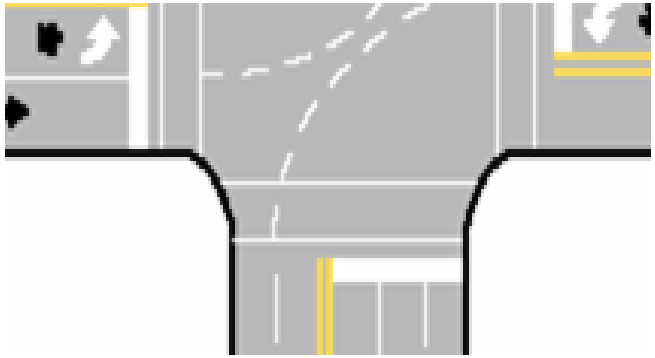
تصميم التقاطعات

Intersection Design

التقاطعات

- منطقة معقدة نسبياً لحركة السائقين،
- الوظيفة الأساسية للتقاطع هي إمكانية تغيير مسارات الحركة،
- تشكل التقاطعات نقاط الازدحام الرئيسية في المدينة،
- بالنسبة للسلامة المرورية (صخب وفوضى في المدينة، وكوارث خارج المدن)



أنماط التقاطعات
Types of Intersections

- متعددة المستويات (Grade separated) مع رامبات ومبادلات للحركة،
- متعددة المستويات (معابر علوية أو سفلية) لا تحوي نقاط دخول أو خروج،
- تقاطعات على مستو واحد (At-grade):
  - تقليدية،
  - تقاطعات دوارة،
  - أشكال خاصة،

أهداف التصميم
Design Objectives

- تخفيف شدة التصادمات بين العربات والمشاة، بالإضافة إلى تسهيل وراحة عبور الأشخاص لمنطقة التقاطع،
- إمكانية ضبط الوصول إلى التقاطع بشكل ملائم ومتوافق مع وظيفة الطرق المشكلة للتقاطع،

متطلبات التشغيل
Operational Requirements

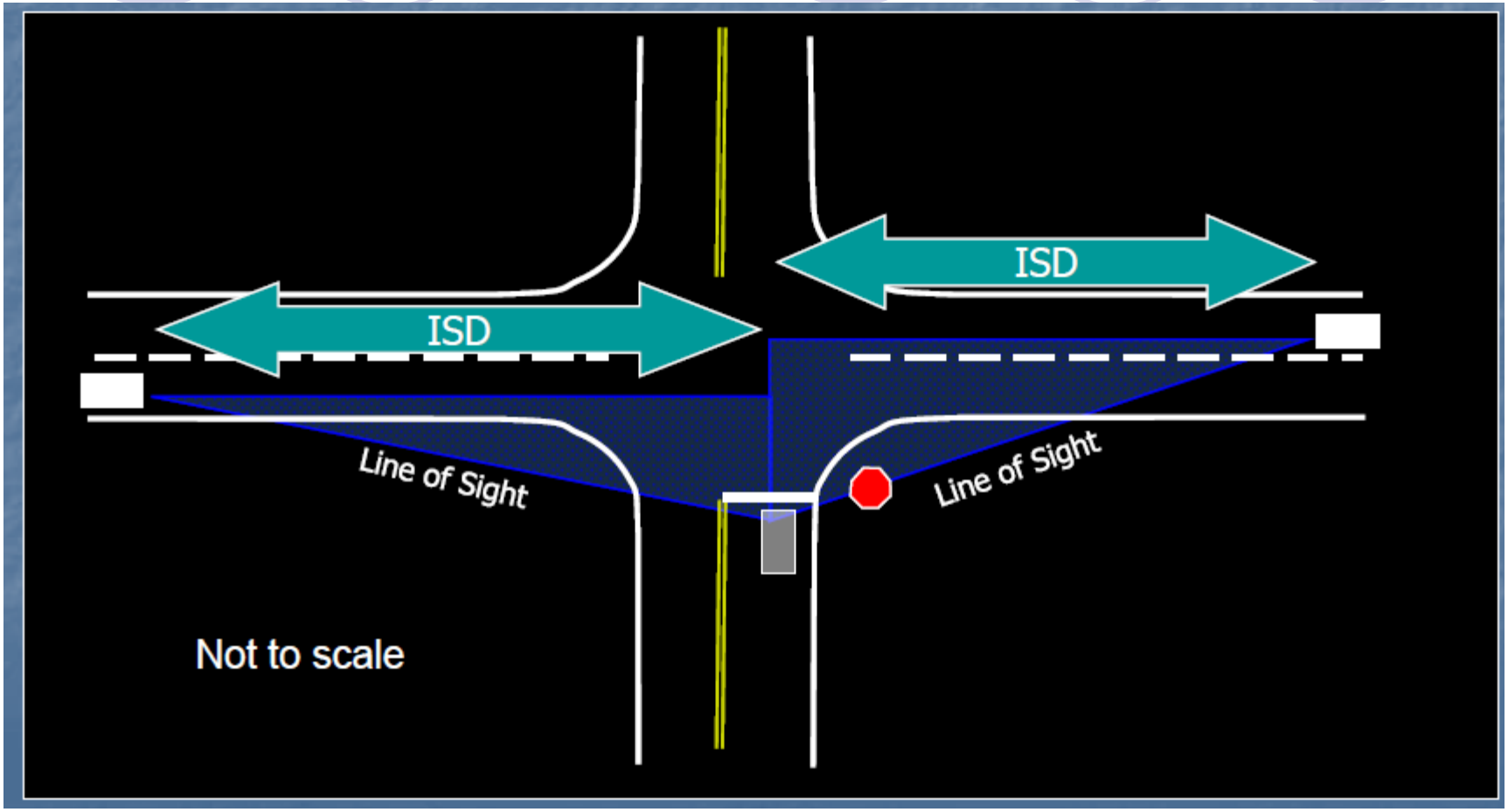
- إيجاد مسافات رؤية كافية بين الحركات الداخلة إلى التقاطع والمغادرة له،
- تخفيف التصادم بين الحركات المنعطفة والحركات المستقيمة،
- إيجاد مسارات طبيعية للحركات المسموحة،
- تجنب الأوضاع الهندسية (منعطفات حادة، ميول شديدة، . . . .) التي تعقد وتعيق القيادة وتؤثر على التسارع والتباطؤ،

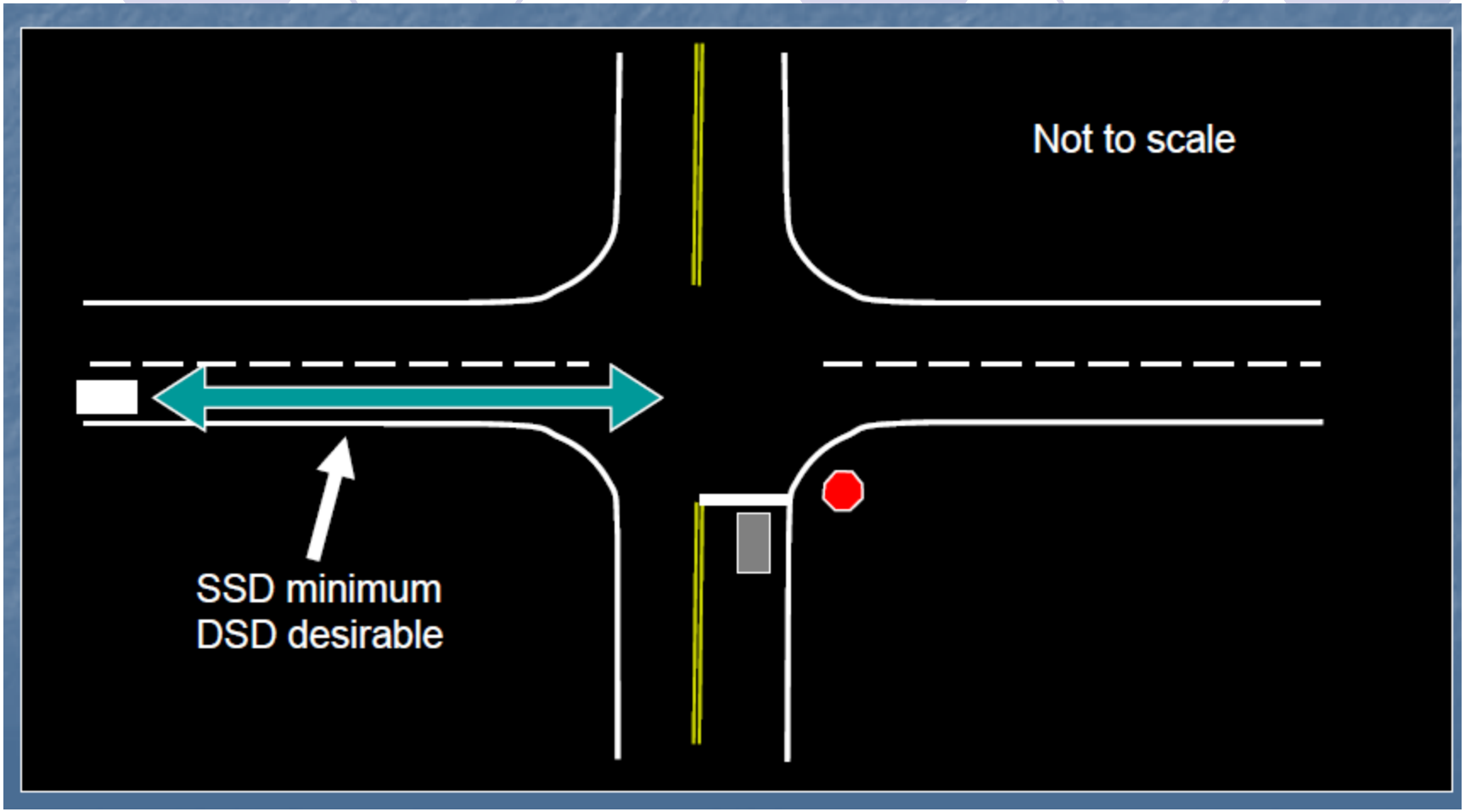
مسافة الرؤية على التقاطع
Intersection Sight Distance (ISD)

- مسافة الرؤية المطلوبة على التقاطع: هي المسافة على الطريق المتقاطع والتي يجب أن تكون مرئية بشكل كامل بحيث يتمكن السائق الذي يقوم بحركة انعطاف أو حركة عبور من اتخاذ القرار وإكمال الحركة بدون أي تصادم مع الحركة المقتربة من الطريق المتقاطع،
- تسمح هذه المسافة للسائق من رؤية التقاطع بدون أية معوقات،

مسافة الرؤية على التقاطع
Intersection Sight Distance (ISD)

- مسافة الرؤية المطلوبة على التقاطع: هي المسافة على الطريق المتقاطع والتي يجب أن تكون مرئية بشكل كامل بحيث يتمكن السائق الذي يقوم بحركة انعطاف أو حركة عبور من اتخاذ القرار وإكمال الحركة بدون أي تصادم مع الحركة المقتربة من الطريق المتقاطع،
- تسمح هذه المسافة للسائق من رؤية التقاطع بدون أية معوقات،


ISD
ISD
Line of Sight
Line of Sight
Not to scale

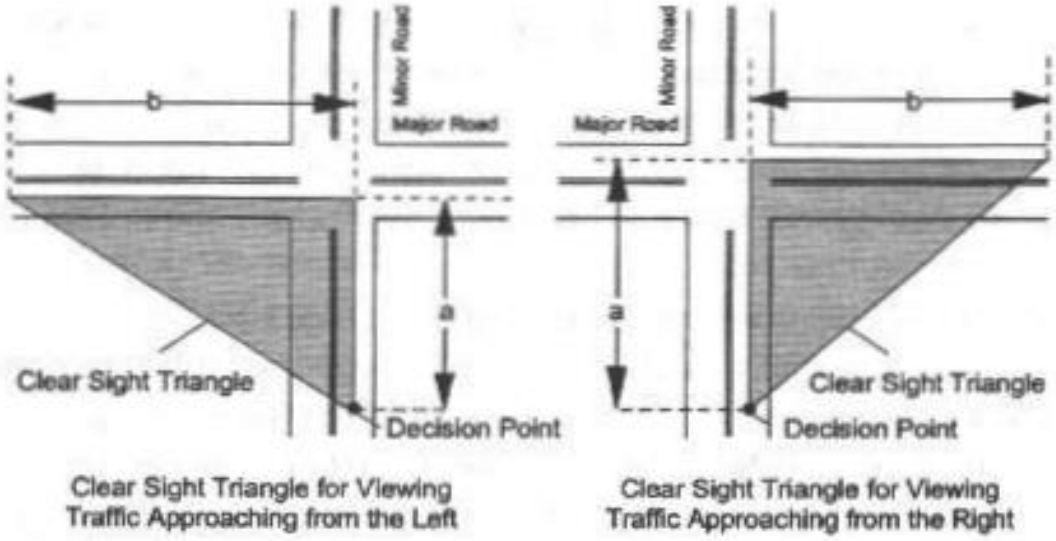

Not to scale
SSD minimum
DSD desirable

Adequate ISD

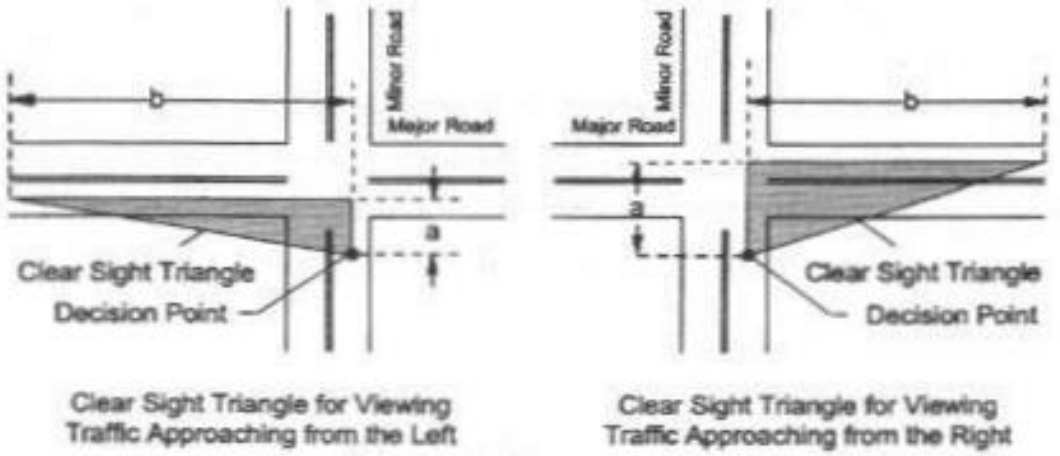
- **Sight Triangle** – area free of obstructions necessary to complete maneuver and avoid collision – **needed for approach and departure** (from stop sign for example)
- Allows driver to anticipate and avoid collisions
- Allows drivers of stopped vehicles enough view of the intersection to decide when to enter

Sight Triangle

- Area free of obstructions necessary to complete maneuver and avoid collision – **needed for approach and departure** (from stop sign for example)
- Consider horizontal as well as vertical, object below driver eye height may not be an obstruction
- AASHTO assumes 3.5' above roadway



A – Approach Sight Triangles



B – Departure Sight Triangles

Exhibit 9-50. Intersection Sight Triangles

معايير مسافات الرؤية على التقاطعات (حسب آشتو):

مسافة الرؤية للعبور:

وهي المسافة اللازمة للعربة لعبور الطريق الرئيسي بالسرعة التصميمية خلال زمن الاستجابة ورد الفعل والزمن اللازم لتسارع العربة وعبور الطريق:

$$T = T_{PR} + T_A$$

حيث:

