Optimising your Transportation System
….THE CALGARY EXPERIENCE

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The City of Calgary

The City of Calgary is Canada's fourth largest city and growing quickly with an economic base of agriculture, oil and gas, and tourism. Since the 1960s, Calgary's population has more than doubled. Today, nearly one million people live in the City that hosts the "Greatest Outdoor Show on Earth" (The Calgary Stampede). Calgary is an ideal location to provide a centre for distribution of goods throughout Western Canada. The resultant infrastructure requirements are significant. Calgary is working towards providing a sustainable Transportation System that relies on both new infrastructure and an optimised transportation system.

Why Optimise?

Calgarians seek improved transportation system operations. Motorists, transit users, pedestrians and cyclists are all experiencing increasing delay, congestion and frustration associated with the City's growth. One major response to this has been a substantial capital investment in new infrastructure, whether it is new interchanges, extended LRT lines or more bus service.

Complementary to the major investment program is a concentrated effort to ensure the existing transportation system is operating at peak efficiency. Most Transportation experts ask questions like, are the traffic signals co-ordinated to maximize traffic flow at all times of the day? Are there places where transit buses are being unduly delayed? Are major links missing in the pedestrian and bike networks that discourage those modes of travel? Are there policies in place for the management of accesses, on-street parking, construction detours, and incidents to maintain the operational efficiency of the transportation system? While this work is lower profile than major infrastructure projects, a comprehensive program of operational improvements can result in a significant improvement to overall mobility of a City.

The City of Calgary emphasizes **Transportation Systems Management (TSM)** to optimise the existing transportation network.

The reasons for a greater emphasis on optimising operations are:

- It is becoming more difficult and expensive to build major projects to relieve congestion because of financial constraints, community and environmental concerns. TSM strategies are usually low-cost projects that improve capacity and reduce delay and thus, generate little, if any, public opposition.

- Major infrastructure takes a long time to plan and build. Comparatively, TSM projects typically take months. They are therefore a quick way to respond to public transportation concerns.

- TSM projects are relatively inexpensive but can result in substantial benefits. A TSM project may even delay or eliminate the need for major construction or capital expenditure.

- New technologies are emerging that can be exploited to gain even more operational efficiency. This provides transportation professionals with new tools to analyze and operate the overall system better. ITS tools can also be used to keep the public informed of where and when to use the transportation.

- TSM initiatives can improve operations on major streets, discouraging traffic short-cutting through neighbourhoods.

- In addition to reduced congestion, TSM projects also improve air quality, reduce fuel consumption, save time for commercial vehicles, provide smoother traffic flow, increase reliability and safety.

Examples of typical TSM initiatives include:

- reducing bus delay by introducing transit priority at traffic signals;
- enhancing traffic flow on corridors by improving co-ordination of traffic signals;
- increasing capacity by building more turn lanes, adding lane reversals and introducing turning and parking restrictions;
- implementing traffic responsive and/or adaptive traffic control systems which adjust signals according to demand;
- developing a comprehensive plan to mitigate major detour congestion;
- re-timing downtown signals to benefit pedestrians and transit (bus and LRT);
- planning proactively for special events, emergencies, and construction / detours.

Transportation Optimisation Division

Recently, the City's Transportation Department reviewed its internal structure and identified changes necessary to ensure its long term sustainability. One of the recommendations from this comprehensive review was to create a new Division called "Transportation Optimisation Division (TOD)" with the goal of managing the transportation system more efficiently. The TO Division's objective is to focus on the operations of <u>all</u> modes of Transportation.

TO Division Mission and Vision

The mission of the TO Division is:

To strategically identify, evaluate and plan improvements that optimise the operation of the transportation system for all Calgarians by co-ordinating timely implementation, promoting innovation and monitoring effectiveness with a team of specialists working in a supportive work environment

The TO Division's long-term (greater than 5 years) vision is:

Calgary is a leader across the nation for having the most efficient Transportation System Operation.

This long term vision is supported by both a short and medium term vision. The medium term vision (1 to 5 years): *Proactive, systematic operational improvements are being made that: Increase capacity, reliability and safety; postpone the need for major infrastructure.* The short term vision (6 to 9 months) is: *to successfully implement three to five projects which demonstrate the effectiveness of the Transportation Optimisation Division.*

The next step to achieving this vision was to develop the group. Resources and staffing needs were identified based on the preliminary workplan.

