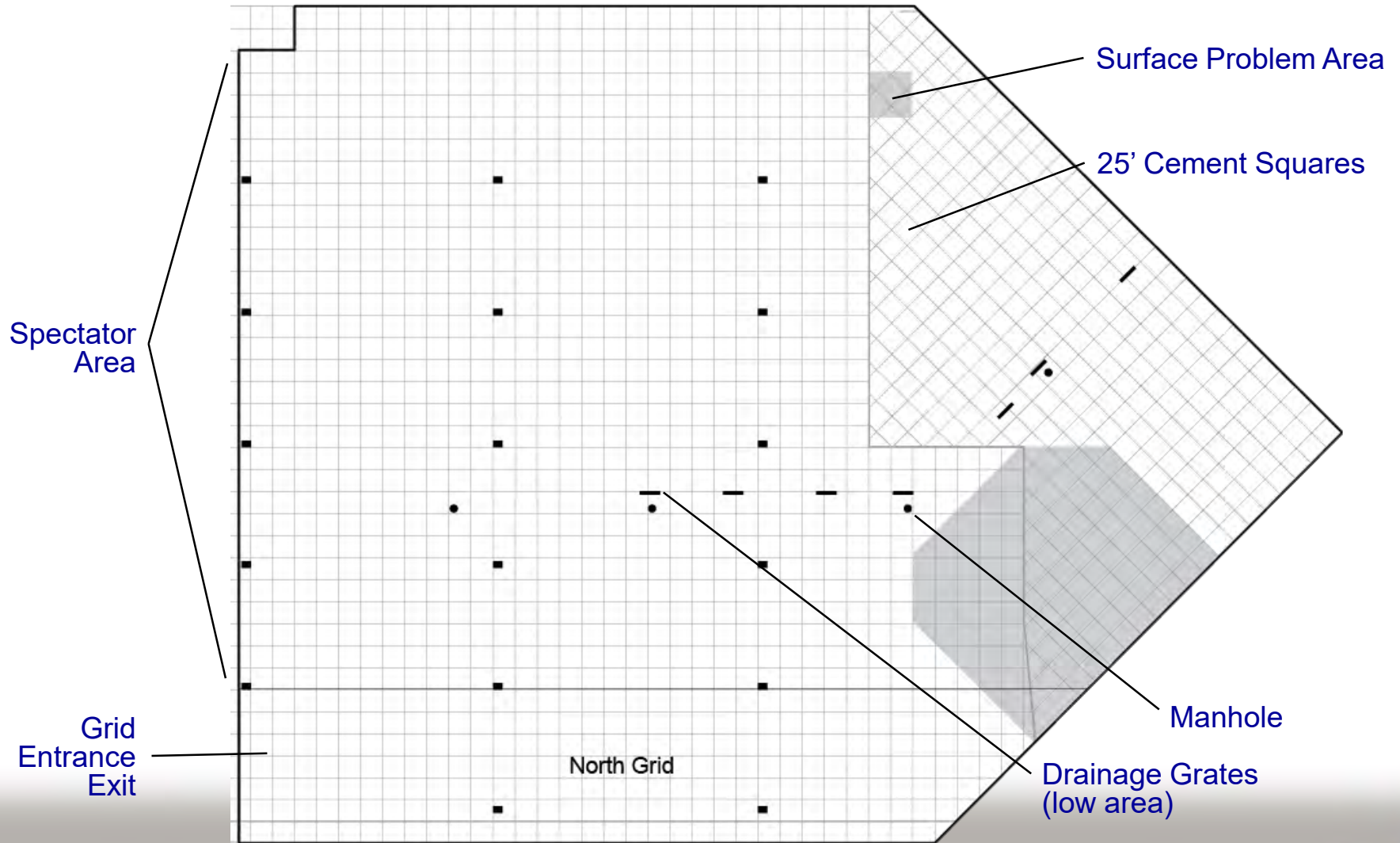
- **Ridges**
- **Valleys**
- **Camber changes**
- **Grates, holes, patches, metal plates, things to just plain not hit**
- **Washboard sections**
- **Concrete seam drop-offs and step-ups**
  - A step-up is worse, but a drop-off can be an axle breaker
  - If it's more than an inch, either way, avoid it
- **Low areas where water can accumulate**



## Off Camber Surfaces, Bumpy Lots/Changing Surfaces **What To Do**

- **Cross ridges and valleys at an angle (the shallower the better) while going straight and preferably not braking**
  - The **closer to parallel** with the groove or ridge you are, the shallower the ditch or peak effectively becomes.
  - This also lets the corners of the car's **suspension work independently** to absorb the deflections.
- **Put a cone on grate/hole/patch/plate**
  - Make it part of the **course marking** boundary
- **Avoid washboard section if possible**
  - Traverse at **lower speed**, or at least with **no turning or braking** if not
- **Avoid low areas if possible, or make the time in them minimal**
  - Rain is a factor - you can't brake or turn when hydroplaning on a **puddle/river/lake**
- **Reduce speed of crossing for drop-offs and step-ups, cross at angle**
  - Try to have cars **not braking** or **accelerating** when they cross it

# Scale Map of the Topeka North Course Area

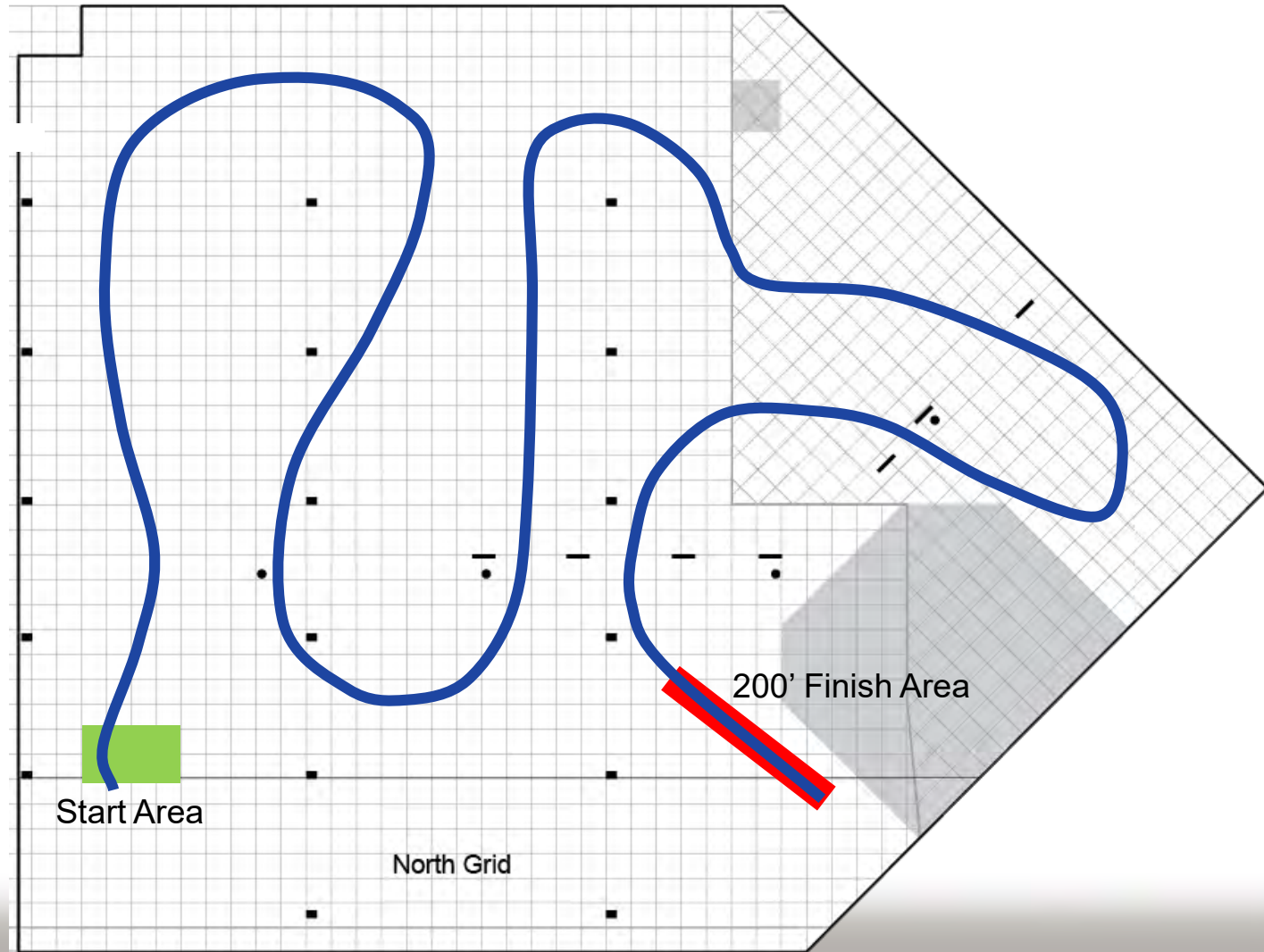


Getting Started (Finally...)  
**Position the Start and Finish**

- **Position the finish area first**
  - **Runoff** and **type of finish**
  - Define **exit/return route** to grid
  - Location of **finish lights**
  - Clear view from **Timing**
  - Avoid **maneuvers** at the lights
  - Avoid the **brakes** at the lights
- **Position the start area next**
  - **Staging** line and **type of start**
  - **Access** from the grid
  - Location of the **start lights**
  - Clear view from **Timing**
  - Place **sharp turn** just **prior** to or just **after** the lights to prevent the need of dumping the clutch
- **Sketch General Route**
  - Do **several** general sketches
  - Anticipate **corner worker positions**
  - Note **boundaries** and **immovable objects**
  - Avoid **crossovers**
  - Provide **separation** between sections



*So You Have a Blank Piece of Paper*  
**Course Design and Event Setup**  
**Example of a sketch**

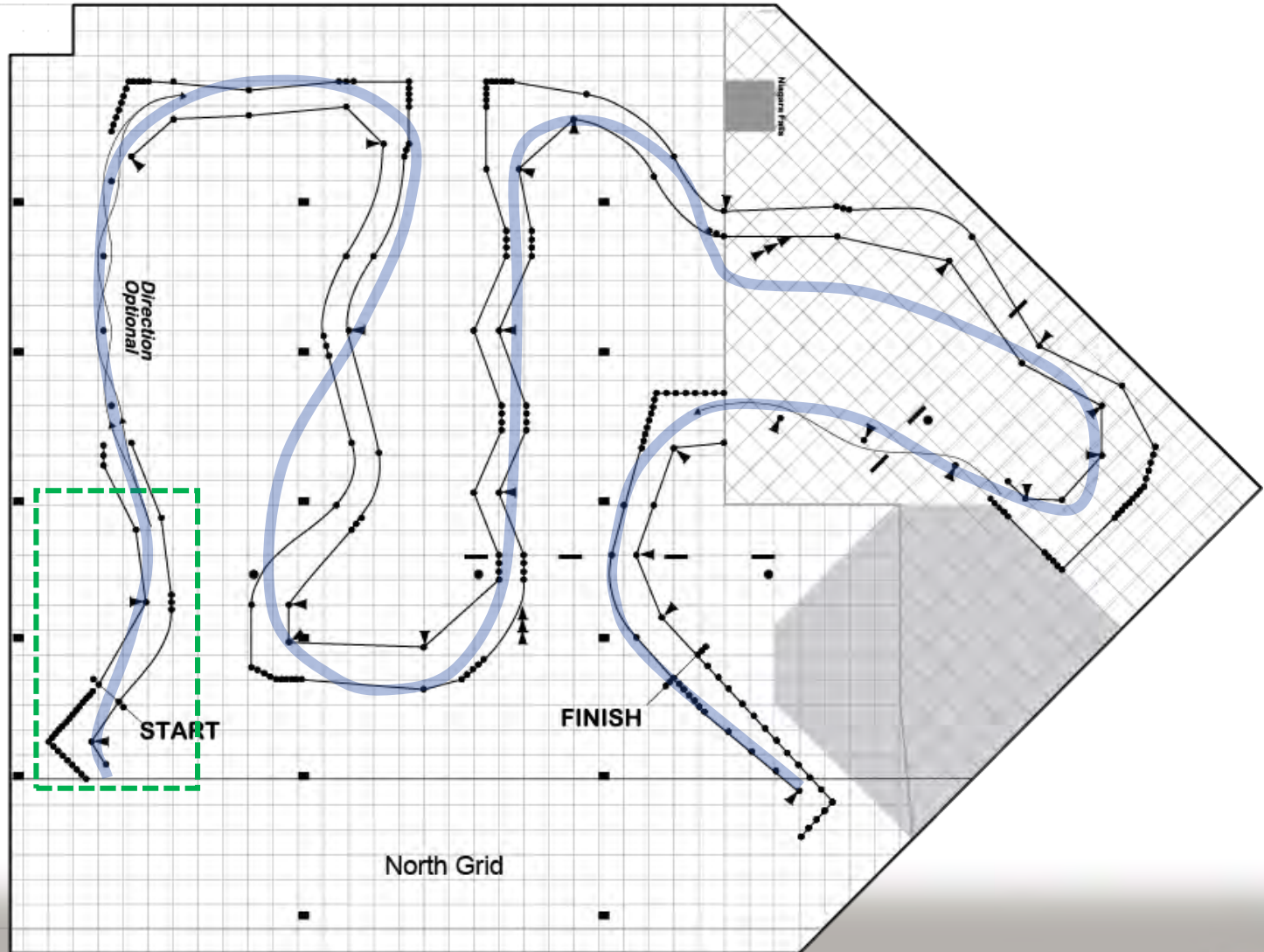


## Finalizing the Design

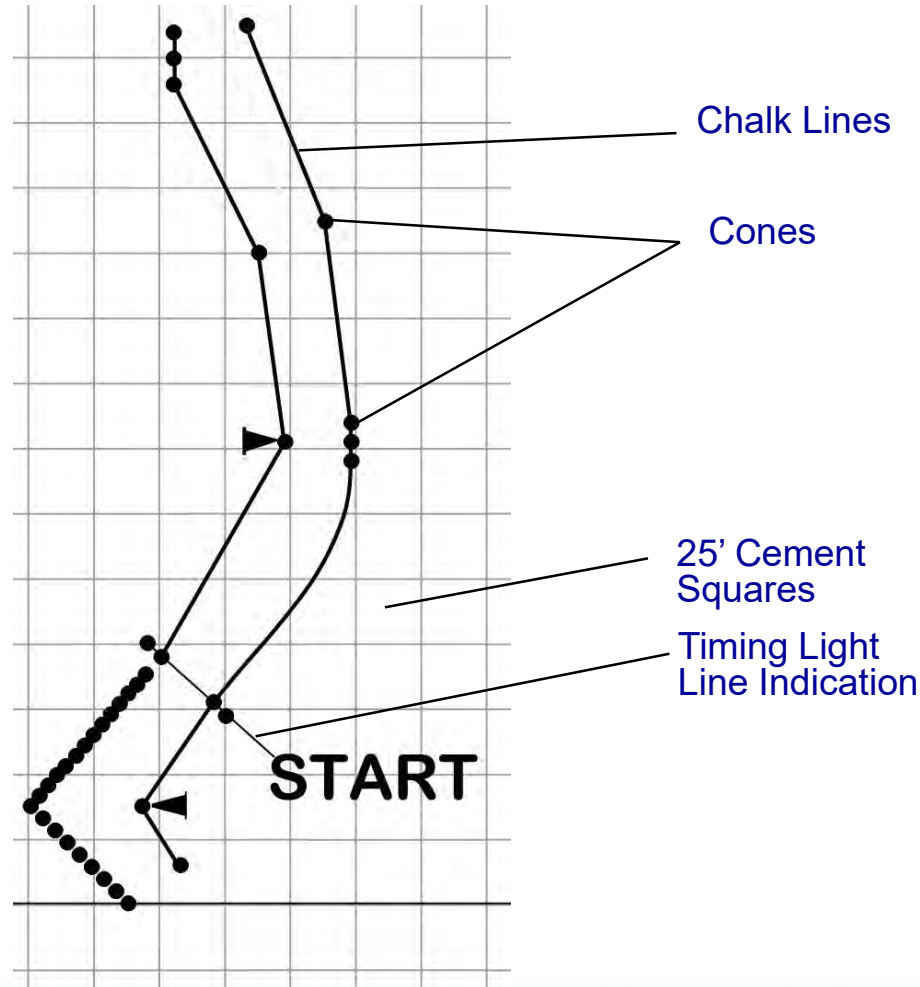
- Choose a **variety** of different types of maneuvers and features
  - **Make a list** of the desired elements
  - Decide which portions of that route **lend themselves** to each of the listed elements
- Pick the elements that seem the best for your pathway and fill them in
  - **Adjust** turn radii and shapes
  - **Add** transients where applicable
  - Ensure a **diversity** of elements
- Add projected cone locations
  - Don't think **chalk line** will guide drivers
    - **Rain or wind** may eradicate those
  - Allow for room **driver error**
  - Prioritize **key cones**
  - Repeat **cone shapes to create patterns**
    - Pointers on apexes
    - Four cone walls on outside of turns
    - Standard gate widths
    - Consistent number of lay downs
  - Avoid **Excess cones** where not required for a desired visual
  - Allow **room for adjustment**
    - no course should be expected to be set up exactly as it was drawn
    - **10' minimum movement** allowance of individual cones, gates or even entire sections

