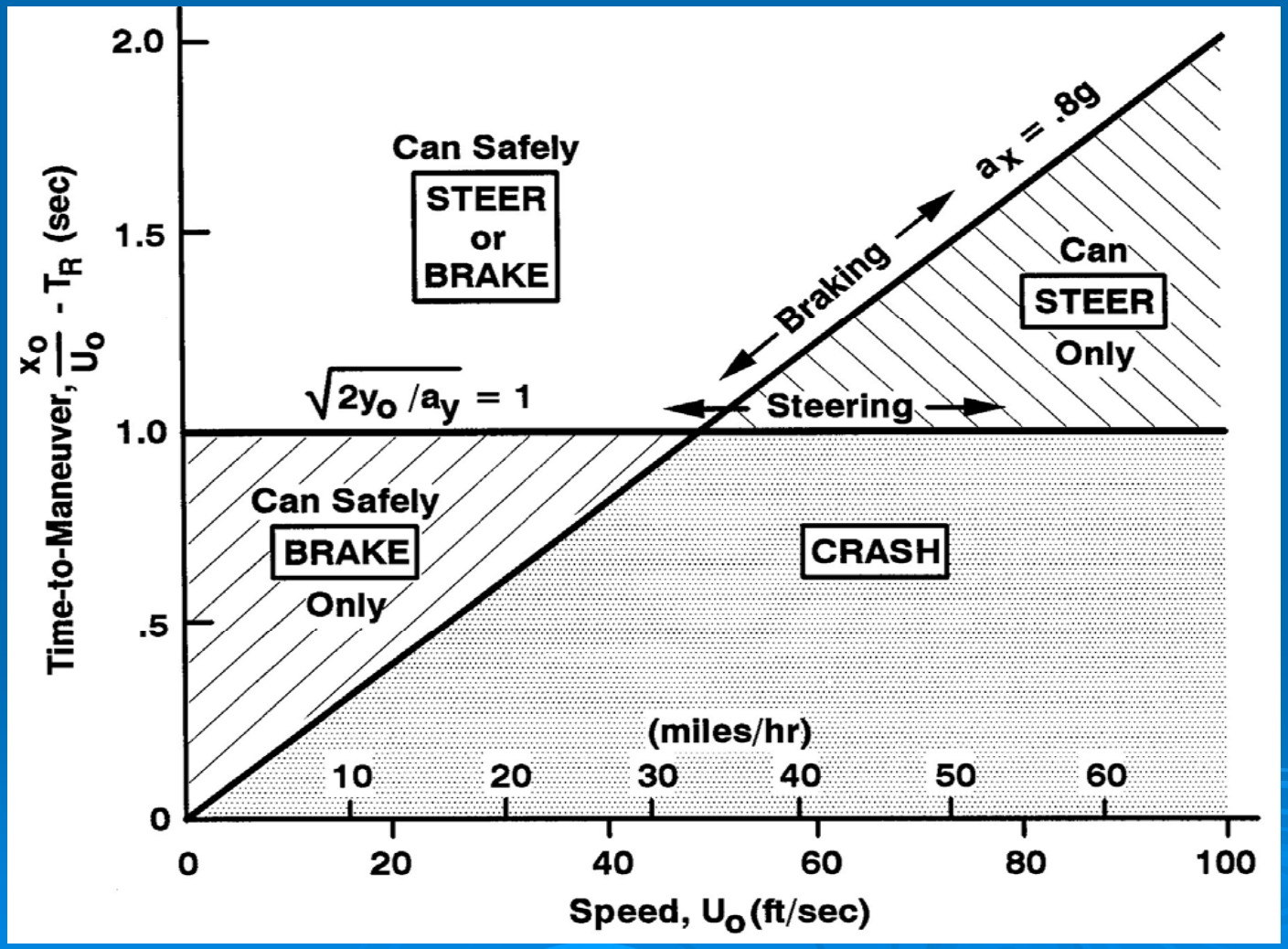
Driver Behaviors (Dependent Variables)

- **Sensory/Perceptual Inputs**
- **Motor Outputs**
- **Psychomotor (Eye/Hand Coordination)**
- **Cognitive (Situation Awareness, Judgment, Decision Making)**

Measurement Paradigms

- **Performance (e.g. lane position, speed maintenance, speed exceedance, tickets, accidents)**
- **Continuous Control (steering and speed)**
- **Decision Making with Consequence (reward/penalty structures)**

