

## TRAFFIC LIGHT COORDINATION IN SHERWOOD PARK

### Report Purpose

To update Council on the findings and recommendations of ongoing efforts to manage traffic flow of arterial roadways within the Urban Service Area of Sherwood Park.

### Recommendation

**THAT Council receives the report "Traffic Light Coordination in Sherwood Park" as information.**

### Background/Justification

#### Strategic Plan

Governance	x	Community Well Being	x
Community Sustainability	x	Economic Viability	
Service Delivery	x	Stakeholder Communication	
		Resource Management	x

**Policy:** SER-009-017 Traffic Control Devices

**Legislative/Legal:** N/A

**Economic:** Improved access to and from businesses within Strathcona County

**Social:** Improves quality of life and safety for residents.

**Environmental:** Improved traffic flow decreases vehicle emissions.

**Stakeholder:** Residents and travelers (visitors, business and regional) from outside the County

**Interdepartmental:** Transportation Agricultural Services, RCMP, Enforcement Services, Transit

### Summary

Strathcona County has maintained a high standard of traffic control services while following recommended industry practices and guidelines to establish traffic signal coordination. Due to demands from an increasing population, new strategies and initiatives are to be implemented to increase emphasis on the traffic signal coordination program.

### Enclosures

Enclosure I Traffic Light Coordination Report (EEP, Transportation library Doc. #45812)

Enclosure II Powerpoint Presentation (EEP, Transportation library Doc. #45963) (available for viewing electronically)

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## TRAFFIC LIGHT COORDINATION

### **A. Introduction**

Traffic signals provide orderly movement of traffic through an urban area. The continuous movement of traffic in any direction is only achieved by prohibiting another. In general, the objectives of well functioning traffic signal timing are:

- Minimizing delays to vehicles, pedestrians, and road users
- Minimizing the number of vehicles that are stopped at an intersection
- Reducing the number of collisions at an intersection
- Maximizing the capacity of each approach lane
- Providing sufficient gaps in traffic to accommodate pedestrian and side street traffic movement

Strathcona County uses the Transportation Association of Canada (TAC) and Institute of Traffic Engineers (ITE) guidelines when creating these plans.

There is a distinct difference between coordinated signals and synchronized signals. Synchronized signals change at the same time and are only used in special instances or in older systems. Coordinated systems are controlled from a master controller location and are designed to have the lights cascade in sequence so a vehicle-platoon (a number of vehicles travelling together), can proceed through a corridor on a continuous series of green lights.

In Sherwood Park, the traffic signal design philosophy has been to manage traffic with focus on the arterial corridors, while accommodating and facilitating side street traffic. This is a common practice used in most municipalities and ensures the greatest number of road users travel through the urban service area with as little delay as possible.

### **B. Signal Operation Modes**

There are several types of operational modes to consider when planning the method of operation for traffic signal lights. They are:

- **Pre-timed/Fixed time** – This is the simplest mode of operation. Each movement of the signal lasts for a specific duration of time before the next phase occurs. This pattern repeats itself, regardless of traffic demands thus the main street traffic is interrupted even if there is no traffic on the side street. This signal operation is typically used in urban downtown environments where traffic volume variations are consistent and predictable.
- **Variable Timed lights** – These types of signals are timed to vary throughout the day to accommodate peak traffic flows and provide priority movement. There are two types of variable timed lights which are called actuated and semi-actuated.

- **Actuated** – These signal controls require actuation by a vehicle or pedestrian which triggers certain traffic movements. Vehicle detection devices and pedestrian push button actuate the change. Actuated controls are generally used at isolated intersections which are not part of a coordinated system or at pedestrian controlled signals. Actuated signal control provides greater efficiency servicing side street traffic and pedestrians only when required so traffic on the main street is not interrupted unnecessarily. This is particularly beneficial during off peak hours as traffic on the main roads does not stop until there is traffic or a pedestrian on the side street.
- **Semi-actuated** – These are variable timed lights with the ability to maintain traffic flow in one priority direction (the coordinated roadway) at all times by detecting side street traffic and initiating signal phases to allow side street movement when there is a need. This system is normally used on higher volume roadways with random arrivals and lighter side street traffic.

Semi-actuated operation is primarily used in Sherwood Park. The length of green light for the side street movement is dependent on demand, up to a pre-set maximum cycle time. The main street movement always has a repeating priority vehicle and pedestrian call. This means the light is green on the main road until a minor street demand is called. This type of operation is used on all of the corridors in Sherwood Park.

- **Free** – Free traffic signals do not operate under predetermined cycle lengths. The signal runs using information provided to the traffic controller by its field detectors. Between midnight and 6 a.m. some traffic lights in Sherwood Park respond to vehicle and pedestrian activation. Others flash amber which is another example of free operation.