Workplan

A very simple workplan was established focussing on three areas:

1. **Optimisation Initiatives**: Investigate and plan operational improvements which include: Transit Priority (Bus and LRT), route planning, lane reversals, dual turn capacity, detour planning and other initiatives.

2. **Corridor Planning**: Develop and maintain an evaluation criteria to prioritize traffic signal corridors for retiming. Conduct Traffic Signal Corridor retiming (consideration of: auto, transit, goods, pedestrian, cyclist)

3. **Implementation and Monitoring:** Assist with implementation planning, monitor system performance with data collection with a goal to have a dynamic display of the current system operation.

Human Resources

One task in establishing a group is determining what skills are needed. Seven areas of expertise were identified as being necessary to execute the work plan successfully.

- Traffic Signals Operations
- Traffic Engineering Operations (Signing/roadmarking/safety/detours)
- Forecasting
- Transit Operations/Planning
- Design (Road)
- Transportation Systems Management
- Management with multiple years of experience in Transportation Operations and Planning

The team was formed in early 2005 and contains all of these specialties. Each of the representatives also has a link to their home Division within the Department to ensure two-way communication is maintained.

Optimisation Initiatives

The workplan identified **optimising initiatives** as one area of focus. There are many good ideas to improve transportation system within the City of Calgary from various stakeholders. It is difficult to select the best ideas to apply the resources on the team. Therefore, a "Candidate Project Evaluation" Form (see Table 1) was created to assist in selecting projects. Two key components were identified as high benefit and ease of implementation.

1) High benefit included a series of categories to assist in creating a score. These categories were:
   - Number of modes improved (1-4 points)
   - Traffic Flow Impacted (1-10 points)
   - Delay Reduction (1-5 points)
   - Stop Reduction (1-5 points)
   - Other Benefits (1-5 points)
   - Safety (1-5 points)

2) Ease of implementation
   - Estimated Capital Cost (0-10 points)
   - Estimated Annual Operating Cost (1-10 points)
   - Potential Budget Source
   - Issues to Resolve (0 to 10 points (none-major))
     - Signal operation
     - Signal construction
     - Road construction
     - Transit operation
     - Signing/roadmarking
     - Land acquisition
     - Community issues
     - Business issues
     - Other

GE5 - CANDIDATE PROJECT EVALUATION

Project Name: _____ **No.** ☐

Initiated by: _____ Date: _____

Problem Being Addressed: _____

_____

Description of Project: _____

_____

Overall Goal of Project: _____

_____

BENEFITS:

No. of Modes Improved:	(1 - 4)	Auto	Transit	Pedestrian	Cycle	☐
Traffic Flow Impacted:	(1 - 10)	**1** Local	**5** Intersection	Corridor	**10** Grid	☐
Delay Reduction:	(1 - 5)	**0** None	**1** Low < 10 %	**3** Medium 10 to 20 %	**5** High > 20 %	☐
Stop Reduction:	(1 - 5)	**0** None	**1** Low < 10 %	**3** Medium 10 to 20 %	**5** High > 20 %	☐
Other Benefits:	(1 - 5)	1. Detour route - GE5				☐
eg. Safety	(1 - 5)	2. _____				☐

Benefit Index **0**

IMPLEMENTATION:

Estimated Capital Costs: **0** $0 — **5** $ 250K — **10** > $ 500K ☐

Estimated Annual Operating Costs: **0** $0 — **5** $ 250K — **10** > $ 500K ☐

Potential Budget Sources: 1. _____ 2. _____

Issues to Resolve: **0** None — **2** — **4** Minor — **6** — **8** Some — **10** Major

Signal Operation	☐
Signal Construction	☐
Road Construction	☐
Transit Operations	☐
Signing / Roadmarking	☐
Land Acquisition	☐
Community Issues	☐
Business Issues	☐
Other (List) peds crossing N/S	☐

Implementation Index **0**

Table 1: Candidate Project Evaluation (CPE) Form

The CPE form is used to ensure each project has a fair and measurable analysis. This system was successfully used in a project described later in this paper, the Traffic Management Plan for the Glenmore/Elbow/5 Street Interchange Project.