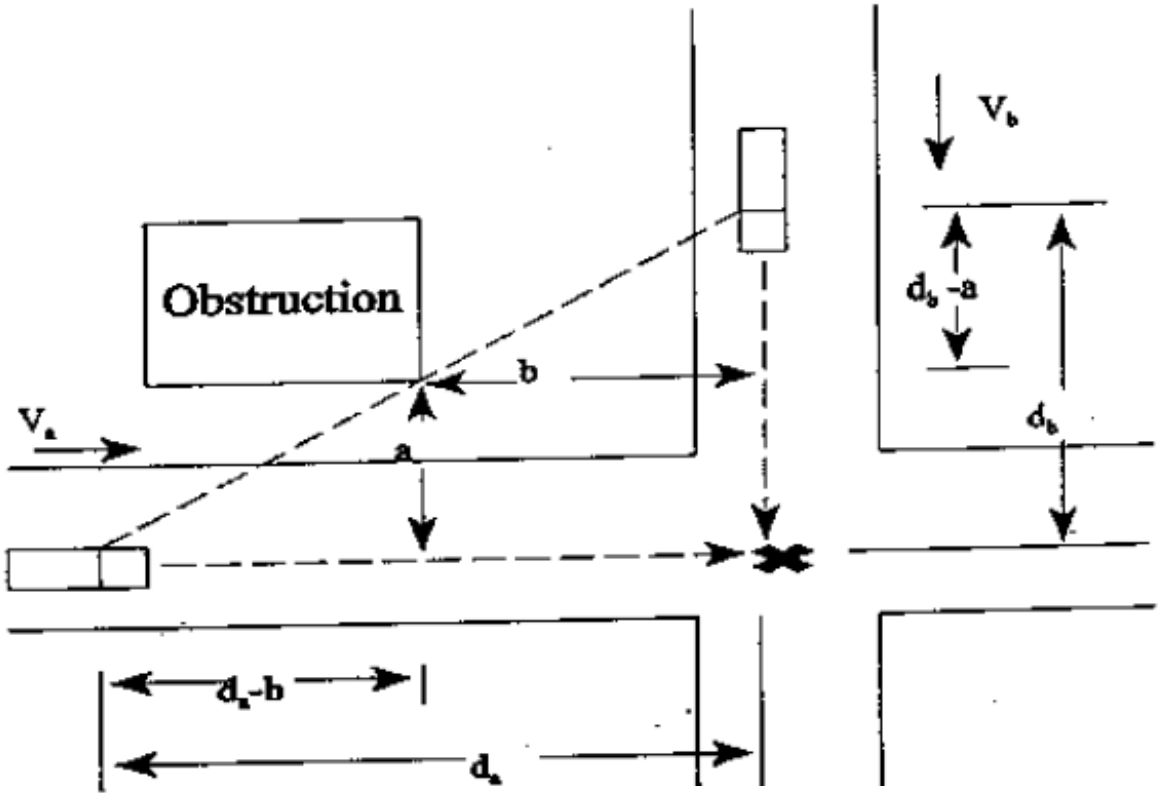
T: زمن العبور،

T_{PR}: زمن التأخير اللازم للإقلاع أو زمن الاستجابة ورد الفعل (يؤخذ ٢ ثانية)،

T_A: زمن التسارع وعبور الطريق الرئيسي،

معايير مسافات الرؤية على التقاطعات (حسب آشتو):

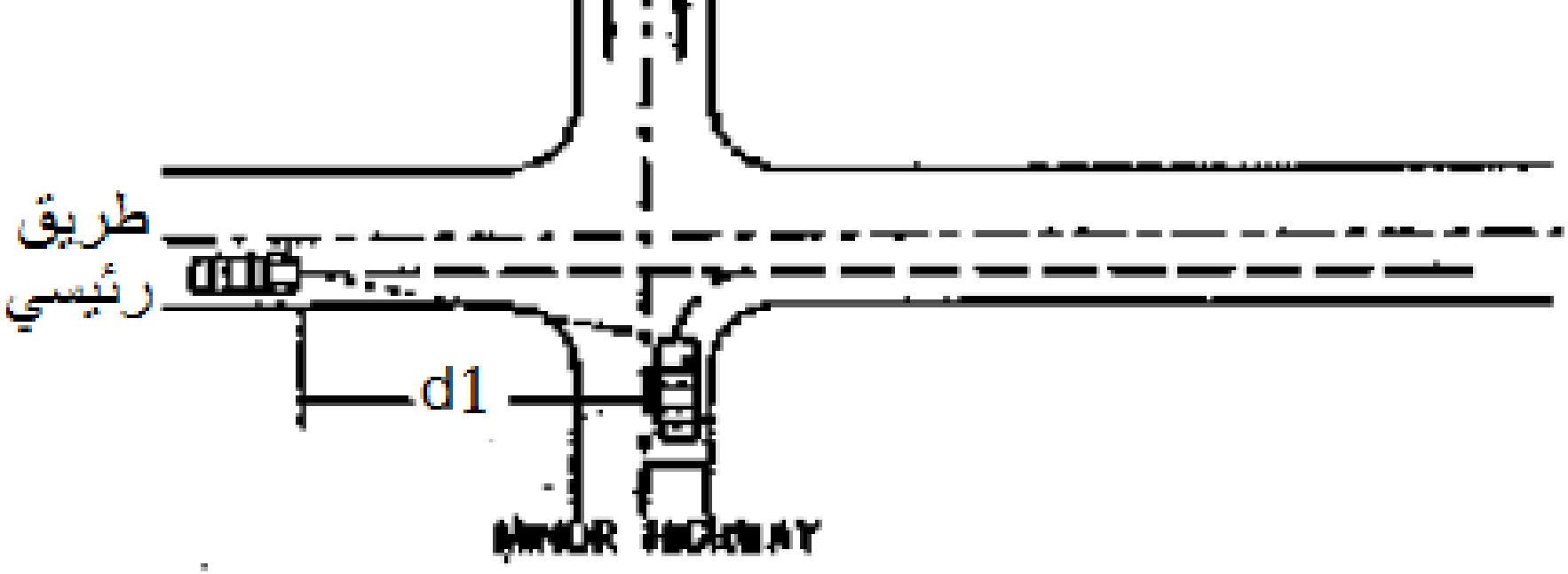
حالة :



يجب أن تكـ
عدم حصو
يفضل أن ت

حيث:
d_b,d_a: الـ
a,b: المسـ

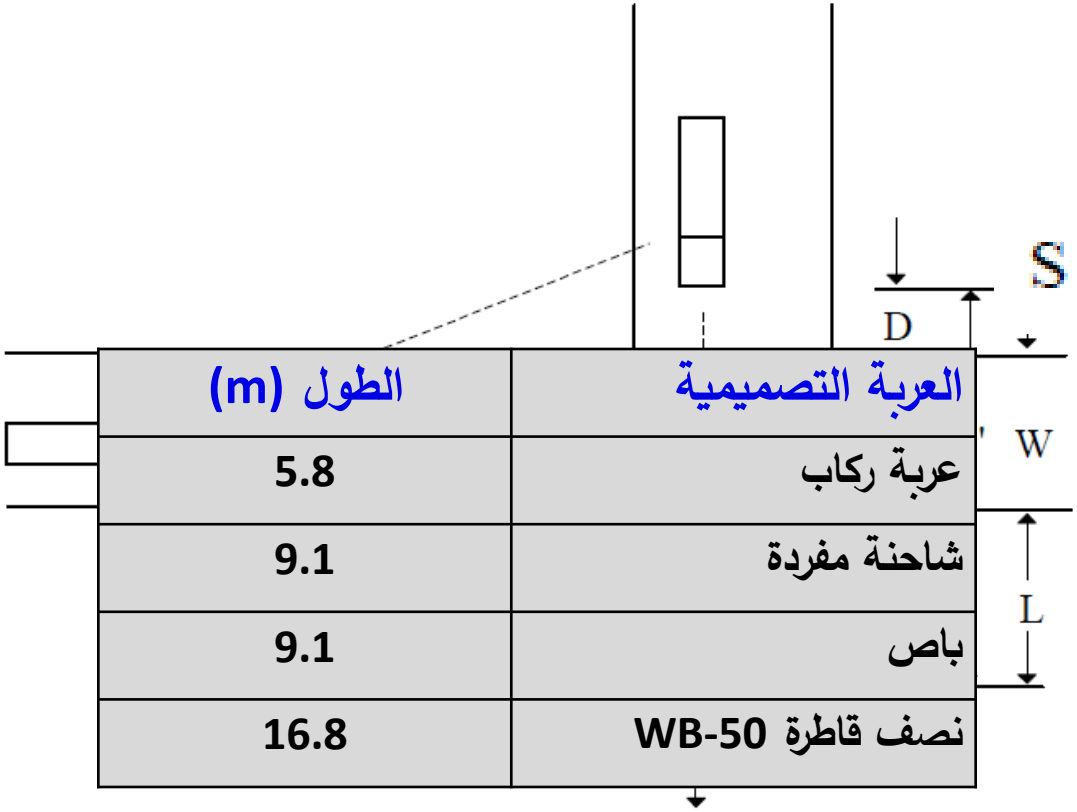
$$d = 0.278\,Vt + V^2 / 254f$$



حالة جـــ: انعطاف لليمين لشارع رئيسي بحارتين

معايير مسافات الرؤية على التقاطعات (حسب آشتو):

حالة آ:



$$S = 3.05\ m + W + L$$

العربة التصميمية	الطول (m)
عربة ركاب	5.8
شاحنة مفردة	9.1
باص	9.1
نصف قاطرة WB-50	16.8

حيث: W: عرض الطريق المعبد أو نصف العرض لحالة مسافة الرؤية للانعطاف لليسار

L: طول العربة المتوقفة، ويؤخذ من الجدول التالي:

أنصاف أقطار المنحنيات على التقاطعات

Design Vehicle Type	Symbol	Metric	
		Minimum Design Radius [m]	Minimum Inside Radius [m]
Passenger Car	P	7.3	4.4
Single Unit Truck	SU	12.8	8.6
Intercity Bus	BUS-40 [BUS-12]	13.7	8.4
City Transit Bus	City-Bus	12.8	7.5
Conventional School Bus (65 pass.)	S-BUS36 [S-BUS11]	11.9	7.3
Large School Bus (84 pass.)	S-BUS40 [S-BUS12]	12.0	7.7
Intermediate Semi-trailer	WB-40 [WB-12]	12.2	5.9
Intermediate Semi-trailer	WB-50 [WB-15]	13.7	5.2

أنصاف أقطار المنحنيات على التقاطعات

Design Vehicle Type	Symbol	Metric	
		Minimum Design Radius [m]	Minimum Inside Radius [m]
Passenger Car	P	7.3	4.4
Single Unit Truck	SU	12.8	8.6
Intercity Bus	BUS-40 [BUS-12]	13.7	8.4
City Transit Bus	City-Bus	12.8	7.5
Conventional School Bus (65 pass.)	S-BUS36 [S-BUS11]	11.9	7.3
Large School Bus (84 pass.)	S-BUS40 [S-BUS12]	12.0	7.7
Intermediate Semi-trailer	WB-40 [WB-12]	12.2	5.9
Intermediate Semi-trailer	WB-50 [WB-15]	13.7	5.2

أنصاف أقطار الـ

Design Widths for Turning Roadways [Metric]

Radius on Inner Edge R [m]	Pavement width [m]								
	Case I One-Lane, One-way Operation—No Provision for Passing a Stalled Vehicle			Case II One-Lane, One-way Operation—With Provision for Passing a Stalled Vehicle			Case III Two Lane Operation Either One Way Or Two Way		
	Design Traffic Conditions								
	A	B	C	A	B	C	A	B	C
15	5.4	5.5	7.0	6.0	7.8	9.2	9.4	11.0	13.6
25	4.8	5.0	5.8	5.6	6.9	7.9	8.6	9.7	11.1
30	4.5	4.9	5.5	5.5	6.7	7.6	8.4	9.4	10.6
50	4.2	4.6	5.0	5.3	6.3	7.0	7.9	8.8	9.5
75	3.9	4.5	4.8	5.2	6.1	6.7	7.7	8.5	8.9
100	3.9	4.5	4.8	5.2	5.9	6.5	7.6	8.3	8.7
125	3.9	4.5	4.8	5.1	5.9	6.4	7.6	8.2	8.5
150	3.6	4.5	4.5	5.1	5.8	6.4	7.5	8.2	8.4
Tangent	3.6	4.2	4.2	5.0	5.5	6.1	7.3	7.9	7.9
Width Modification Regarding Edge Treatment:									
No stabilized Shoulder	None			None			None		
Mountable curb	None			None			None		
Barrier curb: ** one side two sides	Add 0.3 m Add 0.6 m			None Add 0.3 m			Add 0.3 m Add 0.6 m		
Stabilized shoulder, one or both sides	Lane width for conditions B and C on tangent may be reduced to 3.6 m where shoulder is 1.2 m or wider			Deduct shoulder width; minimum width as under Case I			Deduct 0.6 m where shoulder is 1.2 m or wider		

Note:

Traffic Condition A = predominately P vehicles, but some consideration for SU trucks.

Case A– No Control

- Minimum sight triangle sides = distance traveled in **3 seconds** (design or actual?) = 2 seconds for P/R and 1 second to actuate brake/accel.
- **Assumes vehicles slow ~ 50% of midblock running speed** (rural???)

Case A– No Control

- **Prefer** appropriate SSD on both approaches (minimum really)
- Provided on **lightly traveled** roadways
- Provide **control if sight triangle not available**
- Assumes vehicle on the left yields to vehicle on the right if they arrive at same time

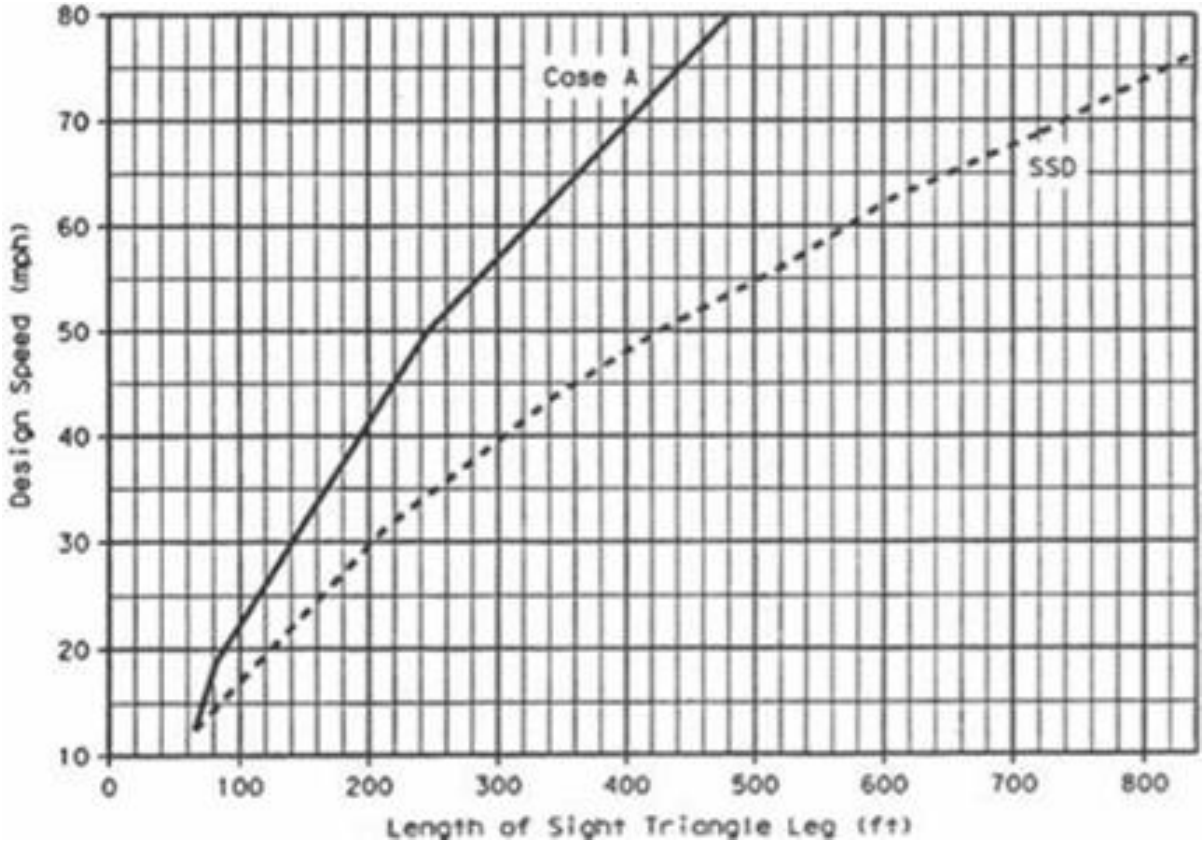
Metric		US Customary	
Design speed (km/h)	Length of leg (m)	Design speed (mph)	Length of leg (ft)
20	20	15	70
30	25	20	90
40	35	25	115
50	45	30	140
60	55	35	165
70	65	40	195
80	75	45	220
90	90	50	245
100	105	55	285
110	120	60	325
120	135	65	365
130	150	70	405
		75	445
		80	485

Note: For approach grades greater than 3%, multiply the sight distance values in this exhibit by the appropriate adjustment factor from Exhibit 9-53.