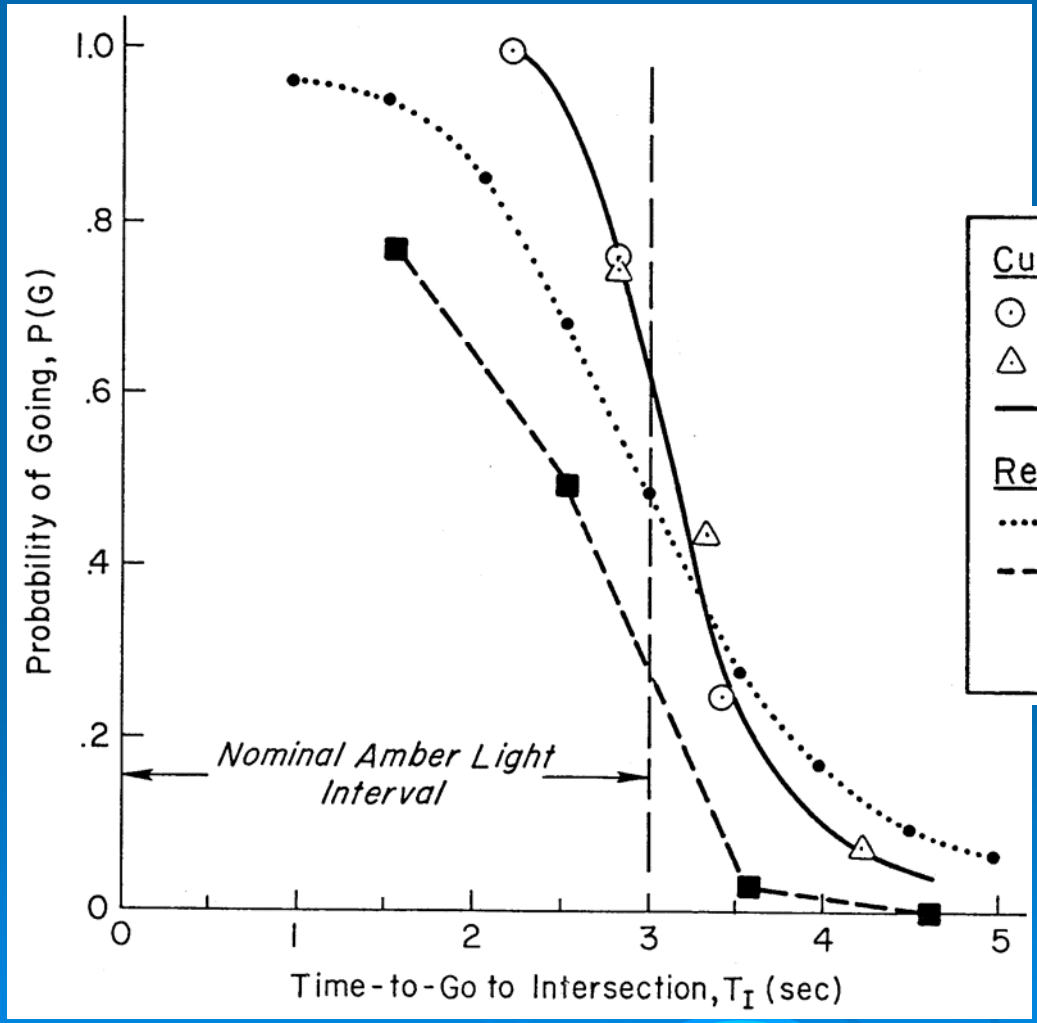
Decision Making Response to Obstacles



Critical Event Timing

$$D_c = U_s \Box T_c$$

DECISION MAKING REPONSE TO SIGNALS



Current Data:
- ⊙ Simulation
- △ Field Test
- ——— Assumed Continuous Function

Real-World Observations:
- ····●···· Williams [11]
- --■-- Konecni, et al. [10], male data, T_I based on assumed approach speed of 40 mph

Global Performance Measures

- Off road accidents
- Vehicle collisions
- Pedestrian collisions
- Speeding violations
- Traffic light violations
- Stop signs missed
- Centerline crossings
- Road edge excursions
- Time-to-lane crossing
- Stops at traffic lights
- Run length
- Time-to-collision (TTC) and minimum distance for each vehicle encounter

Scenario Development Demonstration

Scenario Definition Language Syntax

-1, **Define roadway sections**
0,ROAD,12,2,1,3,.5,10,10,.333,.333,0,-1,-1,0,6,0,6,-5,10,-5,10,0
1000,ROAD,12,4,2,2,.5,10,10,.333,.333,500,-1,-1,0,10,0,10,5,10,5,10,0
-1, **Add some vertical curvature**
1000,VC,500,0.005
2000,VC,1000,-0.0025
3500,VC,250,-0.01
-1, **Throw in some opposing traffic**
100,A,65,1000,-6,*1~4
1075,A,65,1000,-6,6
2000,A,65,1000,-6,*1~4
3100,A,70,1000,-6,*1~8
4500,A,65,1000,-4,*1~4
-1, **Activate various events**
0,TREE,50,10,0,30,70
0,SOBJ,200,15,0,0,0,0,Data\Signs\sp35mph.3ds
-1, **Curve the road to the right**
2850,SIGN,5,1000
3500,C,500,0,500,0,.002