Corridor Planning

The workplan identified **corridor planning** as a second area of focus. It is difficult to establish which transportation corridors to focus on from year to year. Therefore, a rational approach is to pro-actively identify critical routes requiring traffic signal retiming attention. A methodology was developed to determine which Traffic Signal Corridor should be reviewed for retiming and improvements:

Nine criteria are considered along each corridor and are weighted based on their relative importance. The descriptions are provided below:

1. TIIP List. The TIIP (Transportation Infrastructure Investment Plan) is a comprehensive and tactical plan approved by council which provides a prioritized list of projects and funding for roadways, bridges, short-term operational improvements and transit improvements. The intent here is to identify traffic signal corridors that are either affected by upcoming improvements or need attention due to the time gap before an improvement is planned.

2. Highest Peak Hour V/C (volume:capacity ratio). Identify routes where the v/c ratio is high using the regional transportation model. The intent here is to identify traffic signal corridors that have the highest v/c ratio first.

3. Frequency of Review: Ensuring that corridors that have not had a review for extended periods are considered important should other factors be equal.

4. Volume Change. Identify the route with most significant volume fluctuations using the regional transportation model and compare the anticipated volume differences.

5. Transit Route Issues: Using the current route adherence data, each bus route that has the most problematic adherence schedule will be identified as a critical corridor.

6. Goods Movement. Identifying routes which have the heaviest goods movements. (typically this is during mid day.)

7. Community Study. Transportation Planning reviews community traffic and corridors adjacent to where upcoming studies are planned. This identifies corridors that need attention to ensure the main routes are operating as efficient as possible before counter measures are considered on adjacent community roadways.

8. Skeletal Road Network: Ensuring that only the skeletal roadways that serve the transportation system are examined first.

9. No construction disruption: Routes that will not be under construction for the current year are identified. Routes that require attention because improvements are opening and traffic signal timing will need adjusting.

These nine criteria were each given a range and score to establish a weighting so that a list of corridors could be prioritized. An example of the corridor evaluation form is shown in Table 2.

CANDIDATE CORRIDOR EVALUATION

Reference Name: **McKnight Boulevard**

Evaluated by: CE/CJ/CW/ZKM Date: Mar-05

Corridor Description: McKnight Boulevard (4 Street NW to 4 Street NE)

Goals/Objectives: minimize person delay, number of stops

TIIP List:	10 for upstream/downstream effects, etc.; (0 for little or no effect)	**10**
Highest Peak Hour V/C:	1 (V/C <0.7) — 2 (0.8) — 3 (0.9) — 10 (1.0) — 15 (>1.0)	**15**
Frequency of Review:	-25 (1 year); 3 (3 years); 5 (5 years); 10 (10 years)	**10**
Volume Change:	0 (no change 2001 - 2008); 5 (10% increase 2001 - 2008); 10 (20% increase 2001 - 2008)	**5**
Transit Route Issues:	10 points if assists a primary transit route (0 if not) *Used by feeder buses*	**2**
Goods Movement:	0 (<10% trucks); 10 (>10% trucks)	**0**
Community Study:	10 points if adjacent to an anticipated 2005/2006 community study (0 if not)	**0**
Skeletal Network:	10 points if corridor is part of the Skeletal Road Network (0 if not)	**10**
No Construction Disruption:	20 points if corridor is unlikely to be disrupted by construction (0 if so)	**20**
	Total	**72**

Table 2: Candidate Corridor Evaluation Form

Implementing and Monitoring

The workplan identified **implementing and monitoring** as a third area of focus for the TO Division. There is no point in analyzing and evaluating great projects unless they can be implemented and proven worthwhile.
A logical process for any project is Plan, Design, Build, Operate/Maintain. As with a project an action plan was developed for each project to ensure timely implementation. Table 3 shows which task is required for each phase as well as who is responsible and when each item would be completed.

	Plan	*Design*	*Build*	*Operate/Maintain*
18. Create lane reversal on 5 Avenue				
Tasks	18.1 schedule for sign layout, structural analysis, and installation	18.2 sign layout 18.3 structural design	18.4 sign construction 18.5 field installation	18.6 Signal timing installations and review
Responsibility	Traffic Design (Mr. Jones)	Traffic Assessment (Mr. Wilson)	Traffic Assessment (Mr. Wilson)	Traffic Assessment (Mr. Wilson)
Completion Dates		*discuss with subcommittee*	Install sign and signals by April 2005	
19.				
Tasks				
Responsibility				
Completion Dates				

Table 3: Action Plan Form

As far as monitoring, before any project is implemented a before and after study is completed. Criteria are established on what the goal and anticipated improvement of the project is before it is implemented and a comparison is reported. These are described in detail for the following Transportation Optimisation Projects.