Can use table or graph

Modify for grade

US Customary														
Approach grade (%)	Design speed (mph)													
	15	20	25	30	35	40	45	50	55	60	65	70	75	80
−6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2
−5	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2
−4	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
−3 to +3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
+4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+5	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+6	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

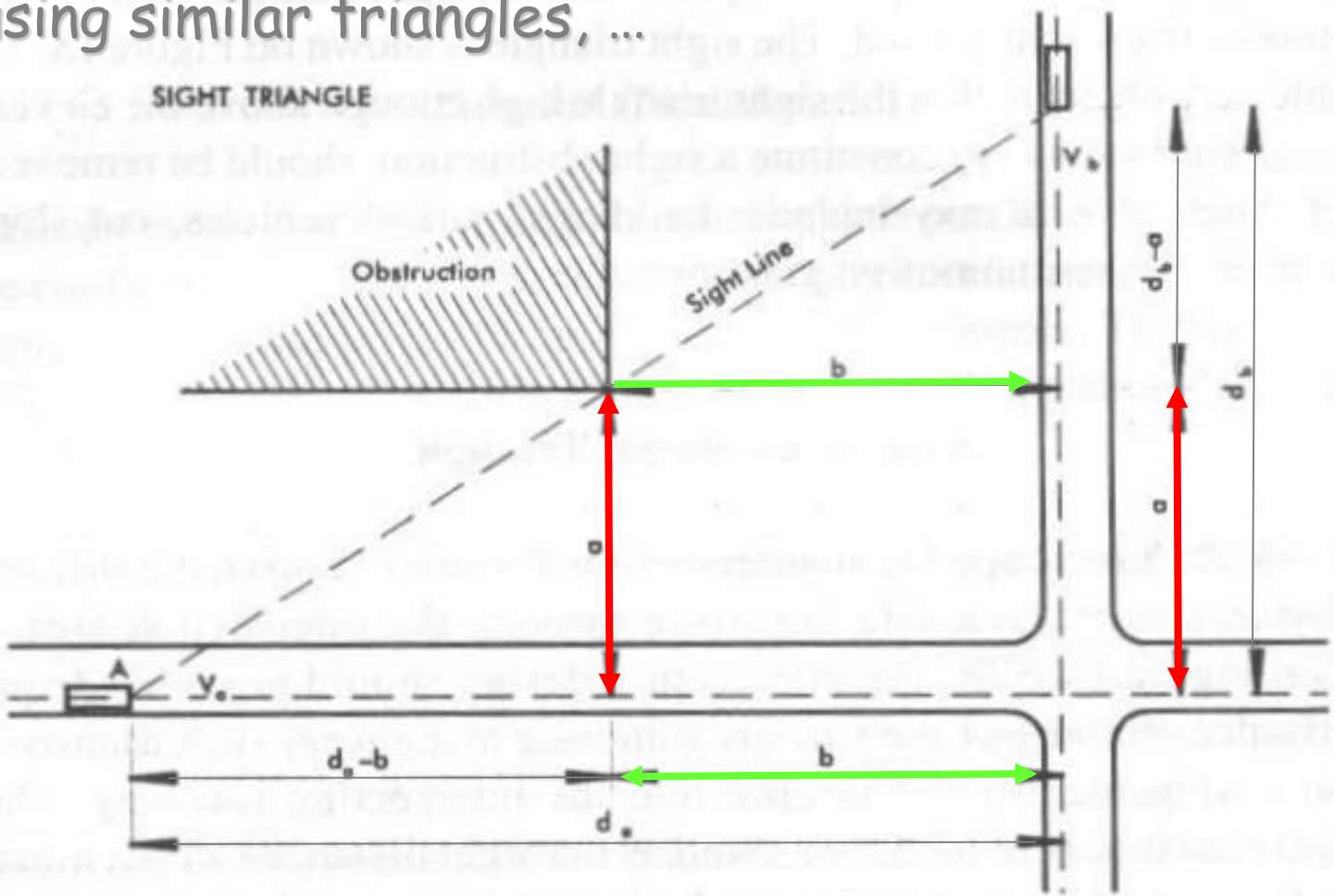


Minimum Distances for Sight Triangle: No Control	
Speed (mph)	Distance (ft)
10	45
15	70
20	90
25	110
30	130
35	155
40	180
50	220
60	260
70	310

From Garber and Hoel

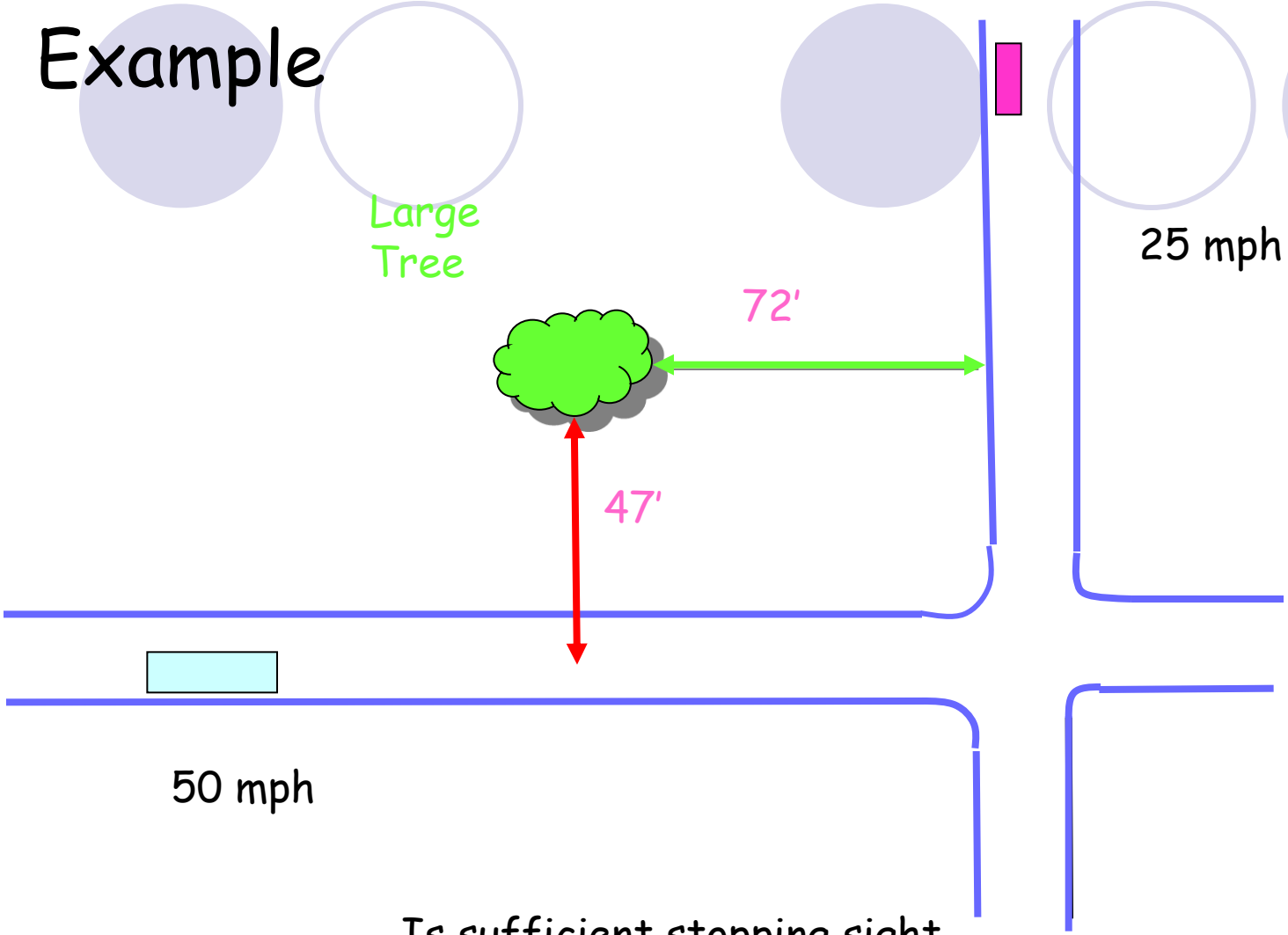
A little lower than Green Book Values

using similar triangles, …



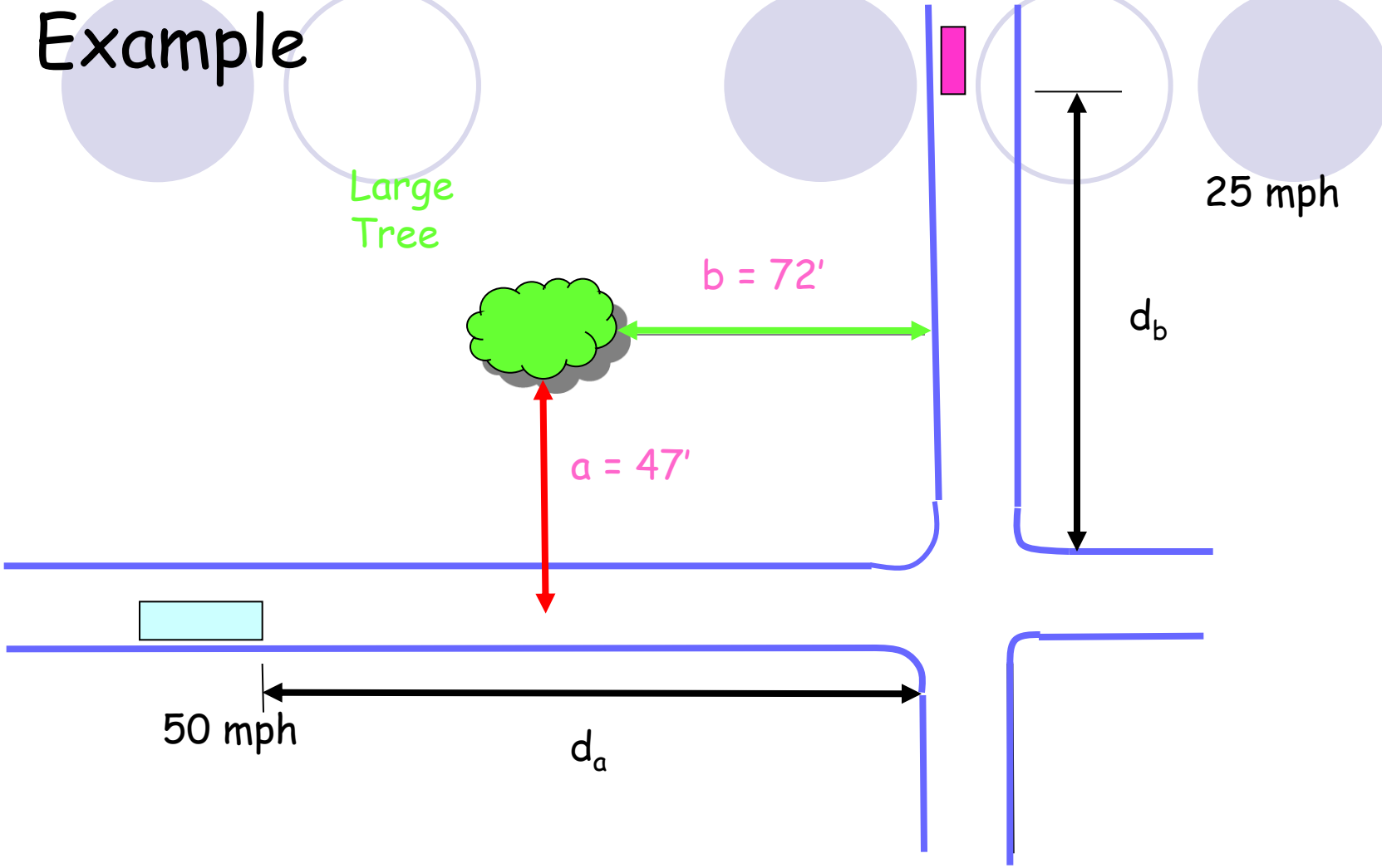
can set critical speed to available stopping distance, $d_b = a \times \frac{d_a}{d_a - b}$

Example



Is sufficient stopping sight distance provided?

Example



$$d_b = a \times \frac{d_a}{d_a - b}$$

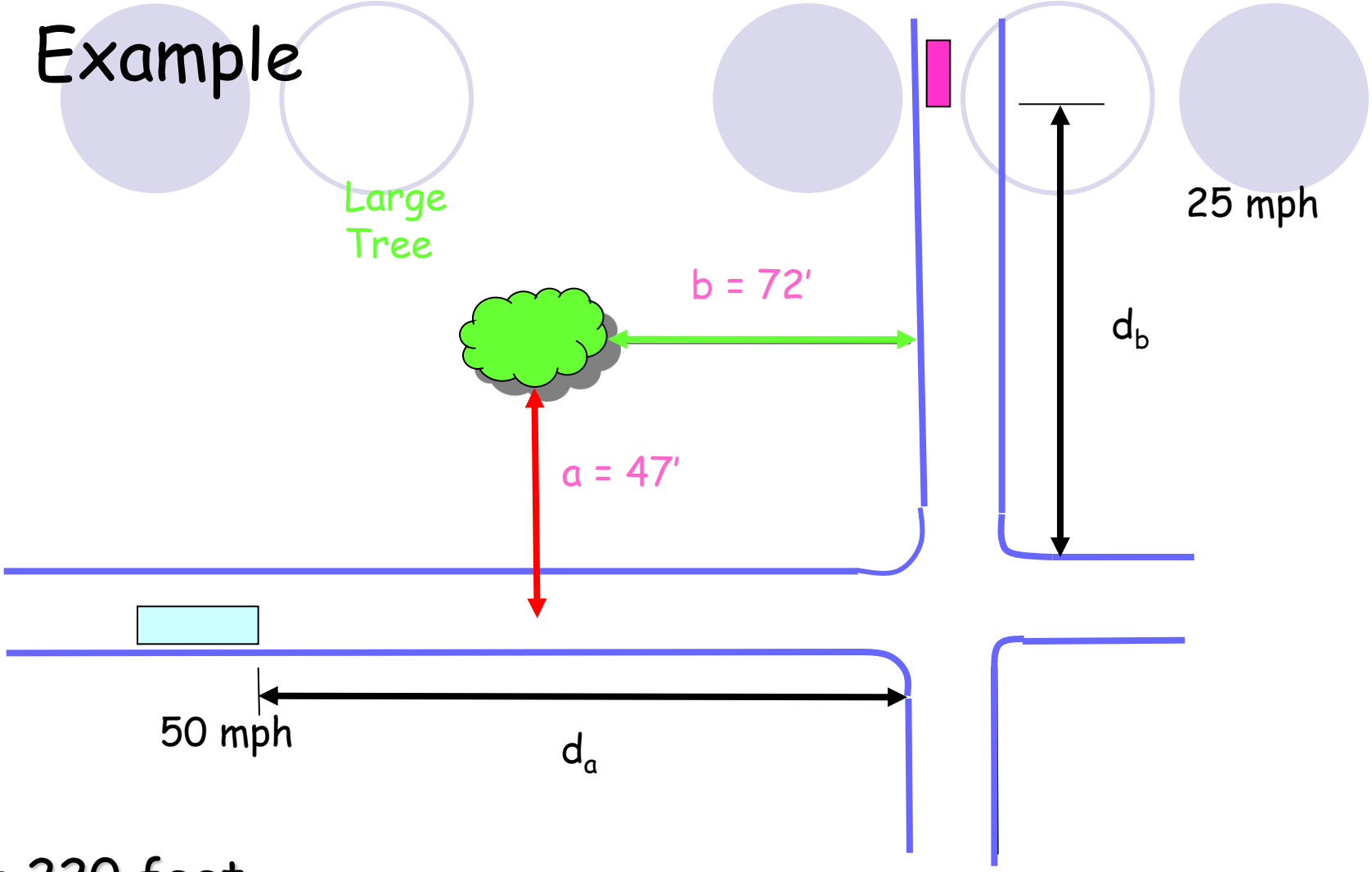
Minimum Distances for Sight Triangle: No Control

Speed (mph)	Distance (ft)
10	45
15	70
20	90
25	110
30	130
35	155
40	180
50	220
60	260
70	310

