ATTACHMENT 2

FACTORS THAT INFLUENCE SIGNAL COORDINATION

There are several factors that influence our ability to provide signal coordination:

Key Factors

Increased Traffic

The City has seen an increase in traffic volume and turning movement demand as a result of growth within and outside the City. The increase in traffic volume on arterial roadways often exceeds the available capacity at signalized intersections. As a result, traffic queues do not clear the intersection during their corresponding green indication.

Balanced Traffic Flows

Approximately 20 years ago, inbound traffic was significantly heavier than outbound traffic in the morning peak period and vice versa in the afternoon peak period. Since there was a predominant traffic flow, traffic signal coordination was based on one direction of travel during the peak periods. Today, inbound and outbound traffic flows during all periods of the day are basically balanced which makes it challenging to provide coordination for both directions of travel.

Traffic Signal Spacing

The spacing of traffic control signals plays a critical role in providing signal coordination. Ideally, for a posted speed of 50 km/h, traffic control signals in a downtown environment should be consistently spaced at approximately 400 metres to provide for reasonable coordination. If the spacing is less, then traffic queuing to or through adjacent intersections is likely to occur resulting in difficulties in providing an effective coordinated system.

Common Cycle Length

For traffic control signals to operate in a coordinated manner, each traffic control signal on a particular roadway must operate on a common cycle length. The cycle length is the time required to serve all traffic movements at an intersection. The cycle length for a group of traffic control signals is generally determined by the largest intersection in the group with the most conflicting traffic movements. Signals with the same cycle length are placed in the same group called a control area. Crossing a control area boundary can result in delays to motorists since signal coordination will be disrupted at the boundary.

Transit Signal Priority (TSP)

On all streetcar and on some bus routes, traffic control signals along these routes are equipped with transit priority that is provided through traffic signal pre-emption. Traffic signal pre-emption means that the traffic control signal is taken off system control (and coordination) to provide TSP. At the present time, the TSP feature is installed at 391 traffic control signals. When TTC vehicles are stopped on the nearside of the signalized intersection, through in-pavement detection, the traffic signal operation can be pre-empted to provide additional green time for transit vehicles in order to allow them to pass through the intersection after servicing the TTC stop. In Toronto, transit vehicles can receive up to 30 seconds of green time extension. If the frequency of transit vehicles is less than five minutes, it means that these TSP signals will never be in coordination. All streetcar routes (e.g. King Street, Queen Street, Dundas Street etc.) and some bus routes (e.g. Dufferin Street, Jane Street, Bathurst Street etc.) are affected.

Other Factors

Updated Signal Coordination Studies

Studies are completed using traffic analysis software to determine the optimum timings for all intersections on the road network. The timings would relate to the split, offset or cycle length and is calculated for different periods of the day. The timings will vary by time of day due to different conditions – traffic volume, pedestrians, transit vehicles, parking, illegal stopping, turning traffic, etc. Coordination studies must be conducted on a regular basis on major arterial roads if efficient signal coordination is to be maintained. Several studies have recommended a 3 – 5 year frequency to address changing conditions.

Reliable Communication Systems

A communication connection between the central computer system and the field computer (called a controller) must be provided. The transfer of current information from the computer system to the signalised intersections ensure that signal timings are tied to a single source of time which allows for intersections to operate in a coordinated manner. At the present time, communication is provided through leased telephone lines from a telecom provider. At the beginning of the MTSS conversion project, in consultation with the telecom provider, Transportation Services decided to install digital channel service (DCS) lines. However, midway through the project, the telecom provider classified digital lines as legacy, and was not willing to devote the resources to keep pace with the conversion. As a result, Transportation Services embarked on a pilot project to evaluate the use of wireless technologies to replace digital service lines. The pilot was deemed successful and Transportation Services is in the process of converting to cellular wireless communication technologies.

In-Pavement Vehicle Detection

Current systems require input from in-pavement vehicle detection to acknowledge the presence of vehicles in left turn lanes and on side streets. Detection of these vehicles allows the system to provide green phases to these vehicles and in some situations, extend the green time. SCOOT relies on additional detection, known as system loops to provide adaptive signal control. Since the vehicle detection is embedded in the pavement, it is susceptible to damage caused by construction, utility cuts and general wear and tear of being driven over by vehicles. Over the last two years, there has been an average of approximately 500 in-pavement vehicle detector faults per year. Faulty detection results in green time being provided to non-existent traffic resulting in delays to existing traffic and contributing further to driver frustration.

Pedestrian Timings

In the downtown core, the cycle length must be kept to a minimum since storage for extremely high number of pedestrians may be an issue. The low cycle length allows more pedestrians to cross per hour thus reducing the potential for the unsafe overflow of pedestrians onto the roadway. However, the low cycle length makes it difficult to provide signal coordination since the available greenband is small. The greenband can be increased by increasing the cycle length but this approach would result in increase pedestrian delay, pedestrian overflow onto the roadway and jaywalking. In the suburbs, adequate pedestrian crossing times must be provided to cross wide arterial roadways. For minor intersections, the pedestrian crossing time often exceeds the time needed for vehicles thus affecting coordination on the arterial road where there are frequent pedestrian crossings.

Lane Reductions

The loss of traffic lanes due to road construction, development, filming, festivals, and special events affects the ability to maintain signal coordination. The signal timings must be adjusted since road capacity and travel time between intersections will be affected by lane reductions. At the present time, within the downtown core, there are more than 60 lane closures that are expected to last for one year or longer. In addition to the long term lane closures, each day, there are hundreds of temporary or short term lane closures that also effect road capacity and travel time between signalized intersections; as a result the available road capacity is constantly fluctuating.