Transportation Optimisation Projects

The vision requires completing a variety of optimisation projects that affect all modes. This is reflected in recently completed projects, which include Downtown Re-timing, the Glenmore Trail/Elbow Drive/5th Street Detour Planning Project, and Transit Signal Priority programs. Projects that will be conducted in 2005 include traffic signal timing, lane reversal, and other operational improvements. These projects address the diverse

challenges experienced in all modes of travel in Calgary. The following describes completed projects and upcoming projects for 2005.

Completed Transportation Optimisation Projects

Downtown Re-timing Project

Downtown is a primary market of Calgary's LRT system, the C-Train. On an average weekday, the three C-Train lines that converge on Downtown carry about 130,000 people to and through the downtown, about 13,000 during the peak hour alone. During the morning and afternoon peak periods, 24 three-car trains enter 7th Avenue at 3rd Street (where the Northeast and South lines meet). At times, a train enters the downtown every two minutes.

Figure 1: C-Train at Olympic Plaza Platform

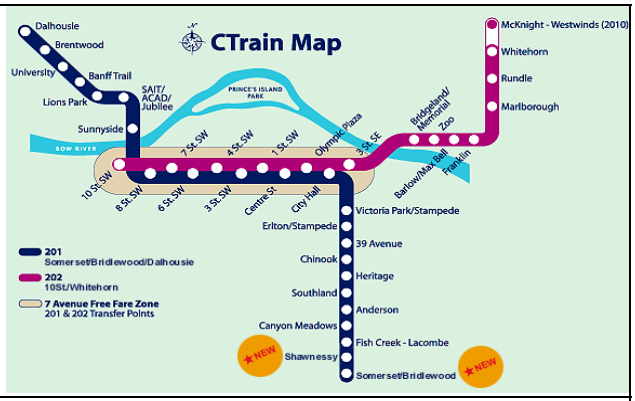

Figure 2: Calgary LRT System

Downtown, the C-Train runs at-grade through 15 traffic signals. These traffic signals were initially programmed to permit trains to travel without stopping between the downtown station platforms that are located about two to three blocks apart. However, over time this function has eroded.

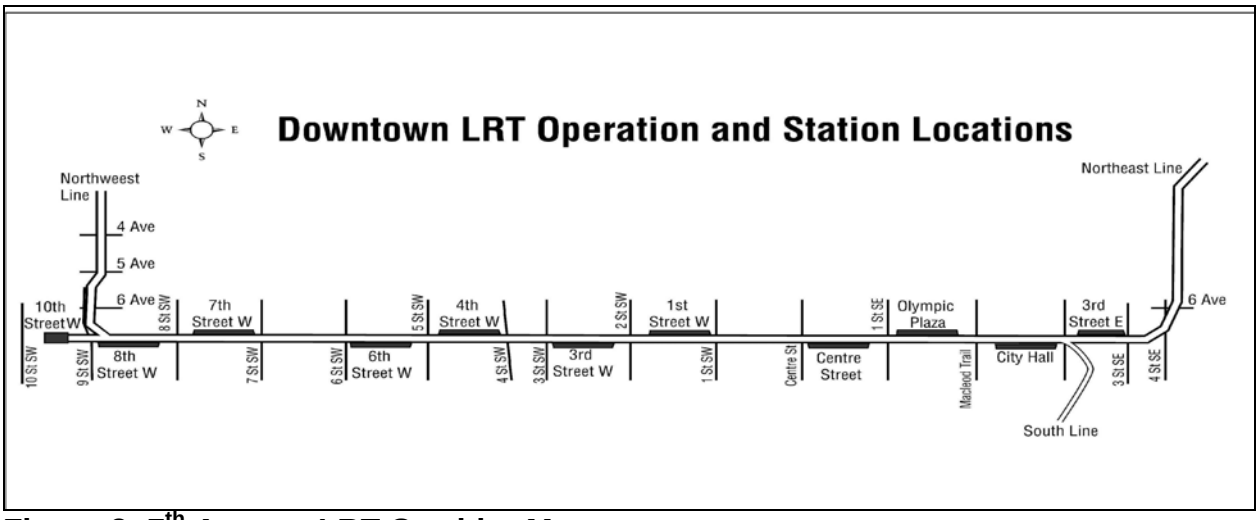

Figure 3: 7th Avenue LRT Corridor Map

The at-grade operation in the Downtown offers a variety of benefits, including significant construction cost savings and accessibility. However, traffic signal control means an inherently slower LRT operating speed and increased likelihood of delays in comparison to the suburban sections of the system. Recent additions to peak hour service amplified these delays.