From Garber and Hoel

d_a = 220 feet

Example



d_a = 220 feet

$d_b = \frac{47' (220')}{220' - 72'} = 69.9'$

$$d_b = a \times \frac{d_a}{d_a - b}$$

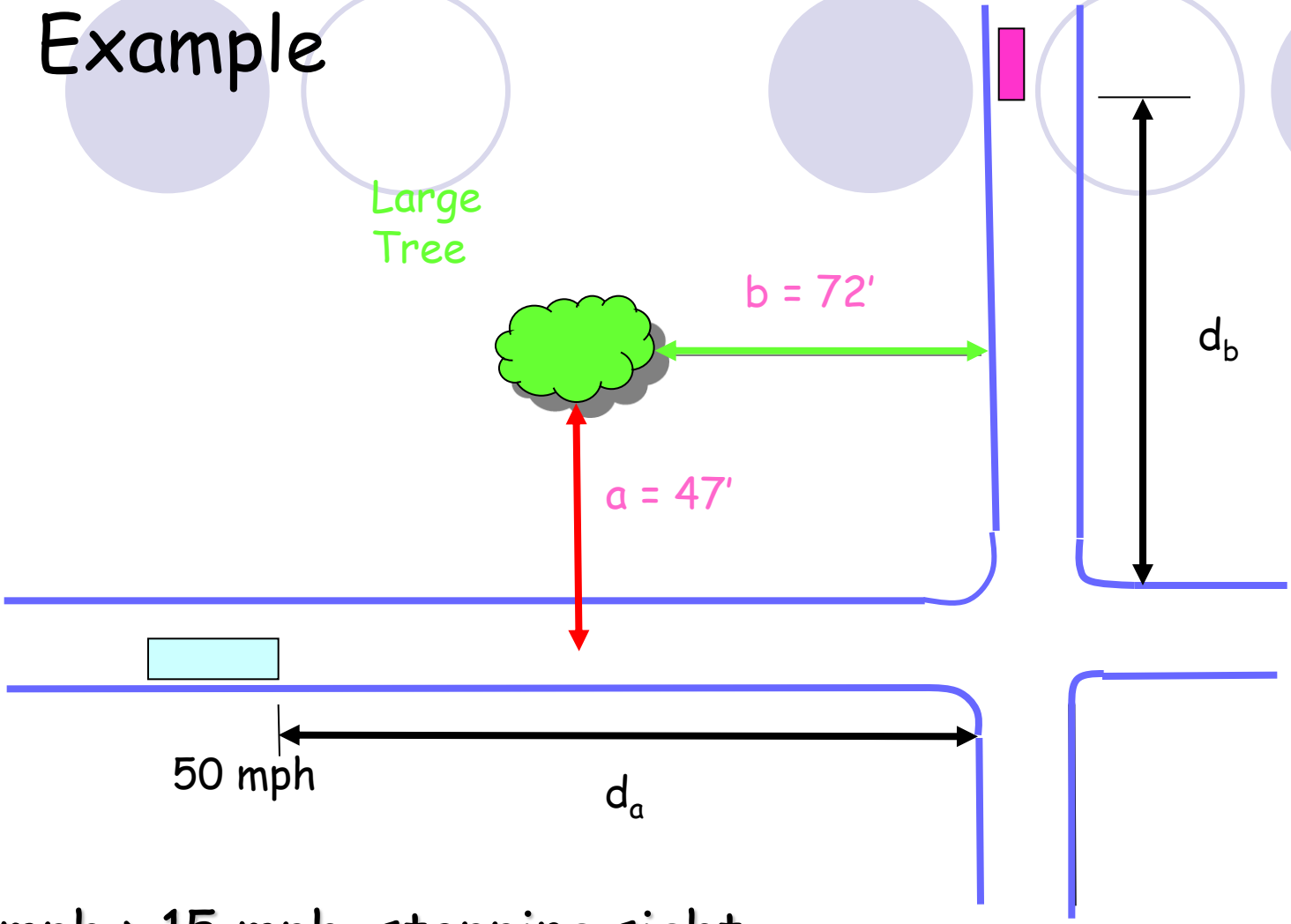
Minimum Distances for Sight Triangle: No Control

Speed (mph)	Distance (ft)
10	45
15	70
20	90
25	110
30	130
35	155
40	180
50	220
60	260
70	310

From Garber and Hoel

d_b = 69.9 feet corresponds to 15 mph

Example



25 mph > 15 mph, stopping sight distance is not sufficient for 25 mph

Case B – Stop Control

Three Sub Cases – Maneuvers

- **Turn left** on to major roadway (clear traffic left, enter traffic right)
- **Turn right** on to major roadway (enter traffic from left)
- **Crossing** (clear traffic left/right)

Case B – Stop Control

- Need ISD for departure and completion even if vehicle comes into view at point of departure = 1.47 $V_{major} * t_g$ where gap time, t_g=**7.5-11.5s**;
- add more time for grade or multilane;
- decrease by 1s. for right turns

Design vehicle	Time gap (s) at design speed of major road (t_g)
Passenger car	7.5
Single-unit truck	9.5
Combination truck	11.5

Note: Time gaps are for a stopped vehicle to turn right or left onto a two-lane highway with no median and grades 3 percent or less. The table values require adjustment as follows:

For multilane highways:

For left turns onto two-way highways with more than two lanes, add 0.5 seconds for passenger cars or 0.7 seconds for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.

For minor road approach grades:

If the approach grade is an upgrade that exceeds 3 percent; add 0.2 seconds for each percent grade for left turns

Exhibit 9-54. Time Gap for Case B1—Left Turn from Stop

Metric				US Customary			
Design speed (km/h)	Stopping sight distance (m)	Intersection sight distance for passenger cars		Design speed (mph)	Stopping sight distance (ft)	Intersection sight distance for passenger cars	
		Calculated (m)	Design (m)			Calculated (ft)	Design (ft)
20	20	41.7	45	15	80	165.4	170
30	35	62.6	65	20	115	220.5	225
40	50	83.4	85	25	155	275.6	280
50	65	104.3	105	30	200	330.8	335
60	85	125.1	130	35	250	385.9	390
70	105	146.0	150	40	305	441.0	445
80	130	166.8	170	45	360	496.1	500
90	160	187.7	190	50	425	551.3	555
100	185	208.5	210	55	495	606.4	610
110	220	229.4	230	60	570	661.5	665
120	250	250.2	255	65	645	716.6	720
130	285	271.1	275	70	730	771.8	775
				75	820	826.9	830
				80	910	882.0	885

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap must be adjusted and required sight distance recalculated.

Exhibit 9-55. Design Intersection Sight Distance—Case B1—Left Turn From Stop

Left turn

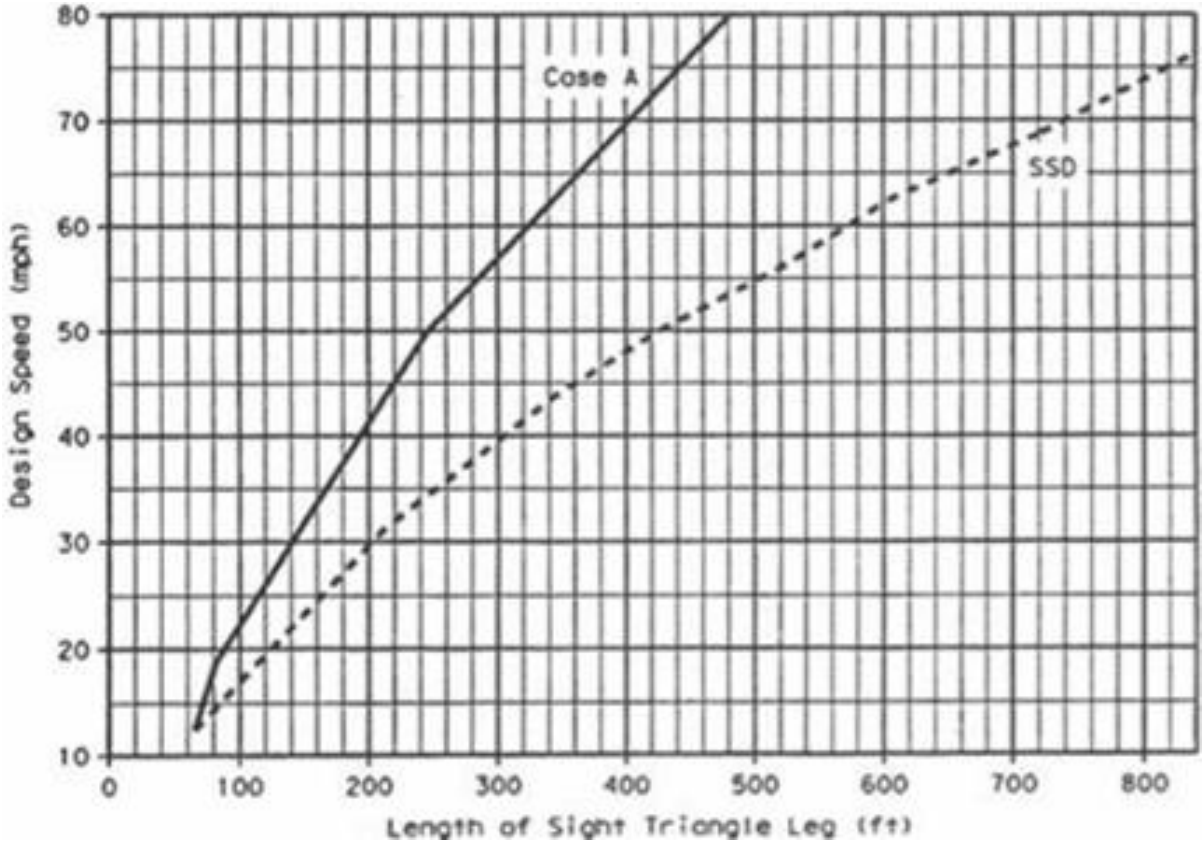
Metric		US Customary	
Design speed (km/h)	Length of leg (m)	Design speed (mph)	Length of leg (ft)
20	20	15	70
30	25	20	90
40	35	25	115
50	45	30	140
60	55	35	165
70	65	40	195
80	75	45	220
90	90	50	245
100	105	55	285
110	120	60	325
120	135	65	365
130	150	70	405
		75	445
		80	485

Note: For approach grades greater than 3%, multiply the sight distance values in this exhibit by the appropriate adjustment factor from Exhibit 9-53.

Can use table or graph

Modify for grade

US Customary														
Approach grade (%)	Design speed (mph)													
	15	20	25	30	35	40	45	50	55	60	65	70	75	80
−6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2
−5	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2
−4	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
−3 to +3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
+4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+5	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+6	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9



right turn and crossing

Design vehicle	Time gap (s) at design speed of major road (t_g)
Passenger car	6.5
Single-unit truck	8.5
Combination truck	10.5

Note: Time gaps are for a stopped vehicle to turn right onto or cross a two-lane highway with no median and grades 3 percent or less. The table values require adjustment as follows:

For multilane highways:
For crossing a major road with more than two lanes, add 0.5 seconds for passenger cars and 0.7 seconds for trucks for each additional lane to be crossed and for narrow medians that cannot store the design vehicle.

For minor road approach grades:
If the approach grade is an upgrade that exceeds 3 percent, add 0.1 seconds for each percent grade.

Exhibit 9-57. Time Gap for Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

US Customary			
Design speed (mph)	Stopping sight distance (ft)	Intersection sight distance for passenger cars	
		Calculated (ft)	Design (ft)
15	80	143.3	145
20	115	191.1	195
25	155	238.9	240
30	200	286.7	290
35	250	334.4	335
40	305	382.2	385
45	360	430.0	430
50	425	477.8	480
55	495	525.5	530
60	570	573.3	575
65	645	621.1	625
70	730	668.9	670
75	820	716.6	720
80	910	764.4	765

Exhibit 9-58. Design Intersection Sight Distance—Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

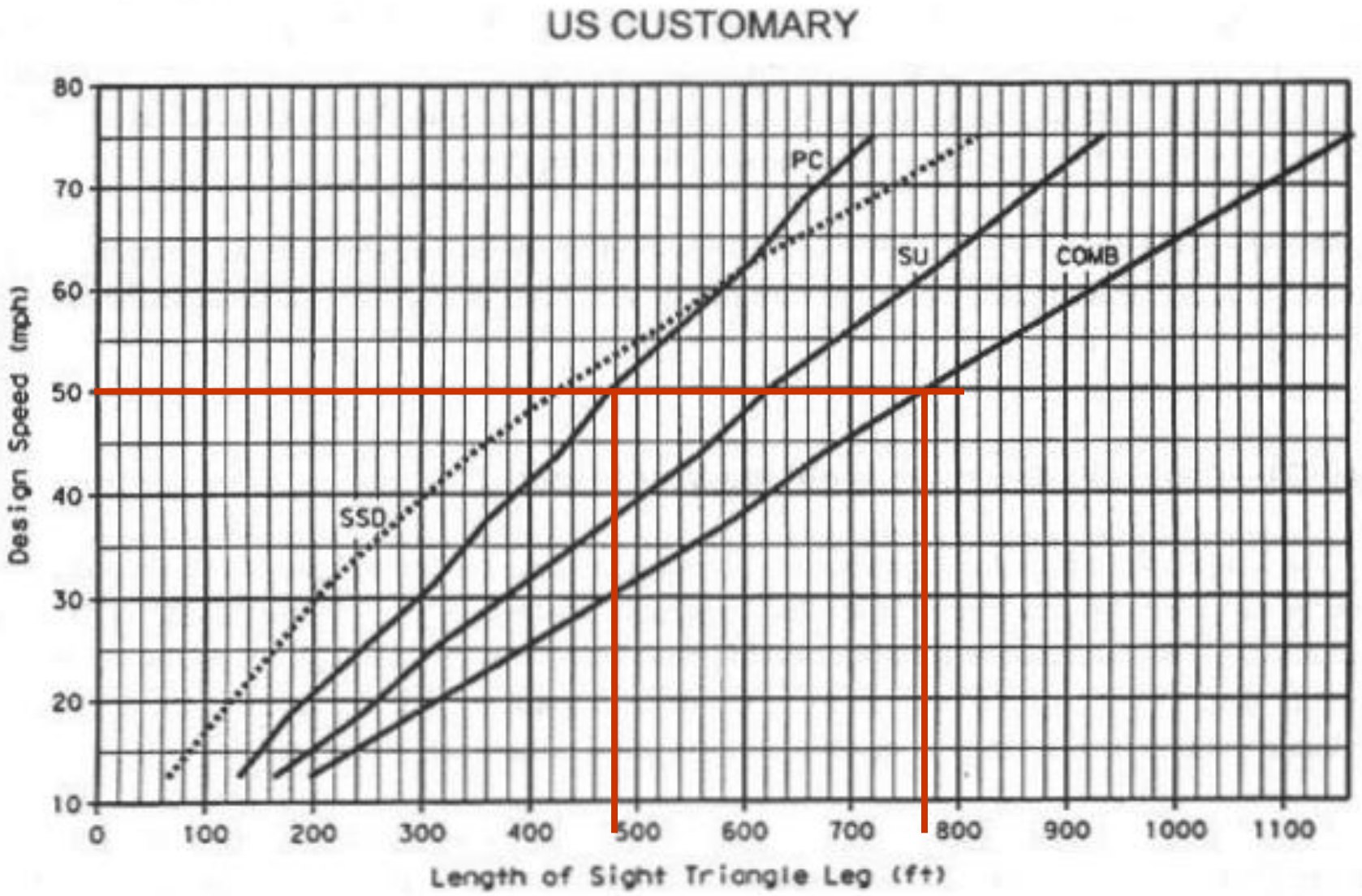


Exhibit 9-59. Intersection Sight Distance—Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

Case C - Yield Control

- Minor Roadway Yields – must be able to see left/right – adjust speed – **possibly stop**
- **Sight distance exceeds that of stop control**
- Similar to no-control

Case C - Yield Control

- **Must** use minimum stopping sight distances for d_a and d_b
- SSD calculation should include effect of grade
- Required distance = **P/R + stopping distances**

Case C - Yield Control

- Typically Known – a, b
- Typically Assume V_a or V_b
- **Similar triangles** can be used to calculate safe approach speeds (given one approach speed) or allowable a and b.
- $d_a/d_b = (d_a - b)/a$
- $d_b = (d_a * a)/ (d_a - b)$

Yield Control

- Case C 1: Crossing maneuver from minor road
- Assumes minor road vehicles that do not stop decelerate to 60% of minor road speed
- Vehicle should be able to:
  - Travel from decision point to intersection decelerating to 60% of design speed
  - Cross and clear the intersection at the same (i.e., 60%) speed

Metric	US Customary
$t_g = t_a + \frac{w + L_a}{0.167 V_{minor}}$	$t_g = t_a + \frac{w + L_a}{0.88 V_{minor}}$ (9-2)
$b = 0.278 V_{major} t_g$	$b = 1.47 V_{major} t_g$
where:	where:
t_g = travel time to reach and clear the major road (s)	t_g = travel time to reach and clear the major road (s)
b = length of leg of sight triangle along the major road (m)	b = length of leg of sight triangle along the major road (ft)
t_a = travel time to reach the major road from the decision point for a vehicle that does not stop (s) (use appropriate value for the minor-road design speed from Exhibit 9-60 adjusted for approach grade, where appropriate)	t_a = travel time to reach the major road from the decision point for a vehicle that does not stop (s) (use appropriate value for the minor-road design speed from Exhibit 9-60 adjusted for approach grade, where appropriate)
w = width of intersection to be crossed (m)	w = width of intersection to be crossed (ft)
L_a = length of design vehicle (m)	L_a = length of design vehicle (ft)
V_{minor} = design speed of minor road (km/h)	V_{minor} = design speed of minor road (mph)
V_{major} = design speed of major road (km/h)	V_{major} = design speed of major road (mph)

t_g

Figure on page 671, AASHTO "Green Book" 2001

Metric					US Customary				
	Minor-road approach		Travel time (t_g) (seconds)			Minor-road approach		Travel time (t_g) (seconds)	
Design speed (km/h)	Length of leg[1] (m)	Travel time t_a[1,2] (seconds)	Calculated value	Design value[3,4]	Design speed (mph)	Length of leg[1] (ft)	Travel time t_a[1,2] (seconds)	Calculated value	Design value[3,4]
20	20	3.2	7.1	7.1	15	75	3.4	6.7	6.7
30	30	3.6	6.2	6.5	20	100	3.7	6.1	6.5
40	40	4.0	6.0	6.5	25	130	4.0	6.0	6.5
50	55	4.4	6.0	6.5	30	160	4.3	5.9	6.5
60	65	4.8	6.1	6.5	35	195	4.6	6.0	6.5
70	80	5.1	6.2	6.5	40	235	4.9	6.1	6.5
80	100	5.5	6.5	6.5	45	275	5.2	6.3	6.5
90	115	5.9	6.8	6.8	50	320	5.5	6.5	6.5
100	135	6.3	7.1	7.1	55	370	5.8	6.7	6.7
110	155	6.7	7.4	7.4	60	420	6.1	6.9	6.9
120	180	7.0	7.7	7.7	65	470	6.4	7.2	7.2
130	205	7.4	8.0	8.0	70	530	6.7	7.4	7.4
					75	590	7.0	7.7	7.7
					80	660	7.3	7.9	7.9

[1] For minor-road approach grades that exceed 3 percent, multiply the distance or the time in this table by the appropriate adjustment factor from Exhibit 9-53.

