

# TRAFFIC AND SAFETY INFORMATIONAL SERIES

## FREQUENTLY ASKED QUESTION #11

### COULD TRAFFIC SIGNALS BE TIMED SO I RECEIVE A GREEN LIGHT AT EVERY INTERSECTION?

Traffic signals cannot be timed so that everyone receives a green light all of the time, and there are several reasons a minor street typically receives a shorter green light than a major street. Signal timing depends on the many different types of and uses for signals and certain guidelines for their placement.

Table 1 shows the speeds that allow a vehicle to progress along a roadway for various signal spacings and cycle lengths (the amount of time each movement receives). The addition of a new signal (possibly due to new development) will alter the signal spacing and may lower or negate the possibility that a vehicle can progress along the roadway without stopping at a traffic signal. The progression of vehicles along a roadway must be reconsidered whenever the characteristics of the roadway or its traffic control change.

**TABLE 1 Maximum progressive vehicle speeds for various cycle lengths and intersection spacings**

Traffic Signal Cycle Length (seconds)	Maximum Progressive Speed (mph)			
	0.125-mile Intersection Spacing	0.25-mile Intersection Spacing	0.5-mile Intersection Spacing	1.0-mile Intersection Spacing
60	15	30	—	—
90	10	22	45	—
120	7.5	15	30	60

Adapted from *System Considerations for Urban Arterial Streets*, Institute of Transportation Engineers, 1969.

### WHY IS THE GREEN TIME SO MUCH SHORTER FOR MINOR STREETS?

This question can easily be answered by considering the definitions of arterial (i.e., major) and collector (i.e., minor) roadways. By definition, an arterial is a main thoroughfare that carries the majority of the traffic volume through an area, while a collector is a street that carries the minority of the traffic volume and provides a route to access the arterial.

Because the arterial street carries the largest traffic volumes, the signal plan should provide the majority of the green time to the arterial intersection approaches. This signal timing minimizes the delay for the traffic on the arterial but sometimes causes longer delays for the traffic on the minor streets. If signals are timed correctly and the appropriate type of signal controller is used, a minimum total delay (for major and minor street traffic) should be achieved.

### WHAT IS THE DIFFERENCE BETWEEN PRETIMED AND ACTUATED SIGNALS?

#### *Pretimed Signals*

Pretimed signals have a preset cycle length for specified times of the day or for the entire day. Unlike actuated signals, a pretimed signal cannot adjust to traffic flow. Therefore, the optimum cycle lengths for these intersections must be determined. Factors considered in designing a cycle length include the

number of phases, the largest number of vehicles that can be served by a green light, and the number of lanes having right-of-way, just to name a few. Pedestrians are also a major consideration, and their presence (with corresponding crossing times) could increase the side-street green times and consequent cycle lengths at an intersection.

### *Actuated Signals*

Actuated signals can vary their cycle length (i.e., vary the length of the green time given to each movement) to adapt to the traffic flow that uses the intersection. Detectors sense vehicles that approach the intersection and send that information to a signal controller. The controller then adjusts the length of the green time for the current traffic conditions. There are two types of actuated signals: fully actuated and semi-actuated.

*Fully actuated signals* are found at intersections that exhibit large fluctuations in traffic volumes from all of the approaches throughout the day. These signals have a set minimum and maximum green time. If no opposing vehicles are stopped at the intersection, the moving traffic will receive additional green time. The minimum green time is often set equal to the time required for a pedestrian to safely cross the intersection.

*Semi-actuated signals* have detectors only on the minor street approaches to an intersection. These types of signals are often found at the intersections of arterials and minor, low-volume roadways. The arterial has a green light until a vehicle is detected on the minor street. When the traffic volume is high on the side streets (during peak travel times) the semi-actuated signal acts as a pretimed signal.

## **HOW IS THE DECISION TO PLACE A TRAFFIC SIGNAL MADE?**

Traffic engineers cannot simply install traffic signals where they are not warranted. Traffic signals are expensive, and incorrect placement can actually be harmful to safety and mobility. Refer to the *Manual on Uniform Traffic Control Devices* (MUTCD) for information on the nine warrants for the placement of traffic signals. A traffic signal should not be placed if one or more of these warrants has not been met.

There are some general objectives in placing a traffic signal. Good engineering judgment must be used in order to balance these objectives. According to the MUTCD, traffic engineers should assess five potential advantages when allocating the right-of-way to traffic:

1. Provide for the orderly movement of traffic
2. Increase the traffic-handling capacity of the intersection
3. Reduce the frequency and severity of certain crash types
4. Provide for continuous or nearly continuous movement of traffic along a given route under favorable conditions
5. Interrupt heavy traffic to permit other traffic and pedestrians to cross