

Dilemma Zone Illustrations

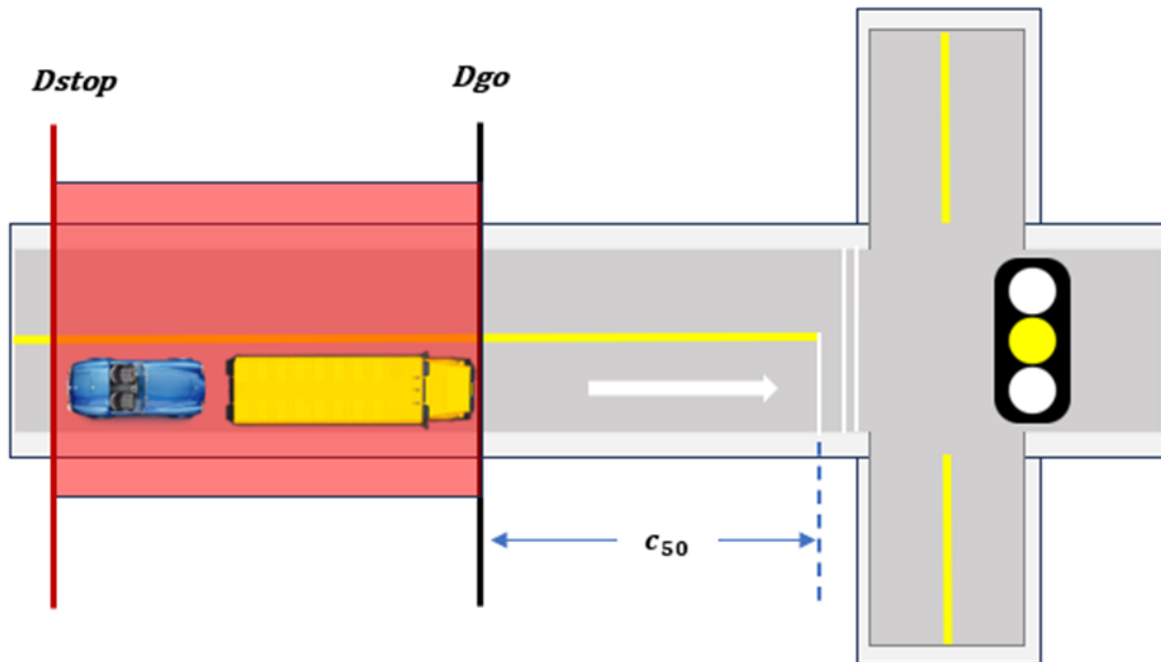
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For the follow illustrations, dilemma zones are in red.

For all illustrations, when a driver is approaching an intersection and he is closer to the intersection than his comfortable stopping distance ***D*stop**, the driver must travel toward and enter the intersection. If the green light turns yellow during this time and the driver is still farther from the intersection than ***D*go**—the distance the yellow light provides to reach the intersection before the light turns red, then the driver has a *dilemma*: he must run a red light.

c50 in the illustration the *critical distance* from the intersection where the 50th percentile driver has a stop-or-go solution. The “c” in **c50** stands for the *critical* point—the point where stop turns into go. Mathematically there is a legal solution to the stop or go problem; but the closer the driver is to **c50** when the light turns yellow, the higher the probability that the driver does not know what the solution is. When drivers are faced with this predicament, drivers often step on the gas. Beating the light is in fact, the directive traffic engineers require of drivers for this predicament.