[2] Travel time applies to a vehicle that slows before crossing the intersection but does not stop.

[3] The value of t_g should equal or exceed the appropriate time gap for crossing the major road from a stop-controlled approach.

[4] Values shown are for a passenger car crossing a two-lane highway with no median and grades 3 percent or less.

Exhibit 9-60. Case C1—Crossing Maneuvers From Yield-Controlled Approaches—Length of Minor Road Leg and Travel Times

Metric									US Customary									
Major road design speed (km/h)	Stopping sight distance (m)	Minor-road design speed (km/h)							Major road design speed (mph)	Stopping sight distance (ft)	Minor-road design speed (mph)							
		20	30-80	90	100	110	120	130			15	20-50	55	60	65	70	75	80
		Design values (m)									Design values (ft)							
20	20	40	40	40	40	45	45	45	15	80	150	145	150	155	160	165	170	175
30	35	60	55	60	60	65	65	70	20	115	200	195	200	205	215	220	230	235
40	50	80	75	80	80	85	90	90	25	155	250	240	250	255	265	275	285	295
50	65	100	95	95	100	105	110	115	30	200	300	290	300	305	320	330	340	350
60	85	120	110	115	120	125	130	135	35	250	345	335	345	360	375	385	400	410
70	105	140	130	135	140	145	150	160	40	305	395	385	395	410	425	440	455	465
80	130	160	145	155	160	165	175	180	45	360	445	430	445	460	480	490	510	525
90	160	180	165	175	180	190	195	205	50	425	495	480	495	510	530	545	570	585
100	185	200	185	190	200	210	215	225	55	495	545	530	545	560	585	600	625	640
110	220	220	200	210	220	230	240	245	60	570	595	575	595	610	640	655	680	700
120	250	240	220	230	240	250	260	270	65	645	645	625	645	660	690	710	740	755
130	285	260	235	250	260	270	280	290	70	730	690	670	690	715	745	765	795	815
									75	820	740	720	740	765	795	820	850	875
									80	910	790	765	790	815	850	875	910	930

Note: Values in the table are for passenger cars and are based on the unadjusted distances and times in Exhibit 9-60. The distances and times in Exhibit 9-60 need to be adjusted using the factors in Exhibit 9-53.

Exhibit 9-61. Length of Sight Triangle Leg Along Major Road—Case C1—Crossing Maneuver at Yield Controlled Intersections

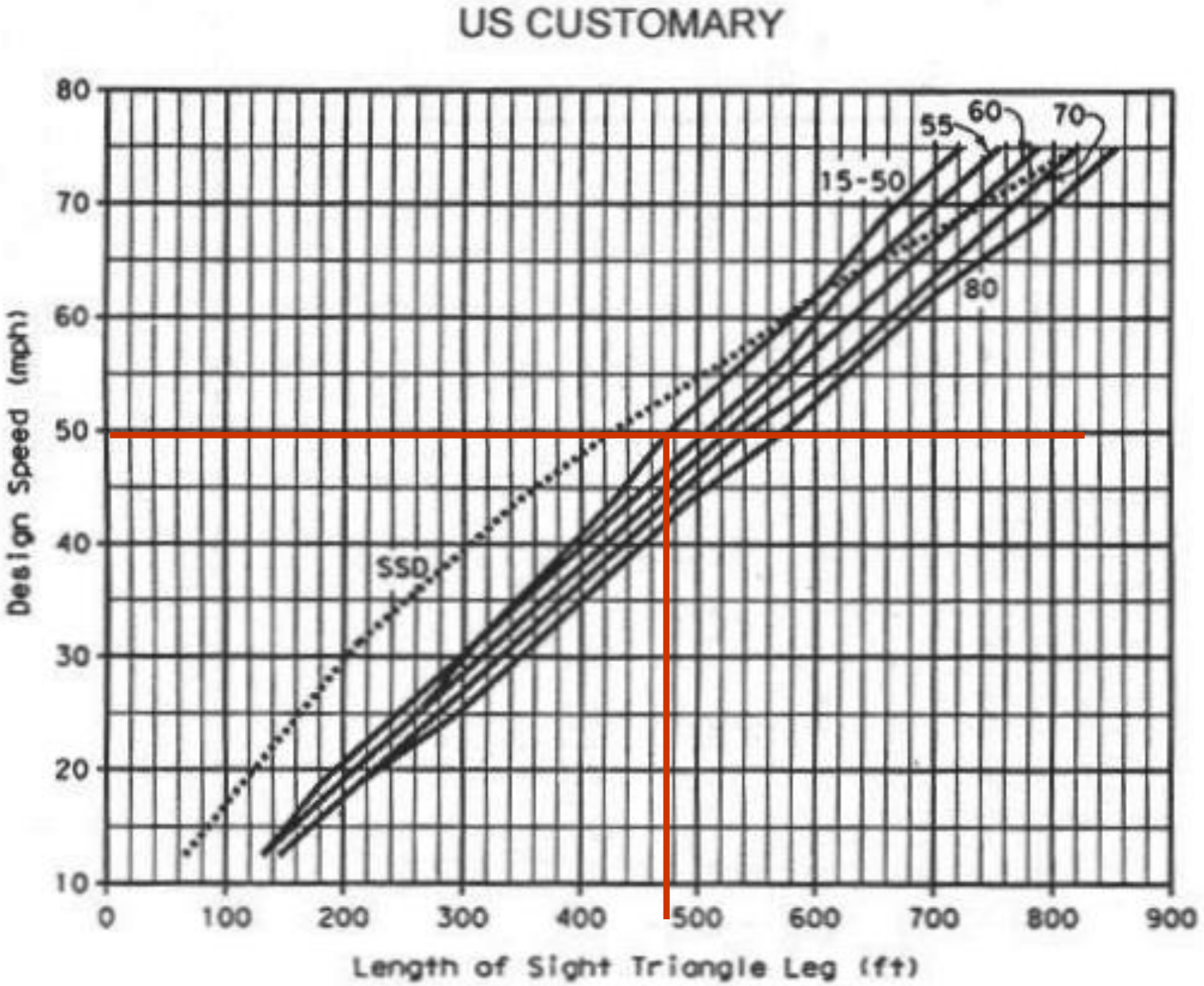


Exhibit 9-62. Length of Sight Triangle Leg Along Major Road for Passenger Cars—Case C1—Crossing Maneuver

Also …

- Case C2: Left and Right turns at **yield control**
- Case D: **Signal** control
- Case E: **All way stop**
- Case F: **Left turn from major**
- tg=5.5-7.5s + **multilane adjustment**
- **Effect of Skew**

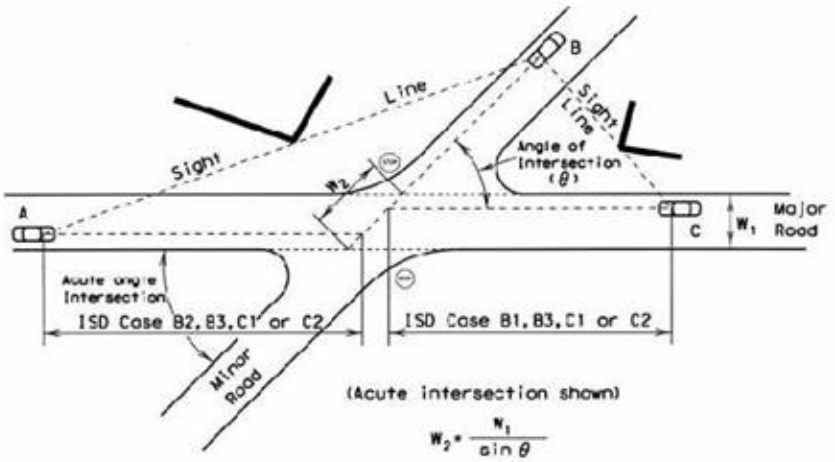
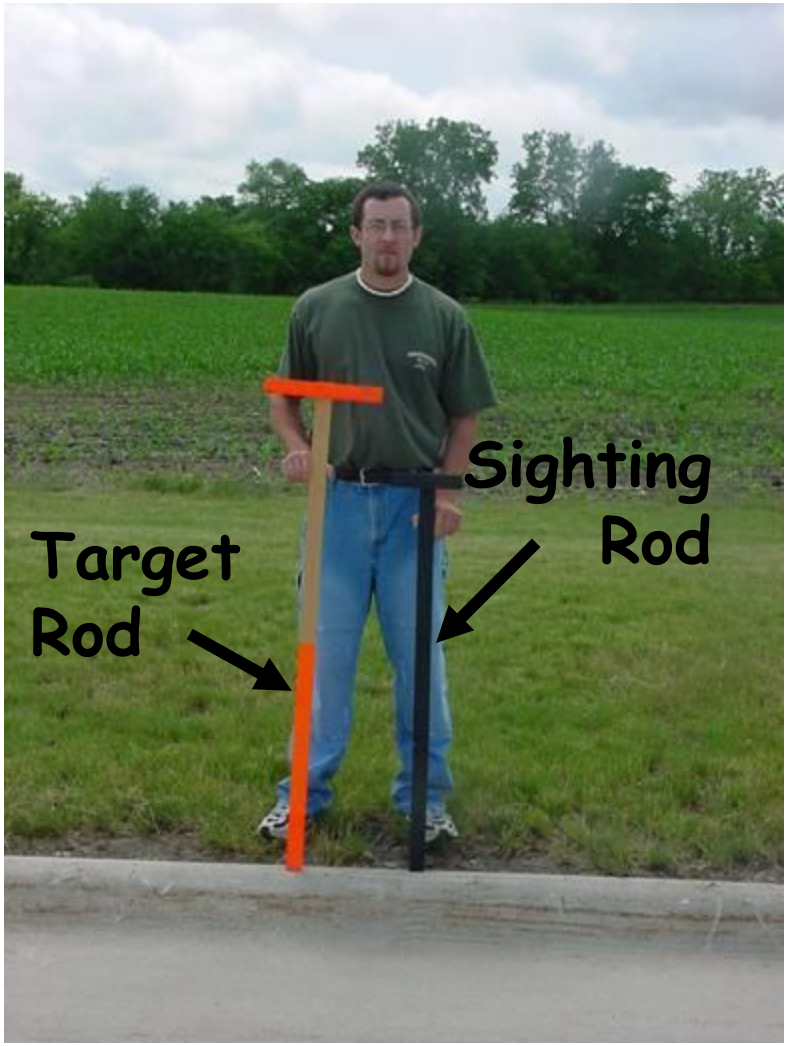


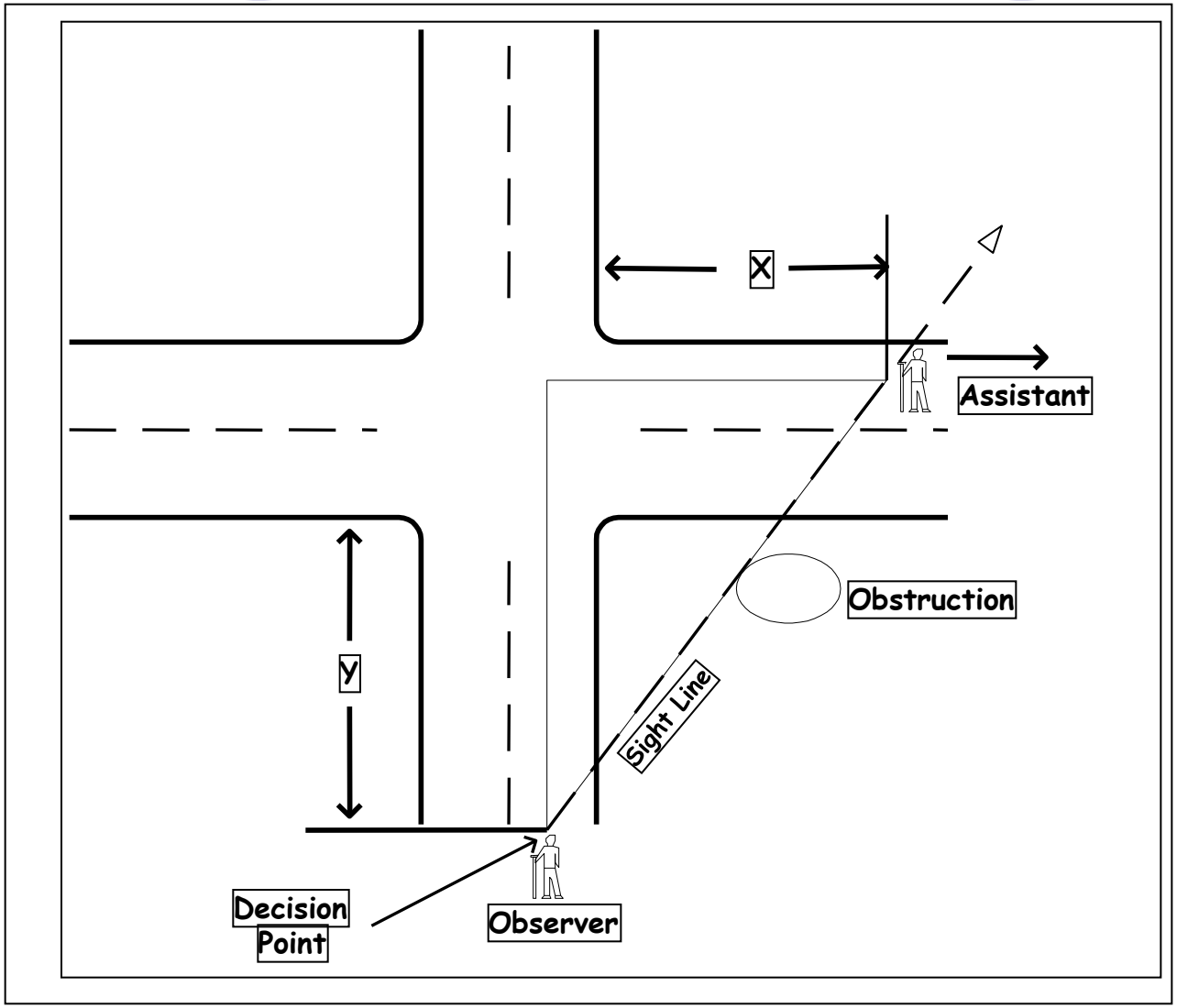
Exhibit 9-69. Sight Triangles at Skewed Intersections

Sighting Rod and Target Rod (AASHTO)

- For vertical sight distance with vertical curves
- Sighting rod- 3.5 feet tall
- Target rod- 4.25 feet tall (Top portion and bottom 2 feet are painted orange)