### C. Signal Cycle Length

Minimum signal cycle length requirements play a significant role in signal operation. There are several factors that are considered to determine the minimum signal cycle lengths for every intersection. They include:

- Speed limit
- Volume and type of traffic at the intersection
- Geometry of the road including inclines, declines, width of the road, and sight lines
- Achievable level of service.

The following are the basic requirements for vehicle flow planning:

- Designed level of service
- Pedestrian walk and clearance times
- Intersection amber and all red clearance times should be incorporated into your plan
- Green phase length

Additional light phases include protected left turns and priority bus signals (although they are not currently used in Sherwood Park.) The more signal phases there are at an intersection, the longer the expected delay time will be.

Short cycle lengths (60 seconds) yield the shortest overall intersection delay times, however they may not be effective at moving high volumes of traffic on the main roadway. Longer cycle lengths (80 to 120 seconds) provide improved capacity on the main roadway but overall delay times are increased. Extended cycle lengths (longer than 120 seconds) can provide effective main street capacity but creates excessive delays for minor street traffic.

#### **D. Current Practices**

Current TAC and ITE guidelines are followed when traffic signal timing plans and coordination patterns are created. Data is collected to determine volumes and traffic patterns. Then signal timing plans and coordination patterns are developed for each intersection and each corridor. Field observations are conducted regularly and modifications are made as appropriate. Continuous monitoring helps to determine if existing plans and patterns are meeting traffic demand.

Strathcona County engineering staff work hard to maintain the signal network system using up to date technology. Bi-annual preventative hardware checks are completed to ensure that the infrastructure and hardware are operating as planned. Infrastructure and hardware repairs are completed as necessary.

#### **E. Emergency Vehicle Pre-emption**

Strathcona County's' traffic signals are equipped with devices that allow emergency vehicles to interrupt existing programming to turn the light green. This allows for faster response time but the interruption can effect the coordination of the lights on the entire corridor for a short period of time while the system automatically resets itself.

#### **F. Corridors in Strathcona County**

Strathcona County is broken down into seven corridors and each has unique characteristics that influence its operation. The corridors are:

- Baseline Road East (Chippewa to Highway 21)
- Baseline Road West (34 Street to east jughandle intersection)
- Broadmoor Boulevard
- Sherwood Drive
- Clover Bar Road
- Wye Road
- Scotford (Range Road 214 north of Township Road 554)

These corridors will be modified to incorporate growth and eventually, new corridors may be required.

## G. Time of Day Plans

To accommodate the changing traffic volumes and patterns that occur throughout the day, various periods of time are used to reflect these changes. The following are typical day periods:

- early a.m. (6:00 to 6:30)
- a.m. peak (6:30 to 8:00)
- a.m. school peak (8:00 to 9:00)
- a.m. off peak(9:00 to 11:00)
- all day (11:00 to 15:00)
- p.m. school peak (15:00 to 16:00)
- p.m. peak (16:00 to 18:30)
- p.m. off peak(18:30 to 21:30)
- late night (21:30 to 24:00)
- free operation or programmed flash (24:00 to 6:00)

The Baseline Road east corridor is an example of changing traffic patterns. It is a main commuter route consisting of eleven sets of traffic signals that span from Chippewa Road/Shivam Boulevard to Clarkdale Boulevard/Highcliff Road. During the morning peak and morning school peak periods, the majority of motorists take their children to school and then travel west into Edmonton. In the afternoon, the pattern is reversed. During the rest of the day, the flow of traffic is more balanced.

## H. Performance Indicators

### H.1 Levels of Service

To evaluate how effectively an intersection is operating, transportation engineers use a standardized letter coding system to express the appropriate Level of Service (LOS). The letters range from "A" for excellent conditions to "F" for failure conditions. The figure below shows what the various LOSs may look like. When intersection capacities begin to overload, upgrading the intersection must be considered.