-1, **Show houses on both sides of the street and add traffic and trees**
1160,BLDG,1000,40,5
1160,BLDG,1000,-40,2
1165,BLDG,1000,40,3
1165,BLDG,1000,-40,4
1170,V,0,1000,30,1,6
1255,TREE,0,10,1,40,100
1300,TREE,50,10,1,40,100
-1,
-1, **Display the intersection, signal light and the signal ahead sign**
170,I,0,2200,1
1700,SIGN,8,1977
1700,SL,2227,10,5,15,0,10,3
-1,
-1, **Add some cross traffic in the intersection**
1700,CT,2206,5,100,95,R,5,1
1905,CT,164,5,80,50,R,7,1
1905,CT,140,5,-100,40,L,8,1

Thank You for Your Attention

Questions???

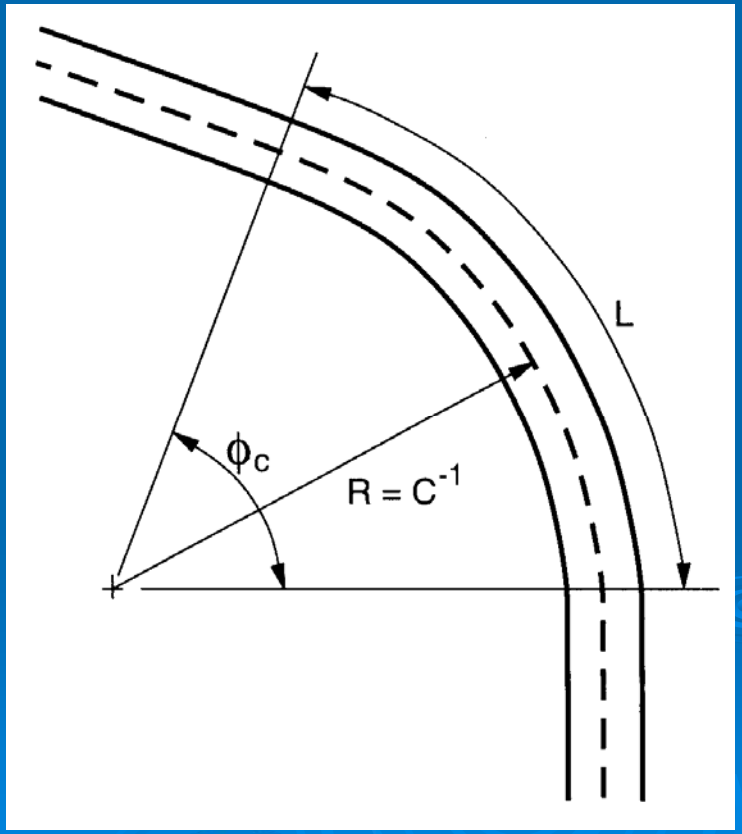
Scenario Definition

- **Define Assessment and/or Training Objectives**
- **Experimental Design Considerations**
- **Define Desired Performance Measures**
- **Specify Critical Events**
- **Outline Scenario**

Roadway Curvature

$$a_c = U^2 / R = CU^2$$

Performance (g's)	
Limit	0.85
Hard	0.50
Typical	0.35
Advisory	0.22



Roadway Curvature and Typical Speeds

Curvature, feet^{-1} (meters^{-1})	Radius, feet (meters)	Advisory Speed, mph (kph)	Curve Length for 30° Turn, feet, (meters)	Curve Length for 45° Turn, feet, (meters)	Curve Length for 90° Turn, feet, (meters)
.001 (.00328)	1000 (304.8)	57.3 (92.2)	523.6 (159.6)	785.3 (239.4)	1,570.7 (478.7)
.003 (.00985)	333 (101.5)	33.0 (53.2)	174.4 (53.1)	261.5 (79.7)	523.0 (159.4)
.01 (.0328)	100 (30.5)	18.1 (29.1)	52.4 (16.0)	78.5 (23.9)	157.1 (47.9)
.03 (.0985)	33.3 (10.2)	11.4 (16.8)	17.4 (5.3)	26.2 (8.0)	52.3 (15.9)

DRIVING SKILL HIERARCHY

- **Control – Speed and Steering**
- **Guidance – Path Following**
- **Navigation – Path Selection**
- **Risk Assessment and Accident Avoidance**

DRIVER BEHAVIORS

- Sensory/Perceptual
- Psychomotor
- Cognitive:
  - Situation Awareness
  - Risk Assessment
  - Decision Making