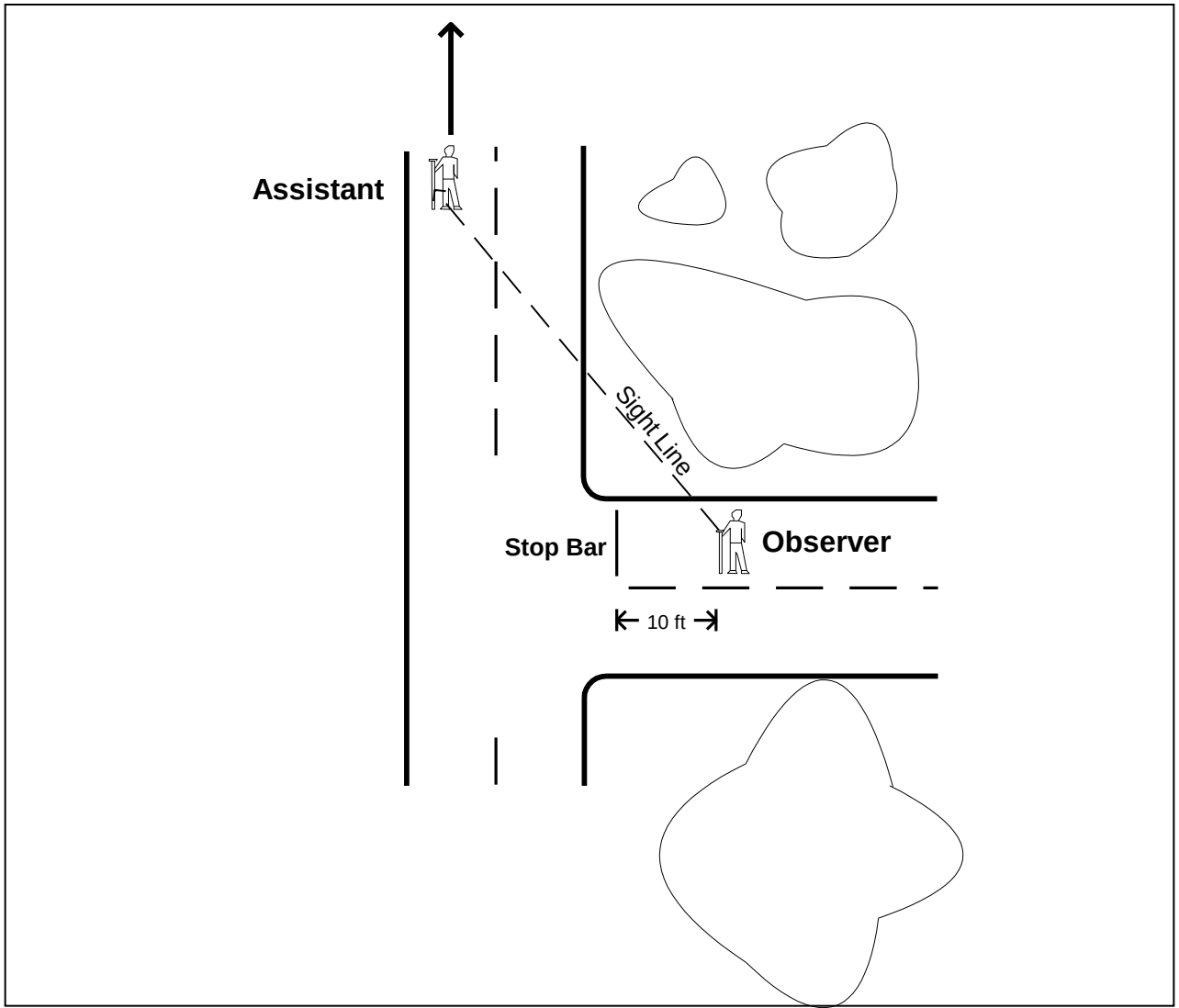


Measuring at an Uncontrolled Intersection




RESEARCH
PARK
Assistant
Movement of Assistant
Observer

Measuring at a Stop-controlled Intersection




STOP
4-WAY
Assistant with Target Rod (4.25 ft)
Observer with Sighting Rod (3.5 ft)

معايير مسافات الرؤية على التقاطعات (حسب آشتو):

حالة ب: مسافة الرؤية للعربات المنعطفة لليسار من الذراع المنظم بإشارة قف:

تكون مسافة الرؤية اللازمة لإنجاز عملية الانعطاف لليسار أكبر من المسافة اللازمة للعبور، وتحسب من العلاقة:

$$d = 0.278\ V\ (T_d + T_a)$$

حيث:

d: مسافة الرؤية لليسار،

حالة جـ: مسافة الرؤية للعربات المنعطفة لليمين من الذراع المنظم بإشارة قف:

تكون مسافة الرؤية لهذه الحالة أقل بشكل بسيط (حوالي ٠.٥ م) منها لحالة الانعطاف لليسار.

لإنعطاف لليسار، وتحسب هذه المسافة من العلاقة:

$$S = 3.05\ m + W_L + L$$

3.05 m: المسافة خلف خط الوقوف،

W_L: عرض الطريق للحركة المنعطفة لليسار = ١.٥ × عرض حارة المرور

L: طول العربة.


Hidden Vehicle

ISD Cases

- **No control**: vehicles adjust speed
- **Stop control**: where traffic on minor roadway must stop prior to entering major roadway
- **Yield control**: vehicles on minor roadway must yield to major roadway traffic
- **Signal control**: where vehicles on all approaches are required to stop by either a stop sign or traffic signal
- ***All way stop***
- Stopped major roadway **left-turn** vehicles – must **yield** to oncoming traffic

Case A– No Control

- Minimum sight triangle sides = distance traveled in **3 seconds** (design or actual?) = 2 seconds for P/R and 1 second to actuate brake/accel.
- **Assumes vehicles slow ~ 50% of midblock running speed** (rural???)

Intersections

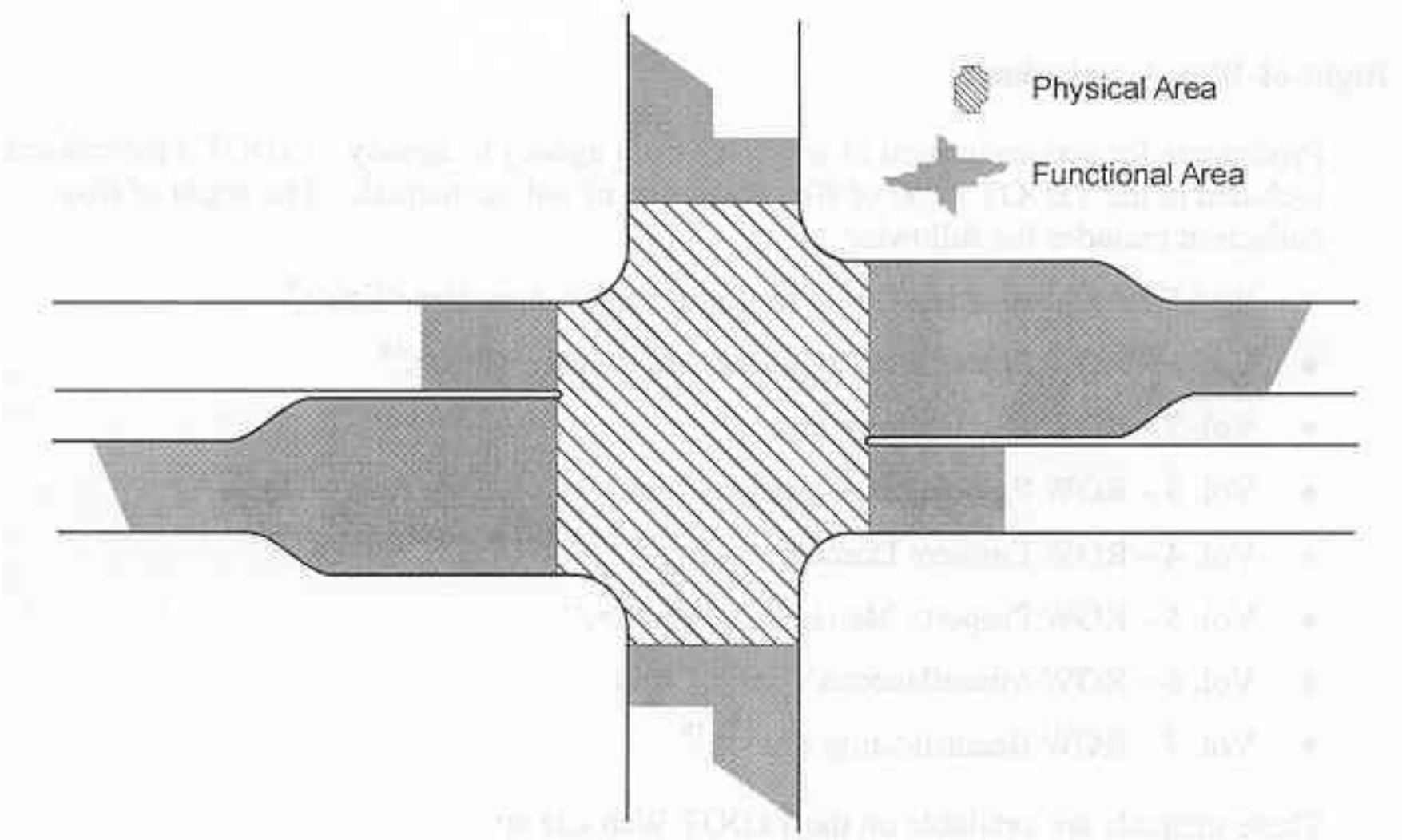
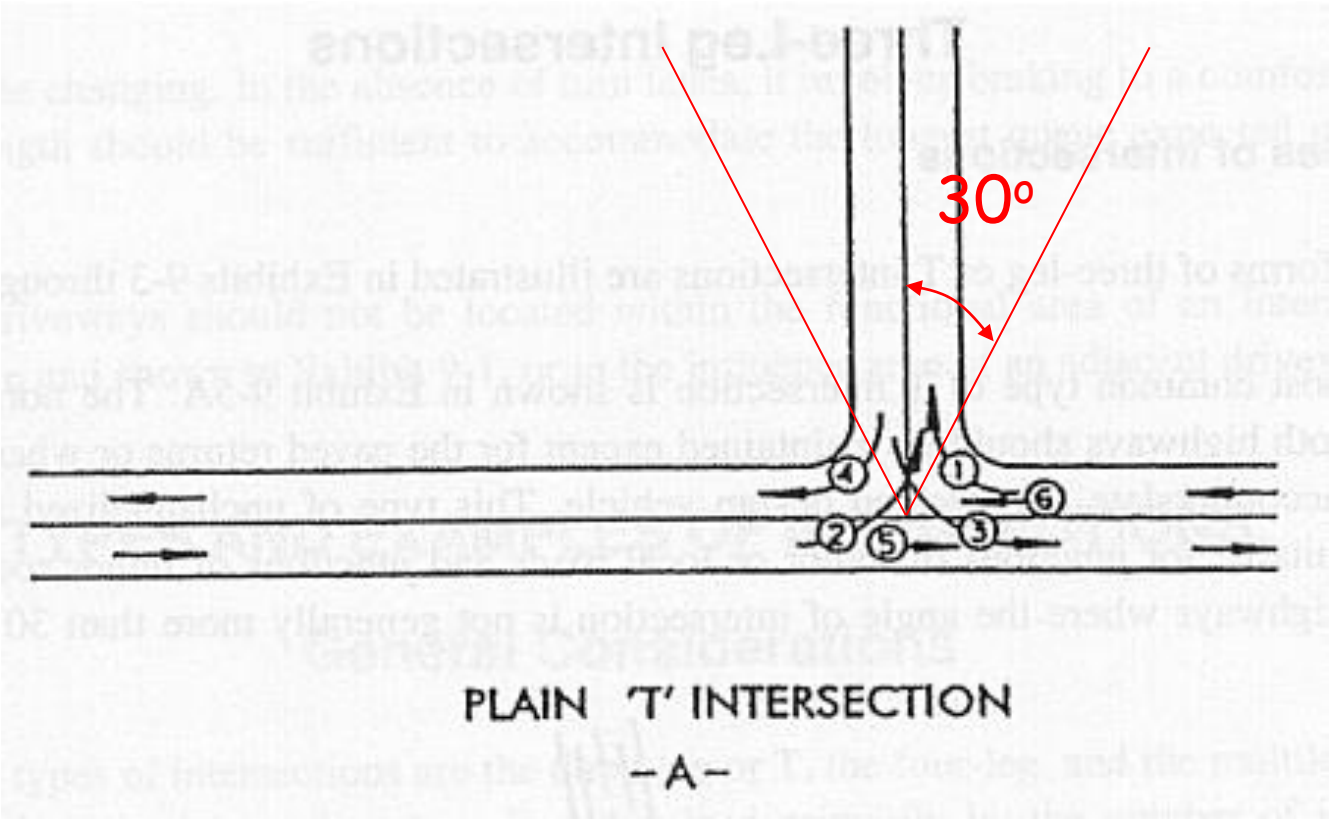


Figure 1-7. Functional Area of an Intersection.[17]

Three-Legged Intersections



PLAIN 'T' INTERSECTION

-A-

Basic Design

Four-Legged Intersections

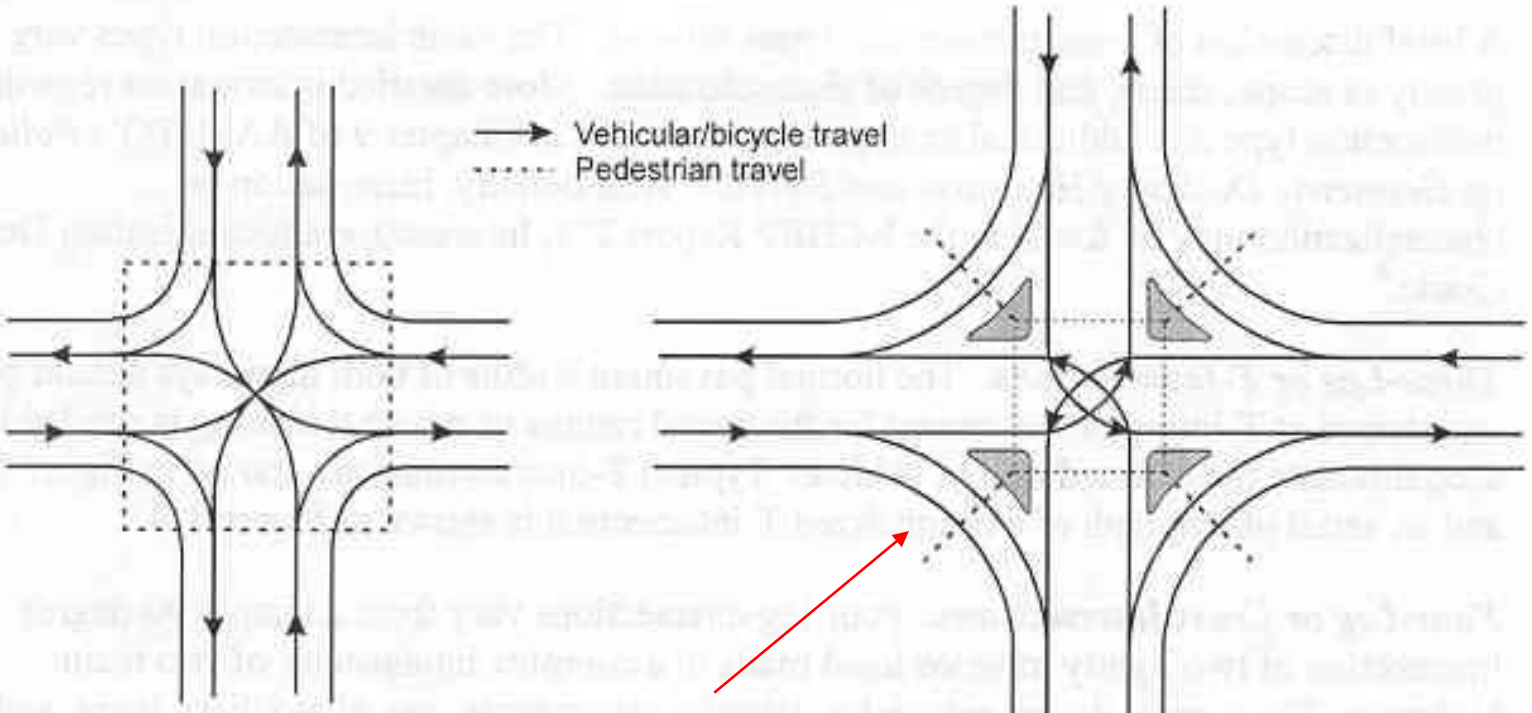


Figure 1-5. Typical Four-Leg Intersections.