# Finalized Design Example

See next  
page to view  
this section



## Section from Finalized Design



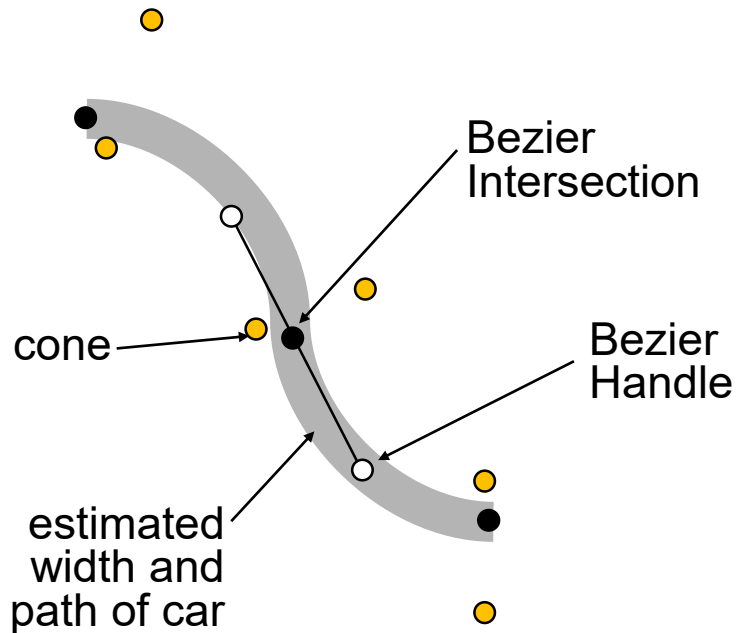
## Course Design and Event Setup

# Computer Design Analysis

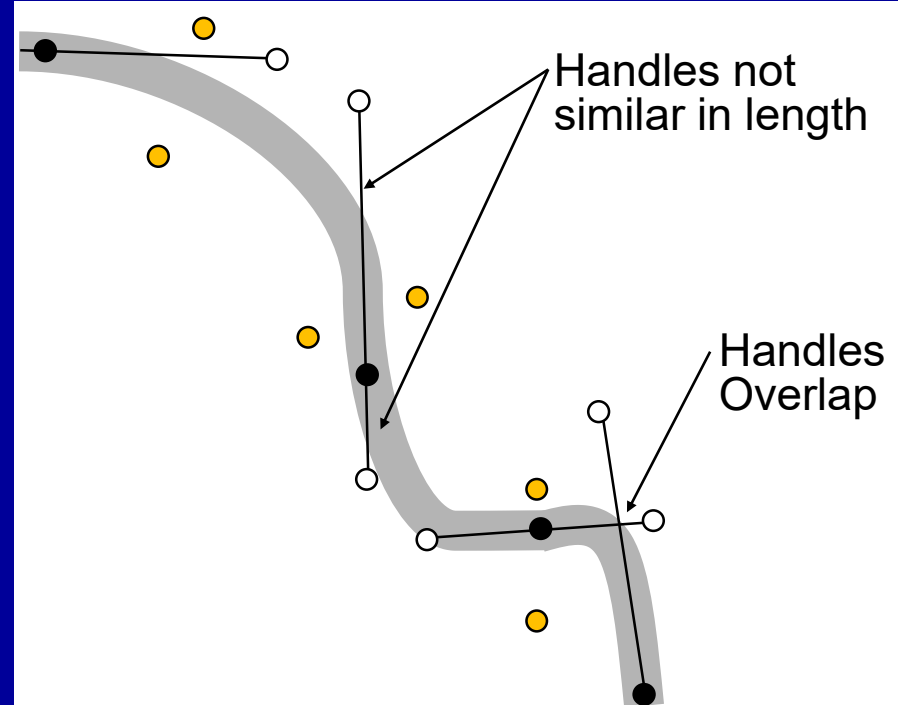
- The following assumes that you have access to a fairly powerful computer with a current Graphics program that utilizes bezier curves and lines such as Adobe Illustrator, Xara, Zoner Draw, Deneba Canvas, Corel Draw, etc.
  - When you input your design into a computer to scale, you can **analyze** how well the **course flows** by plotting the probable path of a car
    - 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) course path**
      - 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 Design Analysis (continued)



Elements of a Bezier Curve



What NOT to do



# Slalom Speeds in MPH

Lateral G's	Slalom Spacing in Feet													
	45	50	55	60	65	70	75	80	85	90	95	100	110	120
<b>0.90</b>	30	33	36	39	42	46	49	52	55	59	62	65	72	78
<b>0.95</b>	30	34	37	40	44	47	50	54	57	60	64	67	74	80
<b>1.00</b>	31	35	38	41	45	48	52	55	58	62	65	69	75	82
<b>1.05</b>	32	35	39	42	46	49	53	56	60	63	67	70	77	84
<b>1.10</b>	33	36	40	43	47	51	54	58	61	65	68	72	79	86
<b>1.15</b>	34	37	41	44	48	52	55	59	63	66	70	74	81	88
<b>1.20</b>	34	38	42	45	49	53	57	60	64	68	71	75	83	90
<b>1.25</b>	35	39	42	46	50	54	58	61	65	69	73	77	84	92
<b>1.30</b>	36	39	43	47	51	55	59	63	67	70	74	78	86	94
<b>1.35</b>	36	40	44	48	52	56	60	64	68	72	76	80	88	96
<b>1.40</b>	37	41	45	49	53	57	61	65	69	73	77	81	89	97
<b>1.45</b>	38	42	46	50	54	58	62	66	70	74	79	83	91	99
<b>1.50</b>	38	42	47	51	55	59	63	67	72	76	80	84	92	101

- Expect <0.90 from stock cars on street tires, 1.10 g's from more prepared cars on race tires, 1.20 g's from a non-winged car such as C Mod, and 1.45 g's from a winged mod car
  - Calculations are based on a constant radius, instantaneous transition model

*So You Have a Blank Piece of Paper*

## Course Design and Event Setup

# Cornering Speeds in MPH

Lateral Gs	Radius of Turn in Feet																
	20	30	40	50	60	70	80	90	100	125	150	175	200	250	300	350	400
<b>0.90</b>	16	20	23	26	28	31	33	35	37	41	45	49	52	58	64	69	73
<b>0.95</b>	17	21	24	27	29	32	34	36	38	42	46	50	53	60	65	71	75
<b>1.00</b>	17	21	24	27	30	32	35	37	39	43	47	51	55	61	67	72	77
<b>1.05</b>	18	22	25	28	31	33	35	38	40	44	49	52	56	63	69	74	79
<b>1.10</b>	18	22	26	29	31	34	36	38	41	45	50	54	57	64	70	76	81
<b>1.15</b>	19	23	26	29	32	35	37	39	41	46	51	55	59	66	72	78	83
<b>1.20</b>	19	23	27	30	33	35	38	40	42	47	52	56	60	67	73	79	85
<b>1.25</b>	19	24	27	31	34	36	39	41	43	48	53	57	61	68	75	81	87
<b>1.30</b>	20	24	28	31	34	37	39	42	44	49	54	58	62	70	76	83	88
<b>1.35</b>	20	25	28	32	35	38	40	43	45	50	55	59	64	71	78	84	90
<b>1.40</b>	20	25	29	32	35	38	41	43	46	51	56	61	65	72	79	86	92
<b>1.45</b>	21	26	29	33	36	39	42	44	47	52	57	62	66	74	81	87	93
<b>1.50</b>	21	26	30	34	37	40	42	45	47	53	58	63	67	75	82	89	95

- Expect <0.90 from stock cars on street tires, 1.10 Gs from Stock and SP cars on race tires, 1.20 Gs from a non-winged car such as C Mod, and 1.45 Gs from a winged mod car
  - During analysis, be aware of the wide line which can affect the outcome

# So You Have a Blank Piece of Paper

## Course Design and Event Setup

### Acceleration and Braking Distances in Feet

#### • Acceleration distances

- The **blue/gray** portion is used to estimate distance needed to reach a certain speed
- Based on a **quick SP car**, which could do **0 - 60 mph** in **4.1 secs**

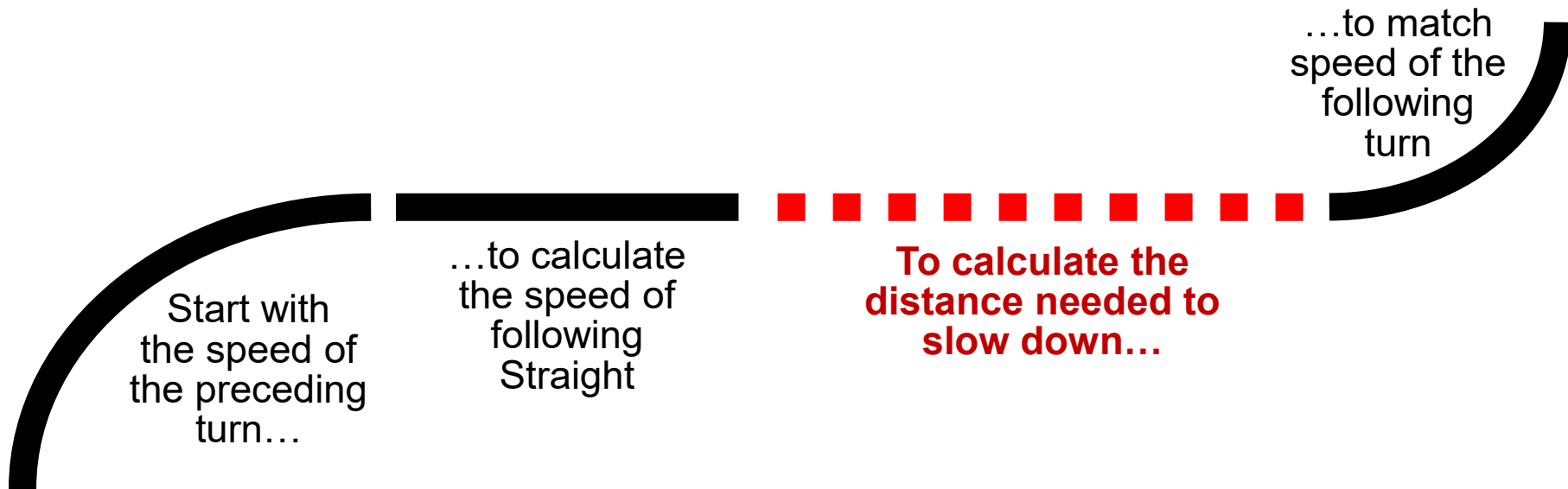
#### • Braking distances

- The **pink** half of the chart is used to estimate braking distances of lower performance cars and for estimating stop box length
- Based on **constant 0.8 g braking**, (typical published vehicle maximum braking effort on street tires)

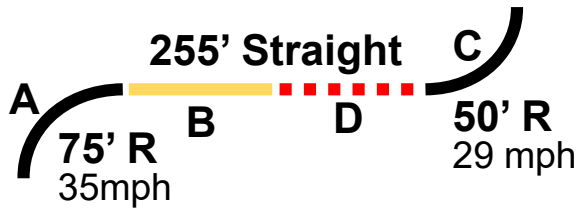
Starting Speed in MPH	Target Speed in MPH													
	0	20	25	30	35	40	45	50	55	60	65	70	75	80
0	0	15	25	37	53	70	94	121	149	180	222	267	311	358
20	17	0	12	26	42	62	88	118	149	182	228	277	338	403
25	26	9	0	14	31	50	77	107	138	171	218	268	330	397
30	38	21	11	0	17	36	63	94	125	158	206	257	320	387
35	51	34	25	14	0	19	47	78	109	143	191	243	307	375
40	67	50	41	29	16	0	28	59	91	125	173	226	291	361
45	85	68	58	47	33	18	0	31	62	96	145	198	264	335
50	104	88	78	67	53	38	20	0	31	65	114	167	234	305
55	126	110	100	89	75	60	42	22	0	34	84	138	205	277
60	150	134	124	113	99	83	66	46	24	0	50	105	173	246
65	176	160	150	139	125	110	92	72	50	26	0	54	123	197
70	205	188	179	167	153	138	120	100	78	54	28	0	69	143
75	235	218	209	197	184	168	150	130	109	85	58	30	0	74
80	267	251	241	230	216	200	183	163	141	117	91	63	32	0

	Starting Speed	Target Speed	Needed Distance
Acceleration Section	35	65	191
Braking Section	65	40	110

## Course Design and Event Setup Practical Application



## Course Design and Event Setup Practical Application



Start Speed (A)	Distance (B)	Ending Speed
35	143	60

Brake Speed	End speed (C)	Brake Distance (D)
60	29	113

### • Calculate braking distance

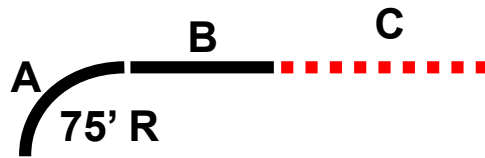
- Determine speed of turn **A**
- Determine speed of straight **B**
  - Speed of A and length of straight = speed
- Determine speed of turn **C**
- Calculate braking distance needed for **D**
  - Speed of B and target speed of C = braking distance
- 143' acceleration + 113' brake = 256' straight

Starting Speed in MPH	Target Speed in MPH													
	0	20	25	30	35	40	45	50	55	60	65	70	75	80
0	0	15	25	37	53	70	94	121	149	180	222	267	311	358
20	17	0	12	26	42	62	88	118	149	182	228	277	338	403
25	26	9	0	14	31	50	77	107	138	171	218	268	330	397
30	38	21	11	0	17	36	63	94	125	158	206	257	320	387
35	51	34	25	14	0	19	47	78	109	143	191	243	307	375
40	67	50	41	29	16	0	28	59	91	125	173	226	291	361
45	85	68	58	47	33	18	0	31	62	96	145	198	264	335
50	104	88	78	67	53	38	20	0	31	65	114	167	234	305
55	126	110	100	89	75	60	42	22	0	34	84	138	205	277
60	150	134	124	113	99	83	66	46	24	0	50	105	173	246
65	176	160	150	139	125	110	92	72	50	26	0	54	123	197
70	205	188	179	167	153	138	120	100	78	54	28	0	69	143
75	235	218	209	197	184	168	150	130	109	85	58	30	0	74

Lateral Gs	Radius of Turn in Feet																
	20	30	40	50	60	70	80	90	100	125	150	175	200	250	300	350	400
1.10	18	22	26	29	31	34	36	38	41	45	50	54	57	64	70	76	81



## Course Design and Event Setup Practical Application



Start Speed (A)	Distance (B)	Ending Speed
35	143	60
Brake Speed	End speed (C)	Brake Distance (D)
60	0	150

### • Calculate stop box length

- Determine speed of turn **A**
- Determine speed of straight **B**
- Calculate braking distance to 0 mph needed for **C**

Starting Speed in MPH	Target Speed in MPH													
	0	20	25	30	35	40	45	50	55	60	65	70	75	80
0	0	15	25	37	53	70	94	121	149	180	222	267	311	358
20	17	0	12	26	42	62	88	118	149	182	228	277	338	403
25	26	9	0	14	31	50	77	107	138	171	218	268	330	397
30	38	21	11	0	17	36	63	94	125	158	206	257	320	387
35	51	34	25	14	0	19	47	78	109	143	191	243	307	375
40	67	50	41	29	16	0	28	59	91	125	173	226	291	361
45	85	68	58	47	33	18	0	31	62	96	145	198	264	335
50	104	88	78	67	53	38	20	0	31	65	114	167	234	305
55	126	110	100	89	75	60	42	22	0	34	84	138	205	277
60	150	134	124	113	99	83	66	46	24	0	50	105	173	246
65	176	160	150	139	125	110	92	72	50	26	0	54	123	197
70	205	188	179	167	153	138	120	100	78	54	28	0	69	143

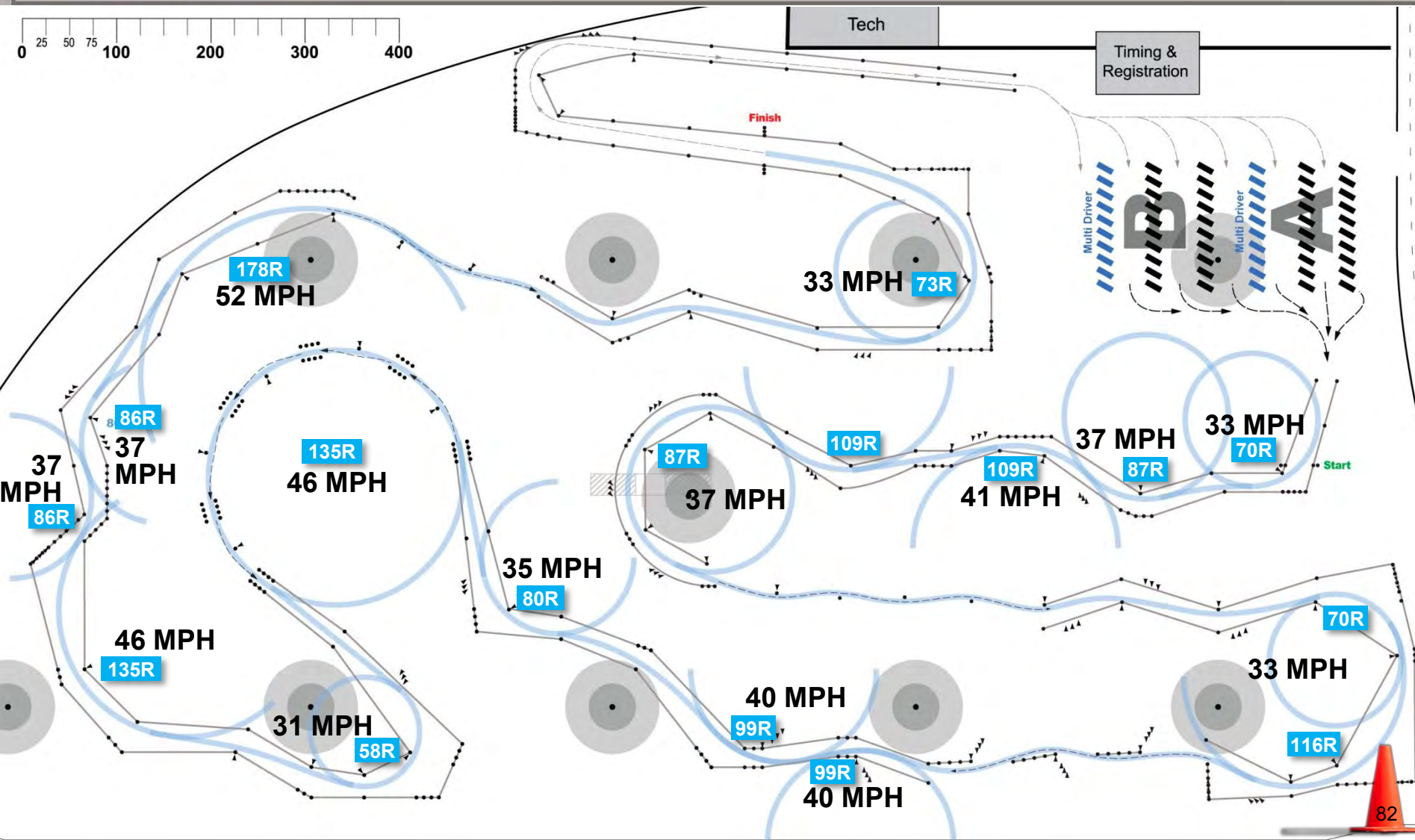
Lateral Gs	Radius of Turn in Feet																
	20	30	40	50	60	70	80	90	100	125	150	175	200	250	300	350	400
1.10	18	22	26	29	31	34	36	38	41	45	50	54	57	64	70	76	81