Illustration 1: Unimpeded Thru-movements with Slower-Reacting Drivers

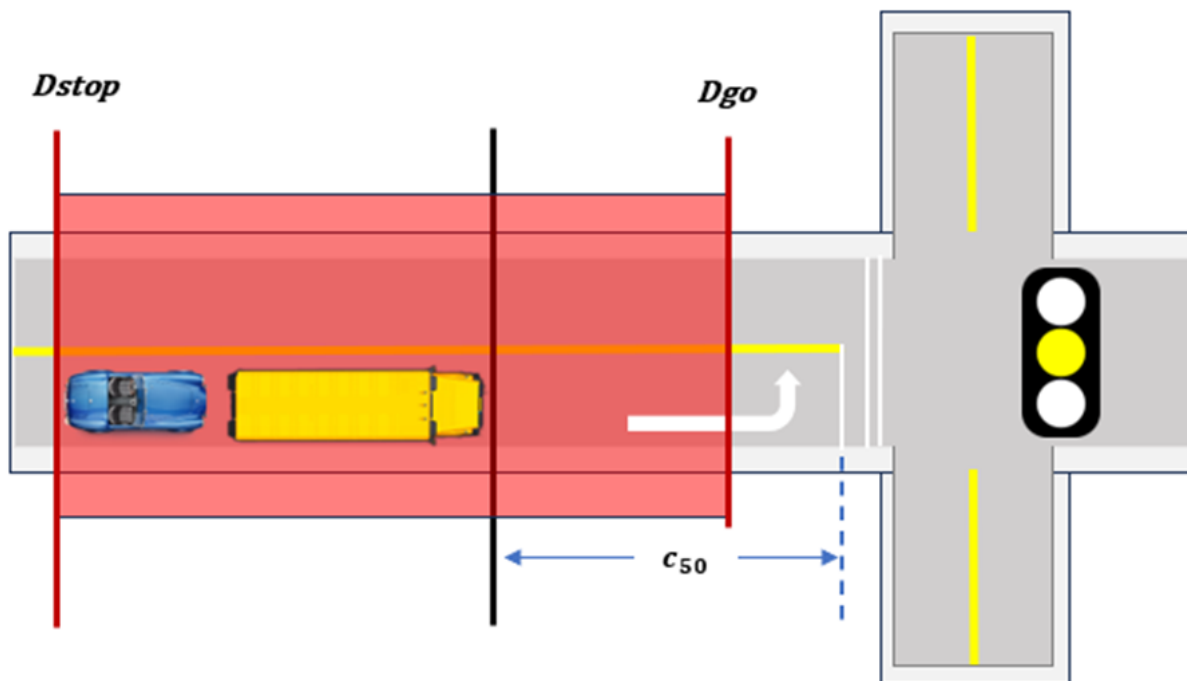


	50 th Percentile Passenger Sedan	85 th Percentile Passenger Sedan	85 th Percentile Commercial Vehicle
D_{stop}	284 ft	419 ft	482 ft
D_{go}	284 ft	284 ft	284 ft
Dilemma Zone Length	0 ft	135 ft	198 ft
Yellow Change Interval	4.3 s	4.3 s	4.3 s
Yellow Required	4.3 s	6.4 s	7.4 s

Illustration 1. When vehicles are not delayed into the intersection by obstacles in front of them, and when these vehicles are going straight, the vehicles' motions are called *unimpeded thru-movements*. In illustration 1, a commercial vehicle (yellow) and a passenger sedan (blue) driven by a slower-reacting driver (like an 80 year-old lady) are approaching the intersection at 45 mph. The perception-reaction time¹ of the 85th percentile commercial vehicle driver is 2.13 s and his deceleration is 6.37 ft/s². His

dilemma zone (**D_{stop}** - **D_{go}**) is 198 feet long. For the 85th percentile blue sedan driven, PR = 1.64 s and deceleration = 7.00 ft/s² and so her dilemma zone is 135 ft long.

Illustration 2. Turning Vehicles



	50 th Percentile Passenger Sedan	85 th Percentile Passenger Sedan	85 th Percentile Commercial Vehicle
<i>Dstop</i>	284 ft	419 ft	482 ft
<i>Dgo</i>	99 ft	143 ft	139 ft
Dilemma Zone Length	185 ft	276 ft	343 ft
Yellow Change Interval	3.0 s	3.0 s	3.0 s
Yellow Required	6.1 s	6.4 s	7.4 s

Illustration 2. This scenario is two drivers approaching an intersection intending to turn left. Both drivers need to slow down to 20 mph upon entering the intersection so they do not flip their vehicles during the turn. The ITE algebra (prior to 2020) demands that vehicles travel from *Dstop* to the intersection at the speed limit or faster. The algebra does not account for the longer time *decelerating* vehicles need to reach the intersection. Therefore, the algebra lengthens the dilemma zone from c_{50} towards the intersection to point *Dgo*.