The variation between the maximum and minimum travel times was up to three and a half minutes in 2001. These travel time variations provided a significant challenge to delivering a reliable C-Train service. The majority of LRT delays were attributed to traffic signals (see Table 4).

Table 4: C-Train Travel Time in Downtown - 2001

Route	From / To	Minimum Time	Average Time	Maximum Time
South/Northwest Lines Westbound	3 St SE thru 4 Ave SW (4 stations)	8:10	9:26	10:56
South/Northwest Lines Eastbound	4 Ave SW thru 3 St E (5 stations)	9:50	11:01	12:29
Northeast Line Westbound	3 St SE Stn thru 9 St SW (5 stations)	8:03	9:43	11:29
Northeast Line Eastbound	9 St SW thru 3 St SE (5 stations)	7:12	8:47	10:35

It was determined that downtown changes were required in order to achieve the capacity potential of the C-Train system.

A project team involving staff from Calgary Transit, Transportation Planning and Traffic Signals was established to examine options and develop a plan to optimise downtown traffic signals for the C-Train. Two options were analysed:

- Traffic Signal Priority (TSP) for C-Train
- Revised Fixed Timing Plan for Downtown Traffic Signals

Field trials were then held to test the proposed timing plan for the 7th Avenue traffic signals. The Downtown signals are connected to Calgary's central traffic signal control system, MIST, allowing the flexibility in implementing timing options, since they could be removed if problems were encountered.

The trials indicated that travel times for the C-Train were significantly reduced. Calgary Transit operations staff had positive comments and there was no observed disruption of other downtown traffic. Table 5 shows a comparison between average C-Train travel times and the times observed during the trials. The average round trip time saving is approximately 25% for the Northwest/South Route and 15% for the Northeast Route.

Table 5: Downtown Travel Times Before and During Signal Timing Plan Trial

Route / Direction	Previous Average	Trial Observed Average	Average Time Saving
South/Northwest Line			
Westbound (incl 9 St)	9:26	7:56	1:30
Eastbound (incl 9 St)	11:01	7:52	3:09
		Total Saving	**4:39**
Northeast Line			
Westbound	9:43	8:31	1:11
Eastbound	8:47	7:33	1:14
		Total Saving	**2:45**

The revised weekday, mid day downtown traffic signal timing plan was implemented on 2002 August 12. Prior to the downtown signal timing changes, a travel time study was conducted on all major downtown streets and avenues during the weekday, mid day period. Following the traffic signal changes, the travel time study was repeated. The findings of this study showed that the changes had resulted in significant travel time improvements for downtown traffic.

Table 6 indicates that travel times on most major roads decreased by an average of 41 seconds or 14% compared to previous times. On one roadway (Macleod Trail at 4 Avenue) the average travel time decreased by about 2 minutes over a 13-block distance. Only one roadway experienced an increase in travel time.

Table 6: Traffic Travel Times In Downtown Following Mid Day Signal Timing Change

(Time Difference in Seconds)

Streets	Macleod Tr	1 St SE	4 St SW	5 St SW	8 St SW NB	8 St SW SB	Average Difference
Before Noon	-62	-22	**63**	-109	-100	-55	-48
Afternoon	-119	**17**	**10**	-47	-72	-40	-42

Avenues	4 Ave	5 Ave	6 Ave	9 Ave	11 Ave	12 Ave	
Before Noon	-122	-15	-2	-20	-48	-18	-38
Afternoon	-93	-81	-20	-38	**26**	-8	-36
	Average Travel Time Difference =						**-41**
							Seconds

One of the advantages of the fixed time signal plan is that the trains are actually metered by the signals. As such, the arrival of a train at an intersection can be predicted within a few seconds. The green time requirement for the train can then be minimized, giving more time back to the opposing street traffic.