### • Be sure to add plenty of margin to the actual stop box so that all cars can easily slow/stop within the box

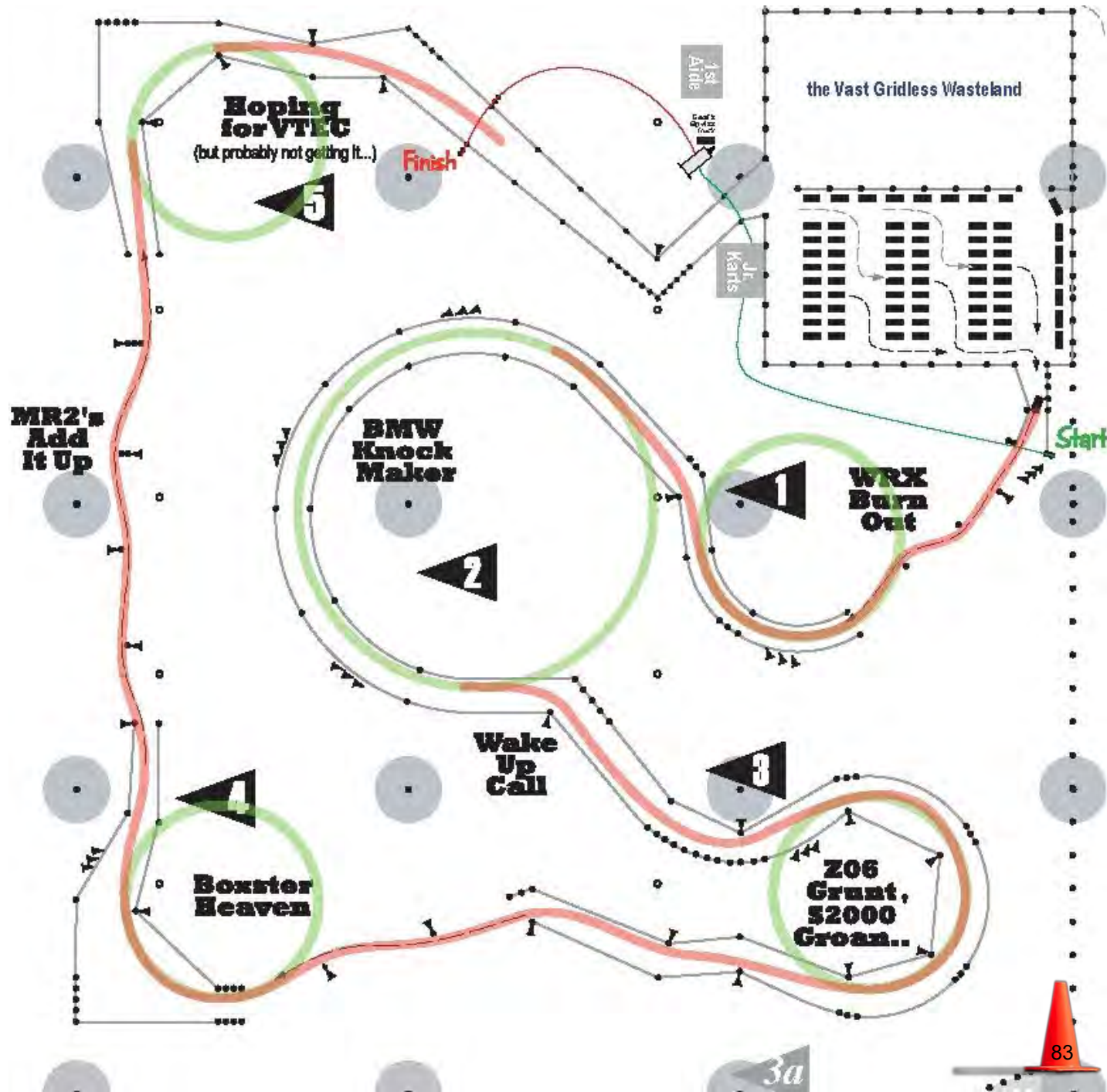
- 150' brake + 50' reaction time = 200' stop box
- In addition, when raining, these stop distances increase considerably (about double)



# Flow Analysis

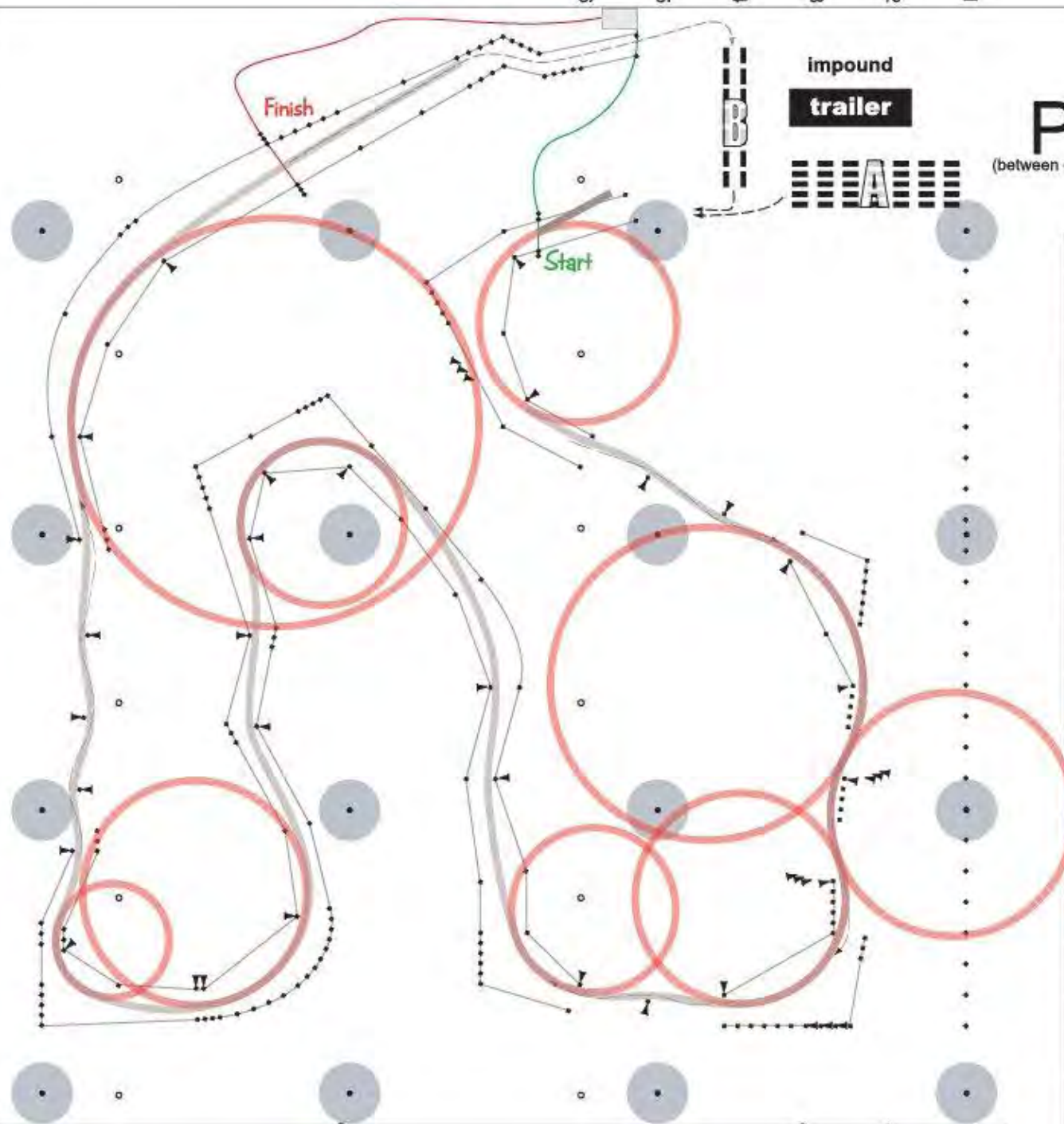


Bezier curve analysis helps to plan a fast line through sections that look slow, as well as discover sections that look fast but are truly painful









impound  
trailer

**Pits**  
(between course and road)

# Seagull Target Practice

Precision Racing Org  
Championship Series

**Event #3**  
LaMarque, TX

Dog Track  
Facility

Curb and Chain link fence

Timing Truck

~200'

Finish

Grid

Light pole

Light pole

**181' R = ~55 mph speed in turn,  
followed by 100' straight**

# Whats Wrong With this Finish?

Light pole



Curb and Chain link fence

**Curb and fence too close for speed of finish**

~200'

**Finish**

Light pole

Timing Truck

**Timing truck too close**

Grid

**181' R = ~55 mph speed in turn, followed by 100' straight**

- Turn too fast for length of finish (does not slow car)

- 55 mph turn + 100' straight = ~68mph at the lights on DOT Race Tires
- Stopping distance ~200' in a 200' stop box – and no one stops right at the lights...

Starting Speed in MPH	Target Speed in MPH													
	0	20	25	30	35	40	45	50	55	60	65	70	75	80
0	0	15	25	37	53	70	94	121	149	180	222	267	311	357
20	17	0	12	26	42	62	88	118	149	182	228	277	330	384
25	26	9	0	14	31	50	77	107	138	171	218	268	323	377
30	38	21	11	0	17	36	63	94	125	158	206	257	312	366
35	51	34	25	14	0	19	47	78	109	143	191	243	300	353
40	67	50	41	29	16	0	28	59	91	125	173	226	284	340
45	85	68	58	47	33	18	0	31	62	96	145	198	257	314
50	104	88	78	67	53	38	20	0	31	65	114	167	226	284
55	126	110	100	89	75	60	42	22	0	34	84	138	197	257
60	150	134	124	113	99	83	66	46	24	0	50	105	164	224
65	176	160	150	139	125	110	92	72	50	26	0	54	120	180
70	205	188	179	167	153	138	120	100	78	54	28	0	69	129
75	235	218	209	197	184	168	150	130	109	85	58	30	0	79
80	267	251	241	230	216	200	183	163	141	117	91	63	32	0



# Designing a Safe Finish

## No Simple Solution

- Every change you make - will impact somewhere else
- Humans can be totally unpredictable
  - So **plan** the finish carefully
    - Each site offers its own strengths/weaknesses, and finishes are too often **afterthoughts** rather than well-planned
    - Ensure **adequate room** for runout, ingress, egress, timing, and all of the other associated issues
- Some of the things that often don't work to control finish speed:
  - **Tight slalom** right before the finish lights
  - Finish lights **near** exit of **decreasing-radius turn**
- Some of the things that often do work:
  - **90 or sharper** turn before *a straight to lights*
  - Moderate **slalom** before *a straight to lights*
  - **S-turn sequence** before *a straight to lights*

*So You Have a Blank Piece of Paper*  
**Designing a Safe Finish**  
**Consider Human Nature**  
**(stupid humans!)**

- Allow them to **“FLOOR IT”** at the finish
  - Most drivers tend to **floor at the finish** in an effort to make up for ALL of the mistakes made up to that point – even if the **design does not allow for it**
  - Since they will do it anyway, (site size allowing) provide opportunity to floor it **SAFELY**
- How can entrants floor it at the finish safely?
  - By making them **slow enough** at the point they begin to floor it for the finish
  - In addition, the **car MUST be settled** when floored or you get a high speed spin
  - The **turn preceding** the straight before the lights must be **\*completed\*** (meaning the car is settled and not wagging) ~100' from the lights
- Make it safe for everyone by planning for the **“unintended line”**
  - Even when the **correct line** ends 100' prior to the lights, will the **wrong approach** end the turn 100' prior to the lights?
    - If not, they will likely be out of control, and flooring it at the finish
  - Walk/drive it **as intended** (on line), and **\*then\*** **as not intended** (not on line)
    - The course will look much different when driven not as intended

## **Designing a Safe Finish Tweaking it at Set Up**

- **Dealing with Acceleration Intoxication**
  - **Impairs the driver's judgment** when to safely stop; and nobody brakes at the lights
    - Can result in going **through the end** of the **finish**; **plan for this**
  - **Define the finish clearly**
    - **Alternately colored cones** after the finish lights; Different **flour line pattern**; Nothing near end of **stop box**
- **Allow enough course area for your finish**
  - Layout the **finish first**, then route the rest of the course to join the start
  - A fast finish should **have 200'; or 250'+** after the lights (refer to speed chart)
  - Long enough to allow stopping with **brakes locked** (not the best way to stop)
  - **Ample buffer** after the end of the finish lane (faster = more buffer – 75' minimum)
- **Make it safe for everyone by planning for the “unintended line”**
  - Test drive it **as intended** (on line), and \*then\* **as not intended** (not on line)
    - The course will look much different when driven not as intended

## Designing a Safe Finish Checklist

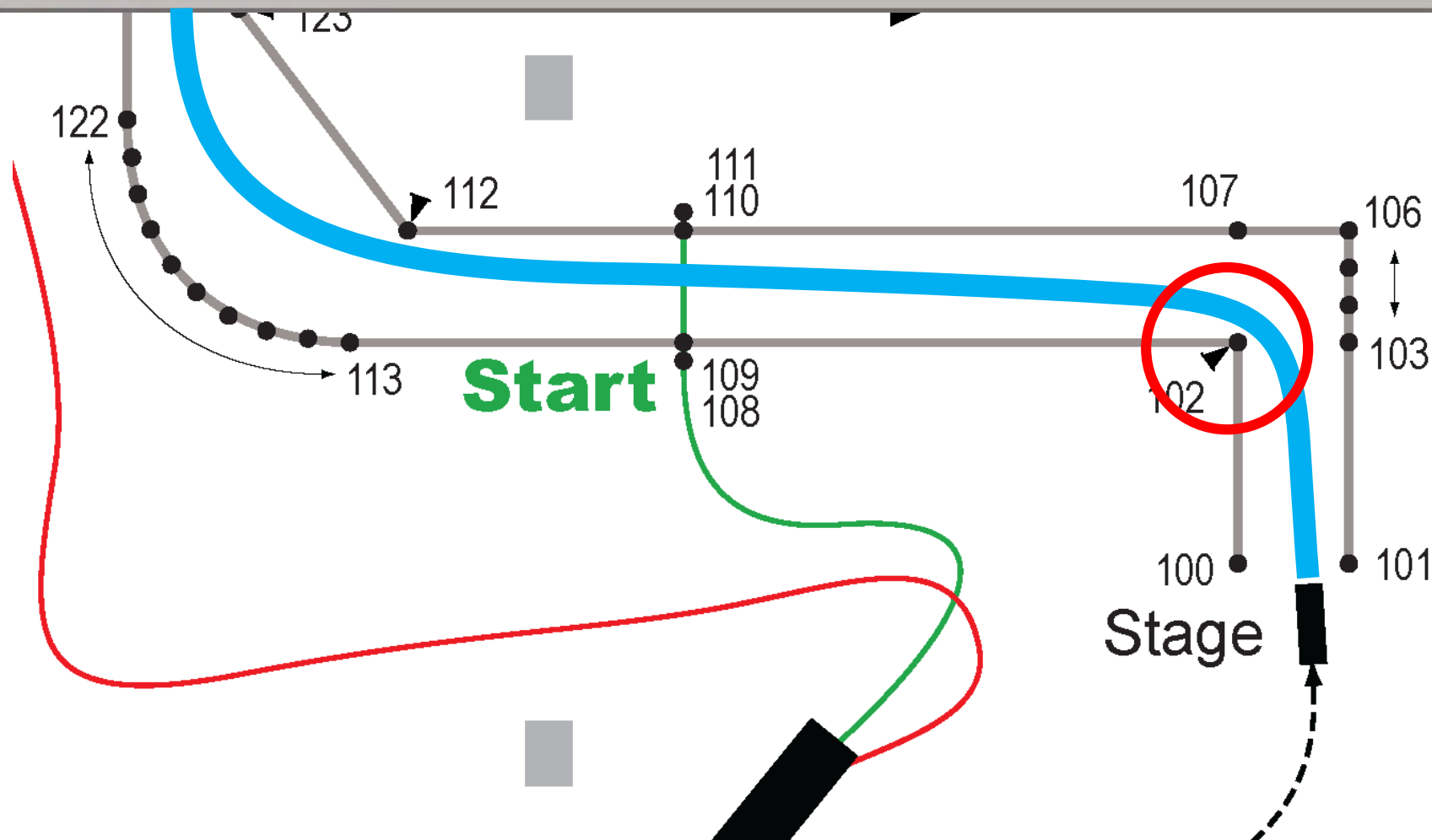
- **In summary, a safe finish:**

- 1.) Allows enough course area to **stop easily**
- 2.) Allows the entrant to “**floor it**” on the **last 100’** to the finish - **SAFELY**
- 3.) Includes a **slowing turn** that is completed **before** the 100’, even if **driven incorrectly**
- 4.) Has considered and been revised for the “**unintended line**”
- 5.) Considers what lies **beyond the finish lane**
- 6.) Does **NOT** depend on **common sense** to prevent an incident

