



TRAFFIC TIPS

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TRAFFIC SIGNAL ACTUATION

Most traffic signals in the state of Michigan are of the pretimed type with fixed splits and offsets that operate different timing plans based on time of day. This type of signal is generally very good when it comes to progressive flow of traffic on an arterial street. However, it has some major drawbacks.

The pretimed signal cannot respond to traffic flow. It runs the same cycle length and split plan, regardless of traffic flow, unless the plan is changed using a time clock or time-based coordinator. This type of operation often leads to congestion if unusual traffic patterns develop or if there are major fluctuations in traffic demand on various approaches. Also, the timing plans in use become obsolete unless they are checked on a regular basis. Retiming requires staffing that many agencies do not have.

Most agencies today use electronic traffic signal controllers. In many cases, this type of controller is used as a pretimed controller using a built-in time-based coordinator. However, most of these controllers can be used as actuated controllers, making them more responsive to traffic demands. Actuated controllers use detectors to sense the presence of traffic and

provide green times based on traffic demand. This type of operation performs well at the controlled intersection, but often does not provide good progression between intersections.

There are two types of actuated controller operations for intersections; semi-actuated and fully actuated. Semi-actuated intersections are those where the minor approaches are actuated and the main street approaches are not. This operation is normally used at minor intersections where continuous pretimed operation of the minor phases would disrupt the flow of traffic on the more heavily traveled main street. This type of operation can be used effectively in a coordinated system because it can be run on a background cycle the same length as the rest of the signals in the system.

Fully actuated intersections are those where all of the approaches are actuated. These are generally intersections of two (2) or more major roads and often include left turn signalization for one or more of the approaches. Fully actuated operation is especially good where traffic demands on the various approaches fluctuate over a wide range during the course of a day. The advantage of full actuation is

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that green time is given based on traffic demand and the green signal indication can end as soon as the demand is gone. In some cases, the traffic demand exceeds the maximum amount of green time allowed by the controller. When this happens, a recall is registered with the controller so that phase will be serviced again after the other approaches have received their greens. During low volume periods, the cycle length will be reduced and the greens will be relatively short. During heavy volume periods, the cycle length will increase and the greens will be longer. This provides for maximum traffic throughput with a minimum of delay to stopped vehicles.

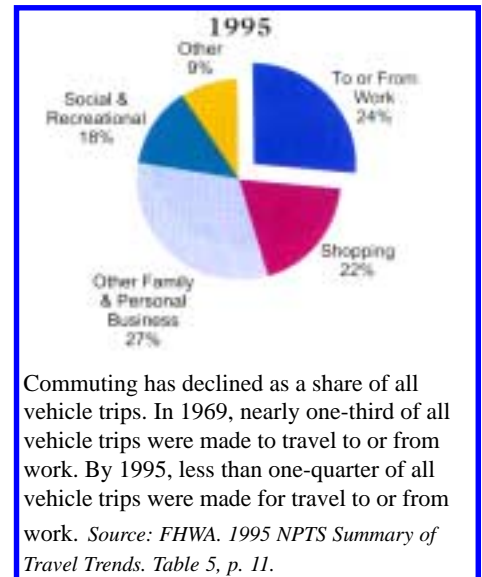
Normally, full actuation is used at isolated intersections, so lack of coordination with adjacent intersections is not an issue. However, there are times when full actuation is used because of a high level of congestion that prevents effective coordination. In these cases, a conscious decision to abandon coordination is made in order to deal with the congestion problem. Delay caused by

lack of coordination is less severe than the delay caused by intersection congestion. It is a sacrifice that many traffic engineers are willing to make because they don't have a tool to deal with coordination of actuated signals.

To provide coordination of signals along a corridor, it is imperative that the cycle length at all of the signals be the same. This requirement can be detrimental to actuated signals because they are designed to operate based on traffic demand, which usually means that the cycle length is different almost every cycle. Systems that attempt to coordinate actuated signals use a background cycle and allow the signal to adjust timing within the background cycle length, using the controller maximum green times. The coordinated phase is the exception. Usually, it will operate as a pretimed phase and the controller will attempt to return to the coordinated phase on time for proper progression. Most systems use fixed cycle lengths based on time of day and this further restricts the actuated controller. Systems like SCATS, which allow

the cycle length to vary based on traffic density and operate a variable maximum for the actuated intersections, do a much better job of controlling traffic and providing coordination. The offsets used by SCATS are based on travel time between intersections rather than cycle length.

One of the drawbacks to full actuation is cost. Full actuation requires good detection. Installing detection can be expensive - it can add anywhere from \$10,000 to \$75,000 to the cost of an intersection, depending on the intersection geometrics and the type of detection used.



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