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TRAFFIC TIPS

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Traffic Signal Timing and Coordination

At a simple intersection, a traffic signal has two phases - green light for the main street, followed by a green light for the side street. The length of each green phase depends on the traffic volume on each street, the number of lanes and the time needed by pedestrians to safely cross. At a simple intersection, the main street generally has a green phase that is much longer than that of the lower volume side street.

At multi-phase intersections, such as those with left-turn arrows, the available green time is divided into smaller intervals. Although the extra phases may facilitate special turns, they reduce the available green time for the other directions, thus resulting in longer red intervals. The desire to have longer green phases for through traffic, the need for safer, exclusive moves, and the desire to avoid inordinate delay for other motorists at the intersection require that green times be shared in a thoughtful and balanced manner.

Along a single route, with traffic signals spaced at one-quarter mile intervals it is possible to drive along a main street and proceed through several green lights before having to stop. This is known as signal progression, where lights turn green consecutively. On a one-way street, this can be accomplished easily, such that if it takes ten seconds to travel from the first signal to the next, the second signal changes to green ten seconds after the first one. On a two-way street, however, it is extremely difficult to have good progression with close or variable signal spacing. If perfect signal progression were to be provided in one direction with close signal spacing, then motorists traveling in the other direction would incur many stops, in a way that is analogous to swimming upstream. In areas with high signal density, two-way progression can be accomplished only for a very few blocks at a time.

In networks where the cross-streets must also be synchronized, the task is most challenging, as main street progression, cross street progression, pedestrian crossing time, cycle length and travel speeds all must be considered. As a result of this complexity, computer traffic models are employed to minimize delay throughout the signal network for various time periods. Usually this results in the least total delay for all drivers, but with less than perfect progression and a few stops for all. The traffic patterns are reviewed periodically and timing is adjusted accordingly. Traffic Engineers work with neighboring cities whenever possible to coordinate signals across City boundaries. Typically, after traffic engineers have retimed the traffic signals for an area, systemwide delay is reduced by 12%.

In some areas, the various timing plans are implemented automatically based on traffic volumes and delays. These factors are identified by detectors in the roadway, and the information is transmitted on a second-by-second basis to computers in a traffic operations center. The detectors are supplemented by closed circuit television cameras at some locations to identify the causes of delay.

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Left Turn Arrows

A popular request is to add left-turn arrows at signalized intersections. Left-turn arrow operation, technically known as left-turn phasing, allows left turns to be made while opposing through traffic is stopped. Left-turn phasing is common at freeway on-ramps, near regional shopping centers, and at intersections of two major crossroads.

Most intersections have "permissive" operation, meaning that they operate without the assistance of left-turn arrows. At these locations, left turns can be made whenever gaps occur in opposing traffic or at the end of the green phase. However, when gaps become inadequate, left-turn phasing needs to be considered.

Left-turn phasing is justified where:

- There is an insufficient number of acceptable gaps in opposing traffic to accommodate left turns, resulting in excessive left turn delay for several hours each day;
- Traffic in the left-turn lane recurrently spills over into the through lane and the lane cannot be extended;
- There is a left-turn accident pattern;
- Sight distance between left-turn and through motorists is restricted;
- An important transit route requires left turns and experiences moderate delay;

- There are dual left-turn lanes that cross opposing traffic; and
- The intersection has an unusual geometric alignment and the operation would be improved.

If not applied with discretion, left-turn phasing can degrade overall intersection operation. Often, left-turn phasing increases overall delay to other motorists at the intersection, since they must endure longer red phases in order to accommodate the added left-turn phase. In addition, "protected"-only left-turn phasing, if not applied for traffic safety purposes, can restrict left turns, since left turns are not permitted during the circular green phase when adequate gaps may appear.

Where there is a clear justification for left-turn phasing and the disadvantages can be overcome, the road agency often installs the "smart" left-turn arrow. Under this operation, known as "protected/permissive" left-turn phasing, the signal displays the circular green when only a few cars are waiting to turn left. However, if the number of waiting cars increases to four or five, a detector in the roadway will sense them and cause the arrow to be displayed shortly thereafter. This operation provides left turn assistance but only when assistance is truly needed.

Adapted from: Los Angeles Department of Transportation internet site, www.lacity.org/ladot

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