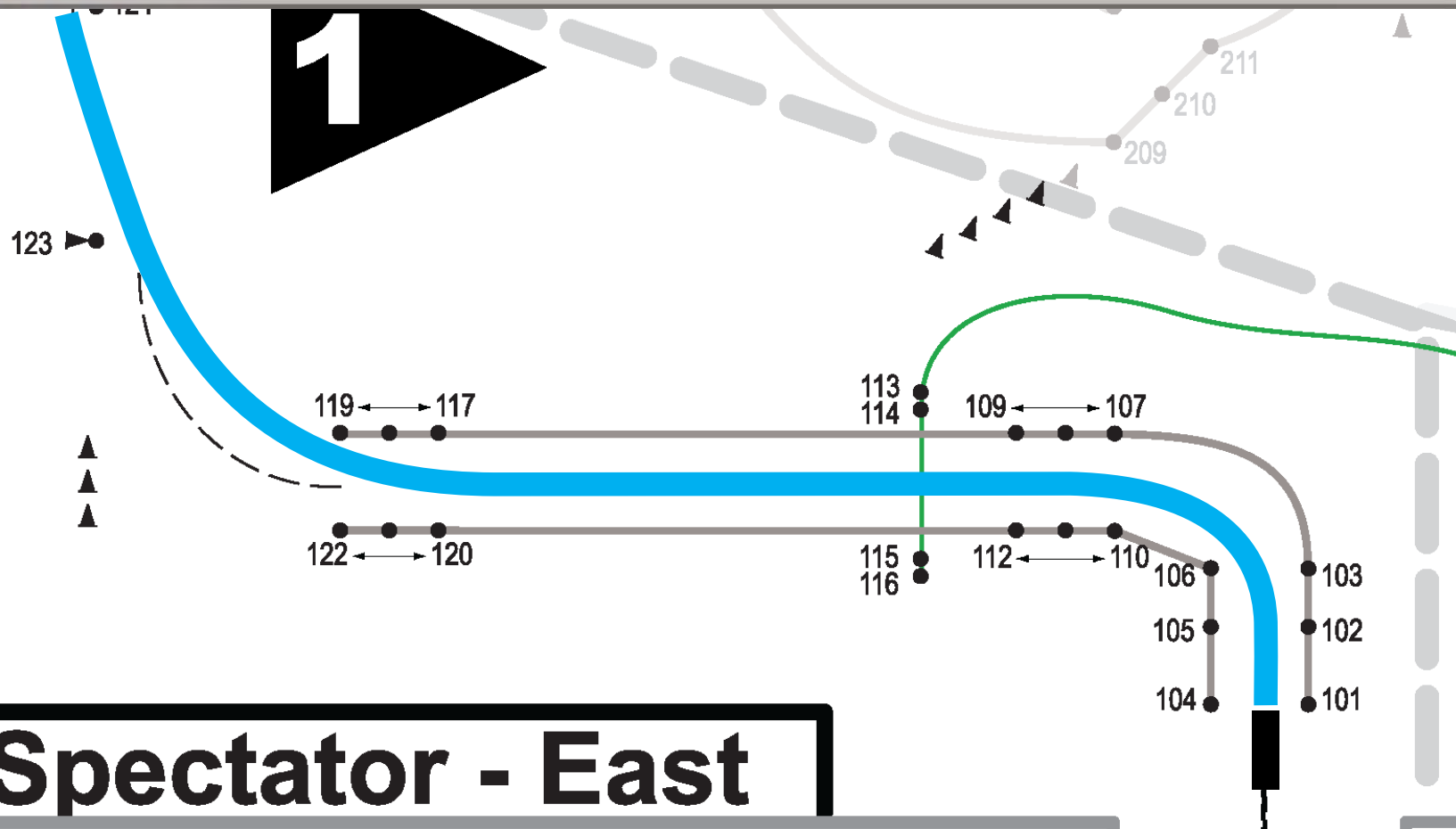
- **Words of wisdom**

- If **course length has to be given up** to provide enough run out after the lights, so be it
  - It will only cost about a second to give another 50-70 feet to the finish
- Make sure the “**slowing turn**” to rein in speeds before the finish, **actually slows**
- It's better to have **folks grumble** about slower speeds than it is to **have an incident**

## Starts and Finishes Turn Before

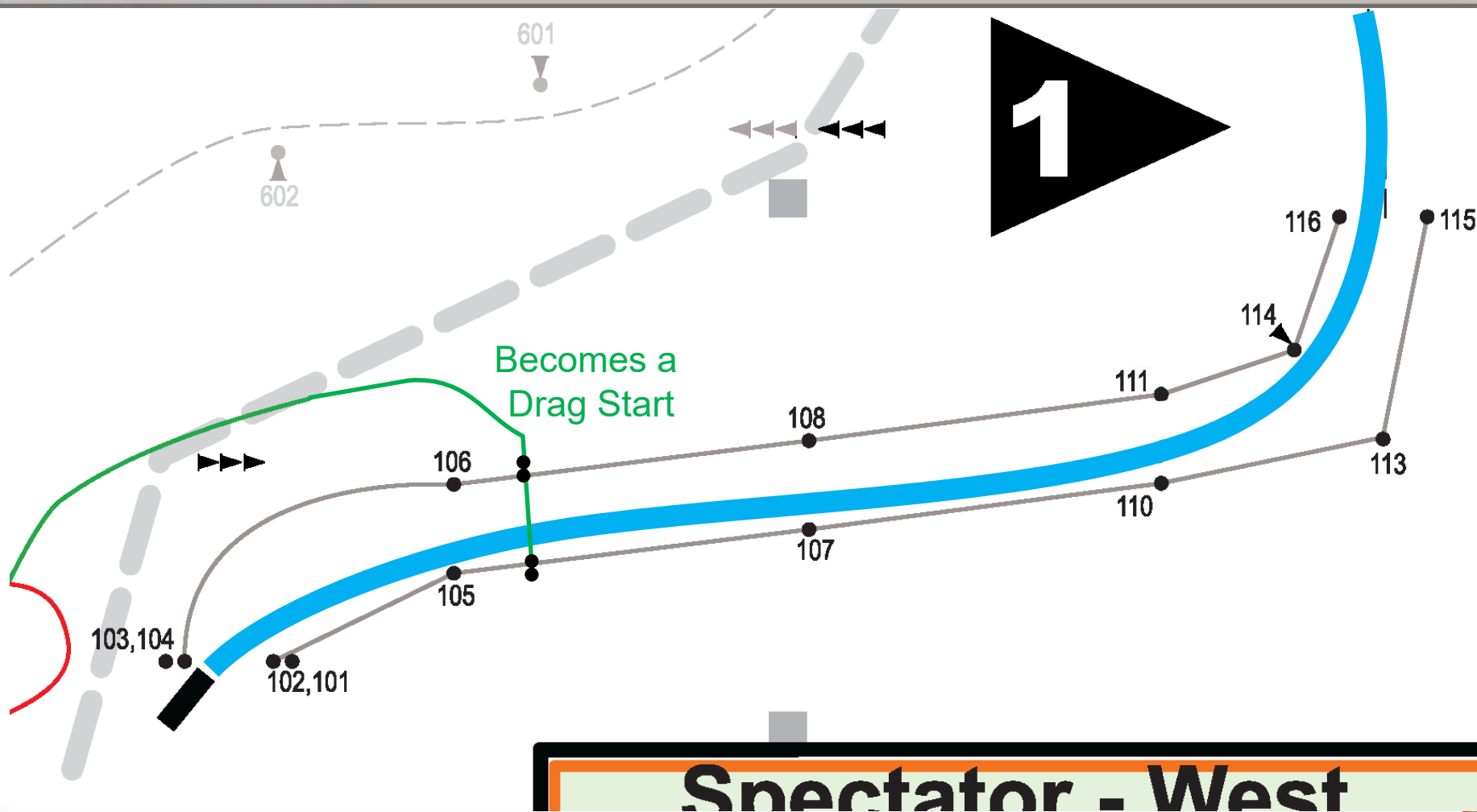


## Starts and Finishes Turn Before

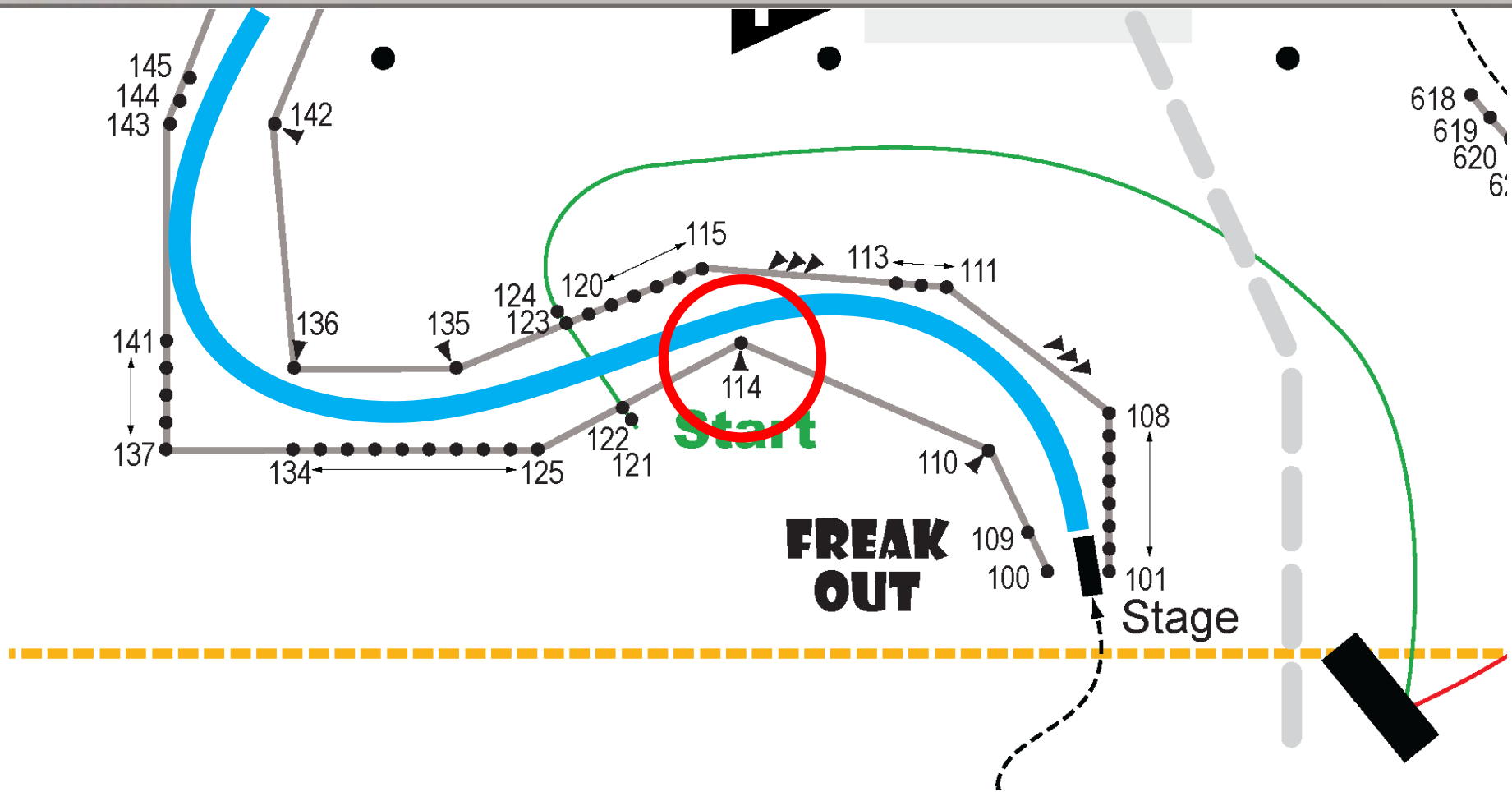




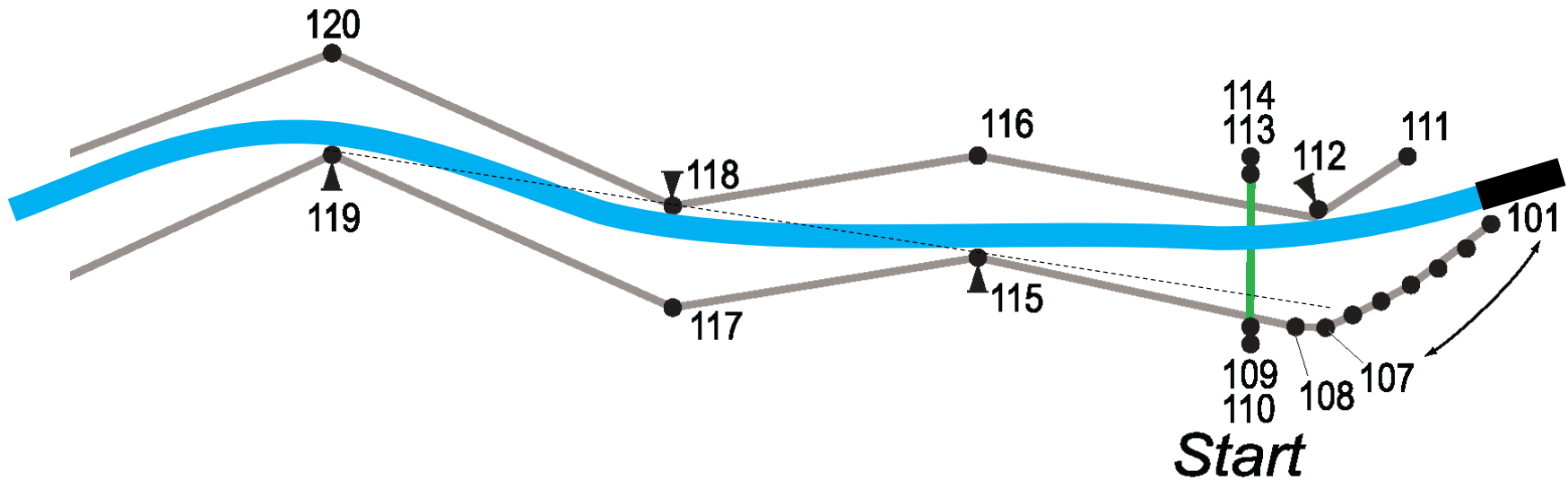
# Starts and Finishes Turn After



## Starts and Finishes Turn Before and After the Lights



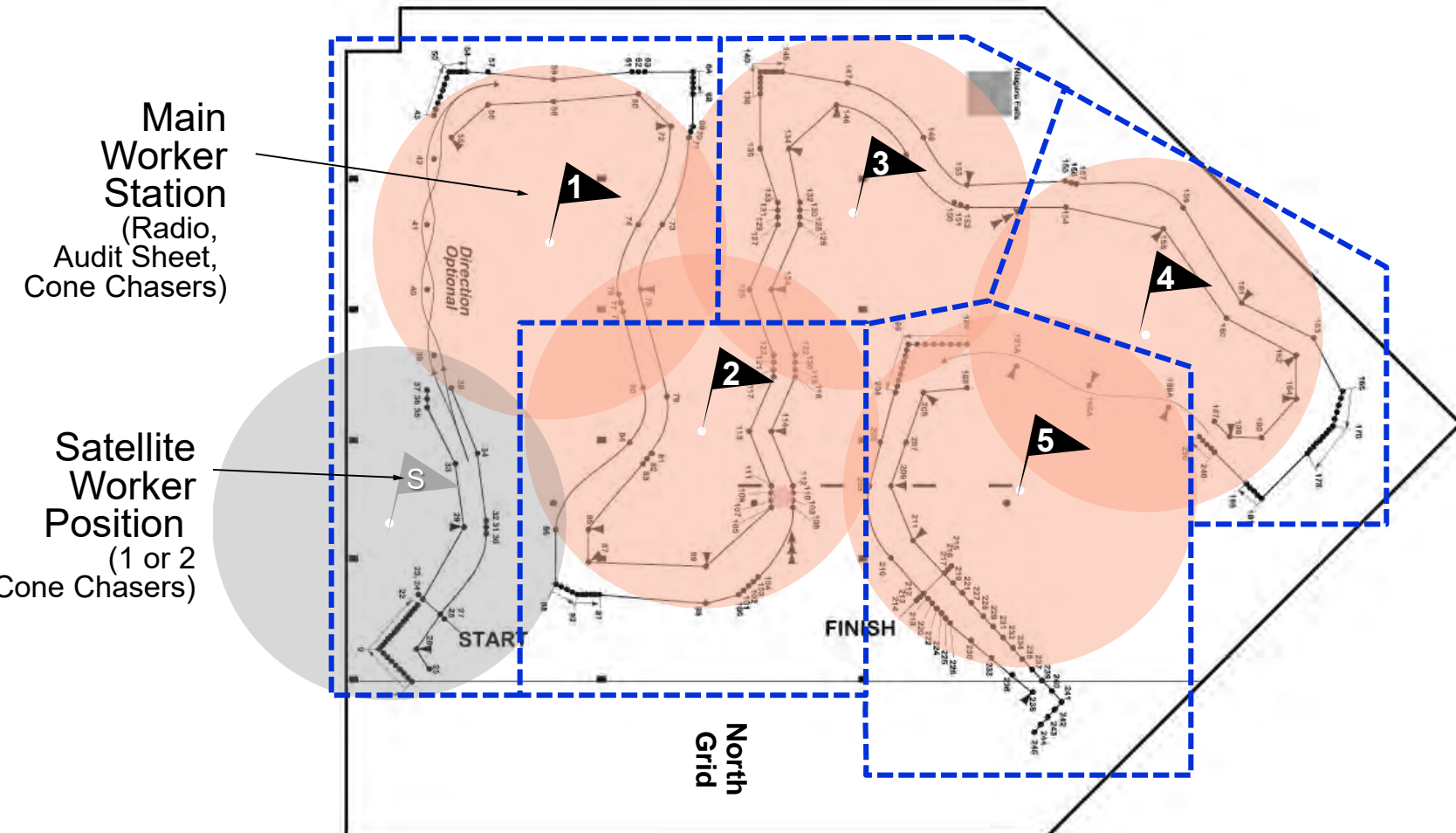
## Starts and Finishes Effectively a Drag Race Start



## Worker Stations

- Now add the projected course worker stations and projected coverage area
  - Keep coverage distances around **200 feet** in any direction 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