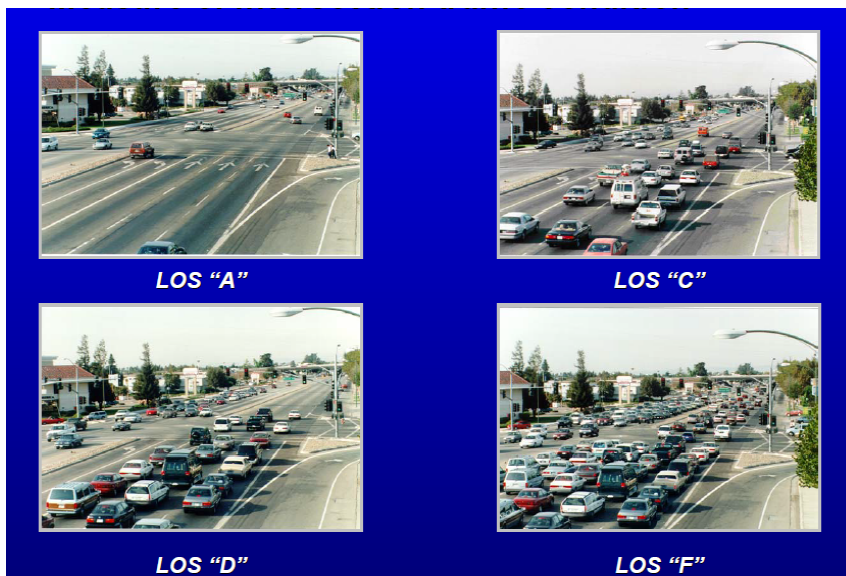


Figure 1: Levels of Service

## **H.2 Travel Time Index**

Motorists want consistent, dependable travel times. Transportation engineers use the Travel Time Index (TTI) which measures travel delays caused by traffic congestion. The TTI is a ratio calculated by comparing peak and off peak travel times for a roadway. It is conveyed in a numerical range from 1.0 to 1.5. A value of 1.0 indicates the best case scenario i.e. peak-period travel is not delayed by congestion. A TTI of 1.5 is the worst case scenario. Transportation engineers aim for TTI's between 1.0 and 1.3.

## **H.3 Traffic Timing**

A well coordinated system relies heavily on accurate time operation. A slight deviation in time from one intersection to another can have a detrimental effect on traffic. Well maintained equipment is crucial to the efficient operation of the signalized network.

## **I. Conclusion**

Traffic signal coordination is a complex and exacting task. A significant amount of planning, implementation and verification is required to ensure traffic signal timing plans and coordinated patterns are effectively servicing a corridor. A small event can have measurable consequences in traffic flow; an interruption at one intersection can have a detrimental and cascading effect to the other intersections in the corridor as well as the side streets.

Even with the best signal plan and operating system, some motorists will still be repeatedly stopped. Stopping at lights can be minimized but never eliminated in any traffic signal plan.

## **J. Recommendations**

1. Create a philosophical document that identifies the goals, objectives and acceptable practices of traffic signal coordination in Strathcona County.
2. Establish a Travel Time Index between 1.0 and 1.3 for corridors in Sherwood Park.
3. Establish acceptable side street wait times, per corridor, while maintaining effective main street traffic flow.
4. Maintain a Level of Service of "D" or better for all movements at intersections.
5. Increase signalized intersection inspections to quarterly inspections to ensure the proper operation of signal hardware.
6. Continue to follow national standards and industry accepted practices for traffic signal timing changes and advancements.



# Traffic Light Coordination

Council Meeting  
July 5, 2011

Engineering and Environmental  
Planning



## Benefits of Coordinated Traffic Signals

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- ❑ Provide orderly movement for road users
- ❑ Minimize delays
- ❑ Reduce collisions
- ❑ Maximize capacity of the road
- ❑ Accommodate side street traffic and pedestrians



# History

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- ❑ Traffic volumes and patterns change with time
- ❑ Programming is modified to reflect changes
- ❑ Public expectation

# Traffic Signal Operation

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- ❑ Pre-timed/fixed time
- ❑ Actuated
- ❑ Semi-actuated
- ❑ Free
- ❑ Flash operation