The next step in the process was completed on 2003 February 23 with the signal timing changes for the remaining off-peak time periods (weekday early morning, late evening, weekends and holidays). In 2003 March, Calgary Transit LRT schedules were revised to reduce the number of trains required for each of these time periods. The annual, full year value of the LRT operational savings is $375,000. Following on the success of the initial trials, A.M., P.M. and weekend fixed timing plans were developed in the same manner, and were implemented subsequently in 2003 and 2004. The adoption of the new fixed timing plan has increased LRT capacity on the transit mall from approximately 27 trains per hour to a theoretical maximum of 36-40 trains per hour, achieved with no capital expenditure.

The Downtown Re-timing project represents a relatively low risk, low cost and high reward plan. However, this solution required considerable imagination, commitment and co-operation.

GE5 Detour Planning Project

This detour plan involved identifying, analyzing, planning and programming transportation management projects in preparation for construction of the Glenmore Trail/Elbow Drive/5th Street SW interchange project (GE5). In December 2003 Calgary's City Council approved $99 million for the construction of interchanges at Elbow Drive and at 5th Street, along with road improvements on Glenmore Trail between Macleod Trail and 14th Street SW. The project would be completed in stages over approximately three years:

- 2005 - Detour construction; Re-route traffic to detour
- 2006 - Full year of construction
- 2007 - Late fall - complete construction; Open new Glenmore Trail
- 2008 - Construction clean up; Landscaping

GE5 detour planning began early in 2004, when the City of Calgary's Transportation Infrastructure business unit established the schedule for temporary traffic detours and restrictions associated with the construction project. In late 2004, the Transportation Optimisation Division (Transportation Planning Business Unit) initiated the GE5 Technical Transportation Management Team ("the Team") to provide a co-ordinated and structured approach to traffic management during the GE5 project. The Team reported to the GE5 Project Manager at Transportation Infrastructure, and was initially envisioned to focus on six areas of detour traffic management: Traveller Information, Incident Management, Traffic Control, Transit, Communications, and Other Strategies.

The Team met once in 2004 to initiate brainstorming of issues and projects. The Transportation Optimisation Division then established a method of evaluating projects

(the benefit-implementation index), and began evaluating some of the early concepts for traffic management.

In January 2005, the detour stages were further refined, and the Team met to formally identify the most important issues and potential projects arising from the new Pre-Stage and Stages 1, 2 & 3 (including the likely schedule for construction on the Causeway west of 14 Street SW). The Team identified the following general issues that would require attention:

- Signal timing to address restrictions
- Maintaining flow on Glenmore Trail
- Responding to increased demand
- Chinook Centre access
- Transit routing
- Cyclist and pedestrian accessibility
- Shortcutting and speeding
- Scenario planning (system & community)
- Knowing diversion routes
- Co-ordination with other projects
- Civil construction timelines
- Incident management
- Engaging affected parties (mall, police, etc.)
- Business awareness (alternate modes)
- Public communication
- Conveying travel information

In late January 2005, the Transportation Optimisation Division then developed a matrix identifying the effectiveness of individual projects in dealing with issues and designating a Project Analysis Lead for each project. The Project Analysis Leads were responsible for analysing the benefits, costs and feasibility of each project.

In February 2005, oversight subcommittees were formed in order to oversee and approve the recommendations initiated by the Project Analysis Leads:

1. Night-time Closures
2. Mall Access Accommodation
3. Community Traffic Strategies
4. Signal Corridor Review
5. Incident Management
6. Traveller Information & ITS
7. Traffic Control & Geometrics
8. Transit
9. Communication Plan

The subcommittees each met at least once in early February to review the proposed projects. They reported back to the Team with a recommendation whether or not to proceed with the project. Many of the projects involved prioritisation of operational staff efforts to focus on the GE5 impacts. Such projects include:

- Monitoring Plan
- Incident Management Plan
- Signing Plan to warn motorists and reroute traffic (including dynamic message signs [DMS])

- Meet with Province, Alberta Motor Trucking Association
- Community traffic strategies
- Adjust timing to accommodate changing traffic patterns
- Signal co-ordination along alternate routes
- Carpool signage and “Escape the Rush” promotions
- Plotting anticipated traffic diversions using travel demand model
- Restrict parking on alternate routes

Other projects involved capital expenditures and significant planning, design and/or procurement. Examples of these projects are shown below:

- Increase turn bay storage at intersections to accommodate changing traffic patterns
- Fast track CCTV Camera installations
- Make CCTV Camera images available on WWW
- Intelligent Work Zone system (detection, cameras, and DMS)
- Business/mall access signage
- Queue detection on ramps
- Highway Advisory Radio
- Standby tow trucks

The projects recommended by these subcommittees are now part of the GE5 Traffic Management Plan. These projects will help mitigate the impact of GE5 construction on adjacent communities, businesses, and transportation alternatives.

