TRAFFIC OPERATIONS

INTRODUCTION

The Traffic Operations Section is responsible for the operation and maintenance of all traffic signals, pedestrian signals, flashing school and warning beacons, radar speed limit signs and all other signal related devices in unincorporated areas of Arapahoe County. The County has a computerized traffic control signal system which enables the traffic engineer to control the timing and operation of signals that are connected to the system from the County engineering facility. It also enables the traffic engineer to monitor the operation of the signals and notify the engineer of any interruptions to normal operations or malfunctions on a real time basis.

The County retains the services of a private traffic signal maintenance company to maintain its traffic signals and other related signal devices. Technicians are on call 24-hours a day, seven days a week, to handle emergencies. Currently, the County has 35 traffic signals, 2 pedestrian signals and over 30 flashing school and warning beacons. Each year, these numbers continue to grow as new signals are constructed as lone signal projects or as part of major roadway reconstruction and/or new development projects.

Traffic Operations also handles public concerns/requests relative to traffic engineering. Each year this section receives an average of 30-40 citizen related requests for a variety of traffic engineering concerns/traffic control device installations. All other traffic engineering related issues are also handled by this section and/or in coordination with the Transportation Division.

COMMONLY ASKED QUESTIONS:

- **How do I request a traffic sign be installed?**
- **How do I request that a traffic study be conducted in my area?**
- **Are speed bumps/humps allowed on my street?**
- **What is the speed limit for residential areas?**
- **How are speed limits established?**
- **How do I request that my street be used for a block party?**
- **How do I request the installation of a street light?**
- **How do I obtain traffic information (i.e, volume counts, accidents, etc)?**

- **How do I request a traffic sign be installed?**

    - You may submit a request via mail, email, or telephone to the Public Works Department. Please describe the concern you have. Your request will be input to our electronic tracking system and assigned an engineering services number. We will then schedule a site/field study to determine the best solution to your concern and if any sign or sign(s) or other traffic control device(s) are warranted. Once this step is complete we will notify of what type of action, if any, is warranted and when the solution will be implemented. You may contact us at any time during the above process to get status information. Please refer to your assigned services number.

- **How do I request that a traffic study be conducted in my area?**

    - Please contact the Public Works Department via mail, email, or telephone. Describe the type of study you wish to be completed. Explain the concerns you wish to be addressed. Your request will be assigned an engineering services number. Traffic will then schedule a traffic study to evaluate the conditions. Once the study has been completed, you will then be notified of measures that may be taken to alleviate the traffic concerns you have, if any. You may contact us at any time during this process to get status information. Please refer to your assigned services number.

- **Are speed bumps/humps allowed on my street?**

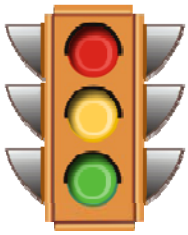
    - No, Arapahoe County will not install speed humps/bumps. It has been proven that these devices not only slow emergency response time but can also cause damage to the emergency vehicles. They also increase traffic noise in a residential area.

- **What is the speed limit for residential areas?**

    - The prima facia speed limit in a residential area is 30 miles per hour unless otherwise posted.

- **How are speed limits established?**
    - Speed limits are primarily established based on road design, type of road and also using the 85th percentile speed (85th percentile speed is the speed that motorists are traveling at or below).
- **How do I request that my street be used for a block party?**
    - Please submit your request at least two weeks prior to your event. Request must be sent in writing and include a map you're the area in which the event will take place. Once approved you will be given specific conditions and requirements to close off your street for your party. Fire Districts and the Sheriffs office will be notified of your closure.
- **How do I request the installation of a street light?**
    - Arapahoe County does not install street lighting. Depending on where you live you will need to contact with IREA or Xcel Energy
- **How do I obtain traffic information (i.e, volume counts, accidents, etc)?**
    - Arapahoe County makes every effort to keep our website update with the most current traffic counts and accident data. If you can not find what you are looking for please contact Public Works for further assistance. Usually just the arterials and major collectors are included in the annual traffic count program.

