Iona Physics Experiment

Engineering Lab: To Check the Timing of a Yellow Light

Now that we've studied the distance/time/speed relationships, we can investigate a very practical application: Is the yellow portion of the timing cycle of a traffic light set properly?

Explanation: As you approach an intersection where the light is green, it suddenly turns yellow. If you are far enough away (before the intersection) you can stop before entering the intersection. However, if you are unable to stop before entering the intersection, you must continue all the way through it.

The law in most states may be understood to say that you may neither enter nor continue through an intersection when the light in your direction is red. Therefore, the light needs to be yellow for a long enough time that any auto traveling at the legal speed limit which cannot stop before entering the intersection is able to completely clear the intersection before the light turns red.

If the light is yellow for too short a time then there will exist a DILEMMA ZONE. A Dilemma zone is a region before an intersection where the driver who is traveling at the legal limit is too close to stop, and too far away to clear the intersection before the light turns red.

Since a car must not be crossing the intersection when the light turns red, a dilemma zone exists if a car traveling at the legal speed limit cannot, during the time the light is yellow, travel a distance equal to the width of the intersection plus the length of the car (use 17 feet as an average) plus the stopping distance. (We call this the Required Yellow Distance).

Procedure:

1. Choose an intersection with a traffic light. Record the intersection location and the direction you are traveling.

2. Time the duration of the yellow light several times in the direction in which you will be traveling. Find the AVERAGE of these readings and use the average in your calculations.

3. Measure the width of the intersection in feet.

4. Record the local speed limit in the direction you will be traveling.

5. Calculate the Required Yellow Distance and the Actual Yellow Distance.
   - RYD = (width of intersection) + (17 feet) = (Stopping Distance [see chart])
   - AYD = (Duration of the yellow light in seconds) * (Speed limit in ft/sec)

6. Arrive at your conclusion:
   - If the Actual Yellow Distance (AYD) is greater than or equal to the Required Yellow Distance (RYD), then the light is properly timed and there is no dilemma zone.
   - If the Actual Yellow Distance (AYD) is less than the Required Yellow Distance (RYD) then the difference is equal to the length of the dilemma zone. The light is improperly timed and should be yellow for an amount of time equal to the (Required Yellow Distance in feet)/ (Speed limit in ft/sec).

Conservative estimate of the Stopping Ability of a standard passenger car on dry, clean, level pavement (Including reaction time of driver.)	
Speed (mi/hr)	Stopping Distance (ft)
20	44
25	59
30	78
35	97
40	124
45	153

Name _____ Date _____

Data:

Intersection of (street 1) _____and (street 2) _____

Traveling (direction) _____ on (street) _____

Duration of the yellow light (average of 4 timings) _____seconds

Width of the intersection _____feet

Speed limit _____mi/hr = _____ft/sec

Calculated values:

Actual yellow distance _____ft.

Required yellow distance _____ft.

Conclusion:

Either: The light has a dilemma zone of _____feet and should be yellow for _____seconds.

OR: The light is properly timed