Transit Signal Priority (TSP) Projects

The Traffic Signals Division (Roads Business Unit) has recently installed Opticom™ detectors on two arterial corridors in Calgary, Centre Street N. and Elbow Drive SW. A total of 38 traffic signals (including 7 from Phase 1) now provide bus priority for Route 3 and the north Calgary express bus routes. To support this initiative, Calgary Transit has been installing Opticom™ emitters on all new buses added to the fleet since 2002. A total of 150 of Calgary Transit’s 750 buses are now equipped with TSP emitters.

Travel time studies on Route 3 were conducted prior to and following the implementation of TSP. The before and after studies identified the number and duration of stops at traffic signals. The result of these studies is shown in Table 7 below.

Table 7: Route 3 Opticom TM Analysis

Comparison of Before and After Travel Data

	Signal Stops			Signal Delays (seconds)		
	North Section	South Section	Total	North Section	South Section	Total
Before						
Northbound	8	8	15	175	192	367
Southbound	7	8	16	165	211	375
Total Before	**15**	**16**	**31**	**340**	**402**	**742**
After						
Northbound	6	6	12	163	189	352
Southbound	3	6	9	91	177	269
Total After	**9**	**12**	**21**	**254**	**367**	**621**
Changes						
Northbound	-2	-2	-4	-12	-2	-14
Southbound	-4	-2	-6	-73	-33	-107
Total	**-6**	**-4**	**-10**	**-85**	**-36**	**-121**
Percent Change	**-38%**	**-25%**	**-32%**	**-25%**	**-9%**	**-16%**

Before Studies done in 2001 May
After Studies done in 2004 Mar/Apr/May

These data indicate that the number of stops due to traffic signals has been reduced by 32% while the time spent stopped at traffic signals has been reduced by 16% or about two minutes per round trip.

TSP also yielded significant schedule adherence benefits, identified in Table 8.

Table 8: Route 3 Schedule Adherence

	Leave Early	Leave Late	On Time
TSP Buses	10%	10%	**80%**
Non TSP Buses	18%	12%	**71%**

Based on 2,678 records.

Currently, Calgary Transit drivers use the travel time saved to extend layovers at time points and transfer locations. In the future, reduced delays at traffic signals will certainly hedge increasing delays due to traffic congestion on these roads.

Other benefits will be realized over time, including maintenance and fuel savings, as well as emissions reductions. At 2004 fuel prices the value of the fuel saved is approximately $4,600 per year. This saving will offset some of the costs associated with Opticom™ installation.

Transportation Optimisation Projects Currently Underway

The Transportation Optimisation Division is currently completing the projects discussed below, among other operational improvements.

9 Street SW Downtown Project

Issue: Delays on 4, 5, 6 Ave for Buses and Passenger cars in West End of Downtown due to C-Train crossing on 9 Street
Goal: Improve service to 4/5/6 Avenue without impacting train service
Proposed Solution: Replace preemption with coordinated fixed time operation
Improvement: Increase car/bus capacity on the avenues without impacting C-Train progression

Figure 4: Looking North along 9th Street

Figure 5: Looking East on 6th Avenue

5th Avenue Connector Project

Issue: Delays to traffic and transit into the downtown core.
Goal: Use existing infrastructure differently to improve service.
Proposed Solution: Install a lane reversal on 4th Avenue and 6th Avenue and tie into a major corridor on 5th Avenue.,
Improvement: Improve travel time by 25%. Increase eastbound capacity Reduce weaving at 11 Street

