Signal Lights

Signal lights have a red light that means stop, a green light that means go, and a yellow (amber) light, which when on by itself and not flashing means stop if able to do so safely.

A flashing amber means that a motorist may go ahead with care if the road is clear, giving way to pedestrians and to other road vehicles that may have priority. A flashing red essentially means the same as a regular stop sign.

There may be additional lights such as a green arrow to authorize turns. A turn light preceding the opposing through movement is called a leading left turn because it leads the opposing through green light. Likewise, a left turn arrow that follows the opposing through movement is known as a "lagging left turn".

Unless prohibited by regulatory signs, traffic may turn right after stopping on a red provided they yield to pedestrians and other vehicles. Some intersections (northbound Main at Cascade) have a green arrow to indicate specifically when a right turn is allowed without having to yield to pedestrians (this is when westbound traffic on Cascade is making a left turn onto main Street and thus no pedestrians are allowed in the intersection anyway).

Some signals have dedicated signals for turning across the flow of opposing traffic. Such signals are called dedicated left-turn lights since opposing traffic is on the left. With dedicated left turn signals, a left-pointing arrow turns green when traffic may turn left without conflict, and turns red or disappears otherwise. Such a signal is referred to as a "protected" signal if a red arrow appears after the phase; a "permissive" signal has no left arrow.

Three standard versions of the permissive signal exist.

1. One version is a horizontal bar with five lights - the green and yellow arrows are located between the standard green and yellow lights.
2. A vertical 5-light bar holds the arrows underneath the standard green light.
3. A third type is known as a "doghouse" or "cluster head" - a vertical column with the two normal lights is on the right hand side of the signal, a vertical column with the two arrows is located on the left, and the normal red signal is in the middle above the two columns.

If there is no left-turn signal, one must yield to opposing traffic and turn when it is safe to do so. Such lights tend to make intersections safer by reducing the risk of head-on collisions and may speed up through traffic, but may decrease the overall efficiency of the intersection as it becomes congested, depending on what proportion of traffic is turning.

Traffic light failure in most jurisdictions must be handled by drivers as a four-way stop, pending the arrival of a police officer to direct traffic or deploy emergency unfoldable stop signs.

Technology

In the mid 1990s, cost-effective traffic light lamps using light-emitting diodes (LEDs) were developed; prior to this date traffic lights were designed using incandescent or halogen light bulbs. Unlike the incandescent-based lamps, which use a single large bulb, the LED-based lamps consist of an array of LED elements, arranged in various patterns. When viewed from a distance, the array appears as a continuous light source (unless closely examined).

LED-based lamps have numerous advantages over incandescent lamps; among them are:

- Much greater energy efficiency. The operational expenses of LED-based signals are far lower than equivalent incandescent-based lights.
- Much longer lifetime between replacement, measured in years rather than months. Some of the longer lifetime is due to the fact that the light is an array which allows the light to be used even if some of the LEDs in the array are dead.
- Brighter illumination with better contrast even in direct sunlight. The ability to display multiple colors and patterns from the same lamp. Individual LED elements can be enabled or disabled, and different color LEDs can be mixed in the same lamp.

Control and Coordination

Traffic signals must be instructed when to change phase. They can also be coordinated so that the phase changes called for occur in some relationship with nearby signals.

Traffic signal phase changes are based on one of three systems: pre-timed, semi-actuated, and fully-actuated. The simplest control system uses a timer; each phase of the signal lasts for a specific duration before the next phase occurs; this pattern repeats itself regardless of traffic. Many older traffic light installations still use timers; timer-based signals are effective in one-way grids where it is often possible to coordinate the traffic lights to the posted speed limit. (See also Signal timing)

More sophisticated control systems use electronic sensor loops buried in the pavement to detect the presence of traffic waiting at the light, and thus can avoid giving the green light to an empty road while motorists on a different route are stopped. A timer is frequently used as a backup in case the sensors fail; an additional problem with sensor-based systems is that they may fail to detect vehicles such as motorcycles or bicycles and cause them to wait forever (or at least until a detectable vehicle also comes to wait for the light). The sensor loops typically work in the same fashion as metal detectors; small vehicles or those with low metal content may fail to be detected.

It is also commonplace to alter the control strategy of a traffic light based on the time of day and day of the week, or for other special circumstances (such as a major event causing unusual demand at an intersection).

Reporting Problems

Although the use of sophisticated technology allows signal light to operate more efficiently, it also introduces the potential for malfunctions to create significant traffic problems. As described above, modern signal system utilize electronic sensor loops to detect the absence and presence of vehicles. These detector loops are subject to the following modes of failure:

- The sensors may not detect a vehicle waiting for a green light. This problem can be caused by a number of factors:
    - Vehicles stopping behind or in front of the detector loops. Drivers should pay close attention to the "Stop Lines" (12" - 24" thick white lines) at a signalized intersection making sure they stop and remain stopped just behind the stop lines.
    - The detectors may have malfunctioned due to a variety of reasons. Often, such a problem can be fixed by a technician visiting the signal controller cabinet and "resetting" the detector.
    - Physical makeup of vehicle is not detected by loop. Although this problem has been reduced by advancements in loop technology, occasionally problems still crop up If you repeatedly experience problems with your vehicle being detected, report the problem to the Engineering Department. Some adjustments to the sensitivity of the detectors are possible.
- The sensors may detect a vehicle waiting for a green light even though one is not present. This can cause considerable problems with mainline traffic during peak volume hours because the signal will give large unnecessary periods of "green" to the minor street cross traffic which really does not exist.
    - This problem is most always the caused by malfunctioning detectors. Often, such a problem can be fixed by a technician visiting the signal controller cabinet and "resetting" the detector.

Contact the Engineering Department at 425-0900 to report problems with the signal lights within the City.

Preemption

All traffic signals in River Falls are equipped with traffic light preemption for emergency vehicles such as fire engines, ambulances, and police squad cars. These systems operate with small transmitters that signals that are received by a sensor on or near the traffic lights. Upon activation, the normal traffic light cycle is suspended and replaced by the "preemption sequence" that gives a green light in the direction of the oncoming vehicle that has triggered the preemption sequence. A white signal light is placed nearby to indicate to the preempting vehicle that the preempting sequence has been activated and to warn other motorists of the approach of an emergency vehicle. The normal traffic light cycle resumes after the sensor has been passed by the vehicle that triggered the preemption.