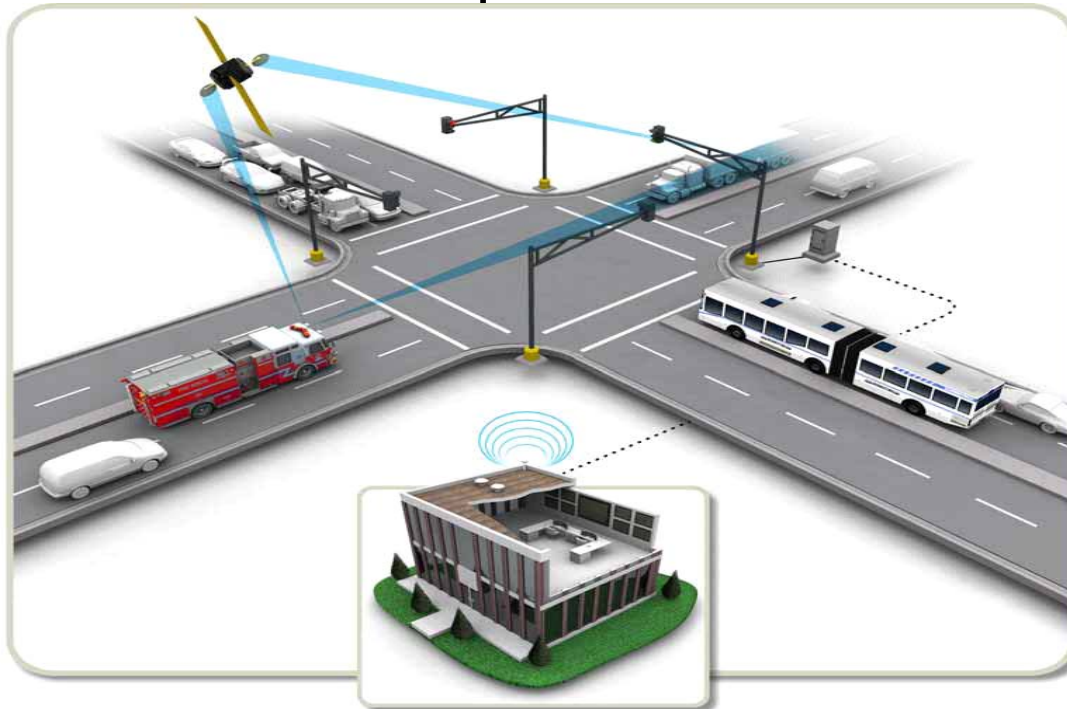
## Current Practices

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- ❑ Collect road data
- ❑ Design coordinated signal timing plan
- ❑ Computer simulation to test signal timing plan
- ❑ Implement new plan
- ❑ Conduct field observations and fine tune as needed

# Emergency Vehicle Pre-emption

- ❑ Interrupts the coordination of traffic signals on a corridor for a short period of time



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# Performance Indicators

## □ Level of Service



LOS "A"



LOS "C"



LOS "D"



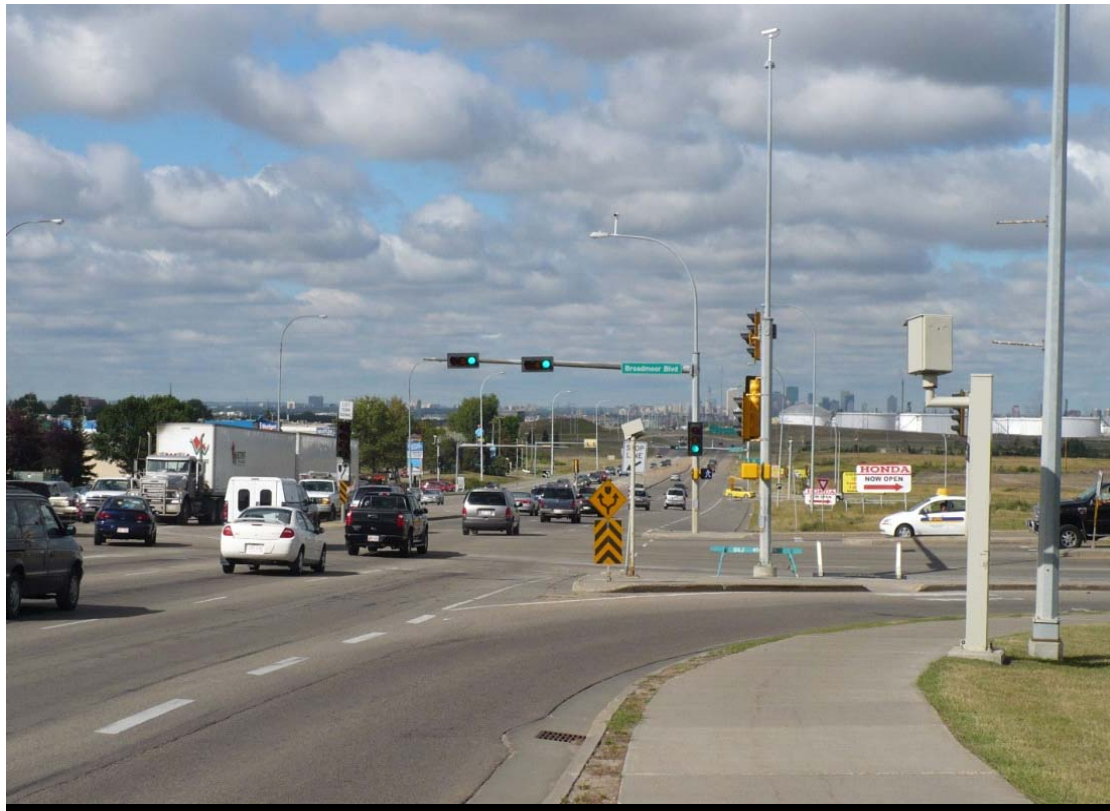
LOS "F"

# Performance Indicators

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- Travel Time Index

Ratio of actual travel time vs optimum travel time



# Conclusion

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- ❑ Complex and exacting task
- ❑ Stopping at traffic lights can be minimized but never eliminated



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## Recommendations

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- ❑ Create a philosophical document
- ❑ Establish performance indicators to evaluate overall coordination effectiveness
- ❑ Inspect signal network quarterly
- ❑ Continue following accepted standards and practices



# Traffic Light Coordination

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Questions?