Illustration 3. Impeded Vehicles

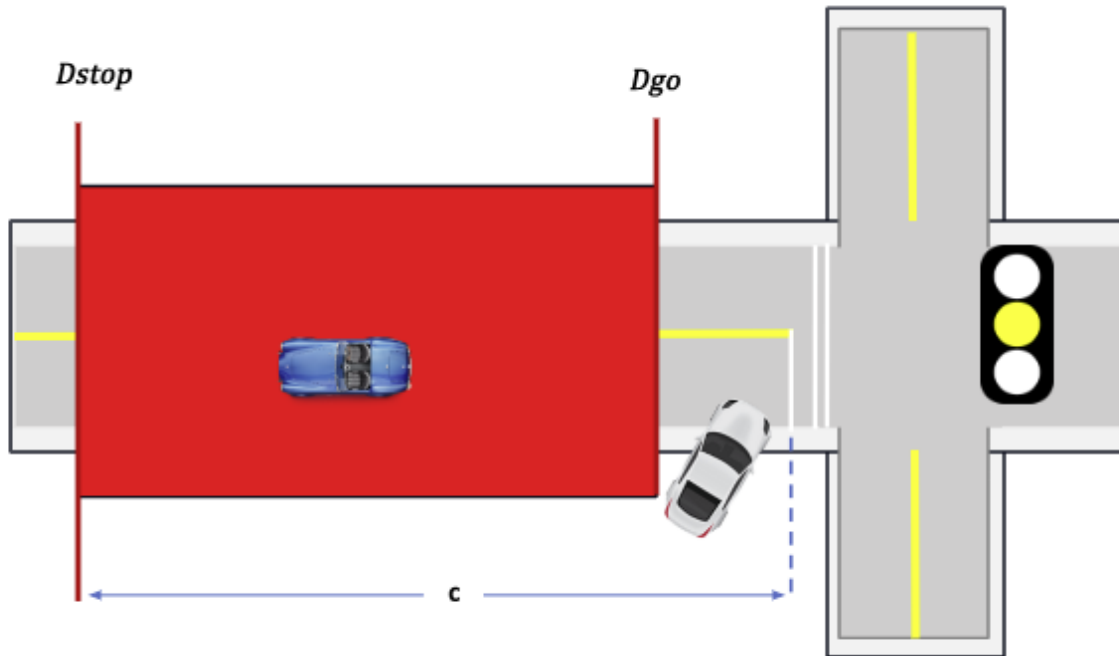


Illustration 3. This scenario shows a blue car approaching an intersection at the moment the light turns yellow. Because the blue car is within distance ***Dstop***, he must travel into the intersection. To conform to the ITE practice, the driver must go at least the speed limit through ***Dstop*** to enter the intersection before the light turns red. If the driver slows down by even the slightest amount, the yellow light will turn to red before he enters the intersection.

As the blue car travels toward the intersection, a white car enters the road from a nearby parking lot. The white car pulls in front of the blue car, causing the blue car's driver to brake in order to avoid rear-ending the white car. The blue sedan runs a red light.

Illustration 4. Thru-movement Case - No Dilemma Zone

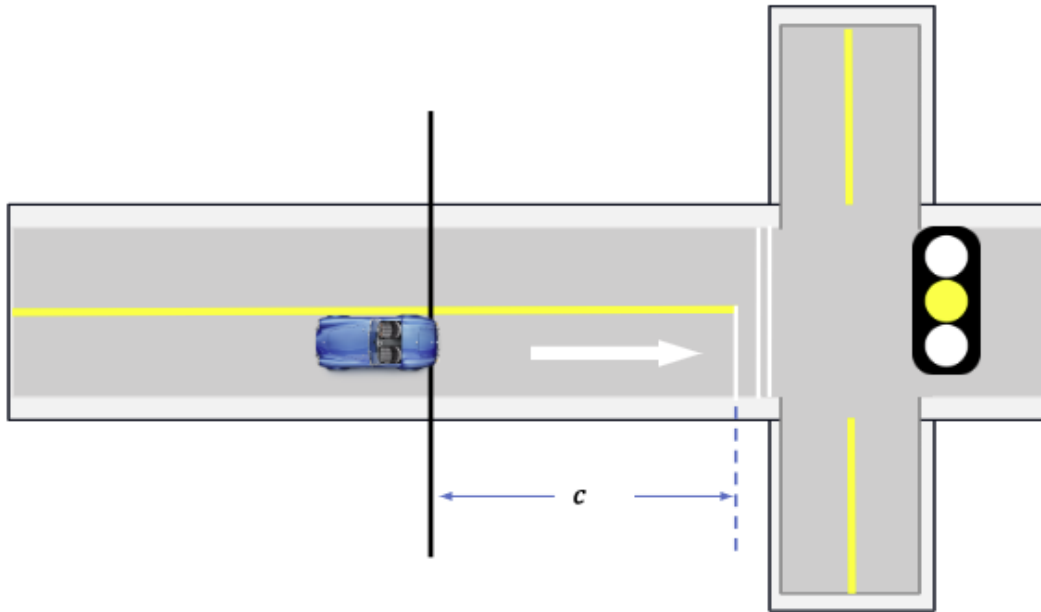


Illustration 4. This scenario is the only case where the ITE practice works. In the vernacular of science, the scenario is called a *special case*. The special case is unimpeded thru-movement for the 50th percentile sedan driver on dry pavement at the simplest intersection where there are no distractions. When these conditions are met, then when the driver is farther from the intersection than the c —the critical point (a.k.a., comfortable stopping distance), the driver stops comfortably. When closer than c , the driver traverses the distance into the intersection at the speed limit or *faster*, thus entering the intersection before the light turns red.

Notes:

1. Timothy Gates and David Noyce, *Dilemma Zone Driver Behavior as a Function of Vehicle Type, Time of Day and Platooning*, pp. 88, 89, Transportation Research Record Journal of the Transportation Research Board (December 2010)