TRAFFIC SIGNALS



- **HOW SIGNALS WORK**
- **COMMON QUESTIONS**
- **SIGNAL TIPS / FACTS**

HOW SIGNALS WORK

Traffic signals are installed to provide for the safety of the motoring public and at the same time keep traffic moving as efficiently as possible. Arapahoe County's signal system and associated traffic signals are designed to do just that. When used appropriately, traffic signals can reduce travel time and delay and also reduce the occurrence of most accident types, specifically the ones considered most severe.

Managing a signal system and/or the operation of multiple signals along a corridor takes more than simply switching lights from green to yellow to red. There must be balance between the needs of all who use and depend on the traffic signals (i.e, pedestrians, bicyclists, drivers on different approaches, etc). Ultimately, this means you must stop for others to go.

Traffic signals make sure intersection traffic moves in an orderly fashion and assign right-of-way in situations that cannot be effectively controlled by stop signs or other devices. Bottom line: traffic signals make travel safer and faster for all who use them.

How Arapahoe County's signals work

Arapahoe County has a computerized traffic system that is designed to be as efficient as possible while providing for safe travel for all types of transportation.

Each signalized intersection is equipped with a computerized controller. Those linked to the County's signal system are done so by a variety of possible communication mediums, (phone lines, microwave, cellular, etc) that connect them back to the County engineering facility at the

traffic engineer's office.

Each controller is programmed with different timing settings. Some have one timing plan, while other may have multiple programs and change according to time of day as traffic volumes and patterns vary. Some controllers operate with fixed timing setting, however, most use multiple programs based on changing traffic patterns.

There are three basic ways signals are controlled.

- Fixed Time Control
- Semi-actuated
- Fully actuated

Types of Fixed Time Signal Control

Fixed time signal control can be classified as either pre-timed control or actuated control. Further each of these strategies can be applied either to an isolated intersection or to a signal system.

Pre-timed control has a repetitive signal cycle and split timings in the case of isolated intersections. This means that the cycle length and duration of the splits remains constant. The phase sequence for each cycle also remains the same. When in a signal system, all intersections operate on a single cycle length and constant offsets. On the other hand, actuated control provides variable length of splits for phases that are equipped with detectors. Actuation at isolated intersections adjusts green interval lengths and phase sequences

continuously, depending on detected demand. However, offsets remain constant in the case of actuated control. Based on the extent of detection (or actuation), actuated control is further categorized as semi-actuated or fully actuated.

Semi-actuated control

Semi-Actuated: Semi-actuated control is deployed at intersections where a major road intersects a low volume road. Traffic movements can be differentiated as major or minor based on the volume of traffic they carry. Semi-actuated control also is classified as coordinated or uncoordinated. In semi-actuated control, the major movement always is coordinated and detection is along the minor movement. This means that the major movement always is green for a certain fixed time during a signal cycle thereby providing progression along the corridor. For the remaining duration of the cycle, the side street receives green time only if a vehicle is detected. If no vehicle is detected along the minor movement, the additional green time is given to the major movement.

In semi-actuated un-coordinated control, detection is similar to semi-actuated coordinated control but the major movement is not under progression.

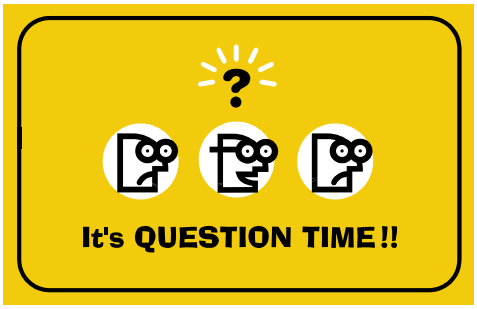
Semi-actuated signal control is probably the most common type of signal operation found in Arapahoe County.

Fully actuated control

Fully actuated signals are signals are found at intersections that exhibit large fluctuations of traffic volumes from all of the approaches during the day. Detectors are placed on all approaches. There is a set minimum and maximum green time for each phase. The moving traffic will receive green time unless the opposing vehicles are stopped at the intersection. The minimum green time often is set equal to the time required for a pedestrian to safely cross the intersection. Pre-timed and actuated controls both have their advantages and disadvantages. Good coordination can be achieved in pre-timed control because of consistent cycle lengths and splits. Closely spaced intersections and intersections with high pedestrian volumes perform better with pre-timed control. Due to absence of detectors, pre-timed control is cheaper to install and maintain, and is free from detector related faults. Actuated control on the other hand give higher efficiency when volume variations are high or when signal control is needed for brief periods. They increase safety by reducing rear-end collisions. Detection allows ability to have demand dependent phases and requires less future engineering to ensure best fits between demand and signal timing.

