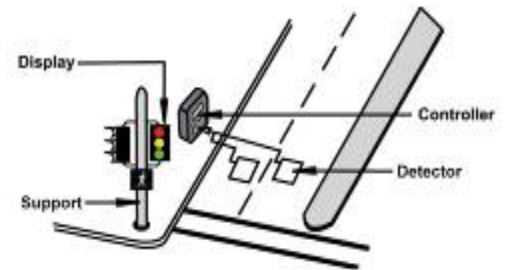


## Traffic Signals 101

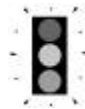
### What are the Parts of a Traffic Signal?

Traffic signals have four main parts:

1. Display
2. Controllers
3. Detectors
4. Supports



**Signal display:** The signal display is what the motorist sees. A simple signal display consists of three colors: red, yellow and green.



Did you know that in a typical traffic display, the circular indication is 12 inches in diameter? A typical signal display is more than 3-feet tall and weighs up to 50 pounds.

**Signal controllers:** The traffic signal controller is the “brain” at an intersection that tells each signal display when to change colors. Years ago, traffic signals were controlled by a simple electric mechanism that made the signals change every so many seconds, like a clock. But these simple mechanisms were not able to adjust when traffic changed during the day.

Later in the pre-computer era, electro-mechanical controllers were developed that could be adjusted for the time of day. These controllers are much like the switch timers in your local hardware store that have green and red pins to set the time that you want lights to go off on a predetermined schedule.

Now, computerized traffic signal controllers get real-time information about the presence of vehicles from sensors in the roadway and on poles. Controllers adjust the amount of green time for different movements based on sensor information. The most sophisticated controllers and software programs allow for “synchronization” of signals at adjacent intersections along a road to minimize stops and delays.

**Detectors:** The square black lines you may see in the roadway as you approach an intersection are called loop detectors. The loop detector is a thin wire buried in the roadway. When a vehicle drives over the loop it sends a message to the signal controller. The signal controller's software evaluates the messages from all the loops at the intersection and appropriately changes the signal timing. Small TV cameras can also be used to detect if a vehicle is present.

### What is Signal Timing?

Traffic signals are timed with two goals in mind: 1) to make the traffic system as safe as possible for all users; and 2) to improve traffic flow. Each traffic signal controller is programmed with different timing settings, depending on time of day (morning or afternoon rush hour) or according to what is happening at the intersection at that moment.

There are three basic types of signal timing:

1. Fixed time
2. Actuated
3. Coordinated

**Fixed time:** Fixed time signal control uses preset time intervals that are the same every time the signal cycles, regardless of changes in traffic volumes. They give the most green time to the heaviest traffic movement based on historical information. Some fixed time systems use different preset time intervals for morning rush hour, evening rush hour and other busy times.

**Actuated:** An actuated signal controller is able to change the amount of green time for each cycle, based on information from loop detectors. Actuated signals are best where traffic volumes fluctuate considerably during the day or when interruptions to major-street traffic flow must be minimized.

**Coordinated:** In addition to timing an individual traffic signal, some signals are timed as a coordinated network. The goal of signal coordination is to help traffic flow through a series of signals at a pre-determined speed to minimize or avoid stops. In other words, the signal at an intersection turns green just as you arrive. This isn't always possible because of the need to provide smooth flow in two or more directions. This is why traffic engineers use computer programs to determine the best compromise between all the competing directions of traffic.

### Who handles the operation of traffic signals?

Traffic engineers within local public works or transportation departments and state departments of transportation.

### Who funds traffic signal operations?

Funding for all forms of traffic and highway projects stems from local, state and federal funds—in other words, from taxpayer dollars. However, it is up to the individual localities and/or states to decide how to spend that money and what portion of the money is used for traffic signal timing and operations.

### Who created the first ever traffic signal?

The first electric traffic signal was installed in Cleveland, Ohio, in 1914 by the American Traffic Signal Company. Now there are more than 260,000 traffic signals nationwide.

The man credited with inventing the traffic signal and applying for the 1923 patent is Garrett Morgan. Morgan, said to be the first African American to own an automobile in Cleveland, also invented the gas mask and the zigzag attachments for sewing machines.



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### What do the acronyms mean?

**NTOC** is an organization of associations interested in advancing transportation operations. The acronym stands for National Transportation Operations Coalition—members include ITE, AASHTO, ITS America and APWA. NTOC is sponsored by the Federal Highway Administration.

**ITE** is the Institute of Transportation Engineers. It is a professional transportation organization consisting of more than 16,000 members in 90 countries. ITE members include traffic engineers, transportation planners and other surface transportation experts.

**AASHTO** is the American Association of State Highway Transportation Officials. It is a nonprofit, nonpartisan association that represents the highway and transportation departments of all 50 states.

**APWA** is the American Public Works Association. Representing more than 27,000 members, APWA is an international association of public works agencies, private sector companies and individuals working together for the betterment of public works departments.

**ITS America** is the Intelligent Transportation Society of America. It is an organization of public and private sector members who are interested in the development and deployment of ITS in the United States.

**FHWA** is the Federal Highway Administration. FHWA is a major agency within the U.S. Department of Transportation, which is a cabinet level organization within the presidential administration. FHWA is responsible for ensuring that the nation's roadways are safe and technologically up to date.



U.S. Department of Transportation  
Federal Highway Administration