# Placing Worker Stations



## Course Set Up at the Event Site

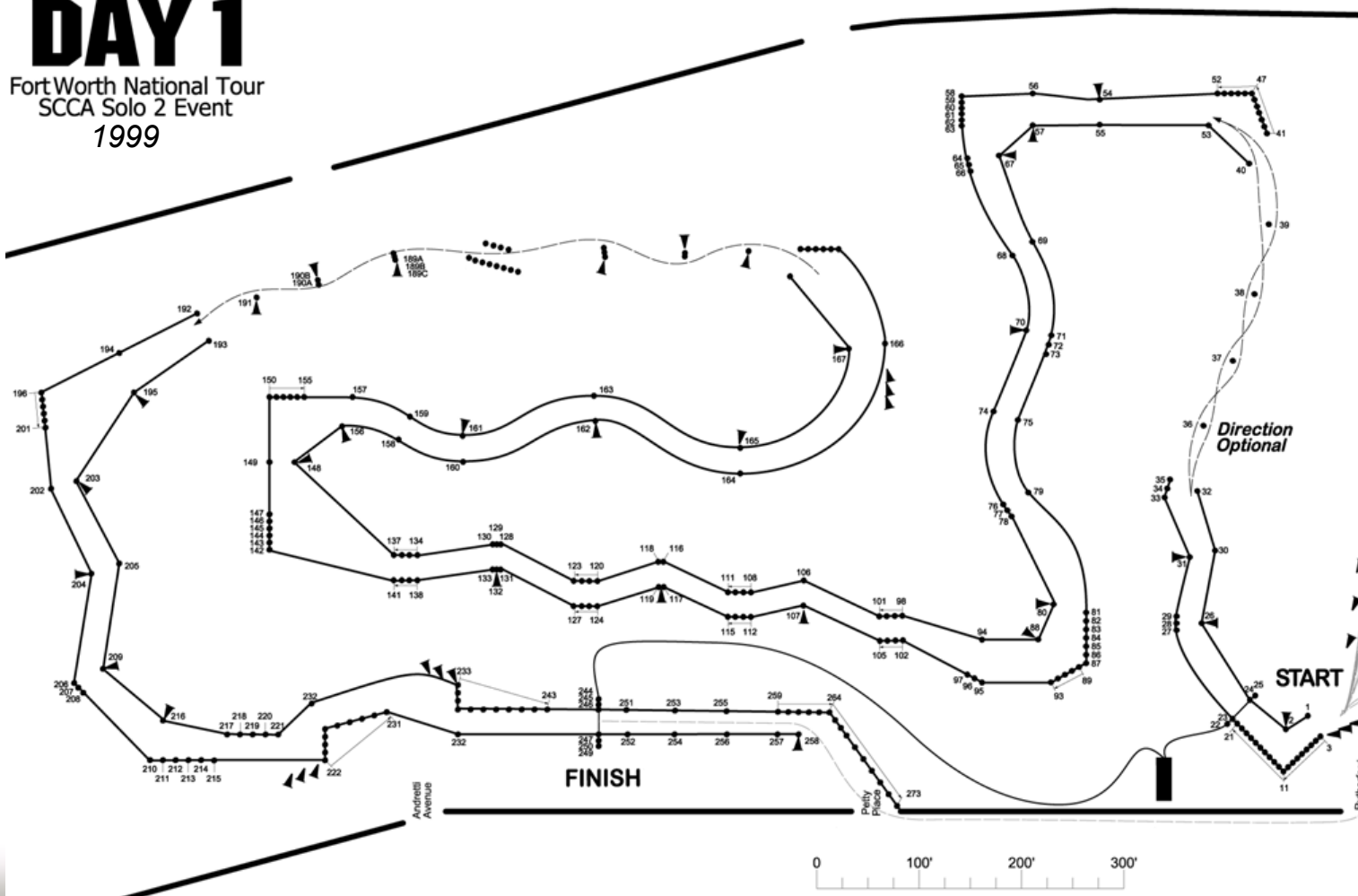
- **Things are not always what they seem - or - I could have sworn they'd have to lift there!**
  - It is rare to be able to say that the entire design **worked the way it was intended**
    - The 1995 Nationals course shown earlier turned out to be **flat out from the start** until the first 90° turn - 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
      - 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**



# Large, Expansive Sites

## DAY 1

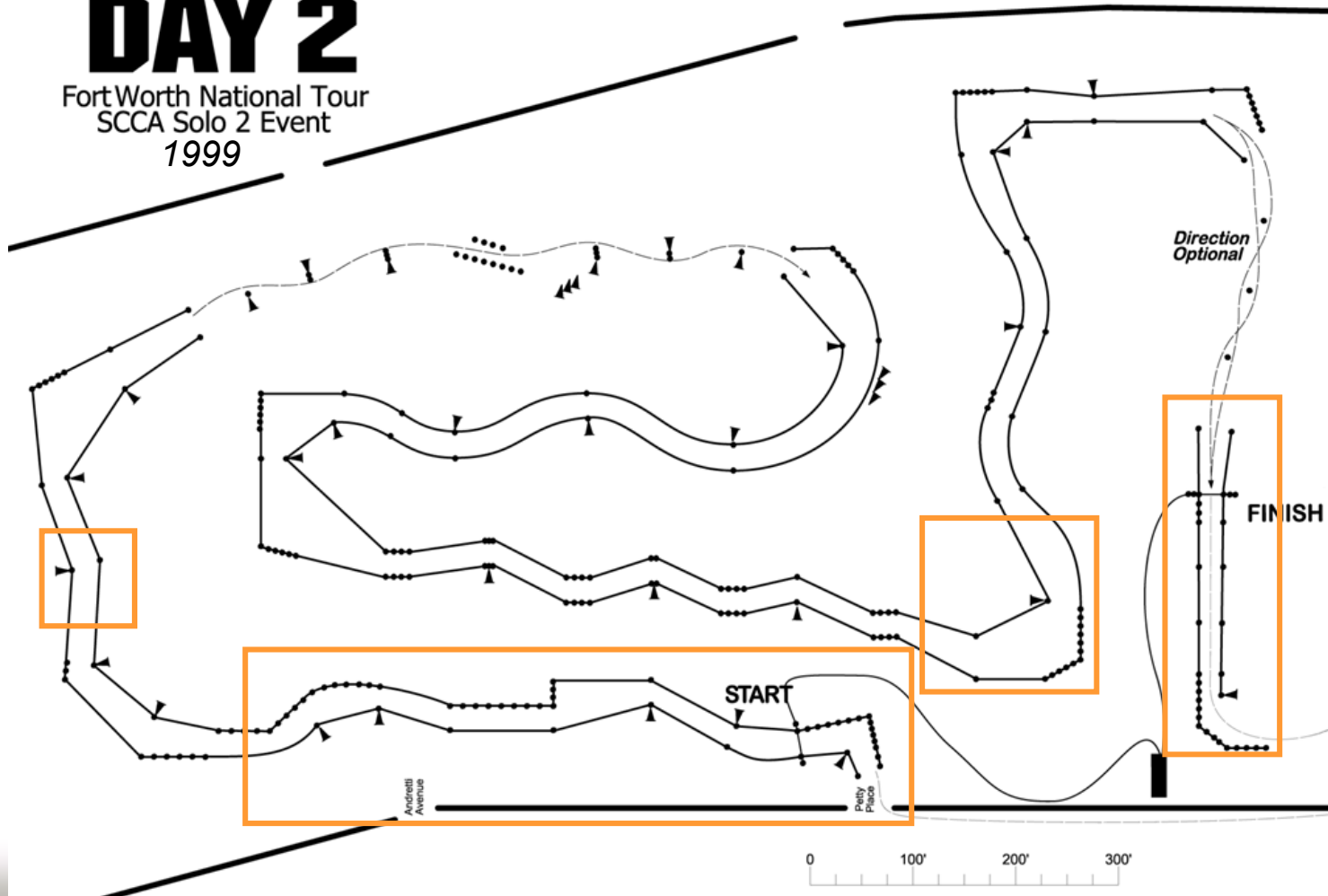
Fort Worth National Tour  
SCCA Solo 2 Event  
1999



# Large, Expansive Sites (continued)

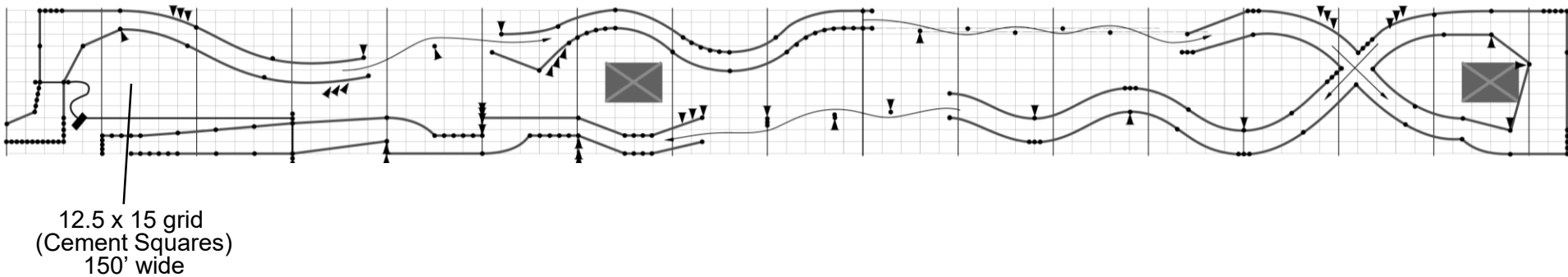
## DAY 2

Fort Worth National Tour  
SCCA Solo 2 Event  
1999



□ Differences between Day1 and 2 besides course direction

# Long Skinny Sites



- **How about a “long and skinny” event site?**
  - Avoid slalom down, 180° turn, slalom back
  - Balance between slaloms, sweeping turns, and offset gates, just as you would in an open lot
  - You just have to be more creative to do so... 8^)