Basic Design

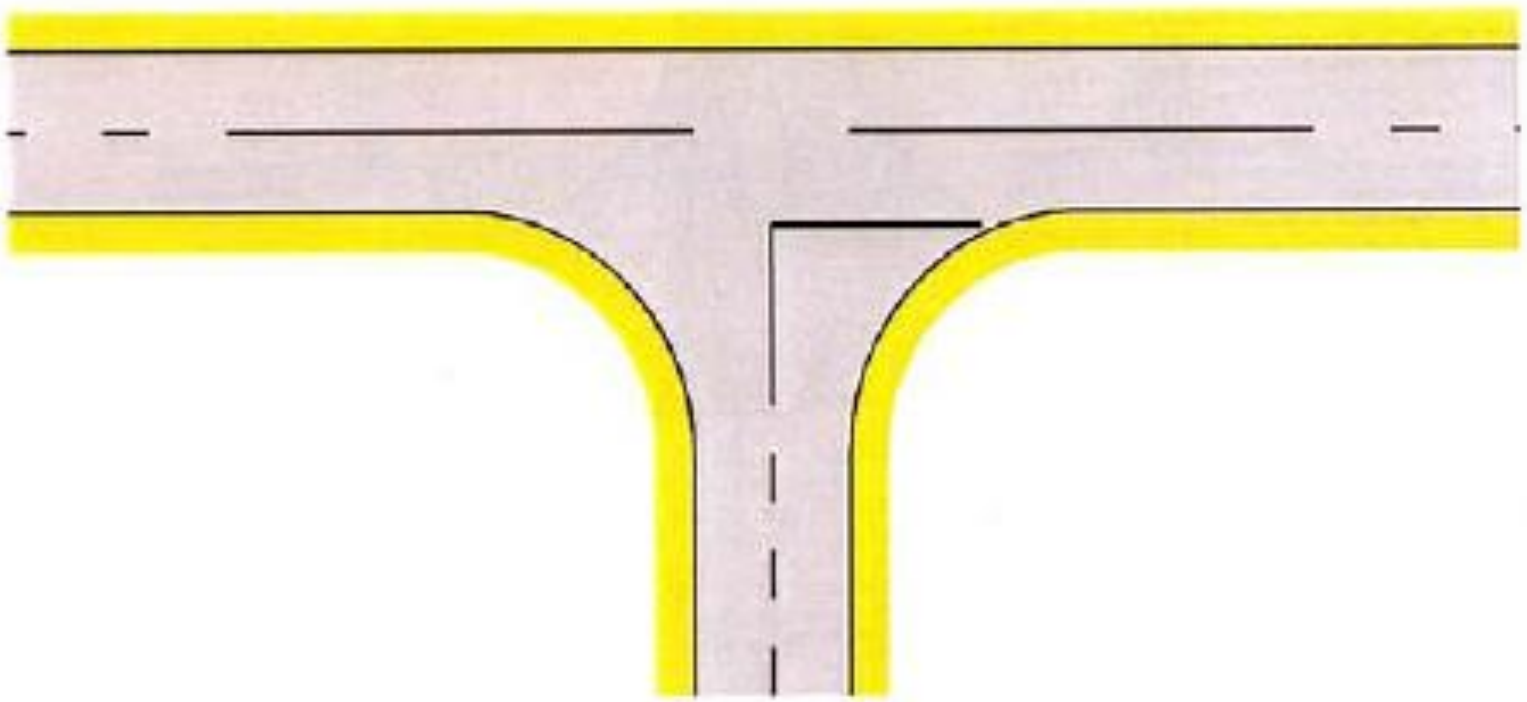


Figure 13.2 : Simple T Intersection

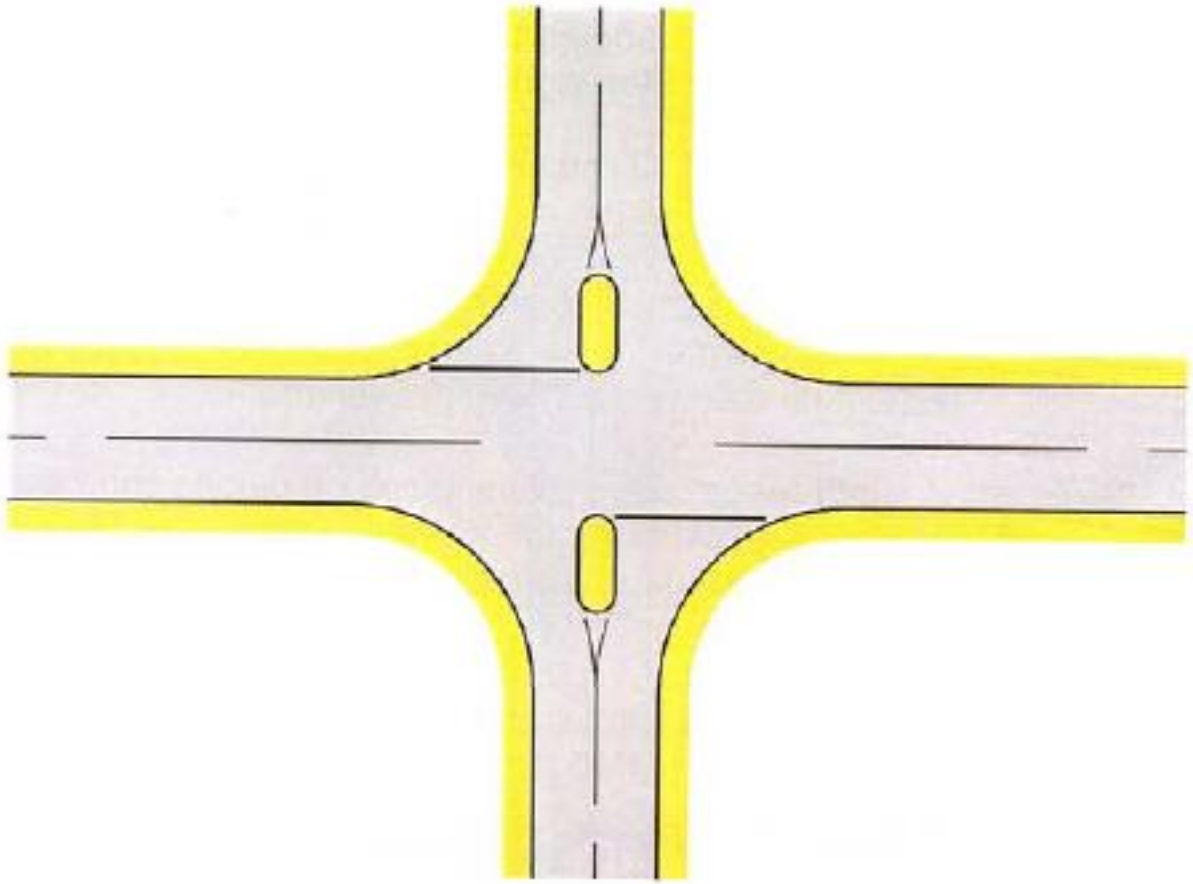
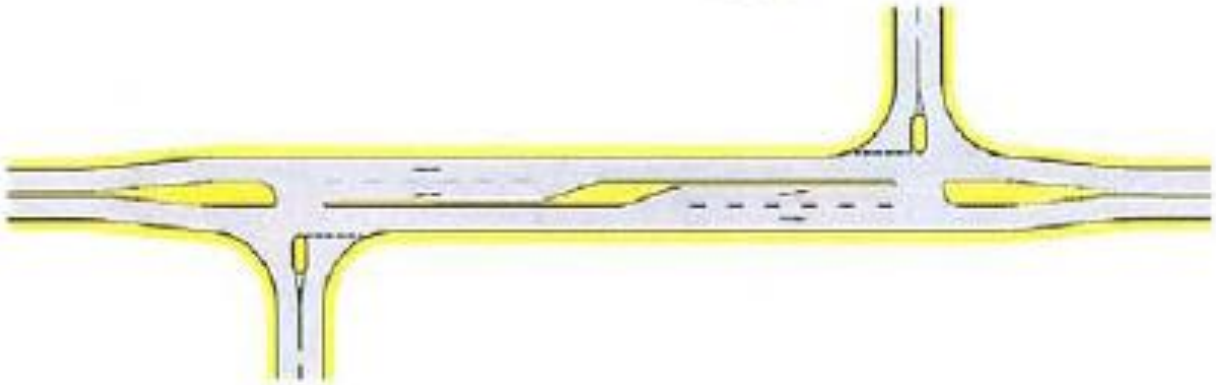


Figure 13.3 : Simple Four-leg Intersection



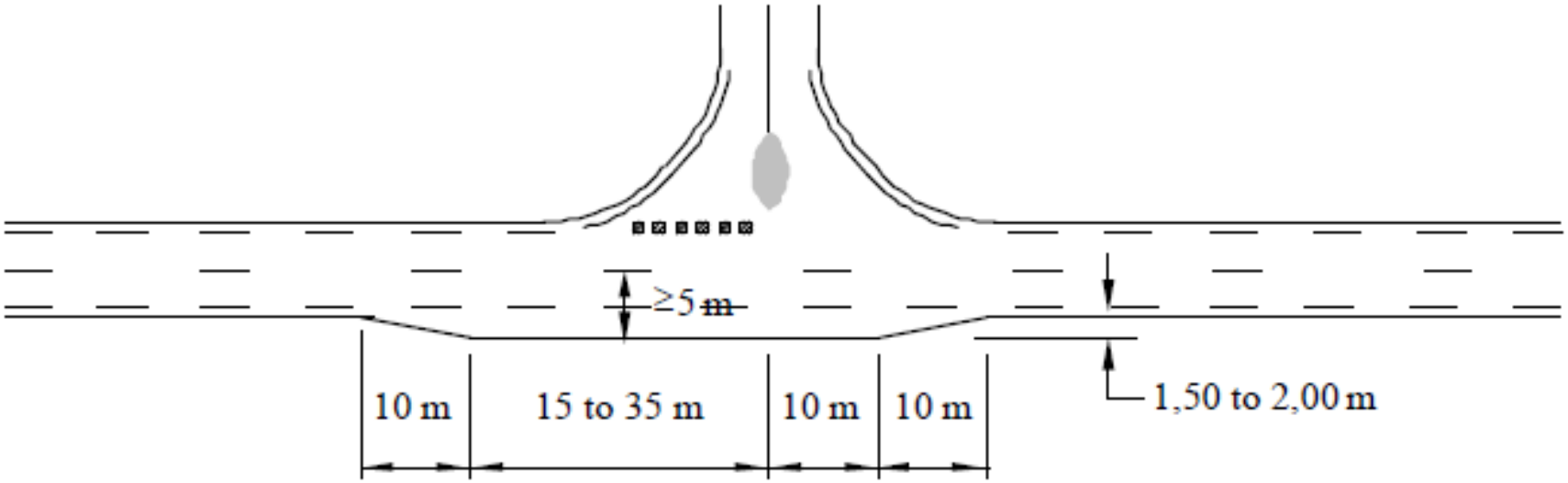
a) Left / right stagger



b) Right / left stagger

Figure 13.4 : Staggered Intersection

Fig. 11 - Facility to assist left-turning movements at a low-traffic T-intersection.



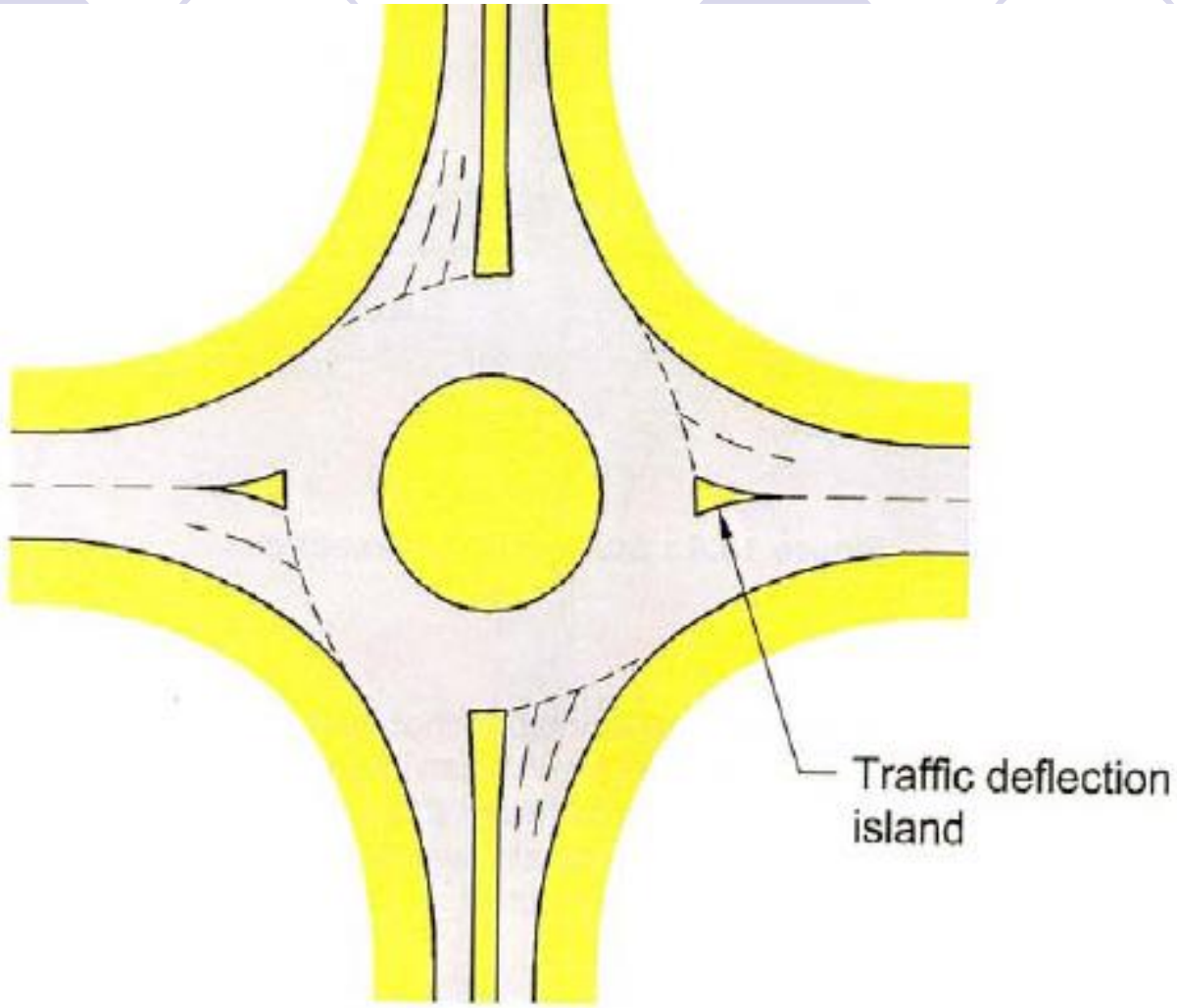
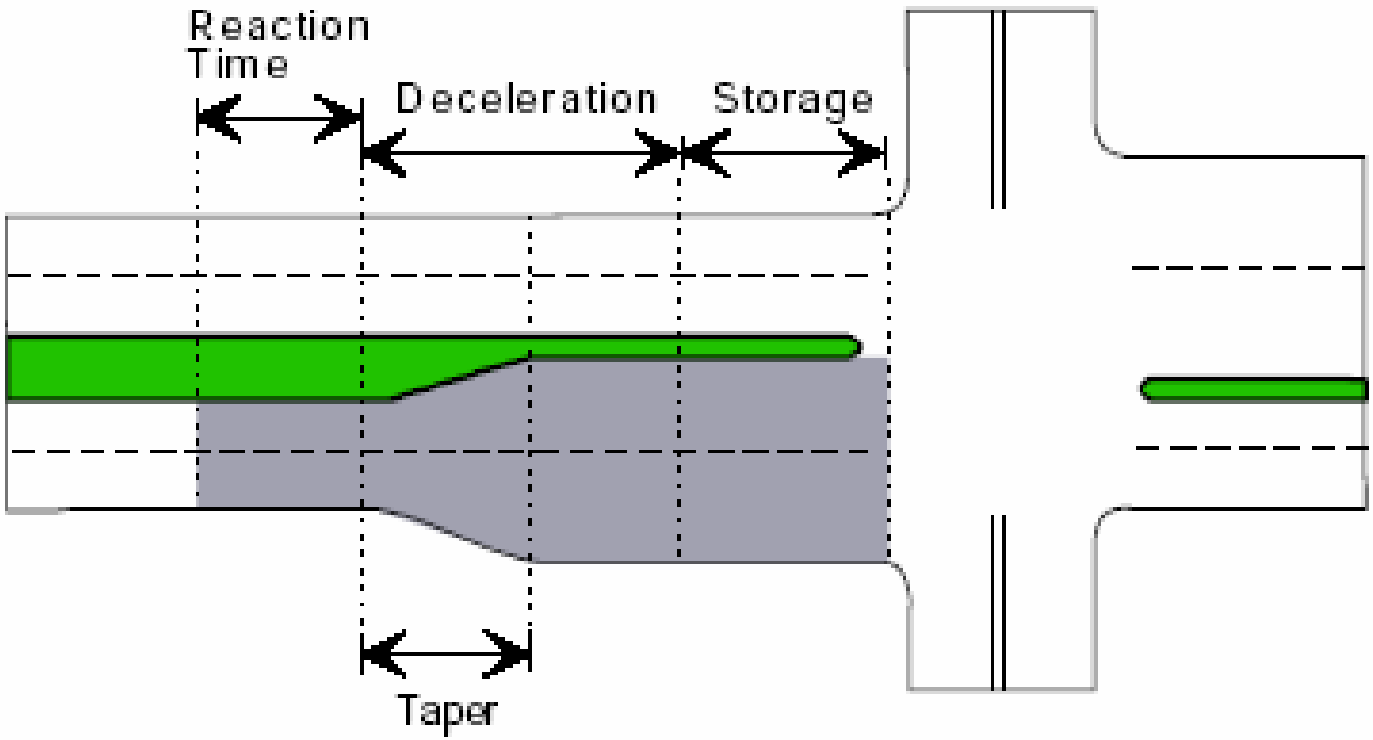