The decision as to what type of fixed-time control is best for any given situation is based on many factors. In Arapahoe County, these factors are primarily based on existing/projected traffic flows for the corridor as well as geometric conditions of the intersections and corresponding signal network.

COMMON QUESTIONS



- How do signals get installed?
- Are the signals really timed to work together?
- Why doesn't traffic flow perfectly on two-way streets?

How do signals get installed?

Before a traffic signal can be considered for installation, it must first meet at least one of the eight warrants found in the Manual On Uniform Traffic Control Devices (MUTCD). The MUTCD is a federal document that is adopted by the Colorado Department of Transportation for the State of Colorado that lists guidelines and/or sets of criteria that justify the placement of traffic control devices, including traffic signals.

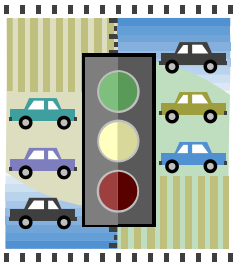
For traffic signals, the MUTCD lists eight warrants or sets of criteria that justify traffic signal installations. For an intersection to be considered for signalization in Arapahoe County, the intersection must meet at least one of the eight warrants found in the MUTCD. The eight warrants are primarily based on traffic volume requirements and/or accident history and other elements associated with signal operations. It should be noted, however, that even if a location meets one or more of the eight warrants, a traffic signal should not be installed unless an engineering study indicates that installing a traffic signal will improve the overall safety and/or operation of the intersection.

Are the signals really timed to work together?

Most traffic signals in Arapahoe County are timed to work together. We call this **Coordination.** There are a few, however, that simply do not lend themselves to be coordinated with other signals and actually operate better not being coordinated. These are typically "isolated" locations.

Why doesn't traffic flow perfectly on two-way streets?

Good traffic flow, or "progression" can always be achieved on a one-way street if the cross streets aren't too busy. But what about two-way streets?



If all the signals on a two-way street were only coordinated in one direction, then traveling the other direction would be like swimming upstream – travel a block and wait, travel a block and wait. To fix this, the beginning time of the green lights must be further adjusted to allow progression in both directions. If all the signals are evenly spaced, fairly good progression can still be achieved, but the "quality" of this progression cab be sensitive to the cycle length. Some cycle lengths will provide better progression while other may not allow any progression at all.

In selecting a cycle length, not only do capacity and delay have to be balanced, but

progression must also be considered, a kind of "juggling act".

When the signals are irregularly spaced, providing progression can be a very difficult task. On some streets, full two-way progression is only possible for very short stretches.

When the cross streets must be also coordinated, the trade-offs become even more complex. Now delay, capacity, main street progression and cross street progression must all be balanced.

Clearly, coordinating traffic signals can be a very complex technical activity. Trade-offs between vehicle delay, intersection capacity, main street progression, cross street progression and system communication must all be considered. Even when good coordination plans are developed, they must be updated whenever traffic volumes change significantly or new signals are added. In growing areas this may mean completely re-timing signals every three to five years.

Despite the difficulties, the benefits of good traffic signal coordination are so significant that substantial effort is being dedicated to making improvements. The benefits of improved traffic signal coordination include:

- ✓ **Reduced auto air pollutant emissions**

- ✓ **Reduced delay for drivers**

✓ **Improved roadway efficiency**

✓ **Decreased fuel consumption**

Because of all these significant benefits, Arapahoe County along with all its neighboring jurisdictions, strive hard to work together in coordinating traffic signals throughout the local region.

SIGNAL TIPS / FACTS

- Drive the posted speed limit as many progression/coordination plans are geared toward this factor.
- Make sure you pull all the way up to the intersection when stopping so the detector sensor picks up your vehicle.
- Pushing the pedestrian button more than once does **not** make the light turn any quicker.

- Most cameras you see on the signal mast arm do not record video. Normally these units are only used for vehicle detection.