# Narrow Road Course Sites

The Houston Region SCCA presents

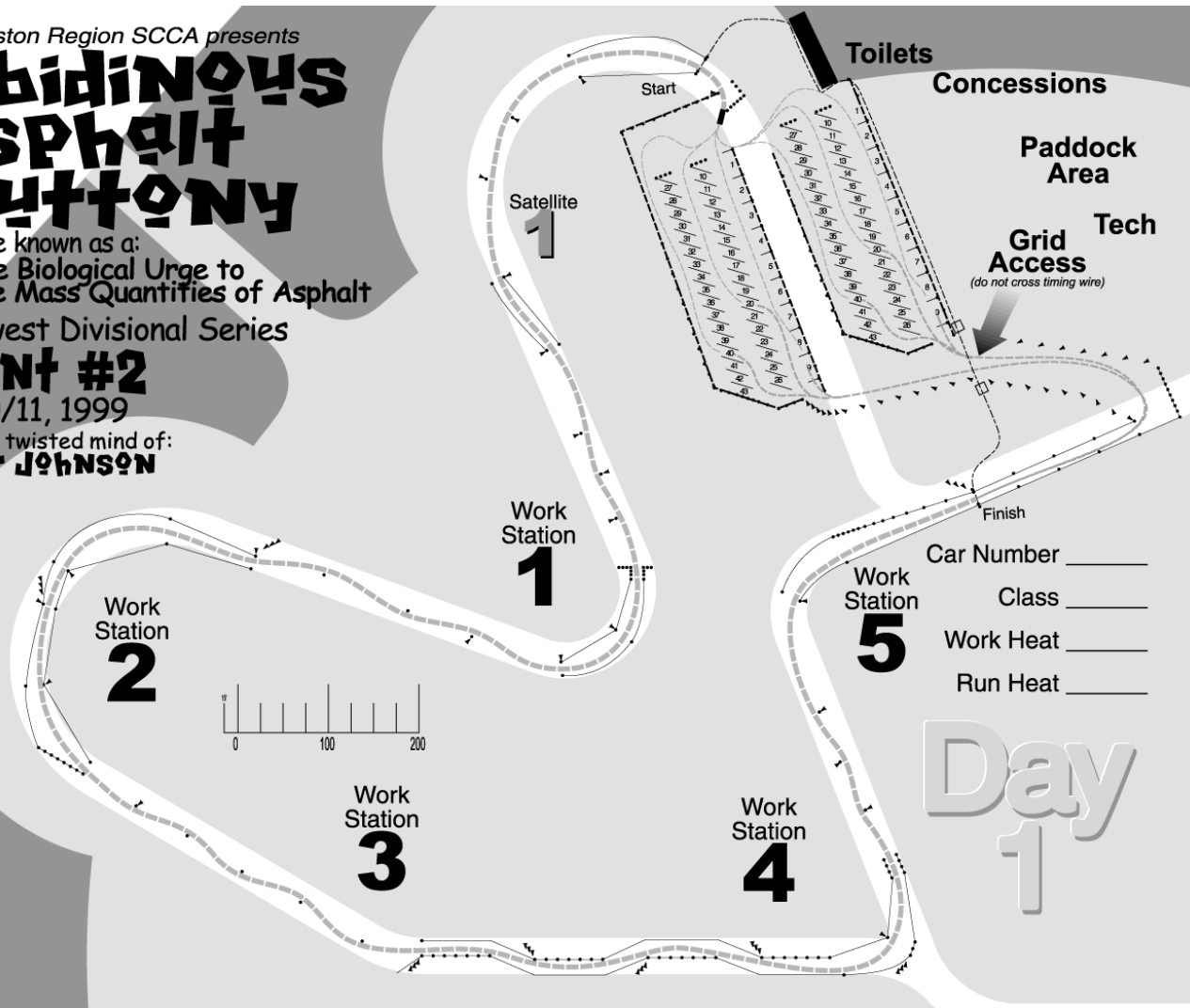
## Libidinous Asphalt Gluttony

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**



# Narrow Road Course Sites (continued)

The Houston Region SCCA presents

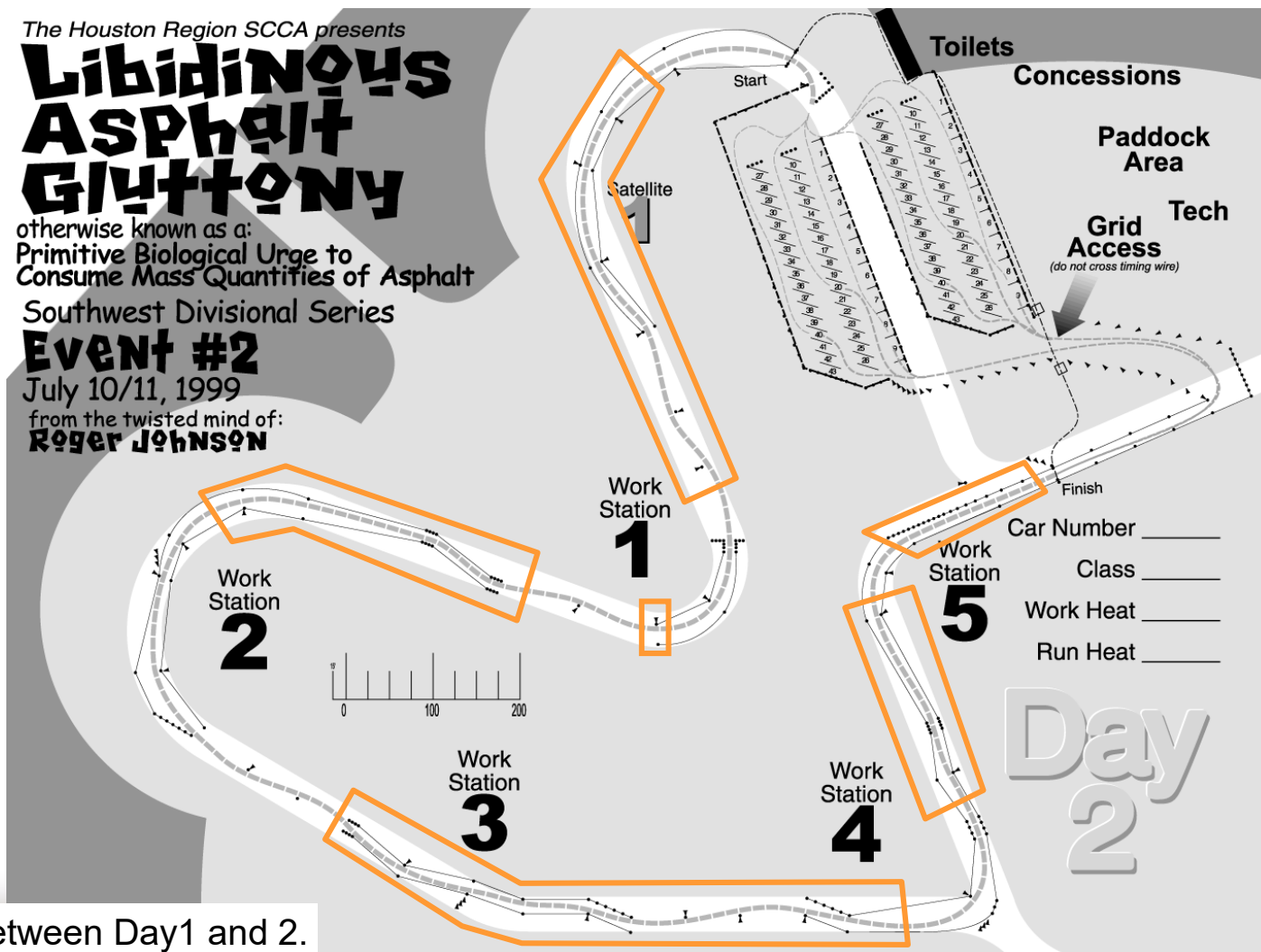
## Libidinous Asphalt Gluttony

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### Event #2

July 10/11, 1999

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

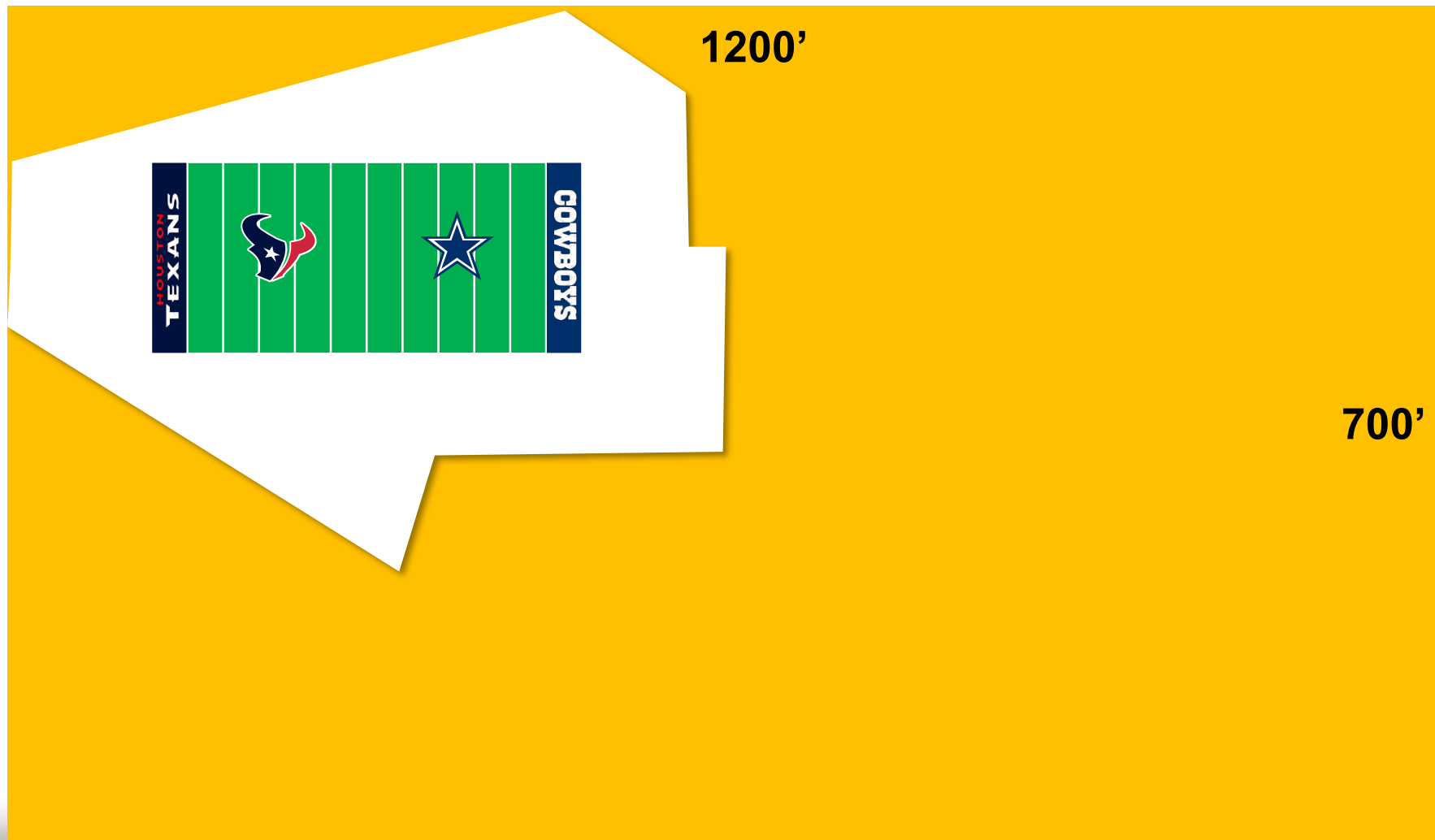


Car Number \_\_\_\_\_  
Class \_\_\_\_\_  
Work Heat \_\_\_\_\_  
Run Heat \_\_\_\_\_

Day  
2

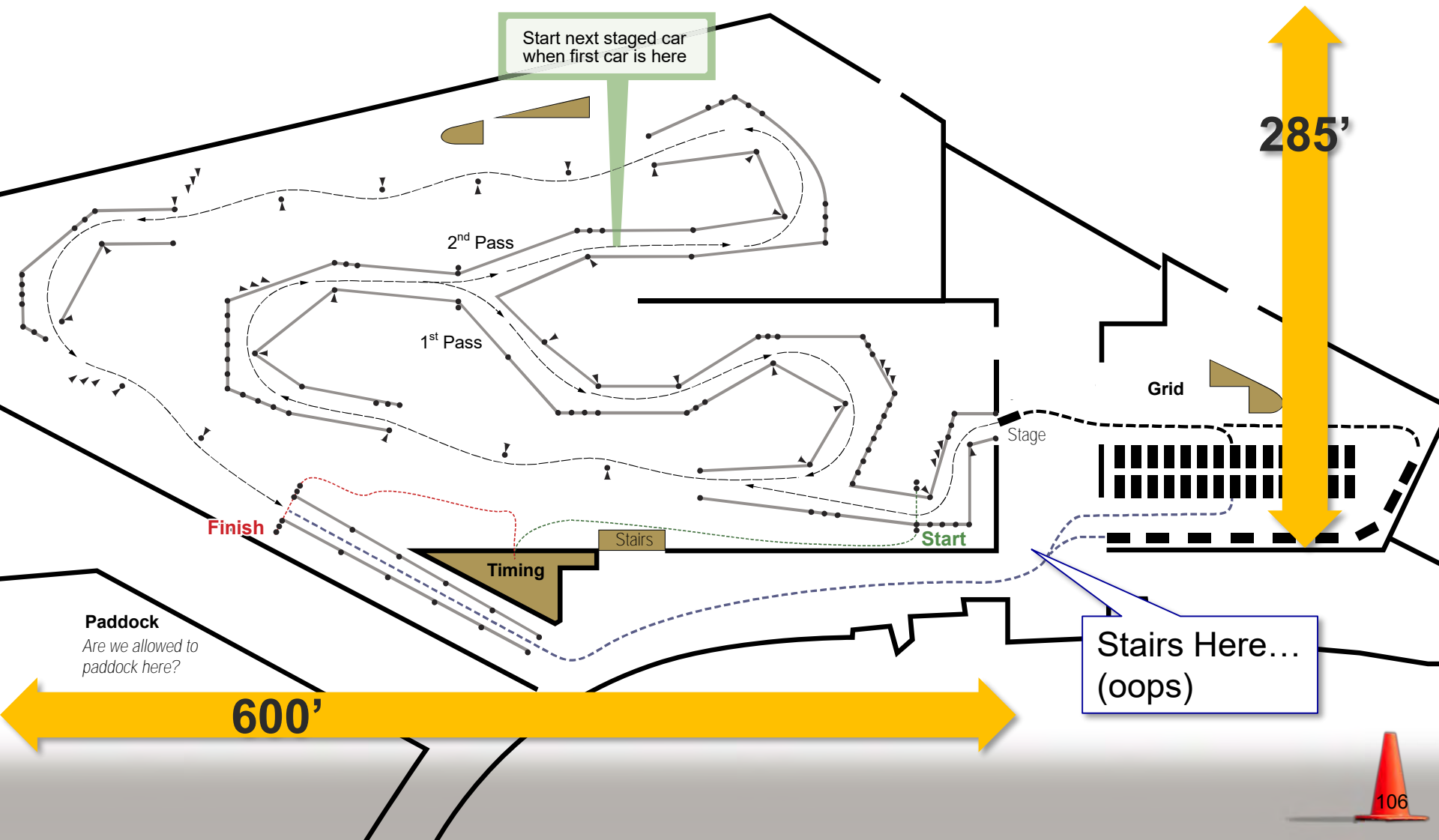
□ Differences between Day1 and 2.  
Note that course direction is same both days

*So You Have a Blank Piece of Paper*  
**Small Or Odd Shaped Lot Utilization**  
**Estadio Monumental vs.**  
**SCCA Nationals East Course Area**

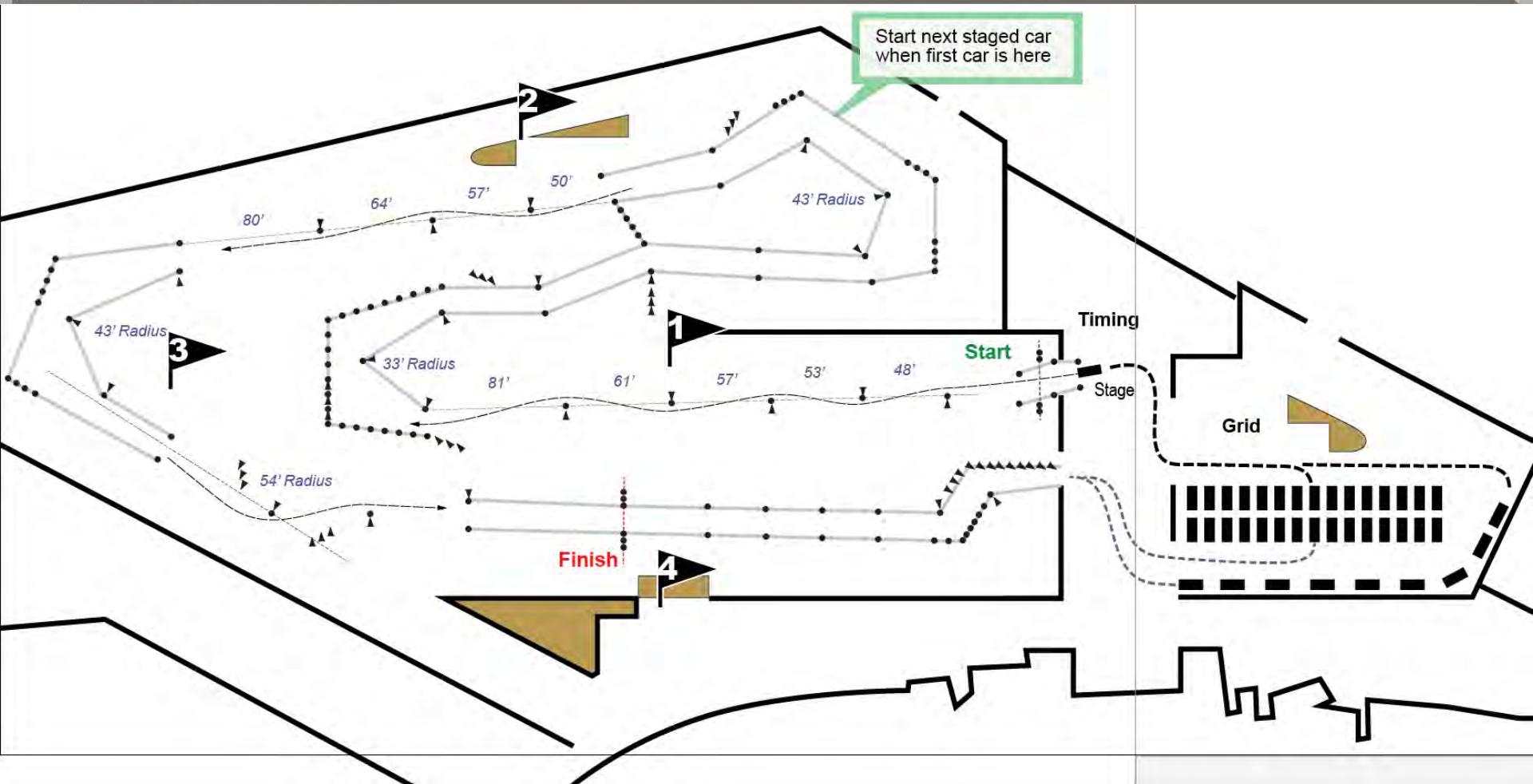




## Small Or Odd Shaped Lot Utilization Estadio Monumental First Try



## Small Or Odd Shaped Lot Utilization Estadio Monumental

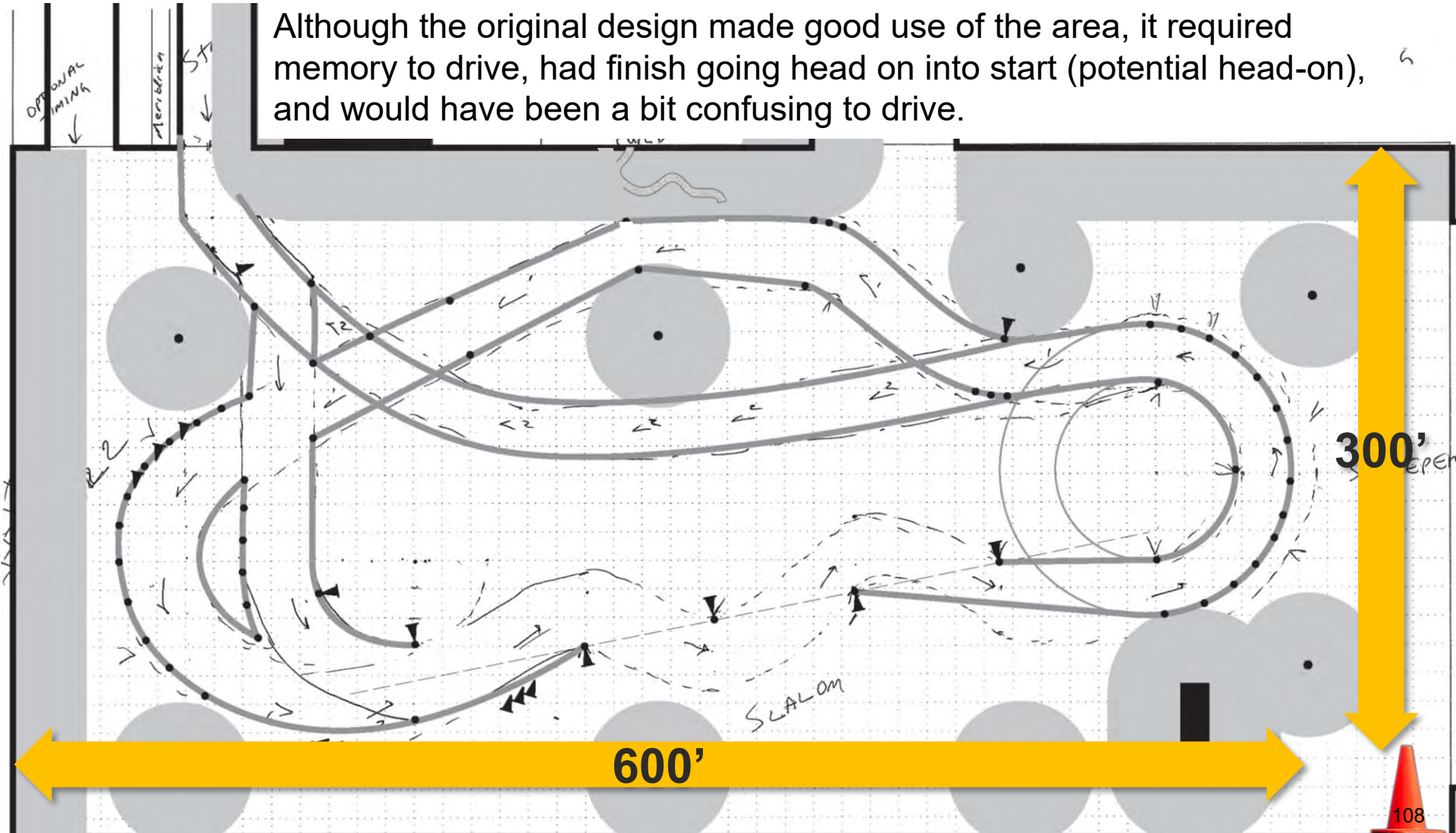


*So You Have a Blank Piece of Paper*  
**Small Or Odd Shaped Lot Utilization**  
**Lumber Yard vs.**  
**Solo Nationals East Course Area**



## Small Or Odd Shaped Lot Utilization Lumber Yard Site

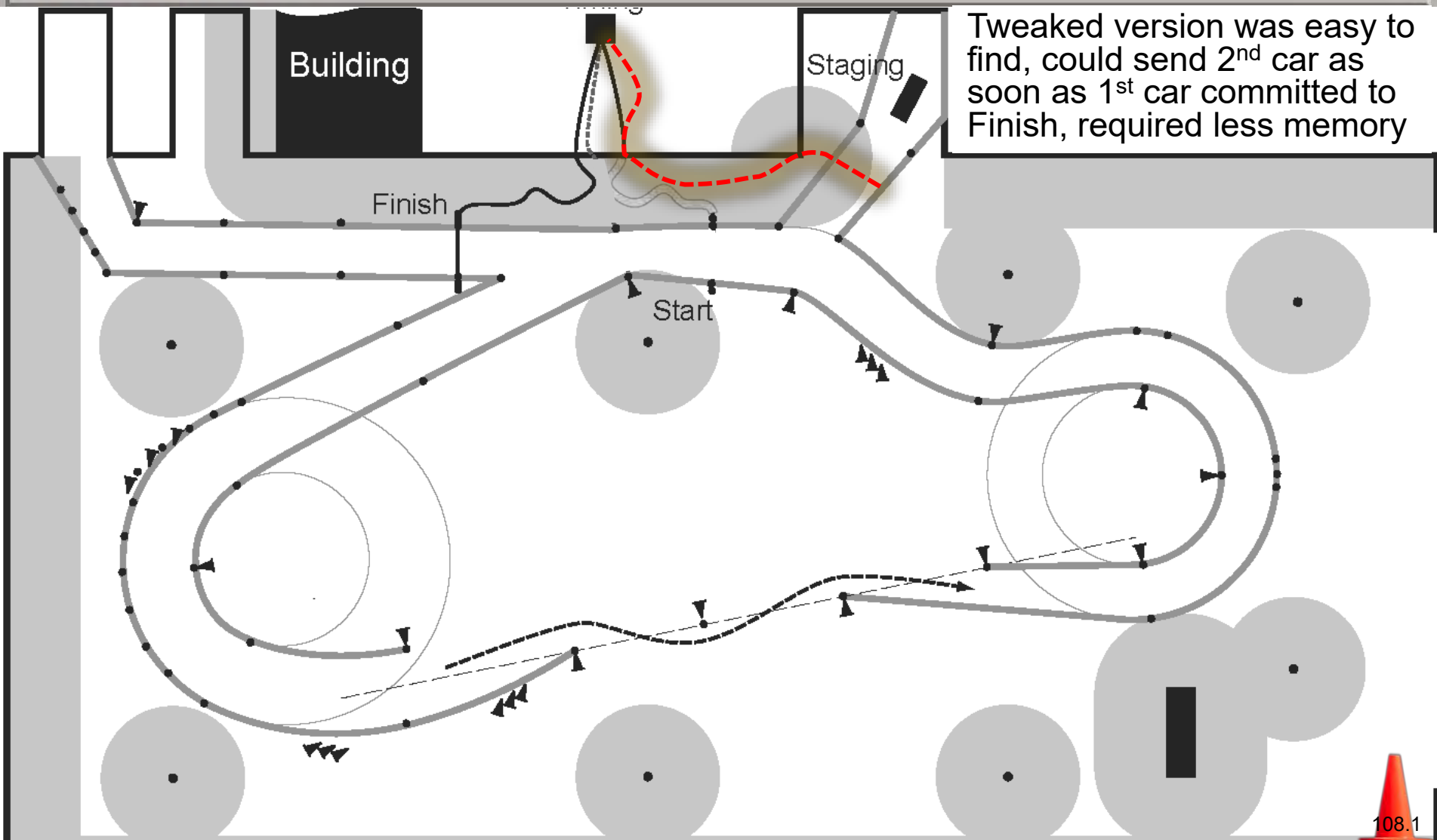
Although the original design made good use of the area, it required memory to drive, had finish going head on into start (potential head-on), and would have been a bit confusing to drive.