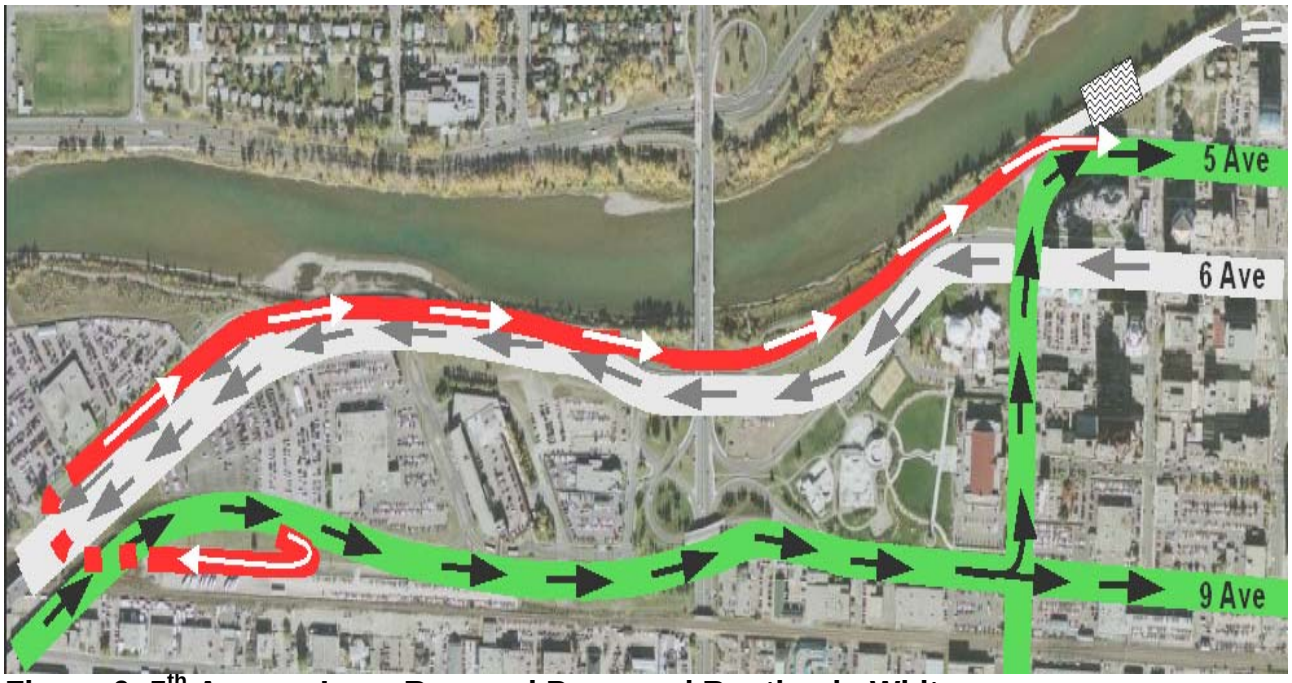

Figure 6: 5th Avenue Lane Reversal Proposed Routing in White arrows

Pedestrian Travel on Stephen Avenue Mall Project

Issue: Delays to pedestrians on a walkway with traffic signals
Goal: Improve pedestrian mobility in high demand time of day
Proposed Solution: Increase the split time to favour the highest demand which is pedestrian and ensure the offset time is optimised for traffic movements.
Improvement: Improve pedestrian service time by 60%

Figure 7: Stephen Avenue Pedestrian Mall

Conclusion

The City of Calgary's Transportation Optimisation Division was initiated in 2004 in order to maximise the effectiveness of the City's existing transportation infrastructure. In 2005, the Division is currently staffed with members with specialties in: Traffic Signals Operations, Traffic Engineering Operations (Signing, roadmarking, traffic safety, detours and parking), Forecasting, Transit Operations/Planning, and Transportation Systems Management. The group is engaged in a systematic approach to evaluating potential issues and identifying cost-effective near-term solutions. This paper has presented examples of the prioritisation methodology used in Transportation Optimisation. The work program that has resulted from the application of this approach includes such projects as:

- pedestrian operation improvements
- transit signal priority
- area and corridor signal timing coordination
- detour transportation management planning
- lane reversal systems
- intersection geometry improvements

The focus on operations-level planning with a cross-section of skills within the group has resulted in expedient analysis and early identification of the feasibility of potential solutions. The success of this approach, which relies upon the expertise within the City of Calgary's existing business units for implementation, has thus far been demonstrated in the significant benefits of early projects. This success is even more significant when considering the relatively low cost of analysis and construction and the high benefit of the resulting operation of optimisation projects.

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