Figure 13.5 : Typical Four-Leg Roundabout


Reaction
Time
Deceleration
Storage
Taper

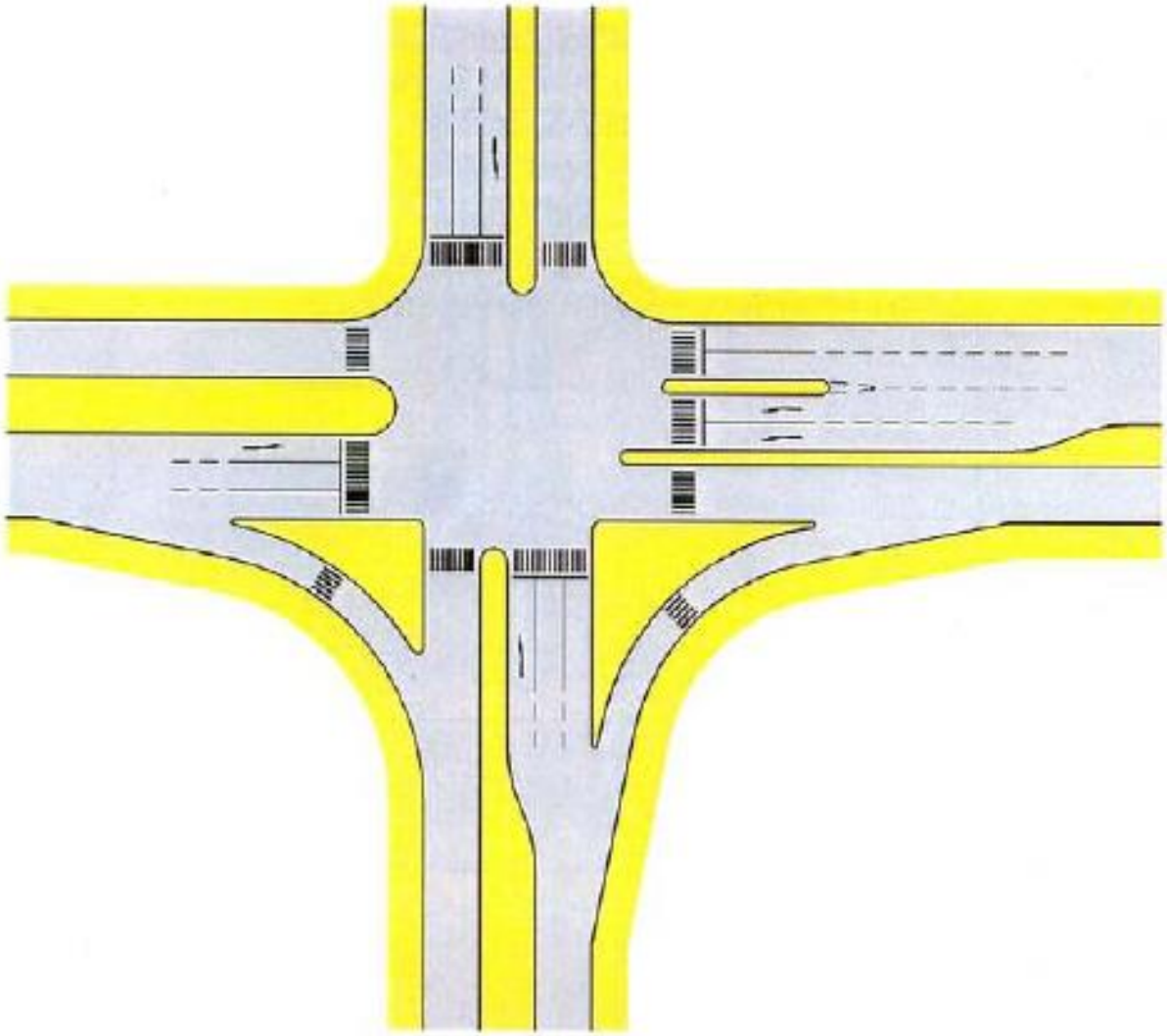


Figure 13.7 : Typical Four-leg Signalized Intersection

Intersections

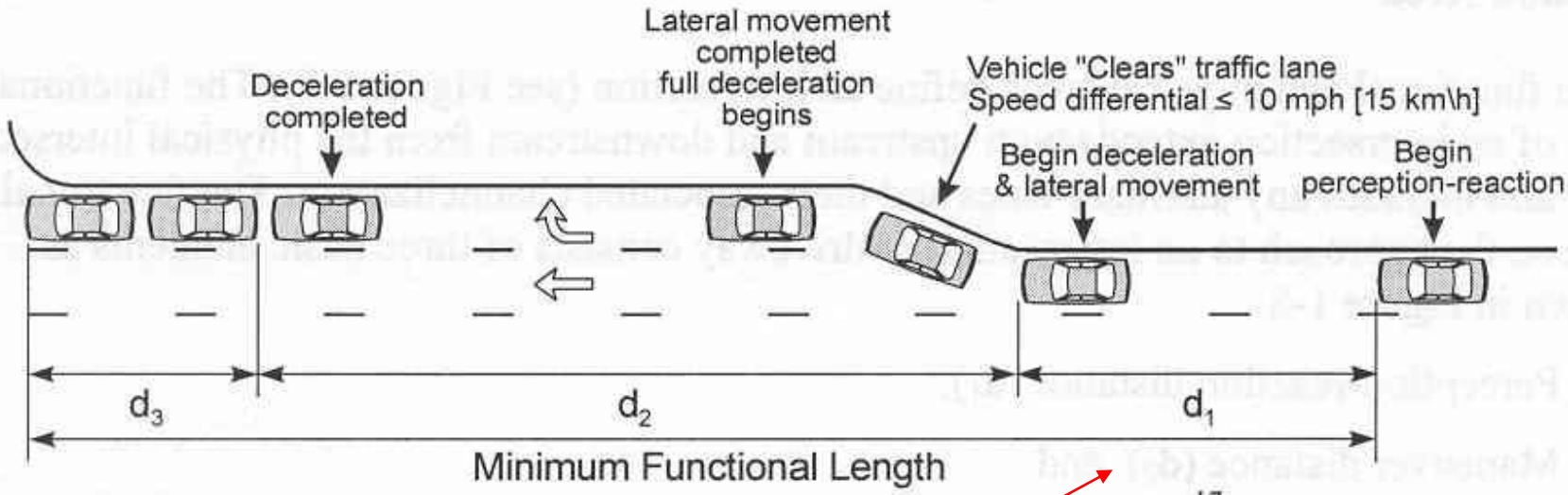
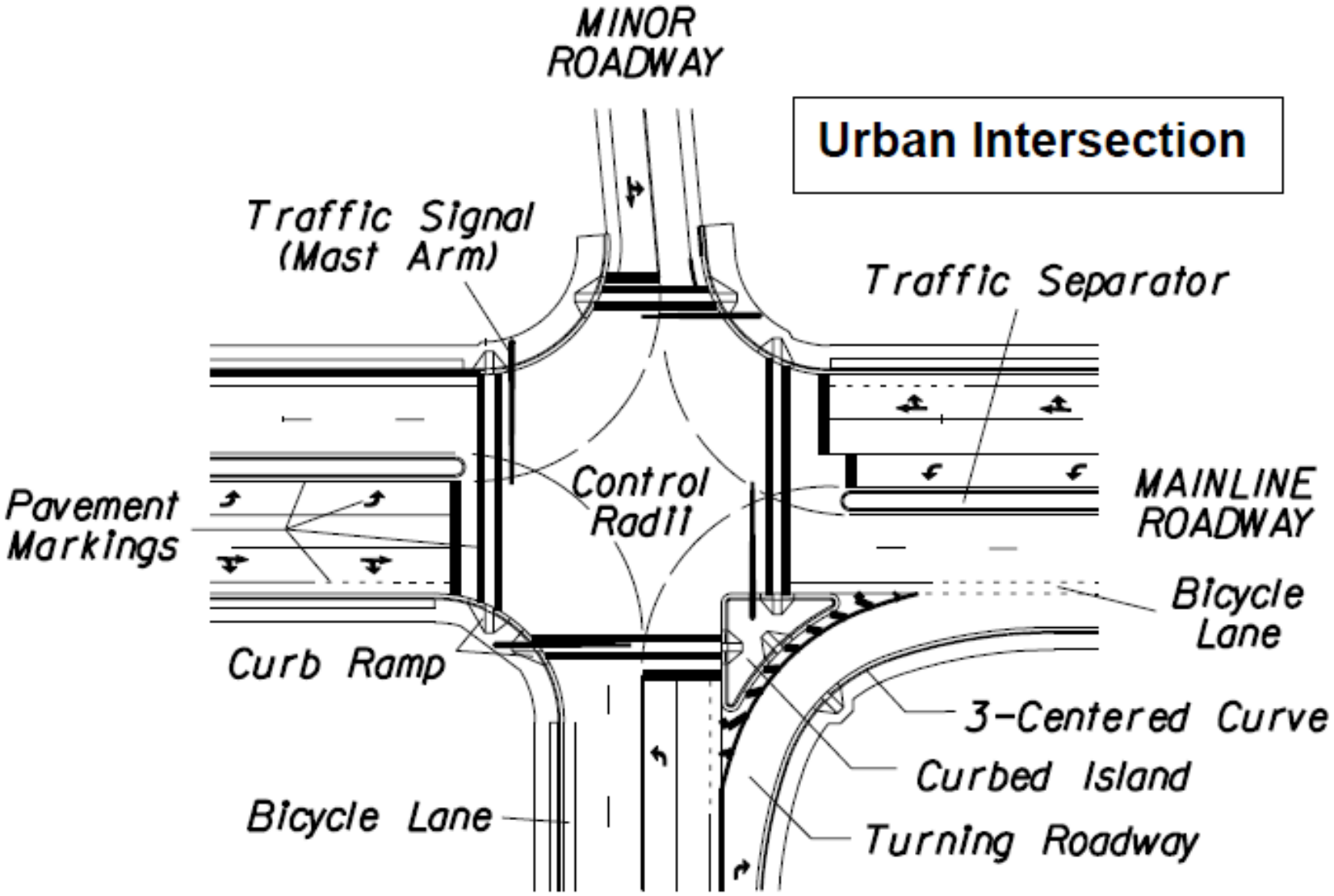
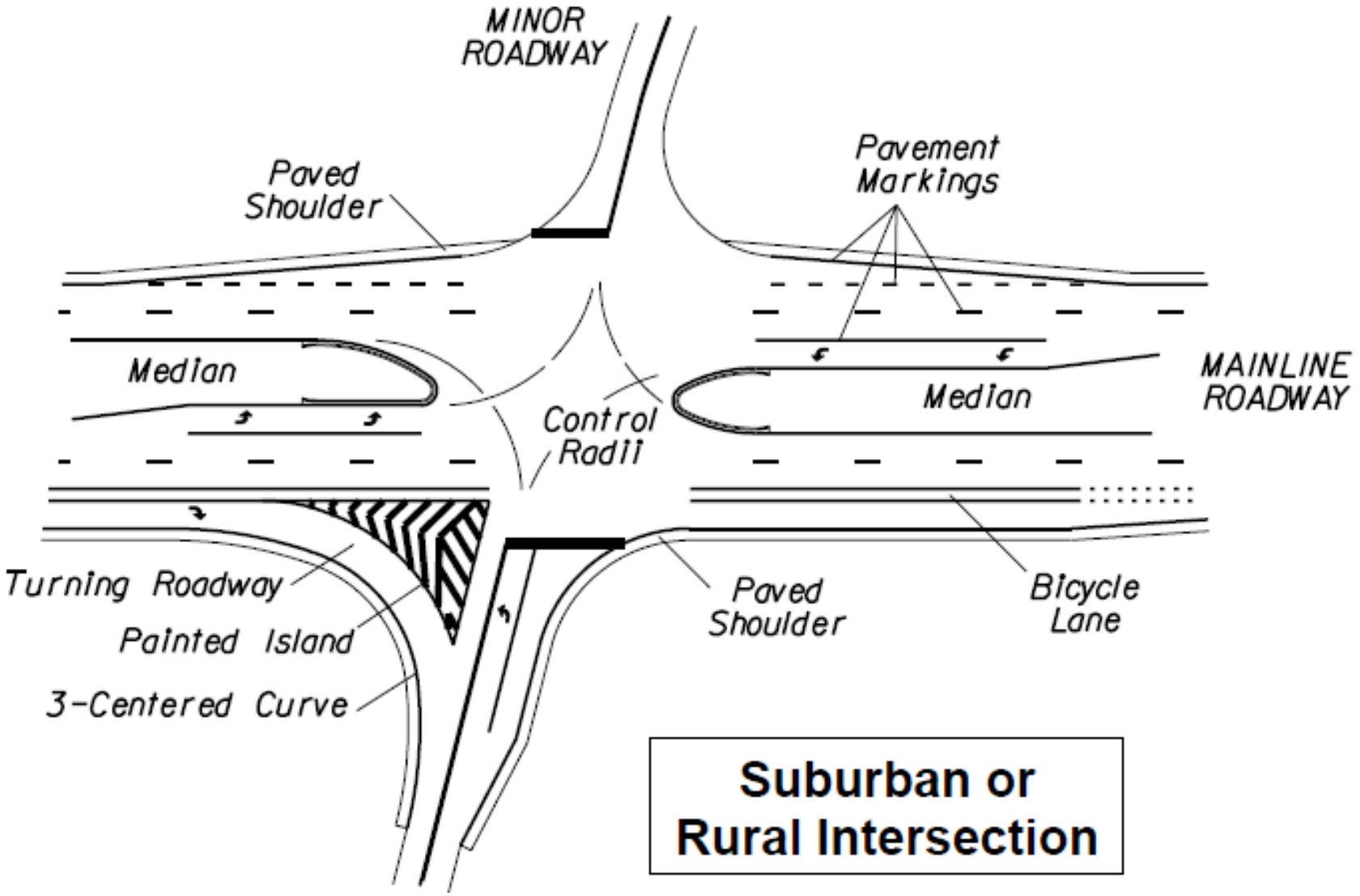


Figure 1-8. Elements of the Functional Area of an Intersection.[17]

Depends on vehicle speed, driver alertness, and driver familiarity with the location


MINOR ROADWAY
Urban Intersection
Traffic Signal (Mast Arm)
Traffic Separator
Pavement Markings
Control Radii
MAINLINE ROADWAY
Bicycle Lane
Curb Ramp
3-Centered Curve
Curbed Island
Bicycle Lane
Turning Roadway


MINOR ROADWAY
Paved Shoulder
Pavement Markings
Median
Control Radii
Median
MAINLINE ROADWAY
Turning Roadway
Painted Island
3-Centered Curve
Paved Shoulder
Bicycle Lane
Suburban or Rural Intersection