## Small Or Odd Shaped Lot Utilization Lumber Yard Site

Tweaked version was easy to find, could send 2<sup>nd</sup> car as soon as 1<sup>st</sup> car committed to Finish, required less memory



# **My Frozen Butte vs. Solo Nationals East Course Area**





# My Frozen Butte Up the Old Glenn Hwy

100'x25'

## Building

Start

this road  
not to scale

125'

150'

600'

75'

## Tower

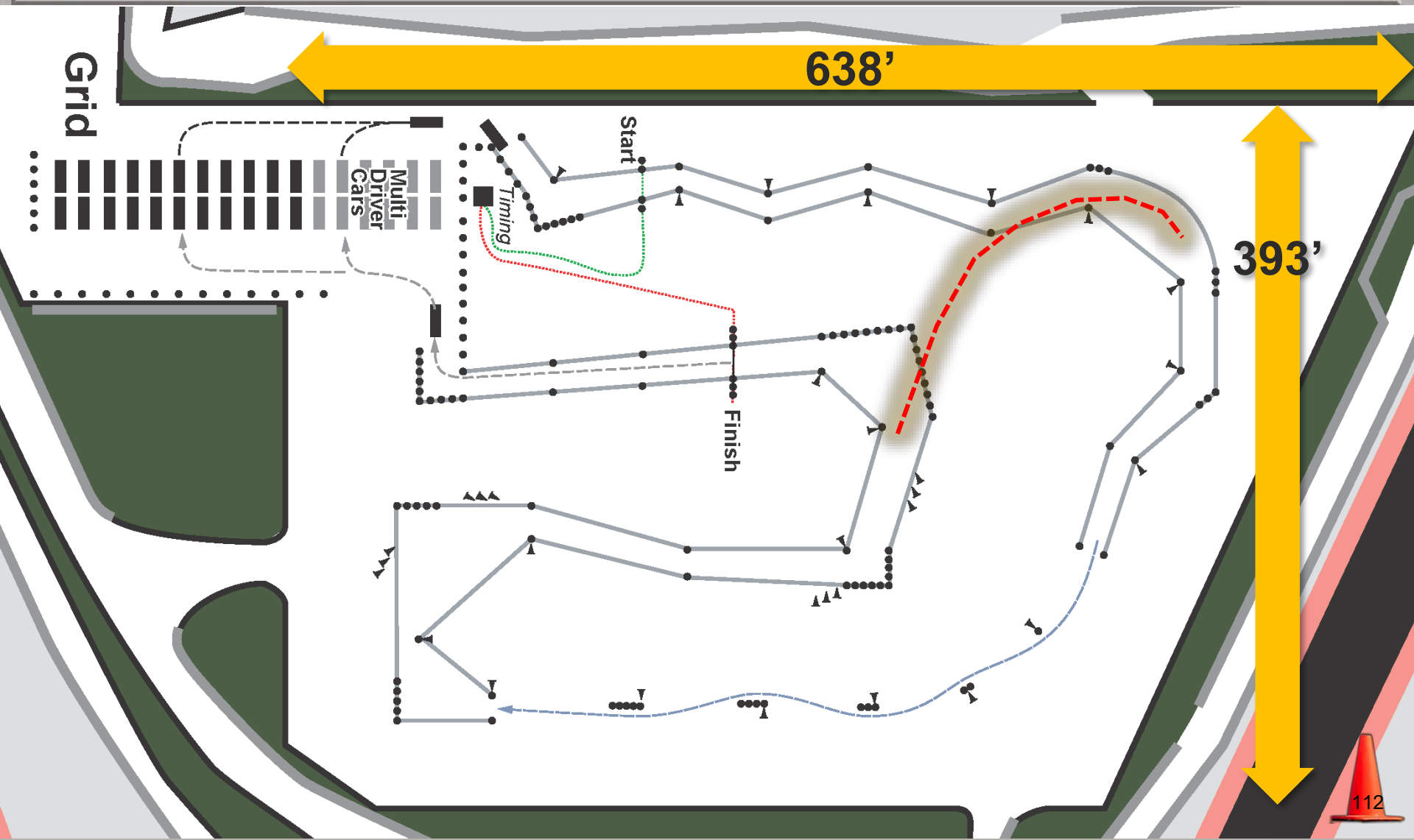
this road  
not to scale

110

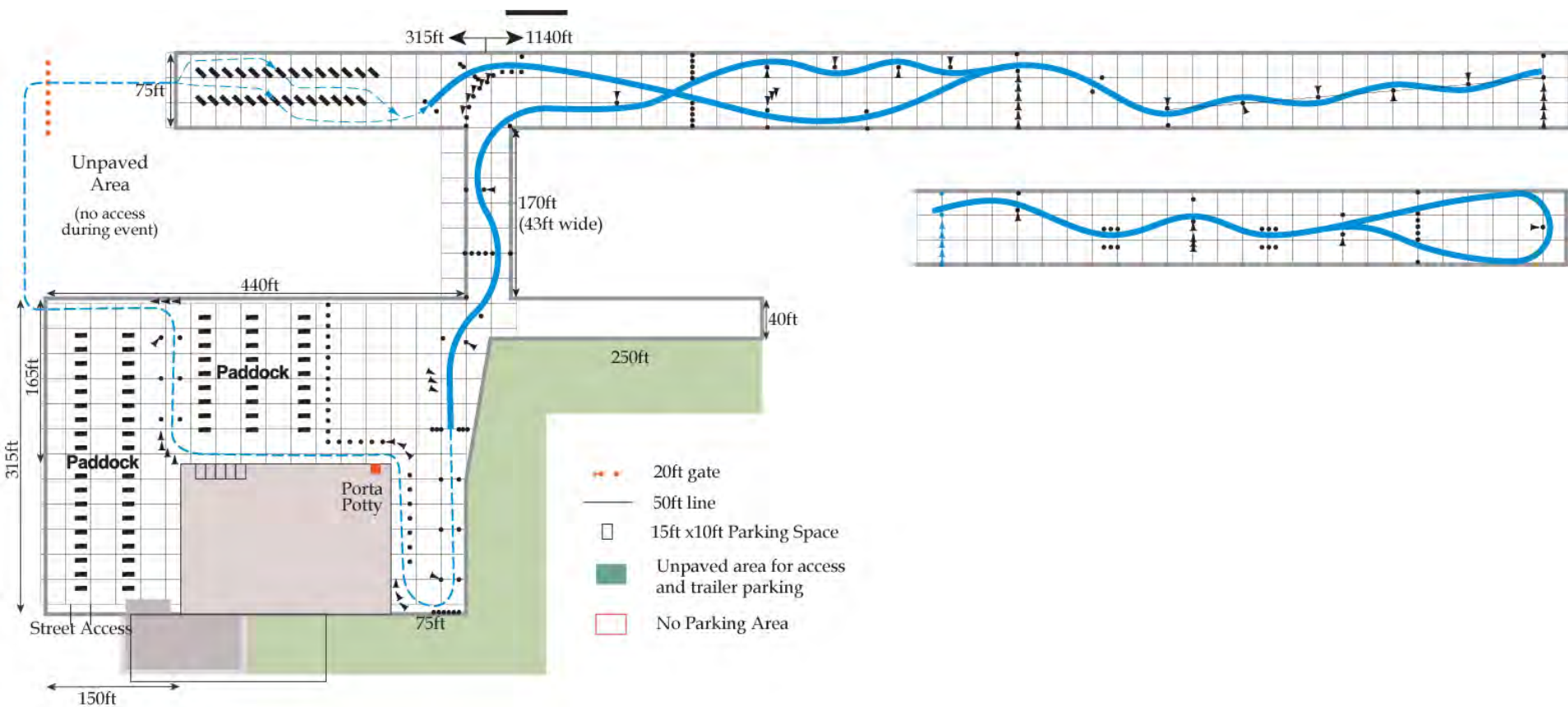
*So You Have a Blank Piece of Paper*  
**Small Or Odd Shaped Lot Utilization**  
**COTA vs. Solo Nationals**  
**East Course Area**



## Small Or Odd Shaped Lot Utilization Circuit of the Americas (COTA)

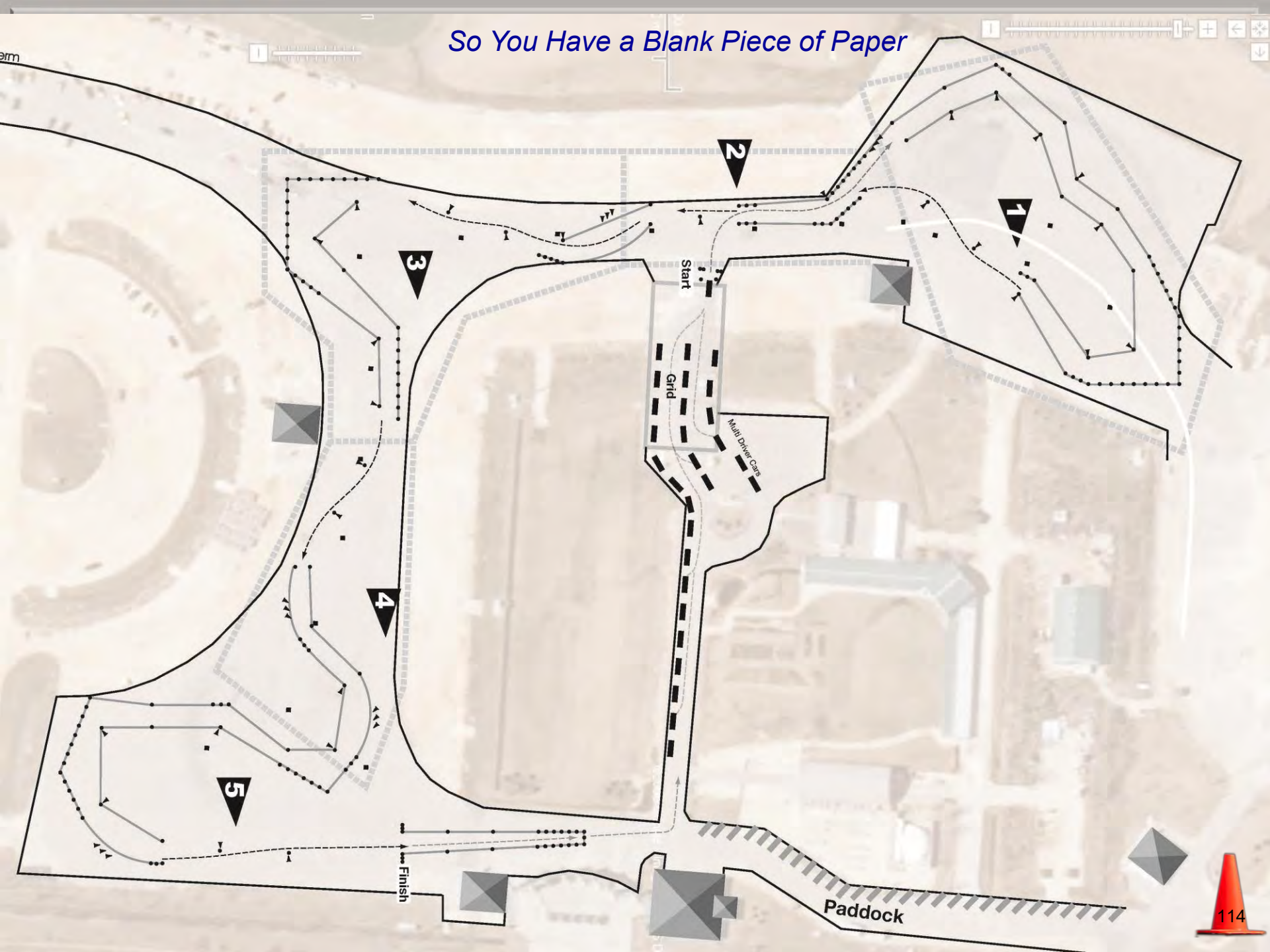


# Other Difficult Shaped Sites



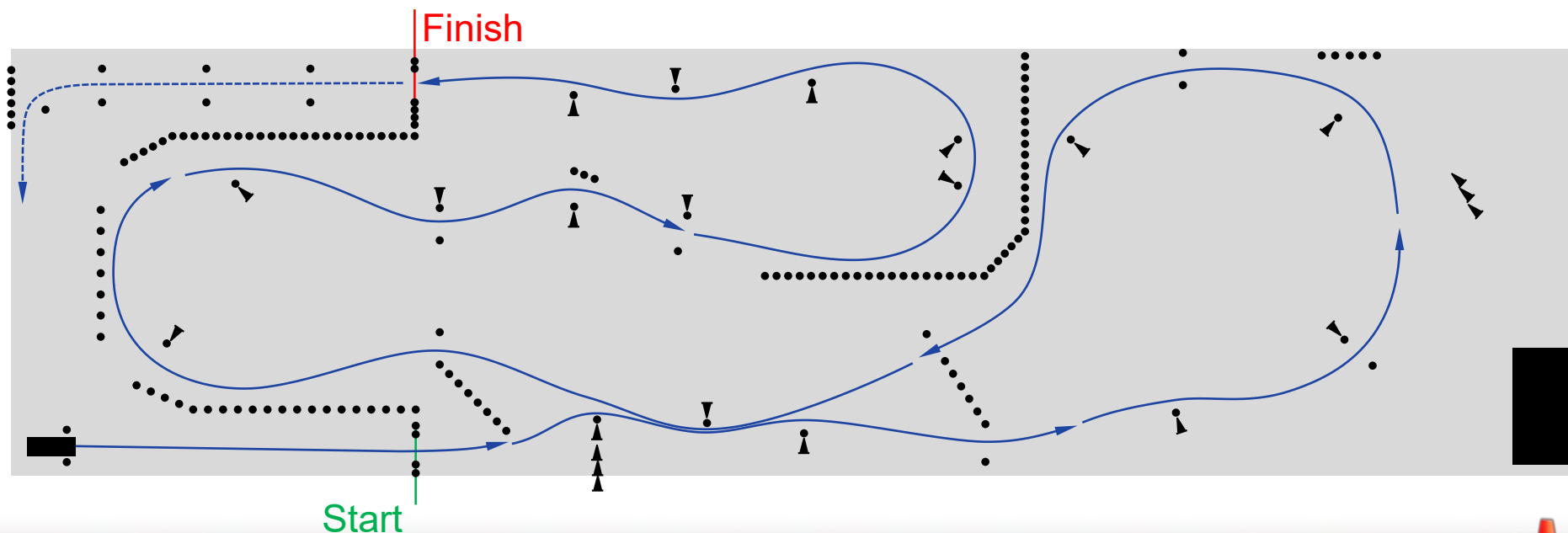


# So You Have a Blank Piece of Paper



# Useful Tricks for Limited Space

- Shared walls
  - Placement may limit to one car at a time
- Out-and-back through section
- Variety through longitudinal spacing





## **Despised Elements Maneuvers to Avoid**

- Any extremely slow maneuver; “technical” and “slow” are not the same thing
- 360 degree pivot turns - or also known as a spin cone - Ditto for 270 pivots
- Narrow, walled in sharp turns with no room for choice of line
- Gates or Slaloms with severe offsets and short spacing
  - i.e. 45' spacing; 10' offset against the driver
- Two narrow (painful) 90 degree walled in turns (shaped like a “Z”) just before the finish lights
  - Which might be O.K. for a start – but no way to finish **if you don't have to**
- Hitting the brakes hard just before the lights



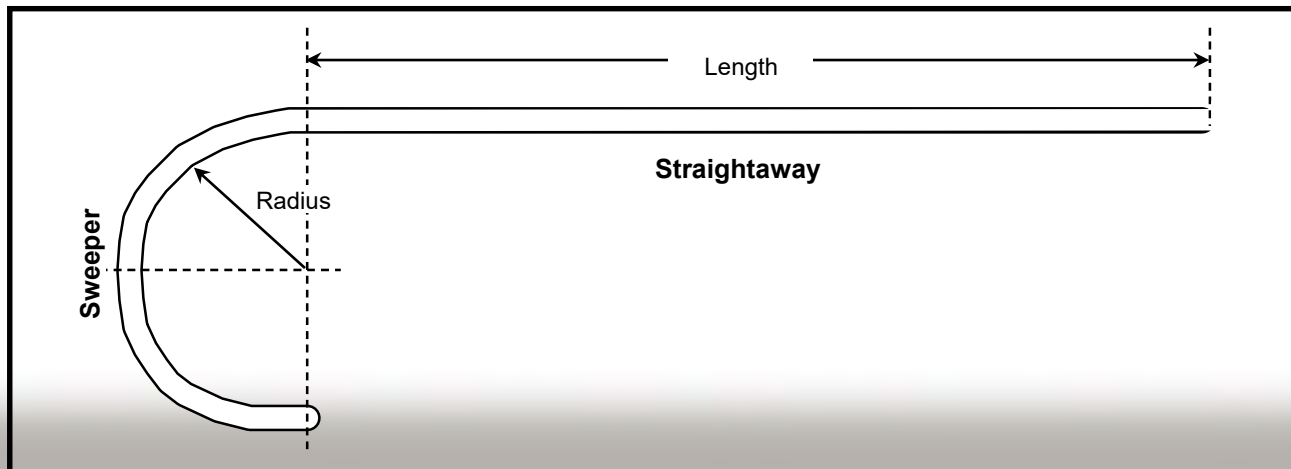
# Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
- Summary and Questions



# 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” 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 (Horsepower vs. Handling)
- 
- This section will address:
    - Sweeper speeds
      - Radius of a turn
      - Cornering G’s of a car
    - Straightway speeds
      - Length of straight
      - Acceleration times

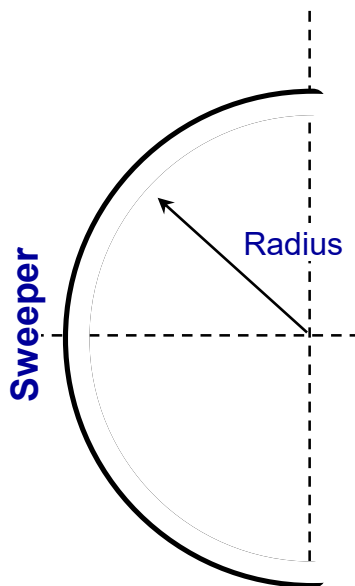


## **Disclaimers**

- **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

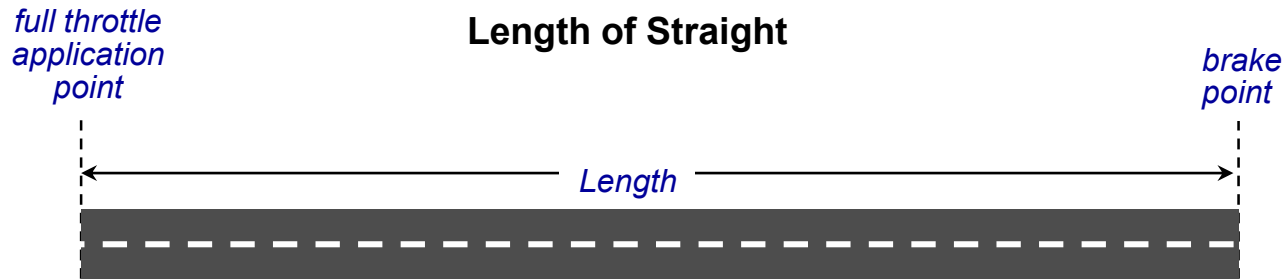
- The relationship of the radius of the turn and the cornering G's is shown in the table below:



		Miles per hour		
		Radius 50'	Radius 75'	Radius 100'
G Force	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 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

# 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.)  
 Option.....Dodge Daytona IROC R/T,  
                                   Talon TS

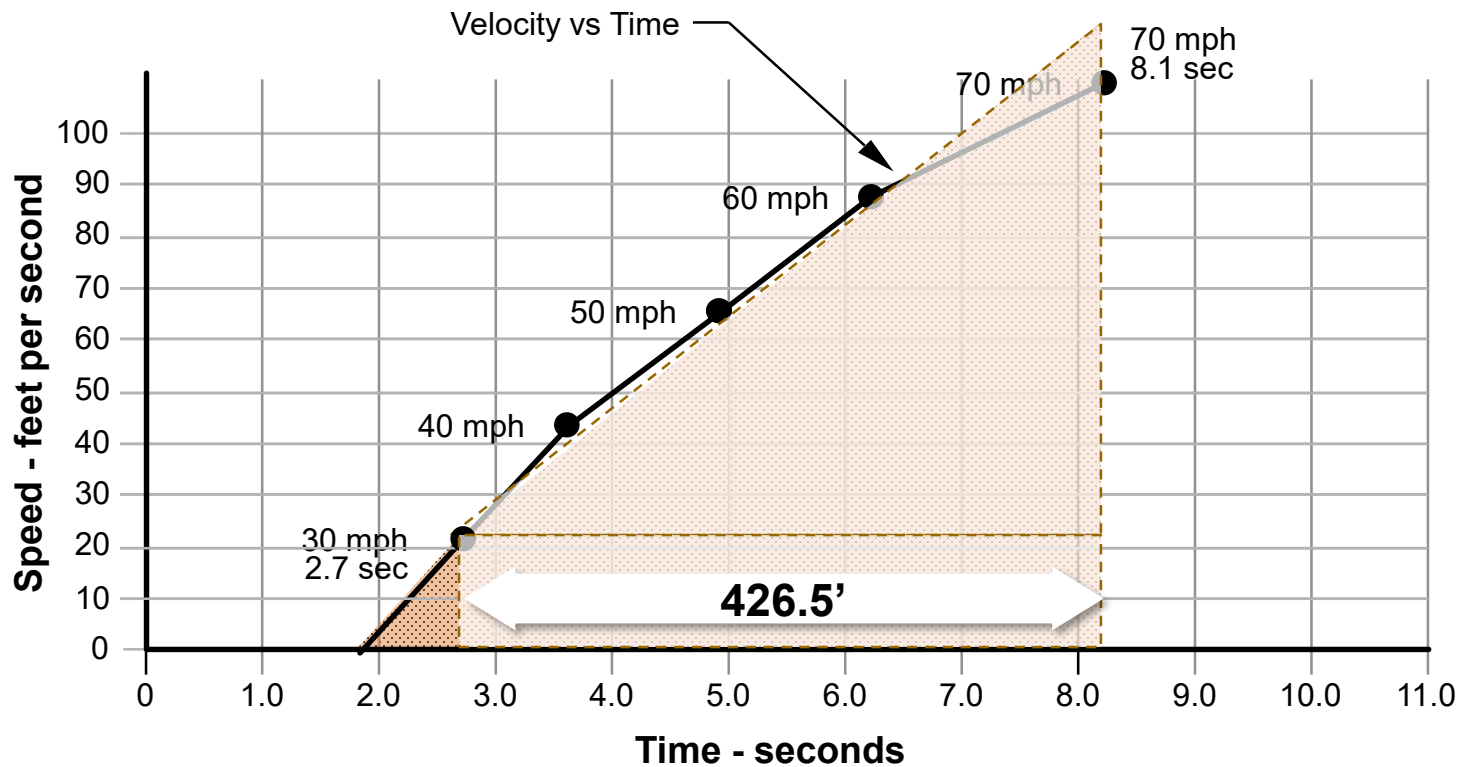
### CHASSIS

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  
                                   type/dia., in.....Vented discs/11.4  
                                   Standard  
 Rear, type/dia., in.....Standard  
 Tires.....Standard  
 Wheel, in.....Standard  
 Wheel, material.....Standard

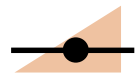
## PERFORMANCE AND TEST DATA

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 500-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

# Camaro Velocity vs. Time



Camaro



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

# Sentra Specifications

## NISSAN SENTRA SE-R

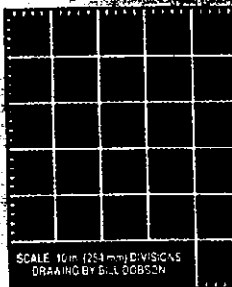
### PRICE

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 sun-  
roof (\$800), ABS (\$200), CD player (est. \$450), Call  
emissions (est. \$100), racing 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

DRIVING BY BILL DOBSON



### ENGINE

Type ..... aluminum head & block  
Displacement ..... 1.8 liter  
Valves ..... 16  
Horsepower ..... 122 cu in./1998 cc  
Torque ..... 3.39 x 3.39 in.  
Bore x stroke ..... 86.0 x 86.0 mm  
Compression ratio ..... 9.5:1

### DRIVETRAIN

Transmission ..... 5-sp manual  
Gear ratio ..... Overall ratio (Rpm) Mph  
1st ..... 3.16:1 ..... 12.79:1 ..... (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

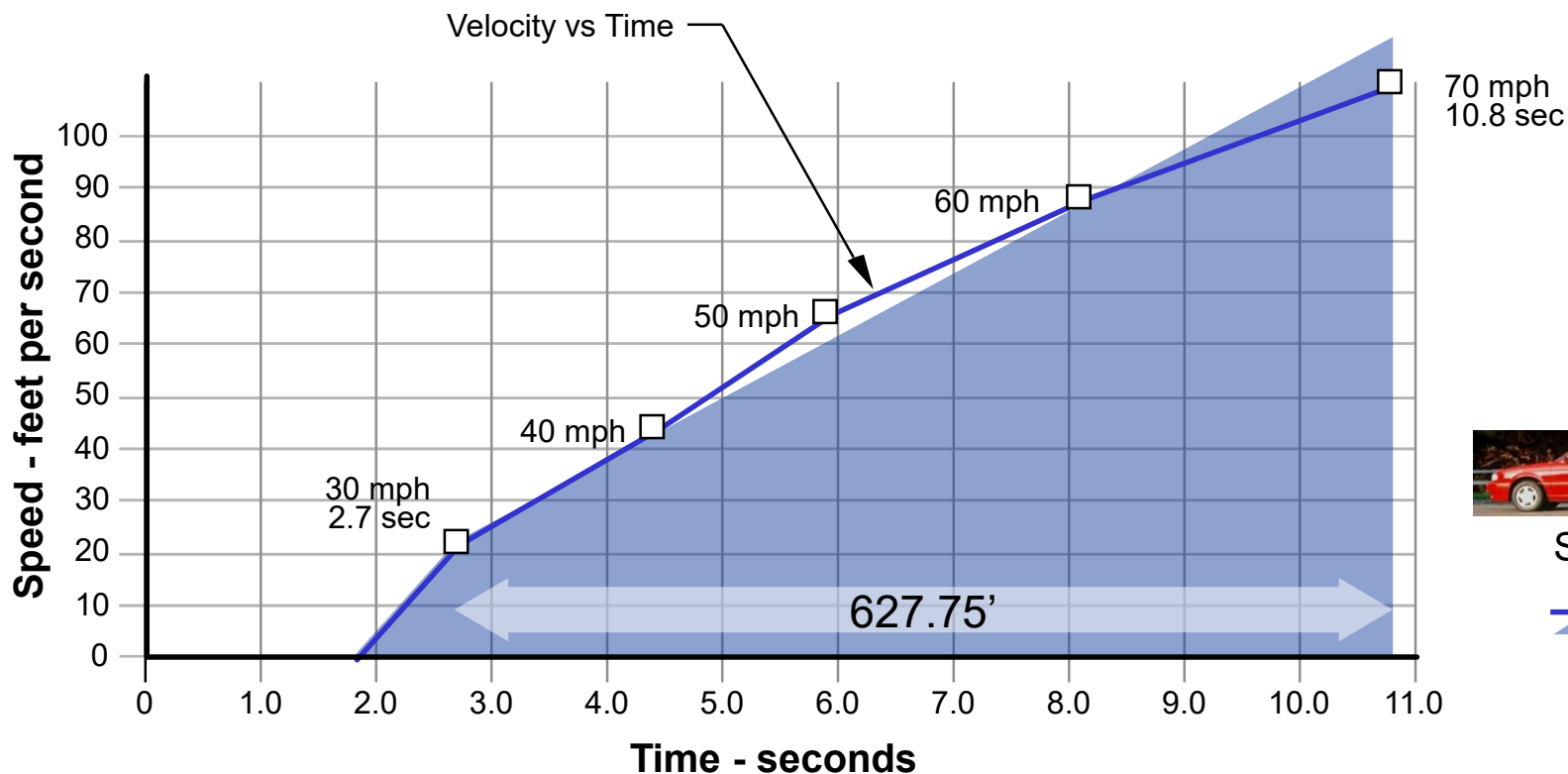
### ACCELERATION

Time to speed ..... Seconds  
0-30 mph ..... 2.7  
0-40 mph ..... 3.4  
0-50 mph ..... 5.1  
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

# Sentra Velocity vs. Time

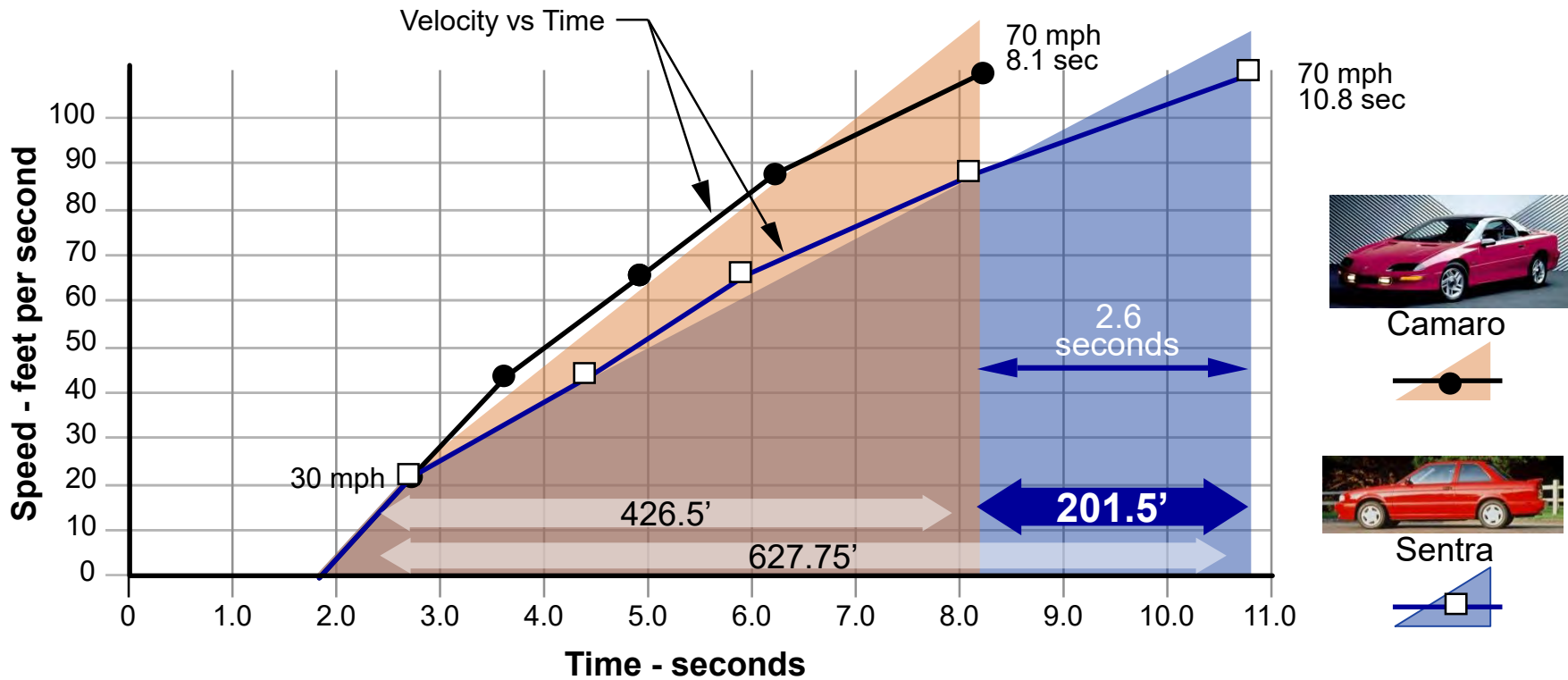


Sentra

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



# 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?**
  - **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 a car with power
  - The Camaro isn't classed with the Sentra, but classes do contain such mixtures
  - For example in **2018**, the **FStreet** class contains:
    - **2008 Mercedes C300**
      - 3,700 pounds / 228 horsepower = 16.22 lbs/hp (where bigger = slower)
    - **2015 Camaro SS 1LE**
      - 3,884 pounds / 426 horsepower (oh my...) = 9.12 lbs/hp
    - That is a **78% difference** in power to weight ratio 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
  - **1993 Camaro V8**
    - 3373 pounds / 275 horsepower = 12.30 lbs/hp
  - That is only a **51% difference** between the cars in our example

Horsepower to weight disparities within class structure  
make it essential to balance your course design between power and handling

## Speed in Solo2 Course Design

- How fast do we go?
- Why do we care?

**The following is critical  
to allow us to continue our sport...**

## What the Rules Say

- “...should not normally exceed the mid-60s (mph) for the fastest Street and Street Touring® category cars”
  - This doesn't mean the average:  
it means the maximum
  - Don't try to get cute with “normally”



# Why Is Speed Compliance So Important?

- **Keywords (from Risk Management):**
  - Negligence
  - Gross Negligence
  - Release/Waiver Effectiveness
  - Punitive Damages
  - Compensatory Damages
  - Insurance Rates
  - Coverage Refusal

## What's The Point?

- A good **Street or Street Touring®** car can get a **lot more speed** a lot more quickly than many people realize (remember, the rule says “**fastest**”)
- It's easy to figure these things out in terms of something simple like the **length of a straightaway**, or the **size (radius) of a turn**
- This is different from the “**I could have sworn they'd have to lift there**” problem

## What Does All This Mean?

- A **Stock Z06** can get from **30 mph** (speed in a sweeper of ~65' Radius) to **80 mph** in just over **400 feet**
- There are probably **SP cars** that can do it even **quicker**
- Pure straights much **over 400 feet** in length are iffy; much longer ones are just plain irresponsible

## What Can You Do?

- Have higher density of quick elements that are not straights; which can be plenty of fun
  - Connected sweepers (“esses”)
  - Lane changes
  - Big slaloms (70’-80’ spacing)
  - Elements that require throttle modulation and/or even (*horrors*) a little braking

## What Should You Not Do?

- **As administrators:**
  - Don't let course designers think they have the last word  
(Event Chairs and Safety Stewards do)
  - Don't rationalize "letting it go this time"
  - Don't listen to competitors who whine about not being able to go "real fast"

## What Should You Not Do?

- **As designers:**
  - Don't focus on "pushing the envelope" with regard to speed
    - Focus instead on delivering a challenging, fun driving experience that provides quality competition
  - Don't put a tightening transient element near the end of a fast stretch, to slow cars down (recipe for sedan rollovers)



## **Protect Our Sport**

- **If Solo, as the Rules define it, isn't what someone wants to be driving, they should go try something else**
- **These folks should not be allowed to corrupt our sport into something it was never meant to be: they put us all at risk!**

# Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a Blank Piece of Paper...
- Elements, Dimensions and Real Speed
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# Questions? Comments? Good Stories?



Stolen from <http://www.flickr.com/photos/brettkiger/5699668143/>

## Contact Information

- Remember, the more courses you design and set up, the better your courses will be
- Please feel free to contact me with any future questions
  - I can be reached as listed below:
    - **Home of the Criminally Insane**  
Attention: Roger H. Johnson  
3910 Gallaher Court  
Missouri City, Texas 77459
    - (281) 226-4569                      work                      **Central Time**  
(281) 217-5310                      home/cell                      **Central Time**
    - roger.h.johnson@boeing.com  
rogerthereal@entouch.net
- **Complete Course Design Booklet**
  - <http://houscca.com/solo/courses.php>
    - Then scroll to the bottom of the page and select **Solo Course Design Manual**